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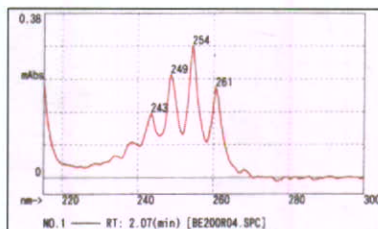
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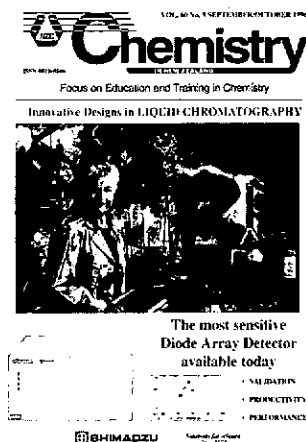
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UP FRONT ...

Shimadzu New Zealand announces the release of their newest HPLC detector, the SPD-M10AVP photodiode array detector. The SPD-M10AVP is the detection solution for analysts who demand sensitivity, spectral resolution and regulatory compliance in a compact, modular footprint.



For further details see the cover story on page 2

NZIC Chemistry

IN NEW ZEALAND

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The New Zealand Institute of Chemistry Incorporated

P O Box 12-347, Wellington, New Zealand
Phone +64-4-4739444, Fax +64-4-4732324
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General Secretary/Executive Officer: Alan A Turner

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Ancat Holdings Limited
32 Murvale Drive, Bucklands Beach, Auckland
P O Box 38-546, Howick, Auckland, New Zealand
Phone: +64-9-5353475, Fax: +64-9-5353476
Email: ancat@ihug.co.nz

Editorial Board:

Dr L J Wright • PhD, MNZIC
Dr R Whiting • PhD, MNZIC
R B Hall • MSc, Dip BIA, FNZIC
R B Lyon • BSc, MNZIC

Managing Editor & Advertising Sales:

Robert B Lyon • BSc, MNZIC
Ancat Holdings Limited
32 Murvale Drive, Bucklands Beach, Auckland
P O Box 38-546, Howick, Auckland, New Zealand
Phone: +64-9-5353475, Fax: +64-9-5353476
Email: ancat@ihug.co.nz

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COMING UP ...

November 1996 - Focus on
the Dairy Industry

January 1997 - Focus on Environmental
Control, Waste Management,
Water Analysis

Deadline for material:
5th of the month of publication

Contributions and enquiries to:
The Editor,

Chemistry In New Zealand,
P O Box 38-546, Howick, Auckland, New Zealand
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Shimadzu Photodiode Array Detector for HPLC redefines the limits for PDA sensitivity

Shimadzu New Zealand announces the release of their newest HPLC detector, the SPD-M10AVP photodiode array detector. The SPD-M10AVP is the detection solution for analysts who demand sensitivity, spectral resolution and regulatory compliance in a compact, modular footprint. It features Shimadzu's newest technology and boasts the world's lowest noise level of $\pm 0.8 \times 10^{-5}$ AU. This represents a new performance standard for PDA detection. Superior sensitivity and increased resolution (optical resolution of 1 nm for the spectral range of 190-800 nm) permit the SPD-M10AVP to bring new accuracy levels to trace component identification, spectral elucidation, and library searching. The SPD-M10AVP's new total purity assessment function evaluates all spectra under a given peak for greater confidence in detecting impurities. Additionally, a multi-channel analog output option will provide the convenience of interfacing to existing LIMS or in-house data systems. The SPD-M10AVP provides built-in GLP functions including self-diagnostics, automatic wavelength verification with D₂ and built-in filter, and maintenance

information for enhanced validation efficiency. It features improved maintenance through easy front access to the flow cell and the pre-aligned deuterium and tungsten lamps. The SPD-M10AVP's standard safety features include a leak sensor and a lamp replacement protection system which automatically turns off lamp power. The SPD-M10AVP's compact 10.25 inch design matches the dimensions of Shimadzu's standard modular component line-up, enabling it to easily integrate into a complete LC-10A HPLC System. The SPD-M10AVP may also be used stand-alone to complement any existing LC system. Further information on the SPD-M10AVP may be obtained by calling your local Shimadzu sales representative or by calling our customer support hot line at 0800-735-725.

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LOCAL NEWS

BIOLAB SCIENTIFIC BOOSTS MARKET POSITION WITH AUSTRALIAN ACQUISITION

Biolab Scientific Ltd, part of the Salmond Smith Biolab Group, has acquired Selby Scientific Pty Ltd, a major supplier of scientific and laboratory products and equipment in Australia and New Zealand.

Selby Scientific Pty Ltd supplies both the New Zealand and Australian markets and is a subsidiary of F H Faulding & Co Ltd, a major Australian health care company.

"Integration of the two operations is a logical move - the companies share many agencies (product suppliers)", said Bruce McKinnon, Group General Manager of Biolab Scientific's Australia and New Zealand businesses. "But more important, building a stronger Australasian company will result in better customer service and greater efficiencies."

This acquisition will double Biolab Scientific's turnover and balance the business between Australia and New Zealand. Mr McKinnon said that "with the trend in the market for testing products moving towards greater use of auto-analysers and in-process instrumentation there was a need for some industry rationalisation in what has become a very fragmented market. Biolab Scientific's strengthened business and product portfolio will bring new levels of service to the customer base in Australia and New Zealand"

The merging of Biolab Scientific and Selby Scientific operations in Australia and New Zealand creates the largest distributor of scientific equipment and laboratory products in Australasia. The merged Australian operation will continue to operate from the Selby Head Office in Melbourne while the New Zealand operations will operate from Biolab Scientific's Head Office in Auckland.

A.i. SCIENTIFIC APPOINTED EXCLUSIVE DISTRIBUTORS FOR LEEMAN LABS

A.i. Scientific is pleased to announce that they have been appointed exclusive distributors of Leeman Lab's mercury and cyanide analysers in Australia and New Zealand. A.i. Scientific will be exhibiting Leeman Lab's new generation mercury analysers on their booth at the Science 2000 exhibition in Melbourne from September 24th-26th.

MOVING MOMENTS FOR SHIMADZU NEW ZEALAND

Shimadzu Oceania New Zealand has just completed its new Auckland premises and the team moved in on the 6th of September 1996.

Shimadzu now have attractive purpose-built premises as a base from which to support customers; comprising a modern, well-

equipped service facility, parts warehousing, a demonstration area and offices for sales, service and support people.

We at Shimadzu trust that you won't experience any turbulence after take-off! Certainly the team is working hard to ensure that the transition to new systems is seamless and that dealing with us remains an easy and enjoyable experience.

Come and visit us. We are just off the Lincoln Road off-ramp on the North-Western motorway. Just a 10 minute buzz down the motorway from the central city. If you are visiting from out of town we are right on the West Auckland wine trail so combine business with pleasure and come and see us.

Our new contact details are:

Shimadzu Oceania Pty Ltd, New Zealand Office

13-15 Collard Place, Lincoln

P O Box 45-077, Auckland 1230

Tel: (09) 8367750

Fax: (09) 8367757

Freephone: 0800 735 725

Mobile: 021 990 732 (Chris Nipper)

021 631 283 (Nigel Beardsworth)

Email: xyz@shimadzu.co.nz

(where xyz = clare, chris or nigel)

Contacts: Clare Hodgson

Chris Nipper

Nigel Beardsworth

Our other office addresses remain unchanged, i.e.

Shimadzu Central Region Office

19 Ngatiawa Street, Nelson

Tel: (03) 5456016

Fax: (03) 5457017

Mobile: 021 904 047

Email: phraser@nelson.planet.org.nz

Contact: Bruce Fraser

Shimadzu Southern Region Office

25 Leslie Hills Drive, Riccarton, Christchurch

Tel: (03) 3488202

Fax: (03) 3481202

Mobile: 021 904 046

Contact: Bob Foulkes

ADDITIONAL SERVICE ENGINEER JOINS

A.i. SCIENTIFIC SUPPORT TEAM

Nils Stephenson joins A.i. Scientific's quality certified Customer Support team as a Customer Support Engineer. His role will take him to all parts of Australia, New Zealand and PNG in support of both A.i. Scientific manufactured and resale products. His first few months with A.i. Scientific have involved an intensive training program in A.i. Scientific's own manufactured products and hands on experience with Dohrmann's TOC analysers. He will soon be going to Canada and the USA for specialised training on Phase Technology on-line analysers as well as Leeman Lab's mercury and cyanide analysers. The knowledge and expertise Nils has acquired will place him in an excellent position to provide any support required for A.i. Scientific manufactured and resale products.

LAUNCH OF SCIENCE AND TECHNOLOGY RESOURCE GUIDE FOR SCIENCE TEACHERS

Schools will soon be tapping into *The Resource Guide* for science and technology projects. *The Resource Guide*, accessible through the Education Web at <http://www.cwa.co.nz> was officially launched by the Minister of Research, Science and Technology, the Hon. Simon Upton, on 5 August 1996.

A creation of Copeland Wilson & Associates' On-line Editor Dr Brenda Leeuwenberg, the guide was funded by the Science and Technology Promotion and Advisory Committee (SATPAC), which is administered by the Ministry of Research, Science and Technology. The project received additional support from Internet Service Provider ACTRIX and software developers QED and Golden Microsolutions.

The database itself consists of nearly 1000 New Zealand-based resources drawn from over 300 contributors and took Dr Leeuwenberg a year to develop and compile. Contributors included organisations as varied as Waitomo Museum of Caves, Greenpeace, ECNZ, Kelly Tarlton's Underwater World, Cadburys, Learning Media Ltd and the National Heart Foundation.

The guide will give teachers a range of resources available on most science and technology projects, the level for which each resource is appropriate, and the nature of the resource – book, pamphlet, statistics or a video. The listing also offers a name, contact address and the cost of each resource.

To ensure the guide reaches the widest possible audience, in addition to internet access, it will also be made available to schools on an education CD-ROM magazine, called *MAC ATTACK* and *WINATTACK*.

Teachers will be able to transfer *The Resource Guide* database from this CD to their school's hard drive or access it "on-line" through The Education Web for the most up-to-date information. *The Resource Guide* has had ongoing input from primary and secondary classroom teachers, who are the main target user group. Its development was overseen by a consultative committee consisting of education representatives, resource providers and individuals drawn from the science and technology communities.

For further information regarding *The Resource Guide* please contact: Brenda Leeuwenberg, On-line Editor
Copeland, Wilson and Associates
Ph: (04) 6190669
email: brenda@cwa.co.nz

FULL STEAM AHEAD FOR RS&T:2010

It's full steam ahead for *RS&T:2010*, the Government's strategy for research, science and technology in New Zealand to the year 2010, which was launched by the Prime Minister, the Rt. Hon. Jim Bolger, on board NIWA's *Tangaroa* in Wellington Harbour on 21 August 1996.

Hosted by the Minister of Research, Science and Technology, the Hon. Simon Upton, the launch was attended by members of Parliament, the news media, scientists, researchers, technologists

and engineers from Crown Research Institutes, Universities, Research Associations and private enterprise.

The message behind the Government's development of a national strategy for research, science and technology is that research, science and technology will play a critical role in the future of all New Zealanders. Investment in new knowledge will underpin innovation in our enterprises, sustainable management of our natural resources, and the evolution of a cohesive society. It will enable individuals to make well-informed decisions about their lives.

The strategy, called *RS&T:2010*, was released in draft form for public consultation twelve months ago, and was recently given final approval by Cabinet. The strategy follows up on the Government's commitment, made in 1993 in its strategic document *Path to 2010*, that it would aim to increase public investment in research, science and technology to 0.8% of the gross domestic product by the year 2010. This represents a considerable increase in investment. The Government has already announced increases of \$45 million in 1997/98 and \$40 million in 1998/99.

The *RS&T:2010* strategy recognises that the Government's investment is made through a number of Votes, including Health, Education, Agriculture, Fisheries and others in addition to the major investment through Vote Research, Science and Technology. The strategy encompasses all of these areas, and aims to achieve progress towards following three broad goals:

- Fostering societal values and attitudes that recognise science and technology as critical to future prosperity;
- Ensuring an adequate level of investment in science as a component in national life which has cultural value in its own right; and
- Maximising the direct contribution of science and technology to diverse social, economic and environmental goals.

The *RS&T:2010* strategy provides for progress towards the goals to be measured and reported at three-yearly intervals. An "action agenda" lists steps to be taken in the near term. Examples of such steps are as follows:

- The quantity and quality of careers information on science, technology and engineering will be improved. This will be supplemented by initiatives to encourage more direct interaction between employers, teachers, students and science and technology professionals;
- Social science research will be promoted so that social policy decision-making will be supported by better understanding of society in order that policies can be better designed to meet people's needs, and social outcomes will be monitored; and
- Technology-linked programmes will receive an increasing share of the overall investment in science and technology, and these will focus more strongly on the key issues of improving access to and use of technology, assisting firms to become technology-capable, and helping move effective enterprises into new areas of technology with growth potential.

The increased investment in science and technology is to be used primarily to contribute to the health and social well-being of New Zealanders, to sustain our "clean, green" environment, and to underpin the creation of wealth by the nation's industries. But the strategy also makes it clear that scientific research is valued for the simple purpose of advancing knowledge "for its own sake", and for the role it plays in allowing people to make rational decisions and to challenge conventional wisdom.

Decision-making in science investment to date has been driven almost exclusively by information about social, environmental and economic conditions and trends. Socio-economic factors will continue to be crucial because they underlie the justification for investment. Increasingly however, information about trends and developments in science itself – i.e. a "science-based perspective" – will also be applied, both to link science itself into decision-making and to ensure that our knowledge bases and capabilities in science reflect long-term needs.

A good example of a "gap" in our knowledge base relates to The Exclusive Economic Zone surrounding New Zealand. This area is 14 times larger than the landmass, containing most of the country's fisheries resources and significant potential mineral wealth. To date less than 10% of this part of New Zealand has been even crudely explored. Another example relates to a critical capability. To date only half of our insect species have been fully described by biosystematics experts. Yet such work is essential to containing and controlling pests which threaten our primary production industries, and to assuring the biological diversity of our natural environment. Maintaining capability in areas such as biosystematics is crucial.

The greatest proportion of investment in science and technology will continue to be aimed at achieving the third goal listed above, and be made through the Public Good Science Fund (PGSF). A medium-term goal is for the level of the PGSF to increase to \$330 million by 2000/01. Most funding invested through the PGSF is won by government-owned Crown Research Institutes. The Government has explicitly stated in *RS&T:2010* that it will not sell Crown Research Institutes. Investment in the Marsden Fund, which supports excellent research and researchers no matter what the topic of the research, will be increased and maintained at a level of 10% of the Public Good Science Fund, increasing it from its current level of \$11 million to a level of approximately \$33 million by 2000/01.

This is the first time that a national strategy for research, science and technology, has been articulated. It is the first time that the whole of the Government's investment in science and technology has been drawn together within one coherent framework. *RS&T:2010* will affect not only the future of the science and research community, the major industries and government departments, but also parents and students contemplating individual future directions.

For copies of the documents please contact:
Patricia Morgan, Ministry of Research, Science and Technology
P O Box 5336, Wellington
Ph: (04) 4726400, Fax: (04) 4711284
Email: patricia@morst.govt.nz.

MARSDEN FUND GRANTS ANNOUNCED

The Minister of Research, Science and Technology, the Hon. Simon Upton, recently announced the recipients of grants from the Marsden Fund.

The University of Waikato did particularly well with eight grants being made from 25 preliminary applications and nine full applications. The University of Auckland received 21 grants from 109 preliminary applications and 29 full applicants.

Among the larger grants were:

- \$325,000 over three years awarded to Professor Hugh Morgan of the University of Waikato to continue his research into ancient enzymes.
- \$405,000 over three years awarded to Dr Michael Walker of the University of Auckland to study the magnetic sense of trout and to determine whether it is based on magnetite crystals. Research has shown that bees, tuna and trout can sense the Earth's magnetic field but little is known about the basis of this sense.
- \$310,000 over three years awarded to scientists of the Institute of Geological and Nuclear Sciences, Wairakei to investigate what controls the type of eruptions of New Zealand's rhyolite volcanoes.

In total, universities received 62 grants, fourteen went to Crown Research Institutes, three grants were awarded to private individuals, and one grant went to a Crown Health Enterprise. All grants totalled \$11 million for the year taking into account 2-year and 3-year grants made last year.

The Marsden Fund was named after Sir Ernest Marsden, the founding secretary of what was the Department of Scientific and Industrial Research (DSIR).

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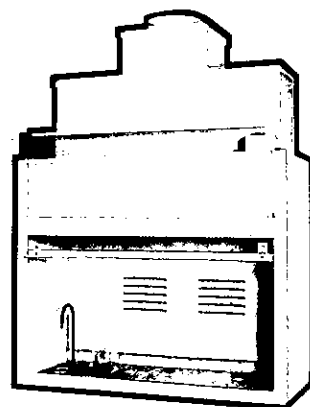
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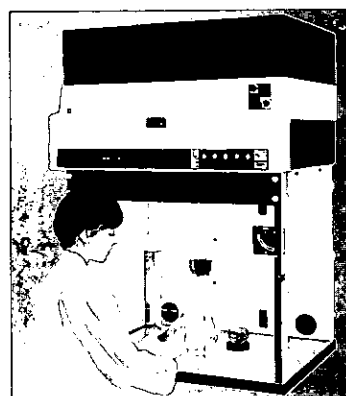
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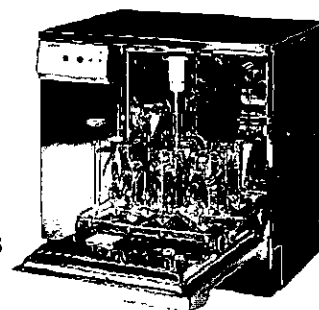
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Making Sense of Learning Science in New Zealand

Lydia Austin, Lecturer in Science Education, University of Auckland
Private Bag 92019, Auckland

The 1993 introduction of a new science curriculum for all New Zealand schools heralded a revolution in the teaching and learning of science in this country as science began to take its place as one of the core subjects in schools – from new entrants to form 5 (or in the new terminology years 1 to 10). There would no longer be a “quantum leap” in the nature of the learning of science as a student advanced from primary (including intermediate) to secondary school. The introduction of this new curriculum was a response to a well-recognised need for revision of a science curriculum that had been in place, virtually unchanged, since 1944. However such a drastic change was unlikely to be made without at least some serious consequences for some of the players. It is the consequences for future scientists and engineers of this country that are the concern of this article.

The 1993 constructivist-inspired, process-led curriculum mandates a revolutionary change in the way science is to be learnt in both primary and secondary schools. Its immediate predecessor was, in stark contrast, a closely prescribed, content-led curriculum designed to lead up to the school certificate examination at the end of form 5. The new approach was clearly needed to respond to changes in the perceived purpose of science education as a necessary part of the education of every New Zealand child. There was also considerable pressure to implement the findings of the indigenous research into children’s learning in science, carried out by the LISP team at the University of Waikato. This work, under the leadership of Roger Osborne, had attained international recognition, and thus acquired guru-like importance (tragically enhanced by Professor Osborne’s untimely death) among the limited numbers of people making up the professional science education community in this country. Cognisance had also been taken of research (e.g. Lantz and Kass, 1987) that showed the extent to which teachers modify any curriculum promulgated by a central organisation. The political pressures exerted by the PPTA (Jesson, 1995) to have a greater control of what was to be taught in schools added its influence. The resulting curriculum document presented what might, in other circumstances, have been seen as merely a philosophical motivation for science teaching. There is a heavy emphasis on developing the student’s performance in the processes of science but the content through which these processes should be taught is indicated only in a series of disjointed contexts, which contain no indication of the importance of the underlying structure of the discipline. I believe the consequences of this serious omission will only be fully appreciated in the future as would-be scientists proceed to further education.

PROBLEMS WITH TEACHER-DEVELOPED CURRICULA

That teachers modify and interpret any curriculum according to their strengths and interests, the facilities available to them, the

expectations of the students and the community, the priorities of the science department, and the direction given by the principal is well known (e.g. Brickhouse, 1991). The multi-million dollar initiatives of the 1960s and 1970s in the United States and Britain to produce “teacher-proof” curricula complete with student textbooks, films, film strips, massive teacher guides, assessment materials, laboratory kits, and laboratory manuals were not adopted in more than a small fraction of the schools for which they were designed (de Boer, 1991). It was argued that teachers prefer to develop their programmes to respond to the particular needs of their own students. They did, in fact, adopt many facets of the so-called “alphabet curricula” (e.g. Chem study, PSSC, MACOS, BCSC) and indeed many of the PSSC designed experiments have become part of the fabric of physics teaching all over the world. This freedom in the hands of the experienced, enthusiastic, well-resourced teacher can result in magnificent science teaching. Pockets of such excellence have been evident in New Zealand from as early as 1849 when Robert Huntly developed and taught a science programme in his Wellington school that would have inspired any modern-day student. However the difficulties with such an approach become apparent when the less experienced, less well-educated and resourced, and more time-constrained teacher is obliged to develop all the teaching programmes without the benefit of the guidance of subject matter or pedagogical experts (Shulman, 1986).

TEACHING TRAINING

Some of the problems and consequences for student learning that arise from the training provided for science graduates have been well documented by Oughton (1995). Teachers having to teach outside their areas of expertise is an almost inevitable consequence of the current degree structures. (Incidentally the University of Auckland has a B.Sc.Ed., a four-year degree program specifically designed to give the breadth in science background required of today’s science teacher. For whatever reason, very few students have taken up this course of study.) The broadening of the scope of science teaching in school becomes a more serious requirement when teachers are *designing* the instruction programme as opposed to merely *interpreting* it. It is here that a lack of understanding of the structure of a subject can lead to serious difficulties.

The New Zealand Chemistry and Physics Curricula both guide teachers by attempting to define a structural organisation of their subjects. Similar guidance is not provided in the Science Curriculum. It could be argued that such guidance is unnecessary for the teaching of primary school children for whom the structure of science is too difficult a concept. However the science curriculum is meant to extend to form seven and will be the basis for the only formal science to which most students

will ever be exposed. To have students study science for all those years and not gain some appreciation of the structure would, I suggest, be an abdication of responsibility as a science teacher. The curriculum should attempt to make this task easier for teachers. Furthermore, the constructivist notion that all knowledge is constructed by the individual has led to the bizarre situation where teachers are being encouraged in the belief that they must avoid telling students any fact because students can't construct knowledge by that method. The student must always investigate for themselves. An investigative approach is useful in some situations, but how else are students to learn to represent chemical reactions by the use of formulae and equations in the accepted way if they are not told?

For many years, a lack of science knowledge of teachers has severely limited science teaching in many primary and intermediate schools. With the number of subjects a primary teacher is required to teach and the perceived difficulty of university science papers, very few take science outside of the very limited time available for content instruction in the training college. (This raises the question of whether stage-1 non-continuing or other science papers provide appropriate training for pre-service primary teachers, but that must be considered elsewhere.) One of the consequences of the new curriculum and the training that is being provided for its implementation is that both pre-service and in-service teachers are being encouraged to believe that they can teach science even if they have very little content knowledge. While this may help to ensure that science is not left out of the teaching schedule through lack of interest, it raises serious questions of the notion of science that students will gain and the misconceptions that are likely to arise. For example Wolfe (1989) has clearly demonstrated that what children take away from a learning experience is not only highly dependent upon the teacher's philosophy of teaching, but also their content knowledge.

THE PROCESS-CONTENT DEBATE

The swing from a content-led to a process-led curriculum has important consequences for the future scientist. The adoption of a process-led curriculum has been influenced by considerable debate in Britain, the USA and Australia on the nature of science education and the nature of science itself, although it has had most impact on the lower levels of schooling. Some of the reasons given for the adoption of the processes of science (rather than content knowledge) as the basis of a science-for-all curriculum have been summarised by Wellington (1989). These are, firstly, that with the content-led approaches many students have been turned off from doing any more science than they are required to do, and many others who have taken extra science have failed to learn it adequately. Although this is clearly a problem that needs to be addressed, it is not at all clear that a process-led curriculum will *ipso-facto* solve the problem. A second reason, suggested by Shayer (1986), is that a reduction in content and less emphasis on the abstract aspects would make the study of science accessible to a wider range of students. However there is little research evidence to suggest that even if not everyone can understand scientific ideas, almost everyone can be taught the skills of science – that is to observe, classify or hypothesise (Jenkins, 1987). Another reason given for this emphasis on process is that scientific knowledge is only provisional, it will soon be out of date and thus not worth teaching. This argument is not really tenable, for practically all

of the school science programme has been formally established and has already stood the test of considerable time. Indeed, although (for example) quantum mechanics has revolutionised ideas about atomic structure, it hasn't changed the fact that when you add an acid to a base you get a salt and water, or that when you burn magnesium you get magnesium oxide. Nor does it seem likely that these occurrences will change in the near future.

This argument also relies on the notion that while science knowledge is subject to change in the light of new evidence, science skills and processes are not. Kuhn (1963) has shown that the present nature of the scientific enterprise is very different from that of the last century. A further claim for the predominance of process skills over content knowledge has been the idea that skills are more "relevant", more transferable, and a better preparation for the uncertainties of the future than content knowledge. The word "relevant" has been used so much that its meaning is no longer clear. It has come to be used as a term of approval rather than an adjective in need of a complement as it was originally.

As Wellington (1994) points out, science education in the past has placed emphasis on the content of science to the detriment of its processes. However if the imbalance is to be rectified then an accurate account of the processes of science is required. It is doubtful that it can be offered (Medawar, 1969). A more important consideration for the education of future scientists is the claim that the scientific processes of observing, classifying, inferring and hypothesising can be taught. This would imply that students can be made into better observers or better hypothesisers with instruction. It would also require a notion of development, for example from elementary classifying to advanced classifying, and a necessity to distinguish between such levels. It is not clear how such differences would be manifest. There is evidence to suggest that ability in these skills is inherited and that no amount of instruction will make significant improvement in the student's performance. An even more serious implication is that assessment of these skills will favour those with the inherited characteristics and penalise those students who work hard but do not have these innate abilities. It is also almost self-evident that one cannot even attempt to teach processes divorced from some form of content. The debate then shifts to the form of that content.

The New Zealand Science Curriculum implies, through omission, that there is no core of science knowledge that should be acquired by all students. The question of what knowledge is of the most worth in any programme of study has been debated at least since Spencer published his famous essay in 1862. That the problem cannot be definitively resolved is not an adequate reason for side-stepping the issues and not including any! The latest national curricula developed in Britain, Australia and the United States all specify what the writers believe students should know at various stages in their science education. The New Zealand curriculum advises that as long as the student "investigates, describes and communicates" then it doesn't really matter what they investigate, describe and communicate. There are minor exceptions to this generality. For example, at level 6 of the Living World* the objectives are that the student can describe cell division and the transfer of genetic information, and in the Physical World levels 6, 7 and 8 the concept of energy has been specifically included in the achievement objectives. The Material World has references to distinguishing between

elements, compounds and mixtures at level 5, and the idea of classification of chemical substances by their properties at level 6.

The teacher is given several examples of what are considered by the writers to be appropriate contexts in which the teacher might attempt to ensure that students achieve the intended aims. The suggestions are not meant to be followed in any sort of order, but the result is nevertheless analogous to the much-criticised "object lessons" of the early part of this century where, with similar disregard for structure or coherence, the teacher would present, on sequential days, an elephant, an orange and a pencil as subjects for observation and study.

The curricula for the levels 6, 7 and 8 Physics and Chemistry Curricula do not suffer from this lack of structure, whereas the Biology Curriculum is very similar to the Science Curriculum. This may be due to the fact that the coordinating writers in both these latter cases were biologists, with views of curriculum development which are subject dependent. Undoubtedly it is a fact that it was only after the distribution of the science curriculum document that academic physical scientists, in general, became aware of the immense changes in the teaching of science that were in the process of being implemented in schools. This was no doubt aided by the media's involvement in the Bell/Matthews controversy over the role of constructivism in the curriculum. The academic scientists were able to voice their concerns through their national associations (NZIC and NZIP) in sufficient time to ensure that the same errors did not befall the curriculum documents for forms 6 and 7. It is interesting to note that the names of the contributors are proudly displayed at the end of the science curriculum document whereas no mention of the contributors is made in subsequent documents for the individual sciences.

Another serious difficulty with the science curriculum is the notion of progression. One of the requirements of any curriculum is that it guides the student's learning towards the objectives that the curriculum writers have set. The objectives need to be set and assessed such that the student is able to achieve them in the order intended. In other words the objectives for level 4 must be somewhat more difficult to achieve than those of level 3 but there must be a clear link between the objectives of various levels. This problem is less pronounced when the curriculum is content-led, since the topics are specified for a particular year with different topics for different years. However there has been debate in Britain over the relative cognitive requirements for topics in their curriculum, particularly the strand dealing with investigations. For example it is difficult to see how "research and describe how selected materials are manufactured and used in everyday goods and technology" (Material World, level 5) and "investigate and describe the applications and effects of chemical processes in everyday situations" (Material World level 6) represent a distinct progression.

Although discussions concerning a new curriculum and the development and subsequent rejection of the Form 1 to 5 Science Curriculum took place over a number of years, the present science curriculum was written, consulted on and implemented in a very short space of time. In view of the total change in direction of this curriculum over previous ones, it is nothing short of scandalous that there appears to be no plan for

reconsidering or possibly modifying this deficient document in any way.

ASSESSMENT

Another of the thorny issues presented by a process-led curriculum is that of assessment. The change from the assessment of knowledge and comprehension to those of scientific skills forces a change from norm-referenced to criterion-referenced assessment. This has much to commend it, but also raises many problems. One of these is that the measurement of the performance of a skill depends on one's views of how skills develop. If you take a developmental view that the students acquire increasing competence, then you need to develop some kind of hierarchy in what students can do. This notion led to the so-called ABA (achievement-based assessment) by which every skill was supposed to be assessed on a scale of 1 to 5 with the result that the criteria for each level of each skill led to a totally ridiculous and undifferentiable scale of criteria. This Education Department directive was dropped in 1993 after much protest about the impossibility of applying it in a systematic and defensible fashion.

WHAT DOES THE FUTURE HOLD?

The ultimate effect that the NZQA assessment of unit standards (beginning at level 6) will have on the delivery of the curriculum is not yet totally clear. The uncertain future of bursary and scholarship examinations has added to a clouding of the picture. What is clear is that the NZQA approach is to use pass/fail criteria for every unit of learning. The fragmentation of the entire curriculum into bite-sized pieces has some appeal for those students who need a carrot to be held in front of their noses in order to perform. However the ability to work for long-term goals is not likely to be encouraged under such a system. Furthermore, I believe this process is fundamentally flawed in that this fragmentation of the material and its assessment will preclude development of an overall view of the subject or development of a notion of overall structure; the latter objective is not part of the NZQA's framework of unit standards, nor indeed the science curriculum.

The problem of moderation is another cause for concern. The farcical situation of the 1995 School Certificate Science examination is clear evidence of the inability of NZQA to effectively moderate the internal assessment of unit standards in the schools. This one examination was riddled with errors which would have been easily picked up by even a slightly attentive moderation process. Not only were the errors not picked up, but NZQA tried to put the blame anywhere but in its own court, including accusing professors who pointed out fundamental flaws of being excessively picky. In replacing external examinations by internal assessment, teachers must submit details of each of their proposed assessment exercises to NZQA for approval six weeks before the proposed assessment date. NZQA has clearly shown its inability to moderate one examination. What confidence can one have of NZQA's ability to moderate thousands of individual exercises? Obviously errors in any of these will not gain the publicity that the errors in the school certificate examination did, but NZQA's credibility must surely be questioned, and with it, so must be the validity of the unit standards subsequently obtained by students.

* I have omitted the problematic "Making sense of" preceding each title heading in the Curriculum document (for a discussion of this see Matthews, M R (1995) *Science in the New Zealand Curriculum*, Auckland: Dunmore).

A final problem associated with internal assessment and the possible demise of the bursary examinations is a loss of the notion of academic excellence. With a pass/fail system of internal assessment of fragmented learning designed so that most students can pass, what external inducement is there for students to excel? While we would like students to be internally motivated, it is probably unrealistic for us to expect this, even from our best students. Most of us like to experience some extrinsic reward and public recognition of our efforts. Furthermore, on what basis will universities and other tertiary education establishments select students? It has always been the aim of universities to offer education to those who can benefit from it. With a system of open entry with no criteria then the question of differentiated courses for students of different abilities and interests will need to be addressed. Will bright and capable students have to wait until graduate school for instruction that will stretch their minds? Perhaps the universities will set their own entry examinations? Will those students planning to go on to university study be required to follow a different curriculum from those going the unit standards approach? Two tracks in any school has long been deemed unacceptable, but if schools can chose to develop their own strengths then perhaps we will see the introduction of North American-style magnet high schools, especially in the larger population areas, specialising in the preparation of future scientists and engineers? This seems to me to be one of the few potential solutions to the problem of adequately preparing advancing science students, but it would mean that we would have to return to a situation similar to the Grammar/Secondary Modern School division which was reflected in England thirty years ago.

REFERENCES

- Brickhouse, N W, (1991), Teachers' content knowledge about the nature of science and its relationship to classroom practice. *Journal of Teacher Education*, 41(3), 53-62.
- de Boer, G E, (1991), A history of ideas in science education. Implications for Practice. New York: Teachers' College Press.
- Jesson, J, (1995), Curriculum in New Zealand, is it policy by dodgems? *Educational Review*, 42 (2), 143-155.
- Kuhn, T S, (1963), The structure of scientific revolutions. Chicago: Chicago University Press.
- Lantz, O and Kass, H, (1987), Chemistry teachers' functional paradigms. *Science Education*, 71, 117-134.
- Medawar, P B, (1969), Induction and intuition in scientific thought. London: Methuen.
- Oughton, T, (1995), Knowledge and pedagogy: Critical dimensions in the training of chemistry teachers. *Chem NZ*, 61, 5-15 (and printed in this issue on pages 46-52).
- Shayer, M, (1986), Data processing and science investigations in schools. *Papers in Education*, 1 (3), 237-253.
- Shulman, L S, (1986), Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15 (2), 4-14.
- Wellington, J J, (1989), (Ed.). Skills and processes in science education: A critical analysis. London: Routledge.
- Wellington, J J, (1994), (Ed.). Science in the secondary curriculum: Contemporary problems and practical approaches. London: Routledge.
- Wolfe, L, (1989). Analysing science lessons: A case study with gifted children. *Science Education*, 15, 77-101.

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THE RISE AND DECLINE OF *d* ORBITALS:

Bonding in Hypervalent Compounds

Owen J Curnow, Department of Chemistry, University of Canterbury
Private Bag 4800 Christchurch

INTRODUCTION

Since the advent of Lewis's octet rule¹ and Gillespie's VSEPR theory² molecules of the main group elements have been placed into three groups: electron deficient molecules in which one atom has less than 8 valence electrons (e.g. BF_3); those that obey the octet rule (the vast majority of main group compounds); and those which have an atom with more than 8 valence electrons (e.g. PF_5 and SF_6 , Figure 1, in which the central atoms are said to have 10 and 12 valence electrons respectively). The molecules in this latter group are commonly referred to as hypervalent.

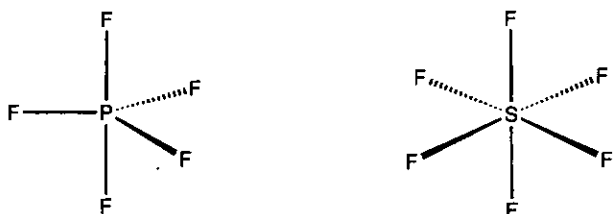


Figure 1. Trigonal bipyramidal PF_5 and octahedral SF_6

It has been convenient to describe the bonding in hypervalent molecules by invoking hybridisation of the valence *s* and *p* orbitals with low-lying empty *d* orbitals, which in the case of P and S would be the 3*d* orbitals. PF_5 is, therefore, described as sp^3d (or alternatively $sp^2 + pd$) hybridised and SF_6 as sp^3d^2 hybridised. The right number of molecular orbitals in which to place the extra electrons are then provided, and the molecular shapes (trigonal bipyramidal and octahedral respectively) are also explained. The inclusion of *d* orbitals in the bonding of such molecules has also provided a nice rationale for the lack of hypervalent molecules from the first period (B, C, N, O and F); there are no low-lying empty *d* orbitals available with which to form hybrid orbitals.

Initially, many theoretical chemists agreed with this picture. The high oxidation states of the central atoms should lower the energy of the *d* orbitals and also reduce their size. These factors are said to favour hybridisation on energy and spatial-overlap grounds, respectively. Indeed, many calculations found significant *d* orbital contributions to the bonding. However, as calculations have become more accurate, it has become clear that the *d* orbital contributions are significantly less than expected from hybridisation considerations. Take SF_6 , for example, where sp^3d^2 hybridisation would predict a 3*d* contribution of 33%, whereas only 6-8% is found.³ Calculations on H_2S , SF_2 , SF_4 and SF_6 show that the *d* orbital contribution per bond is small and constant, despite significant differences in the hybridisation of the S atom.⁴

Some say that if the theoretical chemists try long and hard enough, that they'll eventually change their minds again, but

this is a rather unscientific argument, and a changing of minds doesn't seem likely. It now seems quite clear that *d* orbitals do not participate significantly in the bonding of hypervalent compounds. However, many chemists still cling to the idea of *d* orbital hybridisation. One of the reasons for this is that people are unaware of the simple molecular orbital and valence bond descriptions that are available for hypervalent molecules. This article aims to introduce one such bonding scheme.

If *d* orbitals are not significantly involved in the bonding of hypervalent molecules by forming hybrid orbitals, a number of questions then arise. Perhaps the most important are:

- What is the true role of the *d* orbitals?
- What is the nature of the bonding in hypervalent molecules?
- Why don't the first row elements form hypervalent compounds?

THE ROLE OF THE *d* ORBITALS

In a teaching environment this question would not normally need to be answered, but in light of the present beliefs, and the flavour of this article, it should be addressed. The currently accepted answer is that the *d* orbitals play a role in polarising the *p* orbitals.⁵ When an orbital is placed in an electric field, such as exists near any charge or in any molecule, the electron distribution will be polarised. In the case of a positive charge (Figure 2) an orbital will be polarised towards that charge.

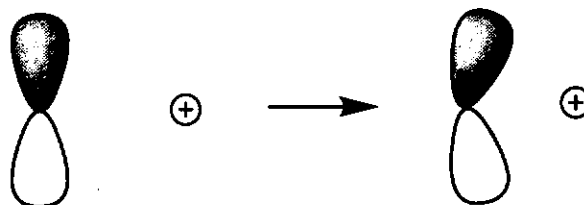


Figure 2. Polarisation of a *p* orbital by a positive charge

Mathematically, it is easiest to polarise a *p* orbital by adding a small amount of *d* character (Figure 3). This, however, does not produce a *pd* hybrid orbital. (A similar trick must be used for accurate calculations of H_2 ; but in that case the 1*s* orbitals are polarised by adding a small amount of *p* character. Obviously, this does not produce *sp* hybrid orbitals.)

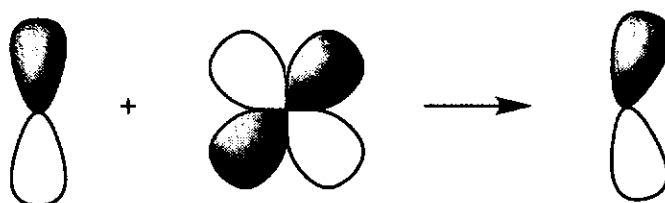


Figure 3. Formation of a polarised *p* orbital by addition of a small amount of *d* character

A rather crude way (by the standards of theoretical chemists) to look at the difference between hybridisation and polarisation is to consider the effects on the energies of the orbitals (Figure 4). Hybridisation produces **two** identical hybrid orbitals which both lie **higher** in energy than the original *p* orbital: these then interact with the orbitals of the substituents. On the other hand, polarisation of an orbital adjusts the shape to account for the electric field created by the substituents; effectively it is lowered in energy in that field.

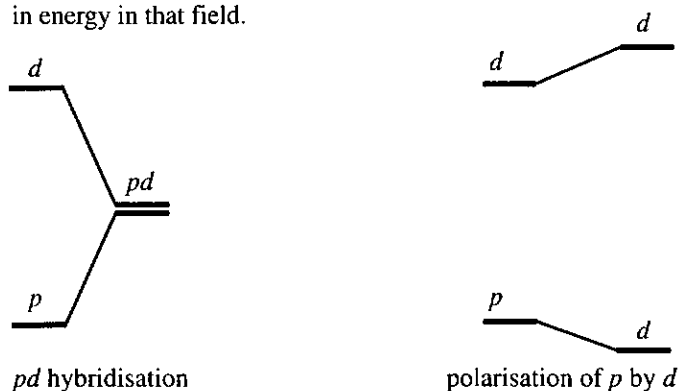


Figure 4. Hybridisation versus polarisation

BONDING IN HYPERVALENT COMPOUNDS

So how do we describe the bonding in hypervalent compounds? In 1963 Rundle proposed a 3-centre 4-electron bond to describe the bonding in XeF_2 (Figure 5).⁶ Six electrons are accommodated in three sp^2 lone pairs on the Xe atom. The remaining p_z orbital interacts with two other orbitals, one from each F atom, to give a filled bonding molecular orbital (σ), a filled non-bonding molecular orbital (n), and an empty anti-bonding molecular orbital (σ^*). The Xe—F bond order is 0.5 and the formal charges are +4/3 on the Xe atom and -2/3 on each F atom. We have essentially melded a valence bond description (the sp^2 lone pairs) and a molecular orbital description (the 3-centre 4-electron bond). The “valence” picture at the bottom of Figure 5 shows an approximation of the molecular orbital picture for the 3-centre 4-electron bond that emphasises the 0.5 bond order and the important fact that the octet rule is **not** broken. The octet rule is not broken because two of the electrons are located entirely on the F atoms in the non-bonding orbital.

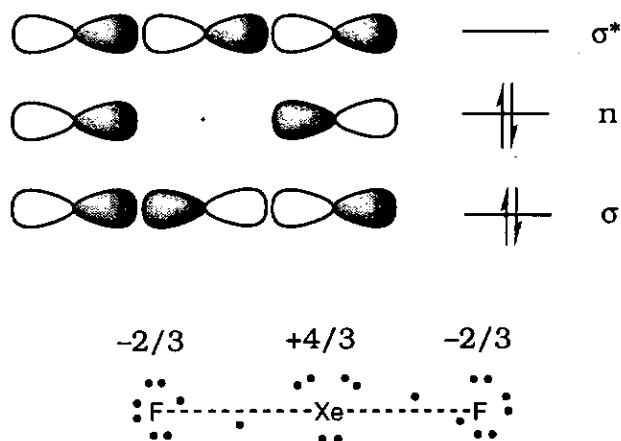


Figure 5. The 3-centre 4-electron bond of XeF_2

Does this mean that there is something wrong with VSEPR theory? Not really. It is a misconception that VSEPR says anything about the number of valence shell electron pairs. It only says what the geometric distribution of the substituents and lone pairs is likely to be once the nature of the bonding has been independently established. VSEPR works because four electrons are accounted for both in a 3-centre 4-electron bond and in two regular covalent sp -hybrid bonds, so the number of electrons left to form lone pairs will be the same and the VSEPR structure will be the same. As far as the octet rule is concerned, it should be remembered that there can only be up to 8 electrons in 4 valence orbitals.

There have been many detailed calculations performed on both PF_5 and SF_6 , and there are also molecular-orbital diagrams available.⁷ However, these are not readily extended to other hypervalent compounds and are not really suitable at an introductory level of chemistry. The simple valence pictures shown in figure 6 provide a useful alternative.

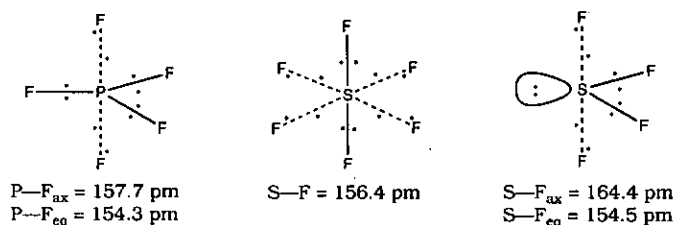


Figure 6. Valence bond pictures of PF_5 , SF_6 and SF_4

PF_5 contains three covalent bonds, made using three sp^2 orbitals with the equatorial F atoms, and one 3-centre 4-electron bond for the axial F atoms. The lower bond order for the axial bonds provides a simple explanation for the greater axial bond distances in trigonal bipyramidal molecules. SF_6 can be described as two regular sp -covalent bonds and two 3-centre 4-electron bonds. Since the F atoms are all equivalent, there are two other resonance descriptions. This will then give an average S—F bond order of 2/3. This is quite a nice result as the S—F bond distances in SF_6 fall between those in SF_4 (also shown) in which the formal bond orders are 1.0 and 0.5.

Many more interesting observations can be made using these simple valence descriptions. For example, based on a consideration of the formal charges, what would you expect for the structure of PF_3Me_2 ? Also, the structures of other less trivial hypervalent molecules, such as IF_5 , IF_7 , XeOF_5 , and InCl_5^{2-} , can be rationalised.⁸

THE ABSENCE OF FIRST-ROW HYPERVALENT COMPOUNDS

Let's now address the third question: Why don't the first row elements form hypervalent compounds? A simple answer is that they do! A few examples are shown in Figure 7.⁹ Although the Au clusters are not hypervalent, having 8 valence electrons, they do cause a hybridisation problem for those who insist on using *d* orbitals—there are no low-lying *d* orbitals.

A better question is: why are there so few hypervalent compounds of the first row elements? The answer to this lies in the very small size of the first row elements (Figure 8) and their high electronegativity (Figure 9). Both of these factors disfavour the formation of hypervalent compounds, the first

on obvious steric grounds and the second on electronic grounds. (Recall that the formal charge on the Xe atom in XeF_2 with only one 3-centre 4-electron bond, is $+4/3$.)

We can also explain the stability of CCl_4 to water versus that of SiCl_4 , which readily hydrolyses with water. The conventional explanation is that Si is able to expand its valence shell by using low-lying d orbitals, thus allowing the attack of water at the Si atom. A more correct explanation is that the small size of the C atom, and its higher electronegativity, prevents attack of a water molecule at the C atom.

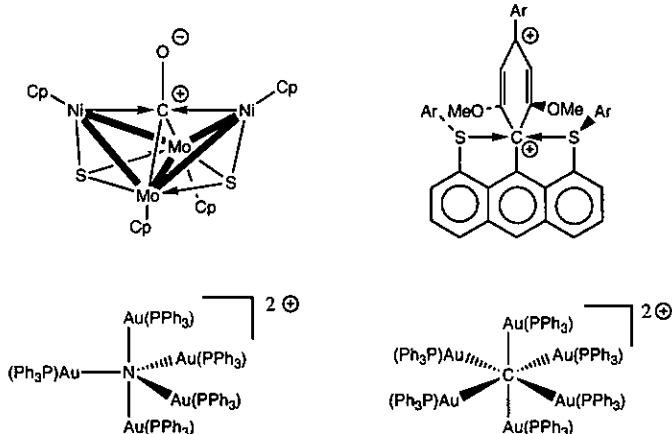


Figure 7. Five and six coordinate compounds of C and N

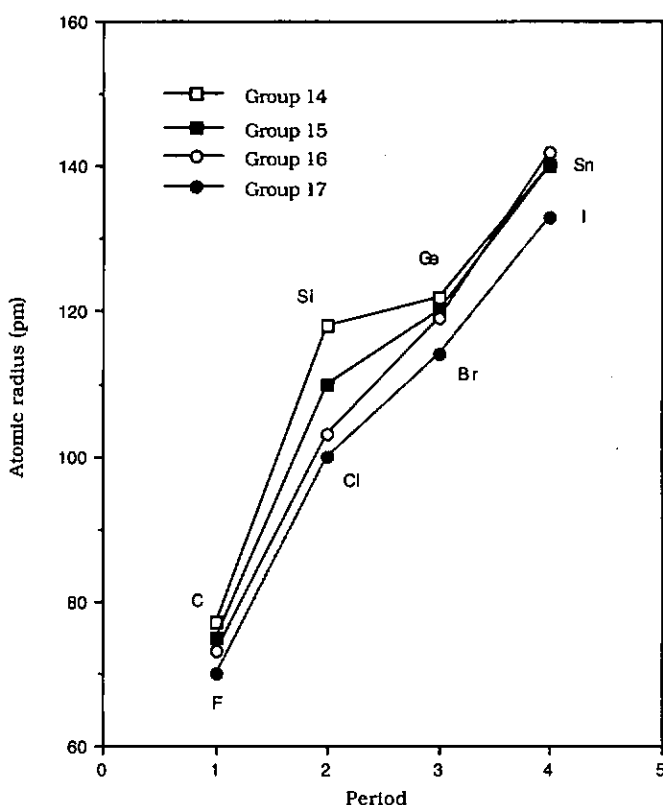


Figure 8. Atomic radius versus period for the main group elements

BACK-BONDING TO THE SECOND-ROW ELEMENTS

Two other related areas in which the participation of d orbitals is often invoked are those of the back-bonding ability of phosphines in phosphine-metal complexes, and the reason for the exceptionally strong single bonds of O and F with the second row elements Si, P and S. Why, for example, do we get SO_4^{2-} but not OO_4^{2-} ?

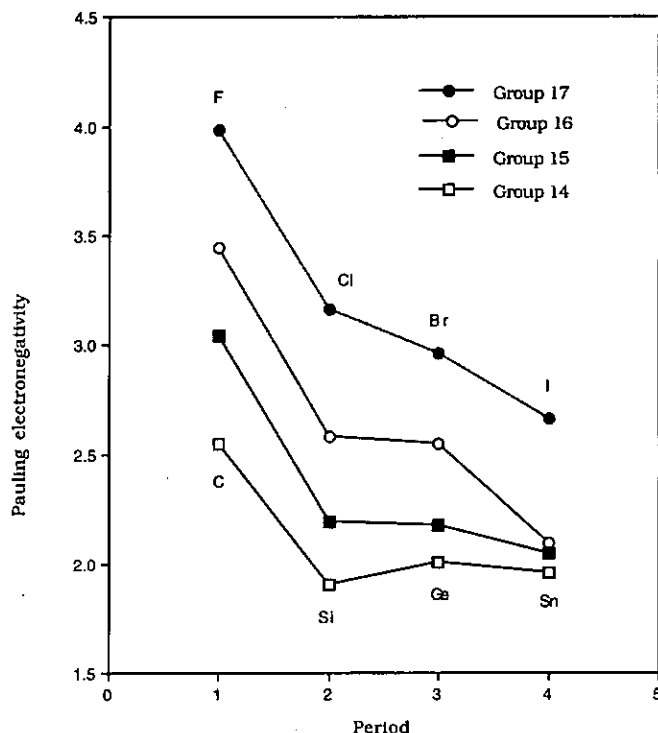


Figure 9. Electronegativity versus period for the main group elements

The conventional answer is that back-bonding occurs from filled metal d orbitals, or O or F p orbitals, into empty $3d$ orbitals on the Si, P or S atom (Figure 10(a) and (b)). Again, it has been found that d orbitals are not involved beyond a polarisation function. Instead, it appears that low-lying σ^* orbitals are involved (Figure 10(c)). In the case of the first row elements these σ^* orbitals are not low lying, and in the case of the third and later row elements the longer bond distances result in poorer overlap between the bonding orbitals (though still significant compared to that of the first row).

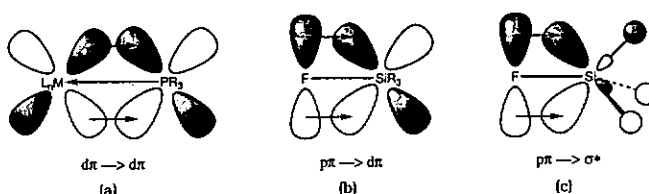


Figure 10. Back-bonding to the second-row elements via d orbitals (a and b) and via σ^* orbitals (c)

In the case of SO_4^{2-} versus OO_4^{2-} , because the octet rule is **not** broken we should draw the valence picture as shown in Figure 11. For SO_4^{2-} , the high positive charge on S can be reduced by back-bonding from the O atoms. This would not be possible, however, with the more electronegative central O atom in OO_4^{2-} .



Figure 11. Valence bond pictures of SO_4^{2-} and a hypothetical OO_4^{2-} species

CONCLUSIONS

The demise of *d* orbitals in main group bonding has been slow (a number of otherwise respectable texts, which should remain anonymous, still use them), but the tide has turned. The development of simple valence pictures and bonding rules, such as those introduced here, will undoubtedly speed up the process.

REFERENCES

1. Lewis, G N, (1923). Valence and the structure of atoms and molecules; Chemical Catalog Co.: New York
2. Gillespie, R J (1972). Molecular Geometry; Von Nostrand-Rheinhold: London.
3. Reed, A E, Weinhold, F J, (1986). *Am. Chem. Soc.*, **108**: 3586.
4. Magnusson, E J, (1990). *Am. Chem. Soc.*, **112**:7940.
5. Coulson, C A, (1969). *Nature*, **221**: 1106.
6. Rundle, R E J, (1963). *Am. Chem. Soc.*, **85**:112.
7. Albright, T A, Burdett, J K, Whangbo, M -H, (1985). Orbital Interactions in Chemistry; Wiley: New York.
8. Curnow, O J, manuscript in preparation.
9. (a) Grohmann, A, Riele, J, Schmidbaur, H, (1990). *Nature*, **345**:140.
(b) Forbus, T R, Martin, J C J, (1979). *Am. Chem. Soc.*, **101**: 5057.
(c) Li, P, Curtis, M D J, (1989). *Am. Chem. Soc.*, **111**:8279.

Following the publication of the above article (*CHEM NZ* No. 61 (November 1995)), the following correspondence ensued ... *Ed.*

The Editor
CHEM NZ

Dear Sir

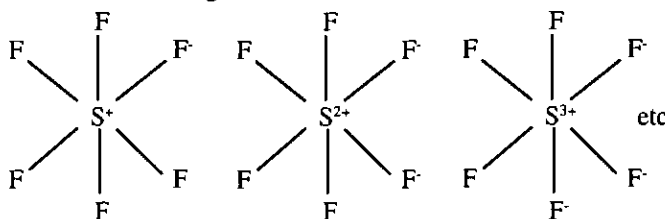
Hypervalent Molecules and the VSEPR Theory

In a recent issue of *CHEM NZ* Owen Curnow¹ states that "... it is a misconception that VSEPR says anything about the number of valence shell electron pairs: it only says what the geometric distribution of the substituents and one pair is likely to be once the nature of the bonding has been established." This statement is incorrect in several ways. VSEPR is based directly on Lewis structures and, as I state in my recent book,² "... the arrangement of the covalent bonds around an atom depends on the total number of electron pairs in the valence shell of an atom including those that are non-bonding or lone pairs". Moreover, the VSEPR theory is independent of any orbital bonding model – it depends only on knowing the Lewis structure – so it is not necessary to establish the nature of the bonding before using the VSEPR theory. Most introductory text books use the VSEPR theory to predict the shapes of some simple molecules before discussing the bonding in terms of orbitals. Indeed in many cases a suitable set of hybrid orbitals cannot be constructed until the geometry of the molecule is known either from experiment or from the VSEPR theory. In general orbital models are useful for describing the bonding but not for predicting the geometry.

Lewis structures of hypervalent molecules such as PF₅ and SF₆ show that they have five or six electron pairs in their valence shells and are therefore exceptions to the octet rule. Lewis

himself pointed out these exceptions. He did not regard the octet rule as a law of nature but as an empirical rule based on the observation that in the majority of molecules each atom, except hydrogen, has eight electrons in its valence shell. Indeed he regarded the "rule of two" – the tendency of electrons to be found in pairs as more important than the "rule of eight" as he called the octet rule. It is only more recently that the octet rule seems to have been transformed into a law of nature so that many chemists seem to feel that they must show that there really are no exceptions.

There is no mystery about the bonding of hypervalent molecules. The bonds are polar covalent bonds, in which the bonding electron pair is unequally shared. Thus the bonds in PF₅ and SF₆ are polar covalent bonds just like those in CF₄, for example. The problem is that there is no completely satisfactory way of representing this polarity using Lewis structures. We can either add δ⁺ and δ⁻ signs to the bonds or we can use resonance structures involving ionic bonds as in



but there is no need to assume that we must limit the number of "pure" covalent bonds to four to obey the octet rule. Depending on the polarity of the bonds we might need contributions from structures with five or even six covalent bonds or contributions from structures with only two or three such bonds. Unfortunately we have rather little information on just how ionic these bonds are so we do not really know what mixture of structures to use.

The question of to what extent *d* orbitals are needed to describe the bonding also depends on the polarity of the bonds that we are trying to describe. If there is equal sharing then to describe the bonds in SF₆ using either valence-bond theory or molecular-orbital theory we need to use 6 orbitals on S so we need two *d* orbitals. But if the bonding is polar then we made use of fewer orbitals on S by fully occupying one or more F orbitals. In the extreme case of fully ionic bonding S⁶⁺ 6F⁻ we would not need any orbitals on S as all twelve electrons would be in F orbitals.

Models such as the 3-centre 4-electron bond are approximate and unnecessarily complicated and lead to inaccurate or at least very approximate conclusions. For example, it is predicted that the axial F atoms in PF₅ carry a charge of -1/2 while the equatorial fluorines have a zero charge whereas all the F's have a negative charge. Moreover this model suggests a larger difference in axial and equatorial bond lengths than is observed. This difference in bond lengths is a necessary result of the nonequivalence of the axial and equatorial positions in a trigonal bipyramid and the resultant greater repulsion felt by the axial pairs than by the equatorial pairs. There is no need to assume that the axial and equatorial bonds are different in character. The difference in length between axial and equatorial bonds would be expected to decrease with increasing size of the central atom as the interelectronic repulsions become smaller, and recent work by Seppelt has shown that the bond lengths in Bi(CH₃)₅ are all the same.³ In general all types of orbital models are after the facts *descriptions* of bonding based on known geometries – and are not explanations of molecular geometry. The VSEPR theory is

the only simple theory by which molecular geometry can be predicted – it depends only on the Lewis structure and is independent of any more detailed description of the bonding.

References

1. Curnow, O J (1985). *CHEM NZ*, **61**: 29
2. Gillespie, R J and Hargittai, L (1991). *The VSEPR Model of Molecular Geometry*. Allyn and Bacon (Prentice Hall Int.). See also *Molecular Geometry*, Gillespie, R J (1972). van Nostrand Reinhold (London) and the "VSEPR Model Revisited", *Chem. Soc. Rev.* **59**. (1992).
3. Seppelt, K (1994). *Angew Chem. Int. Ed.* **33**: 976.

Ronald J Gillespie, McMaster University, Ontario, Canada

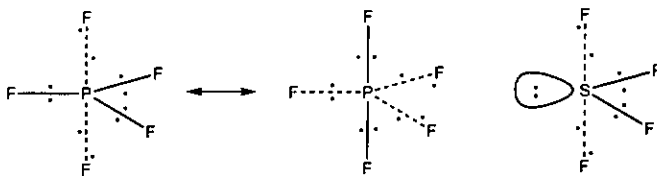
Owen Curnow replies:

I would have to agree with Ron Gillespie that my statement regarding VSEPR is incorrect. It should have read "It is a misconception that VSEPR says anything about the number of valence-shell electron pairs on the central atom; it only says what the geometric distribution of the substituents and lone pairs is likely to be based on the Lewis structure". Gillespie is certainly correct that "VSEPR is the best theory by which molecular geometry can be predicted and that it depends only on the Lewis structure and is independent of any more detailed description of the bonding".

As VSEPR is independent of any more detailed description of the bonding, it can say nothing regarding the whereabouts of the 12 valence electrons of SF_6 , nor does it attempt to. However, once we have recognised that d orbitals must be eliminated from any bonding description, we must limit the number of covalent bonds to S for the simple reason that we are now limited to only four valence atomic orbitals on S (s + three p). Thus there can be only 8 valence electrons on the central atom, at the most, the rest must be on the F atoms. Although we might use the second and third of the ionic valence bond structures drawn above by Gillespie, we cannot use the first because there are not enough valence atomic orbitals on S. Based on the octet rule, we can in fact determine a minimum charge for the S atom as +2. Calculations by Cioslowski and Mixon (*Inorg. Chem.* 1993, **32**, 3209) have shown that the actual charges in hypervalent molecules do not fall below the formal charge that satisfies the octet rule. It is incorrect that a charge of $-1/2$ is predicted for the axial F atoms on PF_5 while the equatorial atoms have zero charge. These are only formal charges, not actual charges.

Yes, the 3-centre 4-electron model is an approximation, but so is any other model. All models have their limitations, but that does not mean they should be discarded. The advantages of the 3-centre 4-electron bonding model are that it is not dependent upon the existence of d orbitals and it can be used to rationalise trends in bond distances based on simple bond order and formal charge considerations. The similarity of the P—F distances in PF_5 (P—F_{ax} = 157.7 pm and P—F_{eq} = 154.3 pm) compared to the very different distances in SF_4 (S—F_{ax} = 164.6 pm and S—F_{eq} = 154.5 pm) can be explained by a simple extension of the 3-centre 4-electron model. In SF_4 , the s orbital is largely tied up in the stereochemically active lone pair and is, therefore, mostly involved in the bonding to the equatorial F atoms. The axial bonds are then best described using a 3-centre 4-electron bond

which uses only the p_z orbital on the S atom. Consequently, the axial bonds are much longer. In PF_5 (and $BiMe_3$) the s orbital is almost equally available for bonding to both the axial and equatorial atoms, thus the similarity in these distances. One can now draw two types of valence bond structures for PF_5 , which both obey the octet rule, but only one for SF_4 :



The ionic valence bond pictures, shown above by Gillespie for SF_6 and originally proposed by Pauling, can also be used to explain the existence of these molecules without using d orbitals, however, they do not as easily rationalise trends in bond distances. I do not believe that the 3-centre 4-electron bond is unnecessarily complicated, we introduce the 3-centre 2-electron bond for boranes at the 2nd or 3rd year of university.

In conclusion, the 3-centre 4-electron model depends upon VSEPR to describe the geometry and VSEPR depends upon the Lewis structure. A simple change to the Lewis structures so as not to exceed the octet rule, and thereby remove any implied necessity for d orbital contributions, does not affect the VSEPR model.

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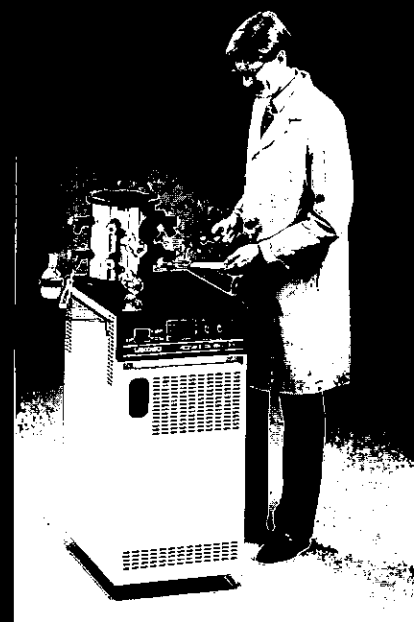


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Patent Proze

by Jane Calvert and Greg Lynch

We began, in the last issue of *Chemistry in New Zealand*, with a brief introduction to the patent system in New Zealand. Before Patent Proze considers some of the aspects of patent law and procedure relevant to New Zealand scientists, we believe it appropriate to say something of the New Zealand Patent Office.

THE NEW ZEALAND PATENT OFFICE

Many of you will be aware that the Patent Office is located in Lower Hutt. Under the auspices of the Ministry of Commerce, it is responsible for the administration of, not only the patent registration system, but also the corresponding systems for trade marks and designs.

With approximately 150 staff, the Patent Office received around 4,500 patent applications, 12,000 trade mark applications and 800 design applications in the year to July 1995. Of the patent applications filed in any year, more than half are for chemistry related inventions. Naturally, not all these new developments in the field of chemistry originate in New Zealand. Most are generated by the large multinational pharmaceutical and agrochemical companies who deem it worthwhile protecting their inventions in many countries including New Zealand. The proportion of local to foreign chemistry related inventions, for which patent protection is sought, has in the last few years been in the vicinity of 6-8%. It is anticipated that this number will steadily increase as the awareness of the value of patent protection among local chemistry researchers grows.

The principal functions of the Patent Office, insofar as patents are concerned, are as follows:

- to examine patent applications and grant patents when all the requirements of patent law have been met,
- to provide public records of granted patents, and
- to make technical information available to the New Zealand public.

Examination of patent applications is conducted by Patent Office examiners skilled in a relevant area of technology (chemistry, electronics, physics, biotechnology, engineering) and knowledgeable in the aspects of patent law concerned with

the patentability of novel developments. Patent attorneys acting for an applicant for a patent correspond with examiners on a day to day basis sharing the common goal of ensuring a patent application meets the requirements of New Zealand patent law thus providing strong protection for the applicant's invention.

A wealth of technical information is held by the Patent Office in its library. This library is open to the public. Accessible are most published patent specifications from Australia, Great Britain, Europe, United States and, of course, New Zealand. Furthermore, the library maintains an index of abridgements of all published New Zealand patent specifications. This index is particularly useful for conducting searches to ascertain whether or not a possible invention has already been the subject of a New Zealand patent.

A further function of the Patent Office is the publication of a monthly journal incorporating an abstract of every New Zealand patent application which has been accepted in the past month. The Patent Office Journal is therefore a valuable source of recent developments in many areas of technology. Some developments may not have been published earlier in the general scientific literature.

DID YOU KNOW?

- That New Zealanders per capita file more patent applications than any other nationality except for the Swiss.
- That the inventor of the highly successful VELCRO hook and loop fastener went on to invent a somewhat less successful asparagus peeler.
- That the artificial sweetener aspartame was a serendipitous discovery by a research chemist who courageously licked a finger while investigating small peptides for an unrelated purpose.

If you have any queries regarding patents, or indeed any form of intellectual property, please direct them to:

Patent Proze,
Baldwin, Son & Carey
P O Box 852, Wellington
Email: @bscwlg.baldwins.co.nz



Jane Calvert

Jane Calvert and Greg Lynch are both employed in the patent department of Baldwin, Son & Carey, Patent and Trademark Attorneys, and Solicitors, where they specialise in chemistry patents. Jane joined Baldwins after completing a PhD in chemistry at Canterbury University in 1994. Greg also joined Baldwins in 1994 after three years research at Industrial Research Ltd in Wellington. Following completion of a PhD in chemistry at the University of Otago in 1989, he spent a two year period as a post doctoral researcher at Oxford University.



Greg Lynch

Chemistry at the University of Otago: 125 years old

David V Fenby, Department of Chemistry, University of Otago,
P O Box 56 Dunedin

NATURAL SCIENCE AT OTAGO

The University of Otago was established by the provincial government in 1869. In public debate preceding this event, the role of science was conspicuous, and James Macandrew, the provincial Superintendent, wanted to see a school of mines and of agricultural chemistry in the new institution. Natural science was not one of the three chairs established by the university council at its first meeting (10 November, 1869). The council claimed that the funding was inadequate to establish such a chair, and asked for a subsidy from the provincial government to enable it to do so. This was eventually agreed to, and the university council advertised a chair in natural science, specifying that preference would be given to candidates able to teach chemistry and mineralogy, and the applications of these sciences to agriculture and mining.

JAMES GOW BLACK (1835-1914)

On 22 February, 1871 James Gow Black was unanimously chosen from a list of 23 applicants for the chair of natural science. He and his family arrived in Dunedin at the end of 1871.

Black, "the son of a poor highland crofter", came to New Zealand with qualifications from the University of Edinburgh [MA(1864), BSc(1867), DSc(1869)] and about 20 years of teaching experience. The practical application of science was the central focus of his career. His two books, "Chemistry for the gold fields" (1885) and "Lectures on agricultural chemistry" (1895), were manuals as well as textbooks.

During his first two academic years at the University of Otago (1872 and 1873), Black's class included chemistry, geology and mineralogy. By 1877 he was professor of chemistry and mineralogy, and soon afterwards, with the establishment of the School of Mines, professor of chemistry, a position that he held until his retirement in 1911.

Black was first and foremost a teacher and populariser of science; he was not active in research. Following the success of a lecture series that he gave in Lawrence in 1884, he spent the following three long vacations touring the gold fields of New Zealand. These tours encouraged the establishment and development of many local schools of mines.

125TH JUBILEE CELEBRATIONS

To mark this occasion, the Department of Chemistry will hold an informal get-together for graduates and staff on Saturday, 7 December, 1996, following the NZIC Conference, which will be held in Dunedin on 2-6 December 1996. The main function will be a dinner on the Saturday evening at University College, but there will also be an opportunity to visit the Chemistry Department


All those interested in this informal reunion should contact:

Mrs Diana Evans
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University of Otago
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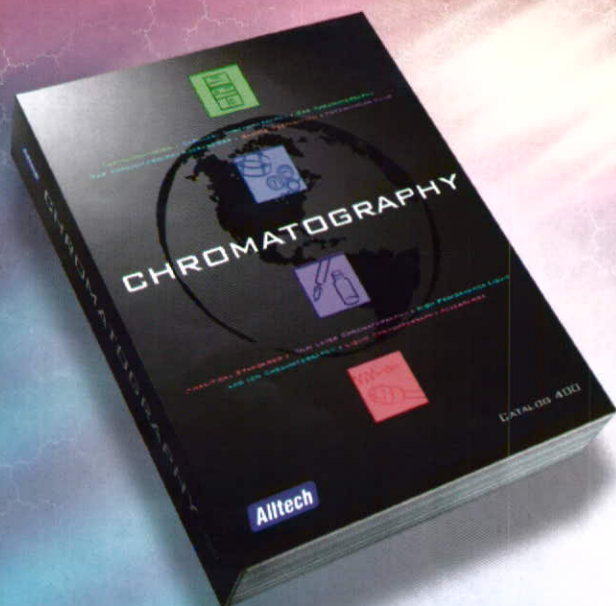


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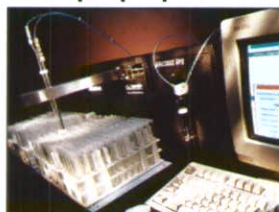


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NEW AUTOMATIC DENSITOMETER

A.i. Scientific has just released the MiniDens, an instrument for the automatic determination of the absolute density of solid and liquid samples in the range of 0.5 to 5 gcm⁻¹ from Grabner Instruments. It is designed to handle solids like asphalts, plastics and other compounds that cannot normally be injected into a standard densitometer. Measuring the weight and volume of a sample in a small aluminium container, MiniDens uses these values to calculate the density. Weight is measured by a built in standard scale. The volume is determined by measuring the pressure change after subjecting the sample in a closed volume when expanded by a precision piston drive for approximately 20 kPa. The MiniDens requires only 6 mL of sample for complete measurement, has a typical measuring time of only one minute and can be powered by a car battery for field use.

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NEW AMMONIA MONITOR FOR POWER PLANT

A.i. Scientific have introduced the new ASA-400 ammonia analyser from Applied Analytics to be utilised in the monitoring and control of ammonia slip (0 to 20 ppm) in DeNO_x units at power plants. The reduction in the amounts of certain chemicals released to the atmosphere as a result of a combustion process, is required to comply with the Clean Air Amendment of 1990. Among the specified components are the nitrogen oxides, found to be related to the formation of acid rain and ground level ozone (smog). The heart of the new ASA-400 is the third generation solid state diode array spectrophotometer – the OMA 517. The implementation of a hyphenated technique GC-UV allows for simultaneous measurement of ammonia in the presence of high concentrations of SO₂. Several different processes have been developed and applied in worldwide locations ranging in process efficiency levels, temperatures, reducing reagents, etc. However, the common factor in all is the need to maintain the ammonia concentration below about 5 ppm for the following reasons:

1. Excessive ammonia concentration pollutes the flue gas.
2. Plugging of heat exchangers by the formation of ammonia bisulfate leads to down-time
3. Contamination of fly-ash and flue gas and desulfurisation of wastewater.
4. Ammonia consumption-cost.

Applied Analytics, Inc. is a Boston-based manufacturer of spectrophotometric process monitors. These analysers are used for a variety of applications in the chemical, petrochemical, pulp and paper, food and pharmaceutical industries.

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NEW AUTOMATED MERCURY ANALYSIS SYSTEM



A.i. Scientific has released the second generation AP/PS200II Mercury and Preparation System from Leeman Labs, a leading manufacturer of instrumentation for elemental analysis. The AP/PS200II Mercury System provides automated digestion and analysis of soils, soil, blood and fish tissue samples. The system employs EPA compliant Cold Vapour Atomic Absorption Spectroscopy (CVMS) to deliver a detection limit as low as 1 ppt. The PS software that runs both the mercury preparation and analysis units from one computer is both intuitive and versatile. While optimum performance is achieved when the digestion unit (AP200II) is combined with the analyser (PS200II), the units are also available separately.

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AUTOMATED CYANIDE SAMPLE PREPARATION SYSTEM

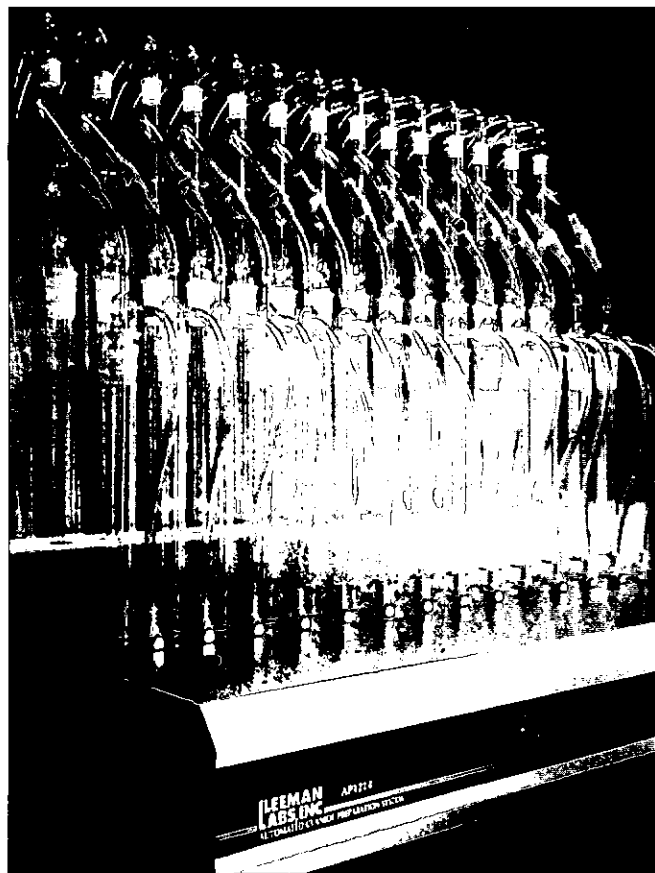
A.i. Scientific has introduced the Leeman Labs AP1214, an automated preparation system for cyanide samples. This system eliminates the labour intensive and time consuming preparation associated with the distillation of cyanide samples. The AP1214 is highly automated, offering one button operation and allows for completely unattended operation of 14 samples simultaneously.

The system consists of a thermostatically controlled heating block, a cold finger trap, 15 sets of MIDI glassware, all water interconnections, a vacuum pump, and proprietary 14 channel mass flow controller module. The compact design of the MIDI system allows for simple installation under a standard laboratory fume cupboard.

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NEW PRODUCTS

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The MIDI distillation system not only reduces reagent costs but also significantly reduces hazardous waste by 90%. The system can be combined with Leeman Labs' PS1214 automated cyanide analyser, which utilises an EPA-compliant colourimetric measurement technique. It is a dedicated flow injection analyser for free and total cyanide offering a detection limit of 5 ppb, a random access autosampler and a throughput of 30 samples an hour.

The AP/PS1214 combination provides unparalleled performance, convenience and reliability in the preparation and analysis of cyanide.

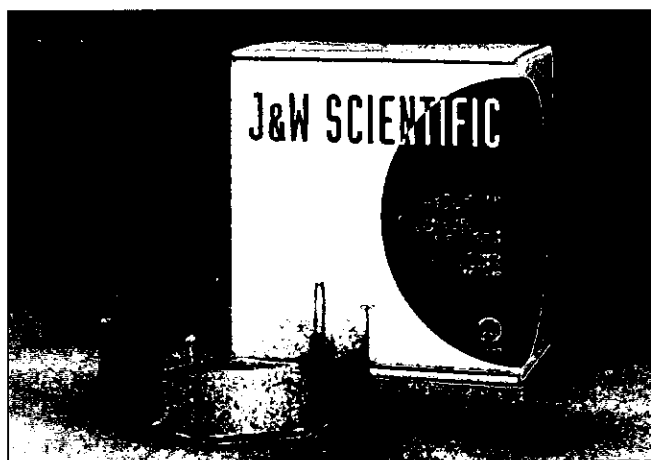
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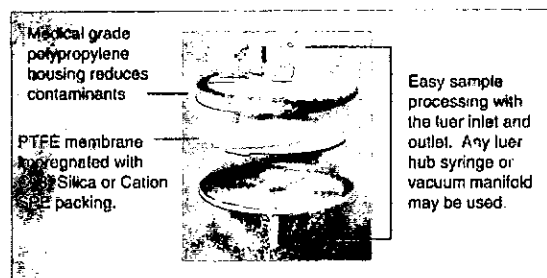
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This 16-page quarterly newsletter (Vol.10, No. 2) includes GC application notes for foods and flavours, environmental and industrial chemical analyses and drugs of abuse.

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Available exclusively from Alltech, Jade Valves eliminate septum bleed in the inlet volume. No septum – no bleed! With nothing to wear out or degrade, the Jade Valve will last the lifetime of your GC. You'll bend fewer needles, suffer less frustration as the insertion force of a Jade Valve is much less than a septum. You'll save money! No changing septa at the end of each day and no lost analyses from septum leakage. Overnight and weekend autosampler runs become routine with the cost-effective Jade Valve. Finally inlet temperatures to 400 °C can be used without bleed or degradation.

Contact: Alltech Associates Inc.
P O Box 100-352 NSMC, Auckland
Ph: (09) 4443230, Fax: (09) 4442399, Freephone: 0800 - ALLTECH
circle number 33 on the reader reply card

PE NELSON TURBOCHROM AND ALLTECH

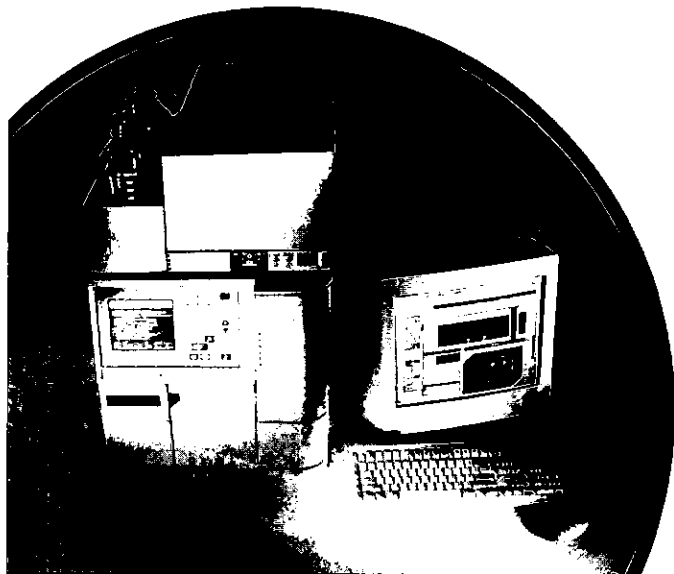
Alltech wish to announce their appointment as distributor for Perkin Elmer HPLC, Brownlee columns and PE Nelson data systems in New Zealand. PE Nelson pioneered the concept of uninterrupted data acquisition in the early 1980s with the first desktop data systems. Now, with the TurboChrom work station family of chromatography data systems they have reached the highest level in performance and reliability. TurboChrom easily interfaces with any IC, LC or GC, maintaining data collection during PC or Network failure. Priced at integrator-like pricing, TurboChrom is an easy-to-use Microsoft® Windows-based graphical user interface to your data. TurboChrom Entry Level (EL) is a new member of the TurboChrom family with the outstanding features that has made TurboChrom the *Scientific Computing and Automation* "Readers Choice Award" winner for 1996, the fourth year in a row. Pick a Winner with Alltech and PE Nelson TurboChrom Entry Level.

Contact: Alltech Associates Inc.
P O Box 100-352 NSMC, Auckland
Ph: (09) 4443230, Fax: (09) 4442399, Freephone: 0800 - ALLTECH
circle number 34 on the reader reply card

ALPHATECH PROUDLY INTRODUCES THE NEW ALLIANCE SYSTEM FROM WATERS

For years, major instrument suppliers have been gradually improving their HPLC systems. Yet fundamental system design has remained basically unchanged. Perhaps this is why the prevailing attitude is that maximum performance and reliability

have been reached. Today, Waters challenges that attitude, and sends HPLC in a bold new direction. A direction inspired by a fresh perspective and innovative technology, and grounded in a thirty year dedication to HPLC excellence. Introducing the Alliance line of HPLC systems.



Alliance differs from conventional HPLC in several important areas. And it is these differences that help Alliance give you more confidence in your results than any HPLC system before it. They make Alliance easier to use and maintain. More compact, more flexible, and more reliable.

Key to the Alliance concept is the Waters 2690 Separations Module – the industry's first HPLC system platform that combines solvent and sample management. The functional integration of a new design for solvent delivery with the world's most respected autosampler means consistent performance, enhanced reproducibility and higher quality results.

Alliance is designed to meet the needs of all chromatographers. Integrated solvent and sample management provides optimised control over the fluidic process of HPLC, while allowing the flexibility to meet the specific requirements of users in different laboratory environments.

Contact: Alphatech Systems Ltd & Co.
P O Box 37-583 Parnell, Auckland
Tel: (09) 3770392, Fax: (09) 3098514
circle number 35 on the reader reply card

DRYLAB® – INNOVATIVE MODELLING SOFTWARE FOR CHROMATOGRAPHY FROM LC RESOURCES

You should be using DryLab if chromatography is part of your job. Separations have never been easier. DryLab gives you more information about your separations than you would ever learn through competitive runs on your instrument. Chromatographers who use DryLab consider it a necessity.

What can DryLab do for me? To put it simple, DryLab streamlines and speeds the process of developing good methods

NEW PRODUCTS

by letting you rapidly model changes in separation conditions on a personal computer. DryLab eliminates expensive, time-consuming laboratory runs. Instead, you get instantly generated chromatograms that correspond to the conditions you've chosen. These detailed results are based on tested algorithms applied to data from two or three scouting runs on your chromatograph.

Contact: Alphatech Systems Ltd & Co.
P O Box 37-583 Parnell, Auckland
Tel: (09) 3770392, Fax: (09) 3098514
circle number 36 on the reader reply card

LOW COST, TOTALLY INTEGRATED LIQUID CHROMATOGRAPHY SYSTEMS FROM D-STAR INSTRUMENTS

Designed to meet even the smallest scholastic budget, D-STAR Instruments introduces the first of its new line of totally integrated HPLC systems at prices thousands of dollars less than equivalent, competitive systems. The LC-10 is a complete HPLC system including detector and flowcells available for industrial as well as biocompatible analytical or preparative applications. The LC-10 is fully equipped with a high pressure isocratic pump PAEK injector valve (stainless steel is an option), and a biocompatible UV-Visible detector.

The pump's PEEK construction permits the instrument's use for biochemical as well as industrial analytical applications. Because of the systems's relatively low price compared to all other isocratic systems currently available, the instrument is ideal for undergraduate and scholastic use where a basic understanding of chemistry, and in particular chemical instrumentation, is being taught. This system's simple operation is straightforward, yet provides a scholastic challenge to the student. The small footprint of the instrument and its relatively light weight permits its transportability. This is ideal for environmental field testing, as well as quality control procedures and dedicated industrial processes.

Contact: Alphatech Systems Ltd & Co.
P O Box 37-583 Parnell, Auckland
Tel: (09) 3770392, Fax: (09) 3098514
circle number 37 on the reader reply card

ALPHATECH OFFERS HPLC COMPUTER-BASED TRAINING FROM HPLC TECHNOLOGY LTD

HPLC Technology Ltd have used their extensive knowledge of HPLC training, gained through many years of holding both Beginners and Troubleshooting residential courses, to develop a computer-based interactive training package. The HPLC training package provides the user with a powerful means of learning about the rudiments of HPLC theory and practice.

Key features include:

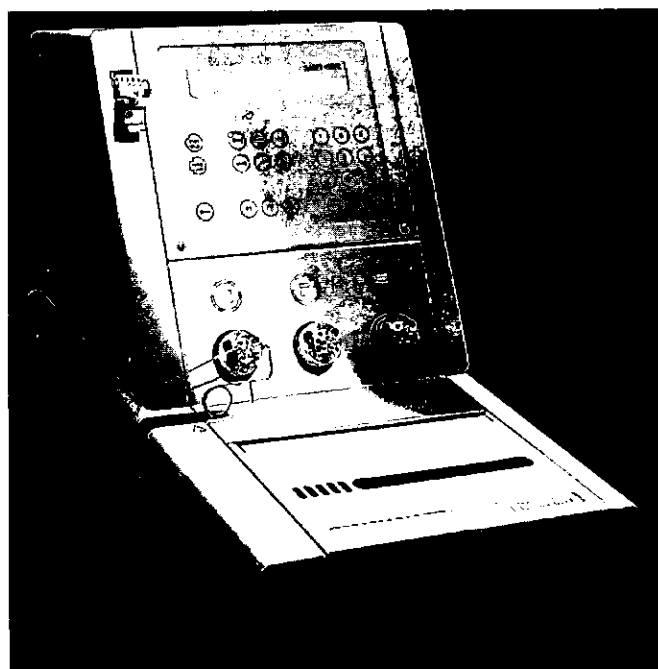
- Colourful, highly animated graphics.
- Fun to use.
- Requires no computer knowledge.
- Scrolling text is always accompanied by pictorial

presentations (no full screens of text!)

- Faster and more effective method of training (working through manuals is notoriously SLOW!)
- Trainees can choose as much time as they require in the programme, return or skip to key sections for refresher sessions.
- "Mouse" used for fast and simple access and movement around the package.

Contact: Alphatech Systems Ltd & Co.
P O Box 37-583 Parnell, Auckland
Tel: (09) 3770392, Fax: (09) 3098514
circle number 38 on the reader reply card

ALPHATECH INTRODUCES PROSPEKT FROM SPARK HOLLAND



Spark Holland, a leading manufacturer in the field of HPLC sample handling technology is represented by Alphatech Systems. Spark Holland has in its product range the Prospekt, a dedicated system for automated on-line solid phase extraction.

Solid Phase Extraction (SPE) has rapidly evolved to become one of the most popular methods for sample clean-up today. Based on well known chromatographic principles, SPE is easily performed, typically provides superior results, and will continue to replace traditional liquid-liquid extraction. As the use of SPE increases, a growing number of analysts seek increased productivity through automation. SPE can be automated using robotic type sample processors; however, for SPE followed by HPLC, there is a much more efficient alternative! With the Prospekt, the extraction cartridge is switched directly into the mobile phase flow path of the HPLC system, via a high pressure valve. The purified analytes elute directly from the SPE column onto the analytical column for HPLC analysis, thus eliminating off-line sample transfers including eluate collection, evaporation, reconstitution and injection! This on-line SPE approach offers ruggedness, excellent precision and high sample throughput.

The Propekt combines on-line SPE with automated extraction cartridge exchange, resulting in state-of-the-art SPE-HPLC automation.

Contact: Alphatech Systems Ltd & Co.
P O Box 37-583 Parnell, Auckland
Tel: (09) 3770392, Fax: (09) 3098514
circle number 39 on the reader reply card

NEW GBC AVANTA Σ AA SPECTROMETERS

GBC Scientific Equipment is pleased to announce the latest in totally automated atomic absorption spectrometers. The Avanta Σ is a true double-beam instrument with all operation under computer control, including the burner adjuster, lamp optimisation, wavelength and slit setting and gas control. The Avanta Σ ; is controlled by the latest in Windows 95™ operating software. This new software package, which is also available as an upgrade to the 906, 908, and 909 range of instruments from GBC, offers unmatched power with simplicity of operation. As few as two mouse clicks are all that is required to start collecting results. Enhanced features include comprehensive report writing, multi-tasking, quality control protocols and simplified networking capabilities. Even the footprint of the instrument will be a pleasant surprise at just 86 x 55 cm: small enough to fit in even the most crowded laboratories. The Avanta Σ really is the sum of all other atomic absorption spectrometers.

Contact: GBC Scientific (NZ)
P O Box 68-330, Newton, Auckland
Ph: (09) 3735765, Fax: (09) 3600683, Freephone/fax: 0800 428428
circle number 40 on the reader reply card

NEW ENHANCEMENTS TO THE HP 6890 SERIES GC SYSTEM STRENGTHEN SENSITIVITY AND PERFORMANCE

Medtec Products Limited is pleased to announce that Hewlett-Packard Company has announced enhancements to its integrated gas chromatography (GC) system that strengthen the system's sensitivity, detection limits, and performance.

Enhancements to the HP 6890 Series GC include the following:

- a programmable temperature vapourising (PTV) inlet that accommodates large-volume injections and decreases sample decomposition;
- a volatiles interface for trace-level detection of pre-vapourised samples;
- a cryo-focus option that cools down a short section of the capillary column to refocus the analytes on the column;
- a micro electron-capture detector (ECD) that provides method linearity in the CPL concentration range, increases linearity overall, offers higher sensitivity and less susceptibility to dirty samples;
- a single- or dual-signal flame photometric detector (FPD) for the detection of sulfur, phosphorous, tin or other elements;
- local area network (LAN) communications and control from the HP ChemServer 4930;
- an open interface module for easy connectivity and seamless

integration of customised solutions into the HP 6890 series GC system;

- an improved automatic liquid sampler that offers greater flexibility by providing more injection parameters, fast tray speed, large-volume injections and an injector turret that can accommodate up to eight samples.

PTV Inlet Provides Greater Sensitivity for GC and GC/MS

The HP PTV inlet is a temperature-programmable split/splitless inlet that can handle large injection volumes. With the HP 6890 series Automatic Liquid Sampler (ALS) with enhanced parameters, it is possible to deliver 25 μ L with a single injection and much larger volumes using multiple injections. A Gerstel Large Volume Injector (LVI) is available to handle still greater volumes. The PTV inlet can be cooled to -70 °C using liquid carbon dioxide or to -160 °C using liquid nitrogen. It can be heated up to 450 °C in up to three ramps, with heating rates as fast as 12 °C/min. The pneumatics for this inlet are controlled electronically. The inlet is available with a septum-less or a septum-containing head.

With the HP PTV inlet, it is possible to concentrate the sample in the injection port. This not only enhances sensitivity but can also save time on sample preparation. The HP PTV inlet lets chromatographers inject large sample volumes at temperatures that vapourise only the solvent, not the analytes of interest. After the solvent has evaporated, the inlet can be heated to an appropriate temperature to release the analytes into the separation column. This injection technique is much gentler to the sample than a regular split/splitless inlet. It is therefore also beneficial when analysing thermally labile compounds.

One area in which the HP PTV inlet is beneficial is in water analysis. As drinking-water requirements become more stringent, minimum detectable levels go down, and higher sensitivity is needed. By taking advantage of the larger sample volume capacity, chromatographers can inject larger sample volumes and cut back on time-consuming sample concentration steps without sacrificing the quality of their analytical results.

Volatiles Interface Optimised for Gas-phase Samplers

To help ensure optimal interfacing between the HP 6890 series GC system and virtually any kind of gas-phase sampling system, HP designed a new volatiles interface that offers minimum dead volume and excellent inertness. The HP volatiles interface is ideal for applications requiring trace level detection of pre-vapourised samples, especially headspace analysis, purge and trap analysis, thermal desorption and air toxics analysis.

The inlet typically is configured in direct splitless or split mode. A simple plumbing and flow change provides easy conversion between modes. The small internal volume and Silcosteel (Restek Corp.) deactivation provide minimal solute residence time and maximum inertness. As a result, there is less sample degradation and improved peak shapes. Using the HP volatiles inlet, chromatographers can achieve better sensitivity and more accurate, reproducible quantitation.

NEW PRODUCTS

Cryo-focus Option Enables Exceptionally Sharp Chromatography Resolution

The HP cryo-focus option is a cold trap inside the HP 6890 series GC oven that cools down a short section of the capillary column and uses considerably less cooling reagent than other alternatives. It can be used either for head-of-column trapping or for trapping after a precolumn, backflush valve or Dean switch. The HP cryo-focus option is available in two cooling options – liquid nitrogen or liquid carbon dioxide. The temperature of the trap can be programmed from the HP 6890 series GC keyboard and has a low temperature limit of -180°C with liquid nitrogen or -70°C with liquid carbon dioxide.

When used in conjunction with the HP volatiles interface, the HP cryo-focus option can offer a significant increase in minimum detectable levels of pre-vapourised samples, especially for GC and GC/MS applications requiring high quantitative and qualitative performance, such as water-purgeable organics – specifically, volatile organic carbon and air toxics analyses.

Micro ECD Provides More Linearity, Higher Sensitivity and Extended Up-time

The HP micro electron capture detector is a new electron capture detector design that offers lower minimum detectable quantities, a wider linear range and increased tolerance for dirty samples, thereby delivering extended up-time. It complies with the recommended Statement of Work found in the environmental testing industry's contract laboratory program (CLP) guidelines for pesticide analysis (OLM03.0).

With the detector's extended linearity, environmental laboratories are expected to be able to run more billable samples in the same amount of time. More robust performance also means less maintenance and potentially fewer extraneous sample preparation steps.

Single- or Dual-signal FPD Increases Range of Detectors on HP 6890 System

The HP flame photometric detector is available in two configurations – the single-signal version and the dual-signal version. The flame photometric detector (FPD) makes it possible to detect sulfur and/or phosphorous containing analytes, either simultaneously or sequentially, depending on the detector option. Using different optical filters, the FPD also can be configured to detect other elements, such as tin.

LAN Connection to the HP ChemServer 4930

The HP 6890 series GC system now can communicate with the HP ChemServer 4930 over a LAN connection. The HP ChemServer 4930 can acquire and process data from the HP 6890 series GC system. Essential GC parameters can be controlled by the HP ChemServer as well. This connectivity makes it easy to integrate GC data into the laboratory's control and information management systems.

Greater Connectivity, Flexibility and Productivity Broaden HP 6890 Use

Recognising that many laboratories have specialised needs, HP developed an open-interface module, which provides easy

connectivity to the HP 6890 series GC and seamless integration of customised solutions and applications developed by third parties. Further functionality is afforded by the HP automatic liquid sampler (ALS) with enhanced parameters, which improves the up-time and performance of the GC system.

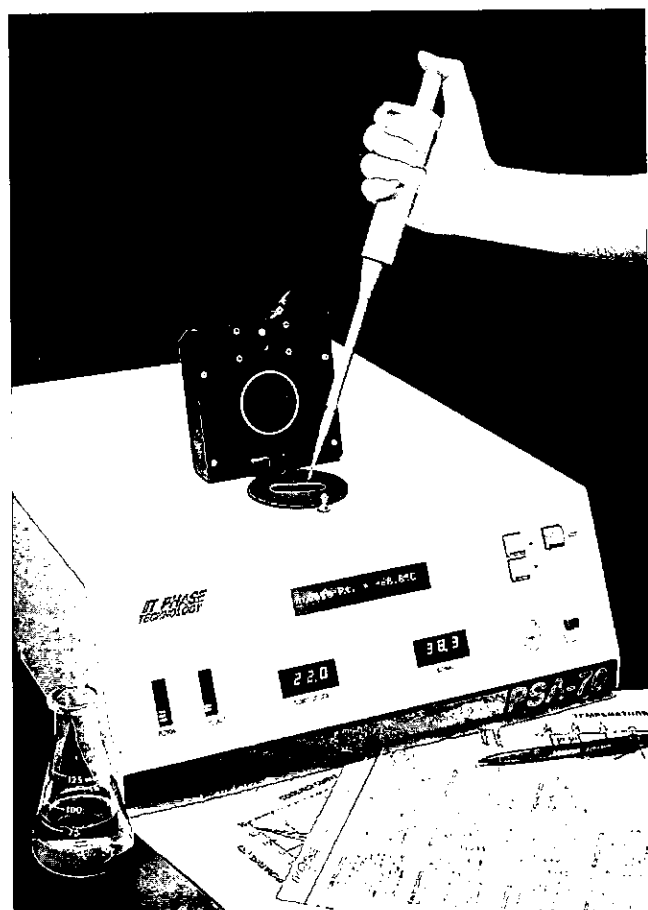
The new features of the ALS offer more flexibility for injecting larger volumes as well as greater control over parameters, such as variable pre- and post-injection dwell time and plunger speed. These allow the chromatographer to replicate manual injection techniques more closely. Variable needle depth within the vial permits sampling of individual liquid layers as well as access to very small sample volumes.

To increase productivity, an eight-sample injector turret yields significantly better throughput than the standard three-sample turret. For even higher throughput, a 100-vial ALS tray can be used. The tray has been optimised to transport vials twice as fast as previous models.

Information about HP analytical products and services can be found on the World Wide Web at <http://www.hp.com/go/chem> or by contacting:

Medtec Products Limited
P O Box 34-241, Birkenhead, Auckland
Ph: (09)4806763, Fax: (09) 4806386
circle number 41 on the reader reply card

PHASE TECHNOLOGY ACHIEVES ASTM APPROVAL



NEW PRODUCTS

Phase Technology analysers for cloud point, pour point and freeze point measurements of petroleum products have been approved by ASTM. This is the first time in over seventy years that ASTM allows the use of automatic instruments in these measurements. The cloud point method, ASTM D 5773, is scheduled to be published in the 1996 ASTM Standards Volume 05.03. The title is "Standard Test Method for Cloud Point of Petroleum Products (Constant Cooling Rate Method)". This method offers the highest precision of all the methods evaluated in an ASTM round robin study, documented in Research Report ASTM RR:D02-1373. It states a repeatability of 0.5 °C and reproducibility of 2.6 °C and is also the only automatic method which showed no bias in comparison with the manual method D 2500.

The method for the freeze point function is ASTM D 5972, "Standard Test Method for the Freezing Point of Aviation Fuels (Automatic Pressure Pulsing Method)". This method offers precision that is approximately twice as good as the manual method and there is no bias relative to the manual technique.

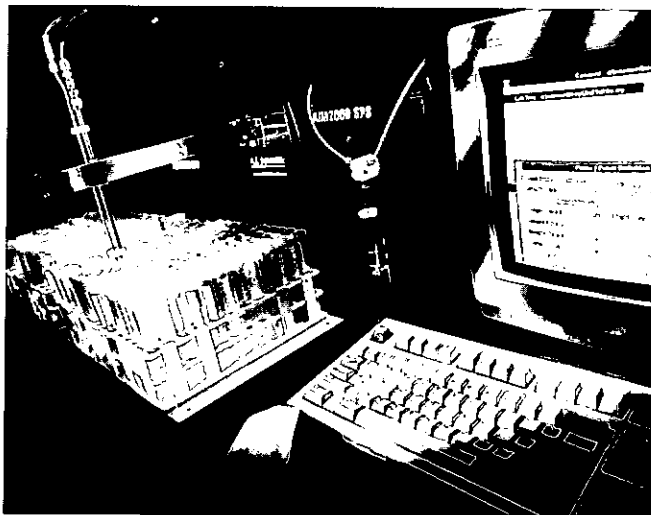
The pour point function is ASTM D 5949, "Standard Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)". This approved automatic method offers better reproducibility and repeatability than the manual

method D 97. For a wide range of petroleum products studied in an ASTM inter-laboratory program, no bias relative to the manual method was observed. Phase Technology's on-line freeze and cloud point analysers use the same technology as the ASTM approved laboratory instruments and have been welcomed by the refining industry. Since their introduction in 1995, all the installations have been extremely successful. This new series of analysers was highlighted in *HP Innovation*, Hydrocarbon Processing magazine, May 1996 issue. It was selected by the HP editorial panel because it met the criteria of "true industry innovations – a cut above the typical product offerings".

Contact: A.i.Scientific
P O Box 35579, Browns Bay, Auckland
Ph: (09) 4781351, Fax (021) 788940
circle number 42 on the reader reply card

AiM2000-SPS AUTOMATES REPETITIVE DILUTIONS

The AiM2000-SPS is a high capacity, high precision, automatic dilution and dispensing system that is manufactured in Australia by A.i. Scientific. The AiM2000-SPS features easy-to-use windows operating software (Concord) that allows for the programming of customised applications. The software provides a robust and flexible controller that allows for easy starting of regularly run routine methods. With a capacity of up to 540 sample positions and 20 standard positions the AiM2000-SPS will cater for the most demanding work schedules. To ensure consistent accuracy a high resolution syringe drive is standard and the syringe aspiration speed can be varied and controlled between runs. With the AiM2000-SPS, samples can be aspirated from any point in the vessel to avoid problems with interference from centrifuged particulates or flocculent. AiM2000-SPS can dispense samples from any height to ensure the probe exterior does not touch the dispensed sample. The flexibility of the AiM2000-SPS allows it to fit easily with a laboratory's existing sample preparation routine and to utilise existing sample racks.



Contact: Kevin Moloney, A.i. Scientific
P O Box 35579 Browns Bay, Auckland
Ph: (09) 4781351, Fax: (021) 788940
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NCRL

NATIONAL CHEMICAL RESIDUE LABORATORY

A laboratory with over 25 years experience and expertise in analytical chemistry, particularly residue analysis.

NCRL provides a comprehensive analytical and consultancy service, including:

- Veterinary Drugs • Pesticides • Herbicides
- Environmental Contaminants • Trace Elements
- Field and Animal Trials • Heavy metals • Vitamins
- Protein & amino acids • Fat fibre and moisture content

The laboratory is well equipped with modern instrumentation, including:

- Atomic Absorption • HPLC • GC • GC/LC-MS
- Audited by US Department of Agriculture and the European Commission.

For further information

Dr John C. Turner - National Chemical Residue Laboratory
Wallaceville Research Centre, P.O. Box 40-063, Upper Hutt.
Telephone (04) 528-0718. Fax (04) 528-0493



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CONFERENCES & SEMINARS

New York, NY 10005, USA
Tel: (+1-212)-2480200
Fax: (+1-212)-2480245
Email: avsnyc@vacuum.org

Fax: (+61-2)-7179268
Email: ainse@ansto.gov.au

20-23 October 1996

International Symposium on Laboratory Automation and Robotics (ISLAR '96)

Venue: Boston Park Plaza Hotel
64 Arlington Street
Boston, MA 02117, USA
Contact: ISLAR '96
Zymark Center
Hopkinton, MA 01748, USA
Tel: (+1-508)-4359500
Fax: (+1-508)-4353439
Email: islar@zymark.com
www: <http://www.zymark.com>

22-25 October 1996

19th International Federation of Societies of Cosmetic Chemists Congress

Venue: Darling Harbour, Sydney, Australia
Contact: Secretariat
P O Box 249 Kingsgrove
New South Wales 2208, Australia
Fax: (+61-2)-5543228
or Peter Strasser
Tel: (+61-3)-93875371

23-24 October 1996

Near Infrared Spectroscopy and Imaging of Living Systems - A Royal Society Discussion Meeting

Venue: London, England, UK
Contact: Science Promotion Section
The Royal Society
6 Carlton House Terrace
London SW1Y 5AG, England, UK
Fax: (+44-171)-8392891
Tel: (+44-171)-8395561

23-25 October 1996

Applications of Membrane Technologies - A Short Course

Venue: University of Auckland, Auckland
Contact: Mr David Robinson
Professional Courses (Engineering)
Centre for Continuing Education
University of Auckland
Private Bag 92019
Auckland
Tel: (+64-9)-3737599 ext 8378 or 7619
Fax: (+64-9)-3737419

10-12 November 1996

Australian Institute of Nuclear Science and Engineering: RADIATION '96

Venue: AINSE Theatre
Lucas Heights, Sydney, Australia
Contact: The Conference Manager, AINSE
PMB 1, Menai
NSW 2234, Australia
Tel: (+61-2)-7173376

12-15 November 1996

Pacific Rim Biotechnology Conference

Venue: Seoul, Korea
Contact: Fax: (+82-42)-8604739

✗ 19-21 November 1996

Joint ICP and New Zealand Trace Elements Groups Conference

Venue: Le Grand Hotel, Victoria Street, Hamilton
New Zealand
Organisor: Waikato Branch, New Zealand Institute of Chemistry, New Zealand Trace Element Group

Topics to be included:

Trace elements - analysis, importance in agriculture, horticulture, health, and the environment.

ICP-MS and ICP-OES - instrumental technique, sample preparation, applications.

The conference will include Plenary Speakers, invited and submitted papers, a trades display and a conference dinner.

Contact: Dr Peter Robinson
R J Hill Laboratories Ltd
P O Box 4048
Hamilton, New Zealand
Ph: (+64-7)-8552266
Fax: (+64-7)-8549886
Email: Peter@rjhill.co.nz

24-27 November 1996

Australian Society for Medical Research, National Scientific Conference

Venue: Gold Coast, Queensland, Australia
Contact: Fax: (+61-7)-38757665

25-29 November 1996

13th International Corrosion Congress

Venue: Carlton Radisson Hotel, Melbourne, Australia
Contact: Conference Secretariat
P O Box 5142, Clayton
Victoria 3168, Australia
Tel: (+61-3)-95440066
Fax: (+61-3)-95435905

2-6 December 1996

NZSBMB/NZIC Joint Conference 1996: "Molecules for the Future"

Venue: University of Otago, Dunedin, New Zealand
Contact: Dr K J F Farnden
Biochemistry Department
University of Otago
P O Box 56, Dunedin, New Zealand
Ph +64-3-4797874
Fax +64-3-4797866
Email: kevinjff@sanger.otago.ac.nz

See details on pages 53-60 for more information.

9-11 December 1996

4th Annual RACI Research and Development Topics In Analytical Chemistry Meeting

Venue: RMIT, Melbourne, Australia

CONFERENCES & SEMINARS

29 September - 4 October 1996

The International Meeting and Exhibition of the Australian and New Zealand Societies For Microbiology

Venue: Christchurch, New Zealand
Contact: ASM and NZSM '96 Secretariat
G P O Box 128
Sydney, NSW 2001, Australia
Tel: (+61-2)-2622277
Fax: (+61-2)-2622323
Email: TOURHOSTS@TOURHOSTS.com.au

3-4 October 1996

The Second Australian Molecular Modelling Workshop (ASBMB/ASPP Satellite Meeting)

Venue: John Curtin School of Medical Research
Australian National University
Canberra, Australia

The Workshop has invited overseas and local speakers presenting review/future directions talks, selected oral papers, posters and software demonstrations. The planned program includes sessions on:

Protein Structure Prediction (1-D to 3-D profiling/threading, sequence analysis, secondary structure prediction, derived 3-D databases and folds, homology building)

Drug Design (molecular similarity, docking, *de novo* ligand design)

Computational Chemistry and Simulations (hybrid quantum and molecular mechanics (qm/MM), conformational searching, protein dynamics, free-energy perturbation/molecular dynamics)

Force Fields and Solvation (force field development, electrostatic potentials, solvation).

Contact: Dr Jill Gready
John Curtin School of Medical Research
Australian National University
Canberra, ACT 0200, Australia
Tel: (+61-6)-2798304
Registration: mmworkshop@jcsmr.anu.edu.au
www: <http://biocomp.anu.edu.au/Wkshops/MolMod>

6-11 October 1996

Australian Institute of Medical Scientists, National Scientific Meeting

Venue: Adelaide, South Australia
Contact: Tel: (+61-8)-2391515

8-11 October 1996

Hands-On Computer Workshop on Molecular Modelling and Bioinformatics of Protein Structure and Function (ASBMB/ASPP Satellite Meeting)

Venue: Computational Science and Engineering Laboratory, Australian National University
Canberra, Australia

The Workshop will focus on developing skills in accessing and analysing database information on protein structure (1-D and 3-D) using molecular graphics and other display tools, manipulating protein structure and investigating protein-protein and protein-ligand interactions, undertaking limited computations (molecular mechanics and dynamics), and using

protein structure prediction methods (1-D to 2-D and 1-D to 3-D). The format will be mostly structured exercises leading into project work chosen within participants' interests. Exercises will be conducted on SGI workstations using commercial software and with net access to external databases and servers. There will be a minimum of lectures to introduce topics. The main targeted participants are research students and postdoctoral workers in experimental biomolecular science.

Contact: Dr Jill Gready
Computational Molecular Biology and Drug Design Group
Division of Biochemistry and Molecular Biology
John Curtin School of Medical Research
Australian National University
Canberra, ACT 0200, Australia
Tel: (+61-6)-2798304
Fax: (+61-6)-2490415
Email: Jill.Gready@anu.edu.au
Registration: mmworkshop@jcsmr.anu.edu.au
www: <http://biocomp.anu.edu.au/Wkshops/HandsOn>

8-11 October 1996

AUSPLAS '96 (Australian Plastics Conference)

Venue: Melbourne Exhibition Centre
Melbourne, Australia

Contact: John Kelly
Exhibition Management Pty Ltd
Melbourne, Australia
Tel: (+61-3)-96464044
Fax: (+61-3)-96461828

9-11 October 1996

Anti-Cancer Targets and Strategies for the 21st Century

Venue: Castres, France
Contact: Marian Cabailh
Conference Secretariat, CRPF
17 Avenue Jean Moulin
81106 Castres Cedex, France
Tel: (+33-63)-714368
Fax: (+33-63)-714299

14-18 October 1996

6th Post-Doctoral Course on Degradation and Stabilisation of Polymeric Materials

Venue: Brighton, England, United Kingdom
Contact: Dr N C Billingham
School of Chemistry and Molecular Sciences
University of Sussex, Brighton
BN1 9QJ, England
Tel: (+44-1273)-678313
Fax: (+44-1273)-677196
Email: N.Billingham@sussex.ac.uk

14-18 October 1996

43rd National Symposium: American Vacuum Society

Topics: Thin Films, Microelectronics, Nanostructures, Processing, Surfaces, and Vacuum
Venue: Philadelphia, Pennsylvania, USA
Contact: American Vacuum Society
120 Wall Street, 32nd Floor

CONFERENCES & SEMINARS

Contact: Marie Bou-Raad
Secretary of the Organising Committee
Tel: (+61-3)-96602557
Fax: (+61-3)-96391321
Email: chem_rd96@bunyip.ph.rmit.edu.au

13-15 December 1996

Second Symposium on Oceanian - Japanese Organic Chemistry Synthesis and Natural Products

Venue: Tokushima Bunri University
Faculty of Pharmaceutical Sciences, Japan

Contact: Associate-Professor Rob A J Smith
Chemistry Department
University of Otago
P O Box 56
Dunedin, New Zealand
Tel: (+64-3)-4797924
Fax: (+64-3)-4797906
Email: rajsmith@alkali.otago.ac.nz

10-14 December 1996

Fifth Eurasia Conference on Chemical Sciences

Venue: Zhongshan (Sun Yatsen) University
Guangzhou (Canton), China

Contact: Professor Liang-Nian Ji
General Secretary, EuAsC₂S-1996
Biotechnology Research Centre
Zhongshan (Sun Yatsen) University
Guangzhou (Canton) 510275, China
Tel: (+86-20)-4185461

or Tel: (+86-20)-4186300-7115
Fax: (+86-20)-4189173 or (+86-20)-4185551
Email: leiy@pebc2ihep.ac.cn

or Professor Charmian O'Connor
Chemistry Department, University of Auckland
Private Bag 92019, Auckland, New Zealand
Tel: (+64-9)-3737999

2-6 February 1997

The Australian and New Zealand Society for Mass Spectrometry 16th Conference (ANZSMS 16)

Venue: University of Tasmania, Tasmania, Australia

Contact: Mures Convention Management
Victoria Dock
Hobart, TAS 7000, Australia
Tel: (+61-002)-312121
Fax: (+61-002)-344464
Email: mures@hba.trumpet.com.au
<http://www.csl.utas.edu.au/ANZSMS/anzsms16.html>

3-7 February 1997

22nd Australasian Polymer Symposium

Venue: Auckland, New Zealand

Contact: Mr N R Edmonds
Faculty of Science and Engineering
Auckland Institute of Technology
Private Bag G P O, Auckland, New Zealand
Tel: (+64-9)-3079999 ext: 8181
Fax: (+64-9)-3079973

9-13 February 1997

1997 Lorne Meeting on Protein Structure and Function

Venue: Lorne, Victoria, Australia

Plans for the meeting will be available on the WWW site:
<http://grimwade.biochem.unimelb.edu.au>

Contact: lorne_orgs@unimelb.edu.au

10-14 February 1997

Microscopy 97. Microscopy New Zealand Conference

Venue: Medical School, University of Auckland
Auckland

Contact: Dr Ian Hallett
HortResearch, Private Bag 92169, Auckland
Tel: (+64-9)-8493660
Fax: (+64-9)-8154201
Email: ihallett@hort.cri.nz

16-20 May 1997

Seventh Asian Chemical Congress

Venue: International Conference Center Hiroshima
Hiroshima, Japan

Contact: Mr A Nakanishi
Head, Administration Office of 7ACC'97
Chemical Society of Japan
1-5, Kanda-Surugadai
Chiyoda-ku, Tokyo 101, Japan
Tel: (+81-3)-32926161
Fax: (+81-3)-32926318
Email: 7acc97@chemistry.or.jp
www: <http://www.t.soka.ac.jp/chem/csj/7ACC.html>

18-22 August 1997

8th European Congress on Biotechnology, 70th Event of The European Federation of Biotechnology

Venue: Budapest, Hungary

Contact: Professor Laszlo Nyeste
Department of Agricultural Chemical
Technology
Technical University
Budapest, H-1121 Budapest XI
Hungary
Tel/Fax: (+36-1)-463220

21-26 September 1997

XXX Colloquium Spectroscopicum Internationale

Venue: World Congress Centre
Melbourne, Australia

Contact: The Meeting Planners
108 Church Street
Hawthorn, Victoria 3122
Australia
Tel: (+61-3)-98193700
Fax: (+61-3)-98195978

* 23-25 November 1997

6th Conference of the Society for Free Radical Research (Australasia)

Venue: Dunedin, New Zealand

Contact: Dr Mike Murphy
Biochemistry Department
University of Otago
P O Box 56, Dunedin, New Zealand

CONFERENCES & SEMINARS

Tel: (+64-3)-4797871
Fax: (+64-3)-4797866
Email: murphy@sanger.otago.ac.nz

25-28 November 1997

Pacific Oils 2000: An International Conference on Plant Oils and Marine Lipids

Venue: Auckland, New Zealand
Contact: Professor Con Cambie, Conference Chairman
Chemistry Department
University of Auckland
Private Bag 92019
Auckland, New Zealand
Tel: (+64-9)-3737999 ext. 8259
Fax: (+64-9)-3737422
Email: c.cambie@auckland.ac.nz

13-17 July 1998

MACRO 98 AUSTRALIA

37th IUPAC International Symposium on Macromolecules

Venue: Gold Coast, Queensland, Australia
This forefront conference will bring together polymer-oriented scientists, technologists, educators and students from all areas of the scientific community: academia, industry and government. It will provide an international forum for the communication and discussion of general and specific contemporary topics of interest to the polymer community.

The conference will embrace both the fundamental and applied

aspects of polymer chemistry, polymer physics, materials, technology and engineering. The program will focus on a number of broad themes which will incorporate a range of symposia, involving plenary and invited lectures, and contributed verbal and poster presentations. Plenary speakers will be Professor J Economy (USA), Professor J Feast (UK), Professor A Khokhlov (Russia) and Professor Y Tabata (Japan). A special International Symposium will be held in honour of the late Professor Jim O'Donnell.

Contact: MACRO98 Secretariat
Chemistry Department, University of Queensland
Brisbane, Queensland 4072
Australia
Fax: (+61-7) 33654299
E-mail: macro98@chem.chemistry.uq.edu.au
Homepage:
<http://www.uq.edu.au/~cmawhitt/macro98.html>

6-11 February 2000

RACI 11th National Convention

Venue: Canberra, ACT, Australia
Contact: Dr W D Cook
Department of Materials Engineering
Monash University
Clayton VIC 3168, Australia
Tel: (+61-3)-99054926
Fax: (+61-3)-99054940
Email: WDCOOK@eng2.eng.monash.edu.au

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For further information contact:

Colin Malcolm

Laboratory Manager, Ruakura Research Centre, Private Bag 3123, HAMILTON
Tel: 07 856 2835 Fax: 07 838 5085 Email: MalcolmC@hort.cri.nz

**The Horticulture and Food
Research Institute of New Zealand Ltd**

A Crown Research Institute



circle number 6 on the reader reply card

Science Helps Horticultural Industry

News of HortResearch's scientific findings and research "break throughs" appears in various media around the country every week. Yet who and what is HortResearch, and where is it located?

HortResearch simply means horticultural research. It is a Crown Research Institute (CRI). Its full name is The Horticulture and Food Research Institute of New Zealand, established on July 1, 1992.

The work HortResearch undertakes is basically focused on the production of superior plants and crops, improved management methods, better plant health, and high quality fresh and processed produce, all in a sustainable manner. Fruit, flowers, other horticultural crops, and timber trees form the basis of the research.

There are 14 HortResearch sites and orchards around New Zealand, from Kerikeri in the north, to Clyde in the south. The Corporate Office is in Palmerston North, along with the Palmerston North Research Centre. The Institute has three science divisions, Plant Improvement, Production Systems, and Postharvest and Food Science.

Plant Improvement plays a leading role in the horticultural industry through innovative research and development in plant breeding and biotechnology, this includes 63 new cultivars that have been developed and most are now grown widely in New Zealand. For example, HortResearch's new apple selections accounted for more than 70 percent of all "buds" sold through the Fruit Industry Plant Improvement Agency (FIPIA) last summer.

Originating from the apple breeding programme at Havelock North, of the established commercial varieties released for more than one season, Pacific Rose represented 30 percent of buds sold.

Early maturing kiwifruit, new high-quality apricots, white-fleshed peaches, new boysenberry cultivars, new hop cultivars, and new blueberry cultivars have all originated from Plant Improvement's Plant Breeding Group. Two blueberries released last season for the home garden, Tasty Blue and Blue Magic, exceeded all expectations, and quickly sold out. Attractive when in flower and in fruit, there will be more of these in the retail stores this coming spring.

Production Systems works to develop sustainable management systems for horticulture. Staff play a leading role in developing integrated production systems which limit the environmental impact of horticultural activities by developing better methods for enhancing product quality and yield efficiency.

Recent successes include the control of sapstain in *Pinus radiata* timber using natural products, the discovery that a natural compound extracted from a fungus protects kiwifruit from

Botrytis infection, the release of new poplar tree hybrids that are possum and disease resistant, and the development of methods to trigger plants' natural defences against diseases.

Postharvest and Food Science, through a number of partnerships with the food industry, plays an important role in the horticultural industries' export performance.

This Division has developed high temperature controlled atmosphere postharvest treatments to control the pest light brown apple moth. They have developed an advanced non-destructive technology for fruit sorting, based on fruit quality, and they are involved in research to improve fruit juice clarity, maintaining the quality of sparkling clear kiwifruit juice and extending storage life.

Heat treatment now employed in the Cook Islands to disinfect pawpaw of potential fruit fly contamination before export to New Zealand, was developed and installed by HortResearch. The heat treatment replaces the previous method of fumigation with ethylene dibromide.

The environmentally safe disinfestation treatment plant has been in operation for two and a half years during which time its performance has been carefully monitored by HortResearch, and modifications and fine tuning made as needed. HortResearch is now involved in similar projects in New Caledonia, Tonga, and Western Samoa.

An important part of HortResearch's work is to ensure there is access to research findings for growers and other interested sectors. Information is passed on to growers and consultants and other industry people through field days, seminars, videos, computer programmes and through HortNET, an internet information base developed by HortResearch.

For further information contact:

Liz Brook, Journalist,

HortResearch, Private Bag 11-030, Palmerston North.

Tel: 06 356-8080, Fax: 06 351-7517

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NEW ZEALAND INSTITUTE OF CHEMISTRY



Nath Pritchard

From the President ...

These are exciting times that we live in. The world around us is changing. Changing so rapidly. To be part of those changes must be taken as an opportunity for us all. To have reaffirmed in Sydney, some weeks ago, that chemistry in all its guises is very much an essential element of the change process was so reassuring.

The New Zealand Institute of Chemistry (NZIC) is the organisation which represents the profession of chemistry in New Zealand. It consists of some 1500 members who participate in the study, practice, teaching, promotion and management of chemistry in New Zealand. They operate within a constitution and a code of ethics.

The Institute is administered by a Council (of elected members and Branch Delegates) which appoints a number of committees and representatives to perform specific tasks. Such tasks vary from promoting chemical education to making submissions to Government select committees on handling hazardous materials.

There are six NZIC Branches throughout New Zealand, in the main centres of Auckland, Hamilton, Palmerston North, Wellington, Christchurch and Dunedin which administer the membership in their area and organise local meetings, symposia and conferences. There are also eleven specialist groups which concentrate their activities on a particular facet of chemistry such as Analytical, Biochemistry, Chromatography, Education, Electrochemistry, Fats and Oils, Inorganic and Organometallic Organic, Physical, Polymer, X-ray Crystallography. One of the objectives of the Institute is to promote a better understanding of chemistry in all walks of life and in this way counteract any negative image of chemistry and chemicals. There is a growing fear of chemicals and chemical accidents and this can be countered by active discussion and education.

Membership is open to everybody who has an interest in chemistry – we invite you to join. A membership application form can be found on pages 33 and 34. When you join you will gain the advantage of keeping in touch and moving with chemistry in New Zealand and internationally through the following services:

- the journal *Chemistry in New Zealand*, containing news and information on all aspects of chemistry and chemists in New Zealand – industry, Government, academic, Crown Research Institutes, research associations, educational institutions etc.
- lectures, discussions, workshops and conferences on all areas of chemistry organised by special interest groups and branches of the NZIC on a local, national or international level at which you will receive substantial discounts in registration fees as an NZIC member.
- the opportunity to meet and hear leading chemists from overseas as well as from New Zealand.
- newsletters from your branch with information about local chemical activities, and from groups with news on your special interest in chemistry.

'INTERSECT 96'

I start my report this month in Sydney. I had the pleasure of attending, on behalf of my company ECNZ, "Intersect 96", a conference jointly run by RACI, The Australian Society of Ecotoxicology and SETAC. The theme of the conference was environmental chemistry and toxicology. The conference was superbly organised for some 400 truly international delegates. The plenary speakers were of top quality. To say that I was a trifle envious would be litotes. Understandable though, in my guise as President of the NZIC. New Zealand was well represented by some 30 delegates. At least five of whom gave papers.

I personally derived a great deal from the technical presentations. It was the first conference that I have attended where chemistry and biology came together so well, as associated sciences. It explained much in my particular domain, or environment, in regard to 'effects' upon fish and river biota by various agents

COUNCIL

By the time you read these notes your Branch Delegates will have reported back to you the outcomes of the August Council Meeting. The Executive Officer's report elsewhere in the issue details the Meeting.

I should like to pay tribute to your Council; Mel Carr, Ian Graves, Rowena Holder, Dennis Karl, Alistair MacGibbon, Gill Norris, Rod Tilbury, Alan Turner, Rob Whitney and James Wright.

They debated long and hard some key issues that you had placed before us. They debated in an open and constructive environment. They took some bold decisions. Decisions for change and the re-inforcement of our Institute. I acknowledge them for their efforts.

Their performance reminded me of a quote of the late J F Kennedy; "Ask not what your country can do for you, ask what you can do for your country" They gave of themselves to the Institute.

PIE CHART

An interesting chart was produced by Manawatu which showed the industrial membership was the largest sector in the NZIC. This fact was kept to the fore during the debates.



OFFICE USE

**NEW ZEALAND INSTITUTE OF CHEMISTRY
INCORPORATED
P O BOX 12-347 WELLINGTON, NEW ZEALAND**

MEMBERSHIP APPLICATION FORM

APPLICATION FOR ENROLMENT IN THE GRADE OF

1. FULL NAME		Male/Female
..... (PREFERRED TITLE) (OTHER NAMES) (SURNAME)

2. ADDRESS FOR MAILING

.....

.....

.....

Contact Telephone Number

3. PRESENT POSITION & EMPLOYER'S ADDRESS

.....

.....

.....

.....

4. PERSONAL DETAILS

Date of Birth Country of Birth Current Nationality

5. ACADEMIC QUALIFICATION(S)

Qualification(s)	Institution	Year Awarded/Completed
.....
.....
.....

6. MEMBERSHIPS OF OTHER RELEVANT PROFESSIONAL BODIES, WITH YEAR ADMITTED

.....

.....

.....

NOTE: PLEASE ATTACH EVIDENCE OF YOUR ACADEMIC RECORD AND COPIES OF CERTIFICATES OF QUALIFICATIONS AND MEMBERSHIPS OF OTHER BODIES UNLESS THESE HAVE PREVIOUSLY BEEN SUBMITTED.

Please turn page over and complete

7. SUMMARY OF RELEVANT EXPERIENCE SINCE OBTAINING INITIAL QUALIFICATION. INCLUDE AS A MINIMUM, POSITION HELD, EMPLOYER AND DATES.

[Please continue on separate page if necessary]

8. APPLICANTS FOR CORPORATE MEMBERSHIP ARE REQUIRED TO NAME 2 REFEREES (MEMBER) OR 3 REFEREES (FELLOW) TO WHOM THE APPLICANT IS KNOWN PERSONALLY AND WHO ARE WILLING TO ATTEST EXPERIENCE AND SUITABILITY FOR ADMISSION. REFEREES SHOULD PREFERABLY BE INSTITUTE MEMBERS AND AT THE SAME GRADE OR HIGHER THAN THAT FOR WHICH THE APPLICATION IS BEING MADE.

Referee 1 (Name) (Address)

.....

Referee 2 (Name) (Address)

.....

Referee 3 (Name) (Address)

.....

9. IF ENROLLED IN THE ABOVE GRADE I UNDERTAKE TO BE BOUND BY ALL THE RESPONSIBILITIES AND OBLIGATIONS REQUIRED BY THE ETHICS AND RULES OF THE INSTITUTE.

.....
(SIGNATURE)

.....
(DATE)

FORWARD YOUR APPLICATION TO:

Executive Officer Telephone: (04) 473 9444
NZ Institute of Chemistry Facsimile: (04) 473 2324
PO Box 12-347
WELLINGTON

Both these proposals will be the subject of two motions which will be put to corporate members by postal ballot.

NZIC BRANCH NEWS

MEMBERSHIP REPORT

MANAWATU

New Members:

Fellow

Otago	McQUILLAN	Alexander James
	TROTMAN	Clive Norman Albert

Member

Auckland	COVENY	Philip Kenneth
	FITZPATRICK	Michael
	HUEBLER	Ute
Waikato	MENZIES	Catherine Margaret
	VAN LOON	Nicolaas Gijsbert
Canterbury	SUTTON	Angela Aitchison
Otago	MURPHY	M P
Overseas (Canberra)	PAGE	Dennis Martin

Associate

Auckland	CHADWICK	Drew
	WANG	Yang
Waikato	HARDING	Raki Rakana
	JOHNSON	Glenn Stewart
Wellington	REID	Joanne
	RUTLEDGE	Sue Moira
Canterbury	EATHORNE	Leanne Maree
Otago	BAILEY	Karl Bevan
	CLARKSON	Andrea Jane
	EDGECOMBE	Kathryn Ann
	FANSHAW	Rachel Lois
	SHAW	Jo
	TURNBULL	Margaret

Student

CRESSWELL	Murray Allan	Otago University
HORNER	Stephen	Auckland University
HUNT	Patricia	Auckland University
URWIN	Jacob	Massey University
WOODGATE	Scott	Auckland University

Deceased

It is with sadness that we record the deaths of the following Members and Fellows:

FURNESS	Alan R, MNZIC; Palmerston North
GALLAHER	Peter J, FNZIC; Auckland
HOUNSELL	Eric R, FNZIC; Christchurch
LINZEY	John, MNZIC; Auckland
SPACKMAN	Leonard S, Hon FNZIC; Auckland

TURNERY	Thomas A, MNZIC; Auckland
WATSON	Charles C, MNZIC; Napier
WHITE	Stanley, MNZIC; Fielding

Professor John Garratt, Department of Chemistry, University of York, UK, spoke to Branch and Massey University staff in the Aston 1 lecture theatre at Massey University on Friday 5 July on the topic "Problems, Judgements, and Decisions in the Teaching and Learning of Chemistry". His visit to New Zealand was sponsored by the Royal Society of New Zealand and NZIC. Professor Garratt is a recipient of the prestigious Nyholm medal, awarded in recognition of his outstanding contribution to chemical education. The first message in his talk was that not enough time was taken for teachers to talk with each other and exchange ideas. He is involved in a network for chemistry teaching, an informal collection of professional chemists interested in improving the quality of chemical education, financially supported by the Department of Education and several private organisations in the UK. Professor Garratt said that less emphasis should be placed on teaching chemistry and more on being a chemist, and there should be more talk about learning than teaching. He described exercises with students involving critical thinking to identify a conclusion, assess an argument, and read critically, using primary scientific literature. Computer simulations were also used in a highly focused way to carry out complex investigations in an accelerated learning approach, as in the "eLABorate" project where, for example, a programme was set up for optimising the instrumental signal in a NMR spectrometer. Professor Garratt pointed out that computer simulation can never replace benchwork, but can fill in gaps in student learning experiences. The simulations used are packages that include pre-exercise information. Professor Garratt concluded his talk by posing the questions – should students learn descriptions or learn how to describe?, learn experiments or how to experiment?, and learn explanations or how to explain?

The annual "Dead Chemists" meeting was held in the new Seminar Room of the Dairy Research Institute (DRI) on Wednesday 31 July. This is the meeting where "The Society of Dedde Chymists" enjoins "All participants should, by their dress, other apparel or item(s), allude to the existence of chymistry or of a deceased chymist". The meeting started with a social half-hour to find out over refreshments who was chemically who or what. The winner of the dress competition was Gill Norris, Biochemistry Department, Massey University who represented Lavoisier. There was also a prize for the most obscure dead chemist but this writer can't remember who it was!. Next came "A phylosophical discourse" by the "Guest Dedde Chymist", who this year was M. Gay-Lussac. The address "Memoir on the combination of gaseous substances with each other", last read before the Philomathematical Society on 31 December 1808, was delivered on Gay-Lussac's behalf by David Officer, Chemistry Department, Massey University. Supper followed the address and then "Ye chymistry quiz" masterminded by Mike Boland, DRI, who provided "a truly unorthodox set of chemical brain-teasers with a prize for the top table". There were five teams of four or five persons, with team names of Dalton, Arrhenius, Davy, Cannizzaro, and Hoffman. The winner of the Quiz was the Arrhenius team,

**Meet and mix with others
with an interest in Chemistry
Join the NZIC Now!**

To give Council sufficient time to debate the issues before it, a two day meeting was organised.. This allowed Council the opportunity to host, socially, members of the Wellington Branch at the close of the first afternoon's business. It was a pleasure to see and welcome such stalwarts of the Institute as Jim Ellis, David Bibby, David Weatherburn, Neil Curtis, still active in the Institute and chemistry.

The opportunity to recognise the efforts of one of the Wellington Branch members was taken at the gathering. Council had debated during the day the need for the Institute to publicise its activities. Brian Halton, by his efforts through Pacificchem, had done precisely that. He had placed the NZIC very firmly in the middle of the Pacific, alongside peer organisations. He represented the Institute with the enthusiasm and professionalism that I would expect of him. It was my pleasure on behalf of Council and the Institute to present Brian Halton with a small token of appreciation.

SIR IAN AXFORD



Sir Ian Axford

Out of town Members of Council had a rare honour dining out in the capital. The occasion was shared with the eminent scientist, Sir Ian Axford. Sir Ian, director of the Max Planck Institute, was in Wellington in his guise as Chairman of the Marsden Fund. To suggest that some intense, informal lobbying accompanied dinner would be hyperbole!

Nath Pritchard
President, NZIC

NZIC COUNCIL NEWS

Council met in Wellington on the 8th and 9th August, 1996 and, as at previous meetings, the focus of the meeting was the strategic review. Highlights included the following:

ELECTION OF OFFICERS

The term of officer holders for the 1995/96 year is extended to 31 December 1996 and thereafter the elected members of Council will hold office from 1 January to 31 December in following years. As a consequence of this change, nominations for the elected members of Council will close with the secretariat on 30 October each year.

Due to changes in the university calendars, it is becoming virtually impossible to hold the NZIC Conference in August. December appears to be a more suitable month and consequently the AGM will also be held in December, either at the Conference (as this year) or in the Branch of the President. This will also allow transfer of office from the current President to the incoming President.

FINANCIAL

The business plan has just about been finalised. This will prioritise the services to members and other activities like promotion of chemistry. This will allow allocation of resources, particularly financial and establish budget requirements to be balanced by incoming subscriptions.

Our debenture holding in Equiticorp Holdings Ltd (in Statutory Management) has now returned some 50% of our original investment following the market collapse in the late 1980s. The successful recent action by the Statutory Management against the Government should increase this return.

MEMBERSHIP

The membership report follows. As a result of the imminent changes in the membership structure it has been decided to speed up processing of standard applications for membership. Whereas this could take three to four months, the aim will be to complete the processing within 6 weeks.

CONFERENCES

The planning is well advanced for the NZIC/NZSBMB Conference in Dunedin in December 1996. At least one student from each Branch will be presenting papers in the student paper competition – this results from generous financial assistance from the Conference Organising Committee.

Pacificchem '95 in Hawaii was a big success. Professor Brian Halton has been confirmed as the NZIC delegate for Pacificchem 2000, and a presentation was made to Professor Halton for his fine efforts in assisting with the organisation of Pacificchem '95.

STRATEGIC REVIEW

A draft strategic business plan and draft revision of the membership rules were presented by the Vice-Presidents and formed the basis of intense discussions amongst all members of Council. Both the business plan and the membership rules revision are presented elsewhere for the consideration of all members.

With respect to the review of the membership rules two major modifications are proposed by Council:

1. Membership classification would now include students, life members and local members. Unwaged, life members and local members would be distinguished by fee structure only.
2. The designation of MNZIC would no longer be an approved abbreviation to be used by members.

comprising Harry Percival (Landcare Research), Lee Furness (Palmerston North City Council), Nick Robinson (DRI), and David Newstead (DRI).

Professor Ted Baker, Department of Biochemistry, Massey University has been elected President of the International Union of Crystallography for a term of three years. Ted has won international recognition for his leading role in the crystallographic analysis of the structures of protein molecules. His research team in the Structural Biology Laboratory was recently the recipient of a low-temperature macromolecular crystallography cryogenic unit worth \$45,000. The New Zealand Lotteries Board and the Health Research Council both contributed funding for the unit. The unit enables crystals to be frozen to about minus 150 °C before collecting crystallographic data from them. The advantage is that the lifetime of crystals can now be extended indefinitely, compared to only a few days under the old systems.

Margaret Burrell, a teacher at Freyberg High School in Palmerston North, attended the 14th International Conference on Chemical Education, at the University of Queensland in Brisbane, Australia, 14-19 July, 1996. The Conference theme was "Chemistry: Expanding the Boundaries", and topics included the influence of technology on chemistry, environmental chemistry – its place in school, assessment and the national curriculum framework – and the challenge of standards-based teaching. The Conference also looked at curricula in different countries. Margaret will share information gained from the Conference with the Manawatu Science Educators Association. She received a \$250 grant from the Manawatu Branch as well as support from local businesses for conference expenses.

The Manawatu Science and Technology Fair was held at the Palmerston North Science Centre in late July. The Manawatu Branch prize (now named the Alan Furness Memorial prize) was awarded to Torrance Hodgson from Intermediate Normal School in Palmerston North for the exhibit "What effect does salt have on ice".

In the 1996 Manawatu Branch Chemistry Quiz for schools, 997 students (588 junior and 409 senior level) entered the competition from 27 schools. A high proportion of the students were awarded certificates for their achievements, with "High Distinction" certificates going to 113 students. Most overall entries were from Central Hawkes Bay College with 133. The highest mark in the Junior Quiz went to Tobias Van den Berg, Form 5 of Taradale High School. In the Senior Quiz, Chris Manning (Form 7 of Awatapu College, Palmerston North), Grant Lowe (Form 7 of St John's College, Hastings), and Rowena Vincent (Form 7 of Solway College, Masterton) gained the highest mark.

Harry Percival

WAIKATO ANALYTICAL CHEMISTRY COMPETITION

On Wednesday, June 26, 1996, an NZIC-sponsored Analytical Chemistry competition organised by Professor Brian Nicholson took place in the Chemistry Department at Waikato University's School of Science and Technology. Because of the falling

response to the old-format competition where the samples were sent out to schools, it was decided this year to invite teams of three students from each school to attend the University for one day to compete on site. The response to this was excellent with 16 schools represented (five withdrew at the last minute for transport/flu/teachers' strike reasons).

The task was to analyse a sample of calcium carbonate. When titration experiments were being thought of for the competition, the idea of analysing the calcium carbonate content in eggshells was initially considered, however, preliminary experiments carried out to test the feasibility of this showed non-reproducible results and so synthetic calcium carbonate was analysed instead. Analysis was carried out by a back-titration method. Analysis of carbonates by back-titration is actually an experiment in the first year Chemistry laboratory course at Waikato University which requires far more logical and careful thought on the part of the students in the analysis of the results than would be the case in an ordinary titration. However, the calibre of the students participating in the competition was so high that the experiment was carried out extremely well with the consequence that the task of the judges in deciding the best results was a very difficult one indeed.

The following prizes were awarded:

- 1st Prize :** John Paul College
(*Rowan Hooper, William Tremaine, David Horgan*)
2nd Prize : Champion College
(*Simon McLaughlin, Luke Leydon and Martin Blake*)
3rd Prize : Otumoetai College
(*Patrick O'Connor, Leah Coxes, Heidi Nelson*)
4th Prize : Mount Maunganui College
(*Tony Moyle, Simon Deane, Reece Olsen*)

Many people contributed to the success of the occasion and are hereby acknowledged for their involvement:

Dr Bill Henderson, for arranging satchels and publicity material.
Dr Michele Prinsep for designing participation and prize certificates.

Natalie Curnow and Annie Barker for setting up the laboratories.
Dr Richard Coll, Trevor Mathieson, Scott McIndoe and Stefan Hill for demonstrating.

Dr Peter Robinson of R J Hill Laboratories, Hamilton for help with the judging.

Terry Walsh of Bryant Halls for excellent lunches.

We are also grateful to R J Hill Laboratories for sponsoring the prizes as well as to the Waikato Branch of the NZIC for funding the lunches and to the Chemistry Department, University of Waikato for facilities provided.

Overall the competition enabled 48 keen 7th form chemists to spend a day in the University laboratories and mix with peers from other schools, and for the 8 teachers who accompanied them to meet each other and with University chemists. It was therefore an effective publicity occasion for both the NZIC and for the University.

We would strongly recommend that another competition along the same lines be held in 1997.

Michael R Mucalo/Brian K Nicholson

THE NEW ZEALAND INSTITUTE OF CHEMISTRY

DRAFT STRATEGIC PLAN

The draft strategic plan has been developed by Council and will be formally adopted by Council at its next meeting. The plan sets out The Institute's Mission, Aims and Values. It identifies in a SWOT analysis the strengths and weaknesses of the Institute and the opportunities and threats over the next few years.

The plan also contains a more detailed business plan for 1997. It will be the First Vice President's responsibility in the future to prepare this plan for the next year. Council will also be able to review the strategic plan each year and adopt the business plan for the following year. The Institute's budget and decisions will be based on this plan.

It's the first time we've done this so there are sure to be things we could have done better, or that have been forgotten. We want you to let us have improvements and omissions so they can be included in the final plan.

We also want to improve the plan by building some key specific five year goals, and developing strategies for achieving these goals. Please let us have your ideas.

Remember this still a draft plan, and we need your input. Please send your comments to the Executive officer or email them directly to me at r.whitney@crl.co.nz.

Rob Whitney
First Vice President

MISSION

"To support, develop and promote all aspects of chemical science, and to support the needs of the Members"

AIMS

MEMBERSHIP

- To increase the active membership of the Institute.
- To broaden the membership base of the Institute.
- To reduce subscriptions while improving services.
- To encourage Members' involvement in Institute activities

FINANCIAL

- To be a not-for-profit organisation and not to get into debt.
- To cover the basic costs of running the Institute by membership subscriptions.
- To obtain funding from sponsors and members for special projects.
- To seek a return from Institute activities.

RECOGNITION

To develop a procedure which honours excellence and commitment in the promotion of all aspects of chemical sciences.

BRANCHES

To retain the existing number of Branches, and to increase the number of activities undertaken by those Branches and the participation by members in those activities.

SPECIALIST GROUPS

To nurture and support Specialist Groups and increase their involvement in all activities of the Institute.

PUBLICATIONS

To improve the quality and increase circulation of *Chemistry in New Zealand* such that a greater return is received by the Institute.

To raise the profile of the Institute through *Chemistry in New Zealand*.

To promote chemistry in schools and provide resource material for chemistry teachers by continuing to produce *Chem NZ* and circulating it to schools and other education organisations.

CONFERENCES

To run regular and successful conferences.

To assist specialist groups in running specialised conferences and seminars.

PROMOTION

To promote all aspects of chemical science through publicity, education and policy initiatives.

CORE VALUES

OUR MEMBERS

- Striving for better communication
- Providing a professional environment for members to develop
- Caring for the members
- Recognising excellence and achievement

CUSTOMER SERVICE

- Being responsive to members' needs
- Providing value for members' subscriptions
- Providing high quality services
- Providing value to sponsors

CONTINUOUS IMPROVEMENT

- Commitment to searching for improvements
- Researching for better means of promoting all aspects of chemical science
- Efficient office practices and management systems

INTEGRITY

The essential element

SWOT ANALYSIS

STRENGTHS	WEAKNESSES
<i>Chemistry in New Zealand, Chem NZ</i> Conferences Specialist symposia Chemical exams Internet site Social and scientific events for members Branch activities The membership (well qualified, dedicated, long-standing and loyal) Voluntary work by members Networking opportunities Potential new members yearly Fellowship Wide expertise and breadth of membership Specialist Groups Continuity of secretariat Established Institute, Incorporated society Government recognition Reciprocity (RACI, RCS etc.) Professional image Tradition credibility Unified voice lobby group	State of membership lists Treatment of new members Publicity for services Apathy of members Vague links between regional groups Aging membership Lack of industrial involvement Declining membership White-coated image Elitist (graduates club) Specialist group members not in NZIC Operation of secretariat, admin. systems Lack of support from Departments, Institutes Not widely known, lack of profile Perceived old image Lack of vision
OPPORTUNITIES	THREATS
Obtain more return from services Funding from other than subscriptions Implement Denny Report Computer technology for secretariat Contract out membership list Royal Society providing services Affiliations with other societies New name Build on <i>Chemistry in New Zealand</i> and <i>Chem NZ</i> Information technology Promote the understanding of chemistry Advisory body for research, teaching, industry on chemistry Involve undergraduates and schools in NZIC More specialist groups Closer involvement with specialist groups Promotion of chemistry to young people Teachers Freedom for local activities	Dwindling membership Cost of membership Lack of finance Not attracting top students Declining NZ chemistry industry Image of chemicals (dirty, nasty, toxic) Chemistry difficult subject to learn Lack of public appreciation Government research not discipline based Apathy, indecision Being left behind as an outmoded wet chemistry social group Reluctance to change Other groups fulfilling our role Competition for our time and money from other activities and organisations Inability to react quickly to challenges

NZIC BUSINESS PLAN 1997

KEY RESULT AREAS

COUNCIL

- **Make the Secretariat more business-like in its operation.**

Review base of operation.
 Review activities.
 Identify core activities.
 Review procedures.
 Review business systems.
 Review computer hardware.
 Introduce a project management ethos.

- **Ensure the Institute remains financially sound.**

Prepare a break-even budget for the Institute.
 Ensure the Institute manages its business so that the budgeted end result is achieved.

- **Provide for the core activities of the Institute through members' subscriptions.**

Establish a three level subscription fee to cover unwaged members, ordinary members and Fellows, with the fee for members to be less than \$100.
 Maximise subscriptions and allocate to core activities.

- **Seek alternate sources of funds via agencies and sponsors for special projects**

Identify special projects.
 Identify alternate sources of funding.
 Promote projects to potential funder.

- **Maximise returns to the Institute from its activities.**

Identify activity.
 Prepare budget.
 Identify financial controls.
 Maintain controls.

MEMBERSHIP

- **Increase the membership of the Institute to include the majority of chemists, and those people with an interest in chemical science, in New Zealand.**

Promote the activities of the Institute, through the Branches; in Universities, Polytechnics and Teacher Training Colleges
 Target key industry sectors
 Target Research Institutes
 Target teaching professionals

- **Provide an efficient service to Members**

Maintain an up to date database of members
 Provide an efficient payment service for subscriptions

Answer members queries on institute or professional matters
Counsel members on employment matters

RECOGNITION

- **Develop procedures for the Institute to recognise excellence and commitment to the promotion of all aspects of chemical science.**

Establish two grades of membership, Fellow and Member.

Review members' understanding of the grades of membership.

Review other mechanisms for recognising contribution to the Institute and its aims.

Develop criteria for the use of the initials MNZIC and FNZIC.

Develop procedures to recognise excellence and commitment.

Promote concepts to the greater membership.

- **NZIC Prizes**

Award a range of sponsored prizes for excellence in chemical sciences.

Ensure publicity and promotion for these prizes and prize winners.

THE BRANCHES

- **Retain the existing number of Branches**

Identify the needs of Branches.

Service the needs of Branches.

- **Support the activities undertaken by the Branches.**

Provide what support Branches call for.

Ensure Branch activities are well publicised.

Ensure any new members are made aware of local Branch.

Encourage new members to join the local Branch.

Ensure Branches maintain their Membership lists.

Ensure Branches send updated lists to the Secretariat.

Ensure Branches are made aware of any new members

SPECIALIST GROUPS

- **Encourage the formation of Specialist Groups within the Institute.**

Ensure members are aware of Specialist Groups and their activities.

If an area of chemical science is not catered for encourage the formation of a Specialist Group.

- **Nurture and support Specialist Groups.**

Provide Specialist Groups with timely and cost effective services.

Respond to the needs of Specialist Groups.

- **Increase the involvement of Specialist Groups in all the activities of the Institute.**

Ensure Specialist Groups provide reports of activities.

Ensure activities are publicised.

Ensure activities are known to the members of the parent body.

- **Produce *Chem NZ* to promote chemical science in schools.**

Support the chemical education group in the production of *Chem NZ*.

Approach MoRST and other organisations for financial support.

PUBLICATIONS

- **Increase the circulation of the journal, *Chemistry in New Zealand*.**

Make available to Corporates.

Sell as a commercial industry sector journal.

- **Maintain or enhance the quality of *Chemistry in New Zealand* by continuous improvement.**

Appoint and support an Editorial subcommittee of Council.

Encourage a higher class of feature articles.

Encourage Branches to provide reports of activities.

Encourage members to provide reports of individual activities

- **Maximise the return to the Institute from the activities of *Chemistry in New Zealand*.**

Produce *Chemistry in New Zealand* in the most cost effective manner.

Maximise advertising revenues.

Maximise profit to the Institute.

- **Continue to produce *Chem NZ* for distribution to the education sector**

- **Distribute and support overseas chemistry publications in New Zealand**

Chemistry 13 News.

International Newsletter on Chemical Education.

Chemistry International.

RCS schools publication.

CONFERENCES

- **Organise regular conferences at appropriate venues and centres**

Commence planning for the next NZIC conference.

- **Encourage Branches and Specialist Groups to organise workshops, seminars and conferences.**

Publicise current support policies.

Provide support and sponsorship of a plenary lecturer for 22APS (22nd Australasian Polymer Symposium) to be held in Auckland, February 1997.

Provide support and sponsorship for Oils and Fats Specialist Group Conference in November 1997.

- **Maximise the return to the Institute from the running of such conferences, seminars and workshops.**

PROMOTION

- **Education**

Appoint and support a Chemical Education Committee.

Provide input into the chemistry curriculum.

Distribute and organise the RACI chemistry papers to schools.

Distribute and mark Chem 13 papers.

Assist the Manawatu Branch in wider distribution of their chemistry quiz.

Provide for Student Travel Grants.

- **Other Promotion Activities**

Meet with the new Minister of Science.

Prepare press releases on chemistry related news items.

Maintain links with MoRST and the Royal Society.

Appoint and support a Public Affairs and Science Policy Committee.

Appoint and support an Environmental Committee.

Commence planning for an International Chemistry Celebration in 1999.

LETTER TO THE EDITOR

Dear Sir,

Encarta 96

Your faith in Mr Gates and his Encarta is touching, but misplaced.

I came across the following claims in an article on "Global Warming" on the very latest Encarta 96 CD:

- A list of "greenhouse gases" which did not include the most important one, water vapour.
- A claim that the greenhouse effect has been known "since 1896". (Fourier published a paper on the subject in 1827).
- "The mean rise in global temperature since 1850 has been 1 °C." (The official figures are "between 0.3 °C and 0.6 °C").
- A disembodied voice telling me that "carbon dioxide in the atmosphere has almost doubled during the past century" (it has increased by 28%).

How many million copies of this misinformation have been sold?

Yours sincerely

Vincent Gray

SITUATIONS VACANT

POST TITLE: Advisor, Central Environmental Laboratory

DUTY STATION: Central Environmental Laboratory, Mauritius

DURATION: Six months

START DATE: As soon as possible

RESPONSIBLE TO: Head, Central Environmental Laboratory

DUTIES:

The Advisor will be required to:

- help the Department of Environment with the establishment and management of the Central Environmental Laboratory;
- review activities to be carried out by the Central Environmental Laboratory and to make recommendations with regard to implementation accordingly;
- review and recommend analytical methodology;
- train staff in the selected analytical procedures and on the use of major equipment;
- set up calibration procedures of the equipment;
- establish inter-laboratory quality control procedures;
- assist in devising quality assurance programmes for the various laboratories;
- design monitoring programs and sampling procedures;
- train staff in data evaluation;
- advise on procedures for the reception and storage of samples;
- undertake any other related duties as may be assigned from time to time.

EDUCATIONAL QUALIFICATIONS AND EXPERIENCE REQUIRED

At least a first degree in Environmental Chemistry together with at least ten years' laboratory experience and management.

Full details available from the NZIC Secretariat in Wellington.

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The VisChem Project – Visualising Chemistry With Multimedia

Roy Tasker and W Chia, University of Western Sydney, Nepean, P O Box 10 Sydney, NSW 2747
Bob Bucat, University of Western Australia, Nedlands, WA 6009
Ray Sleet, University of Technology, Sydney NSW

Chemistry involves interpreting visible changes in matter at the laboratory level (e.g. colour changes, formation of solids, boiling) in terms of changes in structure and processes at the invisible molecular level (including atoms and ions). These changes are represented at an abstract level in two ways: qualitatively, using specialised notation, terminology, and symbolism (Figure 1); and quantitatively, using mathematics (equations and graphs).

Chemistry students generally have difficulty linking observations in the laboratory to imagined molecular structures and processes, and they have difficulty communicating their ideas through abstract notation, terminology, and mathematics.

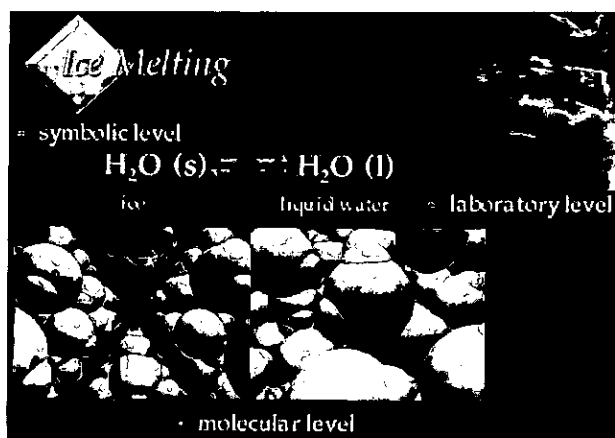


Figure 1. Frame from the VisChem presentation on ice melting, showing the three “thinking” levels – the symbolic (chemical equation), laboratory (ice melting in beaker), and molecular (frames from QuickTime™ animation).

EDUCATIONAL RESEARCH INTO PRACTICE

Johnstone¹ refers to the three levels as the macro, sub-micro and representational, and pictures them at the corners of a triangle. Thinking in chemistry is then likened to moving between “a series of points within the triangle depending on the proportion of the three levels at any one time”. In terms of his Perception/Working Space/Long Term Memory learning model he describes the “mental gymnastics of operating within the triangle” as difficult for students because these levels are not part of the long-term memory. This is important because the long-term memory operates the perceptual process and helps to organise information in the limited working space. One of the authors has developed a lecture presentation strategy based on this work.²

Nakhieh³ has reviewed many studies of student misconceptions in chemistry, many of which result from incorrect images of the sub-micro (or molecular) level. Several ways have been

suggested to help students develop correct images of the molecular world (see, for example, Sleet⁴).

Based on this and other educational research, the VisChem Project has produced multimedia resources (animations, video, text and sound) to explicitly link the three levels – the molecular, laboratory and symbolic – for a variety of difficult topics in chemistry. The novel resources have been the molecular animations (see Table 1) which represent substances in different states, phase changes and reactions.

Great care has been taken in the representation of molecular structures and processes because research by Ben-Zvi, Eylon and Silberstein^{5,6} and others has indicated that misconceptions are easily generated, and perpetuated, with poorly drawn images.

THE SCIENTIFIC AND TECHNICAL CHALLENGE OF VISUALISING THE MOLECULAR WORLD

The difficulties involved in the specification and design of the animations will be reported in detail elsewhere. In summary, the speed of atomic and molecular movements, and the uncertain (non-Newtonian) nature of electrons in atoms, requires substantial “artistic license” to enable the structure and collisions at this level to be represented. For this reason the presentation of these animations as only a “model” of reality must be reinforced often in the program modules.

The animations are produced using the three-dimensional drawing package Infini D (Specular International), and assembled in Director™ (Macromedia). Compressed as QuickTime™ movies, they range from 200 to 300 frames running at 10 frames per second, and use 3-15 MB of memory. They play well from CDs and Internet browsers (e.g. Netscape).

Although the relative scale of atomic and molecular size is consistent, no attempt is made to simulate the relative movement and energies of these entities in real time. The imagery is designed to correct specific misconceptions in chemistry identified from science education research, and to emphasise the importance of constructing useful mental models of the molecular level.

VISCHEM RESOURCES - AVAILABILITY AND USE

The VisChem resources will soon be available in a variety of Formats - OHP transparencies of single frames, on video and as a computer-assisted learning (CAL) program with an interface authored in Director™ (Macromedia). A sample of the animations is shown in Table 1, and a complete list is available on the web page (see later).

Table 1. Frames from selected animations.

Water series

Evaporation

Starting within the liquid water the camera moves up to the surface. Molecules break away, with some difficulty, and some return. More leave than return.



Dissolving and precipitation

Dissolution of NaCl

Skating over the surface of the solid NaCl the camera pauses to see the vibrating ions in the lattice. Then water molecules come tumbling down, hydrating the ions in a "tug 'o war" due to competing forces between water molecules and ions.



AgCl Precipitation

In a solution containing silver, sodium, nitrate and chloride ions a silver ion and a chloride ion collide and form a stable ion pair. Another ion pair joins it, and the resulting cluster joins a growing crystal of silver chloride, with spectator ions in the background.



Sodium chloride melting

To show the difference between dissolving and melting we see the kinetic energy of the ions in solid NaCl rise until the structure collapses to the liquid state.



Redox reactions

Reactions of Ag⁺ ions with Cu metal

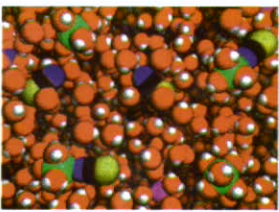
Hydrated silver ions migrate towards the copper surface. Part of the electron cloud moves onto each of the silver ions, with concomitant release of copper ions to the solution. Both anodic and cathodic sites are represented.



Complexation reactions

Simultaneous formation and dissociation of iron (III) thiocyanate complexes

Formation and dissociation of two SCN⁻ complexes of iron (III), with solvent background and spectator ions. A simplified version of this animation is also available.



Acid/base reactions

Reaction of ammonia with water

An ammonia molecule pulls a proton off a water molecule, with some difficulty, to form and ammonium ion.



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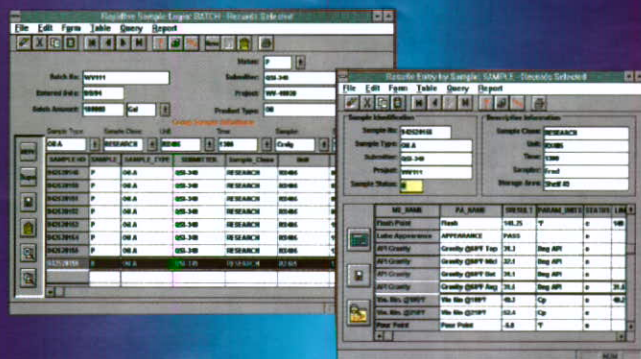
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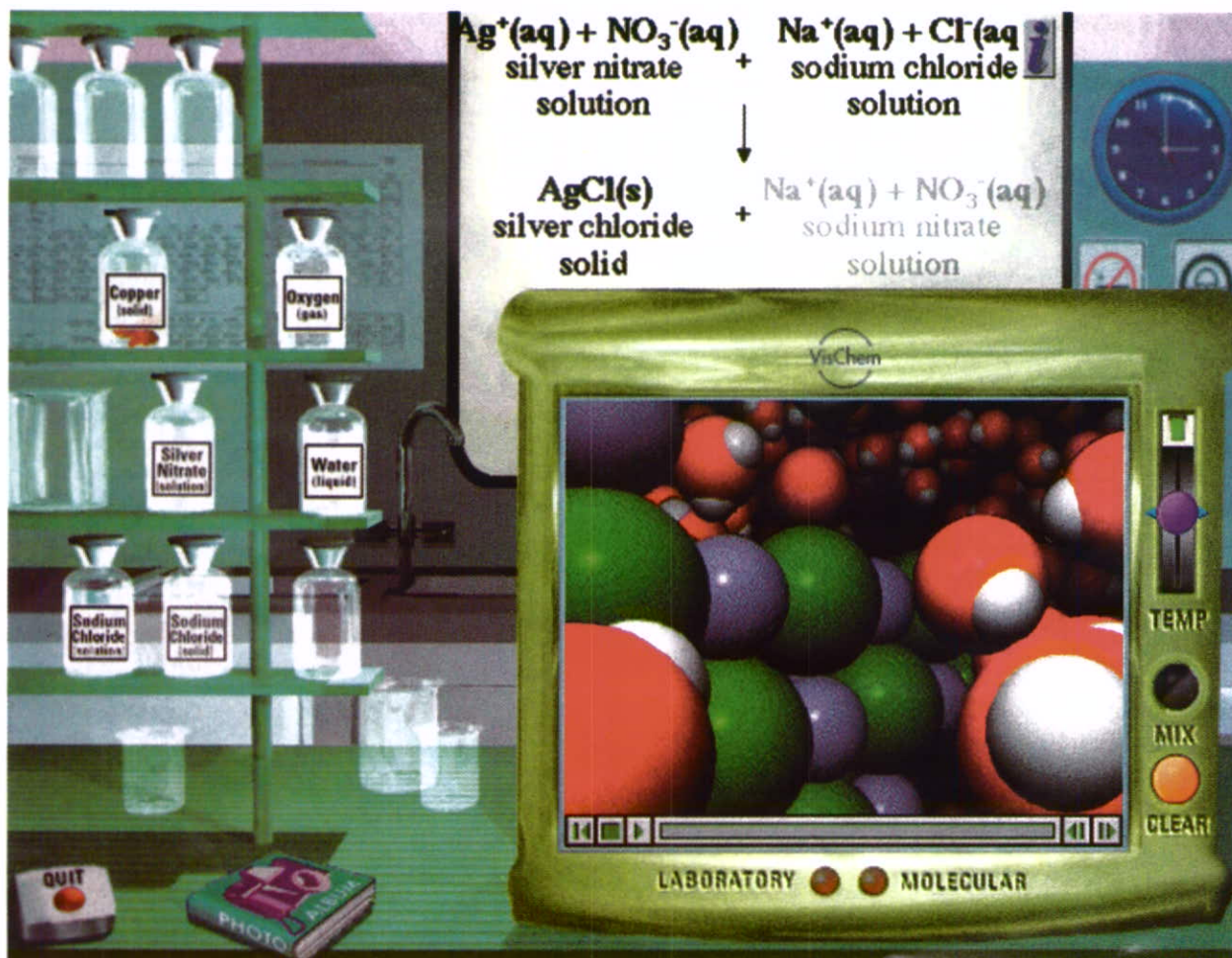


Figure 2. A screen dump showing the program interface after the user has mixed solutions of silver nitrate and sodium chloride, clicked on the product, and "zoomed" down to the molecular level to see a representation of what caused the resultant white precipitate.

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EVALUATION BY EDUCATORS AND STUDENTS

To our knowledge, the quality and type of molecular animations that we have produced make them unique, and they have for the first time enabled educators to illustrate a range of chemical concepts at the molecular level, accurately and effectively. They have attracted considerable interest within Australia and overseas, and arrangements for licencing them for distribution are presently being made.

Analysis of an evaluation pre-test/post-test survey on the video *Water: Let's look into it*, involving educators and students at both secondary and tertiary levels, was encouraging. Students indicated that after a single viewing they corrected their misconceptions and/or enriched their understanding. The video was launched at the 14th International Conference on Chemical Education in Brisbane, Australia, in July 1996.

PRODUCTION OF AN INTERACTIVE MULTIMEDIA INTERFACE

We have developed an interface to enable students to select and see the animations in context. The central aim of the program is to encourage learners of chemistry to link experimental observations at the laboratory level to their imagination of what happens at the molecular level. In so doing, the communication of these molecular events using chemical formulas and equations should become easier and more intuitive.

The metaphor for the interface is the laboratory bench, where students can drag and drop chemical substances in bottles into a "visualisation chamber". Here they can click on the substances and visualise the molecular level.

Phase changes and reactions between pairs of substances are possible, all with molecular visualisation of the structural changes involved. The corresponding chemical formulae and equations are shown on a whiteboard in the background. In this way, the linking between the three thinking levels – laboratory, molecular and symbolic – is continually reinforced.

The major features of the interface are:

- the ability for the educator to customise and optimise the program
- the incorporation of a game with varying degrees of difficulty
- the use of a constructivist pedagogy.

Many computer-assisted learning programs use a model based on the assumption that knowledge and skills can be transferred intact from the programmer's mind to that of the learner. This model has been superseded by the contention that "knowledge is constructed in the mind of the learner".⁷ This can result in

- a *misconception* – knowledge is linked to existing information but through an inappropriate connection
- *rote learning* – knowledge is retained on a short-term basis in an unconnected form
- or *meaningful learning* – knowledge is linked correctly to an existing mental framework of concepts, thereby enriching the framework that is continually constructed.⁸

Using this constructivist approach, students are asked questions and given the opportunity to represent their own models of the molecular level before seeing the accepted scientific model as

an animation. They can click and drag images of molecules and icons into a box (thin "slice" of the substance of solution) and position them according to their imagination of the molecular level. After seeing an animation and a "slice" representation of the accepted model, learners are asked to compare their "slice" with the one provided (with the salient points highlighted).

MORE INFORMATION

For more information on the VisChem resources and the computer-assisted learning package, please see our web page <http://chem.st.nepean.uws.edu.au/VisChem.html> or contact: Roy Tasker, Department of Chemistry, University of Western Sydney Nepean, P O Box 10, Sydney, NSW 2747, Australia Ph: (+61-47) 360809/960428, Fax: (+61-47) 360742/360713 Email: r.tasker@nepean.uws.edu.au

ACKNOWLEDGMENTS

The animations were produced with artistic skill and attention to detail by Stefan Markworth, and the interface was written in Macromind Director™ by Bill Stern, with graphic design by Libby Blainey, and coordination by Simon Thomas and David Hegarty, all using the facilities at the Centre for Advanced Design and Research Education at UWS, Nepean. The project has been funded by the Committee for the Advancement of University Teaching (1993-1994) and by a grant from the Apple University Development Fund (1995).

REFERENCES

1. Johnstone, A H, (1991). *Int. Newsletter Chem. Ed.*, **36**: 7-11.
2. Tasker, R F, Basden, K and Roberts, P, *Chem. Aust.*, March 1992: 108.
3. Nakhieh, M D (1992), *J. Chem. Ed.*, **69**: 191-6.
4. Sleet, R J, Attitudes and images in chemistry, in "Australian Chemistry Resource Book" (Ed. C. Fogliani) (Charles Sturt University, 1993).
5. Ben-Zvi, R, Eylon, B and Silberstein, J, *Ed. Chem.*, May 1988: 89-92.
6. Ben-Zvi, R, Eylon, B and Silberstein, J, *Ed. Chem.*, July 1987: 117-120.
7. Bodner, G M, (1986). *J. Chem. Ed.*, **63**: 874.
8. Ausubel, D P, Novak, J D and Hanesian, H, "Education Psychology: A Cognitive View (Holt, Rinehart and Winston: New York 1978).

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4th Annual RACI Research and Development Topics In Analytical Chemistry Meeting (9-11 December 1996)

Hosted By: RMIT, Melbourne, Australia

This conference provides a forum for young researchers in the area of analytical chemistry to present their work. We are now calling for expressions of interest from people who wish to be added to our mailing list.

Contact: Marie Bou-Raad
Secretary of the Organising Committee
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Email: chem_rd96@bunyip.ph.rmit.edu.au

KNOWLEDGE AND PEDAGOGY

Critical Dimensions in the Training of Chemistry Teachers

Tim Oughton, Christchurch College of Education
P O Box 31-065 Christchurch

Current Issues

There has been considerable public debate recently regarding the quality of science teaching in New Zealand. The catalyst for this debate was an Australian, Dr Michael Matthews, formerly Foundation Professor of science education at the University of Auckland. Matthews launched an attack on the new national science curriculum through a series of newspaper articles culminating in a book *Challenging New Zealand Science Education*. This book contained a number of claims about "falling standards" in science teaching and learning. Matthews wrote about a "loony, insidious educational doctrine" that threatens teaching – constructivism. He provided his own definition of constructivism and proceeded to denounce that meaning as being educational nonsense. Leaving aside the philosophical arguments about the definition of constructivism and the extent to which it has influenced our curricula, another criticism Matthews levels at the New Zealand science education fraternity concerns the training of science teachers in Colleges of Education. He contends that science teacher education courses stress process skills and undervalue content mastery.

This claim was given further media airing in an article by Dr Kelly Duncan (*The Press*). Duncan, Dean of Science at the University of Canterbury, claimed "...science education in New Zealand is deficient because teachers are a product of our deficient system, and because their delivery is inadequate and is based on a weak personal grasp of science." Like Matthews he also states that "teacher trainees learn plenty about how to teach, but little about what to teach." These are serious statements and would certainly be treated with the utmost gravity if they were proven to be correct. As yet, no research data are available to back up the assertions that many science teachers have a poor grasp of their subject matter. And just what is the relationship between subject expertise and teaching effectiveness in this country? Here lie two of the many challenges for science education researchers.

What does the research tell us?

In the past decade, when the advocates of educational reform made their calls for improvement in science education they usually targeted teacher education as the starting point for correction and change. Matthews and Duncan lay the "blame" for the perceived sorry state of science education in New Zealand fairly and squarely at the feet of teachers. A lack of subject expertise is often quoted as the root cause of "falling standards". International OECD studies have shown that standards in science understanding have not fallen in this country and this seems to have been ignored by those who are quick to condemn the state of science teacher training. Nevertheless, standards can always improve, and evidence from the literature reminds us that there are a number of critical issues relevant to the training of beginning science teachers. From a theoretical perspective there

are a number of conceptual views about the goals of teacher preparation and the means of achieving them. Feiman-Nemser (1990) identified five conceptual aspects of teacher education:

- i. *academic*; which focuses on transmitting knowledge and developing understanding.
- ii. *practical*; which focuses on the craft of teaching (i.e. techniques and skills) and is commonly associated with the practicum (teaching practice).
- iii. *technological*; which focuses on the goal of producing teachers who can carry out the tasks of teaching with proficiency. This orientation draws heavily on the research on effective teaching.
- iv. *personal*; which focuses on the teacher-learner as the centre of the educational process. Learning to teach is construed as a process of learning to understand, develop and use oneself effectively.
- v. *critical/social*; which focuses on combining theories of teaching and learning with a vision for a new social order. Trainees in such programmes are encouraged to remove social inequities, promote democratic values in the classroom and promote group problem solving amongst the students.

Teacher education programmes perhaps should ideally strive to incorporate all of Feiman-Nemser's aspects, but this paper will concentrate on the academic or subject matter orientation.

The importance of teachers knowing their subject is at the centre of teacher education. Teachers' knowledge of their subject is critical in shaping their curriculum and pedagogical decisions. Teachers' subject matter preparation begins at high school level, expands in undergraduate courses, and continues during the early teaching years. At the undergraduate level, most science subject matter preparation occurs outside Colleges of Education. Historically, subject matter knowledge has been equated with the completion of an undergraduate degree that showed evidence of accumulated course credits within an appropriate discipline. At secondary school the predominance of broad-balanced or general science in the first three years (Forms 3-5) demands teachers have content knowledge in Biology, Chemistry, Physics, Earth Science and Astronomy. Few, if any, teacher trainees have an undergraduate background that encompasses all these subject areas.

Since the late 1980s many teacher education programmes have emphasised a "flexible subject matter understanding". McDarmid *et al.* (1989) suggest that "flexible understanding of a subject entails the ability to draw relationships within the subject as well as across disciplinary fields and to make connections to the world outside school."

Grossman *et al.* (1989) refer to four dimensions of subject matter knowledge that affect teaching and learning;

- content knowledge
- substantive knowledge
- syntactic knowledge
- beliefs about subject matter.

The first category is the traditional one commonly thought of when speaking of studying a subject.

The substantive structures of a discipline include the explanatory frameworks or paradigms that are used both to guide inquiry in the field and to interpret data. In some disciplines, like chemistry and physics, a dominant structure may prevail at any one time, as is reflected in Kuhn's (1970) discussion of normal science and the nature of scientific revolutions.

Syntactic knowledge refers to the way in which new knowledge is brought into the field – scientific enquiry in the case of chemistry.

The fourth category mentioned in Grossman's model addresses teachers' beliefs about subject matter. How teachers view science and what is important to teach strongly influences their teaching. Equally influential is how the teacher approaches science in terms of how one comes to know it.

Historically, subject matter preparation has been the responsibility of universities. Grossman *et al.* (1989) write:

"Subject matter knowledge has provoked more controversy than study. As teacher educators, we have been satisfied to leave this crucial piece of teachers' knowledge behind its opaque velvet curtain, remanding responsibility for its transmission to departments of arts and sciences ... Given the central role that subject matter plays in teaching, we must reexamine our assumption that the subject matter knowledge required for teaching can be acquired solely through courses taken in the appropriate university department. The preliminary results of the growing body of research exploring the relationship between pedagogy and subject matter knowledge show that these are particularly important to the task of teaching. As teacher educators, we must consider how best to introduce this knowledge into programmes of teacher education." (p. 24).

The pedagogical aspects of teacher training have come under more criticism than perhaps any other. The "methods" and "strategies" of teaching are, however, intrinsically linked to content knowledge. The integration of subject matter with pedagogy is referred to as pedagogical content knowledge and includes the knowledge of how to teach particular topics (Shulman, 1986).

Mason's (1988) research has revealed that beginning and prospective teachers considered to have good knowledge of their content area are unable to apply this content information to teaching methodologies. They had difficulty in conceptually organising their knowledge of science and the relationships of major concepts, and consequently were ineffective. Mason concluded that there is a need to merge content and pedagogy in teacher education programmes. Knowledge of subject matter influences the way teachers sequence content and interact with

students (Gallagher and Tobin 1985). Results of a study of 15 high school science teachers indicated that teachers behave differently when they are teaching outside their content expertise. The manner in which teachers sequenced content and the quality of the interactions with students both appeared to be influenced by teachers relative lack of knowledge when teaching outside their content expertise.

In another revealing piece of research Gess-Newsome (1992) examined the sources of teachers' subject matter structures. Teachers reported that their high school level content courses and actual teaching experience were the primary influences on subject matter structures. Gess-Newsome suggests that these findings must be considered in relation to the nature and amount of science content that should be included in science teacher education programmes.

Current Practice

In my role at the Christchurch College of Education training secondary science teachers I have often evaluated the effectiveness of my courses and reflected on how best to spend the very limited amount of time I have at my disposal to encourage and support a beginning science teacher into the classroom/laboratory. The issue of content knowledge is a serious one for many student science teachers as a significant proportion of them have had little or no tertiary study in their non-specialist field of science, e.g. Biology, Chemistry, Physics, Earth Sciences.

What are the backgrounds of those who are training to become specialist science teachers? The academic qualifications of those enrolled in the senior chemistry curriculum course at the Christchurch College of Education over the past three years are summarised in Table 1.

Table 1: Summary of qualifications of enrolled chemistry teacher trainees

Year	Highest Level of Chemistry Studied	Number	Grades
1993	Masters/Hons	1	
	300	10	2As, 6Bs, 2Cs
	200	2	1B, 1C
	100	<u>3</u>	2As, 1C
		16	
1994	Masters/Hons	5	
	300	8	2As, 5Bs, 1C
	200	5	1B, 4Cs
	100	<u>2</u>	2Cs
		20	
1995	PhD	1	
	Masters/Hons	7	
	300	5	3Bs, 2Cs
	200	7	4Bs, 2Cs
	100	<u>6</u>	2As, 2Bs, 2Cs
		26	

It should be pointed out that there are a number of trainees enrolled in the course who do not consider themselves chemistry specialists; namely those who have studied chemistry for one year or possibly two years at university. Some interesting features emerge from this data.

- The majority (> 80%) had biology as their other major subject in their degree.
- Over 40% of those taking the chemistry course listed biology as their first teaching subject.
- Less than 10% had physics in their degree.
- Less than 5% had any earth science in their degree.
- The proportion of those with higher qualifications (Masters/Honours) is increasing, as verified by 1996 applicants (3 PhDs, 8 Masters/Honours).
- The number of those wishing to teach senior chemistry is increasing, which reverses the trend in the late eighties/early nineties.
- of the total secondary science intake into the Christchurch College of Education in the past three years, biology graduates outnumber chemistry and physics graduates by two to one.

The figures continue to reinforce the trends revealed in a survey undertaken ten years ago by Dodd and Warrington at the University of Otago. They examined the qualifications and deployment of science teachers in all New Zealand secondary schools and found that teachers with a major in a biological subject dominate. Biology majors were found to predominate chemistry majors by three to one. The effect of this dominance

of the biology majors, the surveyors claim, is compounded by the fact that, on average, they have a low content of mathematics (0.6 yrs), physics (0.4 yrs) and chemistry (1.4 yrs).

The majority of secondary chemistry teachers trained in New Zealand are trained at either the Christchurch College of Education (CCE) or the Auckland College of Education (ACE). Both Colleges offer a one year post-graduate diploma course with similar structural components as shown in Table 2. (Time allocations are derived from 1995 courses.)

The content of the science and chemistry courses offered are also remarkably similar and include familiarity with curriculum and prescription statements, development of teaching strategies, safety issues, operation and maintenance of laboratory apparatus, assessment issues and procedures, micro-teaching and peer and self-appraisal, development of resource units and field trips.

There is little, if any, time given to the teaching of pedagogical content knowledge. During the past five years that I have been involved teaching the Senior Chemistry course at the Christchurch College of Education I have become more convinced that the trainees need more curriculum time and certainly more time invested in examining the content/knowledge structures in a pedagogical context.

A review of my course evaluation sheets over the past 3 years has also revealed some interesting data. The students were asked to circle, on a continuum, how confident they felt in their understanding of certain aspects of their chemistry teaching. The continuum used a 1-5 scale as follows:

1	2	3	4	5
Not at all confident		Quite confident		Completely confident

Course Component	Approximate Time (ACE)	Allocation (Hrs) (CCE)
Curriculum Studies: Science	90	120
Curriculum Studies: Chemistry	60	40
Second Teaching Subject (e.g. Maths, Physics)	40-60	40-60
Professional Studies (e.g. Management, Presentation Skills)	120	140
Education Studies (e.g. Learning Theory, Adolescent Development)	70	70
Extension/Short courses (e.g. Health, Education Technology)	80-100	80-100
Teaching Practice	12 weeks	14 weeks

Aspect	% Frequency				
	Confidence Scale				
	1	2	3	4	5
Curriculum Structure	-	-	-	35	65
Laboratory Practice	-	12	36	34	18
Assessment Procedures	-	10	53	37	-
Teaching Strategies	-	-	18	40	42
Chemistry Content	12	36	42	10	-

The data are summarised in Table 3, and represents the opinions of 56 trainees in the years 1993-1995.

The obvious area of concern is that of content knowledge. Trainees are not confident in their own understanding of the chemistry content they will be teaching the following year. If this is a problem for those who have studied chemistry at tertiary level then how much of a problem is it for those who have little or no study of chemistry beyond their own school experiences? The answer has not been found by systematic research, but certainly anecdotal evidence I have accumulated over the years would suggest that there is a real need to provide specialist content courses for trainees who, for whatever reason, require them. The major obstacles in a one year post-graduate diploma course are time available and the relative importance of other aspects of the course.

Teacher Training in Britain

Earlier this year, thanks to the British Council, British Airways and my employer, I visited several teacher training institutions in Scotland and England. I was particularly interested in training programmes for chemistry teachers and was privileged to be able to interview some of the key players in teacher education. The major difference between British and New Zealand teacher training programmes is the length of the practicum, i.e. the amount of time spent in school practising teaching.

The structure of four different post-graduate teacher training programmes is shown in Table 4.

In Scotland approximately one half of the trainees' time is spent in school, in England two thirds, and in New Zealand one third. The accent on training in schools originates from successful research-based models of school-based, initial teacher education.

The rationale for the change appears to be that learning what it means to be a school teacher can only be learned in schools. In 1992, the British Government decided that teacher training for secondary teachers be predominantly school-based. No doubt economic reasons also influenced this decision.

The basic competencies of Initial Teacher Training defined by national authorities in Britain have been grouped as:

1. Subject Knowledge
2. Subject Application
3. Class Management
4. Assessment and Recording of Pupil's Progress
5. Further Professional Development

Teacher trainees are assessed by external examiners at the end of their course and must demonstrate competency in each of the above categories. It is left largely to the school 'mentor' (associate teacher) to provide specialist curriculum-based training since virtually no time is given in the College courses to content-based pedagogical knowledge. How well trained these mentors are in delivering subject-based competencies in knowledge and delivery is debatable. Certainly many of the teacher trainees I spoke with in Britain suffered similar confidence problems with knowledge structures (i.e. the organisation of a specified domain of knowledge such as chemistry) as do trainees in New Zealand.

A well-formed knowledge structure should not be expected without actual experience with real secondary students. Other than simply increasing the length of teaching practice it may be necessary to provide increased opportunities for trainee teachers to conduct systematic classroom observations and reflect upon instructional consequences.

Table 4: Summaries of the structure of four different programmes currently operating in the United Kingdom

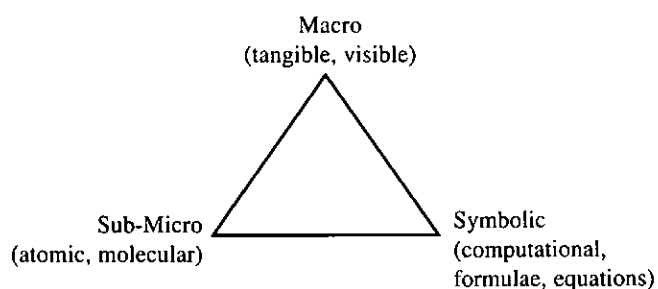
Institution	Moray House (Edinburgh)	Jordanhill (Glasgow)	University of York Department of Educational Studies	University of Oxford Department of Educational Studies
Length of Programme	36 weeks	36 weeks	36 weeks	36 weeks
Time Spent in Teaching Practice (In School)	16 weeks	17 weeks	23 weeks	23 weeks
Nature of College-Based Studies	20 weeks • Generic studies 4 hrs/week • Subject studies 5 hrs/week	17 weeks • Subject studies 2 days/week • Generic issues and strategies for teaching 1 day/week • Professional Studies 1 day/week • Elective studies 1 day/week	13 weeks • Educational studies 1 day/week • Science Curriculum studies 2 days/week	13 weeks • Professional Development Programme 1 day/week • Science Curriculum studies 2 days/week
Specialist Chemistry Courses	Yes	Yes	No	Yes

Other Critical Aspects of Preservice Training for Chemistry Teachers

My experience in teacher education in the past five years combined with research data I gathered in the UK identify several other critical aspects in the training of chemistry teachers:

- Student teachers must appreciate the genuine difficulty pupils have in learning chemistry. Learning chemistry is difficult for several reasons according to Alex Johnstone (Professor of Science Education, University of Glasgow). These include:

1. The intangible nature of many chemical concepts; ideas like the electron, bond energy, structures of molecules are beyond our senses, and pupils have little or no experience in constructing such concepts.
2. The multi-level thought that we often inflict on pupils simultaneously can be represented by the following conceptual triangle:



Too much teaching takes place **within** the triangle where the three levels interact in varying proportions and the teacher may be unaware of the demand being placed on the pupils. Plenty of good chemistry can, and should, be taught at the macro level only, especially in the early stages.

3. A lot of practical work creates more problems than it solves and pupils often find it difficult to distinguish 'signal' from 'noise'.
 4. Language problems exist, especially in the use of unfamiliar technical words and words that have alternative meanings in other (non-scientific) contexts (e.g. solution, volatile).
- Student teachers must be able to justify teaching their own curriculum speciality – i.e. they should be able to articulate what special knowledge and skills chemistry instils in a pupil.
 - Student teachers should engage in simple co-operative problem solving activities in the laboratory. Once student teachers are encouraged to 'tip out' their ideas onto the table in a non-threatening way, and subsequently see how inadequate many of their ideas are, then confidence starts to build as they reflect on their own knowledge structures.
 - Collegial supervision of student teachers by associate teachers that encourages reflective practice is much more effective than a directive apprenticeship model of supervision. Associate teachers must acknowledge that student teachers bring with them ideas shaped by their own education, and their learning is accelerated by taking time to explore their preconceptions.

- Student teachers should be aware of safe laboratory practice, especially the handling and storage of hazardous substances.
- Student teachers should be encouraged to think about the nature of their subject and the nature of their knowledge. Some study of the history and philosophy of science should be included in science teacher training programme.
- Student teachers should examine and reflect on the structural relationship between the underpinning ideas or concepts that "define" chemistry.

A Conceptual Organisation for Secondary School Chemistry

It is difficult (impossible?) to state the necessary and sufficient conditions that must be fulfilled by a discipline or theory in order that it qualify as a science. Hurst (1974) lists the distinguishing features of a discipline or form of knowledge as one having

- i. its own peculiar concepts
- ii. its own logical structure regarding the relationship between these concepts
- iii. its own testing procedures regarding procedures for testing the truth or falsity of factual statements emanating from this structure.

Chemistry certainly qualifies as a "discipline" using Hurst's definition and in the development of *Chemistry in the New Zealand Curriculum* an attempt was made to define a conceptual organisation for secondary school chemistry. I am not aware of any such similar organisation in school chemistry curricula elsewhere, and I have used Table 5 to help my students examine their own knowledge structures.

Recommendations for the Future Training of Chemistry Teachers

This paper has attempted to signal the importance of knowledge and pedagogical structures, amongst other things, in the training and development of beginning chemistry teachers. The following recommendations arise out of my interpretation of selected research and my observations in the United Kingdom.

1. Course advice be given to undergraduates who may be considering secondary science teaching as a career.
2. Secondary science graduates accepted in Colleges of Education should have at least one year's study of biology, chemistry and/or physics in their degree.
3. Primary school trainees should be encouraged (required?) to include science units in their B.Ed. degrees.
4. Colleges of Education should provide short courses in pedagogical content knowledge covering biology, chemistry, physics and earth science. Pre-service, in-service and distance courses should be offered for science teachers who wish to improve their knowledge and skills in unfamiliar subjects.
5. Alternative models of science teacher education should be trialed and researched, e.g.

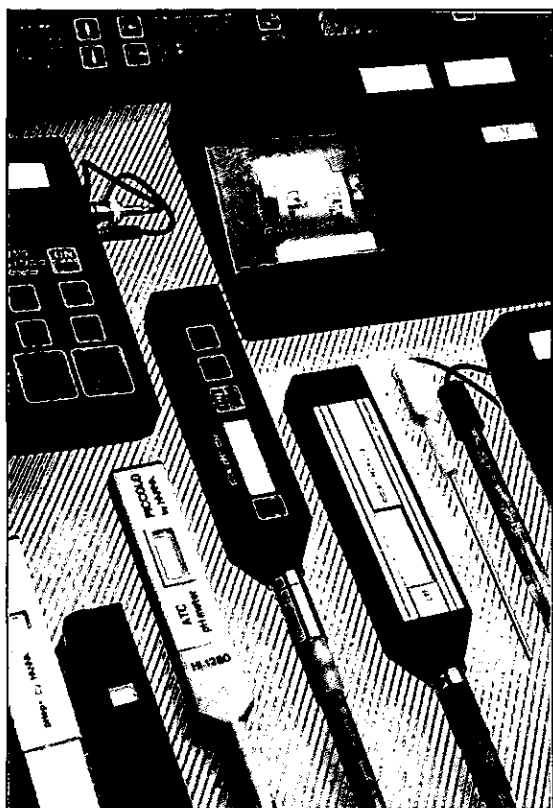
Table 5 : Important Concepts and Major Patterns of Chemistry*

- The central concepts provide students with a theoretical framework in which to operate.
- The major patterns of chemical behaviour provide students with guidelines for organising information about substances and the ways in which they behave.

A.	
Central Concepts	Important ideas they encompass
• The atom is the basic unit of chemical composition and chemical change.	Symbols, formulae and equations. Stoichiometry The mole as the unit of amount of substance
• The chemical behaviour of an element is largely determined by the electron configurations of its atoms.	Periodicity (Since electron configuration exhibits periodicity, so does chemical behaviour.)
• All the important forces between atoms, molecules and ions are electrical.	The strong forces: ionic and covalent bonds. The weak forces: van der Waals forces, hydrogen bonds.
• Chemical changes and changes of state have energy changes associated with them.	Thermal energy changes are the net result of bond breaking and bond making.
• At any temperature above absolute zero, the particles in any sample of matter are in constant, random motion.	The states of matter. The role of rotational movement about single bonds in determining the shapes of molecules. The role of translational movement of molecules in gas pressure and in collisions leading to reactions.
• The reversibility of chemical reactions and the nature of equilibrium systems.	The equilibrium state and its dynamic nature. The factors that cause systems at equilibrium to change. Equilibrium constants.
B.	
The Patterns	What is involved?
• The periodic table.	The distribution of metals and non-metals. Similarities and trends within groups, and trends within periods.
• The classification of elements as metals and non-metals.	The basis of the distinction. The characteristic chemical properties of metals and non-metals, and of their compounds.
• The classification of compounds as ionic and molecular.	The basis of the distinction. The properties of ionic substances are those of their constituent ions.
• The classification of chemical reactions.	Precipitation, complex formation, oxidation-reduction, acid-base, condensation, and the classification of organic reactions as addition, substitution and elimination.
• The classification of organic compounds in terms of their functional groups.	The characteristic reactions of specified functional groups

* Table 5 is an updated version of a discussion of the central ideas and major patterns of chemistry that first appeared in the Teacher's Guide for *Chemistry For Sixth Forms* (Wooff, Howarth and Rendle (1987)).

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- a school-based model using College tutors in schools
 - a College-based course where professional studies is taught in a science context
 - a two year Masters of Science Teaching degree.
6. More time should be dedicated to pedagogical content studies in science-based teacher training courses.
 7. Research should be undertaken to provide a greater understanding of what constitutes constructivist teaching and the impact such teaching has on pupils' learning.

Bibliography

Feiman-Nemser, S (1990). Teacher preparation: structural and conceptual alternatives in handbook for research on teacher education.

Duncan, K, Why Johnny knows little about science: a crisis in teaching. *The Press*, July 14th 1995.

Gallagher, J and Tobin, K (1985). Teacher management and student engagement in high school science. Paper presented at the annual meeting of the National Association for Research in Science Teaching, French Lick Springs, IN.

Gess-Newsome, J (1992). Biology teachers' perceptions of subject matter structure and its relationship to classroom practice. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston.

Grossman, P L, Wilson, S M and Schulman, L S (1989). Teachers of substance: subject matter knowledge for teaching in M Reynolds (Ed) "Knowledge base for beginning teachers". New York: Permagon.

Hurst, P (1974). Knowledge and the curriculum. London: Routledge and Kegan.

Johnstone, A H (1991). Why is science difficult to learn? *Journal of Computer Assisted Learning*, 7.

Kuhn, T (1970). The Structure of Scientific Revolutions. University of Chicago Press.

Mason, C (1988). A collaborative effort to effectively evolve pedagogical content knowledge? Paper presented at the annual meeting of the American Educational Research Association.

Mathews, M R (1995). Challenging N.Z. Science Education, Dunmore Press.

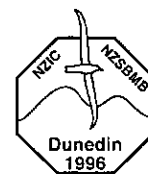
McDiarmid, G W, Ball, D L and Anderson, D W (1989). Why staying one chapter ahead doesn't really work: subject specific pedagogy in M Reynolds (Ed). Knowledge base for beginning teachers. New York: Permagon.

Ministry of Education (NZ). (1994). "Chemistry in the National Curriculum".

Schulman, L S (1986). Those who understand: knowledge growth in teaching. *Educational Researcher*, 15 (2) 4-14.

Molecules for the Future '96

National Conference of the New Zealand Institute of Chemistry and
the New Zealand Society for Biochemistry and Molecular Biology



University of Otago, Dunedin, New Zealand
2 - 6 December 1996

The New Zealand Institute of Chemistry and the New Zealand Society for Biochemistry and Molecular Biology are pleased to extend an invitation to attend this conference. Participants will assemble in Dunedin on Monday 2 December and the meeting will close on the afternoon of Friday 6 December.

The conference will emphasise many aspects of chemical and biological science and is organised around three major themes: Analytical Chemistry; Biological Chemistry; and Colloids, Surfaces and Materials. In addition, lecture and poster sessions will represent the interests of various specialist groups from within the Institute of Chemistry and the Society for Biochemistry and Molecular Biology. A highlight of the conference will be a symposium on Chemical and Biological Hazards to be held on Friday 6 December. This will be targeted at scientists working in the education sector, public bodies, government departments, chemical and biological industries and academic research.

Venue

The conference will be held at the University of Otago, with lecture and poster sessions centred around the Castle Lecture Theatre complex. Delegates and accompanying persons will also have an opportunity to explore the many natural, historical and cultural attractions of Dunedin city.

Registration

All persons attending the conference must register in advance. The registration deadline is 15 October 1996. Late Registrations may be accepted up to 15 November 1996 on payment of a surcharge. Applications should be made as early as possible on the **Registration Form** which can be found on pages 45/46 or obtained from:

Dr R M Carr
Department of Chemistry
University of Otago
P O Box 56 Dunedin New Zealand

Tel: +64 3 4797908
Fax: +64 3 4797906
e-mail: nzicconf@alkali.otago.ac.nz

Applications should be returned by 15 October to the above address. Payment by Credit Card (Bankcard, MasterCard or Visa) is permitted for all applicants. Payments must be made **IN FULL** by completing and signing the appropriate section of the Registration Form.

All Registration forms and remittances received will be acknowledged. **Tickets for functions and final programmes will not be sent out in advance.** This material, together with a list of participants, badges and any last minute information, should be collected by participants at the Registration Desk on arrival. The Registration Desk will be located in University College from 4.00 pm on Monday 2 December. It will reopen in the Castle lecture theatre at 8.00 am on Tuesday 3 December.

Registration Fees

	Registration by 15 Oct	Late Registration by 15 Nov
Full participant (NZIC/NZSBMB Member)	\$160	\$200
Full participant (not NZIC/NZSBMB Member)	\$200	\$240
Student participant (NZIC/NZSBMB Member)	\$30	\$40
Student participant (not NZIC/NZSBMB Member)	\$60	\$80
One day registration for Symposium on Chemical and Biological Hazards (Not required for Conference Registrants)	\$30	\$40
Accompanying person	NIL	NIL

The special Registration fees for NZIC/NZSBMB members also apply to members of the RACI, ASBMB and other equivalent professional bodies. A Registration may be cancelled by writing to the Conference Secretary. Fees will be fully refunded if notification arrives before November 15 1996. Applications may be cancelled up to November 30 1996, in which case a partial refund will be made for fees already paid. It will not be possible to refund any fees if cancellations are received after this date.

Participant Categories :

Full participant

The full Registration fee entitles the participant to a program and book of Abstracts, entry to all lecture, exhibition and poster areas, entry to the mixer, and refreshments at poster sessions. Attendance at the Symposium on Chemical and Biological Hazards is included in this Registration fee.

Student participant

A person enrolled in full-time study is entitled to register as a student participant with the same entitlement as a full participant. To be accepted in this category, the Registration form must be signed by the students supervisor.

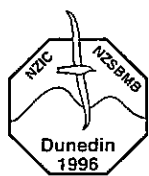
Accompanying persons

An accompanying person may be registered only with a full or student participant. An accompanying person is entitled to request accommodation at University College at conference rates, and to attend the mixer.

Scientific Programme

The conference will feature plenary lectures by a number of distinguished scientists whose research covers the major themes of the conference. A number of symposia have also been arranged within the general conference themes as indicated in the Table below. Each of these symposia will include keynote lectures (30 min.) and shorter (20 min.) orally presented papers. Speakers who have accepted invitations to present plenary and keynote addresses include:

Theme	Plenary	Keynote
Conference Lecture	Dr John Emsley, <i>Imperial College London</i>	
Chemistry and Climate Change	Professor Peter Liss, <i>University of East Anglia</i>	Dr Martin Manning <i>NIWA Wellington</i>
Analytical Chemistry		Professor Alan Bond <i>Monash University</i>
Environmental Chemistry		Professor Don Macalady <i>Colorado School of Mines</i>
Protein Structure and Function	Professor Bill Cullen, <i>University of British Columbia</i> Dr Jenny Martin, <i>University of Queensland</i>	Dr Richard Simpson <i>Ludwig Institute of Cancer Research, Melbourne</i>
Plant Cell Walls	Professor Nick Carpita, <i>Purdue University</i>	Dr Robert Redgwell <i>Hort Research Auckland</i>
Plant Pigments	Professor Raymond Brouillard, <i>Université Louis Pasteur</i>	Dr Tim Holton, <i>Florigene, Australia</i>
Molecular Pathology		Professor Richard Faull, <i>Auckland School of Medicine</i>
Microbial-Eukaryotic Interactions		Professor Howard Jenkinson, <i>University of Otago</i>
Cancer and Development		Dr Martin Kennedy, <i>Christchurch School of Medicine</i>
Gene Structure, Function and Regulation		Associate Professor John Tweedie, <i>Massey University</i>
Regulation of Gene Expression		Dr Chris Brown, <i>Iowa State University</i>
Light and Molecules		Dr Brian Jordan, <i>Crop and Food Research, Levin</i>
Colloids and Surfaces	Professor Roger Horn, <i>University of Adelaide</i>	Dr William Ducker, <i>University of Otago</i> Dr Roger Stanley, <i>Industrial Research Ltd, Lower Hutt</i>
Spectroscopy and Theoretical Chemistry		Professor Ron Hester, <i>University of York</i>
Energy		Professor Nigel Sammes, <i>Waikato University</i>
New Materials		Professor Douglas Russell, <i>University of Auckland</i>
Bio-organic Chemistry		Dr Brent Copp, <i>University of Auckland</i>
Organic Synthesis		Dr Mick Sherbourne, <i>Massey University</i>



Molecules for the Future



National Conference of the New Zealand Institute of Chemistry
and the New Zealand Society for Biochemistry and Molecular Biology.

University of Otago, Dunedin, NEW ZEALAND
2-6 December 1996

Registration Form

The completed form should be sent to:

Dr R.M. Carr
Conference Secretary
Department of Chemistry
University of Otago
DUNEDIN

Phone : 03-479-7908
FAX : 03-479-7906
e-mail : nzicconf@alkali.otago.ac.nz

arriving no later than 15 October 1996 for normal Registration, or 15 November 1996 for late Registration.

Family name: Initials: Title:

Address:

Telephone: Fax: E-mail:

Number of accompanying persons:

Name(s) for the conference badge(s):

Participant category : full / student Will you be presenting a paper/poster?

Name and signature of supervisor if participant is a student:

Name Signature

Conference Fees

Registration Fee (Full participant) \$

Registration Fee (Student participant) \$

Registration for the One Day Symposium on Chemical and Biological Hazards; not required for conference Registrants \$

Details of the Registration fees are given on page 2 of the Second Circular. N.B. If payment is made after 15 October 1996 but before 15 November 1996 please pay the appropriate Late Registration fee(s)

Conference dinner @ \$40 Number attending \$

TOTAL \$

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Accommodation at University College* Number of persons

Arrival date Departure date

Excursions (Wednesday 3 December)

Please indicate by ticking the appropriate box below if you wish to book on any of the following excursions.

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Harbour Cruise Visit to Macraes gold mine

Do you require information for accompanying persons' activities? Yes/No

ONE DAY SYMPOSIUM ON CHEMICAL AND BIOLOGICAL HAZARDS
Friday 6 December 1996

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- Chlorine in the environment.
- Hazardous Substances and New Organisms Act (update on developments including the development of the regulations).
- Monitoring of airborne releases of chemicals from industrial sites.
- Hazardous waste technology.
- Laboratory-based containment of genetically-engineered material.
- Field release of genetically-engineered organisms.
- Volcanic emissions.

A panel discussion of speakers will conclude the symposium. A special one day Registration is available for the symposium at a cost of \$30; attendance is included in Registration for the full conference. For further information on this symposium contact:

Dr W A Temple
National Toxicology Group
University of Otago
P O Box 56
DUNEDIN
Fax: (03)-4770509
Email: wtemple@gandalf.otago.ac.nz

Support for students

Some financial assistance is available to help full-time postgraduate students to attend this meeting. Chemistry students should check with their Head of Department for further details. NZSBMB student members are referred to the information given in *NZ BioScience* Vol. 4, No. 2 (May 1996), page 40.

Easterfield Lecture

The 1996 Easterfield Lecture will be presented by Dr Andrew Abell, University of Canterbury. The award is made to the New Zealand chemist under the age of 35 who has made the most distinguished contribution to research.

The Watson-Victor Award 1996

This prestigious award is presented annually by Watson-Victor Ltd to the biochemist or molecular biologist belonging to the NZSBMB who has contributed most to the advancement of the discipline over the previous year or so. The award consists of a NZ\$500 cash prize and a travel grant of up to NZ\$300 to assist the winner to attend the NZIC/NZSBMB conference and deliver the Watson-Victor Lecture.

Student Paper Competitions

Separate competitions are to be held for NZIC and NZSBMB members. The NZIC competition is being arranged by individual NZIC branches. For further information on the NZSBMB competition see *NZ BioScience* Vol. 4, No. 2 (May 1996), page 40.

Trades Display

Scientific supply houses and publishers will display a variety of instruments, equipment and books at the conference. On Tuesday 3 December, Thursday 5 December and Friday 6 December, lunch will be provided for participants in the vicinity of the trade displays to allow an opportunity to examine the material on display and to discuss requirements with trade representatives.

Call for Papers

Participants are invited to submit abstracts on any aspect of chemistry, biochemistry or molecular biology with special reference to the topics of the symposia given above. In general, contributions will be presented as posters (poster board size 1.2 m high x 1 m wide). Participants should indicate whether they would prefer to present their paper orally (20 minutes including discussion) or in a poster session. Prizes will be offered for the best posters in the Chemistry and Biochemistry and Molecular Biology sections. For further details on the NZSBMB poster competition see *NZ BioScience* Vol. 4, No. 2 (May 1996), page 40.

Abstracts should be sent to the Conference Secretary to arrive on or before 15 October 1996. Abstracts submitted by post should not be folded and should be sent in duplicate, one original and one copy. Abstracts should not be transmitted by fax machine. Abstracts prepared using Microsoft Word or WordPerfect wordprocessing programs may be submitted electronically by email either as Binhex or Uuencoded files or "attached" to the message at transmission time. Email submissions to: nzicabs@alkali.otago.ac.nz

The subject line of the electronic message should include the submitting author's name, fax number, and the name and version of the word processing program used to prepare the abstract, e.g. John Smith, 03-4791996, Word for Windows 6.1.

Except by special arrangement, each registered participant may submit only one abstract. There are no restrictions on co-authorship of abstracts submitted by others. Accepted abstracts will be included in the Conference Program only if the presenting author has registered for the conference.

Abstract preparation guidelines

Abstracts should be printed on one A4 page only, in 12-point type using 1.5 or double-line spacing. The abstract text and figures should be contained within a frame 150 mm wide by 230 mm long. The title of the abstract should be left justified followed by two blank lines and the authors names and addresses, with the name of the presenting author underlined. Diagrams, figures or chemical structure diagrams should be mounted on the abstract page.

Abstract book

A book containing the detailed scientific program and collected abstracts will be provided to registered participants at the conference. Copies will not be available prior to the conference.

Social programme

There will be a mixer on the evening of Monday 2 December at the University College beginning at 7.00 pm.

Light refreshments will be available during the poster sessions on the evenings of Tuesday 4 December and Wednesday 5 December.

The afternoon of Wednesday 5 December will be kept free for sightseeing and recreational activities. Visits are planned to the albatross colony, a yellow-eyed penguin sanctuary, and the Macraes gold mining operation. Harbour cruises and trips into central Otago on the Otago excursion train will also be available. As places in some of these activities will be limited, participants are urged to pre-book on the Registration form.

The Conference Dinner will be held on the evening of Thursday 5 December in the University Union.

Accompanying persons are warmly invited to participate in all of these functions. Apart from the Wednesday excursions, no formal programme is offered for accompanying persons. Dunedin offers a wide range of activities from stately home/castle/art gallery visits through museums to relaxing in gardens on beaches or on golf courses. Further information will be provided on request and will be available from the conference desk or from the Dunedin Visitors Centre.

Notes on the Wednesday Excursions

The albatross colony at Taiaroa Head is the only mainland breeding colony of these giant seabirds. There is a gallery display and a colony viewing observatory.

The yellow-eyed penguin is an endangered species and its nesting/roosting habitat may be seen at Penguin Place.

The Monarch Otago Harbour Cruise allows viewing of the spectacular scenery of the harbour and peninsula; the breeding sites of albatross, seals, penguins, cormorants and other birdlife with emphasis on habitats, ecology and conservation.

The Taieri Gorge Train provides a relaxing and informative journey through history, rugged scenery (inaccessible by road), Victorian stonework and engineering examples unique to Dunedin.

Macraes Gold Mine, 1.5 hours drive from Dunedin, is a hard rock open cast mine with recovery plant employing froth flotation and cyanidation extraction processes. Cyanide disposal is effected in oxidation ponds.

125th Anniversary of the University of Otago Chemistry Department

1996 is the anniversary of the appointment of Professor Black as the first Professor of Chemistry. To recognise this important anniversary, various functions are being organised during the weekend following the Conference. In particular, there will be a dinner on Saturday 7 December which will also be the Department's end-of-year function. Class reunions will be facilitated. A warm invitation is extended to all graduates and ex-staff to join us for this weekend of activities. Special travel and accommodation deals are available.

Information can be obtained from:

Dr Allan Blackman
Chemistry Department
University of Otago
P O Box 56 Dunedin, New Zealand
Tel: (+64-3)-4797931
Fax: (+64-3)-4797906
Email: blackman@alkali.otago.ac.nz

Accommodation

Accommodation has been reserved at University College on the University of Otago Campus. The tariff is \$33 per night for bed and breakfast, single rooms only. Participants wishing to book accommodation in University College should fill in the appropriate section of the conference Registration form.

For travel reservations or Hotel/Motel accommodation bookings:

Brooker Travel

369 George Street
P O Box 6309
Dunedin

Phone: (+64-3)-4773383, Freephone: 0800-800630, Fax: (+64-3)-4771813
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Brooker Travel have been appointed as conference travel agents and to coordinate motel and hotel accommodation. We would strongly recommend that you book such accommodation early as there are graduation ceremonies on during the weekends before and after the conference.

Airfares:

A group fare has been arranged with Ansett New Zealand. This allows discounts of up to 50% off the standard fare. Please note that these seats are limited so we advise participants to book early.

Brooker Travel can also book flights with Air New Zealand should you prefer.

Accommodation:

Brooker Travel can arrange accommodation in motels or hotels close to the University if required. When reserving accommodation please state if you require hotel or motel accommodation, your arrival and departure dates, how many people it is for and what type of room is required, i.e. single, double, twin etc.

Because the City is busy with other events on at the same time as the Conference, we suggest you give this your urgent attention. A \$50.00 deposit may be required to confirm your reservation. This will be advised at the time of booking.

Rental Cars:

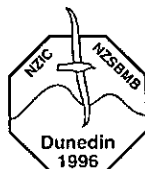
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Molecules for the Future
NZIC/NZSBMB Conference
University of Otago, Dunedin
2-6 December 1996

Chemical and Biological Hazards Symposium

Friday 6 December

The programme is as follows:

9.00 am Opening – Dr D McGregor – Chief Scientist – MoRST

Hazardous Substances and New Organisms Legislation
Dr S Vaughan and Dr A Moeed, Ministry of the Environment

Resource Management Consents – Monitoring Airborne Releases of Chemicals
Dr B Graham, Works Consultancy Services – Environmental

Morning Tea

Genetic Engineering *Professor G Petersen*
Calici Virus *Associate Professor F Griffin*
Field Release of Genetically Engineered Organisms *Dr C Ronson*

Lunch

Cut Out Chlorine and Count the Cost *Professor J Emsley*

Hazardous Waste Technology – Chemical and Microbiological
Mr J Campbell, Waste Solutions

Destruction of Chemical and Biological Weapons *Dr J Fountain*

3.30 pm Closing Remarks

This programme is part of the New Zealand Institute of Chemistry and New Zealand Society for Biochemistry and Molecular Biology Conference but separate registration is available at NZ\$30 for this symposium. It has been designed to inform professionals, teachers and persons needing a generic knowledge of hazardous substances (e.g. Local and Regional Council Employees). The Trades Display will operate until 1.30 pm and a light lunch will be available at a small charge to registrants for the symposium.

Information:

Dr Wayne Temple
National Toxicology Group
University of Otago
P O Box 56, Dunedin
Phone: (03) 4797244
Fax: (03) 4770509
Email: wtemple@gandalf.otago.ac.nz

Registration:

Dr R M Carr
Chemistry Department
University of Otago
P O Box 56, Dunedin
Phone: (03) 4797932
Fax: (03) 4797906
Email: nzicconf@alkali.otago.ac.nz

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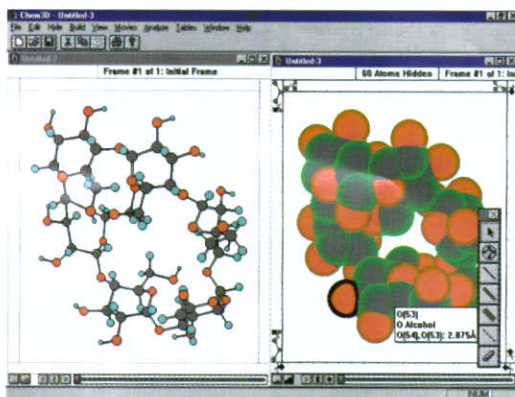
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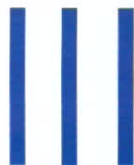
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