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NZIC

Chemistry

IN NEW ZEALAND

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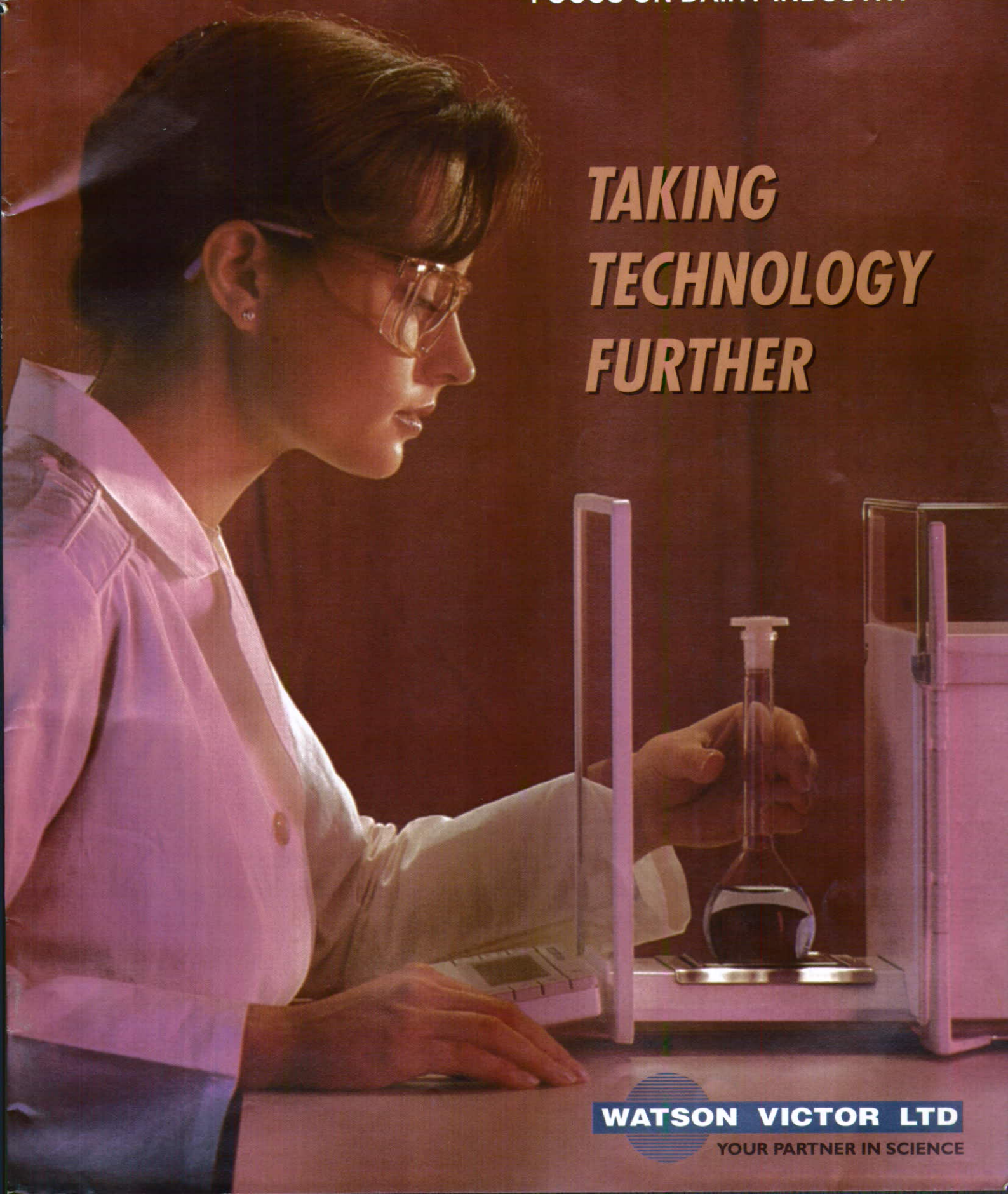
FOCUS ON DAIRY INDUSTRY



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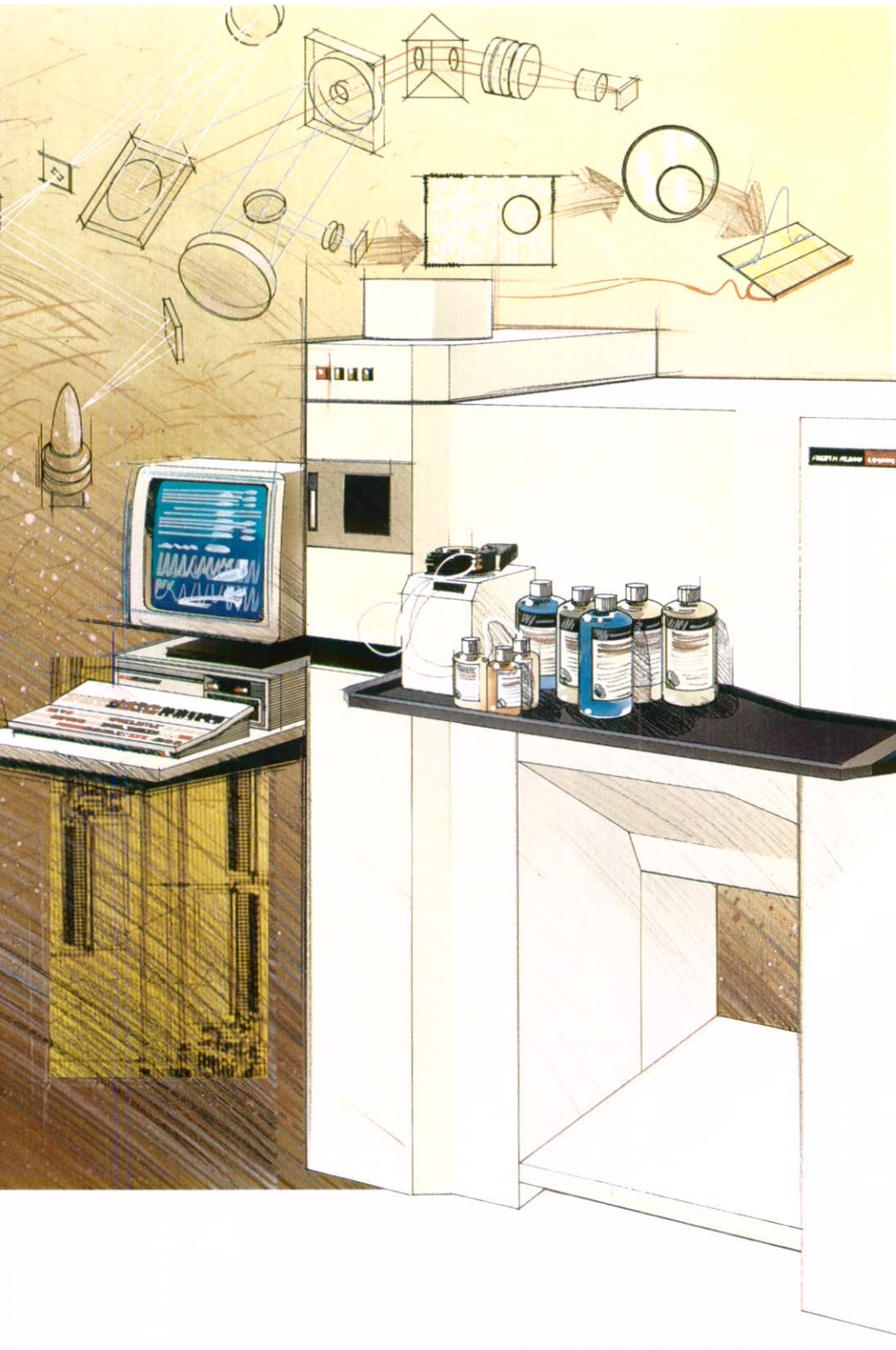

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UP FRONT ...

NZIC Chemistry IN NEW ZEALAND

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January 1996 - Focus on Environmental Control, Waste Management, Water Analysis

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Contributions and enquiries to:
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COVER STORY

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OVERALL TRENDS IN SCIENCE FUNDING

At the national level, Research and Development (R&D) expenditure is usually monitored by calculating it as a percentage of Gross Domestic Product (GDP). This makes it easier to compare one country with another in terms of "R&D intensity" without regard to the size of the economy or its population.

The 23 members of the Organisation for Economic Co-operation and Development (OECD), which includes most of the world's economically-developed countries, have agreed to collect and exchange their R&D statistics on a regular basis and in a standardised way. Inter-country comparisons within the OECD have been available for many years and interesting trends can be observed.

New Zealand was relatively well-placed in R&D intensity during the 1960s and 1970s and as recently as 1981 was above the OECD average in terms of total R&D expenditure to GDP. However, this performance relied on high levels of expenditure by the Government, with the business sector spending less than the OECD average.

During a decade when R&D expenditure in most OECD countries was very buoyant, both the Government and business sectors in New Zealand were reducing their R&D investments. In the early 1990s, the situation in New Zealand was rather static, with modest increases in Government R&D funding and very low GDP growth. This was also the period when the New Zealand science reforms were bedding down and the Crown Research Institutes (CRIs) were being established.

In April 1993 the Government issued a Strategic Statement entitled "Path to 2010", in which a commitment was made to increasing the "public investment in science" to 0.8% of GDP by 2010. The Government made its first moves towards this commitment in the 1994 Budget, with the announcement of increases in the science expenditure baseline to a level $40m higher in 1996/97 than in 1993/94.

Most of the increases flowed into the Public Good Science Fund. The 1994 Budget set a pattern of looking three years ahead.

The 1980s was a disastrous decade for R&D expenditure in New Zealand, as the table shows:

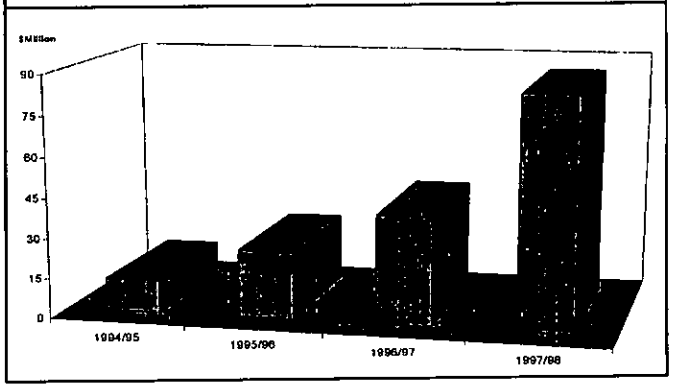
R&D expenditure/GDP %	1981	1989
Government	0.84	0.57
Business	0.52	0.29
Other	0.04	0.05
TOTAL	1.40	0.91
OECD Average	1.37	1.70

The 1995 Budget continues the pattern of announcing a three year profile.

In the third year of the new triennium (1997/98), Government science expenditure will increase by $45 million over the previous year. This is an even more dramatic increase than that announced in the 1994 Budget.

The pattern of increase within the science vote over the five year period is illustrated on the bar graph.

Cumulative Increases in Science Expenditure Since 1993/94



Although information on R&D expenditure by the private sector is never fully up-to-date, there is evidence that as New Zealand came out of recession in 1992, businesses began to invest more in R&D however, our business sector still lags behind those in similar countries from this point of view.

SCIENCE AND TECHNOLOGY PROMOTION

In 1995/96 the Government will spend $317,000 on the promotion of science and technology, and science and technology education. The fund is administered by the Ministry in conjunction with an external Science and Technology Promotion Advisory Committee (SATPAC).

Initiated in 1994/95, SATPAC aims to promote a positive attitude toward science and technology at all levels in the New Zealand community.

Values and attitudes supportive of science and technology are increasingly important in enterprise to assure innovation capability is maximised, and in the general population to ensure that science and technology become implicitly associated with worthwhile careers, sound decision making and successful enterprise.

During 1994/95 emphasis has been on projects targeted at young people, and in particular on projects which would encourage them to consider science or technology as career options.

Because of the need to obtain maximum leverage from a relatively small resource base, a proportion of total funds will be used by SATPAC to proactively initiate highly targeted projects. The remaining funds will be used as contestable grant funding open to the general public.

Within the contestable field in 1995/ 96 the relative emphasis will shift away from education and towards promoting positive values and attitudes towards science and technology by key decision makers in enterprise and amongst groups within the wider community, including parents of children under 12 and Maori, and young people. However, all projects fulfilling the objectives of science or technology promotion will be considered.

Guidelines and application forms are available from Olga Berezovsky, SATPAC's Executive Officer, telephone (04) 472 6400, ext 8948.

SCIENCE AND TECHNOLOGY PROMOTION AWARDS RESOURCES IN SUPPORT OF THE S&T CURRICULA		
Recipient	**Project Title/Description**	**Amount Awarded**
Animal and Veterinarian Sciences Group, Lincoln	Production of Educational Resources in Gene Technology	$500
Copeland, Wilson and Associates	The Resource Guide. Super-catalogue of S&T curriculum resources	$20,800
NZ Food and Beverage Exporters' Council	Development of school resources for the food technology component of the new technology curriculum	$20,000
Taupo Observatory	"The Taupo Volcanic Zone" Education Resources Kits for Primary and Intermediate School Children	$27,175
COMPETITIONS/AWARDS		
Applicant	**Project Title/Description**	**Amount Awarded**
Royal Society of New Zealand on behalf of CREST	Enabled two NZ students to participate in the Malaysian Inventors and Design Society Exhibition and Competition	$3,600
Science and Mathematics Olympiad Organising Committee	Preparation of the Science and Mathematics Olympiad Team for international competition	$30,000
Royal Society of New Zealand	Science Theatre. Contribution to an educational drama competition aimed at young people	$10,000
Crest-NZ	Development of Materials and National Trial of Team CREST Award 1995/96	$20,000
Crest-NZ	Redevelopment of silver and bronze award materials	$21,000
Nick Atkins, Sue Jarvis, George Murray, Graeme Tinkler	Revision of Science Awards Trust scheme in line with the new Science and Technology curricula. Computerisation of schemes administration	$21,200
Manawatu Branch of the NZIC	Contribution to Chemistry Quiz	$2,000
OTHER SCIENCE AND TECHNOLOGY EDUCATION PROGRAMMES		
Recipient	**Project Title/Description**	**Amount Awarded**
Royal Society of New Zealand	Appointment of part-time co-ordinator to promote public participation in The Double Helix Club	$17,500
Discovery World	Young Scientist Club. Hands-on Science and Techology activities not usually experienced by school children	$10,000
IPENZ	A kit to assist Neighbourhood Engineers to form a working partnership with schools	$10,000
New Zealand Pastoral Agricultural Research Institute Ltd	Flytrack follow-up project. Opportunity for school children to participate in a national survey to establish the spread of the Australian blowfly in NZ	$500
New Zealand Pastoral Agriculture Research Institute Ltd	The AgResearch Science Experience. A programme which combines learning experiences and careers advice to primary/secondary students with an emphasis on agricultural and veterinary science	$30,000
Crop and Food Research Institute	Bread and Flour Information Centre	$10,000
PUBLICATIONS WHICH INCREASE THE AWARENESS OF S&T CAREER OPTIONS		
Recipient	**Project Title/description**	**Amount Awarded**
New Zealand Statistical Association	Production/publication of *Woman with Maths Making a Difference* book which aims to encourage young women to appreciate maths, and potential maths careers	$10,500
Physics Department, University of Auckland	Physics Brochures and Posters to increase the awareness of potential physics careers for students at secondary and tertiary level	$4,000
MISCELLANEOUS		
Recipient	**Project Title/Description**	**Amount Awarded**
Royal Society of New Zealand	Co-ordinator for the Science and Technology Festival	$30,000
Vicki Hyde	New Zealand Science Monthly photography tour	$4,500
National Association of Maori Mathematicians, Scientists & Technologists (NAMMSAT)	Contribution to NAMMSAT Inaugural Conference	$16,125

COCA-COLA CLOSES UPPER HUTT FACTORY

Coca-Cola has closed its factory in Upper Hutt. The factory has been making and bottling Coca-Cola for about 60 years. Coca-Cola decided to close the plant because it was more economical to manufacture in Auckland.

GLAXO CLOSES PALMERSTON NORTH PLANT

Multinational pharmaceutical company Glaxo has announced it is to close its Palmerston North plant.

Glaxo, was founded in Manawatu more than 100 years ago and merged with the multinational pharmaceutical giant Wellcome in May this year.

The Palmerston North manufacturing and technical centre will close by the end of next year. The company's Auckland office, which houses marketing, sales and distribution services, will be Glaxo's only presence in New Zealand.

The closure has been blamed on an increasingly hostile operating environment in New Zealand decreasing the plant's viability, and a blanket refusal by Pharmac to fund important new medicines, as well as a review of all Glaxo and Wellcome activities worldwide.

Pharmac is the agency set up under the health reforms and jointly owned by four regional health authorities which decides which new drugs will be put on the pharmaceutical schedule, and therefore subsidised, so patients do not have to pay the full cost of the drug.

MAJOR UPGRADE AT TUI MILK PLANT

Tui Milk Products has spent $14 million transforming an old skim-milk plant at Longburn into a specialised milk-powder unit.

The unit will be producing milk protein concentrates and a range of specific products, like flavoured powders, as well as processing 1.4 million litres of whey a day for the new Longburn cheese plant.

New technology includes a drier imported from the Netherlands, a computerised control system, filtration equipment and a number of silos.

As well as a new specialised powder unit, Tui has also invested $36 million in a new cheese plant to process about 1.4 million litres of milk daily.

GRAYSON LABORATORIES ACQUIRED BY AMDEL

Grayson Group including the extensive laboratory facilities in Auckland and the laboratory dedicated to servicing the McGrae's Flat goldmining operations based in Palmerston, Otago has been acquired by Australian company Amdel Ltd.

Amdel has laboratory facilities throughout Australia with head office situated in Adelaide, South Australia.

* * * * *

LETTER TO THE EDITOR

NEW ZEALAND INSTITUTE OF CHEMISTRY
P O Box 12 347, Wellington

5th September, 1995

The Editor,
Chemistry in New Zealand

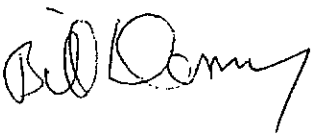
Dear Sir,

We wish to inform members that the report of the Strategic Review Committee was tabled at the recent Council meeting in Auckland on September 4th 1995. A precis of the report was given to the AGM, and appears elsewhere in this issue of the Journal. A copy of the complete report will also be sent to members via the Branches. At this point the report has only been tabled. Only one recommendation, to seek an independent audit of the secretariat (a routine procedure carried out from time to time by many organisations) was approved. The intention is to have this audit complete by the November Standing Committee meeting. This information, together with submissions from members, will then be considered by the full Council meeting in February 1996, which is expected to make specific proposals for reorganisation of the Institute. Members will then be asked to approve these, probably by a postal ballot.

It should be noted that the report makes a number of specific suggestions which, if adopted by Council, **will constitute very significant changes in the structure and nature of the NZIC. It is thus vitally important that we now get feedback from members on these proposals.** These should be sent either to the Executive Officer or to the President. Please have your say on these important issues which will affect the whole future of the NZIC.

Sincerely,

Nath Pritchard
President, NZIC



William A Denny
Immediate Past-President, NZIC

OSCILLATORY RHEOMETRY IN DAIRY RESEARCH

John J Higgins, Alastair K H MacGibbon, Grant D Boston
New Zealand Dairy Research Institute, Private Bag 11029, Palmerston North
Tang Qingnong, Peter A Munro, Owen J McCarthy
Food Technology Department, Massey University, Private Bag 11222, Palmerston North

The technique of oscillatory rheometry provides a useful insight into the character and behaviour of dairy products.

An oscillatory rheometer applies small rapid oscillatory pulses to a test material. The oscillations are so small that the material structure is not destroyed, but the resulting stress on the sample may be measured. This allows the rheological properties to be characterized as a function of frequency, temperature or time. Examples of structural changes that can be characterized are gelling and melting. Interpretation of the results allows a deeper understanding of the chemical and physico-chemical changes to be achieved.

Oscillatory rheometry calculates the storage or rigidity modulus (G') and the loss modulus (G") by measuring the amplitude of the sinusoidal stress resulting from an applied sinusoidal strain, and the phase angle, δ, between the stress and the strain. The relationship between G', G", and δ is tan δ = (G"/G'). δ is a direct measure of the degree of liquid-like behaviour ($\delta = 90°$ for a Newtonian viscous liquid) or, conversely, solid-like behaviour ($\delta = 0°$ for a Hookean elastic solid) (Barnes *et al.*, 1989).

A rheometer which measures these parameters is shown in Figure 1.

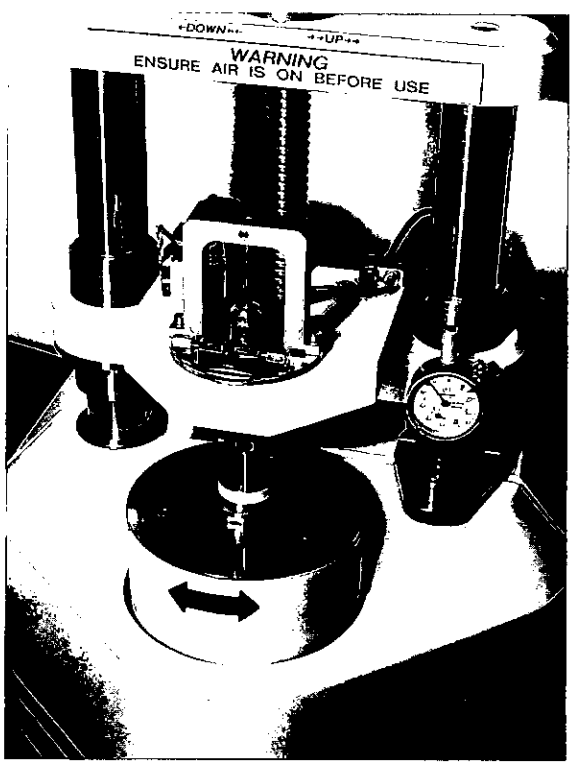


Figure 1: *Oscillatory Rheometer*

In the Whey Products Section at the New Zealand Dairy Research Institute, we are interested in the formation of heat-set gels, an important property of whey protein concentrates. When solutions are heated, various gel types are formed (see Figure 2.

Using oscillatory rheometry we can follow the reaction resulting in gel formation, and study the effect of important variables such as protein concentration, temperature, pH, time and the effect of other food system ingredients such as salt. Collaboration between the New Zealand Dairy Research Institute and Massey University's Food Technology Department has given us a better understanding of systems of value to the dairy industry. Some of the results (Qingnong Tang *et al.*, 1992a, 1992b) are shown in Figures 3, 4 and 5. The point at which gelation takes place when a whey protein concentrate solution is heated can be measured precisely (Figure 3). The effect of reaction temperature on gelation time can be characterized (Figure 4), as can the effect of protein concentration (Figure 5). Gelation of globular proteins is a result of the processes of protein denaturation and aggregation. The type of gel formed depends on the nature of the aggregate, and this in turn depends on the balance of attractive and repulsive forces between protein molecules.

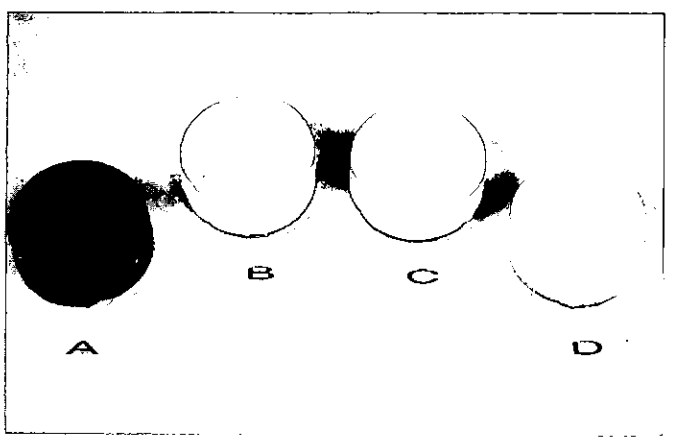


Figure 2: *Gels A-D: clear (A), opaque (B-D), elastic (A), rubbery and brittle (D).*

Too little repulsion, such as that occurring in the isoelectric pH region, can cause particulate and generally poor gels (Figure 2 - Gel B). Too much repulsion, such as that caused by very high pH, can give a viscous solution (at low concentration) or a poor gel (at high concentration) (Figure 2 - Gel C). The right attraction/repulsion balance gives rise to elastic rigid uniform gels (Figure 2 - Gels A and D). In this instance there is an optimum balance between protein-protein interactions (enhanced by attraction) and protein-solvent interactions (enhanced by repulsion). An interpretation of the physico-

chemical nature of these forces can be made by studying the gelation reaction (Figure 3) and the effects upon it of temperature (Figure 4), protein concentration (Figure 5) and other variables.

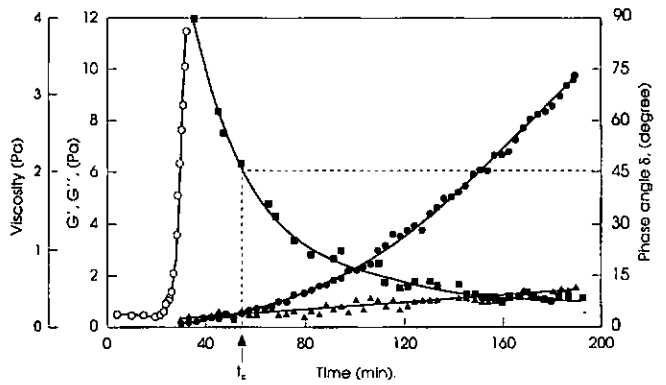


Figure 3: Viscosity (o) versus time during steady shear alone at a shear rate of 0.0231 s^{-1}, and storage modulus G' (•), loss modulus G" (▲) and the phase angle δ(■) versus time during oscillatory measurement alone at 1 Hz and 0.02 maximum shear strain. Both experiments used whey protein concentrate solutions containing 7.9% protein at pH 7 and 80 °C. t_c was the heating time required for sol-gel transition.

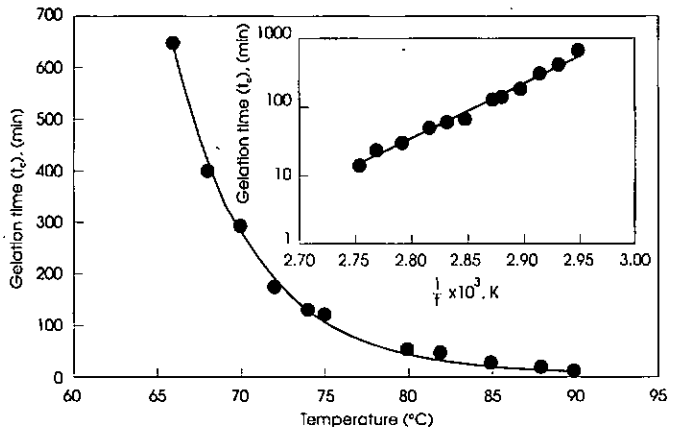


Figure 4: Effect of temperature on gelation time for whey protein concentrate solutions containing 7.9% protein at pH 7, 0.1 Hz and 0.002 maximum shear strain.

The same principles of deformation and flow of matter can be applied to butter. The Milkfat Products Section at the New Zealand Dairy Research Institute has designed studies to improve our understanding of butter's fundamental structure, which will enable predictions of product functional properties, such as spreadability, to be made. The effect of temperature can be seen in Figure 6. At low temperatures (below 15°C) the rigidity modulus G' is large indicating that the butter is rigid or stiff, and there is little change in G' with temperature. At higher temperatures (above 16°C), G' decreases rapidly with temperature, indicating significant loss of rigidity. As G" does not change appreciably with temperature, the decrease in G' reflects not only a loss of rigidity but also an increase in liquid-like behaviour (δ increasing).

Oscillatory rheometry is enhancing our fundamental knowledge of physico-chemical phenomena in dairy products, thus assisting research, as well as process and product development. Collaboration between the New Zealand Dairy Research Institute and Massey University is proving to be mutually beneficial, producing both scientific and commercial progress.

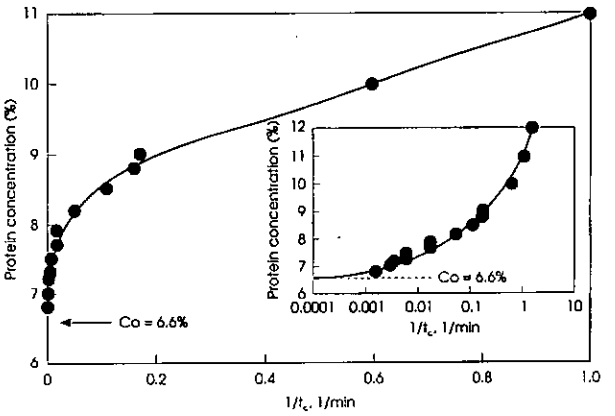


Figure 5: Estimation of the critical whey protein concentration for gelation at 80 °C, pH 7, 0.1 Hz and 0.002 maximum shear strain. Co was the critical whey protein concentration.

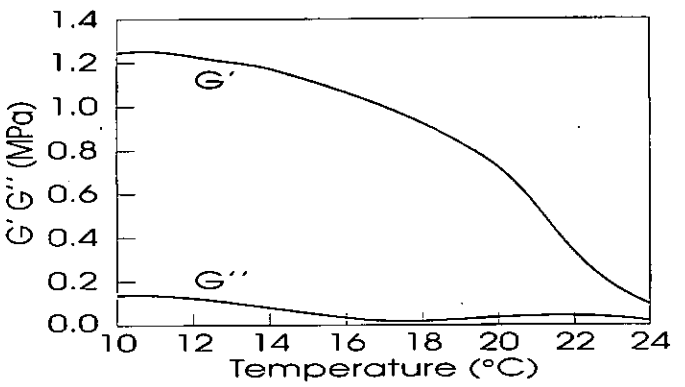


Figure 6: Effect of temperature on the rigidity modulus (G') and the loss modulus (G") of butter (freguency of 1 Hz).

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Qingnong Tang, McCarthy O J and Munro P A. (1992a). Oscillatory rheological study of the gelation mechanism of whey protein concentrate solutions. *Journal of Dairy Research* (submitted for publication).

Qingnong Tang, McCarthy O J and Munro P A. (1992b). Rheology of whey protein concentrate solutions as a function of concentration, temperature, pH and salt concentration. *Journal of Dairy Research* (submitted for publication).

ENVIRONMENTAL ISSUES

LEAD-FREE PETROL MARKET WILL BEGIN IN THE NEW YEAR

Minister of Energy
Media Release - 27 June 1995

The move to a totally lead-free petrol market will begin on 31 December 1995. Most petrol retailed from early 1996 will be lead-free, and no leaded petrol may be sold after 30 September 1996, the Minister of Energy Hon Doug Kidd announced on 27 June 1995.

"Lead is a poison. It is widely recognised that lead can produce adverse symptoms in young children such as dulled IQs, difficulties with concentration spans and behavioural problems, as well as some risk of more severe health problems. Leaded petrol is the only remaining major new source of lead in the environment and it's important to get rid of it," said Mr Kidd.

After the changeover, there will be two grades of petrol as there are now, but the existing leaded high octane fuel, Super, will be replaced by an unleaded high octane grade. This is expected to retail at about 5 cents/litre above the price of low octane unleaded petrol, so the differential between high and low octane fuel is expected to stay the same as currently.

"The Government currently collects about $30 million a year from the tax on lead added to Super petrol. Unleaded high octane fuel will cost around $30 million per year more to produce than the current Super, but the Government was willing to accept the loss of revenue in the interests of the health of New Zealanders," said Mr Kidd.

About half the vehicles currently using high octane leaded petrol will be able to switch to the unleaded version without having to take any other steps.

However, some motorists with older vehicles will need to purchase a valve seat protection additive to ensure their engine valves continue to operate satisfactorily. The additive, which will be added into the car's petrol tank when filling up, will be available for purchase at service station forecourts.

About 10-15 percent of vehicles (those with soft valve seats) will need to use the valve seat protection additive all the time. A further 5-10 percent of vehicles (those with hardened valve seats) will need to use the additive when travelling long distances or when towing. The cost of the additive is likely to be 3-5 cents/litre of petrol for vehicles where it needs to be used all the time. The cost will be proportionately less if use is needed only for long distance driving and towing.

"Those cars currently using the low octane unleaded, which is 48 percent of all petrol sales, will experience no change."

"The oil companies have assured me that they will put in place comprehensive information programmes so that all motorists will be able to find out what petrol they need and whether they require the valve seat protection additive."

"Allegations have been made that introducing a high octane unleaded fuel would unacceptably raise the risk of exposure to benzene emissions. The Government has carried out investigations of these claims and is confident they have no foundation. The risks from benzene are simply not comparable to those from lead. Nevertheless levels of benzene in petrol will be closely monitored by the Ministry of Commerce and the Ministry of Health is monitoring atmospheric levels of benzene," said the Minister.

The Ministry of Health, the Public Health Commission and the Institute of Environmental Science and Research Limited have confirmed that there will be no significant increase in the risk to the public from benzene.

"Further, the introduction of a high octane unleaded fuel will enable New Zealand to import vehicles, designed for such a fuel, that use the most advanced engine management as well as emission control technologies, thereby minimising both fuel use and environmental impact," said Mr Kidd.

Mr Kidd said that in moving to eliminate lead from petrol New Zealand was following the trend taken by most of the developed world. Countries such as Japan, Austria and Sweden are already totally lead-free. In the United States, the world's largest consumer of petrol, unleaded petrol currently has 98 percent of the market. The US will be totally lead-free by next year.

In addition, the Ministry of Transport is undertaking a programme to examine whether applying vehicle emission standards and having vehicles regularly checked may be an appropriate way of containing emissions.

* * * * *

MOVE TO UNLEADED PETROL

QUESTIONS AND ANSWERS

1. Why is the Government getting involved in the petrol market? Why not leave decisions to the commercial interests?

Getting rid of lead is a public health and environmental issue, not a commercial issue. The Government, not the oil industry, has prime responsibility for health and environmental matters.

2. Why is getting lead out of petrol important?

Lead is a highly toxic substance. Once emitted, lead does not break down, but accumulates in the environment. Every year that we carry on adding lead to petrol means more lead distributed along roadsides and concentrated in urban environments.

The lead emitted from leaded petrol, either directly through inhalation or indirectly through contaminated water, soil and food, makes a significant contribution to the body lead burden.

It is increasingly thought that there is no safe level of lead in the body. Exposure to lead may result in a wide variety of health effects, including anaemia, raised blood pressure, irritability and lethargy. The developing nervous system of young children is particularly sensitive to damage by lead. It is widely recognised that exposure to even low levels of lead has been linked with impaired intellectual development and behavioural changes in children. Even small effects, when multiplied over the population, amounts to a serious public health concern.

Leaded petrol also contains lead 'scavengers' which prevent the build up of lead deposits in the engine. These scavengers cause dioxins to be produced, which are potent carcinogens in their own right.

It has been estimated that the economic costs of the effects on human health of petrol lead in New Zealand could be around $60 million per year. This does not include the costs imposed by the dioxins emitted by lead scavengers.

3. Why lead in petrol? What about other sources of lead?

Petrol is the only remaining major source of new lead. Previous significant sources (lead in paint and solder in tinned food) no longer contain lead. Currently about 340 tonnes of lead are added to petrol each year, a large proportion of which gets emitted into the air. Petrol lead is the most readily removed ambient lead exposure for the population as a whole. Our low octane, 91 grade, is already lead-free.

4. What is the role of lead in petrol?

Lead in petrol serves two purposes:

- It is a cheap way of raising octane rating and thereby preventing 'knocking'
- For some older vehicles it acts to prevent valve seat wear or recession.

Each of these purposes can (and will) be achieved in other ways.

Changes in refining methods and petrol constituents will ensure the required high octane levels are achieved without the use of lead. A lead-free valve seat protection additive will be sold at service stations.

5. What will replace the existing high octane leaded petrol when this is withdrawn from the market?

High octane unleaded petrol will take over from high octane (super) leaded petrol.

6. Why can there not be a phase out period during which both a leaded and an unleaded high octane fuel could be supplied?

A phase out period would require three types of petrol to be supplied -unleaded regular and both leaded and unleaded super. The petrol storage and distribution system in New Zealand is organised for two grades of petrol only. Supply of three grades would require considerable additional expenditure for extra storage tanks which is not justified in a petrol market of New Zealand's size.

7. Which cars will need valve lubricant?

Most cars manufactured since 1981 will not need the valve seat protection additive. Up to a quarter of the current car fleet may need a valve seat protection additive as an alternative to lead. About 5-10 percent of the fleet have hardened valve seats and will need the additive for long distance running and towing. Around 10- 15 percent, those with soft valve seats, will need the additive all the time.

Closer to the changeover time, drivers of older vehicles should check with their local service station for information on the vehicles which need the valve seat protection additive and whether these are needed just for long distance driving or all the time. Oil companies will be undertaking a major information campaign in the lead up to the changeover period.

8. How much will the valve seat protection additive cost?

The valve seat protection additive is expected to cost between 3-5 cents per litre of petrol if continual usage is required, but only around 10% of the vehicle fleet will need the additive all of the time.

9. What effect will the move have on petrol prices?

High octane unleaded petrol is expected to retail at about 5 cents/litre above low octane unleaded petrol (i.e. the difference between the two grades is expected to remain similar to the current differential between high and low octane fuel).

Government currently taxes lead in petrol and this tax will disappear. The tax income from lead is $30 million. The Government considers the health of New Zealand's children, present and future, and the environment to be more important than the revenue it previously received.

10. What does the Government's programme involve?

The regulations governing petrol content will be amended so that from 31 December 1995 it will no longer be legal for lead to be used at the refinery or for refined petrol containing lead to be imported. This means that new stocks of petrol delivered to service stations will be lead-free from early in 1996, or sooner, if the oil companies choose.

Nearer to the transition time the oil companies will make arrangements with service stations, so that drivers will be informed when their local service station switches to lead-free high octane petrol.

From September 30, 1996 it will no longer be legal to retail leaded petrol. The nine months delay between the date from which lead can no longer be *supplied* and the date from which lead can no longer be *retailed is* to allow petrol stations with low throughput to sell all their leaded petrol stock.

11. What will the move to lead-free petrol mean for the refinery?

The refining company will continue to produce 91 octane unleaded petrol for the whole country. In its present configuration, the refinery cannot supply the complete high octane unleaded petrol required for the whole country. The refinery will produce high octane unleaded to service the Auckland market via its pipeline and it is expected that the high octane unleaded petrol requirements of the rest of the country will be met by imports.

12. What is happening overseas with regard to lead in petrol

There is an international trend toward getting rid of lead in petrol. A number of countries are now lead-free (Japan, Austria, Canada, Sweden and the Netherlands) and, like New Zealand, a number are moving toward being lead-free, e.g. USA, Finland and Norway (the USA will be lead-free from the beginning of 1996).

13. What does the move mean for air quality?

Lead-free petrol will make it easier to embark on cleaning up vehicle emissions. New cars with factory fitted converters, and used cars with added catalytic converters, will be able to use them without fear that lead will ruin them (catalytic converters are incompatible with lead).

14. Will there be a rise in benzene and aromatics levels/ emissions?

There will be a small rise in the levels of benzene emissions as a result of the move to an unleaded petrol market. The impact of this change on air quality will be minimal.

All types of petrol contain quantities of benzene and other compounds called 'aromatics' (benzene itself is an aromatic). Premium unleaded petrol will contain the same amount of benzene but a higher amount of other aromatics than the current super petrol.

A portion of the other aromatics in petrol breaks down on combustion to form benzene. It has been estimated that there will be a 7% increase in vehicle emissions of benzene as a result of the move to an unleaded petrol market.

15. Will there by any increased health risks?

Benzene is known to cause cancer. But there will be no appreciable increase in the health risk to the public from benzene emissions from petrol and there will be a major health gain from removal of lead.

Exhaust emissions of benzene are just one of many benzene sources to which the public are exposed. A major study undertaken by the US Environmental Protection Agency found that many consumer products such as paints and other surface coatings, marking pens, adhesives and rubber products are all significant sources of benzene.

Cigarettes in particular emit large amounts of benzene. Smokers will absorb more benzene through smoking than from any other source. A person who smokes a pack a day will absorb 3-6 times more benzene than an equivalent non-smoker.

It has been calculated that even after 70 years of exposure to the increase in benzene emissions resulting from the introduction of premium unleaded, than an individual's risk of dying of cancer will be increased by less than one in a million.

The increase in benzene emissions is transitional only. Once we have lead-free petrol we can move forward to cleaner vehicle technology which will lower benzene emissions. Some of this technology was not viable in New Zealand because of leaded petrol.

The Ministry of Commerce monitors levels of benzene in petrol and arrangements have been made to monitor the levels of aromatics in petrol on an ongoing basis. There is already in place a limit on the allowable level of benzene in petrol. If in the future the levels of benzene emitted from exhaust are considered to constitute a health risk, the Government retains the option of amending the petroleum specifications to reduce the benzene limit, and to cap the levels of other aromatics in petrol.

* * * *

A ? OF CHEMISTS

From *Chemistry in New Zealand* Vol 59 No. 4, July 1995

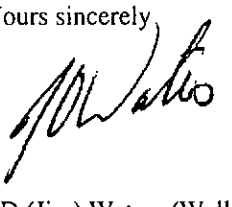
Dear Mr Lyon,

Personally, I think alliteration is essential. So my pick is: A coordination of chemists!

I even managed a small verse.

Canada's geese gaggle
And a herd's made of cattle.
Whales form a pod
But soil's just a sod.
The Empire's now a Commonwealth of Nations
While chemists bond in co-ordination.

Yours sincerely



J D (Jim) Waters (Wellington Branch)

A PRELIMINARY APPRAISAL OF THE RISK FROM BENZENE WITH A HIGH OCTANE UNLEADED PETROL

Prepared by Kevin Biggar, Ministry of Commerce, P O Box 1473 Wellington

Introduction

Several departments, including the Ministry of Commerce, had been directed to provide advice to the Government on the move to a lead-free petrol market. A number of issues were identified as matters that needed to be investigated before advice on the implications of such a move could be given. One such issue was the extent of the health risk posed by vehicle emissions of benzene, particularly in relation to the introduction of the proposed high octane unleaded petrol. This research was therefore undertaken with the objective of providing input to the policy development process.

Executive Summary

Epidemiological evidence from several studies shows that prolonged exposure to occupational levels of benzene increases the risk of contracting leukaemia, mostly acute myeloid leukaemia.

It is not possible to precisely quantify the carcinogenicity of benzene. This is due to,

- lack of accurate long-term benzene exposure records in the key studies;
- lack of agreement on the most appropriate method of extrapolation to low doses;
- the absence of a suitable animal model preventing the direct investigation of the mechanism for benzene's carcinogenic effects in humans (11).

Based on data supplied by the oil industry on the proposed composition of the premium unleaded petrol, it can be calculated that a lead-free petrol market will result in an increase in current levels of tail-pipe emissions of benzene, of around 7%. As vehicle benzene emissions are only one of a number of emission sources of benzene personal intake will increase by some fraction of this amount.

If the average relative risk model is used, along with oil industry data and several exposure assumptions, then it can be calculated that a life time (70 years) exposure to the increased levels of benzene will result in an extra risk of death by leukaemia for an individual of less than 1×10^{-6}.

Background

The National Party in its 1990 election manifesto, set out the intention of achieving 70% unleaded petrol use by 1995. However by mid-1994 market share of unleaded petrol had reached only 47% and was not expected to reach 70% by 1995 - or within the next five years. It had become apparent that the configuration of the vehicle fleet was such that for the target to be reached it would be necessary for a high octane unleaded petrol to be introduced[1]. Consultation with the oil industry revealed that the investment in distribution and retail infrastructure necessary to supply the market with three types of fuel would be prohibitively high (14). As a result, if the premium unleaded fuel is introduced, the current high octane leaded will be withdrawn and New Zealand will 'flip' to a lead-free petrol market.

On 12 July 1994 the CIE[2] invited the Minister of Energy to proceed to release a discussion paper on completing the move to unleaded petrol (CIE(94)M 21/2 refers). The majority of the thirty-three submissions received supported the move while the opposing submissions came mainly from car clubs with an interest in older vehicles and the supplier of the lead additives, Associated Octel. The submissions served to highlight a number of issues warranting further investigation. Accordingly on 16 November 1994 the CIE recommended deferring the decision on what further moves the Government should take to encourage or enforce a move to a lead-free petrol market until these issues were addressed (CIE(94)M 38/8 refers).

The adoption of the proposed 'premium grade' unleaded petrol could potentially increase the emissions of benzene into the atmosphere. The aim of this report is to provide a preliminary assessment of the health risks associated with these emissions.

What is Benzene?

Benzene (C_6H_6) is the simplest member of a group of hydrocarbons known as 'aromatics'. A natural component of crude oil, benzene is a colourless, highly flammable and nonpolar liquid. Historically benzene was widely used in the rubber industry because of its ability to dissolve rubber and its ease of evaporation during the manufacture of formed and coated rubber components. It is still an essential ingredient in the production of organic chemicals and synthetic materials, with about 1.6 billion gallons being produced in the US annually (4, 9, 10, 11).

The majority of benzene emissions into the environment are as vapour. Once in the air, benzene is degraded by sunlight and has a half life of approximately 1 week. The half-life in soil and groundwater at low concentrations is approximately 10-20 days. Under anaerobic conditions benzene resists degradation and can be present for many years (11).

Toxicology of Benzene

About half of the benzene content of a lungful of air is absorbed into the bloodstream. As it is more soluble in fat than in water,

[1]Due to a decline in the amount of lead added to leaded petrol, the current total emissions of petrol lead are less than if unleaded petrol had a market share of 70% with 1990 lead levels. The Government may claim in one sense, to have achieved its goal.

[2]Cabinet Committee on Enterprise, Industry and Environment

it tends to target the fatty tissues particularly the brain and bone marrow[3]. This distribution is reflected in benzene's toxic effects.

At high levels of exposure i.e. > 160,000 μg/m^3, benzene acts on the nervous system, causing drowsiness, dizziness, headaches, lightheadedness, nausea and decreased coordination (2,4,5).

At lower concentrations benzene is a 'myelotoxicant', suppressing the ability of the bone marrow to create new cells. Humans may experience a variety of diseases reflecting the severity of bone marrow interference. These may include a decrease in white blood cells (leucopenia) potentially resulting in death due to infection, or a decrease in platelet count (thrombocytopenia), potentially resulting in death due to haemorrhage or alternatively a decrease in red blood cell count (anaemia) (5). More severe cases, involving a decrease in the number of blood forming cells in the bone marrow, are classified as aplastic anaemia (11).

Benzene as a Carcinogen

It wasn't until the 1970s that sufficient epidemiological evidence was produced to link benzene with cancer. It is now classed by the International Agency for Research on Cancer (IARC) as a Group 1 carcinogen - those chemicals that epidemiological studies have shown to be *proven* human carcinogens.

Prolonged exposure to benzene has been reportedly associated by various researchers with several different types of cancer, but most consistently with the leukaemias. In particular the group known as the acute non-lymphocytic leukaemias. Of this group the most unequivocal association is with acute myelogenous leukaemia (AML) (2,5,11,26). This disease is very often fatal with a long term survival rate, following chemotherapy, of between 5-30% (13). In 1992, there were 135 cases of acute and chronic myelogenous leukaemia diagnosed in New Zealand (12).

Studies examining the carcinogenicity of benzene in rodents have demonstrated that benzene increases the frequency of occurrence of several types of cancers in a number of organs in a variety of species and strains of mice and rats, whether administered orally or by inhalation (24). However there has been no success in identifying an animal model in which benzene produces leukaemia and this severely limits the applicability of animal studies to human populations (11, 25).

Snyder *et al.* (1993) argues that there is a certain degree of 'biomedical plausibility' that links exposure to benzene with multiple myeloma and acute lymphoblastic leukaemia (11). Similarly, the International Programme on Chemical Safety (IPCS) review of benzene risk states that a statistical significant excess risk for multiple myeloma has been found in one study, but the relationship between benzene exposure and the production multiple myeloma remains to be clarified. There have also been studies which report increased risk for skin, stomach and lung cancers but these findings have not been consistent. The IPCS review concludes that the most consistent evidence for a causal association in humans is between benzene exposure and myeloid leukaemia (26).

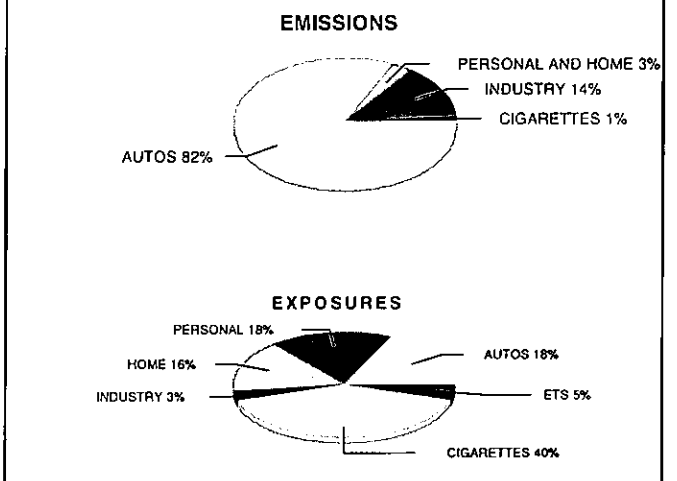
Sources of Exposure

Benzene emissions arise from a variety of sources, such as industrial processes, vehicle exhausts, refuelling and cigarette smoking.

A study by NASA found that benzene vapours, with concentrations ranging from 0.01 μg/g to 140 μg/g are emitted by many commonly owned consumer products. These include paints, adhesives, pens, rubber products, carpeting, liquid detergent, furniture wax and building materials.

The main route of benzene intake is by inhalation. This method is likely to account for more than 99% of the general population exposure. The World Health Organisation (WHO, 1987), has claimed that up to 250 μg/day of benzene may be ingested through consuming certain foods. However a recent study by the American Petroleum Institute contradicts these findings, upon testing foods that were claimed to contain significant amounts of benzene they found that benzene levels were in fact very low or non-detectable (3,11).

Figure 1: Comparing Sources of Exposures with Sources of Emissions



Source: Paustenbach *et al.* (1993)
Note: 'ETS' is environmental tobacco smoke. 'Personal' includes activities related to automobile use.

During the 1980s the United States Environmental Protection Agency (US EPA) carried out a series of investigations on the level of exposure of the general population to benzene. These studies revealed that the major sources of emissions are not necessarily those that contribute most to personal exposures (see Figure 1). The study found that overall mean exposure was around 15 μg/m^3 compared to the mean outdoor concentration of only 6 μg/m^3. The results implied that personal activities and sources in the home far outweighed the contribution of outdoor air to human exposure to benzene. For example the 'average' smoker has a benzene intake 10 times that of a non-smoker (19).

What is the level of benzene in the atmosphere in NZ?

A short study has been carried out in Auckland by Dr Bruce Graham of the Institute of Environmental Science and Research, on behalf of the Ministry of Health, to provide preliminary data

[3]There is no bioaccumulation.

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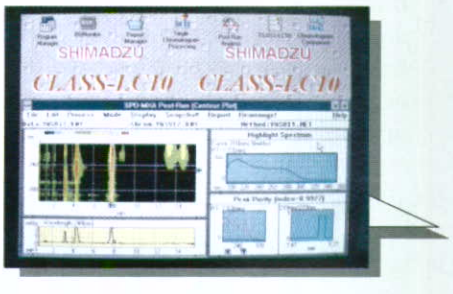

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on ambient urban benzene levels. Fifteen measurements were taken at three sites in Auckland over a period of three consecutive days in June 1994. Each measurement was based on samples collected over a period of one hour. Samples were taken during periods of low wind speeds, and at times of peak traffic intensity in locations chosen for above average traffic densities in order to provide 'worst case' results (8).

The levels of benzene concentrations ranged from 0.9 to 18.5 $\mu g/m^3$ i.e. 0.29 - 5.7 ppb. A close correlation between the benzene and NOx data at the monitoring sites was also revealed. This relationship was used along with long term NOx data in order to estimate an annual average urban benzene level of around 0.7-1 $\mu g/m^3$ (20).

Quantifying the Increased Cancer Risk

While there is general agreement in the medical community that prolonged exposure to high levels of benzene increases the risk of contracting leukaemia, the precise quantification of that risk remains controversial (7). As leukaemia is a relatively uncommon disease, this means that a large number of people must be exposed to reasonable well defined amounts of benzene if any increase in leukaemia is to be statistically extracted away from other sources of mortality affecting a population.

There are a just a handful of cases where this has occurred. On the following page are listed the main studies that form a pool of epidemiological data that is continuously being updated and reassessed as more accurate exposure estimates become known and more sophisticated analytical tools are developed.

Authors	Study	No. of Subjects	Exposure Estimates (ppm-years)	Observed Deaths
Rinksy *et al.*(1987)	Goodyear Pliofilm Plant	1165	<40 40-200 200-400 > 400	2 2 2 3
Wong (1987)	Chemical Workers	3536	< 15 15-60 60	2 1 3
Bond *et al.*(1986) {follow up of Ott (1978)}	Dow Chemical Workers	956	> 0.1-35.5	4
Yin *et al* (1987)	Chinese Factory Workers	27,730	3-300	5
Aksoy (1980)	Turkish Leather Workers	28,500	30-200[4]	23

Source: 'Benzene' - Expert Panel on Air Quality Standards (1994)

The Average Relative Risk Model

There is disagreement over the most appropriate method to extrapolate risk estimates obtained from the studies of workers exposed to high occupational levels of benzene, down to the much lower but prolonged benzene intake that affects the rest of the population. The average relative risk model provides one such method. It utilises a linear extrapolation to estimate the increase in risk of death by cancer from a lifetime exposure to 1 $\mu g/m^3$ of benzene. This model has been chosen for the following reasons:

- The model is conceptually simple and despite the availability of more complex risk extrapolation models there is no evidence to suggest that these alternative models are more valid for benzene.
- By assuming linearity in the dose response function, the model is likely to overestimate risk. It is likely that at low exposure levels, protective mechanisms such as metabolic and excretory processes will be more efficient. This would mean that the shape of the real dose response curve would be sublinear and the actual risk could be zero at very low levels of exposure.
- The model parameters can be adjusted to fit New Zealand background risks for cancer mortality (see below).
- The model can be assumed to have the endorsement of the large multinational group of scientists who put together the WHO "Air Quality Guidelines for Europe". Use of the model was also accepted by the US EPA.

It is assumed that for low exposures the lifetime probability of death (P) from leukaemia may be represented by the linear equation:

$$(1)\quad P = P_0 + \beta X$$

Where:

- P_0 is the rate of leukaemia mortality in the absence of benzene exposure, i.e. the 'background lifetime risk'. For New Zealand the lifetime leukaemia mortality risk for both sexes is 0.009. For the subcategory of myelogenous leukaemias it is 0.003.
- **X** is the average lifetime exposure to benzene in ppm.
- ß represents the increase in the leukaemia mortality rate due to each *increase* of 1 $\mu g/m^3$ average lifetime exposure. ß is also known as the 'unit risk', that is the increased risk of cancer corresponding to exposure to an additional 1 $\mu g/m^3$ benzene over the course of a lifetime.

If it is assumed that the relative risk of leukaemia is independent of the duration of exposure or the age at which exposure occurs in the worker population then ß can be derived as,

$$(2)\quad \beta = P_0(R-1)/X_2$$

Where:

- **R** is the relative risk of leukaemia for a benzene-exposed worker cohort i.e. the ratio between the observed and expected number of leukaemias in the exposed population.
- X_2 is the cumulative occupational exposure to benzene of the cohort, averaged over a lifetime. This factor represents the conversion from the occupational 8 hour, 240 day exposure over a specified number of working years and can be calculated as X_2 = (8 hour time weighted average x 8/24 x 240/365 x years of exposure)/(life expectancy [70 years]).

[4]Average exposure duration of 9.7 years

Calculating the Relative Unit Risk

In their 1987 document, "Air Quality Guidelines for Europe" (2), WHO considered evidence based on two studies.

1) The first was the NIOSH cohort of workers involved in the production of rubber. A total of 748 workers who were exposed for 10 years were followed up for a further period of 25 years. Seven had died from leukaemia compared with an expected figure of 1.25. The average duration of exposure was estimated to be 8.5 years and the average exposure levels during the critical study period were assumed to have been around 300 mg/m^3. The average lifetime daily exposure can be calculated as 8 mg/m^3 (i.e. **X** = 300 mg/m^3 x 8/24 x 240/365 x 8.5/70). Using the lifetime mortality risk for New Zealanders of 0.009 the unit risk associated with a lifetime exposure to 1 µg/m^3 of benzene can be calculated to be 5.2 x 10^{-6}.

2) The second epidemiological study population comprised workers of the Dow Chemical Company. The first analysis was undertaken by Ott *et al.* in 1978. The data as later updated by Bond *et al.* showed a non significant excess of total deaths from leukaemia based on four observed cases. However there was a significant excess in the subcategory of myelogenous leukaemia, the 4 cases giving a relative risk of 4.4 when compared with the 0.9 cases expected. Average exposure for the entire cohort was 16 mg/m^3 for an average of 8-9 years. Based on the lifetime mortality rate of 0.003 for myelogenous leukaemia in New Zealand the incremental unit risk was calculated to be 6.4 x 10^{-6}.

The higher of these risk estimates will be used in further calculations.

The Assumptions

There are a number of assumptions implicit in this method:

- *That the response is some function of cumulative dose*

The method relies on each dose of benzene being responsible for a finite amount of irreparable damage. Analysis has shown that the cumulative dose was a better predictor of death by leukaemia than either duration of exposure or rate of exposure, although this may not apply at very low doses (7).

- *That there is no threshold dose for carcinogens*

It is assumed that humans cannot harmlessly assimilate any level of benzene.

- *That the linear extrapolation model is correct*

There is some scientific justification for the use of a linear extrapolation model from the current understanding of the mechanism of carcinogenesis. While no single mathematical model can be regarded as fully appropriate for low dose extrapolation, those methods based on a linear non-threshold assumption are used more frequently then those models which assume a safe or virtually safe threshold (2).

- *That the correct exposure has been used*

As mentioned above there is only a small pool of epidemiological studies used to assess the risk of leukaemia mortality to persons exposed to benzene. There are major limitations in all of them, mostly relating to the amounts of exposure to benzene that the subjects experienced.

The best quantitative exposure records have been kept for the Goodyear Tyre workers. Nevertheless the limitations of this study, similar to the others, is that the environmental monitoring data is, "*...significantly less than complete.*" (7). There is no sampling data for 27 of the 29 years at one of the two factories involved. This means that for more than 40% of the overall cohort, and two thirds of the leukaemia cases, no directly applicable monitoring data is available upon which to base worker exposures. Nor was exposure through skin contact considered.

Lack of accurate exposure information makes for large margins of uncertainty as the following table illustrates.

Table 6: Margins of Error

Authors	Exposure Estimates (ppm years)	SMR[5]	(95% CI)
Rinsky *et al.* (1987)	0 - 39	109	(12 - 394)
	40 - 199	322	(36 - 1165)
	200 - 400	1186	(133 - 4285)
Bond *et al.* (1986)	1.5-351	162	(33 - 461)
Source: 'Benzene' - Expert Panel on Air Quality Standards (1994)			

It has been argued by Brett *et al.* (1989) that early studies inadequately characterised the benzene exposure history of the cohorts, resulting in an underestimate of the amount of exposure and accordingly overestimated the unit risk (7).

In contrast Rinsky (1989) has stated that in his study of the Goodyear rubber workers, the initial research, if anything, underestimated exposures for two reasons. Firstly benzene concentrations were measured by industrial hygienists who were focusing on 'hot' spots' rather than trying to document typical exposures. Secondly, fugitive benzene emissions were minimised as much as possible due to the high cost of this solvent (21).

The differences in assumptions used by the various researchers to bridge the gaps in the exposure information data are largely responsible for the differences in the risk assessments. Infante (1992) argues that,
"Which set of [exposure] assumptions is closer to the 'truth' will never be known ... Whichever estimate one chooses to use is a matter of personal preference that is not based upon any available data analysis."

What will be the Increase in Vehicle Emissions of Benzene as a Result of the Introduction of Premium Grade Unleaded?

Lead compounds are added to petrol to increase its octane rating. With the lead removed the petrol will need to be reconfigured

[5] Standardised Mortality Ratio, the ratio of the observed number of deaths in the occupationally exposed cohort to the expected number of deaths in the control group, multiplied by 100.

in order to maintain the octane. One of the cheapest ways to achieve this, is by increasing the proportion of 'aromatics' in the petrol. This is the method the oil industry in New Zealand have indicated that they will take.

Aromatics are a group of hydrocarbons of which benzene is the simplest. Other members include toluene (C_7), '*o*', '*m*' and '*p*' xylene and ethyl benzene (C_8) and various C_9, C_{10} and higher compounds. Percentages of total aromatics in New Zealand petrol vary from blend to blend leaving Marsden Point. Generally however the total aromatic hydrocarbons including benzene are around 35% by volume in both grades of petrol currently manufactured by NZRC.

All aromatics, particularly toluene, tend to generate benzene as a product of partial combustion. Additionally, a proportion of the benzene in the fuel is ejected unburnt. Several studies have concluded that the contribution of aromatics to tailpipe benzene is about a tenth of that of the benzene already present in the fuel. Wedel (1988) reports that with increasing engine load, relative aromatics emissions decrease due to more complete combustion, and that benzene emissions decrease with increasing constant speed (22). A report by Tims (1983) for Concawe resulted in the following formula (15)[6];

Equation 1:
wt % Bz (Exhaust) = 0.50 + 0.44 Bz (Fuel) + 0.04 Ar

Where **Bz** and **Ar** are % concentrations by weight in fuel for benzene and aromatics respectively.

Given this formula, along with information supplied by the New Zealand Oil Technical Committee on the predicted composition of the proposed premium grade unleaded and the effect of the reconfiguration of the Syngas plant to methanol, it is possible to form an estimate of the increase in tailpipe emissions of benzene. The results are shown in Tables 7 and 8.

Table 7: Increases in Emissions of Benzene of Unleaded vs Leaded High Octane

	Exhaust	% Increase
Current leaded petrol	3.348	
Premium ULP (without Syngas)	3.864	15%
Premium ULP (with Syngas)	3.728	11%

Table 8: Increases in Fleet Tailpipe Emissions of Benzene

	Exhaust	% Increase
Current Fuel mix (with Syngas)	3.220	
Unleaded Petrol Market (with Syngas)	3.456	7%
Current Fuel Mix (without Syngas)	3.492	
Unleaded Petrol Market (without Syngas)	3.604	3%

Source: *NZ Oil Technical Committee, 1994*

- If made without the benefit of Syngas the premium grade unleaded fuel will emit approximately 15% more benzene then the current leaded fuel. This will drop to 11% if Syngas is used.
- If the move to a lead-free petrol market occurs when synthetic petrol is no longer available as a blend component, then the increase in benzene emissions is only 3%.
- If the move to a lead-free petrol market occurs while Syngas is still available then the increase in benzene emissions will be 7%.

The latter, larger, figure will be used as current urban ambient air levels were measured when synthetic gasoline was available and because supplies of synthetic gasoline may become available again in the medium term. For these reasons it is thought that a figure of 7% increase on the current situation best reflects the effect of government policy on benzene emissions.

What is the Increase in Personal Exposure Resulting from Emission Increases?

There are many sources of benzene that contribute to personal exposure. However this report is concerned only with the affect of increases in benzene emissions from vehicle exhausts on personal exposure. There are five 'environments' that will be affected:

- outdoor urban air
- outdoor rural air
- indoor home air
- indoor office air
- passenger vehicle air

Estimates will be made as to how the increase in benzene emissions will affect the benzene levels in each of the above environments. These increase in exposure estimates will be used with the unit risk estimate to calculate the increase in risk of death by leukaemia from the introduction of a high octane unleaded grade of petrol.

- **Outdoor Urban Air**

Various studies of urban benzene concentrations undertaken overseas report results ranging from 8-60 $\mu g/m^3$ (3). These figures mask significant daily and seasonal variations. For example a study by Dawson *et al.* (1994) of the benzene levels in Sydney's central business district show the daily benzene levels peaking at mid-morning, gradually tailing off during the day, peaking again late afternoon before dropping away at night (17). The study also found significant differences between the benzene concentrations recorded in summer (13-17 $\mu g/m^3$, mean = 13 $\mu g/m^3$) and winter (18-31$\mu g/m^3$, mean = 25 $\mu g/m^3$).

Preliminary research on ambient urban air levels in Auckland was undertaken in the middle of 1994 (see above) which concluded that a first estimate for the average annual concentration of benzene expected in the urban areas of New Zealand to be in the Auckland region was around 0.7-1 $\mu g/m^3$ (20). A figure of 1 $\mu g/m^3 \pm 50\%$ will be used.

Due to the daily variations illustrated in the Dawson study this figure may underestimate the benzene concentrations to which commuting workers are exposed.

[6]The formula used by the US EPA (24) gives similar figures.

Increases. Concawe (1994) reports that in Europe vehicle emissions are 85% responsible for the levels of benzene in the outdoor urban environment (3).

Tailpipe Increase Factor	Contribution to Local Air	Original Exposure ($\mu g/m^3$)	Error	Increase In Exposure ($\mu g/m^3$)	Error
0.07	0.85	1	50%	0.06	50%

- **Rural Air**

From the ESR study mentioned above this is assumed to be 1 $\mu g/m^3$. Given that this figure was derived for the mean level in urban areas, and the relatively short breakdown time of benzene, this almost certainly represents a conservative value.

Tailpipe Increase Factor	Contribution to Local Air	Original Exposure ($\mu g/m^3$)	Error	Increase In Exposure ($\mu g/m^3$)	Error
0.07	0.85	1	50%	0.06	50%

- **Indoor Home Air**

Increases. From the results of a study carried out in London, Perry *et al.* (1991) argue that 50-70% of indoor VOCs[7] were attributable to vehicle emissions (18). A mid-point of 60% will be used.

Tailpipe Increase Factor	Contribution to Local Air	Original Exposure ($\mu g/m^3$)	Error	Increase In Exposure ($\mu g/m^3$)	Error
0.07	0.6	1	50%	0.04	50%

- **Office Air**

Increases. As for Indoor Home Air.

Tailpipe Increase Factor	Contribution to Local Air	Original Exposure ($\mu g/m^3$)	Error	Increase In Exposure ($\mu g/m^3$)	Error
0.07	0.6	1	50%	0.04	50%

- **Driving**

Benzene concentrations in the interior of automobile cabins can be significantly elevated over ambient air concentrations. Three studies undertaken in the United States and one in Sweden found levels of benzene 5-6, 3-8, 3-4 and 5 times higher in the cabin of the automobile than in ambient air collected at the same time[8] (SCAQMD, 1989; Chan *et al.*, 1990; Wallace, 1989; Lofgren *et al.*, 1991). Concentrations in cars in urban areas were found to be higher than those travelling on highways, higher still than cars driving in rural areas.

Weisel *et al.* (1992) claim that benzene concentration in the automobile cabin is highly dependent on traffic density and driving speed (23). Intuitively traffic density increases the 'source strength' and decreases intervehicle distance while higher driving speeds add to turbulence and that facilitates the dispersal of pollutants. Similarly higher wind speeds disperse emissions more effectively. Increasing ventilation through the car by winding down windows and/or switching on the fan also decreases benzene concentrations. Pollutants tend to build up when the car is stopped in dense traffic or at lights and then rapidly diminish as the vehicle accelerates away. With the windows open the exchange rate is rapid enough to reduce any excess concentration build-up that occurred during acceleration to the background levels that surrounded the automobile concentrations. However if windows are closed then the levels stay constant for several minutes.

In a study undertaken in New Jersey a car was driven for 16 km in the morning and afternoon rush hour along a suburban route. The trip took 30 minutes with approximately half the time spent in dense traffic. A number of measurements were taken inside the car and an average of 11 ± 5 $\mu g/m^3$ was found. Ambient air concentrations as measured at the start of the commute - in a university car park - were 1 $\mu g/m^3$. A similar, slightly longer, commute to New York City along a motorway gave in-vehicle benzene levels of 10 ± 12 $\mu g/m^3$. Urban ambient air concentrations were 4 $\mu g/m^3$.

Increases. The range of observed concentrating factors of automobile cabins is 3-8, or $6 \pm 50\%$. The increase will therefore be as follows.

Tailpipe Increase Factor	Contribution to Local Air	Error	Original Exposure ($\mu g/m^3$)	Error	Increase In Exposure ($\mu g/m^3$)	Total Error
0.07	0.85 x 6	50%	2	50%	0.7	70%

What is the Increased Cancer Risk from the Increased Exposure?

In the following table, the increase in concentrations of benzene are given along with the proportion of time the average person spends in each environment, averaged over their whole life. These figures were taken from the report of a 1990 time use pilot survey undertaken by the Department of Statistics[9]. These figures enable the calculation of the 'time weighted average' increase in concentration of benzene. This is then multiplied by the unit risk estimate to calculate the increase in risk of death by cancer from a life time (70 years) exposure to the increase in benzene.

It can be seen that the time weighted average is very sensitive to time spent in automobiles. For this reason a 'high-risk' case was developed representing those groups, such as taxi drivers, that spend their working lives (40 hours a week for 40 years) inside cars.

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[7]Volatile organic compounds

[8]In the TEAM study their figure was 3-4 times the overall mean personal exposure of 15 ($\mu g/m^3$).

[9]This survey was undertaken to investigate the feasibility of a nationwide time use survey and may not be representative of the population. However the 'high risk' case will remain a reasonable upper bound on the risk because the contribution to personal benzene intake from driving is substantially larger than the contribution from other environments.

Table 9: Daily Increase (Lifetime Average) in Benzene Intake and Corresponding Increased Risk For Average NZer

Location	Duration	Increase in Exposure		Time Weighted Average ($\mu g/m^3$)	Absolute Error ($\mu g/m^3$)	Error %	Unit Risk Estimate	Error %	Increased Risk		
	%	Value ($\mu g/m^3$)	Error						Value	Error	Upper Bound
Inside car	4%	0.36	70%	0.01428	0.01						
Inside office	14%	0.04	50%	0.00588	0.00294						
Urban	7%	0.06	50%	0.004165	0.00208						
Rural	0%	0.06	50%	0	0						
Indoor	75%	0.04	50%	0.0315	0.01575						
				0.06	**0.02**	**34%**	**$6.4x10^{-6}$**	**50%**	**$4x10^{-7}$**	**60%**	**$5.7x10^{-7}$**

Table 10: Daily Increase (Lifetime Average) in Benzene Intake and Corresponding Increased Risk for Taxi Driver

Location	Duration	Increase in Exposure		Time Weighted Average ($\mu g/m^3$)	Absolute Error ($\mu g/m^3$)	Error %	Unit Risk Estimate	Error %	Increased Risk		
	%	Value ($\mu g/m^3$)	Error						Value	Error	Upper Bound
Inside car	16%	0.36	70%	0.05712	0.03998						
Inside Office	2%	0.04	50%	0.00084	0.00042						
Urban	7%	0.06	50%	0.004165	0.00208						
Rural	0%	0.06	50%	0	0						
Indoor	75%	0.04	50%	0.0315	0.01575						
				0.09	**0.04**	**46%**	**$6.4x10^{-4}$**	**50%**	**$6x10^{-7}$**	**68%**	**$1x10^{-6}$**

Results and Conclusion

It is estimated that the introduction of premium unleaded grade petrol will result in an increase in emissions of benzene which, if maintained over the course of a 70 year life time, will increase the risk of cancer by approximately 0.4×10^{-6}, (with an upper bound of 0.6×10^{-6}). High risk groups that spend 8 hours a day, 5 days a week inside an automobile over a 40 year working lifetime will experience a slightly higher risk of 0.6×10^{-6} (upper bound 1×10^{-6}). The degree of risk will decrease in proportion to the duration of exposure.

More work needs to be done in quantifying the levels of benzene in the ambient urban air and in determining the relationships between ambient urban air concentrations and the indoor and car environments.

It is important that these actual figures not be overemphasised. They are highly imprecise and other estimates of the same risk could be quite different, depending on what data and assumptions they were based on. The above estimates should be regarded as indicative only. Nevertheless it is clear that the introduction of the premium grade unleaded petrol will result in a very small, perhaps zero increase in the risk of contracting leukaemia.

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A Remarkable Ex-Patriot

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On May 6, 1995, Professor Bill Fyfe FRS received an Honorary Doctorate in Science from the University of Otago; an event witnessed by a capacity audience (close to 3000) in the Dunedin Town Hall. This audience was privileged to hear an outstanding graduation address on 'Education for Planetary Survival' delivered by Professor Fyfe.

Why all this fuss about Bill Fyfe? Well... Bill Fyfe is an Otago graduate and former staff member being, arguably, New Zealand's first academic geochemist (experimental petrologist) and is now one of the most wide-ranging, insightful and productive earth scientists alive today. He was also No. 58 on the New Zealand Geochemical Group's membership list. Bill Fyfe's name must be included among the notable geochemists in our nation's history not only for his authorship of five books and more than four hundred research papers but also for the fact that he established one of the first high-pressure, high-temperature laboratories outside North America when he returned to the University of Otago in 1955. Several of our well-known geochemists including Jim Ellis and Roger Burns were greatly influenced by Bill at various times during their professional careers. Bill Fyfe, a son of a mid-Canterbury farming family, attended Waitaki Boys' High School before studying chemistry and geology at the University of Otago where he came under the influence of Soper (chemical kinetics) and Benson and Turner (geology). He graduated BSc in 1948 and was appointed Junior Lecturer in Chemistry. He investigated coordination chemistry of heavy metals including silver and manganese for MSc and PhD requirements. A Fulbright Award allowed him to spend three years in California at Berkeley and Los Angeles where he worked with Turner, Verhoogen and Kennedy. On his return to Dunedin at the end of 1955 he set up the high-pressure laboratory and lectured in both physical and inorganic chemistry. Jim Ellis was the first student to use the high-pressure facilities and he investigated various aspects of aqueous and zeolite chemistry. This work provided experimental support for a huge amount of field data meticulously collected by Coombs and led to the publication of the benchmark paper in 1959 which delineated the 'zeolite facies'. At the end of 1958 Bill Fyfe underwent a transformation when he resigned from his position as Reader in Chemistry at Otago and emigrated to USA where he took up an appointment as Professor of Geology in the University of California, Berkeley. Since that time he has held the following positions:

Royal Society Professor in Geochemistry at the University of Manchester, UK, 1966-1972
Chairman, Geology Department, University of Western Ontario, London, Canada, 1972-1983
Professor, Geology, University of Western Ontario 1983-
Dean, Faculty of Science, University of Western Ontario 1986-1990.

He has been the recipient of more than thirty awards and honours including:

Mineralogical Society of America Award	1964
Fellow Royal Society London (UK)	1969
Logan Medal, Geological Association of Canada	1981
Willet G. Miller Medal, Royal Society of Canada	1985
Arthur Holmes Medal, European Union of Geosciences	1989
Companion of the Order of Canada (similar to the Order of New Zealand)	1989
Arthur Day Medal, Geological Society of America	1990
Canada Gold Medal for Science and Engineering	1992

Also several Honorary Life Fellowships, five Honorary DScs together with advisory roles to governments and other agencies in South America, Asia and Africa.

Bill's interests are in geochemistry, global tectonics, resource development and conservation, agricultural geochemistry, environmental geochemistry and nuclear waste disposal. While he was in New Zealand recently he lectured on his concerns for planetary survival both in Dunedin and Wellington. Unfortunately many members of the scientific community were unable to be present on these occasions. His message, without the huge volume of data, was encapsulated in his Otago graduation address, the text of which follows. Members of the Geochemical Group congratulate you, Bill, not only for the award of DSc (Otago, Hon.) but also for your immense contribution through science to the well-being of the human race.

From the *New Zealand Geochemical Group Newsletter No. 96*

COMPOSITION OF NEW ZEALAND MILK

Jeremy Hill, Food Science Section, New Zealand Dairy Research Institute, Private Bag 11029, Palmerston North

New Zealand's milk is far from the popular conception of a uniform white liquid. Its composition is influenced by a variety of factors, including the way in which cows are fed almost exclusively on pasture, the distinctive genetic make-up of the livestock, synchronized calving, the climate and the varied weather patterns.

All manufacturing processes must start with the appropriate raw material. If the milk composition falls outside the optimum required for manufacturing a particular dairy product, that product cannot be processed with the utmost efficiency. Understanding the fluctuations in New Zealand's milk composition and the factors that influence them are the subject of ongoing research at the New Zealand Dairy Research Institute. This work involves a number of collaborative projects, with partners including the Livestock Improvement Corporation, Dairying Research Corporation, AgResearch and the dairy companies.

Research focused initially on the influence on milk composition of some of the fixed genetic factors (genes that are passed on to future generations of cattle). Of these, the β-lactoglobulin gene was the first to be selected for investigation. In western cattle breeds, such as Friesian and Jersey, β-lactoglobulin is found as two major variant forms - A and B. The difference between the A and B variants is small and is due to two substitutions in the amino acid sequence of this protein; an aspartic acid residue for a glycine residue at position 64, and a valine for an alanine residue at position 118 (Figure 1).

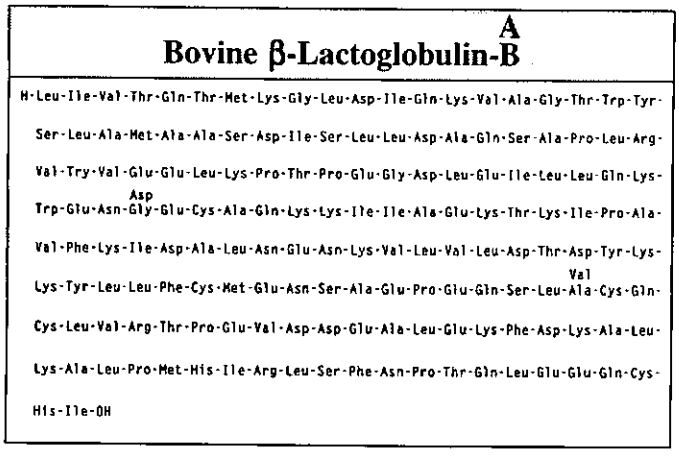


Figure 1: *Amino acid sequence of bovine β-lactoglobulin.*

Cows that produce milk containing only the A variant form of β-lactoglobulin are referred to as AA phenotype cows; those that produce only the B variant as BB phenotype cows, and those producing both the A and B variant forms as AB phenotype cows. The frequency of β-lactoglobulin phenotypes in a sample of New Zealand's cow population was determined, and Table 1 shows the distribution of AA, BB and AB phenotypes to be very similar in both Friesians and Jerseys.

Table 1: *β-Lactoglobulin phenotype distributions in New Zealand cows (as a percentage)*

β-Lg	Breed	AA	AB	BB
	Jersey	12	47	41
	Friesian	16	49	35

Mixed herds of β-lactoglobulin AA and BB phenotype cows were established and milk samples collected from these cows to examine the effect of the β-lactoglobulin variants on milk composition (Hill, 1993, Hill *et al.*, 1993).

Tables 2 and 3 show the effect of β-lactoglobulin phenotype on the compostition of milk in mid and late season.

Table 2: *The relationship of β-lactoglobulin phenotypes with the whey protein, casein, fat, lactose, ash and total solids contents of mid and late season milk.*[1]

Milk component %	AA late season	BB late season	AA mid season	BB mid season
Whey protein	0.88	0.77*	0.64	0.50*
Casein protein	2.48	2.61*	2.49	2.66
Total protein	3.36	3.38	3.13	3.16
Fat	4.92	5.41	4.12	4.62*
Lactose	4.60	4.65	4.73	4.68
Ash	0.71	0.71	0.70	0.70
Total solids	13.54	14.10	12.46	13.23*

[1]Data are expressed as means (n = 4).

Significance values relate to comparisons between β-lactoglobulin phenotypes in either mid or late season, but not between mid season and late season.

*P < 0.05. *P < 0.02. *P < 0.01. *P < 0.002.

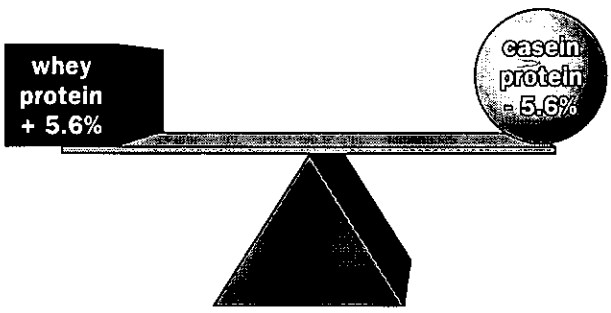
Table 3: *The relationship of β-lactoglobulin phenotypes with the mineral contents of mid and late season milk*[1].

Mineral (mM/kg)	AA late season	BB late season	AA mid season	BB mid season
Calcium	31.87	32.26	31.33	31.08
Phosphate	21.04	21.80	22.53	23.05
Sodium	17.85	17.59	15.70	15.83
Potassium	37.81	37.26	38.73	38.20
Chloride	30.35	29.35	30.73	30.76
Magnesium	4.74	4.64	4.13	4.13

[1]Data are expressed as means (n = 4).

Where as β-lactoglobulin AA phenotype cows produce milk containing a higher concentration of whey protein, β-lactoglobulin BB phenotype cows produce milk containing a higher concentration of casein, fat and total solids. No differences were observed in the concentrations of lactose, ash

and major milk minerals. Similarly the concentration of total protein was identical in the milk produced from both AA and BB phenotype cows. This is because in both mid and late season the increase in whey protein concentration in the milk from the AA phenotype cows is exactly balanced by a decrease in the concentration of casein in the milk from these cows, with the opposite being the case for the milk from the BB phenotype cows.



This result is interesting as it contradicts findings in Canada, where β-lactoglobulin AA phenotype cows were found to produce milk with a higher protein content. Thus when cows are fed and managed as they are in New Zealand, β-lactoglobulin cannot be used as a marker for increased milk protein content. The reason for the difference between the New Zealand and Canadian results is as yet undetermined, but is possibly a consequence of the different management practices. A recent three-month visit from Dr Andre Ng Kwai Hang, Professor of Dairy Chemistry at McGill University in Quebec, and a world authority on milk composition, allowed this theory to be explored.

The effect of β-lactoglobulin phenotype on milk composition appears to be a consequence of the difference in expression of the β-lactoglobulin protein, with the concentration of this protein being markedly higher in the milk from AA phenotype cows. To investigate the biochemical mechanism for these effects, a joint project is being established between the New Zealand Dairy Research Institute and the Lactation Physiology Group of the Dairying Research Corporation. A further extension of this project has resulted in the establishment of a phenotyping laboratory at the Livestock Improvement Corporation's. Herd Testing Centre, where an additional 10,000 two-year old cows will be phenotyped for all the major proteins. This information will allow the effect of protein phenotypes on milk production characteristics such as milk, protein and fat yield, to be determined.

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19-22 November 1995
15th International Symposium on Protein, Peptide and Polynucleotide Analysis (ISPPP '95).
Venue: Boston, Massachusetts, USA
Contact: Judy Heine
Department of Chemistry-BRWN Bldg
Purdue University
W. Lafayette, IN 47907-1393, USA
Ph +1-317-4941648
Fax +1-317-4940359

12-16 December 1995
4th Pacific Polymer Conference
Venue: Kauai, Hawaii, USA

CONFERENCES & SEMINARS

Contact: Professor Ray Otterbrite
Department of Polymer Chemistry
Virginia Commonwealth University
Richmond, Virginia 23204, USA
Fax +1-804-3678588

17-22 December 1995
Pacifichem '95 International Chemical Congress
Venue: Honolulu, Hawaii, USA
Contact: Professor B Halton
Chemistry Department
Victoria University
P O Box 600, Wellington
Ph (04) 4721000

PACIFICHEM '95 UPDATE

The final schedule for the scientific sessions of Pacifichem '95 has now been completed. Copies have been distributed to Branch Secretaries and the information is also available from Professor B. Halton, Chemistry Department, Victoria University, P O Box 600 Wellington. Fax: (04) 4955241, or the NZIC Office in Wellington. Fax: (04) 4732324.

28-30 January 1996
International Macrocyclic Meeting
Venue: Victoria University, Wellington, New Zealand
Contact: Dr Sally Brooker
Chemistry Department
University of Otago
P O Box 56, Dunedin, New Zealand
E-mail: chemsab@otago.ac.nz

4-7 February 1996
5th International Congress on Trace Elements in Medicine and Biology - Therapeutic Uses of Trace Elements
Venue: Méribel, France
Contact: Mme Arlette Alcaras
Laboratoire de Biochimie C
CHRUG B P 217
F-38043 Grenoble Cedex 9, France

4-7 February 1996
21st Australian Polymer Symposium Preceded by Workshop on Polymer Reaction Engineering 3-4 February
Venue: Wollongong, NSW, Australia
Contact: Dr Malcolm Binns
Mirotone Pty Ltd
21 Marigold Street, Revesby
New South Wales 2212, Australia
Ph +61-2-7724555
Fax +61-2-7713601

31 March - 4 April 1996
7th International Symposium on Supercritical Fluid Chromatography and Extraction
Venue: Westin Hotel, Indianapolis, Indiana, USA
Contact: Janet Cunningham
Barr Enterprises
P O Box 279
Walkersville
MD 21793, USA
Ph +1-301-8983772
Fax +1-301-8985596

15-17 April 1996
Starch: Structure and Function
Venue: Cambridge, England, UK
Contact: Mrs MA Staff
Cavendish Laboratory
Madingley Road
Cambridge CB3 0HE, England, UK

21-23 April 1996
2nd International Conference on Clinical Chemiluminescence
Venue: Berlin, Germany
Contact: Dr Gudrun Lewin
Research Institute for Antioxidant Therapy Co
Chausseestr 119-120
10 115 Berlin, Germany

WOMEN IN SCIENCE CONFERENCE

A conference called Science - Women and Our Future is being planned by the Association of Women in Science (AWIS) and will be held in Wellington in late May 1996. This follows the successful Women's Suffrage Centennial Science Conference W2(SC) organised by AWIS in September 1993. To register interest in participating or providing programme suggestions for the 1996 conference, please write to:
Steering Committe, Science - Women and Our Future
86 Daniell Street, Newtown, Wellington, New Zealand
Fax: +64-4-3892589

16-21 June 1996
HPLC'96: 20th International Symposium on High Performance Liquid Phase Separations and Related Techniques
Venue: Marriott, San Francisco, California
Contact: Janet Cunningham
Barr Enterprises
P O Box 279
Walkersville
MD 21793, USA
Ph +1-301-8983772
Fax +1-301-8985596

14-18 June 1996
1st Science Centre World Congress
Venue: Heureka, Vantaa, Finland
Contact: Ms Helena von Troil
Secretary General, Keureka
The Finnish Science Centre
P O Box 166, FIN-01301 Vantaa, Finland

7-12 July 1996
Organometallic Chemistry XVII
Venue: Brisbane, Australia
Contact: Eva Comino
Secretariat, International Conference on Organometallic Chemistry
Faculty of Science and Technology

CONFERENCES & SEMINARS

Griffith University
Brisbane, QLD 4111, Australia
Ph +61-7-8757564
Fax +61-7-8755369

9-11 July 1996
Chromatography '96 Separation Sciences Conference and Exhibition
Venue: Rose Hill Gardens, Sydney, Australia
Contact: Secretariat
Fax +61-2-7937139

14-19 July 1996
RACI/SETAC/ASE International Conference on Environmental Chemistry and Toxicology
Venue: Sydney, NSW, Australia
Contact: Dr Graeme Batley
CSIRO Centre for Advanced Analytical Chemistry
PMB 7, Menai
NSW 2234, Australia
Ph +61-2-7106830
Fax +61-2-7106837

14-19 July 1996
14th International Conference on Chemical Education (14ICCE)
Venue: Brisbane, Australia
Contact: Sally Brown
Conference Secretariat
14th ICCE
Continuing Professional Education
The University of Queensland
Brisbane, QLD 4072, Australia
Ph +61-7-3656360
Fax +61-7-3657099
e-mail:chemed96@ceu.uq.oz.au

29 July - 2 August 1996
Recent Advances in Polymer Synthesis
Venue: University of York, England, UK
Contact: Professor P Hodge
Department of Chemistry
University of Manchester
Oxford Rd, Manchester
M13 9PL, England, UK
Fax +15-44-1612754598
Email: philip.hodge@man.ac.uk

4-9 August 1996
IUPAC MACRO '96
Venue: Seoul, Korea
Contact: Dr Kwang Ung Kim
Secretariat IUPAC MACRO SEOUL '96
Division of Polymers, KIOST
P O Box 131, Cheongryang
Seoul 130-650, Korea
Fax +1582-2-9576105
Email: iupac@kistmail.kist.re.kr

1-4 September 1996
Environmental Biotechnology, An International Conference
Venue: Massey University
Palmerston North, New Zealand
Contact: Confernece Secretary
Environmental Biotechnology Conference
Process & Environmental Technology Dept
Massey University
Palmerston North, New Zealand
Ph +64-6-3505351
Fax +64-6-3505654
Email: G.F.Withers@massey.ac.nz

8-11 October 1996
AUSPLAS '96
Venue: Melbourne Exhibition Centre
Melbourne, Australia
Contact: John Kelly
Exhibition Management Pty Ltd
Melbourne, Australia
Ph +61-3-96464044
Fax +61-3-96461828

9-11 October 1996
Anticancer Targets and Strategies for the 21st Century
Venue: Castres, France
Contact: Marian Cabailh
Conference Secretariat, CRPF
17 Avenue Jean Moulin
81106 Castres Cedex, France
Ph +33-63-714368
Fax +33-63-714299

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
Ph +61-3-93875371

25-29 November 1996
13th International Corrosion Congress
Venue: Carlton Radisson Hotel, Melbourne
Contact: Conference Secretariat
P O Box 5142, Clayton
Victoria 3168, Australia
Ph +61-3-95440066
Fax +61-3-95435905

2-6 December 1996
NZIC Conference 1996 - "Molecules for the Future"
Venue: University of Otago, Dunedin, New Zealand
Contact: Dr R M Carr
Chemistry Department
University of Otago
P O Box 56
Dunedin, New Zealand
Ph +64-3-4797932
Fax +64-3-4797906
e-mail:chemmail@otago.ac.nz

CONFERENCES & SEMINARS

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, EuAsC_2S-1996
Biotechnology Research Centre
Zhongshan (Sun Yatsen) University
Guangzhou (Canton) 510275, China
Ph +86-20-4185461 or +86-20-4186300-7115
Fax +86-20-4189173 or +86-20-4185551
E-mail: Leiy@pebc2ihep.ac.cn

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

CALL FOR ABSTRACTS

Contributed papers are expected in the form of either oral or poster presentations which will carry equivalent scientific status in the program and be published equally. Scientists wishing to present a paper are invited to return an abstract of no more than one page by May 1, 1996. The authors should indicate their preference as to the presentation mode (oral or poster). The abstract should be camera ready and typewritten 1½ spaced in white 21 x 29.7 cm (A4) paper with good quality black ribbon. A margin of 3 cm should be left above, below and on either side of the text. The name of speaker is to be underlined. The IAB/IOC will select a number of oral presentations from submitted abstracts at the closing date.

SECOND CIRCULAR

The second circular will be destributed around January 15, 1996, in which detailed information and registration forms will be included.

LANGUAGE

The offical language of the conference will be English.

3-7 February 1997

22nd Australasian Polymer Symposium

Venue: Auckland, New Zealand

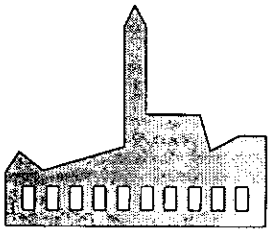
Contact: Mr N R Edmonds
Faculty of Science & Engineering
Auckland Institute of Technology
Private Bag GPO, Auckland, New Zealand
Ph +64-9-3079999 ext: 8181
Fax +64-9-3079973

13-17 July 1998

MACRO '98 - 37th IUPAC International Symposium on Macromolecules

Venue: Gold Coast, Queensland, Australia

Contact: Department of Chemistry
University of Queensland
Queensland 4072, Australia
Ph +61-7-3653511
Fax +61-7-3653628



INDUSTRY APPLICATIONS

ON-LINE ICP FOR PROCESS AND QUALITY MONITORING

Thermo Jarrell Ash Corporation (Franklin, Massachusetts, USA) have recently released a number of applications notes covering the design and use of on-line ICP instruments for continuous monitoring in industrial processes.

The following introduction to the on-line ICP technique has been summarised from "ICP for on-line process control: status and developments", G.A. Meyer, *Spectrachimica Acta Rev.***14**, 6, 437-446 (1991).

Chemical analysis of process streams has undergone a major change over the past two decades. While the basic analytical methods continue to be used, integration of the results into real-time process control has become increasingly possible. Samples that were formerly transported to laboratories for analysis within hours or even days are now evaluated on site by instruments hooked into the process stream. Results are fed back into the process either by the operator observing a read-out or by electronic means - often within minutes.

Two factors are largely responsible for the drive toward real-time process control: regulatory compliance, especially with respect to waste streams; and product quality. Total control of production plant processes and resources requires the analysis of feed, intermediate, and product materials. Increasingly, industries are looking upon inorganic process analysis as a value-added item in itself, one that will improve overall manufacturing operations to yield consistent, high quality products.

Among all the available atomic spectrometries, ICP combines the widest range in elemental sensitivity with moderate installation cost. Applications arise from the need for ppb elemental sensitivities.

Increased manufacturing efficiency, regulatory compliance assurance and industrial hygiene maintenance are some of the biggest advantages of real-time continuous monitoring. The ICP has been an active participant in process control applications already for the last 10 years. A discussion of developments of an ICP for use in determining impurities in radioactive and hazardous materials is part of an 1987 ASTM method. Other Process Control-ICP (PC-ICP) installations are sometimes carefully concealed by their users due to the often proprietary nature of the applications. In fact PC-ICPs have been successfully operated by the aviation, nuclear, automotive, mining and food industries all for the combined benefit of enhancing product quality and reducing waste. For example, in the food business, continuous monitoring of metals in their processes helps reduce inventory, and increase product shelf life because of better quality. Industries relying on municipal water treatment of their waste water have saved money by being able to certify that discharge limits comply with prior commitments, or are able to warn the treatment centre of high discharge contaminant levels.

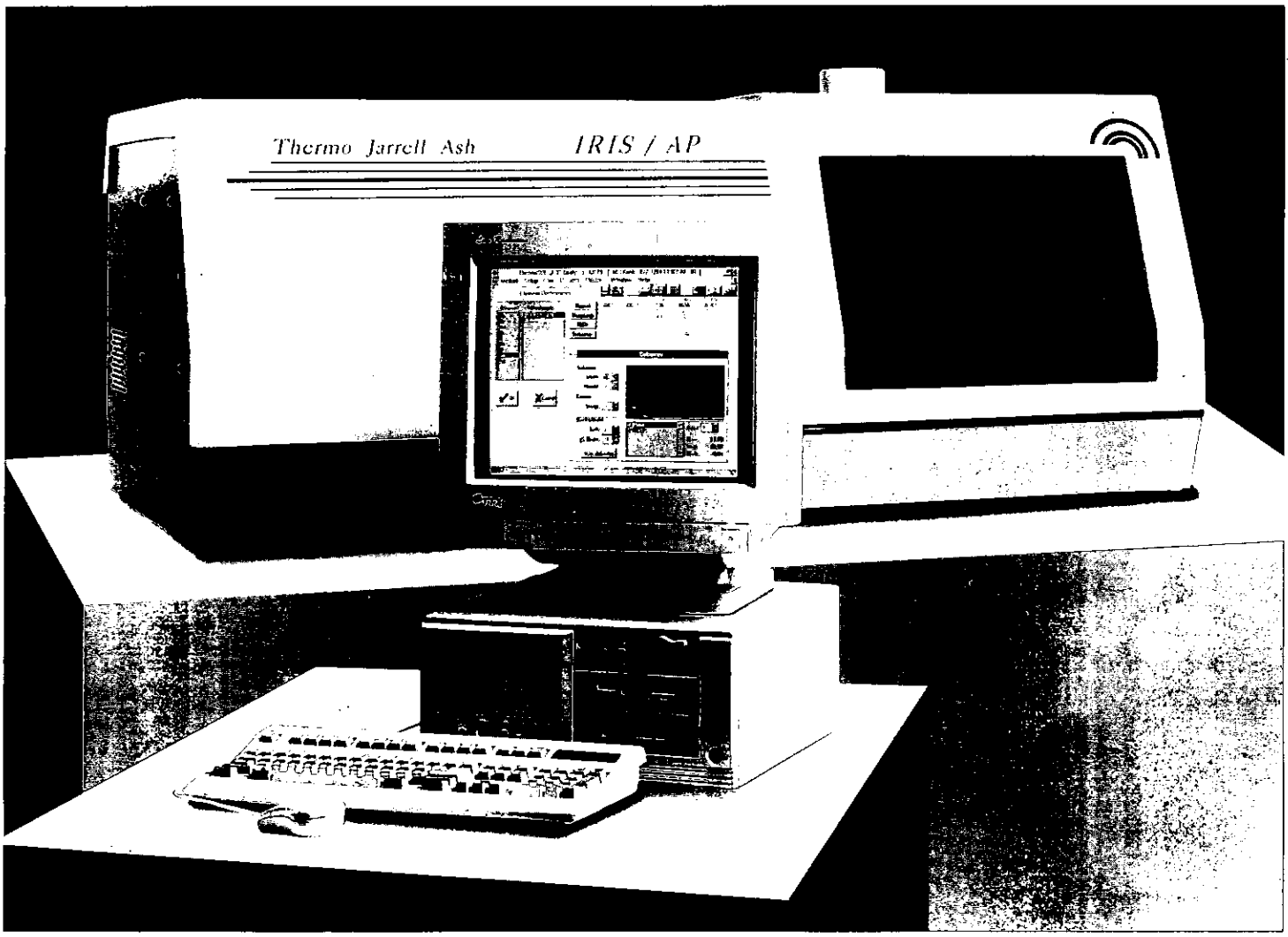
However with the promise of better product quality using PC-ICP comes a challenge to vendors who market commercial PC-ICP units. Responsibility for ensuring continuous monitoring capability also means that the monitoring instrument itself has to perform at greater than 99% efficiency.

The 'process' can often be located at variable distances from the PC-ICP analyser. A single instrument can function as a monitor for several different processes located at some distance from the analyser. Material from various processes can be routed to an overflow sampler located by the PC-ICP which subsequently samples the filtrate at a given frequency dictated by the automation software. Pumping speed at this junction needs to be sufficiently high enough in order for the process monitor to be able to keep up with any changes that may be occurring in the process. The number of different streams that a PC-ICP is capable of supporting depends on the analysis frequency necessary to properly track a particular process analytical variable. For example, to monitor 4 streams in addition to a standard and blank solution each within a 3 minute interval, sampling frequency for just one stream becomes 4 times per hour, or 5 per hour when considering a 2 minute sampling interval. The sampling interval must allow for proper sample rinsing and signal stabilisation.

Examples of industries that currently use custom designed ICP systems for quality monitoring have included power stations (conventional and nuclear), foundries, aircraft and automobile manufacturers, and food manufacturing. Specific applications include effluent monitoring, stack gas monitoring, coal gasefication, and alloy product monitoring.

For copies of the Thermo Jarrell Ash application notes and more detailed descriptions of the instruments used in the examples described above please contact:
Andrew Pearce, SciTech, P O Box 663 Dunedin
Ph: (03) 4777860, Fax: (03) 4777870
circle number 55 on the reader reply card

Another Innovation from
Thermo Jarrell Ash ...



IRIS AP ICP EMMISSION SPECTROMETER

Features

- *Charge Injection Device (CID)*
- *Simultaneous Background Correction*
- *Echelle Optical Design*
- *Axial Plasma Viewing*
- *Microsoft Windows™ based software*

Benefits

- *Continuous Wavelength Coverage from 175 to 900 nm*
- *Simultaneous measurement of any number of wavelengths*
- *Excellent correction in complicated sample matrices*
- *High resolution, compact design*
- *Lowest detection limits available*
- *Powerful software, easy to learn and use*

SCI TECH

Auckland - PO Box 23-611	Phone: (09) 622-2201
Wellington - PO Box 9881	Phone: (04) 801-7220
Christchurch - PO Box 13-734	Phone: (03) 379-8467
Dunedin - PO Box 663	Phone: (03) 477-7860

SCI TECH

or circle number 14 on the reader reply card.

CLIMATE CHANGE 1994

Houghton, J.T., L.G. Meira Filho, J. Bruce, Hoesung Lee, B.A. Callander, E. Haites, N. Harris & K. Maskell, (Eds.), 1995. Climate Change 1994; Radiative Forcing of Climate Change, and An Evaluation of the IPCC92 Emission Scenarios. Intergovernmental Panel on Climate Change; Cambridge University Press.

Reviewed by Vincent Gray, Chemical and Energy Consultant, 75 Silverstream Road, Crofton Downs, Wellington

This volume of 339 pages is the third major scientific publication of the Intergovernmental Panel on Climate Change, a body set up by the World Meteorological Organisation and the United Nations Environment Programme in 1988. The first publication, Climate Change, had 365 pages and was published in 1990 as the final report of Working Group 1 of the IPCC. The second, Climate Change 1992, 200 pages long, was supplementary to the first report, and updated only parts of it.

Climate Change 1994, is another supplement to the original Climate Change. It deals only with two somewhat unrelated subjects, Radiative Forcing of Climate Change, and An Evaluation of the IPCC 1992 Emission Scenarios.

Radiative Forcing of Climate Change - General

Besides the Summary for Policymakers, the report consists of 5 Chapters, "CO_2 and the Carbon Cycle", "Other Trace Gases and Atmospheric Chemistry", "Aerosols", "Radiative Forcing", and "Trace Gas Radiation Forcing Indices".

The First Draft of this report was circulated for comment in February 1994, and the Second Draft in May 1994, together with the First Draft of the Summary for Policymakers. Something of a sensation was caused when the Summary for Policymakers was approved for publication at the meeting of Working Group 1 at Maastricht 13-15 September 1994, before the final wording of the full report had been decided. The full report was eventually passed for publication at the WG1 meeting on 10-12 November 1994 in Nairobi.

The Summary for Policymakers was published with the title Radiative Forcing of Climate Change in early 1995, the present volume includes this summary at the very beginning. The only change is in the addition of a footnote to page 11 which amplifies their statement that "recent low growth rate of carbon dioxide concentration is not unusual". This statement is a change from the second draft of the "Summary" which referred to the recent low growth rate as an "anomaly". They seem to have responded positively to comments that the growth rate appears to fluctuate, and a fluctuation downwards should not be referred to as an anomaly. However, recent changes are still referred to as "anomalies" on page 42 of the main report.

Carbon Dioxide

Chapter 6 of Climate Change (1990) is responsible for promoting the dogma that the "effective" concentration of carbon dioxide in the atmosphere will double in 70 years. They put it this way (page 181): "This rate of increase roughly corresponds, in terms of CO_2 equivalent units, to the present rate of increase of forcing by all the greenhouse gases".

As we shall see below (see also Figure 3), the concentration of the chief "trace gas", methane, is approaching a constant value, and is likely to diminish. The model assumption, therefore amounts to a belief that carbon dioxide concentration itself is increasing by "roughly" 1% a year.

This assumption is made by most of the computer models, and it frequently assumes the status of an established fact in the environmental and political literature. It is based on the solution of the equation:

$$(1.01)^n = 2 \text{ where } n = 69.7$$

In other words, the assumption that the "effective" concentration of carbon dioxide will double in 70 years is based on the belief that the concentration of "effective" carbon dioxide in the atmosphere, beginning in the year 1990, is increasing by 1% compound per year.

Unfortunately, the actual rate of increase of carbon dioxide alone, in 1994, is only one third of this value.

The IPCC have tried to cover up this discrepancy. Their main approach was to conceal as much as possible of the enormous amount of data on carbon dioxide in the atmosphere that has been accumulated in recent years. Then they selected a figure for the current rate of change which was as high as they thought they could get away with, and increased it rapidly to an average of 1% "effective" carbon dioxide a year for their Scenarios SA90 ("Business as Usual") and IS92a, so that these scenarios doubled their "effective" carbon dioxide concentrations in 70 years, to fit the models. In order to do this they had to increase the world coal production 7 times over the next century, and to increase the proportion of total anthropogenic carbon dioxide emissions entering the atmosphere from the current figure of 48% to 57%.

In 1982 the US Government set up the Carbon Dioxide Information Analysis Center as part of the Environmental Sciences Division of the Oak Ridge National Laboratory at Oak Ridge, Tennessee. This organisation has compiled a large data bank of measurements of carbon dioxide in the atmosphere. They publish regular newsletters and some annual summaries (*Trends '90, '91, '93*) which are available without charge to bona fide enquirers. The latest volume (*Trends '93*) has detailed results of carbon dioxide measurements in the atmosphere from 61 stations, worldwide, besides many measurements of atmospheric methane, carbon dioxide emissions, other trace gases and aerosols, global and regional temperatures, and precipitation. Climate Change (1990) and Climate Change 1992 make no mention of the existence of such an organisation, or of any of its tables of results, except one, the figures from the station at Mauna Loa, Hawaii, whose record, from 1958-89 is given as Fig 1.4 in Climate Change (1990).

Both Climate Change (1990) and Climate Change 1992 chose as the current (presumably 1990) rate of increase of carbon dioxide in the atmosphere the figure of 1.8 ppmv/yr (0.5%/yr),

one half of the figure assumed by the models. Anybody with a ruler placed against the record from Mauna Loa in Climate Change (1990) can discover that the rate of change from 1975 to 1989 was 1.5 ppmv/yr, 0.42% a year.

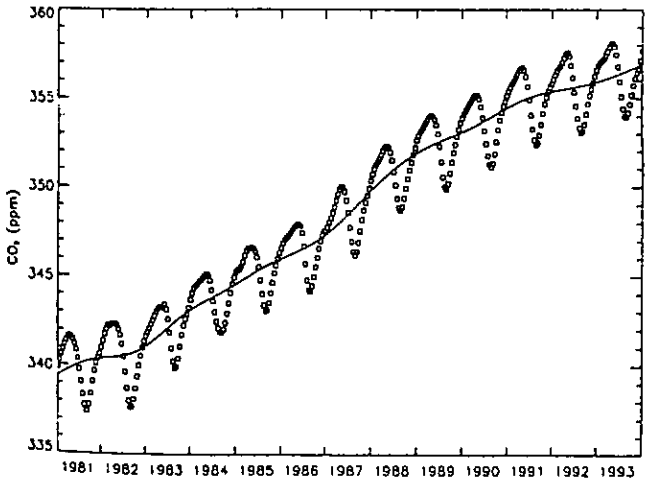


Figure 1: *Globally averaged CO_2 mixing ratio variations from 1981 to 1993, at biweekly intervals. The solid curve represents the long-term CO_2 trend. (from Conway* et al *1993).*

Climate Change 1994 gives a reference to *Trends 91*, and mentions the existence of many other measurement stations and they give the "globally averaged" figure of 1.53 ppmv/yr, (0.44% per year) for 1980-89, as obtained by the network established by the National Oceanic and Atmospheric Administration, Environmental Research Laboratories Climate Monitoring and Diagnostics Laboratory, Boulder, Colorado (NOAA/CMDL).

However, the inclusion of Figure 1.2 on page 43 (see Figure 2 below) rather gives their game away. It shows the variation in the growth rate of carbon dioxide in the atmosphere at the Mauna Loa station, on a yearly, and a ten-yearly basis. It shows that the growth rate of carbon dioxide fluctuates sharply on a yearly basis. It is evident that the source of the 1.8 ppmv/yr figure selected by Climate Change (1990) and Climate Change 1992 was obtained by averaging out the peak from 1987-89. It is also obvious that the current choice of 1980-1989 was made to provide yet another excessively high figure. Any other period would have given a lower figure, and the current (1994) rate of increase of carbon dioxide. based on a ten year average, is 1.2 ppmv/yr (0.34%/yr), one third the "effective" amount assumed by the computer models to have existed since 1990.

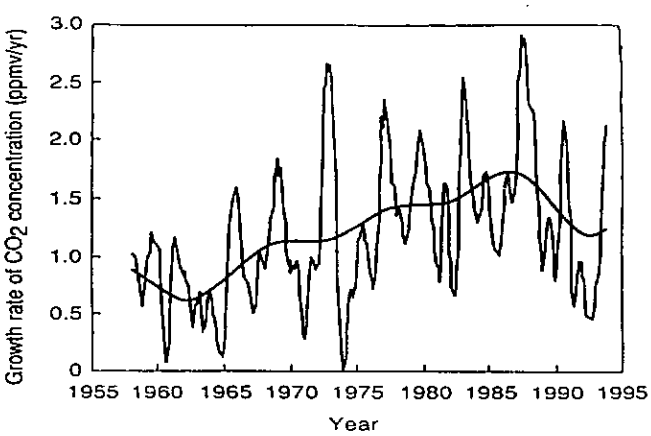


Figure 2: *Growth Rate of Carbon Dioxide Concentration from "Climate Change 1994".*

It is unfortunate that although the phrase "recent anomalies" was eliminated from the "Summary for Policymakers" after comments on the draft, the phrase has remained as a heading of the box on page 42. Figure 2 provides no support for the view that recent behaviour of carbon dioxide is "anomalous", and even less for the view that the upwards fluctuation in 1994 represents a return to "a long term average". The peak-to-peak fluctuation between 1973-1974 was from 2.6 ppmv/yr to zero, and there are obviously several other fluctuations comparable to, or higher than, the present one.

Both the IPCC Future Emissions Scenarios SA90 ("Business as Usual") and IS92a assume a doubling of carbon dioxide alone in 90 years, i.e., at 0.77% per annum to the year 2100. The balance, up to the "effective" 1%, is assumed to come from methane.

The Anthropogenic Carbon Budget

The "Carbon Budget" figures given in Table 1 (page 18) and Table 1.3 (page 55) of Climate Change 1994, are similarly boosted by the choice of the years 1980 to 1989, so as to give the highest possible figure (3.2 GtC/yr: (Gigatonnes of carbon per year)) for storage of carbon in the atmosphere. The 1994 figure would be 2.6 GtC/yr. The "Budget" is also defective in that there is a considerable uncertainty as to the actual total "anthropogenic emissions" of carbon dioxide to the atmosphere. The figures here give 5.5±0.5 GtC/yr from fossil fuel combustion, plus 1.6±1.0 GtC/yr as "net emissions from changes in tropical land use". However, this last figure includes 0.6 GtC/yr from tropical land regrowth, which really ought to be regarded as a "sink", in the same way as "northern hemisphere forest regrowth". If this correction is made the total "anthropogenic emissions" fall from 7.1±1.1 GtC/yr to 6.5±1.1GtC/yr. The range of "anthropogenic emissions" is then between 5.4 and 8.2 GtC/yr, depending on which calculation you believe.

Stabilisation Scenarios

A feature of Climate Change 1994 is the development of a series of stabilisation scenarios which calculate the emission reduction targets which must be performed in order to achieve a particular stable concentration of carbon dioxide in the atmosphere. The models project future carbon dioxide concentrations to the year 2300. These calculations are dependent on a series of carbon cycle models which can be used to calculate the atmospheric concentration from the emissions. These models were "constrained to balance the carbon budget and match the atmospheric record of the 1980s via CO_2 fertilisation of the terrestrial biosphere" (page 39), but they were not constrained to take into account the atmospheric record of the 1990s, so the models are all biased upwards when compared with current trends. One thing they seem to have failed to notice is that emissions from combustion of fossil fuels have already stabilised, if we can assume that the current trends from 1990-92 will continue.

Several carbon dioxide models are considered by the report. The model of Enting and Lassey (1993) gives a doubling of carbon dioxide concentration in 130 years, (an average compound growth rate of 0.53%/yr) and the model of Wigley (1993), for the same scenario, gives 110 years to double (average growth rate of 0.63%/yr). Thus, both these models assume an

average increase in the compound growth rate that is even above the 1980-89 figure of 0.43% a year, and is well above the current growth rate of 0.34% a year. Both studies are admittedly subject to considerable uncertainty.

As shown by Figure 1, the globally averaged concentration of carbon dioxide in the atmosphere for 1994 was 357 ppmv. Wigley's model predicts 370 ppmv. The graphs published in Climate Change 1994 giving stabilisation predictions, based on Wigley's model, are thus already too high by 13 ppmv in 1994, only four years from the start in 1990, so the chance that they could be reliable to the year 2300 is nothing short of ridiculous. Until carbon cycle models ("constrained to model the observations from 1980-89") capable of predicting trends of only a few years later become available there seems little point in using them to try and enforce emission reduction policy.

Methane

The argument used by Chapter 6 of Climate Change (1990) for the assumption of a 1% increase in carbon dioxide concentration per year by the computer models was that it takes into account increases in other greenhouse gases, which may increase the "effective" carbon dioxide to a greater extent than extra carbon dioxide itself. Unfortunately this argument is also in conflict with the facts.

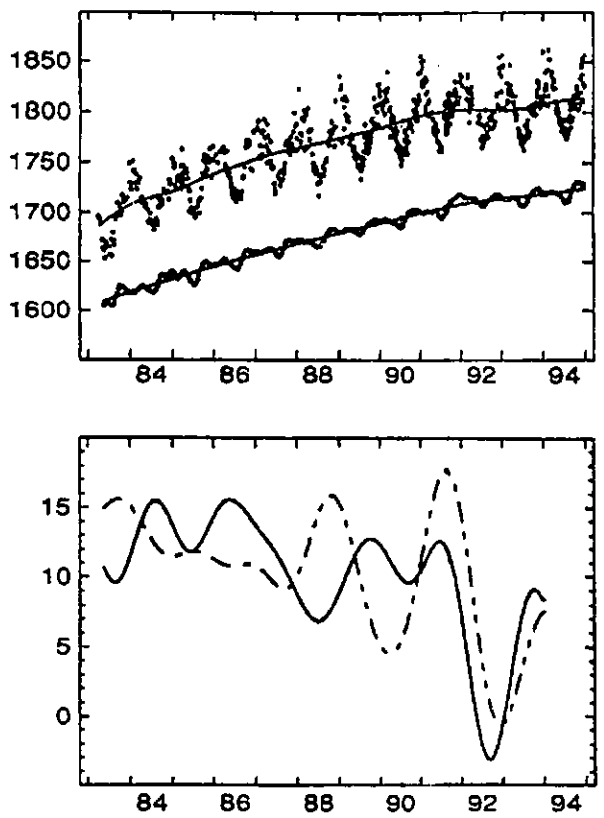


Figure 3: *Growth Rate of methane in the atmosphere. From Dlugocencky* et al *1994.*

Chapter 2 (page 77) begins with the statement "The 1980s were characterised by declining methane growth rates which were approximately 10 ppbv/yr by the end of the decade". They then proceed to take the "average" for the decade at 13 ppbv/yr as the current rate of increase (Table 3, page 25), even though the rate of increase is still falling to zero. They refrain from publishing Figure 3 (from Steele *et al.*, 1992 and Dlugocencky *et al* 1994,, slightly updated) which illustrates this fact. The report admits that there was a zero or negative change of atmospheric methane in 1989, but they clutch on to the fluctuation upwards in 1993 as to "suggest that the growth rate started to increase in 1993". The plain deduction from Figure 3 is that rates of methane increase are steadily declining, but with fluctuations, and that the current, 1994 figure, is 4 ppbv/yr, (0.2%/yr), and declining; probably to zero and possibly to negative values.

The IPCC Emissions Scenario SA90 ("Business as Usual") assumes a rate of increase of methane of 2.25% a year to the year 2100, starting with the year 1990. Scenario IS92a assumes a rate of increase of 1.25% a year, also beginning in the year 1990. These assumptions are completely in conflict with current observations.

Radiative Forcing

The term "radiative forcing" refers to the additional level of radiation at the tropopause (in Watts per square metre), attributable to the presence of greenhouse gases and other identifiable climate changes. Chapter 4 of Climate Change 1994 gives a valuable account of the theory of radiative forcing, but without updating several features of Chapter 2 of Climate Change (1990). Figure 4.8 (page 195), (reproduced below as Figure 4) which gives the various contributions to radiative forcing from 1850 to 1990 illustrates well the point which has not yet been made clear to the general public; that the calculated net radiative forcing over the period in question is very much lower than is commonly claimed, largely because of the direct and indirect effects of tropospheric aerosols. However, the original graph had a caption (still included in the Policymakers' Summary, Figure 3, page 19) which warned "The negative values for aerosols should not necessarily be regarded as an offset against the greenhouse gas forcing because of doubts over the applicability of global mean radiative forcing in the case of non-homogeneously distributed species such as aerosols and ozone". This caveat has been removed from below Figure 4.8, (Figure 4 below) for two good reasons. First, the figures for the "direct greenhouse" already allow for feedbacks from such non-homogeneously distributed species as water vapour, and such aerosols as ordinary clouds, so perhaps these figures should also be doubted. Secondly several models have already been published which incorporate sulphate aerosols.

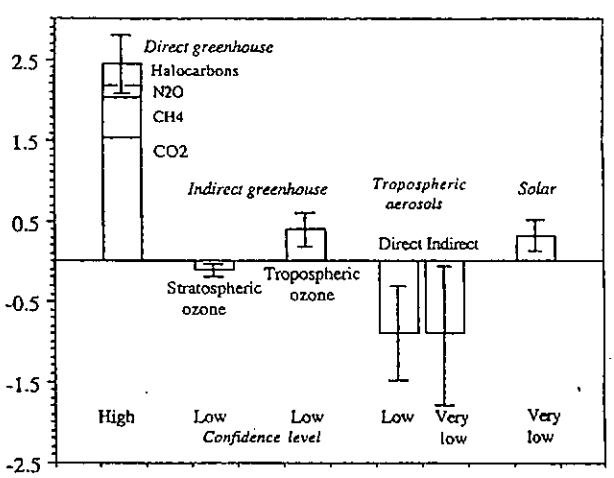


Figure 4: *Radiative Forcing 1860-1990. (from "Climate Change 1994").*

Figure 4 shows considerable uncertainty in the current estimate of net radiative forcing, to the extent that it could even be zero or negative.

Global Warming Parameters

Chapter 5 provides a new name for this concept, "Trace Gas Radiative Forcing Indices". They are the figures required to convert the concentration of a trace gas to "equivalent carbon dioxide". There is still controversy as to whether it is really legitimate to try and compare the effect of a gas such as carbon dioxide, which participates in a "cycle", but is not destroyed, with gases such as methane which have a finite lifetime. There is also the problem that the radiative effects alter with concentration in a non-linear fashion that is different for each gas. Overlapping of infra-red absorption bands is also a complex matter. Anyway, this Chapter provides revised "Radiative Forcing Indices", the chief feature of which is a greatly increased value for methane, 62±20 over 20 years (previously 35), 24.5±7.5 over 100 years (previously 11) and 7.5±2.5 over 500 years (previously 4).

Far from being a drawback, these figures now give to the world a considerable advantage. As has been mentioned above, rates of increase of methane are in decline, and are likely to be zero or negative in a few years time. The increased "radiative forcing indices" for methane means that a reduction in methane can now be considered to have an important offsetting effect to any increases in carbon dioxide, and it may turn out that it is cheaper to reduce "effective carbon dioxide" (methane emissions) than carbon dioxide emissions themselves.

Part II; An Evaluation of the IPCC IS92 Emission Scenarios

The authors of this Chapter admit that it was prepared in a hurry, and it shows. There is quite an interesting comparison between the IS92 future emissions scenarios and those published by the World Energy Council, the International Energy Workshop, the US Environmental Protection Agency, and by several others.

All of these are "non-intervention" scenarios, where it is assumed that there are no policies for reducing greenhouse gases. Since such policies now exist in many countries, and are expected to spread, it seems that the scenarios cannot be taken too seriously. When the effects of such policies are introduced into the scenarios it becomes even more difficult, since it is necessary to forecast how the world might react when they discover that greenhouse effects have been exaggerated.

The real giveaway statement is as follows;

"Scenarios deal with the future, so they cannot be compared with observations" (page 252).

Unfortunately the future has an unwelcome tendency to become the present, and then the past. Many of the scenarios discussed here actually began in the past. IS92 scenarios began in 1990. It is possible to compare their predictions with what has happened since 1990 (Table 1), and it can be seen that they are all exaggerated, even the ones supposed to be on the low side. Since this Chapter indicates that IS92 scenarios are not greatly different from all the other ones, one is forced to conclude that all of them are exaggerated.

An inability and unwillingness to compare the scenarios with current trends is the most serious defect of this report.

Conclusions

An important feature of Climate Change 1994 is that it provides firm evidence that the growth of greenhouse gases in the atmosphere is much less than has been previously supposed. The current (1994) rate of increase of carbon dioxide in the atmosphere is 1.2 ppmv/yr (0.34%), and the current rate of increase of methane is 4 ppbv/yr, (0.23%), and falling, possibly to negative figures. However, the IPCC have ignored these figures by using earlier, larger ones for their carbon budget, scenarios and stabilisation models, thus ensuring that all of these are exaggerated.

Table 1: IPPC SCENARIOS-RELIABILITY OF IPCC SCENARIO FORECASTS FOR 1990-2000

Parameter	IS92a	IS92b	IS92c	IS92d	IS92e	IS92f	Actual
Global Temperature Increase	0.12-0.3 °C	0.12-0.3 °C	0.12-0.3 °C	0.12-0.3 °C	0.12-0.3 °C	0.12-0.3 °C	1990-1994, -0.8 °C
CO_2 Emissions Increase	14%	11%	1%	3%	23%	19%	1990-1992, 0%
Atmospheric CO_2 Increase	20 ppmv	16 ppmv	20 ppmv	20 ppmv	20 ppmv	20 ppmv	1990-1994, 5 ppmv
World Population Increase	18%	18%	16%	16%	16%	22%	1990-1995, 8%
Coal Production Increase	18%	15%	7%	16%	26%	21%	1990-1994, -4.5%
GNP Increase World, %/yr	2.9	2.9	1.8	2.7	3.8	3.8	'91; 0.4%, '92; 1.9%, '93; 2.1%
GNP Increase OECD, %/yr	3.4	3.4	2.3	3.2	4.1	3.4	"91; 1.0%, '92; 1.7%, '93; 1.2%
GNP Increase China, %/yr	5.0	5.0	3.5	4.9	6.2	5.2	'91; 8%, '92; 13%, '93; 13.5%
Sea Level Rise	2.5-7 cm	2.5-7 cm	2.5-7 cm	2.5-7 cm	2.5-7 cm	2.5-7 cm	1.5-2 mm/yr

Sources:

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When the facts of greenhouse gas increases and the mitigating effects of sulphate aerosols are considered, future projections of global warming from the greenhouse effect must surely now be substantially reduced from those made by the SA90 ("Business as Usual") and IS92a scenarios.

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* * * * *

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VALIDATED PASSIVE SAMPLERS FOR METHYLENE CHLORIDE

Medtec Products announces that a diffusive sampling badge fully validated at Level 5 following NIOSH protocol using the proposed PEL of 35 ppm is now available from SKC for the personal monitoring of atmospheres containing methylene chloride. Methylene chloride is a solvent commonly used in paint removers, solvent degreasing, plastics processing, solvent extraction and in aerosol propellants.

SKC's new Passive Sampler (Catalogue No. 575-001), a miniature sampling device weighing less than one-third ounce, contains coconut-based charcoal and utilises a specially designed diffusion barrier that controls the sampling rate at 14.5 mL/min for methylene chloride. Worn as a badge on the collar, this passive sampler requires no pump or calibration, is completely unobtrusive and can be used for sampling up to 8 hours. At the end of the work shift, the device is simply capped and sent to the laboratory for analysis.

Following NIOSH protocol, Level 5 represents the highest level of validation and involves stringent tests at different wind velocities, various temperatures from 10 to 40 °C, relative humidity from 10 to 80%, and effects of potentially interfering compounds, sorbent capacity and reverse diffusion are also tested. The NIOSH protocol validation was developed so that manufacturers could produce passive samplers that reliably assess airborne chemical levels.

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SIMPLE ONE STEP MEASUREMENT OF PERSONAL FORMALDEHYDE LEVELS

Medtec Products announces from SKC a new Personal Formaldehyde Passive Sampler designed to accurately measure personal exposure to formaldehyde in the workplace. It is specifically designed to measure formaldehyde levels as per the current OSHA Permissible Exposure Limit (PEL) and the current OSHA Short Term Exposure Limit (STEL).

The Personal Formaldehyde Passive Sampler requires no technical training to use. Simply attach the small, virtually weightless sampler onto or near the worker's collar and allow them to wear it for the full exposure time (8 hours for PEL or 15 minutes for STEL). Then remove and seal the sampler and mail it to an accredited laboratory for analysis using the chromotropic acid assay method.

The Personal Formaldehyde Passive Sampler is available in two configurations. The Personal Formaldehyde Passive Sampler (PEL) (Catalogue No. 526-201) samples formaldehyde at a low rate, suitable for full-shift monitoring. Detection range of the PEL sampler is 0.2-2 ppm. The Personal Formaldehyde Passive Sampler (STEL) (Catalogue No. 526-200) samples formaldehyde at a high rate. Detection range of the STEL sampler is 0.5-6 ppm. Current OSHA exposure limits are 0.75 ppm (PEL) and 2.0 ppm (STEL).

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PARTICLE SIZING TAKES SHAPE

Ideally particles should be characterised by both size and shape. Particle & Surface Sciences Pty Ltd have introduced a new Particle Size Analyser that also offers image/shape analysis.

It could be argued that the one drawback of most particle size analysers is that they only measure particle size. But what else should be expected of an instrument specifically designed to do just that? To answer the question, a distinction has to be made between particle size analysis and particle characterisation. Since most particle size analysers operate on the assumption that the particles being measured are spherical,

full particle characterization can only be obtained by considering the actual shape of the particles as well.

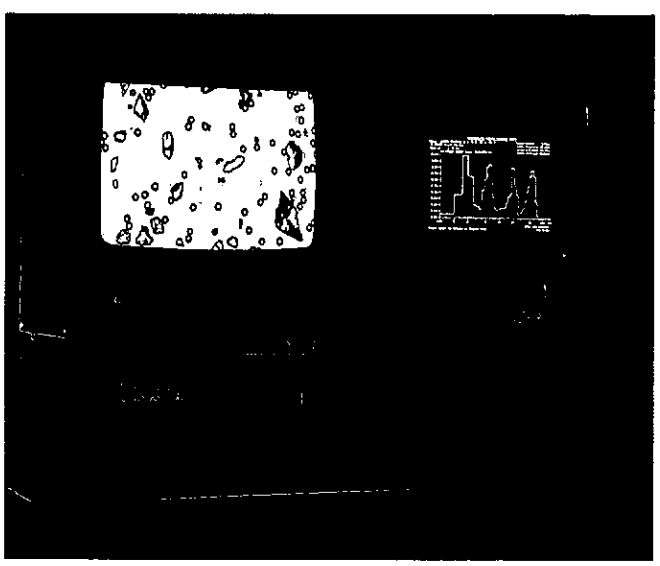
The combination of size and shape analysis is now to be found in a new instrument introduced into New Zealand by Particle & Surface Sciences Pty Ltd. The Galai CIS range combines a laser based particle size analyser with advanced image/shape analysis software to provide a complete particle characterisation system in a single compact, PC-controlled, benchtop unit.

Unlike other laser-based particle size analysers utilising light scattering or diffraction techniques, the CIS range of systems employ the principle of time of transition analysis to measure particle size directly over the dynamic range of 0.5 to 3600 Can (depending on the model). This enables measurement of particles in space at a constant high frequency.

Interaction Pulses

This scanning operation sets up a 'photo defined zone', essentially toroidal in shape, in which any particle passing through produces interaction pulses of light detected by PIN photodiode. The time width of these pulses is directly proportional to particle diameter - the larger the particles scanned, the longer the time of interaction with the laser beam. By rotating the beam in a circle at high frequencies the instrument minimises the effect of any motion of the particles relative to the beam.

According to the system's developer, Nir Karasikov of the Israeli manufacturer Galai Laboratories, time of transition analysis avoids many of the factors which complicate other optical laser methods. Inconsistencies of light scattering or diffraction theories are eliminated, as well as Brownian motion, refractive index, viscosity and thermal effects.



Having recorded the interaction pulses, the CIS systems obviously then have to analyse them to convert them directly into particle size data. This they do with very sophisticated software that not only performs the size analysis but also, by pulse-shape analysis, produces the photo-defined measurement zone. By selectively rejecting pulses whose shape is outside of previously defined criteria, the problem of particles interacting with the laser beam outside of the focus point is avoided. (Since the diameter of the laser beam varies along its length, any interaction of a particle outside of the focus point would produce an erroneous pulse width, and therefore particle size. Similar problems of resolution occur in other techniques which attempt to control resolution by using narrow orifices or capillaries to physically define the measurement area. The CIS software defines instead those particles which are precisely in the focus zone of the laser).

It perhaps needs emphasizing here that this electronic pulse-shape analysis has nothing directly to do with particle-shape analysis. However, the 'open architecture' of the system made possible by the optically defined measurement zone, without any need for orifices has enabled a video monitoring system to be easily added. The CIS range thus incorporates a CCD (close coupled device) microscopic TV camera, placed at right angles to the laser beam, to produce real time images of the particles as they pass through the measurement zone.

Shape analysis software (particle shape this time) gives a wide variety of particle information including Ferret's diameter, Martin's radius, area, perimeter, shape factor, aspect ratio, etc. Since the laser size analysis system, in common with most others, operates on the assumption of spherical particles, this second image analysis channel in the same instrument provides important additional shape information when analysing aggregates and non-spherical particles. Besides being fed into the system's computer for the shape, grain and other geometric analyses, the visual image of the particles in the measurement volume is also displayed on a separate video monitor.

Sampling Modules

A further advantage of the instrument's 'open architecture' is the variety of cell types that can be employed to introduce particles to the measurement zone. Available modules include mechanically stirred, magnetically stirred, microscope slide, flow-through and Peltier heated/cooled cells, and an aerosol generator; a range of sampling devices that illustrate the wide spread of applications to which the CIS range of systems lend themselves. These already include their use in industrial areas such as food processing, ceramics, paint, paper and plastics production, pharmaceutical applications such as assessing microbial contamination in drug solutions and particulate contamination in parenteral solutions, and microbiological work such as monitoring membrane filtration.

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NEW RANGE OF CLEANING AGENTS

Lancerclean Alkali Detergent and Lancerinse Acid Rinse are now available in New Zealand from Watson Victor Ltd. These cleaning agents have been formulated by Lancer - a world leader in the design and manufacture of automatic laboratory washing machines to provide superior cleaning action for the cleaning of glassware and equipment in scientific, medical and industrial laboratories, and are specified for use in the extensive range of Lancer washing machines.

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USER FRIENDLY FLASK FOR BUCHI ROTAVAPORS

The Buchi Beaker Flask is a two-part extra wide distillation and drying flask for Buchi Rotavapors. The top of the flask unscrews, allowing access to the sample via an extra wide 100 mm opening. This results in easy removal of highly viscous or solid samples and additionally, the inside of the flask can now be cleaned by hand. The unique design features a large surface area and cylindrical shape to enhance distillation, and acts as a buffer against bumping and foaming. This user friendly flask even has a flat bottom so it will stand upright on your bench.

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NEW SPM APPLICATION NOTE ON THE IMAGING OF SELF-ASSEMBLED MONOLAYERS USING LATERIAL FORCE MICROSCOPY AVAILABLE FROM TOPOMETRIX

The imaging of self-assembled monolayers demonstrates the extremely high sensitivity of the atomic force microscope to the surface chemical composition of the sample. LFM provides this capability and opens the window to a broad range of tribological studies on the nanometer scale.

TopoMetrix Corporation announces the availability of an application note entitled, "Imaging of Self-Assembled Monolayers using Lateral Force Microscopy", which demonstrates the potential of lateral force microscopy (LFM) in experimental tribology with resolution of localised regions less than 100 nm in width. The regions of a self-assembled monolayer are distinguished by only slight differences in molecular structure so imaging these materials requires extremely high sensitivity to the surface chemical composition. The was done using LFM - showing contrast between different regions of self-assembled monolayer molecules that differ only in the terminal chemical function groups.

LFM, also often referred to as "friction force microscopy," senses the friction differences in materials in contact with the atomic force microscope (AFM) probe by sliding the AFM probe sideways and detecting torsion. It also enhances contrast on sharp edges and is used in conjunction with topographic AFM imaging. In addition, LFM can be used for tribology studies to learn the differential friction between the AFM probe and various sample surfaces.

The self-assembled monolayers in this study were formed by microcontact printing (μCP) of functionalised alkanethiols, $HS(CH_2)_nY$, on gold, where Y can be CH_3 (methyl), CH_2OH (hydroxyl), or COOH (carboxyl). Patterned self-assembled monolayers formed by μCP have many potential applications, including: microfabrication, studies of wetting and nucleation phenomena, protein and cellular adhesion, and patterned formation of microcrystals and microcrystal arrays.

The self-assembled monolayer study discussed in the TopoMetrix application note was performed by J Wilbur, H Biebuyck, J MacDonald, and G Whitesides, at the Department of Chemistry, Harvard University, Cambridge, MA. The work was supported in part by the Advanced Research Projects Agency and the Office of Naval Research.

TopoMetrix designs and manufactures scanning probe microscopes for worldwide distribution. Scanning probe microscopes are used by industry, government, university, and research laboratories to characterize materials by providing extremely high-resolution three-dimensional images of surfaces. This rapidly growing technology builds upon the Nobel Prize-winning invention in 1981 of the scanning tunnelling microscope and its ability to image individual atoms.

For a copy of the TopoMetrix application note, "Imaging of Self-Assembled Monolayers Using Lateral Force Microscopy".

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APPLICATIONS FOR NEW EXTRA LOW BLEED GC COLUMN

J & W Scientific's newest capillary GC stationary phase, providing exceptionally low bleed, is the feature of two recently released application notes. "DB-XLB for Semi-volatiles" and "DB-XLB: Low Bleed and Pesticides Too!"...

Resolve 180 Semi-volatile Compounds in Under 30 minutes!
The first publication illustrates the analysis of EPA methods 525.2 and 8270, and is the first in a series of application notes for the environmental market using this column. DB-XLB successfully resolves 180 compounds for method 8170 in under thirty minutes. Additional chromatograms illustrate effortless resolution of isometric PAHs using DB-XLB, proving its superior to standard 5% phenyl capillaries.

Pesticide Analysis and Low Bleed Results
The second environmental application note features the use of the DB-XLB in the analysis of chlorinated pesticides, organophosphorous pesticides, phenoxy acid methyl esters and herbicides. The superior resolution gained through the use of this low bleed column is demonstrated in this application note.

DB-XLB offers more than just low bleed - it offers the separation of a large collection of pesticides and herbicides, including those most commonly analysed by chromatographers using this application. DB-XLB is available in a number of lengths and film thicknesses. A complete order guide is included with these application notes.

The revolutionary new phase chemistry engineered by J & W scientists is what makes this new column so effective. DB-XLB bleeds less at higher temperatures, lasts longer and bleeds in a unique way which is favourable to trace level GC-MS. It's not zero bleed but it's close.

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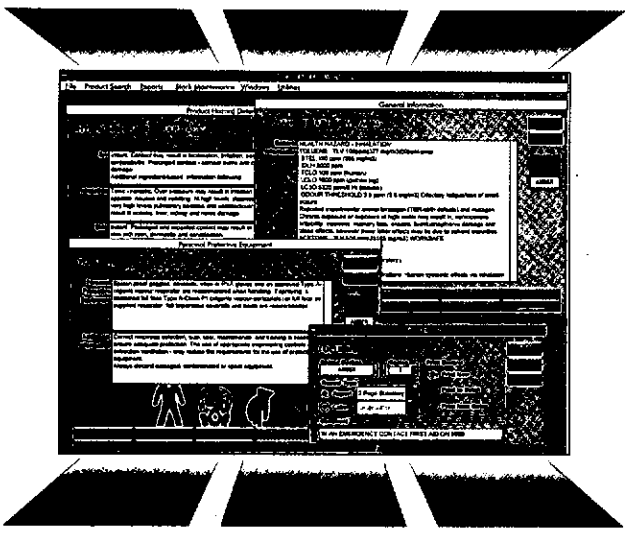
CHEM ALERT FOR WINDOWS THE COLOUR-CODED CHEMICAL HAZARD RATING SYSTEM by AUSTRALIAN HEALTH

NZ Safety Limited has recently secured the exclusive rights to distribute this exciting new software program in New Zealand. "One of the problems facing industry at present is the ongoing maintenance of MSDS files and the overall management of hazardous chemicals" says Ross Appleton, Product Manager for the new product. Chem Alert not only provides a substantial database which is constantly being updated but also provides a management system with a stock register and stock holding facility as well as the capability to calculate Hazchem Ratings and Dangerous Goods Reports.



At the heart of the Chem Alert system, is a complete and independent analysis of over 9000 chemical products in use throughout Australasia. Each and every product record is researched, compiled and checked by a team of qualified phamacologists, toxicologists, industrial chemists and physicians against the latest international sources. Chem Alert is fully supported by Australian Health's 24 hour advisory service (fees apply) and NZ Safety's Safeline 0800 100014, a free service.

As legislation, exposure limits and other criteria change, each product record is automatically updated. Update disks which include new system enhancements, extra chemicals and updated toxicological data are mailed to clients quarterly as part of their subscription. Any chemical products not currently on the system can be added for an additional charge. There are four systems available starting at just $540 per annum and ranging up a fully multi-site network system at $7500 per annum.

Access to this information is made through a simple continuous search option based on product names, or by a free format search which enables you to identify a product based on a wide range of variables. Once a chemical product is found, all relevant details can be viewed on screen, or printed as a full or summary report. In addition the software provides for the printing of four different sized labels.

Because of the colour hazard rating system (essentially a "traffic light" colour coding with red for highly toxic substances and green for low toxicity), at a glance users can assess the relative risk a product presents and the type of PPE required for safe use. This helps to overcome language problems and once implemented, aids in identifying and selecting safer chemicals to work with.

Integrated with the extensive toxicological database, the Stock Management System allows the cataloging of all chemicals on site, in a hierarchical structure which can aggregate stock levels over multiple sites, each with many areas with many locations. Hazardous Goods Manifests and 12 other reports can be printed on demand.

Chem Alert for Windows allows both technical and lay personnel to quickly and accurately manage chemical risks without specialised training. It provides a uniformity of hazard identification and protection and enables the reduction of chemical risk through informed management.

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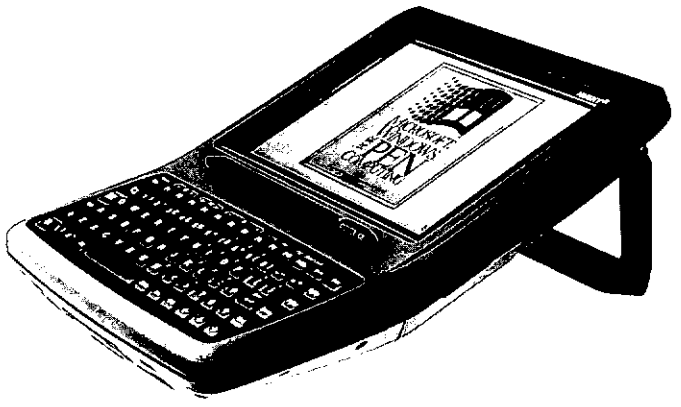
HUSKY LAUNCHES FIRST EVER "GO-ANYWHERE" NOTEBOOK

Soak it, shake it, freeze it - the Husky FC-486 notebook computer will carry on working just as effectively as it does in the comfort of your office. It is the first ever notebook designed to deliver high performance 486 computing for all-weather field operations.

Husky Computers has achieved a major breakthrough with the launch of the FC-486. Applying its long-standing expertise in developing rugged hand-held computers, the company has now addressed the needs of people who want to use a powerful notebook in tough, open-air applications such as field service, surveying and insurance assessment.

The result is a unique configuration which overcomes the inherent weaknesses of the traditional "clam shell" designed notebook and provides an extremely rugged, and very practical field computer.

The fully sealed magnesium alloy case of the FC-486 incorporates both screen and keyboard in a single hingeless unit which weighs approximately 2 kg. Its unique curved profile is ergonomically designed to fit snugly in the crook of the arm so a user can work comfortably standing up and on the move.



The FC-486 has QWERTY keyboard and an optional high performance pen, utilising Microsoft Windows for Pen Software. The use of a built-in digitiser and cordless electromagnetic pen assures field users of high levels of accuracy and ruggedness compared to typical pen interfaces.

The pen is the ideal tool for navigating the screen and selecting menu options in the field. It replaces the orthodox mouse or trackerball function, which are very difficult to use without a desk.

One of the many features of the FC-486 essential to the field user is extended battery charge life. The unit is powered by a standard Duracell DR30 nickel metal hydride battery pack and combines Microsoft's Advanced Power Management (APM) with Husky's own power management algorithms and low-powered circuitry. An effective charge life in excess of 10 hours is provided - ample for a full working day's operation and way in excess of the three to four hours normally expected from a notebook computer. In addition, a fast charge facility allows the unit to be fully recharged again in just one hour.

The FC-486 uses an 80486 slc processor from Texas Instruments, chosen for its low power requirements, and is available in 25MHz or 50MHz versions with a numeric co-processor option. All units have MS-DOS 6.22 in ROM and are available with 2 to 16 Mbyte of RAM. Additional storage is provided by up to 16 Mbyte on flash memory, typically used for software applications.

To maximise expansion capability, the FC-486 is available with two user-accessible PCMCIA slots and two internal slots for specialist customisation, offering access to the world's largest range of plug-in modems, networking, memory and system expansion options. All PCMCIA slots are fully sealed against the ingress of dust and water, a key design feature and a major competitive advantage for use in field conditions.

Accidental drop continues to be the leading cause of early death for notebooks, creating excessive screen and keyboard damage. However the FC-486 is the first ever notebook to have a fully ruggedised screen. For example, it is tested to withstand direct impact from a 1 inch steel ball dropped from a height of two metres.

In addition, the screen is a transflective type which will not wash out in daylight and provides excellent clarity in all lighting conditions, from darkness to bright sunshine. It also has a user-replaceable polycarbonate shield to prevent scratch and impact damage.

As with all Husky products, the FC-486 conforms to a range of environmental and military standards, including accidental immersion (IP67) and IEC 68, MIL-STD-810E, BS2011 standards for temperature, dust and sand, drop test, shock, vibration and altitude. Operating temperature range is from -20 °C to +60 °C, which ensures continued use in the most extreme climatic conditions.

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THE NEW FORMALDEMETER 3

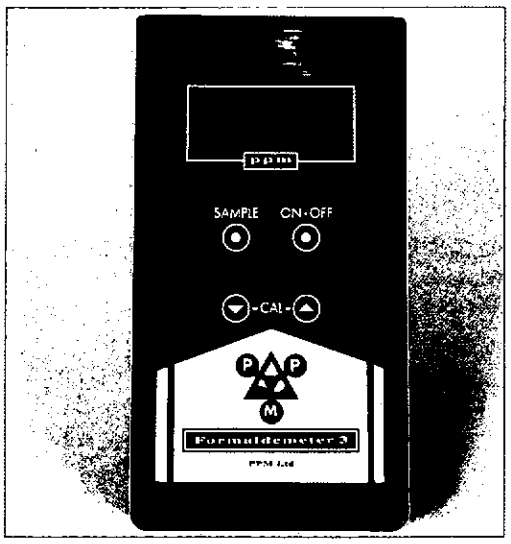
Formaldehyde is a very useful and commonly used substance, but exposure to excessive amounts of formaldehyde is harmful.

In medicine and laboratories, formaldehyde is used as a very active disinfectant to kill microorganisms. In aqueous solution it seals and hardens animal tissue and is widely used by undertakers and others for its embalming and preservation properties. In the food and pharmaceutical industries, formaldehyde is used extensively as a preservative. The tissue sealing and hardening properties have led to the use of formaldehyde as an antiperspirant in deodorants, and it is used extensively as an antimicrobial agent in hair shampoo preparations, dishwashing liquids, fabric softeners, and household cleaning agents.

In the purely industrial context, formaldehyde is used at varying concentrations in the manufacture of synthetic resins, adhesives, fertilisers, paper resins and in particular a wide range of compression moulding resins/aminoplastics, such as those used in the chipboard, woodworking and laminated plastics industries.

But formaldehyde is harmful. Short term exposure to formaldehyde vapour can lead to severe irritation of the nose and throat, especially at concentrations above 3 ppm (parts per million). Eye irritation may occur at 0.3 ppm with serious eye damage above 10 ppm. Long term inhalation can cause respiratory irritation, severe pain in the mouth, throat and intestinal tract and in some cases, occupational asthma and impaired lung function. Formaldehyde is also a suspected carcinogen.

Governments worldwide have imposed occupational control limits on formaldehyde vapour. In New Zealand, a ceiling limit of 1 ppm has been set. It is therefore every employer's duty, under the Health & Safety in Employment Act 1992, to ensure that processes which utilise formaldehyde are controlled in such a manner that the workers are not exposed to excessive levels of formaldehyde vapour.



The newly released Formaldemeter 3 represents a convenient way to check that a process involving formaldehyde is controlled so that staff are not at risk. The Formaldemeter 3 is a hand-held monitor manufactured by PPM in the UK and can detect formaldehyde vapour down to levels below 0.03 ppm. It is accurate to 10% and incorporates software to detect whether other gases (such as alcohols) are interfering with the formaldehyde measurement. It also has the facility to store the last ten readings.

Contact: Total Air Care
P O Box 74227 Market Road, Auckland
Ph: (09) 6304358, Fax: (09) 6309601
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LAYERED IMAGING TECHNICAL NOTE NOW AVAILABLE FROM TOPOMETRIX

Layered Imaging is a new scanning probe microscopy technique that can be used to obtain information about surface adhesion, surface compliance, and the force fields above a surface.

TopoMetrix Corporation is pleased to announce the availability of a technical note entitled, "Layered Imaging Applications in Scanning Probe Microscopy". This new technical note provides a detailed explanation of the new Layered Imaging technique as well as examples of several "real world" applications.

Layered Imaging is new scanning probe microscopy technique that provides information to scientists beyond the topography of a sample - it measures the force/distance (F/D) data at each pixel in an image to obtain information about surface adhesion, surface compliance, and the force fields at various heights above a surface.

The new technical note describes how Layered Imaging was used to characterise the areas of a blended gum sample that have high adhesion versus the areas that have low adhesion. These differences in adhesion could be due to a low adhesion phase blended into the softer gum or the result of small contamination particles. The technical note also describes how Layered Imaging can be used in the analysis of magnetic fields. The experiment mentioned in the technical note was performed on a recorded thin film hard disk and Layered Imaging was used to find the heights above the sample surface at which the optimum magnetic force image can be acquired. Layered Imaging can also be used to determine the optimum decoupling of topography from the magnetic force gradient.

Contact: SciTech, P O Box 663, Dunedin
Ph: (03) 4777860, Fax: (03) 4777870
or TopoMetrix Corporation
5403 Betsy Ross Drive, Santa Clara, CA 95054-1162, USA
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PARTICLE SIZE ANALYSERS

Alphatech are pleased to introduce two Horiba Particle Size Analysers - the LA-910 Laser Particle Size Analyser and the CAPA-300 Size Distribution Analyser.

The LA-910 is fast and flexible and gives results in 20 seconds - all the way from 0.02 µm to 1000 µm - with no optical changes. The rugged dispersant-circulation system and the incredibly stable optical system deliver performance, flexibility and reliability in a user friendly package. The unit has 80 channels for accurate, precise analysis and uses iterative deconvolution methods to calculate particle-size distribution. The results are displayed as histograms giving a highly resolved view of the size distribution. A Powderjet Dry Feeder is available which disperses powders for fast analysis of dry particles down to the submicron range.

The CAPA-300 is a Centrifugal Photosedimentation Particle Size Distribution Analyser using classical gravity and/or centrifugal sedimentation methods. It is is an easy to use, economical analyser aimed at meeting quality control requirements.

Contact: Peter Hassan, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
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PEPTIDE SEQUENCING MADE EASY

Shimadzu is pleased to announce the release of the KRATOS Research MALDI IV. Joining the already highly successful KOMPACT MALDI I, II and III systems, the Research MALDI IV addresses the high end of the market by providing a research grade machine but with all the speed of operation, high sample throughput, accuracy and ease of use that existing users have come to expect.

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In addition to peptide molecular weight analysis, the KOMPACT Research MALDI IV also allows rapid single scan sequencing of peptides by post source decay (PSD) in a way not previously possible.

Unlike conventional PSD machines the KOMPACT Research MALDI IV utilises a novel reflectron design which allows the acquisition of a complete sequence spectrum in a single pass by single scan sequencing. This reduces the acquisition time from several hours to less than two minutes. Calibration is similarly simplified and the entire spectrum can now be automatically calibrated with a single keystroke. With the advent of this seamless data acquisition (SDA) the MALDI sequencing of peptides becomes a realistic proposition for the busy peptide laboratory.

Contact: Shimadzu New Zealand
P O Box 45027 Auckland
Ph: (09) 8375447, Fax: (09) 8360668
Outside Auckland Ph: (0800) 735725
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LOGGING THERMOMETERS

Hanna Instruments offer the HI92810 and HI92840 single and four channel logging thermometers.

- *Logging Capacity:* Up to 16000 readings can be stored in memory.
- *Computer Compatible:* Cordless infrared transmission through the HI9200 receiver requires no extra cables.
- *Flexibility:* Un-housed thermistors are available as well as a wide range of interchangeable probes.
- *Range:* -50 to 150 °C.

A low-power impact printer is available with a range of logging intervals from 1 to 180 minutes.

Contact: Peter Hassan, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
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ICP GOES TRUCKIN'

Thermo Jarrell Ash have produced an innovative approach to the problem of large engines that are constantly in use, e.g. truck engines, whereby the mechanical status of the engine can be determined by WMA - Wear Metal Analysis. WMA is basically a test for certain elements that indicate wear in the engine over time and can tell the operator/owner/company when the engine oil needs changing, prevent major engine damage, and predict or pinpoint component failure.

Thermo Jarrell Ash have developed this technology for a company (OSA) who sells this service to long distance trucking operators in the USA.

By using their 61E Simultaneous ICP Spectrometer as the base they have modified the instrument to an Arc Spark principle, and to date have provided in excess of 200 "Truck Stop ICPs". A key component of this instrumentation is of course the software which interprets the results and tracks the trends to predict a problem.

The system is operated by the truck driver who pulls into a truck stop (USA truck stops provide you everything from diesel to fries, movies and a bed for the night) and whilst refuelling etc., pulls a bar-coded bottle from his glove box, drips some oil into it off the engine's dipstick, walks over to the bright red weather-proofed ICP spectrometer, swipes the barcode, and places the bottle in the sampling bay.

The sample is drawn into the base centre electrode and the top electrode sparks, the emission is them measured by 8-12 photomultiplier tubes (depending on requirements) and late at night when the telephone rates are cheaper, the data is downloaded via modem to OSA's head office in Colorado.

As all the trucks have GPS (Global Positioning Satellite) and their position is known to within 7 feet at any time, the company can contact the driver via satellite, cellphone etc. and advise of any action needed such as engine servicing or repair and they can organize ahead a replacement tractor unit to take the trailer and continue the journey without any time lost.

Contact: Andrew Pearce, SciTech
P O Box 663 Dunedin
Ph: (03) 4777860, Fax: (03) 4777870
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ACCURACY ASSURED - NEW DENSITY METERS FROM METTLER TOLEDO

The extensive range of analytical instruments from Mettler Toledo has now been expanded with the introduction of the new range of Density Meters. The new density meters incorporate the accuracy, reliability and user friendly operations that are features of all Mettler Toledo instruments.

The DA density meters determine the density of gases and solutions and operate according to the oscillating body method. This allows determination of the density of a sample to an accuracy of 0.0001 g/cm^3.

These density meters can be used where rapid and precise results are in demand and where at the same time extremely simple operation is required.

Four models are available, from the portable hand held DA-110M density meter, up to the DA-310M laboratory meter capable of measuring up to 5 decimal places.

The DA-300M/310M models have a memory for 7 methods and can store up to 100 measured values per method.

A range of optional equipment is available for both models such as a sampling pump unit for continuous measurements. A built-in printer generates hard copy records.

Contact: Watson Victor Ltd
P O Box 1180, Wellington
Ph: (04) 3857699, Fax: (04) 3844651
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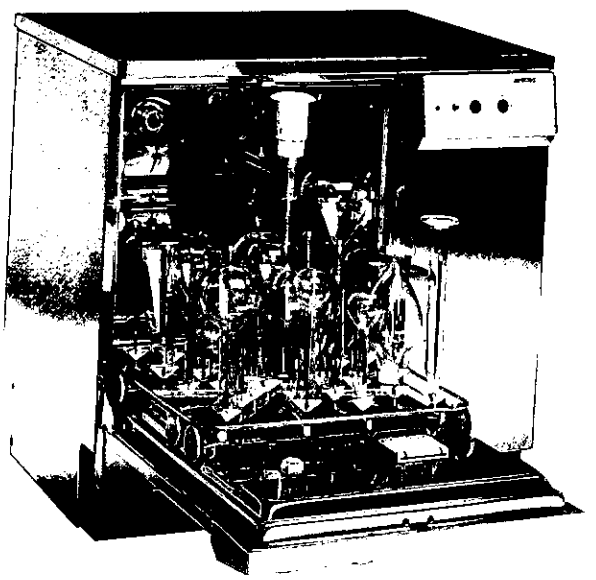
SMEG LABORATORY AND SURGICAL WASHING MACHINES

Smeg laboratory and surgical washing machines are now available in New Zealand at competitive prices. All Smeg models are manufactured from stainless steel for attractive, rugged durability. Each has three inlet connections, with anti-siphon vacuum break, for cold, hot and demineralised water. Demineralised water can also be pumped from a tank if required.



All models incorporate an ionic exchange water softener, easily regenerated with common salt. Two separate thermostats provide precise independent temperature regulation during the wash program. Because of the internal recirculation pump, a complete wash cycle can be performed using only 40 litres of water. Smeg machines can divert waste water from the first three cleaning phases to an external recovery unit. Advanced models incorporate disinfection and forced air drying. A comprehensive range of accessories is available, including special racks for surgical equipment.

Contact: Calibre Plastics Ltd
13 Patiki Road, Avondale, Auckland
Ph: (09) 8286054, Fax: (09) 8284273
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ORION 95/96 PRODUCT CATALOGUE

The new 95/96 Orion Laboratory Products and Field Analysis Catalogue is now available, outlining the full line of Orion products, including over 30 new products. This catalogue provides a comprehensive overview of the range of technologies that have made Orion a world leader in the analytical instrument industry.

Some of the new products introduced in this catalogue include:-

PerpHecT pH Meters: These meters have the ability to perform automatic temperature compensation for most electrodes.

PerpHecT Electrodes: Offering the ultimate in temperature compensated pH performance when combined with PerpHecT pH meters.

Waterproof Dissolved Oxygen Meters: Compact and ergonomically designed.

Sure-flow Combination ISEs: Expanded line of unique Sure-Flow ion selective electrodes which are compact, convenient and provide better performance.

For your copy of the new 1995/96 Orion Laboratory Products and Field Analysis Catalogue, contact:

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NEW ACCESSORY FOR BUCHI ROTAVAPORS

The new BUCHI COMBI-CLIP Vapor Duct protects the Rotavapor user and the sample by eliminating the risk of glassware breakage when removing either the vapor duct or sample flask from the Rotavapor.

The revolutionary design incorporates the unique three-way action COMBI-CLIP performing three important tasks:-

- The COMBI-CLIP locks the flask to the vapour duct protecting your sample.
- By winding the COMBI-CLIP clockwise, the vapor duct is evenly withdrawn from the Rotavapor.
- By winding the COMBI-CLIP anticlockwise, the flask is evenly pushed off the vapor duct.

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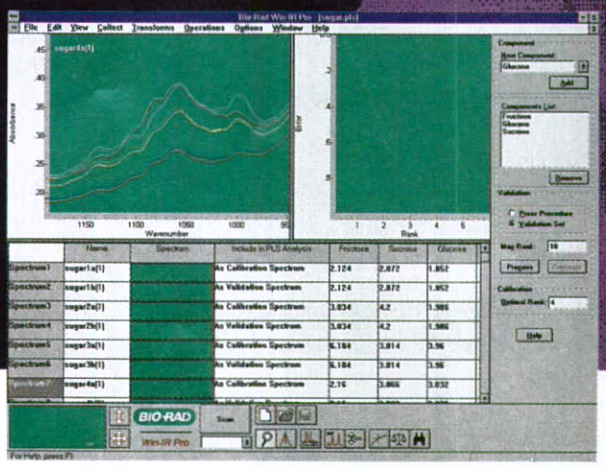
FTS 6000 with Win-IR Pro



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  - Far-IR to UV-Vis Spectroscopy
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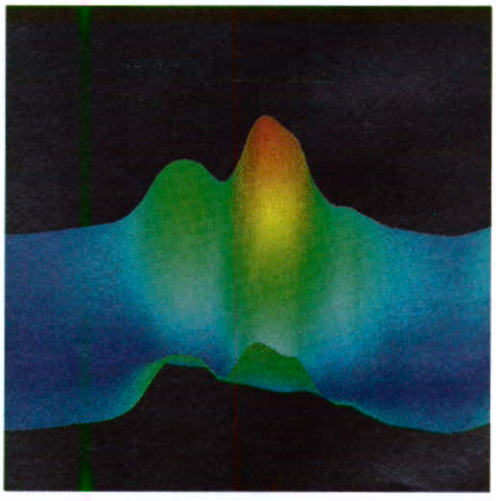

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FUTURE OPTIONS FOR THE NZIC

A precis of the report of the Strategic Review Committee, tabled at the NZIC Council Meeting, 4 September 1995. A copy of the complete report will be sent to all members via their Branch newsletters.

1 : Background

Following requests from many members, and discussions among the elected office-holders of the Institute, the President set up a small review committee (Bill Denny, President; Nath Pritchard, 1st Vice-President; Rob Whitney, 2nd Vice-President; Gillian Norris, Manawatu Branch and Doug Wright, past-President) in late 1994. The task of the review committee was to, without bias, canvass opinion from members and others about the current state of the NZIC and what the role of the NZIC should be as the year 2000 approaches, to consider these opinions, and to make specific proposals to the September 1995 Council meeting about how to achieve any desired changes.

2 : Current state of the NZIC

The New Zealand Institute of Chemistry (NZIC) was founded in 1931. It is comprised of six Branches (Auckland, Waikato, Manawatu, Wellington, Canterbury and Otago). The governing council is made up of one delegate from each Branch committee, together with an elected President, 1st and 2nd Vice-Presidents, General Secretary and General Treasurer. The NZIC has a central secretariat in Wellington, situated in its own office within the IPENZ (Institute of Professional Engineers of NZ) offices in Molesworth House. The paid secretariat comprises the Executive Officer (Mr Alan Turner; 20 hours per week) and a part-time secretary.

The NZIC currently has five different grades of members. In recent years the full fee-paying membership (excluding student members) of the NZIC has declined significantly, from somewhat over 1000 (the much-stated figure of 1400 was always inaccurate) to the current level of about 900. The latest figures show a distribution as follows:

Grade	Number	Full fee paying
Honorary Fellow	32	0
Fellow	325	204
Member	700	601
Associate	140	103
Graduate/Student	193	
Totals	**1390**	**908**

In addition, there are approximately another 1100 addresses in the database which are non-NZIC members, but who are affiliates of the Specialist Groups (which also use the database to circulate their members).

The objects of the NZIC, as set out in the current Procedures Manual, highlight the dual role of the NZIC, in endeavouring to act both as a scientific society and as a professional body.

The main issues seen by members as problems were:

- membership fees (too high, and seen as a major block to increasing the membership)
- membership structure (seen as too complex and discriminatory (e.g., the distinction between Member and Associate Member)
- a lack of relevance of the NZIC as a whole to the modern practice of chemistry (professional chemists and chemistry are less clearly visible as separate groups and disciplines within organisations)
- an improvement in provision of services to members and in promotion of the positive aspects and advantages of membership (to assist Branches in recruiting). The provision of "corporate" services on behalf of members (e.g., submissions to the Government on chemical issues) were seen by many as less relevant than "personal" services to members.
- the role of the Specialist Groups within the NZIC needs to be clarified. The more vigorous of these are filling the role of specialist scientific contact for NZIC members very well, and need to be supported and encouraged, but had to be a more integral aspect of the NZIC. In particular, a mechanism should be found to incorporate the large number of people who were members of individual Specialist Groups but not members of the NZIC into the NZIC in some mutually acceptable way.

3 : What the NZIC should be

Most members supported the continuation of the NZIC much in its present form, provided that changes were made in the fee structure (lower), the role of the Specialist Groups (better links) and the functioning of the secretariat (more attention to "personal" and less to "corporate" services).

4 : Recommendations to Council about how best to achieve this

4.1. It is recommended that the NZIC continue to function as a separate organisation, the New Zealand Institute of Chemistry, but with an altered focus. The NZIC has a long and distinguished history as an independent scientific organisation (the largest in New Zealand, and essentially the only one dealing with chemistry). It has many excellent assets, particularly its official journal *Chemistry in New Zealand*, and the largely self-funding educational publication *Chem NZ*. It has a recognised central secretariat which acts as a focal point. It should continue primarily in its present overall structure, but should focus more on "personal" rather than "corporate" services. The latter should be left more to (or done in conjunction with) organisations such as the Royal Society of New Zealand, through which input can be made. This will permit some simplification in structure of the NZIC (fewer committees) and free the secretariat to focus more on personal services.

4.2. It is recommended that the grades of membership should be simplified to three: Student Member, Member and Fellow. There was some well-argued opposition to any lowering of the standards for membership, on the grounds that this would

destroy the professional standing of the NZIC. However, on balance it was considered that this was not a current strength of the NZIC, which does not operate in any way as an accreditation system. Therefore, it was considered that the membership rules should be as simple as possible, and the refereeing system for members should be abandoned. Admission to membership would in most cases be handled routinely by the Executive Officer from a simple set of rules, which would include prospective members completing a form signed by two current finincial members and including the NZIC code of ethics, which the prospective member would agree to adhere to. Only difficult cases would be passed to the Council or Standing Committee for decision. It is noted that this act would make the Fellowship the primary level of professional recognition within the NZIC. The rules for admission to Fellowship may therefore need to be examined, to see whether a broadening of the grounds for admission are required.

- There is an indisputable value in allowing a special (lower fee) category of membership to beginning students. The rules for admission as student member should remain as they are now.

- The grades of Member and Associate should be amalgamated (all current Associates should be made Members). The rules for admission as Member should be revised to remove the age limit, to accept (subject to the provision noted above) any person with an interest in chemistry and in the NZIC. The requirements for a recognised tertiary qualification in chemistry and the practise of a chemistry-related employment for a period would be abolished (but would be retained as requirements, among others, for later admission to the Fellowship (see later). These changes would provide that current non-qualified members of the Specialist Groups could become full members of the NZIC (see section 4.6).

- The Fellowship would then become the sole means of peer recognition by the NZIC, and the entry to this grade may therefore have to be broadened, to give greater weight to commercial and management functions. However (see below) award of the Fellowship is a two-way street; Fellows also have a larger obligation to the NZIC.

4.3. It is recommended the fee structure should be simplified. Consonant with changes in the role of the NZIC and the central secretariat, the fee structure should be altered. Beginning the next financial year:

- The fee for Student Members be set at $20.

- The fee for Members be set at around $60. This is close to the minimum required for a basic level of service, if the option discussed below for the NZIC to become involved with the Royal Society of New Zealand is chosen, and is the upper level of the range widely seen as not providing a major barrier to joining. The fee should be structured to reflect the necessary allocations to administration, Branch fee, Specialist Group fee, journal subsidy (postage), together with an additional contribution to other NZIC activities. In making this recommendation it is recognised that the income of the NZIC will be significantly reduced. However, this will be ameliorated in the short term by a number of the other recommendations proposed, and (hopefully) in the longer term by an increase in membership.

- The fee for Fellows be set at around $100. As noted above, it is recognised that the concept of Fellows is an appropriate way for the NZIC to recognise the achievements of its senior people. The Fellowship is a public statement of the respect in which a person is held by their peers. However, this in turn has a value to the person concerned. In addition, if there is to be any form of "altruistic" support of the NZIC in terms of what it does for chemistry as a whole, it is the most appropriate that this comes from the Fellows.

4.4. It is recommended that the secretariat undergo an outside review, to redefine its duties and requirements. There is no doubt that the NZIC needs to retain a central secretariat. The change several years ago to this concept was important, and it remains so for an organisation of 900 fee-paying members (1390 total members) distributed throughout New Zealand. It provides, among other things a well-recognised focal point. At a time when it is increasingly difficult for members and their employers to find spare time for NZIC affairs, the basic operations must be carried out professionally. For the same reasons, the elected officers (particularly the Treasurer) need the help of a permanently-located, professional secretariat. However, before any major changes are considered (see 4.5), an outside review to redefine the functions and requirements of the secretariat is desirable. If possible this review should take place before the November Standing Committee meeting this year. It will involve defining and prioritising the Executive Officer's primary tasks, which should focus on servicing the needs of members, including timely support to the Branches in processing membership applications, and full reporting of Council matters and other issues of general interest to members via the journal.

4.5. It is recommended that, following the review of the secretariat, the possibility of a closer accommodation between the NZIC and the Royal Society of New Zealand be explored. The NZIC secretariat is presently situated in IPENZ house, which provides office space and functions and computer services. However, the aims and objectives of IPENZ do not relate well to those of the NZIC. There is an advantage in the secretariat remaining in Wellington as a central location, and a need to reduce costs, but it is not feasible to expect it to operate in isolation; options are therefore relatively few. Some preliminary discussions have been held with the newly-reconstituted Royal Society of New Zealand, which is a centre for science-based administration, serving both its own members, and those of other organisations (usually for a fee). Because the NZIC is the largest science-based organisation in New Zealand, and because the Royal Society of New Zealand is now actively seeking members itself (including chemists), a special relationship has been discussed. Under this, the Royal Society of New Zealand would undertake to provide basic administrative services for the NZIC for a fee, in doing so providing an identifiable NZIC Executive Officer who would be a Royal Society of New Zealand employee, and who would operate out of the Royal Society of New Zealand. All other office costs relating to basic administration would be borne by the Royal Society of New Zealand, but other services required by the NZIC would be paid for separately, on a case by case basis. All NZIC members would also become Royal Society

of New Zealand members, at a reduced fee to the standard Royal Society of New Zealand membership rate (which would be included in the basic NZIC membership fee). In addition to securing Royal Society of New Zealand membership for NZIC members, this approach would see the NZIC secretariat (an identified Executive Officer) working in a supportive environment. Instead of competing with the NZIC, the Royal Society of New Zealand would have a vested interest in cooperating in recruiting new members (who would become both NZIC and Royal Society of New Zealand members).

4.6. It is recommended that the Specialist Groups become more integrated within the NZIC, to the mutual benefit of both. The Specialist Groups represent a major focus of NZIC activities, fulfilling the specialist scientific interests of members. They are an integral and important part of the NZIC, and receive some support from the central secretariat in terms of database maintenance, and have the benefit of the name of the NZIC for their activities. In all other aspects, including financial matters, they are free to run their own financial affairs. They thus resemble the Specialist Divisions of the RACI. However, one major difference is that many of the Specialist Groups have a large number of non-NZIC members (collectively, possibly as many as 1100). This has been justified on the grounds that many people only have a peripheral interest in the NZIC *per se*, and do not find the fees justified.

The concensus of several submissions received was that people who were members of Specialist Groups only should pay a membership fee to the NZIC (without being full members), with some proportion of this being remitted back to the Specialist Groups; the figure suggested was between $40-60. Because this is close to the proposed fee for full membership, it is recommended that members of Specialist Groups be required to belong to the NZIC as Members or Student Members, thus receiving full privileges of membership, including the journal. The problem that many Specialist Group members originally were not qualified to join the NZIC is now largely removed by the proposed relaxation of qualification for membership (see 4.2). Members may nominate a primary Specialist Group which they wish to join (this should be done each year), and a portion of their fee would be held in a special account, to be available to the Specialist Group for their own activities.

Because this would make the more active Specialist Groups an additional source of members for the NZIC, they should be entitled to have a direct influence on NZIC policy by representation on Council, in the same way that Branches do. However, such representation should be extended only to those Specialist Groups which meet certain activity criteria, which would include a minimum paid-up membership and the existence of an elected set of officers. These are the same criteria used for Branch representation (thus sub-Branches do not have representation), and would encourage the less active Specialist Groups to increase their activities. It is therefore recommended that those Specialist Groups which have a membership of greater than 30, an annually-elected set of officers, and which hold at least one annual meeting/seminar/ training courses be entitled to send a representative to Council.

5. **Conclusions**

We feel that the above package of recommendations represents a consensus of the many thoughtful submissions given to the review committee by Branches, Specialist Groups and members. Some of them are drastic, particularly in terms of the (hopefully short-lived) drop in income for the NZIC, but if taken together we believe that the NZIC can accommodate them. Every effort should be made to operate on a balanced yearly budget. For example, in the first year, when income will be particularly difficult to estimate, it may be necessary for the Branches to receive very little in capitation fees until the situation clears. In the longer term it is our hope that, by meeting most of the major problems described by members, the changes will allow them to build the NZIC into a more vibrant and desirable organisation.

Executive Annual Report 1994/95

This report is a departure from previous Annual Reports, in that this year there are two reports - one from the President and a separate one from the Executive Officer. This first Executive Report will give some idea of the happenings in the National Secretariat.

The National Secretariat has become a recognisable focal point not only for members but for non-members as well. Although we do not run an employment service, we have been able to assist some members with opportunities and counselling advice.

A large number of queries are being received from chemists based overseas and these range from giving an assessment of their level of qualification, as required by immigration officials, to steering them towards possible job opportunities. There are now a considerable number of chemists in New Zealand who have qualified overseas.

Membership

The total membership stands at 1400 and is made up as follows:

Honorary Fellows	32
Fellows	325
Members	700
Associates	140
Students	197
Local	6

The split between the Branches is:

Auckland	367
Waikato	161
Manawatu	167
Wellington	248
Canterbury	194
Otago	123
Overseas	140

Processing of applications has been accelerated with the average turnaround time about two months. It must be remembered that Council and its Standing Committee meet only every three months, and it is only at these meetings that applications can be formally received.

Some Branches have been very active in getting students to join. Although some will fall by the way side, it is the students of today who will be the corporate members of the future.

Chemical Education Matters

Again the Secretariat has been quite active in this field. In October 1994 some 1200 secondary school students from 90 schools sat the NZIC/CHEM 13 NEWS Exam and in July this year 2400 students from 80 odd schools in Fiji and New Zealand sat the Australian National Chemical Quiz. The name of the first exam acknowledges that the University of Waterloo, Ontario, Canada writes the paper for 5000 students in Canada as well as students in other countries. For the Australian Quiz we act as the focal point, collecting fees etc. for RACI. In both cases the Secretariat spends a lot of time mailing out and in collating of answers.

Publications

Chemistry in New Zealand continues to be a good asset for the Institute. The Editorial Board under Managing Editor Robert Lyon, is proving very effective and their efforts bode well for the future prosperity of the Journal. James Wright has joined the Editorial Board, replacing Jim Metson who is taking sabbatical leave.

CHEM NZ is a very successful publication. The Institute is well served by the Editorial Committee of this publication under the convenorship of Denis Hogan.

The careers brochure "Opportunities in Chemistry" has been well received. This high quality brochure prepared by Manawatu Branch folds out to reveal information on careers in chemistry and educational requirements. The back folds out to a large poster showing the Periodic Table. Element No. 104 is shown as Rutherfordium, and although the American Chemical Society agrees, IUPAC does not!

Another publication in preparation is "Chemical Milestones in New Zealand". This follows Council recognition that steps should be taken to record significant chemical events in the development of New Zealand industry and the economy. The essential element was to record these events by the people who were involved in these developments. To date some twenty five excellent scripts have been received and it is envisaged a volume of 200 pages can be produced. We are now seeking sponsorship and are hopeful for an initial print which will allow every secondary school, polytech and university library to receive a copy.

Submissions to Government Agencies

The Institute continues to make submissions and give comment to Government agencies, particularly when a significant contribution from a chemistry point of view can be made.

A lengthy submission from the Environmental Committee was made to the Select Committee on the Hazardous Substances and New Organisms Bill, (HSNO). Considerable input was received from Members, particularly from Otago Branch. Subsequently an oral submission was made to the Select Committee and this was very well received.

The Science Policy 6 Public Affairs Committee made a submission to the Science Priorities Review Panel. This was in response to the SPiR discussion document "Establishing Priorities for the Public Good Science Fund (PGSF)". An extract from the submission follows:-

"In summary, the New Zealand Institute of Chemistry supports increased levels of funding for the research classes focused on economic benefits through increased manufacturing activity and notes that these are, in general, the research classes significantly dependent on the expertise of chemists. It considers that the potential for economic gains from the manufacturing sector consequent on increased RS & T activity in chemistry has been under-recognised, with particular reference to output class 7 (Class 7 - Manufacturing and Industrial Technology).

Honours and Awards

We were pleased to see the following Honours announced during the year.

Mr D. J. Hogan Hon FNZIC, received the Queens Service Order.
Dr T. J. Sprott FNZIC, became an Officer of the Order of the British Empire.
Dr T. N. M. Waters FNZIC, became a Knight Batchelor (Sir Neil Waters).

We continue to act as Treasurer for the NZ Chemical Olympiad Project and now supply secretarial and financial services to the Chemical Education Trust. Credit card facilities offered by the Secretariat continue to be used by Conferences and Specialist Groups. We distribute the IUCr Newsletter in addition to IUPAC's 'Chemistry International' and 'International Newsletter on Chemical Education' as well as publications from other chemical societies.

A A Turner
Executive Officer, NZIC
31 August 1995

President's Report 1994/1995

This year there are separate reports from both the Executive Officer and the President. Because the former report deals largely with the functions and achievements of the Institute during the past year, this report will focus primarily on the Strategic Review which was carried out during my term of office.

Following requests from many members, and discussions among the elected office-holders of the Institute, I set up a small review committee in late 1994, to canvass opinions from members and others about the current state of the NZIC and about what people thought should be changed, and to make specific recommendations to the September 1995 Council meeting about how to achieve these. The committee comprised myself, the two Vice-Presidents Nath Pritchard and Rob Whitney, past-President Doug Wright, and Gillian Norris from the Manawatu Branch. I would like to sincerely thank all of these people for the hard work they have done over the past year in helping to put together what I feel is a quite comprehensive report on the current state of the Institute, and helping to formulate a series of recommendations to Council. I would also like to thank all those members who sent in

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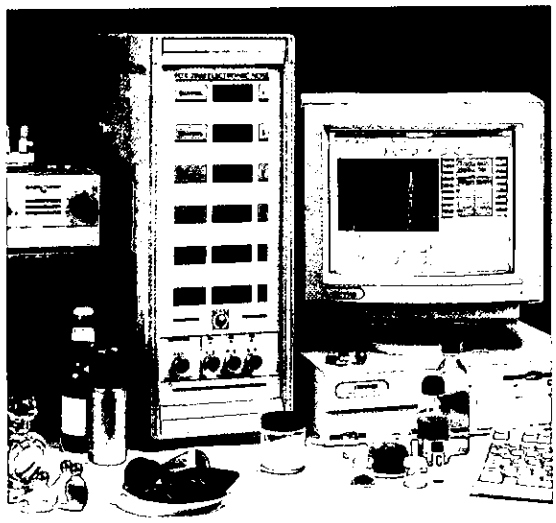

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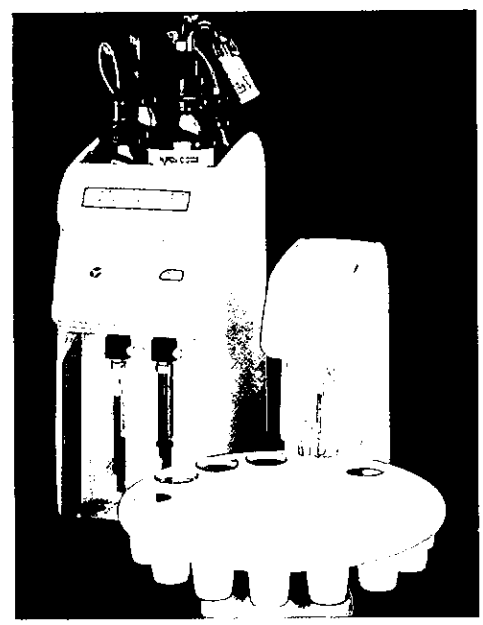

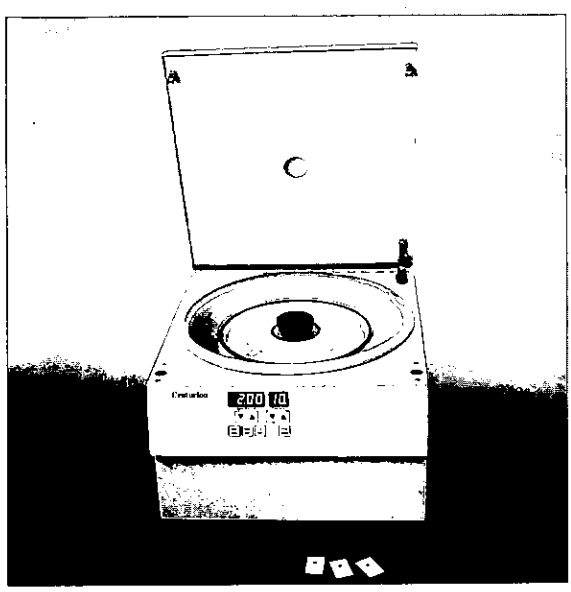

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submissions; all of these were seen and carefully considered by all members of the committee.

Following the first meeting of the committee in February, to consider these submissions and formulate a series of possible scenarios, I then raised these during my tour of the Branches in March/April. This tour was a very enjoyable and enlightening experience, and I would like to thank all those who extended such warm hospitality to my wife and myself. There was a considerable degree of unanimity about the broad form the NZIC should take, with most members supporting retention of the present structure, provided that clear action was taken on membership (simpler), fees (lower), the role of the Specialist Groups (better links) and the functioning of the secretariat (more efficient attention to "personal" and less to "corporate" services).

It was clear that the various Institute Branches are served by many people with a great deal of energy and goodwill, but it was equally clear that these people were experiencing many difficulties in attracting new members and in retaining existing ones. This emphasised to me the need for the committee to consider quite far-reaching changes to the Institute, to address the difficulties and make the job of these dedicated Branch members as easy as possible.

Following these meetings, and the circulation of several drafts of a proposed report among the committee members, with additional input from the Honorary Treasurer Denis Karl, the Journal editor Robert Lyon, the Executive Officer Alan Turner and several senior members whom I asked for comment (and whom I thank very much for their contributions), a final report was prepared, and was presented to the September 4th meeting of Council for their consideration. The report is published later in this issue of *Chemistry in New Zealand, so I* will not discuss it in detail here, except to summarise the recommendations, which were as follows:

1. The NZIC continue to function as a separate organization, The New Zealand Institute of Chemistry but with an altered focus, with more emphasis on "personal" services to members rather than "corporate" services on behalf of members (e.g., submissions to Government organizations).

2. The grades of membership should be simplified to three; Student Member, Member and Fellow. Membership rules should be as simple as possible, and the refereeing system for Members should be abandoned.

3. The fee structure should be lowered and simplified. The fee for Student Members be set at $20, the fee for Members at around $60, and the fee for Fellows at around $100 (exact levels to be decided pending the final structure of the secretariat; see below).

4. An outside review of the secretariat be conducted, to see whether its functions and requirements are still appropriate.

5. Following this review, the possibility of a closer accommodation between the NZIC and the Royal Society be explored. The proposal is that the Royal Society would undertake basic administrative services for the NZIC for a fee, by providing an identifiable NZIC Executive Officer who would be a Royal Society employee. All NZIC members would also become Royal Society members, and the NZIC and Royal Society would cooperate in jointly recruiting new members.

6. All members of Specialist Groups be required to belong to the NZIC as Members or Student Members (as appropriate), thus receiving full privileges of membership, including the Journal. The problem that many Specialist Group members originally were not qualified to join the NZIC is now largely removed by recommendation 2, and the deterrence of high fees by recommendation 3.

7. Those Specialist Groups which have a membership of greater than 30, an annually-elected set of officers, and which hold at least one annual meeting/seminar/training course, be entitled to send a representative to Council.

I believe, as does the committee, that the above package of recommendations represents a reasonable consensus of the many thoughtful submissions given to the review committee. While some of the recommendations are drastic, we believe that together they meet most of the major problems described by members. We hope that these changes, if adopted by Council, will allow the members to build the NZIC into a more vibrant and desirable organisation.

William A Denny
President, NZIC
31st August 1995

COUNCIL NEWS

The NZIC Council held a meeting in Auckland on Monday 4 September 1995, sitting prior to the Annual General Meeting. In those years when there is not a conference the AGM is held in the Branch of the current President. Some highlights of the meeting:-

Financial

The Treasurer spoke to the Annual Financial Report and Balance Sheet. This year overdue subscriptions were written off as a one-off event and will not appear again as an asset in the balance sheet.

A request had been received from FACS (the Federation of Asian Chemical Societies) inviting us to double our subscription. It was felt that our membership numbers did not justify a payment of $800 at this time.

Council approved Branch capitation fees and student travel grants at the same level as previous years.

Assistance from the Overseas Visitors Fund was approved to allow Professor A J Deeming of the University College, London to visit the Branches in November. He is an organometallic chemist.

Membership

The numbers of Fellows and corporate and non corporate members is reported elsewhere. The death of Dr D F Nelson, a Life Member of Auckland Branch was noted. A list of new members is reported below.

Honours
Sir Neil Waters, currently Vice Chancellor at Massey University was made a Knight in the Queens Birthday Honours.

Prizes
Council has awarded the 1995 Institute Prizes as follows:

SGS
Dr G A Bowmaker, University of Auckland

Shell Prize
Dr J B Metson, University of Auckland

Chemical Education Award
Mrs A Mime, Hamilton Girls High School

Specialist Group Meetings
Reports were received from the convenors of two successful Specialist Group meetings held in February 1995 at Massey University - they were the Inorganic and Organometallic Specialist Group and Physical Chemistry Specialist Group. The reports are presented elsewhere.

Conferences
The 1996 Conference will be held in Dunedin, 2 - 6 December 1996. The theme "Molecules for the Future" has been chosen for this conference which will also mark the 125th anniversary of the Chemistry Department of the University of Otago.

A successful conference "CHEM ED 95" was held in Auckland during August 1995. The Institute supported this venture with a grant of $500 towards expenses.

Chemistry Olympiad
The success of the Chemistry Olympiad team in China was noted. The Institute continues to underwrite this project but financial support from MoRST, industrial companies and members is much appreciated.

Strategic Review
The Strategic review report was tabled by the Review Committee headed by Professor Denny. A precis is reported elsewhere in this issue. Council approved expenditure of $5000 to carry out an audit of the Secretariat. A copy of the full report will be sent to the Branches for mailing to all members asking for their comments.

New Members

Fellows Admitted Recently

Manawatu	BURNS,	Janet Ruby
Canterbury	ABELL,	Andrew David
	LAKE,	Robin John
Otago	HUNTER,	Keith Andrew
Overseas	HILL,	Gregory Sui Cheng

Members Admitted Recently

Auckland	TAYLOR,	Carol Maree
	TREDWELL,	Stephen Timothy
Manawatu	MITCHELL,	Kenneth Ross
	ROWAN,	Daryl Dryden
	WRIGHT,	Anthony Hugh
Wellington	BALLANCE,	Julie Anne
	CALVERT,	Jane Louise
	DE SILVA,	Jayasena
	JACKSON,	Tim Graham
	MONK,	Jonathan Paul
	TUFFERY,	Denis Eng
Otago	SANDERSON,	Kevin John
Overseas	BRIENNE,	Stephane Henri
	MCGRATH,	Kathryn Mavis

Associates Admitted Recently

Waikato	BILLETT,	Nicholas Guy
	CALDWELL,	Jonathan Paul
	EKANAYAKE,	Mudiyanselage Sarath
Canterbury	SPILLANE,	Jeffrey William
Otago	BIBBY,	David Charles
	PLIEGER,	Paul

Students Admitted Recently

ADAMSON,	Ross David, (Massey University)
ANDERSON,	Damaris, (Massey University)
BANFIELD,	Matthew, (University of Canterbury)
BLACK,	Stuart, (University of Canterbury)
BLYTHE,	Treena, (Massey University)
BRYCE,	Adele Lorraine, (Waikato University)
BUTTS,	Craig, (University of Canterbury)
CALLAGHAN,	Stephanie, (University of Canterbury)
CAMPBELL,	Paul, (Waikato University)
CAMPBELL,	Wayne, (Massey University)
CHILCOTT,	Jackie, (Massey University)
COLECUTT,	Stuart Alan Grenville, (Waikato University)
COULTER,	Carolyn, (University of Canterbury)
DALDY,	Julia Anne, (Waikato University)
de ZWART,	Kenius, (University of Canterbury)
DEO,	Artéep, (Massey University)
DOMBOSKI,	Jeremy, (Massey University)
DUNN,	Rachel Victoria, (Waikato University)
EDMONDS,	Michael, (Massey University)
EVANS,	Cameron, (Waikato University)
FAYLE,	Sian, (University of Canterbury)
FISHER,	Louisa, (Massey University)
FOULDS,	Glenn, (University of Canterbury)
GATENBY,	Wayne Andrew, (Waikato University)
GILBERT,	Andrew, (Massey University)
GINEVER,	Lyle George, (Waikato University)
HAGYARD,	Marion Louise, (Waikato University)
HARVEY,	Jacqueline, (Massey University)
HARVEY,	Andrew, (University of Canterbury)
HINDMARSH,	Kathryn, (University of Canterbury)
HYINK,	Wouter, (Waikato University)
IRWIN,	Jacob, (Massey University)
JEYARATHAN,	P., (Massey University)
KERR,	Nigel, (Massey University)
KINNON,	Sandra, (Massey University)
KITSON,	Nikolas Dawson, (Waikato University)
LAO,	Wen, (Massey University)

LILL,	Rachel, (University of Canterbury)
LOO,	Trevor, (Massey University)
LOWE,	Andrew, (Massey University)
MAHY,	Chris, (Massey University)
MAJOOR,	Natasja, (Massey University)
MEADE,	Susie, (University of Canterbury)
MOSS,	Jeremy, (Massey University)
NABBS,	Brent, (University of Canterbury)
NGATARERUA,	Bruce, (Massey University)
NICHOLAS,	Gillian, (University of Canterbury)
PEDDIE,	Gaile, (Massey University)
POULGRAIN,	Donald Kenneth, (Waikato University)
REID,	David, (Massey University)
RENDLE,	Phillip, (University of Canterbury)
RICHARDSON,	David, (Massey University)
ROBERTSON,	Jade, (Massey University)
RODDICK,	Alisa, (University of Canterbury)
SIMPSON,	Stuart, (University of Canterbury)
SIVALINGAM,	Geedha, (Massey University)
SMALES,	Mark, (Massey University)
STEADMAN,	Andrew, (Massey University)
STEWART,	Michael, (University of Canterbury)
STRUTHERS,	Hamish, (University of Canterbury)
TAYLOR,	Susan, (Massey University)
TAYLOR,	Kirsten, (University of Canterbury)
VAN DIEPEN,	Angela, (Massey University)
WALSBY,	Charles, (University of Canterbury)
WATSON,	James, (Massey University)
WATSON,	Gillian, (Massey University)
WILLIAMSON,	Rachel, (Massey University)
WOOD,	Bryan, (University of Canterbury)
WOODCOCK,	Jane Christine, (Waikato University)

MANAWATU BRANCH NEWS

Thirty dead chemists refused to lie down and met for the annual Dead Chemist's Society dinner meeting on June 7th. Among the illustrious group were Avogadro, Boltzman, Cavendish, Faraday, Fischer and Pauling. Judging of the costumes was an entertaining task and Gill Norris dressed as "Cave-in-dish" won the best costume award.

Above: Fairy-Day (Grant Boston) demonstrating the Faraday Effect to Lee Furness.

Chemistry trivia masters, Mike Boland and Robert Norris produced another challenging quiz to stimulate the brain cells after a good dinner. We were then joined by our special guest M. Dumas, who presented the first Faraday lecture. M. Dumas' (Tony Wright's) style and delivery captivated the audience and he could teach many of today's speakers about effective lecturing.

Above: M. Dumas (Tony Wright) delivering his Faraday Lecture.

1049 students from 32 schools took part in the 1995 Manawatu Chemistry Quiz and 719 certificates were awarded to students for their achievements. Rosemary Duckett, Central Hawke's Bay College and Matthew Yates, St John's College had the highest mark in the Junior Quiz. Grant Lowe, St John's College and Hayden Rosser, Wanganui Collegiate School had the highest mark in the Senior Quiz. Participation prizes were awarded to Central Hawke's Bay College (211 participants), Wanganui Collegiate School (94), and Fielding Agricultural High School (90). These schools received cash grants to assist their chemistry teaching. Our thanks to the Science and Technology Promotion Activities Council of MoRST for their generous sponsorship.

The Manawatu Branch sponsors prizes at all three of the Science Fairs held in our region and judges the chemistry prizes at the Manawatu Science Fair. This year the Senior Prize was awarded to the Geotropic Crystals project of Lelie Slims, Awatapu College. First prize in the Junior Section was awarded to Esther Small of Fielding Agricultural High School for her project on Enzyme Action and Second Prize was awarded to Marissa Scandlyn of Rongotea School for her project on Evaporation Control.

In August Melanie MacDonald, Manawatu Branch Treasurer resigned her position at Glaxo and has joined Lloyds Register. Melanie is presently training in Australia and will return to New Zealand later in the year to set up the New Zealand branch of Lloyds Accreditation Service. Alastair MacGibbon has assumed the role of treasurer.

* * * * *

NZIC Specialist Group Meetings 1995

Around 150 chemists converged on Massey University for a few days earlier this year for two meetings. The ***Inorganic and Organometallic Specialist Group*** *met first followed by the* ***Physical Chemistry Specialist Group.*** *The fact that both meetings were very successful and relatively easy to organize (but still a lot of hard work!) indicates that Specialist Group Meetings should be part of the NZIC's calendar in the future. Costs were kept to a minimum to ensure a good attendance by graduate students.*

Inorganic and Organometallic Specialist Group Meeting Monday 30 January - Wednesday 1 February 1995.

The main meeting was preceded by an X-ray Crystallography Workshop organized by Geoff Jameson.

Ward Robinson (Canterbury) and Geoff Jameson (Massey) started the discussion and these two expert crystallographers continued to make a significant contribution to the workshop with help from Jim Simpson (Otago) and Graeme Gainsford (IRL). The day finished with dinner at the Massey University restaurant, Periwinkles, which went well in spite of the number of diners being considerably higher than what Geoff had booked for.

The main meeting started on the Monday evening with a mixer and 56 posters being displayed to provide a chemical focus. This gave the graduate students a chance to meet each other and those of us who have been around for a while to catch up with colleagues from other centres. The posters remained up throughout the conference with morning and afternoon tea being served in the same venue giving all of the participants plenty of time to discuss the details of their work.

Tuesday was a day crammed with a feast of excellent talks. Colin Raston (Griffith), whose trip was sponsored by the Royal Australian Chemical Institute (Inorganic Division), started the discussion. The next 3 talks were from Richard Hartshorn (Canterbury), Tony Burrell (Massey) and Olga Gladkilch (Victoria) who have all recently been appointed to inorganic lectureships in New Zealand. The international flavour was continued throughout the day with Martin Schroder (Edinburgh), David Richens (St Andrews) and Russen Hughes (Dartmouth College). The recent appointee line up also included Owen Curnow (Canterbury) and Tim Kemmitt (IRL) plus others who can no longer be classified as such, namely James Wright (Auckland), David Ware (Cancer Research Laboratory), Sally Brooker (Otago) and Neil Curtis (Victoria). Warren Roper, when introducing Cuth Wilkins (Canterbury), paid a very nice tribute to the considerable influence Cuth has had on inorganic chemistry in New Zealand. Cuth has been retired for many years but is still actively involved in inorganic research. The day's talks finished with Alistair Lees (State University of New York) who was the NZIC sponsored visitor. After all this chemistry it was time to relax over the dinner held in the Massey University Student Centre. There was plenty of food and Eric Ainscough finally managed to relax as he discovered the beer was not going to run out! Brian Robinson thanked the hard working Massey Team (Tony Burrell, Eric Ainscough, Geoff Jameson, Andrew Brodie and do not forget Gwen Adams, who kept us all under control) for putting the meeting together. And after much deliberation the prizes (sponsored by Industrial Research Ltd) for the best student posters were awarded to Scott Woodgate (Auckland), Jacinda Allwood (Massey) and Robert Kelly (Otago).

Wednesday's talks had a more physical orientation as we joined with the Physical Chemistry Group. Mark Turnbull (Clark), Graham Wright (Auckland), Bill Henderson and Brian Nicholson (Waikato), Douglas Russell (Auckland), Keith Gordon (Otago) and Terry Adams (Massey) covered a range of topics from molecular magnetic materials, electrospray mass spectrometry, raman spectroscopy to theoretical chemistry in the morning session. After lunch Graham Bowmaker (Auckland), Geoff Jameson (Massey), Alan Langdon (Waikato), Allan Blackman (Otago) and Benny Johnson (Q-Chem USA) completed the joint session and the meeting. The Physical Chemists continued on and the Inorganic Chemists went off feeling that there is plenty of excellent inorganic chemistry going on in the country. It is great to see the influx of new inorganic staff at IRL and in the Universities which bodes well for the future. Meanwhile those of us at Massey are saying, "Whose turn is it to organize the next Inorganic and Organometallic Specialist Group Meeting?"

Andrew Brodie

Physical Chemistry Specialist Group Meeting Wednesday 1 February - Friday 3 February 1995

Recognizing that the ancient boundaries between the Inorganic and Physical disciplines are blurry and of little contemporary significance - to the advantage of both fraternities - it was decided to overlap the meetings by organizing joint sessions on the Wednesday. The speakers at these sessions were drawn from Auckland, Waikato, Massey and Otago Universities as well as various US institutions. Session three began late on Wednesday afternoon and concluded shortly before dinner at the Massey Staff Club at 7 pm. Sitting attentively through 18 lectures in a day is hungry work but, fortunately, the barbequed offerings were both generous and tasty.

The fourth session began promptly at 8:30 am on Thursday morning and, like its predecessor, contained a wealth of first-rate chemistry, well presented. At 12:30 pm, we adjourned for a special luncheon in honour of Professor Geoff Malcolm who will retire from Massey University later this year. The luncheon was a lively affair and contained several speeches which were well worth preserving. Once again, Massey's Meal Service did an excellent job. The fifth session, chaired by Arthur Williamson (Canterbury), was also in honour of Geoff and included lectures by Bob Cunninghame (Otago), Gavin Hedwig (Massey) and Leon Phillips (Canterbury). After a pause for tea, session six commenced and the final student lectures were given. After another packed day, most of those in attendance migrated to the local Cobb & Co. Restaurant where, among other things, the winner of the Best Student Presentation prize was decided by an erudite, and very geographically correct, judging panel. Although the race was certainly a close one, Paul Kilmartin (Auckland) was eventually declared *primus inter pares* and awarded a cheque for $100.

Session seven, which had the distinction of including a speaker who was at least 12 hours ahead of his time - Professor Rebelo of the New University of Lisbon - completed the meeting. Most of those who attended felt that it was a very enjoyable and productive conference and much of the credit for that must go to Gwen Adams who masterminded almost every detail of the organization. The conference chairmen, Peter Gill and John Harrison of Massey, sincerely thank her for her unflagging efforts.

The last word goes to Douglas Russell (Auckland) who, reflecting on the meeting that he had just attended, concluded that "physical chemistry in New Zealand is in good heart!" Long may it stay that way!

Peter Gill

Tribute to Professor Geoff Malcolm
by Professor Paul Callaghan,
Department of Physics, Massey University.

(Delivered at the Physical Chemistry Specialist Group Meeting Lunch on 2 February 1995)

I am very glad to be able to say a few words in honour of Geoff Malcolm in the year of his retirement, especially to a group of his physical chemist peers. In many ways it is a tribute to Geoff that a meeting such as this should be held at Massey University, because, as a physicist, I can, without accusations of bias, assert that chemistry at Massey University is in very good heart and that physical chemistry goes from strength to strength. And much of the credit for that is due to the way that Geoff has nurtured his subject over the 25 years since he was appointed Professor of Physical Chemistry in 1969. I will say more of that in a moment.

First though I want to remind you, as his friends here today, of some of his personal history. Geoff grew up in Feilding, a son of parents who greatly valued education and who produced a family of scholars. As most of you will know Geoff's brother Wilf is a mathematician who was, until recently, Vice Chancellor of Waikato University, and his late sister Margaret was a distinguished educator and Principal of Wellington Teachers College. Geoff attended Feilding Agricultural High School and then Canterbury University (actually the University of New Zealand of which Canterbury was then but a college). He was an outstanding student, and finished up winning an 1851 Exhibition Scholarship to England where he enrolled for PhD in polymer chemistry at the University of Manchester. Geoff completed his PhD in near record time, working almost entirely on his own, after solving some very subtle experimental problems involving some innovative calorimetry.

He then returned to New Zealand as lecturer in Chemistry at Otago University and there began a teaching career in which his role can only be described as one of excellence and leadership. Indeed, I would say that it is for his fine teaching and helpfulness towards students that Geoff will be remembered for years to come. I am always struck by the number of successful New Zealand chemists who still remember Geoff's early Otago lectures, as well as by the legion of Massey University students who so enjoyed his teaching and remember him with affection.

One of the great influences in Geoff's life was undoubtedly the remarkable Dick Batt who died just over 12 months ago. I am sure that if he were still here, it would be Dick who would be giving this speech today. We all miss him, and I as a fellow Wanganui larrikin, miss his divergent outlook on life as much as anyone. It was Dick who recruited Geoff here to Massey University, partly because as a biochemist, Dick needed someone to give leadership to the physical sciences. He gave Geoff this task, which was eventually expanded to include stewardship of the small band of physicists who, until then, had been an adjunct to Agricultural Engineering. In a breathtakingly outrageous move, Dick (and, to a large measure, Geoff) took over the physics operation and created a super-department of chemistry, biochemistry and biophysics. At a time when the university hierarchy was openly hostile to physical science, that turned out to be the best thing that could have happened to us. Among the many benefits to emerge was the beginning of our long and happy association with Geoff.

I hasten to add that a transformation in the outlook for physical science occurred with the appointment of Dr Neil Waters as Vice-Chancellor in the early 1980s. I cannot let this occasion pass without acknowledging my thanks to you Neil, in what is also your retirement year, for what you have done for this university and for physics in particular.

Returning to the story of the monster department, I recall that Geoff, as leader of the physicists and chemists, was charged with overseeing several new appointments. Scott Whineray, David Parry and I were appointed in that order. Scott is now our department section head at Albany, David, who is a brilliant scholar of international standing, has a personal chair and is Associate Dean while I became the first Professor of Physics in 1984 and first head of the Department of Physics in 1985. I am not sure I see Geoff as a Moses figure but certainly we physicists, once independent, had a sense of what the children of Israel felt when finally across the Red Sea. Certainly, (if you will excuse a dreadful pun) it could be said that Geoff helped "move the waters". If I might continue the metaphor I would note that fortunately, it had not been necessary to rain pestilence upon the land of Egypt in order to set us free, though I must admit, the sight of our chemistry colleagues under a rain of frogs would indeed have been interesting.

Becoming the head of a brand new department at 37 is a bit like being thrown in the deep end of a swimming pool at the age of 2. You either sink or swim. One of the vital pieces of swimming advice given to me by Geoff was not to worry about my larrikin qualities. "There are as many ways of being a professor as there are professors. Do it your way", he said. That tiny piece of advice, which Geoff probably doesn't even remember, helped save me from drowning.

For the past ten years Geoff has been of enormous support to me. Whenever I needed advice or encouragement, Geoff has been there. There have been times when his help and guidance has been crucial. One of the really nice things which happened

to me this summer was the chance to repay Geoff in some small measure by taking him fishing on Lake Taupo and to watch him catch his first trout. Not surprisingly, given his multitudinous talents, he is a dab hand with the fly rod.

I think then that it is the personal qualities in Geoff which I wish to stress the most of all in this retirement year tribute.

When Geoff came to Massey University he made a decision to nurture the development of science rather than to carve out a research career for himself. In doing so he not only supported individuals in establishing their research but also by helping them establish their teaching and become effective and all-round academic staff. The strong emphasis on quality teaching which is part of the culture of our Science Faculty is in no small measure due to Geoff's influence.

Geoff's leadership and support was not confined to chemistry, but extended across the Faculty, especially during the past decade when he has been the Dean of Science. However, we cannot fail to notice what has developed in the area of physical chemistry. I know that Geoff has taken enormous pride in the achievements of Ken Volley, Paul Buckley, Gavin Hedwig, Andrew Brodie and Eric Ainscough, and the new physical chemistry strength brought to the department by the appointment of young staff like John Harrison and Peter Gill. Physical chemistry at Massey University is indeed in great heart, as this conference shows.

I would venture to add that in physics we are also in excellent heart and strengthened by our close and abiding ties with chemistry, reflected in our cooperative teaching and research programmes in physical chemistry and chemical physics. The closeness of our relationship is undoubtedly also a tribute to Geoff.

At the end of last year we had a function to farewell Geoff as Dean of Science. Much was said then about this aspect of his work and I will just repeat the essence. As Dean, Geoff was characterised by dignity, scrupulous fairness, total honesty and unbounded kindness and knowledge in advising our students. He is also a fine public speaker, indeed if he were not so damn modest, he could do a far better job than I am doing here today.

Any mention of Geoff's life and work must also include a tribute to the support given him over the years by (his wife) Sheila, and mention of the marvellous job both of them have done in bringing up their children, Andrew, Claire, Helen and Katrina. Geoff and Sheila have passed on their strong values to these fine young people who are a source of tremendous pride and joy to them both.

Today I am surrounded by scientists and scholars. I would like to finish by quoting a few words about scholarship from the *Talmud.*

"A scholar should be like a bottle which lets in no wind,
Like a deep garden which retains its moisture,
Like a pitch-coated jug which retains its wine,
And like a sponge which absorbs everything. "

Today is a celebratory occasion for chemistry. Geoff, you have greatly assisted the development of chemistry not only at this university but throughout New Zealand. We salute you today, as someone who sets an example for us all, both as a gentleman and as a scholar. Your friends and colleagues wish you and Sheila a happy retirement, and may your garden retain its moisture and your jug, its wine.

Professor Geoff Malcolm's Reply

After warmly thanking the Symposium organisers (Gwen Adams, Peter Gill and John Harrison) for arranging the luncheon and the following conference session in his honour, Professor Malcolm Spoke as follows:

I would like on this occasion to pay a tribute to physical chemistry itself, which is the activity which has drawn us together over the years and which has afforded me so much pleasure in my career. For me physical chemistry has brought three good things.

Firstly, it has brought intellectual stimulus and challenge. Even at school I found that scientific explanations gave me genuine intellectual satisfaction. As an undergraduate at Canterbury University College I came serendipitously into a Science Faculty which had been quite recently influenced in its philosophy by the presence of Karl Popper, who had been a philosophy lecturer there from 1937 to 1945. I am grateful to my Chemistry lecturers (Max Christensen, Max McGlashan, Hugh Parton, Jack Vaughan, Cuth Wilkins and others) who made explanatory theories, and not just factual information, the focus of their lectures. Through them I came to experience science as observation, explanation, refutation by further observation and finally application. (Student humourists used to add perpiration!) I loved both the explanatory theories - the main focus of physical chemistry - and the experimental work involved in testing them, and I have been able to continue in this kind of activity throughout much of my career. I recall my long-standing friend and colleague, Arthur Williamson, once remarking on how fortunate we were as lecturers to be paid for following what was essentially our hobby. But as I say that, let us not forget the aspect of application in science. As a philosopher it is enough to understand. That brings intellectual satisfaction. But for a person on the public pay-roll there is a legitimate obligation to apply, and also to give our students the indication that applied science is a meritorious activity. Of course, and here I hark back to a somewhat caustic remark of my applied mathematics lecturer at Canterbury in 1949, "to do applied mathematics one must have some mathematics to apply." It is the same in science.

The second good thing that physical chemistry has brought me is friendship and companionship with like-minded people. You people present here are my respected academic colleagues, and some of you are my close friends. It is a pleasure to have new members in this group, like Peter Gill and John Harrison here at Massey, and also Douglas Russell, the new Physical Chemistry Professor at Auckland. I include here the friendship of students. They enrich one's life both in their student days and in the ensuing years. Bob Cunninghame, my first research student in New Zealand, is here today. There is a proverb which says "he who would have friends must show himself friendly." At Otago, in my time there, students were encouraged to choose their research supervisors and their field of research - limited of course by the talent available! One student, I am told, was quizzed by others in the lab about why he had chosen to work

with me. Was he super-keen on polymer physical chemistry? "Not at all", he replied, "Dr Malcolm was the only one who said he would be pleased to have me!"

After friendship with colleagues and students there is the pleasure of membership in a kind of international club of fellow scientists, through publications, correspondence and conference attendance. You have all enjoyed that, and so have I. I recall with special pleasure the occasion when Maurice Huggins from the Kodak Laboratories in the USA came to visit me here at Massey. For me, and I hope for most of you also, Maurice Huggins is a familiar and respected name through the Flory-Huggins equation in polymer solution thermodynamics. Less well known is the fact that he was the inventor of the concept of the hydrogen bond. Hydrogen bonds have always been central to my research, from the hydration of ions in mixed aqueous solvents to water-soluble synthetic polymers and now protein-solvent interactions. So it was a great occasion when such a man as he was came to visit me on his retirement tour in order, as he generously said, to thank me for the excellent thermodynamic data from my group which he had used extensively in checking refinements to his theories at the Kodak Laboratories.

Lastly, after intellectual stimulus and friendship, physical chemistry has brought me opportunity for service. Life cannot be all receiving, and I have received much, including some inherited family intelligence, the good opportunities of the now despised welfare system of Messrs. Savage, Fraser and Nash, and numerous scholarships from other people's endowments. It is satisfying at some stage to be able to serve the common cause in return. In the NZIC I have been conference secretary, conference chairman, branch chairman, and eventually Council Member, Vice-President and President. It was in the latter role that I first came to know and respect Graeme Wright from Auckland, and through him many others from the far north. There was a lot of hard work, but it was worthwhile. In chemical education I worked with others at Otago and Massey to build up university teaching standards and research schools. At the secondary level I have been Chief Examiner for School Certificate Chemistry and Entrance Scholarship Chemistry, National Convenor for Chemistry for the Universities Entrance Board, and eventually a plenary lecturer at a IUPAC Conference on Chemical Education in Tokyo - thanks to the influential support of Terry Hitchings while he was on the International Committee. Overseas I have been external examiner and advisor for chemistry to the University of the South Pacific in Fiji. In research administration I have been a member of the University Grants Committee Research Committee, eking out the equipment money for maximum encouragement; and on the UGC itself for six years, helping to negotiate with Government and Treasury for increased funding for such things as research equipment, scholarships and fellowships, and for computers.

Service takes its toll in the sense of one's reduced output of research publications. But as part of the team for science in New Zealand and for chemistry in particular, I have found satisfaction in service as well as in scholarship.

But we must not rest on our laurels. It is not widely known that the PhD degree in the University of New Zealand was first introduced in 1922 and was withdrawn in 1926 because it failed through poor supervision. The Chancellor of the time, Sir Robert Stout, was not supportive, but you can guess from his following remarks who were in favour of it. "There is a proposal to create a new degree, namely a Doctorate of Philosophy. So far as I can gather it is to be mainly a Doctorate in Science. Why a doctorate in chemistry should be called a doctorate of philosophy, I cannot understand." (From Hugh Parton's 'History of the University of New Zealand', 1979.) The next attempt, again by scientists including chemists, but this time with the powerful influence of the philosopher Karl Popper, was in 1946, just before I started at University. So far it hasn't failed, but it is not secure and requires the diligence of us all. Good supervision and adequate scholarship money are the challenges of the present. Let us all in the spirit of service keep up the campaign for advancement in research for the benefit of all.

Thank you for honouring me here. May you all continue to enjoy intellectual stimulus, good friendship and the opportunity for satisfying service within the context of chemistry today.

NEWS FROM AUSTRALIA

NEW CEO FOR CSIRO

Dr Malcolm McIntosh has been named as the new chief executive for CSIRO. Dr McIntosh, who is currently with Britain's Ministry of Defence, will take up the position with CSIRO in early 1996. Until then Dr Roy Green will continue acting in the position which he has done since March this year after the departure of Dr John Stocker. The Chairman of CSIRO, Professor Adrienne Clarke, praised the selection of Dr McIntosh, who obtained his PhD in physics from ANU. "Dr McIntosh is a very experienced and able scientist and we welcome his return to Australia. He has scientific, commercial, managerial and international skills that are needed for CSIRO to fulfil its mission to serve Australia by being the world's most effective multi-disciplinary research organisation".

Source: *Chemistry in Australia*, August 1995

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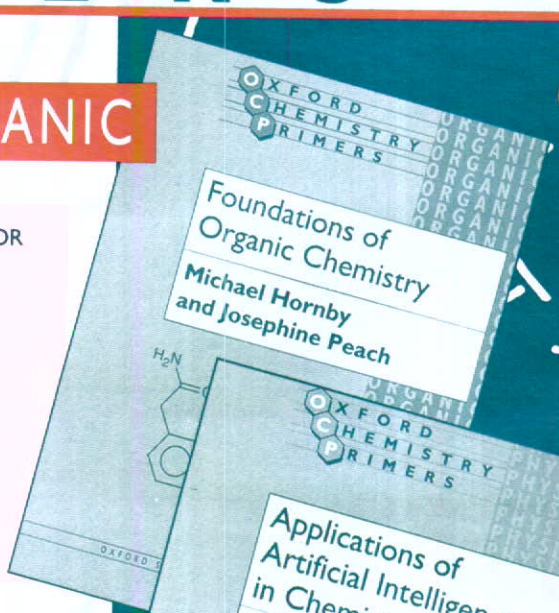

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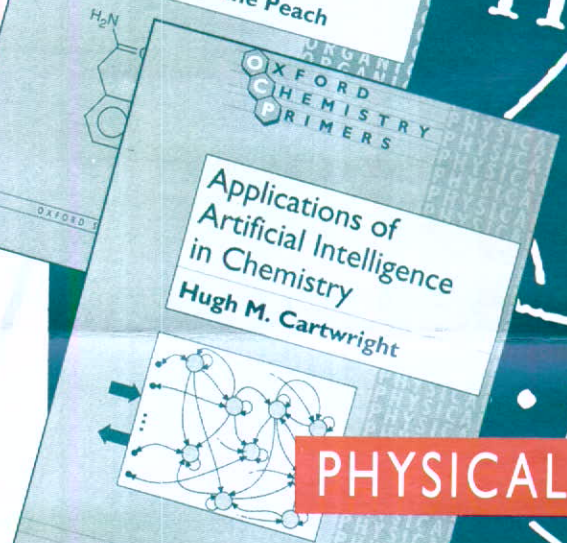

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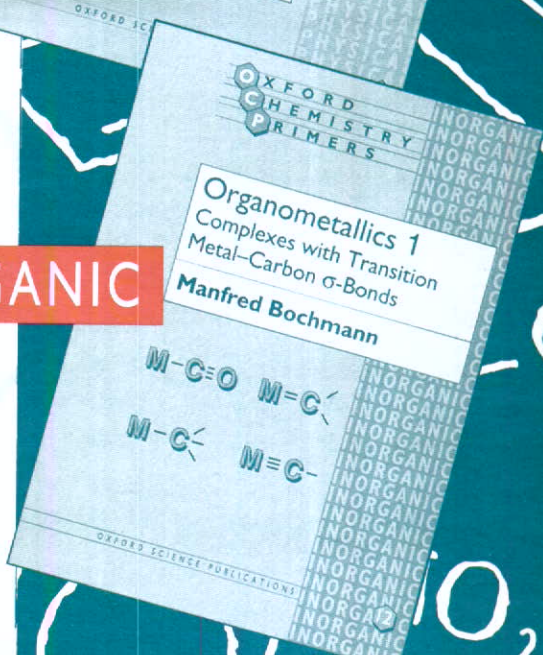

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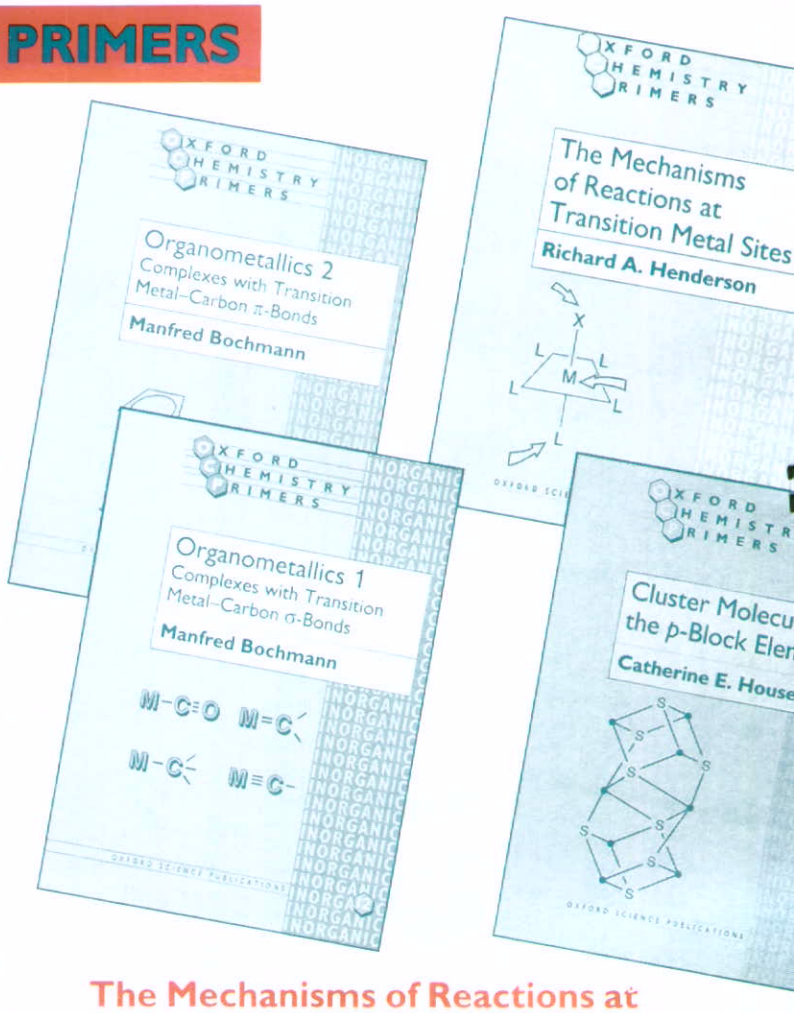

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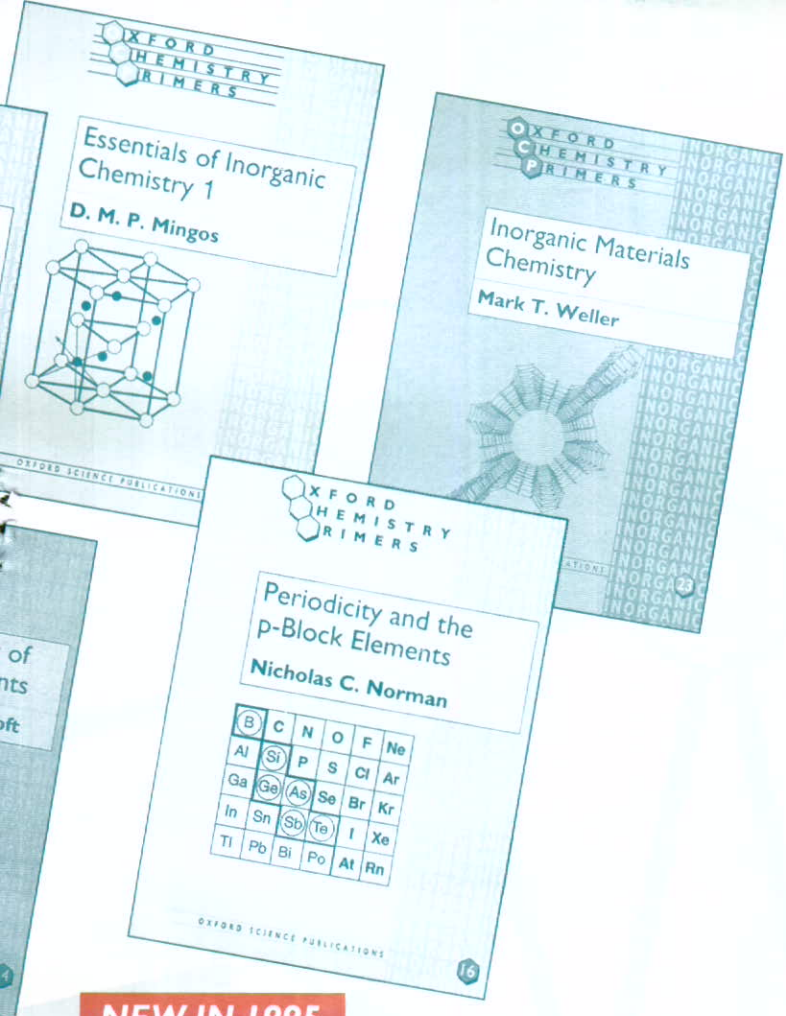

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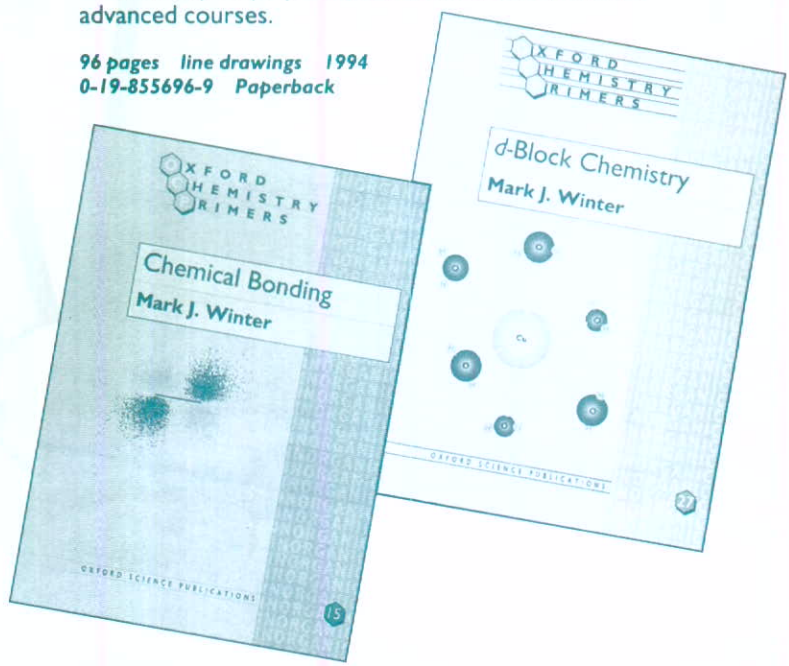

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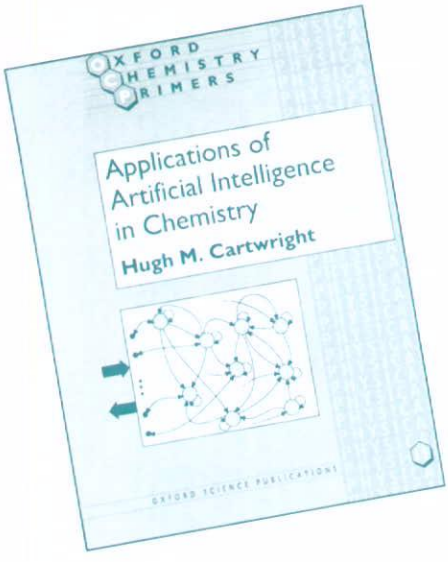

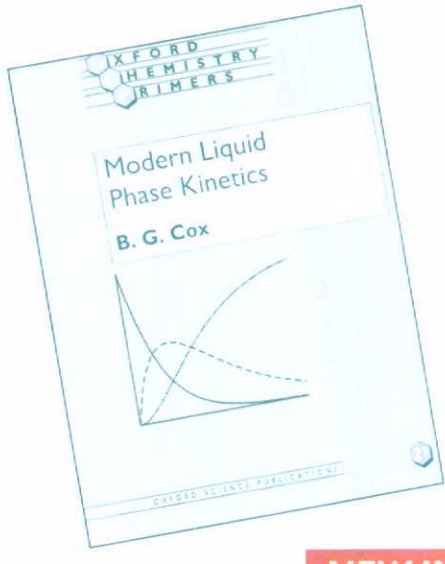

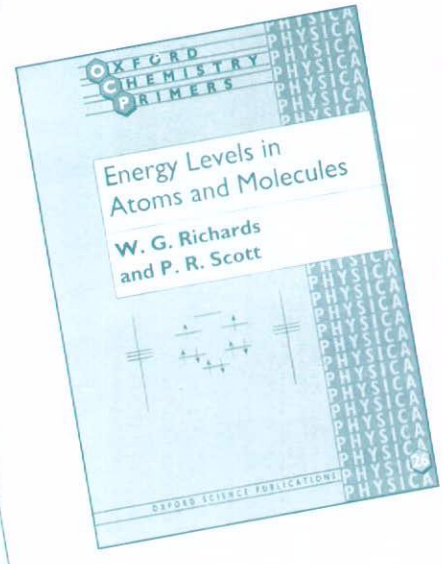

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P.J. Hore

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- focus on basic principles

This book provides a clear and concise introduction to the physical principles of NMR, and the interactions that determine the appearance of NMR spectra. Mathematical and theoretical explanations are kept to a minimum. The text explains chemical shift and spin-spin coupling; exchange and relaxation, and concludes with an outline of the workings of simple one- and two-dimensional Fourier transform NMR experiments. The ways in which NMR may be used to study the structures, motions, and reactions of molecules are illustrated and discussed throughout.

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Energy Levels in Atoms and Molecules

W.G. Richards
Reader in Computational Chemistry, Physical Chemistry Laboratory, University of Oxford
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Deputy Head, Royal Grammar School, Guildford

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Stephen K. Scott
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This Primer shows how 'exotic' patterns arise from underlying chemical mechanisms in reacting chemical systems. The origin of 'chemical feedback' is revealed using three examples: the iodate-reductant (Landolt) reaction, the Belousov-Zhabotinsky reaction, and the combustion of hydrogen, and thermal feedback is also discussed. The reactions and phenomena these mechanisms lead to are covered, and are related to important processes in biology, including the development of cardiac arrhythmias, nervous signal transmission, and animal coat patterning.

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Reader in Computational Chemistry, Physical Chemistry Laboratory, University of Oxford

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David T. Davies
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"The author has managed, in only 88 pages, to distil the essence of the area and present it in a very readable fashion. The approach is modern. The style of writing is clear and straight-forward... In short I recommend this book enthusiastically to all students and teachers looking for a manageable introduction to the area of heterocyclic chemistry." **Trends in the Physical Sciences**

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Stan Lee & Graham Robinson
both from Zeneca Pharmaceuticals, Macclesfield, Cheshire

- a superb introduction to one of the most important topics in applied chemistry

Here, case studies from ICI/Zeneca Pharmaceuticals are included to help illustrate the problems which may be encountered in scaling up chemical synthesis, and what solutions are available to these problems. These real examples present how it is possible to synthesise multi-kilogram quantities of a new organic compound which has been made in the lab on the milligram scale. A wide range of aliphatic, aromatic, and heterocyclic compounds are covered.

96 pages line drawings April 1995
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Polar Rearrangements

Laurence M. Harwood
Lecturer in Chemistry, University of Oxford, Fellow and Tutor, Merton College, Oxford

- deals with all the major rearrangements involving electron-deficient atoms or charged intermediates

"The book provides an excellent introduction to the mechanistic and synthetic topic of rearrangements...the explanations are very clear and concise...This is another excellent book in the series, which continues to impress me. I would recommend this book as essential reading to all undergraduates." **Education in Chemistry**

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Foundations of Organic Chemistry

Michael Hornby
Senior Tutor, Stowe School, Buckinghamshire
& Josephine Peach
Fellow and Tutor in Organic Chemistry, Somerville College, Oxford

- superb introduction to the fundamentals of organic chemistry
- wide range of examples included

"This book...consolidates what should have been learnt at school and prepares the student for a university level course." **New Scientist**

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Organometallic Reagents in Synthesis

Paul R. Jenkins
Lecturer, Department of Chemistry, University of Leicester

- presents a straightforward approach to the area

Looking at the properties and reactions of main group organometallic compounds, this Primer places particular emphasis on their applications in synthesis.

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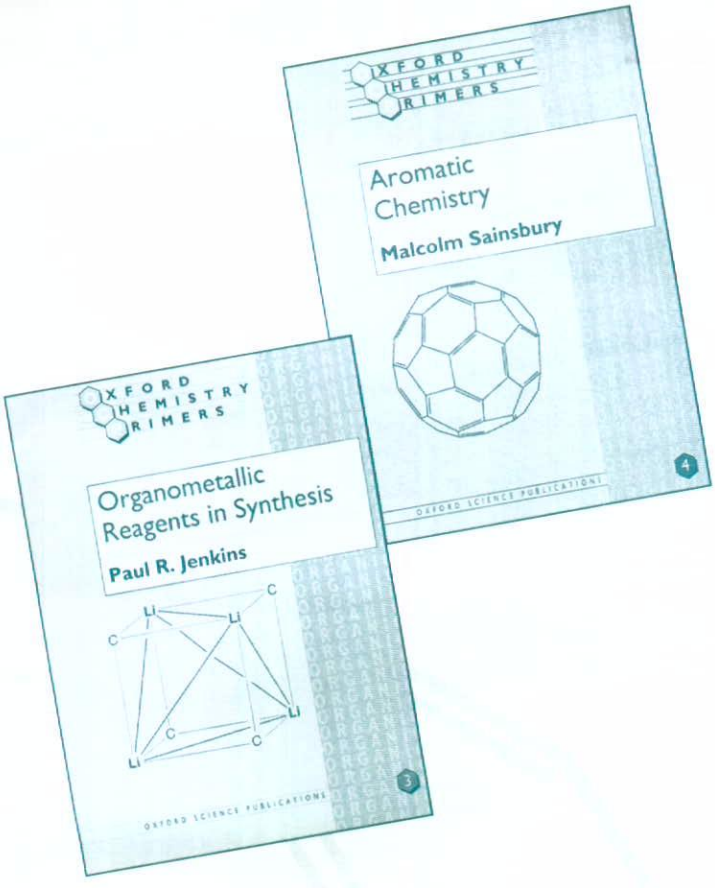

Amino Acid and Peptide Synthesis

John Jones
University Lecturer in Organic Chemistry and Official Fellow and Tutor, Balliol College, Oxford

- surveys role and diversity of amino acids, peptides, and proteins in nature
- describes and explains principal methods of chemical synthesis of amino acids and peptides

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John Mann
Professor of Organic Chemistry, University of Reading

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FORTHCOMING

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Istvan E. Marko
Lecturer, Department of Chemistry, University of Sheffield

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- demonstrates applications of these reactions in organic synthesis

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Reactive Intermediates

Christopher J. Moody
Professor of Organic Chemistry, University of Loughborough,
& Gordon H. Whitham
Lecturer in Chemistry, University of Oxford, & Fellow, Pembroke College, Oxford

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"This concise text concentrates on the last aspect of reactive intermediate chemistry; the important reactions of these electron-deficient species are laid out clearly and simply, with carefully chosen examples illustrating their use in organic synthesis. Each chapter includes a few problems as well as suggestions with an invaluable summary of this important topic in organic chemistry." **Flash Technique**

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Aromatic Chemistry

Malcolm Sainsbury
Professor, Department of Chemistry, University of Bath

- basic principles clearly presented
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- introduces topics such as thermodynamic versus kinetic control

"treatment is authoritative...could usefully supplement a first or second degree course of lectures."
Times Higher Education Supplement

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Organic Synthesis: The Roles of Boron and Silicon

Susan E. Thomas
Lecturer, Department of Chemistry, Imperial College, London

- describes properties and reactions of organoboranes and organosilanes
- emphasises how they can be used to provide simple solutions to a variety of synthetic problems

"The book provides an excellent introduction into the wide applications of boron and silicon in organic chemistry... I would recommend this book as invaluable reading to undergraduates and postgraduates."
Education in Chemistry

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Bifunctional Compounds

Robert S. Ward
Reader in Chemistry, University of Wales, Swansea

- an invaluable introduction to aspects of organic chemistry for students familiar with reactions of monofunctional compounds
- ideal for revision

This concise text outlines some of the methods used to prepare bifunctional compounds, and surveys the chemistry of some of the more important classes. Problems and solutions are provided, as well as references for further reading.

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NEW IN 1995

Organosulfur Chemistry

Gordon H. Whitham
University Lecturer in Organic Chemistry, & Fellow, Pembroke College, Oxford

- the first concise book available on the topic

The main part of this Primer deals with the preparation and chemical properties of the principal types of organosulfur compounds, with plentiful examples included to aid insight into the characteristic features of organosulfur chemistry. Concluding chapters study applications of these compounds in organic synthesis, and summarise organoselenium chemistry, highlighting the similarities and differences between organoselenium and organosulfur chemistry.

96 pages line drawings May 1995
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NEW IN 1995

Organic Synthesis

Chris Willis
Senior Lecturer, Department of Chemistry, University of Bristol
& Martin Wills
Lecturer, Department of Chemistry, University of Bath

- teaches students how to design synthetic routes

Starting with an introduction to retrosynthetic analysis, and focusing on the importance of bond polarity and functional group interconversions, this Primer covers: the identification and targeting of molecules containing more than one functional group; methods for the control of chemo-, regio-, and stereoselectivity, and identification of protecting groups. Four syntheses of the pyrrolidine alkaloids are compared and contrasted using the principles elucidated in the text, and practice examples are included throughout.

96 pages line figures April 1995
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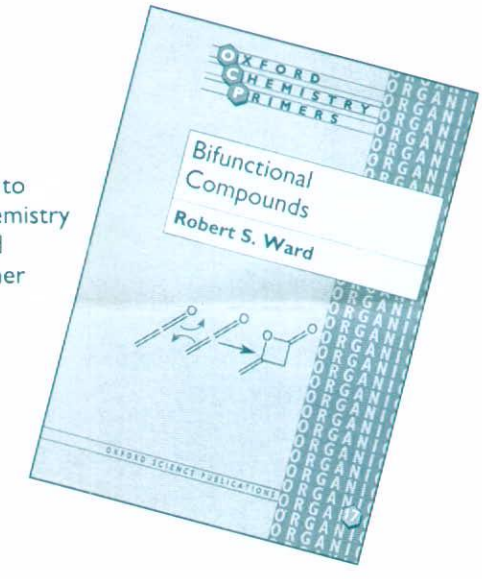

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