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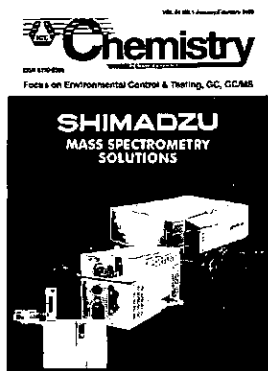
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NZ SCIENCE SCENE

INCREASED FUNDING FOR TERTIARY SCIENCE STUDIES

A major science-based company has increased its spending on tertiary scholarships, citing rising education costs and the need for greater numbers of trained scientists to help create a "Knowledge Economy".

Bayer New Zealand is to provide six new Science Scholarships this year instead of its normal five and will be raising the monetary value of each scholarship from \$2,200 to \$2,500 per annum. These increases will take the combined total of Bayer funding for secondary and tertiary education in New Zealand to more than \$90,000 per annum.

The Auckland-based company has also announced the names of its six

latest Science Scholarship winners, all of whom plan to commence tertiary studies this year.

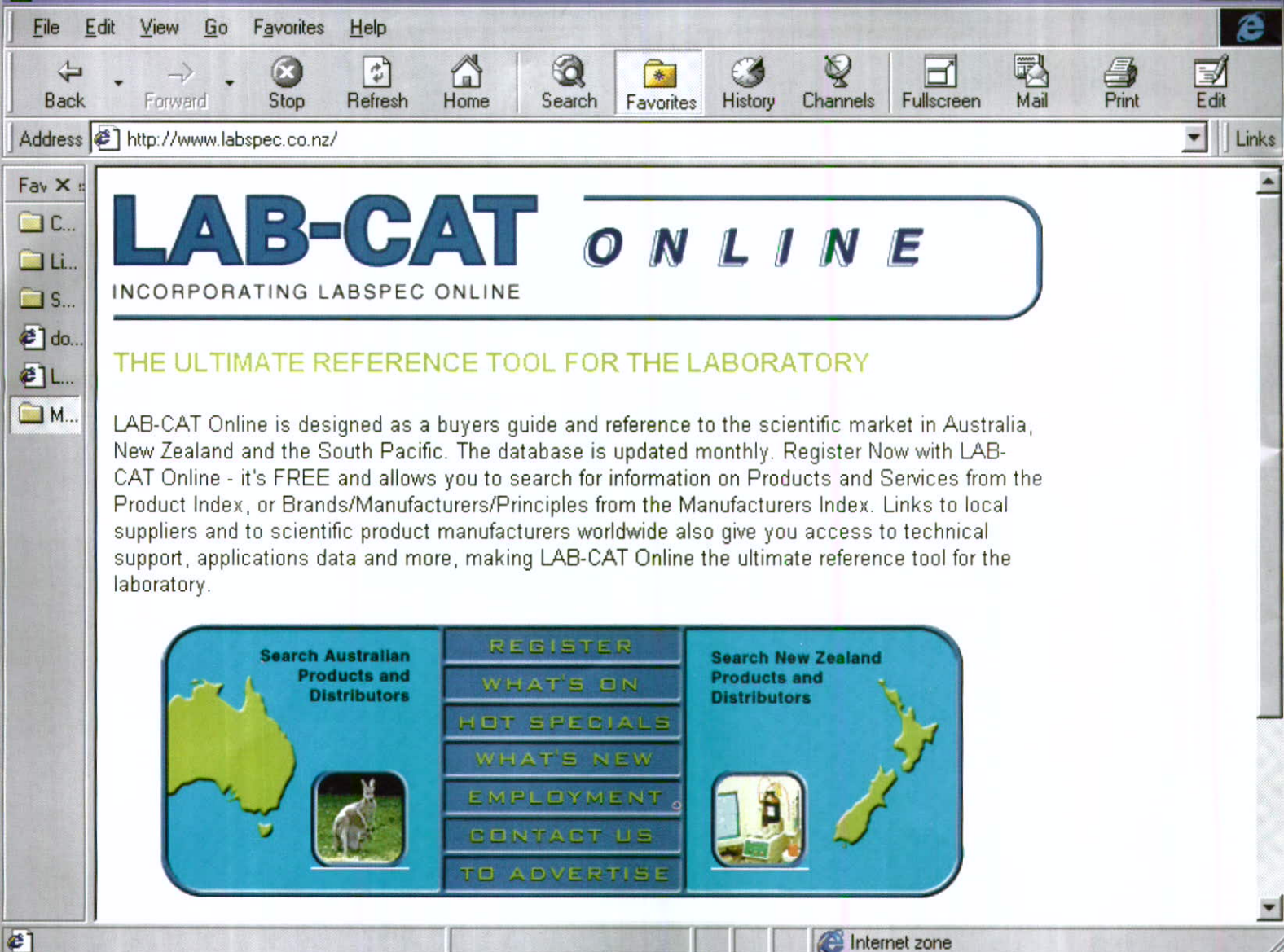
The six are: Alana McDougall from Taipa Area School, Ben Yi from Glenfield College, Kerriden Lloyd from Mount Maunganui College, Kimberley Shaw from Rangiora High School, Oliver Mueller-Gajar from Darfield High School, and Hwee Sin Chong from Otago Girls' High School.

"There's no doubt that scientific education is expensive. But it's a cost that must be met if New Zealand is to create the Knowledge Economy of which we hear so much. It's hard to envisage a future for our economy or our country if we don't start producing many more scientists and technologists as well as increased

numbers of scientifically-literate managers and business people," says Bayer's Managing Director, David Hope-Cross.

"As part of a worldwide group of science-based companies, we at Bayer are acutely aware of the vital role played by science and technology in creating prosperous economies and healthy environments. This makes us particularly pleased to be able to help some of New Zealand's most promising students towards their goals," he adds.

This is the seventh year running in which Bayer has made tertiary scholarships available to students from schools in which the company sponsors science education.



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Ten sponsored schools are chosen annually. Along with the right to apply for one of the Science Scholarships, each school receives \$2,500 worth of scientific resources, a DNA Helix model, \$200 worth of Agfa photographic equipment and a complete set of the much sought-after SATIS Resource Books.

The six new scholarship recipients were selected by Gillian Ward, Head of Centre of Science Education at Auckland College of Education. She describes the six as a highly impressive group of students with superlative academic abilities, clear goals and an obvious love of science.

"I actually felt quite humble reading these applications. With students of this calibre going through our schools and onto our universities, we have cause for confidence in the future of science in New Zealand.

"In just about every case, I was stuck by the breadth of their interests. They're not just high achievers but they are also highly competent and enthusiastic participants in a range of cultural, sporting or other activities. It's quite staggering to think just how much they are packing into their lives," she says.

"Bayer is performing a tremendous service in ensuring that these highly motivated young people are able to afford tertiary education. Their scholarships should alleviate much of the stress caused by the mounting cost of university study and make it easier for them to devote time and energy to their degree courses," Gillian Ward adds.

Bayer New Zealand is a subsidiary of Bayer AG, the German multinational chemical and pharmaceutical company. The New Zealand company's approach to funding science education is now recommended practice for Bayer subsidiaries around the world.

VICTORIA STUDENTS AWARDED MAORI FELLOWSHIPS

Two Victoria University biological science students have been awarded Tuapapa Putaiao Maori Fellowships by the Foundation for Research, Science and Technology (FRST).

The Fellowships have been awarded to Eli Mrkusich (22), who is studying molecular biology for his PhD, and Adele Whyte (21) who is studying human genetics for her MSc (Hons).

For his PhD Mr Mrkusich (Ngati Raukawa, Ngati Kikopiri) is developing new technologies to analyse nucleic acid. The end result will be a product which will be useful for scientists analysing DNA and RNA, especially those working in the forensic, biomedical and agricultural sciences.

Ms Whyte (Ngati Kahungunu) will join a programme in human genetics at the VUW Institute for Molecular Systematics. The programme, which is headed by Dr Geoff Chambers, uses a bank of DNA samples provided by Maori and Pacific Island volunteers. The programme has numerous applications, including improved transplant surgery, forensics and the genetics of alcohol metabolism. Ms Whyte plans to look at genetic markers that have been passed down the maternal line and test ideas about the origins of Maori and Pacific Island people.

The Tuapapa Putaiao Maori Fellowships Scheme supports Maori students in post-graduate study and research programmes undertaken at New Zealand tertiary institutes. Preference is given to institutions considered able to provide effective academic and cultural support for Maori students.

Mr Mrkusich's and Ms Whyte's success means that there are now four Tuapapa Putaiao Maori Fellows at Victoria. Nationally, nine Fellowships were awarded for 2000.

3M NEW ZEALAND WINS PRESTIGIOUS ENVIRONMENTAL AWARD

Auckland manufacturer and importer, 3M New Zealand demonstrated a commitment to innovation and the "triple bottom line" of environmental, social and financial wealth creation by winning the prestigious Deloitte Management Environmental Award 1999.

To win, 3M met or exceeded the following requirements:

- a commitment to superior environmental performance;

- performance measurement in both quantitative and qualitative terms; and
- value added for shareholders and stakeholders;

thus demonstrating the company's commitment to the principles of the international chemical industry's *Responsible Care* programme.

The multi-national company was one of the first manufacturing companies in New Zealand to demonstrate continuous improvement in safety and environmental performance standards.

Since the early 1990s, the company has recycled all office waste, water, cardboard, plastics and glass, giving estimated savings of nearly 10,000 paper sheets by using electronic mail and over 7000 sheets by using voicemail every month.

In 1994, 3M New Zealand initiated a water conservation programme which reduced water use by 65%, and a \$1.3 million system at its Glenfield plant, recovers and recycles 90% of the solvents used in manufacturing.

In 1996, the company gained a Highly Commended Award for its energy reduction initiatives and in the past 18 months, the 3M 'Pallet Programme' has recycled more than 80 tonnes of wood.

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Patent Proze

by Jane Calvert and Greg Lynch

THE SWISS-STYLE CLAIM SAGA – IS THIS THE END?

You may recall that in earlier issues of *Patent Proze* (see *Chemistry in New Zealand* 61, 1 (January 1997) and 61, 4 (July 1997) and 63, 2 (March 1999)) we discussed a change in New Zealand patent practice in relation to the protection of pharmaceutical inventions using "Swiss-style" patent claims. The issue of whether or not these claims should be allowed in New Zealand has been dragged through the courts in New Zealand where Pharmac has battled against the Commissioner of Patents and more than 20 of the world's leading pharmaceutical companies.

A landmark decision, *Pharmaceutical Management Agency Limited (Pharmac) v Commissioner of Patents* CA56/99, issued from the Court of Appeal on 17 December 1999. In its decision, the Court of Appeal dismissed Pharmac's appeal from the earlier High Court decision and endorsed the patentability of Swiss-style claims.

Five Judges heard the case and the decision was unanimous. In legal terms this represents a very strong result. Often there is some dissent amongst a bench of five Judges and one or two dissenting judgments can provide avenues for further appeal. The time period for Pharmac to lodge an appeal from the decision to the Privy Council has expired and it now seems likely that this may mean the end of the saga that has run for approximately 3 years.

The decision is favourable for scientists and companies involved in research to

find new medical/pharmaceutical uses for compounds already known to have pharmaceutical properties.

Swiss-style claims allow those involved in such research to obtain patent protection in return for the often substantial investment required to commercialise a new pharmaceutical use of a compound.

As an illustration, thalidomide, a known and indeed infamous pharmaceutical compound, has recently been used in Australia with unexpected but significant effects in the treatment of brain tumours. A Swiss-style claim makes possible patent protection covering the new use of thalidomide in making a pharmaceutical product for the treatment of brain tumours.

The rationale behind Pharmac's concern was that to allow patent protection for a known pharmaceutical, which was then found to have a new pharmaceutical use, a patent monopoly covering the pharmaceutical would be extended and the price for that pharmaceutical would therefore be kept high. However, it must be kept in mind that with a Swiss-style claim patent protection is provided for the known pharmaceutical compound only when it is used to manufacture a pharmaceutical for the new pharmaceutical use. Any original or existing patent protection for the active compound and original pharmaceutical preparation will still expire at the end of its 20 year patent term.

The Court of Appeal decision represents a pragmatic approach to a complicated issue by encouraging

ongoing investment in pharmaceutical research. The reward of a patent monopoly in return for investing in such research will now be attainable in New Zealand in most instances. This has to be seen as positive for New Zealand in that pharmaceutical companies will consider it worthwhile to sell and market the latest pharmaceutical products here. Otherwise, there could have been a risk that the availability of the latest developments in pharmaceuticals would be seen to diminish here. New Zealand patent law is now in line with the approach to this area of technology that has been taken in most other countries.

We understand that there are approximately 800 patent applications in New Zealand that have been "put on hold" over the last few years awaiting the finalisation of this matter. These applications will be applications that are likely to benefit from the Court of Appeal decision. The 800 or so applications represent considerable research dollars and provide an indication as to how much research does in fact go on in the drive to find new therapeutic uses for known pharmaceuticals.

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

Patent Proze
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Internet: www.bswip.co.nz



Jane Calvert

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



Greg Lynch

Bugs, Metals and Weighing Machines

By Bill Henderson, Department of Chemistry, University of Waikato, Private Bag 3105, Hamilton
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1. Introduction

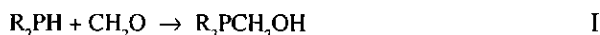
This paper gives an overview of some of the research carried out by the author and co-workers at the University of Waikato, and presented in the Easterfield lecture at the NZIC conference held at Victoria University of Wellington, November 1999. Three main areas have been under investigation, namely:

- (i) the chemistry of organophosphorus compounds, especially hydroxymethylphosphines;
- (ii) the metallacyclic chemistry of platinum, and more recently, gold;
- (iii) electrospray mass spectrometry applied to inorganic chemistry.

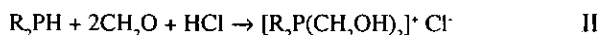
2. Chemistry of hydroxymethylphosphines

2.1 Background

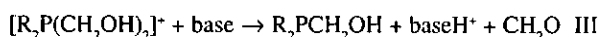
For some time we have been interested in hydroxymethylphosphines which contain P-CH₂-OH functional groups. These are easily synthesised, by the reaction of a phosphine containing a P-H bond (i.e. PH₃, a primary phosphine RPH₂ or secondary phosphine R₂PH) with formaldehyde, equation I.



However, a more convenient method for synthesising and handling these compounds is to react the phosphine with excess formaldehyde and a mineral acid, e.g. equation II.



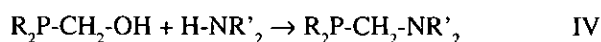
The resulting hydroxymethylphosphonium salts are completely air-stable, and generally crystalline, unlike the hydroxymethylphosphines, many of which can be slightly air-sensitive. The phosphonium salts are then readily converted into the hydroxymethylphosphine by the removal of a CH₂OH group, which occurs by simply treating with a mild base (such as triethylamine), equation III.¹



One phosphine of particular interest is tris(hydroxymethyl)phosphine, P(CH₂OH)₃. The properties of this water-soluble and reasonably air-stable phosphine contrast markedly with other trialkyl phosphines such as P(CH₃)₃, which is a very air-sensitive, odorous compound. The precursor phosphonium salt [P(CH₂OH)₄]⁺Cl⁻ is manufactured industrially (by reaction of PH₃ with formaldehyde and HCl) on the thousands of tonnes per annum scale in Europe and North America, and is used primarily for the manufacture of flame retardants.¹

In view of the low cost and trifunctional nature of P(CH₂OH)₃, we are investigating its chemistry with a view to developing new applications.

Hydroxymethylphosphines have quite a varied chemistry; the CH₂OH groups can be added and removed (as mentioned above), and the OH group can be derivatised in various ways. Perhaps one of the most versatile reactions is the Mannich-type condensation reaction with NH₃, or a primary or secondary amine, equation IV.



This reaction occurs spontaneously at room temperature, and the resulting P-CH₂-N linkage is extremely resistant towards hydrolysis. Industrially, the reaction is used to prepare flame-retardant polymer treatments for cotton.

2.2 Enzyme immobilisation

We have been using the condensation reaction in equation 4 to immobilise enzymes onto solid supports containing amine groups. Starting with an amine-containing surface (such as the aminopolysaccharide chitosan, derived from chitin, a component of crab shells, or aminopropyl-functionalised silica gel), the solid is simply washed with excess P(CH₂OH)₃ solution,² and then with the desired enzyme, which reacts through surface amine groups, to form the immobilised enzyme shown schematically in Figure 1. The reaction of P(CH₂OH)₃ with polyamines leads to condensation polymers still containing P-CH₂OH groups, which can be used to immobilise enzymes; these polymers can be obtained as solids, or cast in the form of thin films, depending on the amine and mole ratio of phosphine to amine used.³

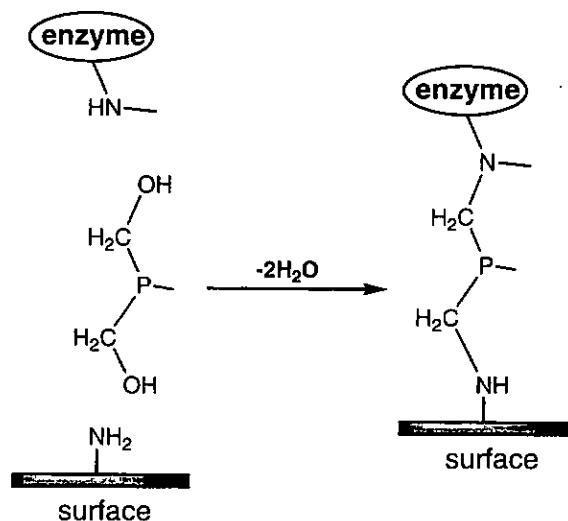
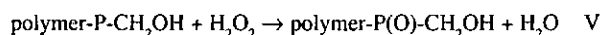


Figure 1. An enzyme immobilised onto an amine-containing surface, by formation of P-CH₂-N linkages using P(CH₂OH)₃.

We have immobilised several enzymes using this phosphine coupling technique, including urease⁴ and alcohol dehydrogenase.⁵ The method is particularly suitable for immobilisation of thermophilic enzymes, which occur in organisms living in hot environments, such as geothermal pools. Thermophilic enzymes are thermally denatured much more slowly than the enzymes in mesophilic organisms (which grow at ambient temperatures) and because they operate at high temperatures they are of much interest as catalysts in a wide range of applications. The robustness of the P-CH₂-N linkage towards hydrolysis is ideal for the immobilisation of the thermophilic enzymes, and we have compared the activity of a thermophilic β -glucosidase immobilised using P(CH₂OH)₃ and using the traditional immobilisation reagent glutaraldehyde.⁶ In all cases, the enzyme immobilised using (PCH₂OH)₃ gives significantly improved stability and activity of the immobilised enzyme.

The presence of active coupling groups when P(CH₂OH)₃ is used can easily be determined. The support, activated by P(CH₂OH)₃, is simply washed with a solution of Ni²⁺ ions; if phosphine groups are present they will form nickel-phosphine complexes. When these have a square-planar geometry they are deep orange in colour, giving a simple colourimetric test for determining the presence and number of coupling groups on the surface. The coupling groups can be easily deactivated by oxidation using hydrogen peroxide, or some other oxidising agent, which converts the hydroxymethylphosphine to its oxide, equation V.



Contrasting with the phosphine, the hydroxymethylphosphine oxide functional group is *unreactive* towards amine groups.

The use of P(CH₂OH)₃ is not restricted to enzyme immobilisation, and we have found that it is also possible to immobilise whole *E. coli* cells. These have surface amine groups which react readily with immobilised P(CH₂OH) groups.⁷

2.3 Ferrocene-derived hydroxymethylphosphines

The organometallic compound ferrocene **1** is a very useful species to incorporate into molecules, because it exhibits a superb one-electron oxidation-reduction cycle, which can act as an 'electrochemical handle' on the molecule of interest. Ferrocene-phosphines are attracting a large amount of interest in areas such as catalysis, but before our work, no hydroxymethyl derivatives had been prepared. We have synthesised a range of

compounds of this type, typified by **2**, which is crystalline and completely air-stable.⁸

When **2** is treated with a formaldehyde-abstracting reagent such as sodium metabisulfite, the primary phosphine **3** is obtained.⁹ Surprisingly, this is completely

PH₂ air-stable, and can be synthesised and sublimed in air with no oxidation occurring. Most primary alkylphosphines are highly toxic, air-sensitive, often pyrophoric substances, with noxious odours, so **3** is a potentially very useful compound for facilitating the further development of primary phosphine chemistry.

The crystal structure of **3** (Figure 2) gives no clues to its air stability, since the PH₂ group appears to show no contacts with either the Fe atom or another PH₂ group. In preliminary studies carried out thus far, **3** seems to show the same type of chemical reactivity towards metal complexes as do other primary phosphines, but a detailed comparison has not yet been carried out.

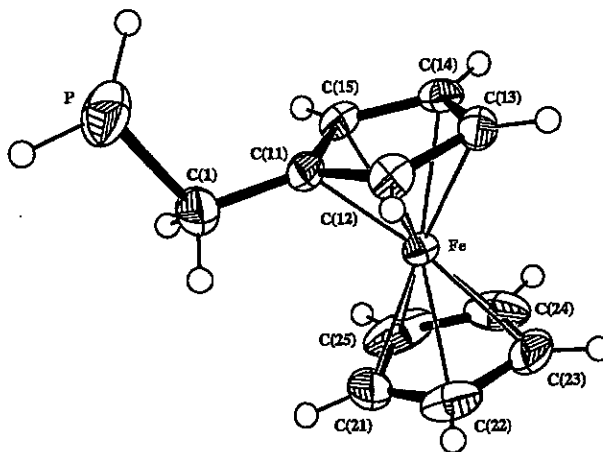


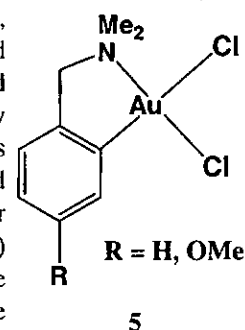
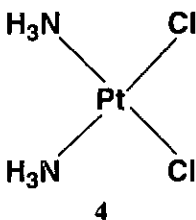
Figure 2. Molecular structure of the air-stable primary phosphine **3**, determined by X-ray crystallography. (From ref. 9, copyright Royal Society of Chemistry).

3. Metallacyclic chemistry of platinum and gold

3.1 Introduction

The chemistry of platinum(II) complexes is extensive; such compounds are typically very stable, and the presence of the (spin-1/2) ¹⁹⁵Pt nucleus provides much information in NMR spectroscopic analysis. Gold(III) is isoelectronic with platinum(II), both being d⁸, and invariably forming complexes with a square-planar geometry. However, the chemistry of gold(III) is less well established than that of platinum(II). In part, this is because simple compounds of gold(III) [e.g. AuCl₄⁻] are more strongly oxidising than the analogous platinum(II) compounds [i.e. PtCl₄²⁻]. Gold also provides less information than platinum in NMR experiments. One of the major driving forces behind the development of platinum(II) chemistry is the anticancer activity of

many platinum(II) complexes, typified by *cisplatin* **4**, widely used in the treatment of testicular and ovarian cancers.¹⁰ There is currently a search for gold(III) complexes which might show different, and ideally improved, anticancer activity compared to platinum(II) complexes. Compounds of the type **5** are attracting much interest in the

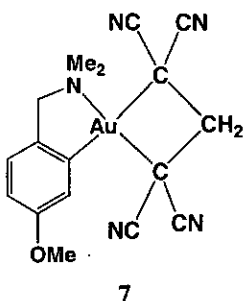


literature, because the cyclometallated dimethylbenzylamine ligand enforces a *cis* geometry at the gold centre, and stabilises the gold(III) oxidation state, reducing its oxidising power. Complex **5** (R = H) has been found to show good anticancer activity.¹¹

Our interests in the chemistry of platinum and gold are mainly in the area of metallacyclic chemistry - the chemistry of ring systems which contain a metal atom.¹² Small-ring metallacycles are important intermediates in many metal-catalysed reactions of organic molecules, and there is also interest in the fundamental properties of such ring systems. While there is an extensive metallacyclic chemistry of platinum(II), few gold(III) metallacycles are known. We have found that platinum(II) and gold(III) show both similarities and differences in their metallacyclic chemistry, and these will now be outlined.

3.2 Metallacyclobutane complexes

The metallacyclobutane ring system **6** is a very important one; metallacyclobutanes of the majority of transition metals, and several main group and actinide metals have been studied. As a result of the stability of platinacyclobutanes, many studies on their chemistry have been reported.¹³ In

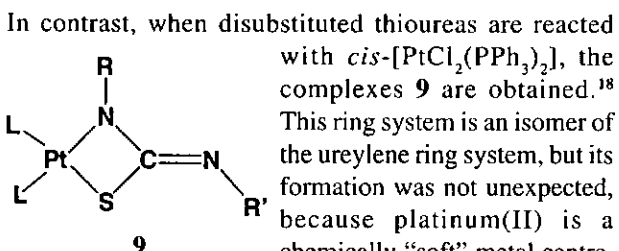


contrast, no auracyclobutanes were known before our work. We have prepared the first auracyclobutane complex **7** by reaction of the precursor complex **5** (R = OMe) with (NC)₂CH-CH₂-CH(CN)₂ in the presence of Ag₂O in dichloromethane.¹⁴ Under these

mild conditions, Ag₂O acts as a halide-abstracting reagent and as a base, forming AgCl and H₂O as byproducts.

3.3 Ureylene and thiourea complexes

We have also been investigating the chemistry of the ureylene ring system **8**, and have prepared a range of analogous platinum(II)¹⁵ and gold(III)¹⁶ ureylene complexes by reaction of a disubstituted urea with a metal dihalide complex, either *cis*-[PtCl₂L₂] or **5**, in the presence of Ag₂O. Overall, the structures and chemistry of the platinum and gold complexes appears to be quite comparable.^{16,17} The structure of one gold complex formed from diphenylurea, determined by X-ray crystallography, is shown in Figure 3.



In contrast, when disubstituted thioureas are reacted with *cis*-[PtCl₂(PPh₃)₂], the complexes **9** are obtained.¹⁸ This ring system is an isomer of the ureylene ring system, but its formation was not unexpected, because platinum(II) is a chemically "soft" metal centre, and prefers to bond to soft, polarisable ligands, containing S (and also P, As, Se etc.) donor atoms. However, when the gold complexes **5** are reacted with MeNHC(S)NHMe

and Ag₂O, the related gold-thiourea ring systems are not obtained. Instead, thiourea desulfurisation occurs, giving complex gold-silver-sulfide-halide aggregate cations.¹⁹ The structures of several cations have been determined by X-ray crystallography, and part of the structure of one complex is shown in Figure 4.

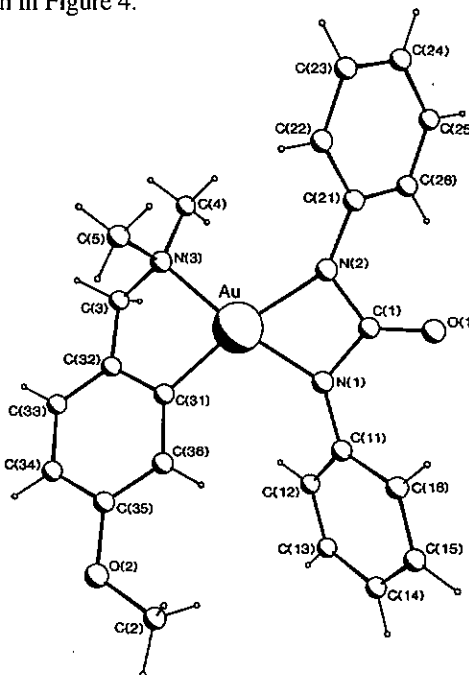


Figure 3. Molecular structure of a gold-ureylene complex, containing the four-membered Au-NPh-C(O)-NPh ring system. (From ref. 16, copyright Elsevier Science).

These cations contain three Au(μ-S)₂Au four-membered rings (with each gold still ligated by the cyclometallated N,N-dimethylbenzylamine ligand). The sulfur atoms are coordinated to silver ions which are themselves bridged by chlorides from the original gold(III) complex. This behaviour is reminiscent of the behaviour of the isoelectronic platinum(II) system, in the form of the "metalloligand" complex (Ph₃P)₂Pt(μ-S)₂Pt(PPh₃)₂. The coordination chemistry of this complex towards other metal centres has been extensively developed primarily by Andy Hor and co-workers in Singapore.²⁰

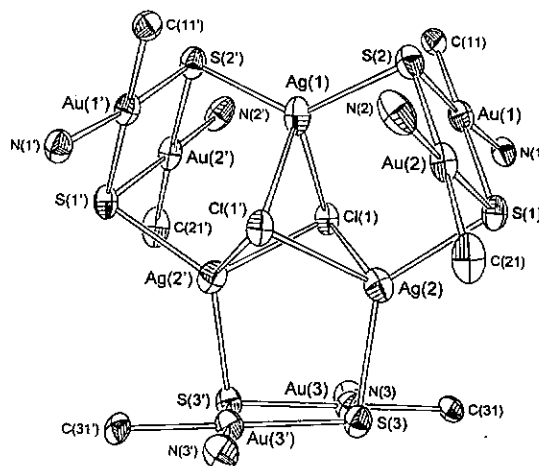


Figure 4. Molecular structure of part of the large aggregate cation [LAu(μ-S)₂AuL]₃Ag₃Cl₂⁺ formed by the reaction of MeNHC(S)NHMe with complex **5**. The cyclometallated benzylamine ligands (L) are omitted for clarity, except for the gold-bonded N and C atoms. (From ref. 19, copyright Elsevier Science).

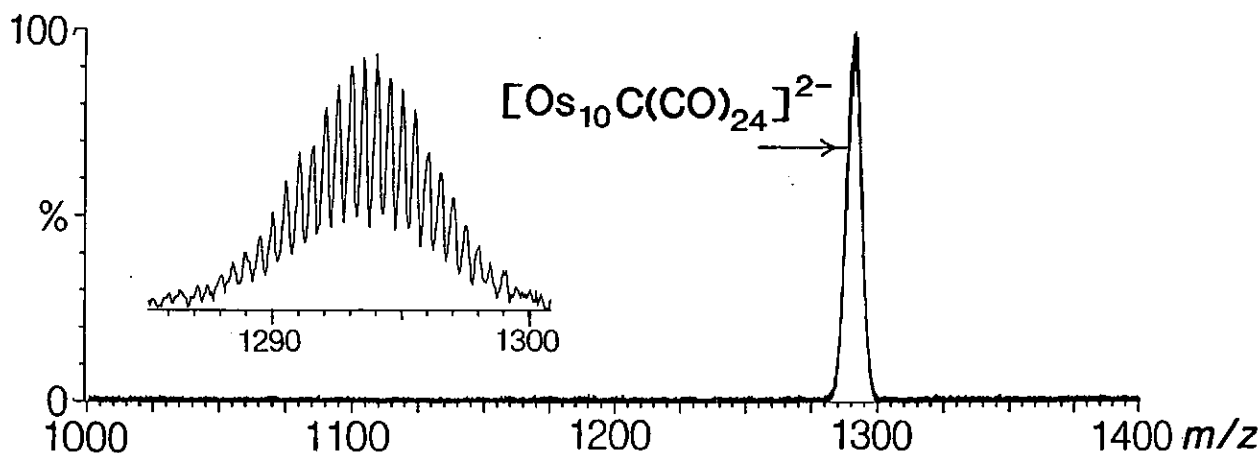


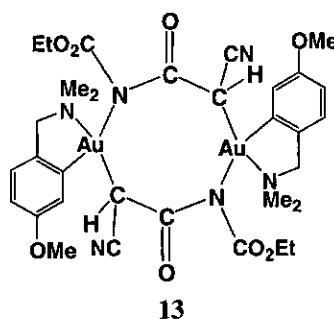
Figure 5. Negative-ion electrospray mass spectrum of the anionic osmium carbide cluster $[\text{Os}_{10}\text{C}(\text{CO})_{24}]^{2-}$. The inset shows the isotope distribution pattern. (Modified from ref. 28, copyright Royal Society of Chemistry).

3.4 Metallalactam complexes

The metallalactam ring system **10** is another situation where platinum and gold show somewhat different behaviour. We have prepared a range of platina- and pallada-lactam complexes by the same Ag_2O method as described above,²¹ including the

complex **11** derived from N-cyanoacetylurethane $\text{NCCH}_2\text{C}(\text{O})\text{NHCO}_2\text{Et}$.²² When the gold complex **5** ($\text{R} = \text{OMe}$) is reacted under analogous conditions,

the initial product formed is the auralactam **12**. However, on standing in solution, a dimerisation reaction occurs, giving the eight-membered ring complex **13**.²³ Such a dimerisation reaction has never been observed before in platinum chemistry, and is most



likely attributable to the higher lability of the gold(III) centre compared to platinum(II), together with the extreme insolubility of the eight-membered ring product **13**.

4. Electrospray mass spectrometry (ESMS)

4.1 Introduction

Our interests in mass spectrometry derive from the desire to simply and reproducibly characterise coordination and organometallic complexes, in the form of mass spectra which (under easily changed conditions) give both molecular weight and structural information. The technique of ESMS is well-suited for this purpose. Since its initial beginnings in biochemistry and polymer chemistry, there is now an exponential growth in usage by inorganic chemistry. We have summarised the applications of ESMS in organometallic chemistry in a recent review,²⁴ and here some highlights of our own work

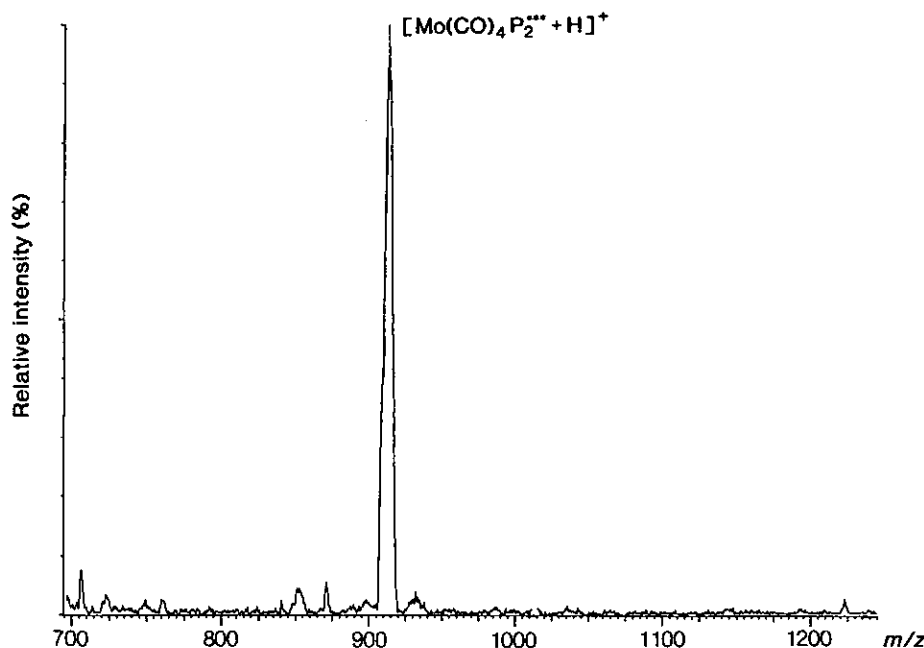


Figure 6. Positive-ion ESMS spectrum of the complex $[\text{Mo}(\text{CO})_4\{\text{P}(\text{C}_6\text{H}_4\text{OMe-p})_2\}_2]^+$, demonstrating the utility of the 'electrospray-friendly' phosphine ligand **14**.

will be presented. The more widespread usage of ESMS in inorganic chemistry has been reviewed elsewhere.²⁵

The principles of operation of the ESMS technique are quite simple - a sample is dissolved in a suitable solvent (often a protic solvent such as an alcohol, or an acetonitrile-water mixture), and sprayed through a fine steel capillary held at a high potential, assisted by nitrogen gas. This produces a spray of charged liquid droplets, which are then evaporated to produce gas phase ions. These are accelerated by applying a *cone voltage*, which determines the amount of fragmentation observed. The ions are then observed by a suitable detector, e.g. quadrupole mass analyser. For charged species, 'ionisation' generally simply involves transfer of ions from the solution to the gas phase, though the charge density of the ion (as well as the cone voltage) is important in determining whether or not fragmentation is observed. Neutral compounds (M) containing basic N or O atoms with lone pairs of electrons generally ionise by association with a proton (or some other cation) giving $[M + H]^+$ ions.²⁶

4.2 Metal carbonyl compounds

In our experience the majority of inorganic and organometallic compounds give good ESMS spectra. As an example, the negative-ion spectrum of the osmium carbide cluster $[Os_{10}C(CO)_{24}]^{2-}$ is shown in Figure 5; the spectral simplicity can be clearly seen, together with the characteristic 0.5 *m/z* splitting of adjacent peaks in the isotope pattern, characteristic of a doubly-charged ion (natural osmium has 6 isotopes, so a complex pattern is seen).

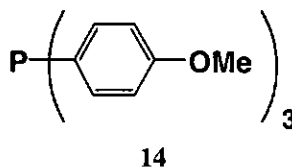
However, there remain a number of types of "difficult" compounds, which give either few, or no ions in their ESMS spectra. We are particularly interested in the challenge of such compounds since they provide an opportunity to use the principles of inorganic and organometallic chemistry in order to furnish charged derivatives suitable for mass spectrometric analysis.

One such class of compound are the neutral metal carbonyls. In conjunction with my colleague Professor Brian Nicholson, and graduate student Scott McIndoe, we have developed several complementary ionisation techniques for analysing such compounds. By dissolving the compound (M) in an alcohol (ROH) and adding a trace of the sodium alkoxide (RONa), nucleophilic attack of RO⁻ at a coordinated CO ligand occurs, giving $[M + OR]^-$ ions which are readily detected in the mass spectrum in negative ion mode.^{27,28} This method is rapid, convenient, and is successful for the majority of metal carbonyl complexes. It is not successful when the complex is very electron-rich; in such cases a complementary ionisation technique involving addition of Ag⁺ ions in MeCN solution can give $[M + Ag(MeCN)]^+$ ions.^{28,29}

4.3 'Electrospray-friendly' ligands

In an alternative approach we are developing the concept of 'electrospray friendly' ligands for widespread use in coordination and especially organometallic chemistry, which will facilitate the analysis of products and reaction mixtures by ESMS. As an example, ligands such as

triphenylphosphine, PPh₃, are ubiquitous in organometallic chemistry, but when coordinated to a metal centre, provide no sites for ionisation by protonation. In the absence of any other ionisation sites (coordinated CO ligands cannot be protonated), such (neutrally-charged) compounds will be invisible in the electrospray spectrum. We have investigated the use of analogues of triphenylphosphine, containing protonatable OMe or NMe₂ groups (in *para* positions on one or more phenyl rings), e.g. **14**.³⁰ While compounds such as $[Fe(CO)_4(PPh_3)]$ and $[Ru_3(CO)_9(PPh_3)_3]$ give no ions in their ESMS spectra, the analogous complexes containing substituted ligands give strong $[M + H]^+$ ions. As an example, the



positive-ion ESMS spectrum of the complex $[Mo(CO)_4\{P(C_6H_4OMe-p)_3\}_2]$ (containing ligand **14**) is shown in Figure 6. In contrast, the triphenylphosphine analogue $[Mo(CO)_4(PPh_3)_2]$ gives no ions. This approach should be widely applicable in many organometallic systems, and we are now extending our studies to electrospray-friendly thiolate and isocyanide ligands.

4. Acknowledgements

I am indebted to the many co-workers who have contributed to the various research projects. In particular, for the work summarised here, I wish to thank Dr Helen Petach, Professor Roy Daniel, Paul Oswald, Fiona Cochrane, Kwabena Sarfo and Nick Goodwin for their work on hydroxymethylphosphines, Maarten Dinger and Allen Oliver for their work on metallacyclic chemistry, and Corry Decker and Scott McIndoe for their work on the ESMS projects. I am indebted to Professor Brian Nicholson with whom many ESMS projects are carried out, and for his many X-ray crystal structure determinations and helpful discussions. Associate Professors Cliff Rickard and George Clark (Auckland), Professor Ward Robinson (Canterbury), Drs John Fawcett and David Russell (Leicester) are also thanked for crystal structure determinations. The University of Waikato, the New Zealand Lottery Grants Board, Albright & Wilson Ltd, The Cancer Society of New Zealand and Johnson Matthey plc are thanked for their financial support.

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3. Measurement of Emulsion Particle Size. Methods Compared
4. Development of a research emulsion reactor
5. Modelling Emulsion Kinetics
6. Cross-Linking Emulsion Adhesives
7. Thermomechanical and Conventional Testing of Wood Adhesive Joints
8. Bench Mark Properties of Wood Adhesive Chemistries
9. Theoretical and Practical Aspects of the Glass Transition
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Environmental Issues

DIOXIN STUDY RESULTS RELEASED

A series of high-profile dioxin media stories has heightened interest in ESR's recently completed national study on organochlorine levels in New Zealander's blood.

First results of the study showed no difference in levels between the sexes or between Maori and non-Maori ethnic groups. Small differences were apparent between the regions: people living in the Waikato/Bay of Plenty area or the Auckland/Northland region appear to have slightly higher levels of dioxins in their blood than those in the lower North Island or the South Island. This may be due to greater industrialisation and higher population density in the North Island.

The geographical trend found for dioxins reversed for DDE (a metabolite of DDT). The highest DDE levels were found in the lower North Island and the South Island regions, reflecting historic agriculture usage patterns of DDT in those areas.

The serum study was part of the Ministry for the Environment's Organochlorines Programme. Initial results have been presented around the country in the programme's consultative roadshow.

"Dioxin" is a generic name sometimes given to a family of 210 chemicals, more precisely known as polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). These chemicals are unwanted by-products of a number of combustion and industrial processes.

Dr Michael Bates, ESR Principal Scientist and environmental epidemiologist, believes the serum study may be the world's first population-based organochlorine survey conducted at a national level. Previous studies from other countries have dealt with particular urban, ethnic, regional or labour force demographics.

The serum study was designed to establish baseline blood-level reference values for dioxins, polychlorinated biphenyls (PCBs) and persistent organochlorine pesticides across the New Zealand population. These baseline levels will be used to develop national environmental standards for these substances, which is the ultimate aim of the Organochlorines Programme.

The programme involves a series of scientific investigations to determine levels of organochlorines in the New Zealand population and environment. The analysis of serum samples was carried out by the Centres for Disease Control and Prevention (CDC) in the United States, regarded as the leading laboratory in the world for this type of analysis.

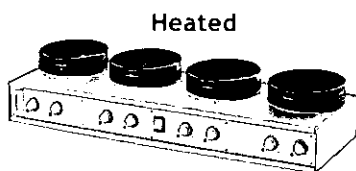
Historically, dioxins have been released from bleaching processes in the pulp and paper industry, emissions from some chemical industries (including metal smelting industries, and hospital and waste incinerators), the use of some pesticides and timber treatment chemicals, and the burning of leaded petrol.

Government regulation over the last decade or so has seen a marked decrease in industrial dioxins, and the Ministry of the Environment's directory of emission sources shows that the bulk of dioxin pollutants are now released by domestic sources. These sources include the uncontrolled burning of domestic fires and backyard incinerators (especially if it involves driftwood or PVC plastic), tobacco smoking and car exhausts. Controlling dioxin levels from non industrial sources will be difficult, says Dr Bates.

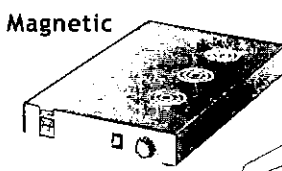
"Industry has cleaned up its act up quite a bit. To reduce domestic emissions would require substantial lifestyle changes".

Dr Bates says that dioxins are known to cause diseases in animals at extremely low levels. Research into what it does to the human body is inconclusive, but suggests that humans may be relatively resistant to at least some of the

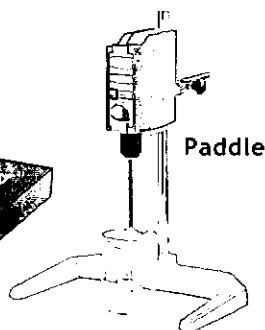
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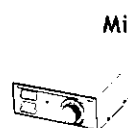
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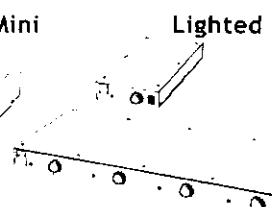
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effects that occur in experimental animals. However, the International Agency for Research on Cancer (IARC) has recently concluded that dioxins are human carcinogens (causes of cancer). Dr Bates says that there is more work to be done in looking at potential effects on humans, particularly on the reproductive process.

Dr Bates welcomes the rigorous attention given to the issue by scientists and the media. Three recent stories have put dioxins in the spotlight. First, a prime ministerial inquiry failed to find conclusive links between exposure of Vietnam veterans to Agent Orange and health problems suffered by their children. Then dioxins and PCBs were discovered in Belgian poultry and dairy and meat products. Most recently, the British World Wide Fund for Nature (WWF) issued a report stating that hundreds of potentially toxic substances, including dioxins, were found in human breast milk.

Dr Bates says that while there is an obvious need to monitor and report such findings, the public should recognise that it is "important to look at the actual levels of dioxins, and what they mean." He says modern analytical methods can detect dioxins at extraordinarily low levels - such that they can be found "practically anywhere".

Ten years ago Dr Bates was involved in an investigation into organochlorine levels in the breast milk of New Zealand women. This study found levels of dioxins and PCBs that were generally low compared to other developed countries. Breast milk is a good medium to study, because it contains a lot of fat, in which organochlorine substances are generally found.

The breast milk study contains the only systematically collected historical data on dioxin and other organochlorine levels in New Zealanders. For this reason, Dr Bates and ESR are now conducting another, similar study (funded by the Ministry of Health), intended to establish whether government measures of the last decade have reduced levels in the bodies of New Zealanders. Dr Bates doesn't expect levels to have gone up, and says it is likely that they will have fallen.

NEW SOLUTION TO A TYRESOME PROBLEM?

Each year millions of used tyres are added to the vast numbers that already fill the world's rubbish dumps.



Now a new and innovative recycling process has been developed by Goodyear, the world's largest tyre manufacturer, that may allow recovery of the natural rubber from scrap tyres.

Rubber in its natural state is too soft and too sticky to be used for the manufacture of tyres, so it must be vulcanised first. Charles Goodyear invented the process of vulcanising natural rubber by mixing it with sulfur and baking it some 160 years ago.

The process of extracting the natural rubber from used tyres (devulcanisation) has been attempted by many methods including pyrolysis, ultrasonics, microwaving, cryogenics and extraction with organic solvents, but with limited success.

But researchers Larry Hunt and Ron Kovalak working at Goodyear's headquarters in Akron, Ohio, USA have discovered that supercritical 2-butanol (at temperatures of 150-300 °C and pressures of 1000-1500 psi) exhibits the right solvation properties to break the carbon-sulfur and sulfur-sulfur cross-links formed during vulcanisation, allowing separation of the rubber molecules from the oil, carbon black and sulfur present in the tyre compound.

The extracted rubber is almost identical to virgin rubber according to microstructural analyses and molecular weight tests and can therefore be compounded, cured and used to make new products. Hunt and Kovalak's technique has achieved up to 80% recovery rates in laboratory tests (US Patent 5891 926). Goodyear says it is too early to say if the process will be commercialised but the cost savings of recycling used tyres could be enormous (US\$800 million per annum in the USA alone!).



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Book Review

NEW ZEALAND IS DIFFERENT CHEMICAL MILESTONES IN NEW ZEALAND HISTORY

*Edited by Denis Hogan and Bryce Williamson
Clerestory Press, Christchurch, 1999
ISBN 0-9583706-3-X*

The New Zealand Institute of Chemistry is to be congratulated in commissioning this splendid chemical history. At this time of year we are flooded with lists of books that form the summertime reading of writers, politicians and media celebrities. Rarely is a work of science included, yet this is a book that could well have appeared on some of these lists. In it there are elements of social history and political and commercial skulduggery, twists and turns typical of the best detective stories, all interwoven with true-life tales about some of New Zealand's outstanding chemists – and written in a style that can easily be understood by the lay as well as the scientific reader. For the 26 essays in *New Zealand is Different* are written by people who not only understand their research (and were often at the centre of the work they describe) but who know how to communicate that work with great clarity and flair.

The book is dedicated to the memory of the late John Pollard and his opening essay sets the scene. New Zealand's chemical problems have not been the same as those of other countries, originating as they do from the country's unique geology and geography. From the earliest days, politicians and administrators, dubious of home-grown expertise, have demanded reassurance from overseas experts. Too often these have come, given their advice, taken their fee and departed, leaving it to the New Zealand chemists and chemical engineers to discover and solve the real problems.

In earlier days, most of the research needed was done in Government research institutions like the DSIR, with little being done by industry or funded privately. Denis Hogan traces the evolution of such institutions from the days of the Colonial Museum through to the creation of Crown Research Institutes in 1991. Since the formation of the CRIs, and perhaps because of the market-driven philosophy that underpins their operations, it has become fashionable to disparage the achievements of the DSIR. Denis Hogan suggests it is too soon to tell whether the new system will produce better science for New Zealand; but one doubts whether the achievements recorded in this book would have been possible under the present system of research funding. In his essay, he pays tribute to Sir Ernest Marsden who had worked with Rutherford at Manchester, and who became head of the DSIR aged 37. One of Marsden's lesser-known initiatives led to the establishment of the Defence Scientific Corps, which allowed many New Zealand scientists and engineers to gain research

experience, generally overseas, and a doctoral degree, then brought them back home so that New Zealand could profit from their expertise. Essayists Dick Earle, Lester Davey and Doug Wright were among the many who benefited thus.

Each essay contains enough information to whet the appetite and plenty of references to allow the interested reader to go further. Abstruse technical detail is kept to a minimum and what there is, is contained in "information boxes" that can (but really shouldn't) be omitted on a first reading. While the essays stand alone, there are common themes and cross-linkages. John Walker (who will be known to many readers as the affable vegetable gardener on the Maggie Barry show) gives an erudite account of the significance of rye-grass and clover-based pastures to our economy, and the importance of superphosphate as a fertiliser. Superphosphate production was New Zealand's first major chemical process industry, and Des Higgins talks of the difficulties the manufacturers faced in handling the raw materials available to them.

Our climate, so good for pasture growth and animal production, has a downside. Doug Wright traces the fifty years of research carried out to try and understand and control facial eczema. Norm Clare meanwhile, relates the bush-sickness saga, where cobalt deficiencies in North Island volcanic soils produced strange effects in grazing animals. In 1966, he estimated that the increase in national income through solving the bush-sickness problem more than paid for all agricultural research done in New Zealand up to that time. Stuart Letham's account of the discovery of cytokinins and their influence on plant development and growth typifies the ability of New Zealand scientists to carry out high-quality research in poor working conditions and with strictly limited resources. This sort of research calls for top-flight analytical support, so it is appropriate that Owen Clinton should describe Eric Allen's work in the development of atomic absorption spectroscopy.

The Wright, Clare and Letham essays are fascinating tales of detection. So too is Ian Walker's account of what caused New Zealand wool cargoes to ignite spontaneously while being shipped to overseas markets. This is one of many examples of the way in which good chemistry can underpin and strengthen an important industry. David Fenby tells how New Zealand developments of the cyanidation process led to a resurgence in the gold industry here; while Roy Kennerley shows how chemistry made important contributions to the science of concrete-making. Lester Davey gives us another tale of detection as the chemists and biochemists of the Meat Industry Research Institute of New Zealand tried to find what made Canterbury lamb tough when it reached the British markets; Peter Robertson introduces us to Cheddarmaster, the cheesemaking system developed by the New Zealand Dairy Research Institute that has mechanised the making of the world's main cheeses; and Peter Foster and his co-authors trace the rise of the New Zealand ceramics industry and its eventual fall as prey to a combination of alternative materials and political ideology.

The commercialisation of chemistry can be fraught with difficulties, as evidenced in Gordon Leary's essay on the work of DSIR's Chemistry Division. The theme is echoed in Ian Miller's story of the growth of a local seaweed industry and, to some extent, in Con Cambie's essay on natural products from New Zealand native plants. His is a meticulous account of the work carried out in this field by university departments in particular. Lester Stonyer's tragic-comedy about the attempts to make terpineol economically from by-product turpentine interested me as I was familiar with the late Tom Hagyard's parallel efforts. I couldn't help but wonder what might have happened had the rival players, Tasman Vaccine Laboratory and AC Nottingham, combined forces. One success story, albeit on a small scale, was the wartime production of fish-liver oils to supply vitamins for the nation's infants. Joan Mattingley reminds us of products like Kariol and Karilac and people like Muriel Bell and Truby King. (Incidentally, I wondered why more women were not among the essay writers since women have always been prominent in chemistry in New Zealand).

Since 1964, when Dr Sutch described the New Zealand economy as a monoculture, with 95 per cent of the value of our exports coming from grass processed by the sheep and the cow, we have seen the growth of chemical and allied industries that are large even by world standards. It is fitting then that industrial chemists and chemical engineers should provide essays dealing with many of these industries. From a chemical engineering viewpoint, John Wood's essay on the lactose industry is particularly interesting. The redoubtable Sandys Wunsch encouraged the chemistry graduates who worked for the Lactose Company to study chemical engineering by correspondence, thereby ensuring a recognition of the importance of chemical engineering in the process industries a decade before the advent of chemical engineering teaching under Stan Siemon at Canterbury College. Forty years later, biochemical engineering under Dick Earle gave us a model for the collaboration between a university department and industry, through the establishment of New Zealand Pharmaceuticals Ltd.

Collaboration between scientists and engineers, and the private and public sectors, has been an essential component in the development of some of our most significant industries. The DSIR played a major role in fostering a geothermal power industry and promoting such

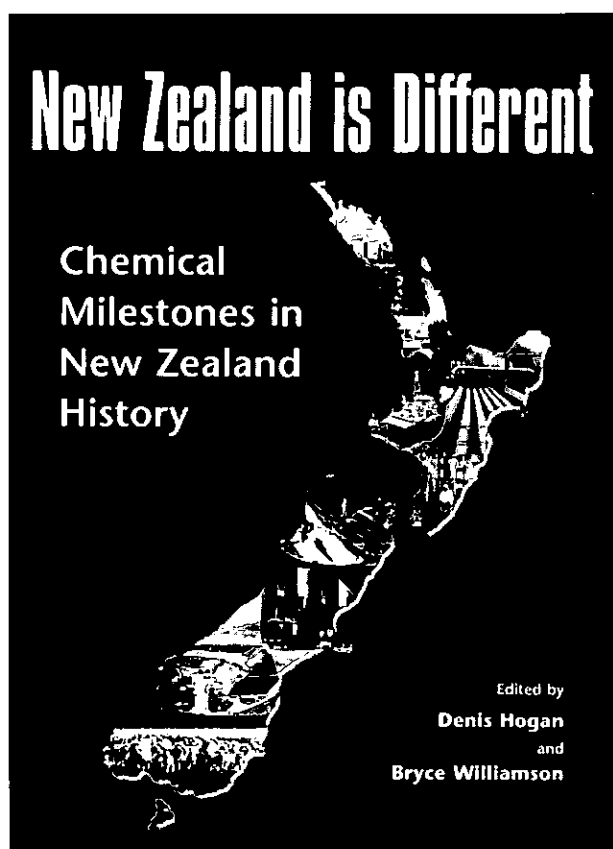
collaboration - and Jim Ellis shows how, as a consequence, New Zealand became a world leader in the understanding and utilisation of geothermal power. Without the DSIR zeolite team of Lynda Parker and her co-authors, it is problematic whether New Zealand could have successfully embarked on that most controversial of "think-big" projects, the conversion of natural gas to petrol by the untried Mobil process. Tom Marshall and Alan Wyld's saga of steel-making from New Zealand's ironsands is a classic case-study in which overseas expertise proved useless and the problems that had to be overcome to establish a successful industry were solved through the ingenuity and resourcefulness of New Zealand scientists and engineers. Much the same could be said of the solar salt industry at Lake Grassmere, a story that John Pollard details in his inimitable style. Last of all, we have one of New Zealand's greatest industrial successes - the establishment of a pulp and paper industry based on *Pinus radiata*, as told by NZ Forest Products Ltd's erstwhile chemist and, later, managing director, Alan Mackney.

What a collection of plots and authors. Appearing in the cast, from time to time, are politicians like Ward and Seddon, Dan Sullivan and Roger Douglas, Birch and Muldoon. Too often, they showed a lack of confidence in the ability and ingenuity of New Zealand's scientists and engineers, and blind faith in the overseas expert. One way to help this change would be to make *New Zealand is Different* compulsory reading for every MP, and every head of a Government department. By this means, the Government's wish to add value to New Zealand's export base might more easily be achieved. And if the high profile which

politicians are espousing for science and technology is to become a reality, copies of the book should be in every secondary school library*. Finally, readers of *Chemistry in New Zealand* will find it a snip at \$30.

Miles Kennedy
Emeritus Professor of Chemical Engineering
University of Canterbury

* Through a generous grant from the Stout Trust a copy of the book is being sent to every New Zealand secondary school. Ed.



Method 8270 For Multicomponent Analyte Analysis

Elaine A. LeMoine¹ and Herman Hoberech²

The Perkin Elmer Corporation, 761 Main Avenue, Norwalk, CT 06859, USA;

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Abstract

The identification and quantitation of multicomponent analytes (yielding more than one chromatographic peak) can be an analytical and productivity challenge.

Multicomponent analytes such as Aroclors, Toxaphene, and technical Chlordane tentatively identified by another method may be confirmed using SW846 method 8270. Alternate confirmation of a tentative identification may be made using an electron capture detector (ECD) method such as 8081 or 8082 with a second column. For instruments with sufficient sensitivity, the mass spectrometer and ECD can be used in parallel for a simultaneous tentative identification and quantification. This paper will investigate the utility of a new mass spectrometer system for the quantitative identification of a mixture of multicomponent analytes. The method will be evaluated for detection limits, linearity, accuracy, and precision. The GC-MS method will be compared with the dual column method for analytical capability, productivity, and compliance.

Introduction

While the ability to positively identify sample analytes can be accomplished with the use of two columns, it is not necessarily the most desirable of options. In many cases the confirmational column alone is not sufficient and additional clean-up procedures need to be performed to eliminate co-eluting analytes. The additional equipment and analysis time required places productivity burdens on a laboratory.

Gas Chromatography/Mass Spectrometry is widely used because it's selectivity enables positive identification without additional sample processing. Along with the ability to make qualitative determinations, GC/MS is an invaluable tool for providing quantitative results. Mass Spectroscopic methods however, are generally considered less sensitive than conventional detector methods, although sensitive enough for most applications. The analysis of multicomponent analytes, such as Toxaphene and the Aroclors is more of a challenge. EPA Method 8270C states, "In most cases, Method 8270 is not appropriate for the quantitation of multicomponent analytes, e.g., Aroclors, Toxaphene, Chlordane, etc., because of limited sensitivity for those analytes. When these analytes have been identified by another technique, Method 8270 is appropriate for confirmation of the presence of these analytes when concentration in the extract permits." [1] The development of more sensitive quadrupole mass spectrometry technology along with innovative sample

introduction techniques, allow for the quantitation of many of these analytes at levels previously not achievable. The data to follow illustrates the ability of quadrupole mass spectrometry to quantitate multicomponent analytes at these lower levels. The ability to accurately identify and quantitate using GC/MS can eliminate the need for additional confirmatory analyses and reduce the amount of sample preparation required.

Experiment Description

Identical standards were analysed using two sets of experimental conditions. A 50 mL Large Volume Injection was used in both cases. One set of standards was analysed using the GC/MS Full Scan mode (FS-50) and the second using the Selected Ion Recording mode (SIR-50). Table 1 lists the chromatographic conditions used for both experiments, while Tables 2 and 3 list the Mass Spectrometer conditions used for each set. The results are evaluated with respect to the accepted standard analytical techniques.

Table 1: Chromatographic Conditions

Perkin-Elmer AutoSystem XL	
Column:	PE-5MS 30 m x 0.25 mm; 0.25 mm film thickness
Pre-Column:	1 m x 0.32 mm deactivated fused silica
Oven Temperature Program:	55°C for 5 min., 45°C/min. to 160°C; 6°C/min to 320 °C
Programmable Pneumatic Control (PPC):	Helium 1.0 mL/min.
Programmable Split/Splitless (PSS) Injector:	55°C for 4 min.; ballistic to 250°C; Solvent Purge Mode
Injection Volume:	50 mL

Table 2A: Full Scan Mass Spectrometer Conditions

FS-50 Perkin-Elmer TurboMass Mass Spectrometer	
Mass Scan Range:	50 - 350 m/z
Scan Speed:	2.0 scans/sec
Filament Delay:	5 min.
Ion Source Temperature:	150 °C
Transfer Line Temperature:	250 °C
Ionisation Mode:	EI

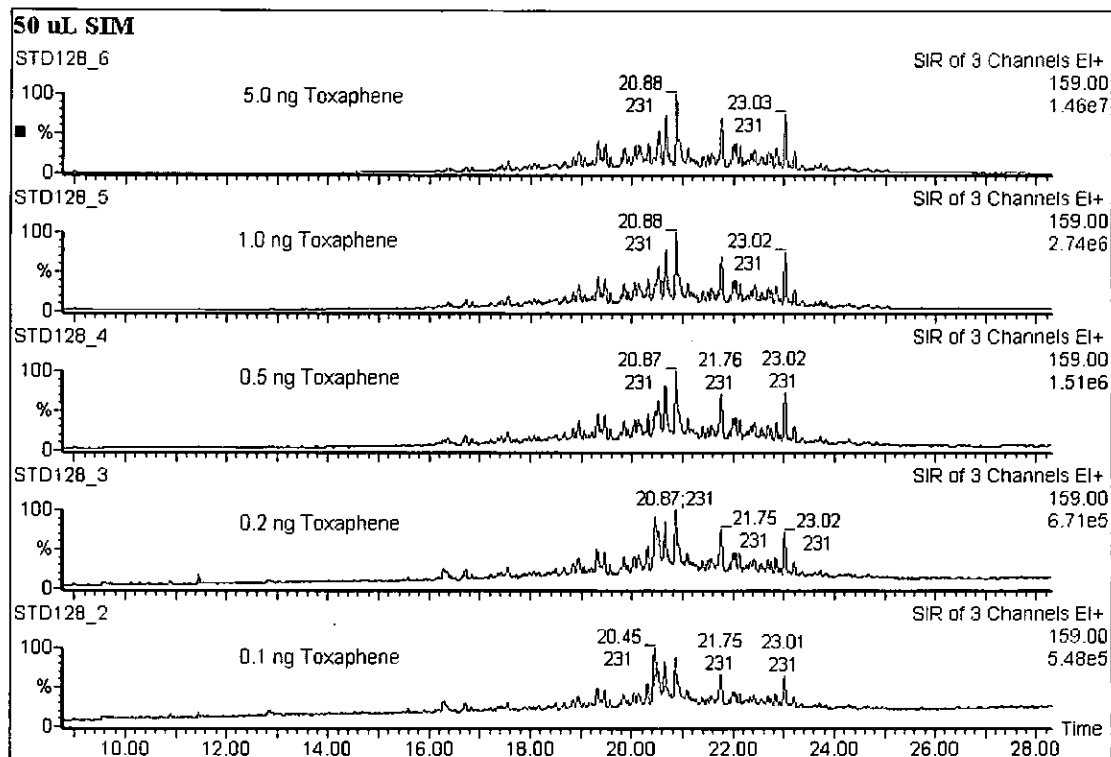


Figure 1. Calibration standards show recognisable pattern for all levels.

Table 2B: Selected Ion Recording (SIR) Mass Spectrometer Conditions

SIR-50

Perkin-Elmer TurboMass Mass Spectrometer

Selected Scan Masses: 159, 231, 233 m/z
 Scan Speed: 2.0 scans/sec.
 Filament Delay: 5 min.
 Ion Source Temperature: 150°C
 Transfer Line Temperature: 250°C
 Ionisation Mode: EI

Enhanced Sensitivity Quadrupole



- Quadrupole pre-filters prevent contamination of the analytical quadrupoles and provide enhanced sensitivity
- Turbomolecular pump for cleaner background spectra
- Large diameter analytical quads for greater sensitivity and resolution

- Low noise photomultiplier for better detection limits

Experimental Results

Toxaphene standards at 0.10 ng/mL, 0.20 ng/mL, 0.50 ng/mL, 1.00 ng/mL, and 5.00 ng/mL concentrations were analysed using both methods. The chromatograms shown in Figure 1 were obtained using the SIR mode. All the calibration standards clearly exhibit the characteristic Toxaphene pattern.

Calibration Curve using Full Scan Mode

Compound 3 name: Toxaphene-3
 Correlation coefficient: $r = 0.999812$, $r^2 = 0.999624$
 Calibration curve: $674.670 \cdot x + 79.0644$
 Response type: External Std, Area
 Curve type: Linear, Origin: Exclude, Weighting: Null, Axis tran:

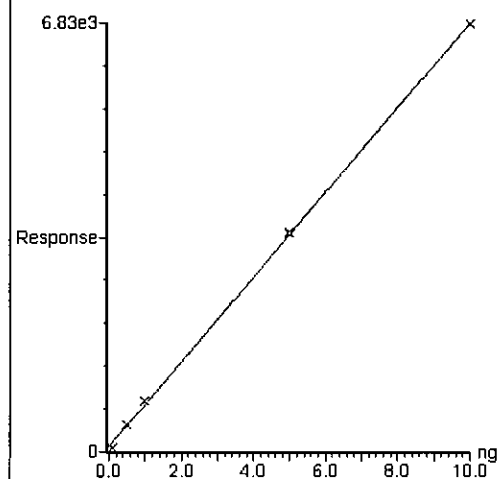


Figure 2. Toxaphene peak #3.

Four chromatographic peaks were selected and determined as representative of the multicomponent analyte Toxaphene. Calibration Factors (CF) were calculated based on the integrated peak areas and the known standard concentrations. From these results, the Relative Standard Deviation (RSD) for each multilevel concentration range was determined. These results were averaged providing a final Toxaphene RSD.

Correlation coefficients were calculated in a similar fashion and are illustrated in Figures 2 and 3.

The results of all the calibration data and acceptance criteria are listed in Tables 4 and 5. Both experimental results easily comply with method performance specifications.

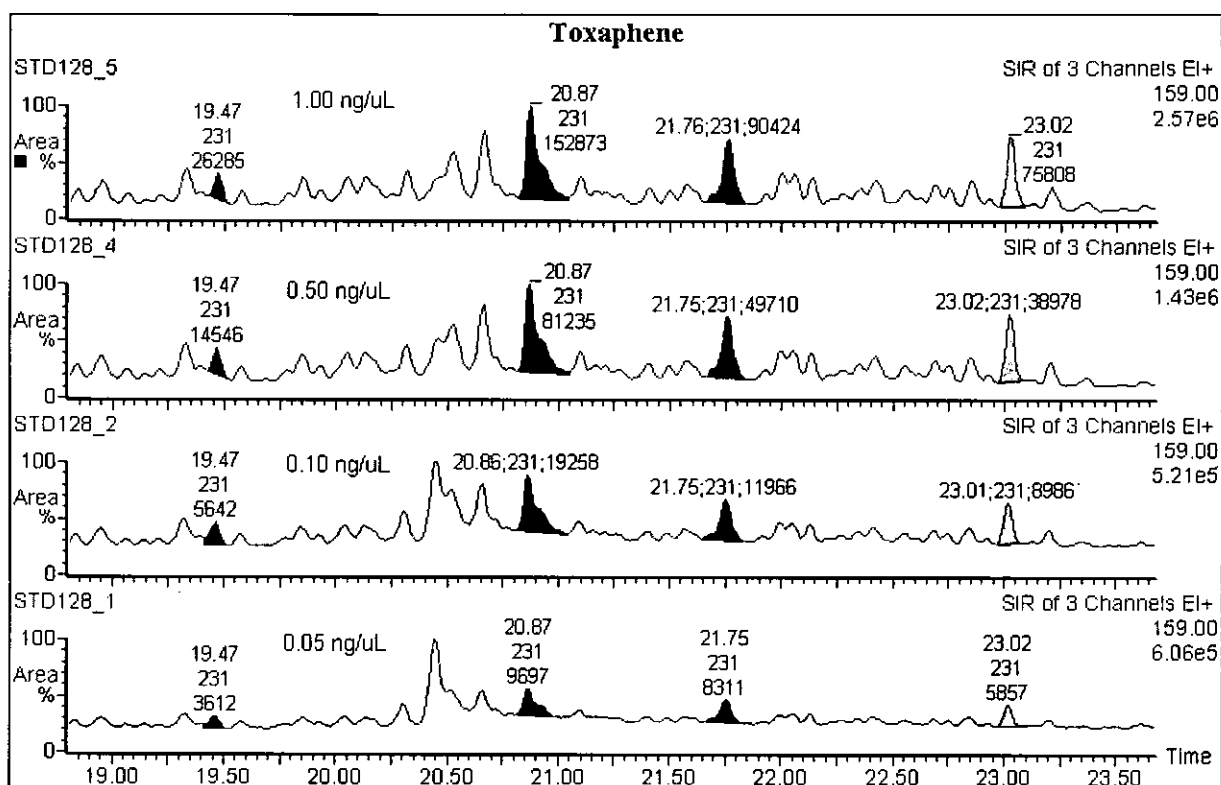


Figure 4. Integrated Toxaphene Peaks

Calibration Curve using SIR Mode

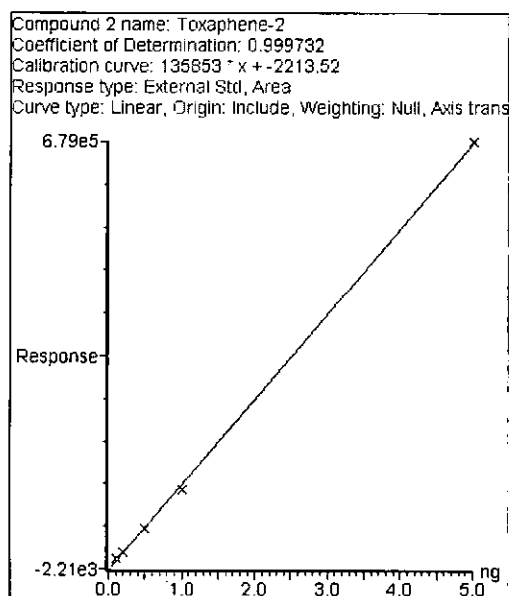


Figure 3. Toxaphene peak #2.

Table 4: Full Scan-50				
Calibration Peaks	RSD		Correlation Coefficient	
	Actual	Acceptance Limit	Actual	Acceptance Limit
Peak #1	11.0		0.99934	
Peak #2	13.6		0.99949	
Peak #3	12.6		0.99962	
Peak #4	8.4		0.99948	
Toxaphene (Average of 4 peaks)	11.4	15.0	0.9995	0.99

Table 5: SIR-50

Calibration Peaks	RSD		Correlation Coefficient	
	Actual	Acceptance Limit	Actual	Acceptance Limit
Peak #1	10.4		0.99936	
Peak #2	8.2		0.99973	
Peak #3	10.8		0.99967	
Peak #4	7.5		0.99934	
Toxaphene (Average of 4 peaks)	9.2	15.0	0.9995	0.99

Table 6: Detection Limits

Calibration Peaks	Calculated Analytical Detection Limits	
	FS-50 (ng/mL)	SIR-50 (ng/mL)
Peak #1	0.073	0.065
Peak #2	0.089	0.009
Peak #3	0.105	0.021
Peak #4	0.035	0.014
Toxaphene (Average)	0.076	0.027

The Method Detection Limits (MDLs) listed in Table 6 are the result of seven (7) replicate injections of a 0.10 ng/mL standard using the standard deviation and the *t*-statistic. Integrated peaks representative of the entire calibration range can be seen in Figure 4. The bottom chromatogram was obtained from a 0.05 ng/mL standard which is below the lowest calibration standard of 0.10 ng/mL. The peaks are readily discernible above the noise and can be easily integrated. What sets the Mass Spectrometer apart from other forms of detectors is the ability to selectively identify individual masses. Figure 5 shows the Total Ion Chromatogram (TIC) of a mixture of 100 ng/mL Toxaphene and 0.10 ng/mL

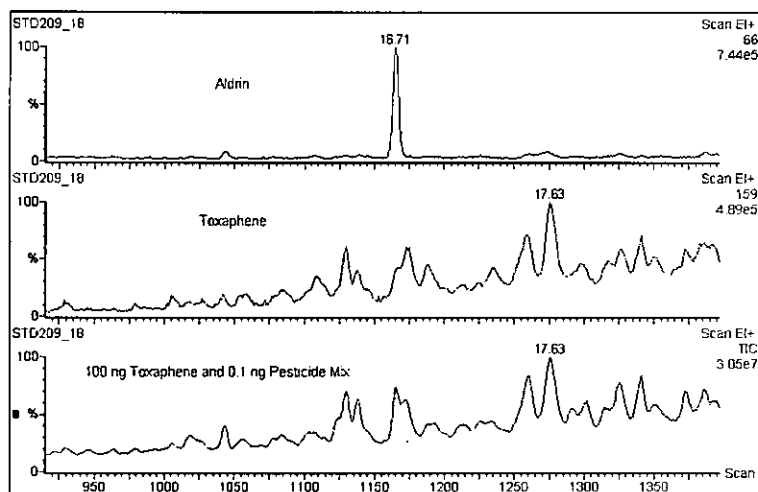


Figure 5. Aldrin and Toxaphene Extracted Ions

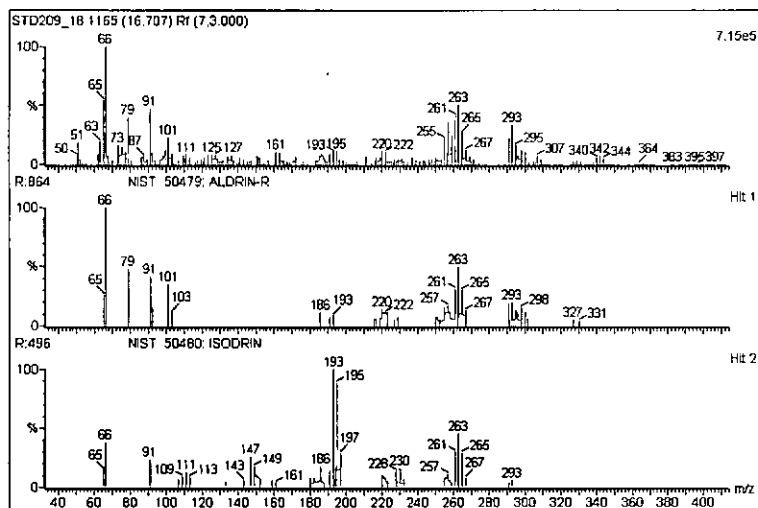


Figure 6. Library Searchable Spectra

Pesticide Mix. The Extracted Ion (EI) mass 159 is Toxaphene, and the Extracted Ion (EI) mass 66 is Aldrin which was confirmed by a NIST library search as seen in Figure 6. Aldrin is easily identified and integrated without additional preparatory procedures. The Contract Laboratory Program (CLP) lists 0.2 ng/mL as the quantitation limit for Aroclor 1221 using an Electron Capture Detector. Figure 7 shows Aroclor 1221 well above the noise level at the 0.20 ng/mL quantitation level, using GC/MS in the SIR mode and large volume injection.

Conclusions

The ability of GC/MS to selectively identify a component based on an extracted ion chromatogram from a mixture of compounds

not only assures a positive identification, but also saves time by eliminating additional clean-up and analyses. Recent technological advances in quadrupole mass spectrometry have increased the instrument's sensitivity. The use of Selected Ion Recording provides further sensitivity enhancements. In addition to the detector and its mode of operation, the use of large volume injection with a programmable inlet system allow for introduction of larger sample volumes.

The combination of these elements enhances the sensitivity of a GC/MS system so multicomponent analytes can be identified and quantified in an efficient and productive manner.

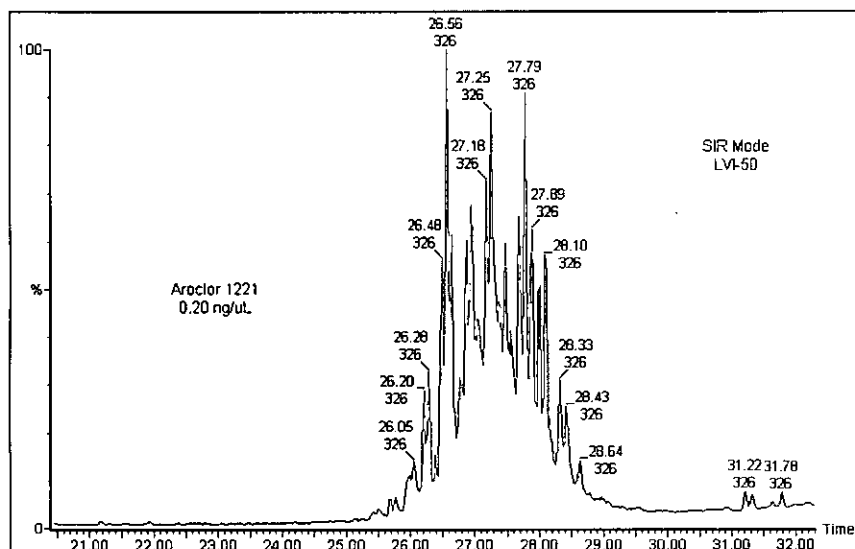


Figure 7. Quantitation Limit Pattern Recognition

CONFERENCES & SEMINARS

6-11 February 2000

RACI 11th National Convention

Venue: Canberra, ACT, Australia
Contact: Dr Graeme Moad
 Molecular Science, CSIRO
 Private Bag 10, Clayton South MDC
 Clayton, VIC 3169, Australia
 Tel: (+61-3)-95452509
 Fax: (+61-3)-95452446
 Email: graeme.moad@molsci.csiro.au

14-18 February 2000

ACUN-2 International Composites Meeting - Composites in the Transportation Industry

Venue: University of New South Wales
 Sydney, New South Wales, Australia
Contact: Dr Sri Bandyopadhyay
 School of Materials Science & Engineering
 University of New South Wales
 Sydney, NSW 2052, Australia
 Tel: (+61-2)-93854509
 Fax: (+62-2)-93855956
 Email: s.bandyopadhyay@unsw.edu.au

27 February - 2 March 2000

Sixth Eurasia Conference on Chemical Sciences

Venue: Bandar Seri Begawan, Brunei
Contact: Miroslav Radojevic
 Department of Chemistry
 Universiti Brunei Darussalam
 Gadong BE 1410, Brunei
 Tel: (+673)-2249001 ext 345
 Fax: (+673)-2249502
 Email: euas6@ubd.edu.bn

2-5 March 2000

Changing Landscapes, International Landcare 2000

Venue: Melbourne, Australia
Contact: Mandy Bromilow
 Tel: (+61-3)-96906744
 Fax: (+61-3)-96907155
 Email: wscn@bigpond.com
Website: <http://www.nre.vic.gov.au/conf/landcare2000/>

2-3 March 2000

2nd International Dangerous Goods Conference

Venue: Amsterdam, The Netherlands

9-10 March 2000

Florida Heterocyclic Conference

Venue: Gainesville, Florida, USA
Contact: Scientific Update
 Wyvern Cottage, High Street
 Mayfield, East Sussex TN20 6AE, USA
 Tel: (+1-435)-873062
 Fax: (+1-435)-872734
 Email: register@scientificupdate.co.uk
Website: www.scientificupdate.co.uk

11-17 March 2000

Xth World Water Conference

Venue: Melbourne, Australia
Contact: Tel: (+61-3)-96820244
 Fax: (+61-3)-96820288
Website: <http://www.icms.com.au/worldwater>

19-21 March 2000

49th Oilseed Conference

Venue: New Orleans, USA
Contact: 49th Oilseed Conference
 P O Box 3489
 Champaign, IL 61826-3489, USA
 Tel: (+1-217)-3592344
 Fax: (+1-217)-3518091
 Email: meetings@aocs.org
Website: www.aocs.org/oilseed.htm

19-23 March 2000

Water 2000 Conference and Expo - "Guarding the Global Resource"

Venue: Auckland, New Zealand
Contact: New Zealand Water and Wastes Association
 P O Box 13880
 Onehunga, Auckland, New Zealand
 Tel: (+64-9)-6363636
 Fax: (+64-9)-6361234
 Email: water@nzwwa.co.nz
Website: <http://www.nzwwa.org.nz>

22-25 March 2000

Chain Growth Polymerisation - New Chemistry for the New Millenium

Venue: Santa Rosa, California, USA
Contact: Professor Bruce Novak
 University of Massachusetts
 Tel: (413)-5452160
 Fax: (413)-5450764
 or
 Kris Matyjaszewski
 Carnegie Mellon University
 Department of Chemistry
 Tel: (412)-2683209
 Fax: (412)-2686897
 Email: km3b@andrew.cmu.edu

23-24 March 2000

Inbio Europe 2000

Venue: Amsterdam, The Netherlands
Contact: Scientific Update
 Wyvern Cottage, High Street
 Mayfield, East Sussex TN20 6AE, USA
 Tel: (+1-435)-873062
 Fax: (+1-435)-872734
 Email: register@scientificupdate.co.uk
Website: www.scientificupdate.co.uk

25-29 March 2000

Interactions of Biomolecules with Model Membranes and Monolayers

CONFERENCES & SEMINARS

Venue: Halle, Germany
Contact: A Blume
 Martin-Luther-Universitat Halle-Wittenberg
 Institut für Physikalische Chemie
 Muhlpforte 1, D-06108, Halle, Germany
 Tel: (+49-354)-5525850
 Fax: (+49-354)-5527157
 Email: blume@chemie.uni-halle.de

2-5 April 2000

Foods - Nutraceuticals - Confectionery - Beverages and Cosmetics

Venue: Doubletree Mission Valley Hotel, San Diego
 California, USA
Contact: Mr P C Hereld
 Managing Director
 The Hereld Organisation
 200 Leeder Hill Drive
 Hamden CT 06517, USA
 Tel/Fax: +1-203-2816766

3-5 April 2000

GreenTech 2000 - Sustainable Raw Materials

Venue: Utrecht, The Netherlands
Contact: Europoint bv
 P O Box 822, NL-3700 AV Zeist
 The Netherlands
 Tel: (+31-30)-6933489
 Fax: (+31-30)-6917394
 Email: info@europoint-bv.com
Website: www.europoint-bv.com

4-10 April 2000

10th International Conference on High Temperature Materials Chemistry

Venue: Aachen, Germany
Contact: Professor K Hilpert
 Forschungszentrum Julich GmbH
 Institut für Werkstoffe der Energietechnik
 52425 Julich, Germany
 Tel: (+49-2461)-613280
 Fax: (+49-2461)-613699
 Email: k.hilpert@fz-juelich.de

11-14 April 2000

Food Asia 2000

Venue: Singapore
Contact: Tel: (+65-3)-384747
 Fax: (+65-3)-395651
 Email: info@sesmontent.com
Website: www.food.asia.co

25-28 April 2000

11th International Global Warming Conference

Venue: Boston, Massachusetts, USA
Contact: World Resource Review
 22W381 75th Street
 Naperville, IL 60565-9245, USA

Tel: (+1-630)-9101551
 Fax: (+1-630)-9101561
Website: www.globalwarming.net

14-17 May 2000

Foresight and Precaution - Risk Analysis and Safety

Venue: Edinburgh, United Kingdom
Contact: The Safety and Reliability Society
 Clayton House, 59 Piccadilly
 Manchester M1 2AQ, United Kingdom
 Tel: (+44-161)-2287824
 Fax: (+44-161)-2366977
 Email: secretary@sars.u-net.com
Website: www.sars.u-net.com

21-25 May 2000

10th International IUPAC Symposium on Mycotoxins and Phytotoxins

Venue: Sao Paulo, Brazil
Contact: Dr Myrna Sabino
 Instituto Adolfa Lutz
 AV Dr Arnaldo 355
 Sao Paulo, Brazil, 01246-902
 Fax: (+455-11)-8533505
 Email: myrna@sti.com.br

14-18 June 2000

Challenges for Science and Engineering in the 21st Century

Venue: Stockholm, Sweden
Contact: Dr John Peet
 Department of Chemical & Process
 Engineering
 University of Canterbury
 Private Bag 4800, Christchurch
 Phone: (+64-3)-3642538
 Fax: (+64-3)-3642063
 Email: j.peet@cape.canterbury.ac.nz
Website: www.cape.canterbury.ac.nz/people/njp/njp.htm

26-28 June 2000

Pharma R&D Directions 2000

Venue: Barcelona, Spain
Contact: Tracy Moring
 Marketing Manager
 ECPI, QAIC Worldwide
 Second Floor, 100 Hatton Garden
 London EC1N 8NX, United Kingdom
 Tel: (+44-171)-8275977
 Fax: (+44-171)-2421508
 Email: ecpi@aic-uk.com
Website: www.ecpi-online.com

1-5 July 2000

13th International Conference on Organic Synthesis

Venue: Warsaw, Poland
Contact: Professor M Chmielewski

CONFERENCES & SEMINARS

Institute of Organic Chemistry
Kasprzaka 44, 01-224 Warsaw 42
P O Box 58, Poland
Tel: (+48-22)-6318788
Fax: (+48-22)-6326681
Email: ichos@ichf.edu.pl

3-6 July 2000

University of Waikato/Amersham Pharmacia Biotech Protein Purification Course

Venue: Hamilton, New Zealand
Contact: R McGowan
Centre for Continuing Education
University of Waikato
Private Bag 3105, Hamilton, New Zealand
Email: rmcgowan@waikato.ac.nz
Website: www.mape.waikato.ac.nz/courses/522.htm

9-12 July 2000

Chemeca 2000: Opportunities and Challenges for the Resource and Processing Industries

Venue: Perth, Western Australia
Contact: Conference Secretariat
Chemeca 2000
C/- Congress West Pty Ltd
P O Box 1248
West Perth, WA 6872, Australia

9-14 July 2000

38th International Symposium on Macromolecules

Venue: Warsaw, Poland
Contact: Professor Stanislaw Penczek
Polish Academy of Sciences
ul. Sienkiewicza 112, 90363 Lodz, Poland
Tel: (+48-42)-6819815
Fax: (+48-42)-6847126
Email: spenczek@bilbo.cbmm.lodz.pl

9-14 July 2000

34th International Conference on Coordination Chemistry

Venue: Edinburgh, Scotland, United Kingdom
Contact: Professor P Tasker, Chairman
Dr John F Gibson, Secretary
The Royal Society of Chemistry
Burlington House, London W1V 0BN
England, United Kingdom
Tel: (+44-171)-4403321
Fax: (+44-171)-7341227
Email: gibsonj@rsc.org

17-20 July 2000

40th Microsymposium on Polymers In Medicine

Venue: Prague, Czech Republic
Contact: Dr Jaromir Lukas
Institute of Macromolecular Chemistry
Academy of Sciences of the Czech Republic
Heyovskeho na. 2, 162 06 Praha 6

Czech Republic
Tel: (+420-2)-360341
Fax: (+420-2)-367981
Email: sympo@imc.cas.cz

6-11 August 2000

7th International Symposium on Polymer Electrolytes

Venue: Noosa, Queensland, Australia
Contact: Dr Astrid Nordmann
Centre for Advanced Materials Technology
Monash University, Wellington Road
Clayton, Victoria 3168, Australia
Tel: (+61-3)-99055791
Fax: (+61-3)-99054998
Email: ispe7@eng.monash.edu.au
Website: www.chem.monash.edu.au/electrolytes/ispe7

6-11 August 2000

16th IUPAC Conference on Chemical Thermodynamics

Venue: Halifax, Nova Scotia, Canada
Contact: Dr Peter G Kusalik
Department of Chemistry
Dalhousie University
Halifax, Nova Scotia B3H 4J3, Canada
Tel: (+1-902)-4943627
Fax: (+1-902)-4941310
Email: kusalik@is.dal.ca

14-18 August 2000

12th International Conference on Thermal Analysis and Calorimetry

Venue: Copenhagen, Denmark
Contact: Dr O Toft Sorensen
Risoe National Laboratory
Tel: (+45-4)-6775800
Fax: (+45-4)-6775758
Email: o.toft.sorensen@risoe.dk

20-25 August 2000

XIIIth International Congress on Rheology

Venue: Cambridge, England, United Kingdom
Contact: Dr D M Binding
Fax: (+45-1970)-622777
Email: rheology2000@aber.ac.uk

1 September 2000

22nd International Symposium on the Chemistry of Natural Products

Venue: Sao Paulo, Brazil
Contact: Dr M Fatima das G F da Silva
Universidade Federal de Sao Carlos
Depto. de Quimica, Via Washington Luiz
km 235, CP676, Sao Carlos, Brazil
Tel: (+55-16)-2748208
Fax: (+55-16)-2748350
Email: dmfs@power.ufscar.br

CONFERENCES & SEMINARS

3-8 September 2000

11th International Biotechnology Symposium

Venue: Berlin, Germany
Contact: Professor G Kreysa, DECHEMA eV
c/o 11th IBS, Theodor-Heuss-Allee 25
60486 Frankfurt/Main, Germany
Tel: (+49-69)-7564205
Fax: (+49-69)-7564201
Email: info@dechema.de

10-15 September 2000

XXth International Conference on Polyphenols

Venue: Freising-Weihestephana, Germany
Contact: Professor Dr G Forkmann
Chair of Floriculture and Horticultural
Plant Breeding
Technical University Munich
D-85350 Freising-Weihestephana, Germany
Fax: (+49-81)-61713886
Email: d.treutter@lrz.tum.de

11-14 September 2000

21st International Federation of The Societies of Cosmetic Chemists

Venue: Berlin, Germany
Contact: DGK Secretariat, Konrad-Zirkel-Str 22
D-97769 Bad Bruckenaue, Germany
Tel: (+49-9)-7414323
Fax: (+49-9)-7413934
Email: dgk.ev@t-online.de

19-22 September 2000

5th International Chemical Industry Fair

Venue: Beijing, China

7-10 October 2000

NZIFST/MIRINZ Joint Conference 2000: Horizons MM! - Designing Foods That Consumers Will Choose
This conference will run concurrently with Xpo's Food Tech 2000, Pack Tech 2000 and the Massey Food Awards.

Contact: Julie Watson
Swift NZ Ltd, P O Box 27056
Mt Roskill, Auckland
Tel: (+64-9)-6256169
Fax: (+64-9)-6256655
Email: jwatson@im.aust.com

8-10 November 2000

2nd International Symposium on Food Packaging - Ensuring the Safety and Quality of Food

Venue: Vienna, Austria
Contact: Dr L Contor
ILSI Europe, 83, Avenue E. Mounier
Box 6, B-1200, Brussels, Belgium
Tel: (+32-2)-7620044
Fax: (+32-2)-7710014
Email: laura@ilsieurope.be

19-22 November 2000

Corrosion & Prevention 2000

Venue: Hyatt Hotel, Auckland
Contact: Corrosion Prevention Centre
P O Box 2340, Mount Waverley
Victoria 3149, Australia
Tel: (+61-3)-98095266
Fax: (+61-3)-98095344
Email: corrprev@internex.com.au

3-8 December 2000

Soil 2000: 2nd Joint New Zealand and Australian Soil Science Societies Conference

Venue: Lincoln University, Canterbury
Contact: Helen Shrewsbury
P O Box 84, Lincoln University
Christchurch, New Zealand
Tel: (+64-3)-3252811 ext 8955
Fax: (+64-3)-3253840
Email: shrewsbh@lincoln.ac.nz

9-13 December 2000

Poly Millenium 2000

Venue: Hilton Waikoloa Village, Waikoloa, Hawaii
Contact: William H Daly
Department of Chemistry
Louisiana State University
Email: bill.daly@chem.lsu.edu

14-19 December 2000

Pacificchem 2000

Venue: Waikiki, Honolulu, Hawaii
Contact: Professor B Halton
Department of Chemistry
Victoria University of Wellington
P O Box 600
Wellington, New Zealand
Fax: (+64-4)-4955241
Email: brian.halton@vuw.ac.nz

19-20 January 2001

Chem Expo India 2001

Venue: Mumbai, India

19-21 June 2001

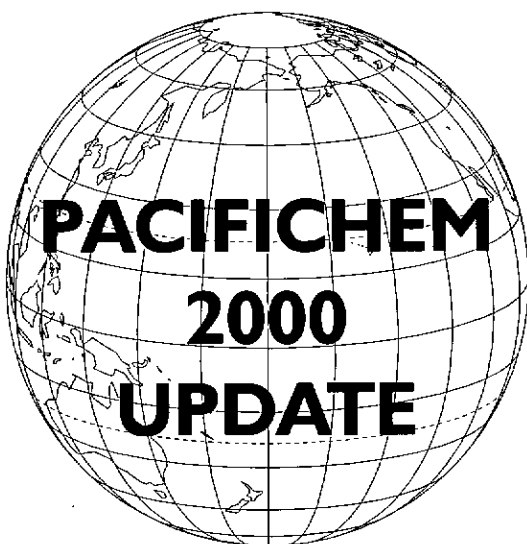
10th Loss Prevention and Safety Promotion in the Process Industries

Venue: Stockholm, Sweden

26 August - 1 September 2001

XXXIV International Congress of Physiological Sciences "From Molecule to Malody"

Venue: Christchurch, New Zealand
Contact: The Conference Company
P O Box 90-040, Auckland, New Zealand
Tel: (+64-9)-3601240
Fax: (+64-9)-3601242
Email: info@tcc.co.nz



The programme for Pacifichem 2000 has been finalised with the last few symposium proposals sought by the programme committee now assessed. Chemists and biochemists are reminded that the last date for submission of abstracts for oral and poster presentation at Pacifichem 2000 in Washington, DC, is **14 April 2000**.

Abstract forms are available for downloading directly from the internet from January 15, 2000. Pacifichem has direct access from:

<http://www.acs.org/meetings/pacific2000/>

Advance registration will not be available until after July 1, 2000 and details for this, accommodation and pre- and post-congress tours will be publicised in *Chemistry in New Zealand* in the July/August 2000 issue.

Registration fees have been finalised (with late on-site registration in parentheses as:

NZIC Member \$US 340 (410), Non-Member \$US 420 (505), Full-time student \$US 75 (90), Guest of Registrant \$US 50 (50).

Abstracts must be in received Washington by 14 April 2000.

All contributed abstracts for papers should be submitted to the Congress Secretariat at the American Chemical Society. Copies of the abstract form and additional information on submitted papers are available from:

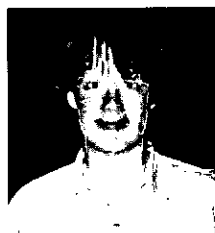
Professor B Halton
School of Chemical & Physical Sciences
Victoria University, P O Box 600, Wellington
Email: brian.halton@vuw.ac.nz

Pacifichem Congress Secretariat
American Chemical Society
1155 Sixteenth Street, NS, Washington, DC 20036, USA
Email: pacifichem@acs.org

All details of the Congress including the updated programme listings are available from the web site that can be accessed easily from the Pacifichem listing on the ACS meetings web page at:

<http://www.acs.org/meetings>

PACIFICHEM 2000 WINNER



Sarah Hickford

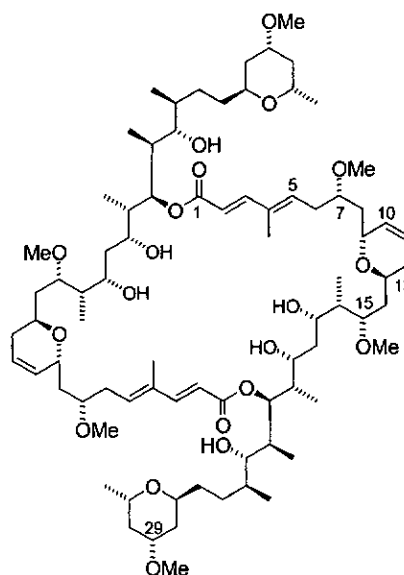
Sarah J H Hickford is to be the NZIC sponsored student to Pacifichem 2000. Her poster "Microbial Origins and Tumour Targeting of Cytotoxins" was judged winner at the November 1999 NZIC Conference in Wellington by a panel led by Professor Ron Breslow of Columbia University. Interestingly,

Breslow is to present the inaugural Glen T Seaborg Pacifichem Lecture at the 2000 Congress.

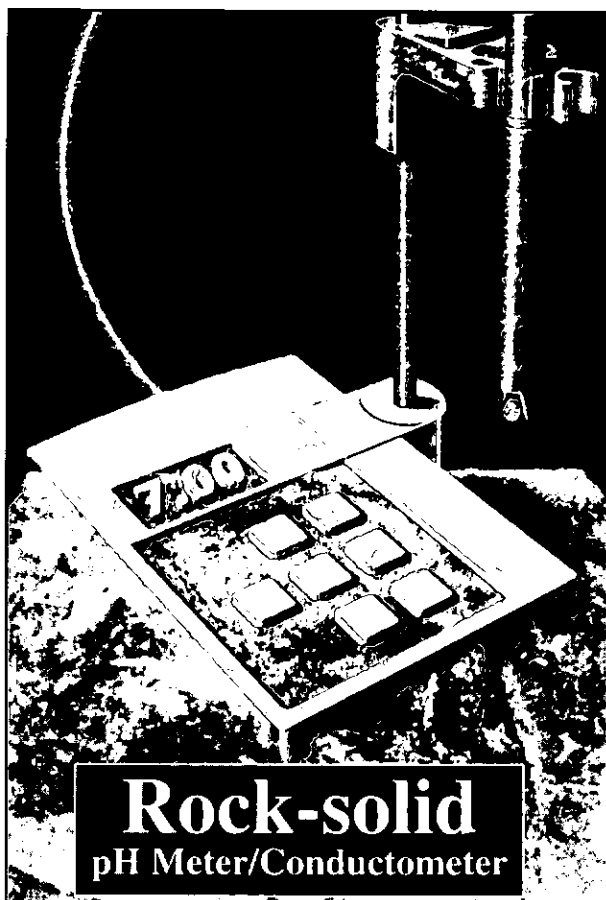


Professor Ronald Breslow (left) and Professor Sir John Cadogan (right) at the 1999 NZIC Conference in Wellington.

Sarah, whose research is directed by Professor Murray Munro and Dr John Blunt of the University of Canterbury, is investigating the cellular location of cytotoxins in marine sponges and the delivery of the cytotoxin swinholide H specifically to cancer cells through incorporation in a polymer-drug conjugate. Swinholide H is from the deep water sponge *Lamellomorpha strongylata* found along the Chatham Rise. The swinholide H di-methylene acetal and the theonellapectolide IIIe shown have been localised within unicellular and filamentous heterophilic bacteria, respectively, associated with the sponge.



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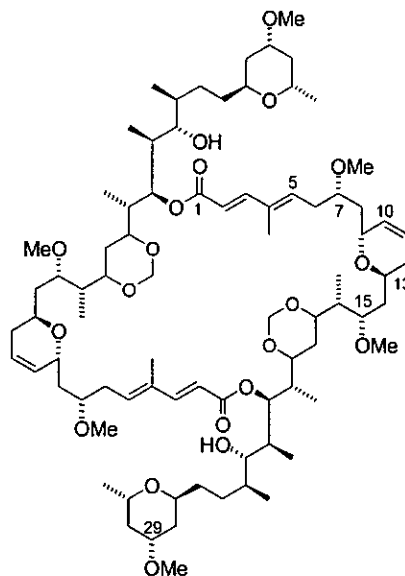
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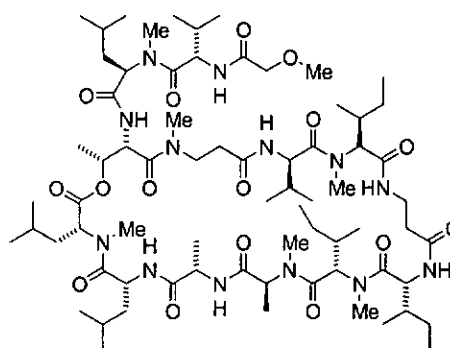
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The award is provided by NZIC from funds generated by the Pacificchem activities, with additional sponsorship from Harbour City United Travel, Wellington.

IUPAC PRIZE FOR YOUNG CHEMISTS

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

IUPAC will award up to four prizes annually. Each prize will consist of US\$1000 cash and travel expenses to the next IUPAC Congress. In keeping with IUPAC's status as a global organisation, efforts will be made to ensure fair geographic distribution of prizes. Prizes will be presented biennially at the IUPAC Congress (next congress is to be held in Brisbane, Australia from 1 to 6 July, 2001). Each awardee will be invited to present a talk on his/her research and to participate in a plenary award session.

Applications will be judged by a committee of eminent scientists appointed by the President of IUPAC.

Complete information, including application forms is available on the IUPAC website. The URL is: <http://www.iupac.org/news/prize.html>

SUMMARY OF NATIONAL CHEMISTRY WEEK ACTIVITIES 1999

Dr Owen J Curnow
Department of Chemistry, University of Canterbury

The NZIC contribution to the International Chemistry Celebration 1999 (IChC99) took place over the week of 11-17 September. In addition to many regional events, the national events held were:

- a national high school chemistry challenge (form 7)
- a national flag competition
- a short story competition (forms 5-7)
- a crystal growing competition

An event of this nature requires a significant amount of funding. In addition to the NZIC, who provided the majority of the sponsorship, the following sponsors are gratefully acknowledged for their generous support: Auckland Chemicals, Baldwin Shelston Waters, Canterbury Science Teachers Association, Christchurch College of Education, ESR, G L Bowron and Co. Ltd, Nuplex Industries, Shimadzu, University of Canterbury, Victoria University, Wilsons Chemicals Ltd, and WRONZ.

The National High School Chemistry Challenge

This competition involved teams of four students from around the country competing regionally for a place in the finals in Wellington. Some regions had over 20 schools competing and some schools even entered three teams. The final was held in Wellington on 22-23 September 1999 rather than during chemistry week due to a clash with APEC. The finalists were Auckland Grammar School (Auckland), St Peter's School (Waikato), Palmerston North Boys' High School (Manawatu), Wellington College (Wellington), Shirley Boys' High School (Canterbury) and an Otago regional team. The teams arrived in Wellington during the morning and, after lunch at the Victoria University Chemistry Department, were given a tour of the facilities of the department. A competition for the ESR Environmental Prize involved the determination of bicarbonate in a tap water by a series of three titrations in which each student performed a different titration and the bicarbonate concentration could only be found by pooling their results at the end. The fourth student did a more direct determination of the bicarbonate concentration and all the students did well with this. By far the best results came from the Otago regional team of Ben Handley, Sofie Yecavich, Hannah Ross and Hwee Sin Chong.

After dinner at the University Staff Club, the competitors moved to the Beehive for the final quiz section of the competition. Since our host, the Hon Simon Upton, Minister for the Environment, had to go overseas, the Right Hon. Sir Douglas Graham was present to ask some of the questions and present the prizes. First prize, with 97 points (out of 120), went to Wellington College (Darren Foo, Ben Revell, Tim King and Shashi Wijesinghe), second, with

87 points, was Shirley Boys' High (Ben Perston, Brendan Holland, Ze-Fu Weng and Jen Jie Chu) and third went to Auckland Grammar (Desmond Chik, Michael Downard, Wing Chan and Ashish Tanesa) with 86 points. The Otago regional team was very close behind at 85 points while St Peter's and Palmerston North Boys' High were only a little further away at 72 points each.

The following day involved tours of BRANZ, Resene and Te Papa during which the students were shown some applications of chemistry. I personally found the chemistry involved in art restoration to be most fascinating.

The national coordinator for this event, Michael Winter, did a great job and the local organisers Rod Tilbury and David Weatherburn were fantastic in their efficiency and reliability.

The National Flag Competition

Students from forms 1-4 were asked to extract natural dyes and then use these dyes to design and make a new national flag. The winning flags and information on the competition is given on the web site:
www.chem.canterbury.ac.nz/ichc/ichc.htm

This event was a great success. A total of 58 entries were received and at least 110 students were involved. Considering the amount of effort that the students clearly put into their projects, this was a very pleasing result. Furthermore, a number of organisations are interested in displaying some of the entries. The staff at Te Papa were so impressed with the entries that they are displaying all of the flags listed below over the summer in their NatureSpace area. The exhibit looks great and I would encourage you to check it out if you're in the area.

Judging the entries was a challenge. To ensure that the artistic merit could be properly taken into account, one of the two judges (myself being the other) came from the University of Canterbury School of Fine Arts: Dr Diedre Brown was thrilled to be invited to judge a chemistry competition! Other considerations included colour intensity, report of experimental details and the description of the meaning of their flag.

The winning entries were:

Forms 1 and 2:

- *First:* Shay Te Koari, Sarah Triplow, Roannna Jellyman (Aromoho School, Wanganui)
- *Second:* Samantha Hague (Linkwater School, Picton)
- *Third:* Pupils of Te Kupenga at Oturu School, Kaitaia

This year, the competition had joint winners. The teams from Christchurch Girls' High School (Hui Ling Chong, Xuan Zhang, & Dora Hu) and Cashmere High School (Helen Bones, Kim Stedman, & Jenni Barrett) both scored 101 points out of a possible 110, which the markers all agreed was a superb effort. Each member of the winning teams received \$75 of CD and book vouchers, donated by the polytechnic. All competition participants received a certificate of participation, and appeared to have an enjoyable evening.

Colourimetry Competition for Year 12 Students

This annual event was organised by Neil McKeegan of Riccarton High School and was held at the University of Canterbury chemistry department. This year it was won by Avonside Girls' High School with Villa Maria College in second place and Shirley Boys' High School in third place.

Regional High School Chemistry Challenge

Dave Stevenson of Shirley Boys' High School again organised this successful annual competition at his school. This year though, the students were also competing for a place in the national final. Although the eventual winners also came from Shirley Boys' High School, we don't think the home advantage was significant since they went on to place second in the national competition. Burnside High School came second in the regional competition and Christchurch Boys' High School came third.

- *Hon. Mentions:* Beth Kate Parker, Ramona Millen, Svenja Herbert, Emily Stein and Emma Jordan (all from Linkwater School, Picton)

Forms 3 and 4:

- *First:* Ollie Whalley (Nelson College)
- *Second:* Gemma Robinson and Jessica Sharpe (St Mary's College, Wellington)
- *Third Equal:* Selina Smith, Rhea Vine, and Naseem Khan (Motueka High School) and Aleise White (Sacred Heart Girls' High School, Hamilton)
- *Hon. Mentions:* Sally Ann Hart and Alex Dreaver (Motueka High School), Clare Bridgman (Sacred Heart Girls' High School, Hamilton) and Julia Kingham (Sacred Heart Girls' High School, Hamilton).

The Short Story Competition

This was not as successful as last year and only attracted a handful of entries, although the stories did seem to be of a higher standard this year. Considering the value of the prizes (\$250 for first, \$150 for second and \$100 for third), I found this rather surprising. The eventual winners were:

- 1st "The Perfect Solution" - Will Baker (Kaipara College)
- 2nd "Subject Matters" - Nicola Haszard (Epsom Girls' Grammar School)
- 3rd "Chernobyl Catastrophe" - Allison Teh (Epsom Girls' Grammar School)

The winning stories have been published in CHEM NZ and are on the Chemistry Week web pages (www.chem.canterbury.ac.nz/ichc/ichc.htm).

The Crystal Growing Competition

Dr Bill Henderson (University of Waikato) organised a very successful competition with exactly 100 crystals (from 22 schools) entered in total. There were four categories covering years 7 to 13.

Canterbury Regional Events

Year 11 Chemistry Competition

Thirteen high schools from the greater Christchurch area sent teams of three students to the annual Year 11 chemistry competition at Christchurch Polytechnic in September 1999. The competition is part of a series for high school chemistry students organised by the local branch of the New Zealand Institute of Chemistry.

The competition involved three activities to be completed within a very tight 60 minute time period. "To succeed, a team needs to be good at working as a team as well as having a good knowledge of chemistry. This year, all teams had a good grasp of chemistry so the competition was won or lost on team work", said David Hawke, the polytechnic tutor who organised the competition.

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NEW ZEALAND INSTITUTE OF CHEMISTRY



BRANCH NEWS

WAIKATO

The Waikato branch of the NZIC hosted Dr Yinqiu Wu from the Technology Development Group HortResearch Ruakura, Research Centre in Hamilton. Dr Wu told the members about his research into the functional properties of glucuronide and glycoside conjugates. Glucuronide and glycoside conjugates are important bio-conjugates in the fields of biotechnology and have a variety of functions such as the ability of endogenous steroid glucuronides conjugates to reveal the physiological status of humans or animals in relation to different hormones such as stress and sex hormones. Drug glucuronide conjugates have many important roles in the therapeutic and toxic response associated with drug use for humans and animals. Dr Wu's interesting talk gave a fascinating insight to this growing and important area of research. Dr Wu has also taken on Waikato BSc(Technology) student John Mitchell to help with his research continuing a long standing beneficial relationship between the Technology Development Unit managed by Kevin O'Donnell and the University chemistry department. The Waikato Branch AGM was hosted by Hill Laboratories. Dr Bill Henderson stood down from the post of Branch President to be replaced by Dr Richard Coll from Waikato's Chemistry Department. Michael Mucalo has agreed to continue being Treasurer and Shane Burggraaf the Secretary. The Branch approved funding for the following Waikato students to help with their attendance at the recent NZIC Conference in Wellington: Kathleen Paterson, Natalia Panova, Cameron Evans, Tracey Adams, Stefan Hill, Corry Decker, Gwion Harfoot and Sadiq Al-Haidar all received a contribution towards their travel expenses. The AGM concluded with an address by out-going President Bill Henderson, the NZIC Easterfield prize winner. Bill gave an overview of his research conducted since joining the Chemistry Department including a discussion of the chemistry of platinum, gold and phosphorus, and electrospray mass spectrometry. The National Crystal Growing Competition, was a roaring success, producing some 100 impressive crystals from 22 schools all over the country. There were some huge crystals produced, mostly of copper sulfate and alum and salt. The judges Professor Brian Nicholson and Bev Cooper from the School of Education at Waikato were

highly impressed by the standard of crystals although, as Brian pointed out they were a little large for X-ray crystallography, and the structure of copper(II) sulfate and sodium chloride are probably well enough established. The senior prizes went to SC Non from Otorohanga College and Richard Lord from Naenae College. Intermediate winners were Kelle Sloan and Richard Henderson (no relation to Bill Henderson) from Mount Aspiring College, and the School prize went to Inangahua College. Primary winners were Lori Ross, Lauren Hood and Samantha Hartell from Aramoho School. There were a large number of entries in the junior category and prize winners were; Rebecca Gree from Iona College, Jason Ertell and James Chamberlain from Thames High School, Angela Childs and Marjolein Baerselman of Nayland Collge, Damien Lower and Richard Campbell of Chanel College, Toby Ryan of Waiopahu Collge, Christian Smith, Krystle Marsters, Josh Brinkworth, Aaron Morrow and Fayzul Islam of Melville High School. The 1999 ChemQuest proved another success for the Waikato Branch with an enthusiastic crowd of sixth-formers treated to a barrage of chemistry related questions, match-ups, demonstrations and other dubious practices. A fun night was enjoyed by all, and replete with pizza and resplendent in a ChemQuest 1999 t-shirt the students went away happy. Prizes were presented by Professor Richard Price, Dean of the School of Science & Technology, with 1st prize going to Elena Vazey, Chris Paterson and Chris Fisher of St Pauls Collegiate, Hamilton, 2nd to Christy Bodle, Anita Lala and Clinton Van Marrewijk of St Peters, Cambridge, 3rd Andrew Myres, Zach Ward and Tim Wong of St Pauls Collegiate, 4th to Stephen Graham and Joseph McCarter of Hillcrest High School, Hamilton, and 5th to Aaron Jonassen, Annie Fan and Jonathan Saunders from Hamilton's Fraser High School. Plans for the New Year include the Branch's first vegetarian BBQ (only joking — about the vegetarian!) and a joint meeting with Auckland Branch at Rongopai Winery at Te Kauwhata. The Waikato Branch wishes to take the opportunity of thanking Dr Bill Henderson for his enthusiastic work for the Branch, serving for five years as treasurer and two years as President. We wish Bill well for his study leave in 2000.

Richard Coll

WAIKATO BRANCH AGM 6.10 PM TUESDAY 17 NOVEMBER 1998

Venue: Hill Laboratories Ltd

Present: Peter Robinson, Bill Henderson, Shane Burggraaf, Don Llewellyn, Louise McCaffery, Mike Crump, Richard Coll, Cameron Evans, Michael Mucalo, Brian Nicholson.

Apologies: Doug Wright, Gavin Robinson, Johannes Zender, John Harris, Roy Daniels.

Minutes:

Last meetings minutes were read and confirmed (moved Henderson, seconded Coll, carried unanimously).

Chairman's Report:

Bill Henderson presented the Chairman's report (moved to be accepted Llewellyn, seconded Nicholson, carried unanimously). Thanks to Bill for all his hard work this past year.

Treasurer's Report:

Michael Mucalo presented the Treasurer's report (moved to be accepted Henderson, seconded Burggraaf, carried unanimously).

New Executive Committee Members for 1999:

President: Richard Coll (Moved Henderson, seconded Nicholson, carried unanimously).

Treasurer: Michael Mucalo (Moved Nicholson, seconded Burggraaf, carried unanimously).

Branch Editor: Richard Cole (Moved Henderson, seconded Robinson, carried unanimously).

Secretary: Shane Burggraaf (Moved Nicholson, seconded Henderson, carried unanimously).

Branch Delegate: Pat Holland (Moved Robinson, seconded Coll, carried unanimously).

Committee Members:

Peter Robinson, Doug Wright, Carrick Devine, Paul Judd, Nath Pritchard, Don Llewellyn, Martin Van Thiel, Louise McCaffery, Cameron Evans, Brian Nicholson, Mike Crump, Robert Franich, Ron Newth.

AOB

Treasurer's business continued:

(a) 9 applications were received for funding assistance to go to the NZIC conference. The applicants include the following: Kathleen Paterson, Tracy Adams, Gwion Harfoot, Natalia Panova, Stefan Hill, Sadiq Al-Haidar, Cameron Evans, Corry Decker. It was agreed that Cameron Evans (committee member) should receive \$100 while other applicants should receive \$50 providing that they have NZIC membership approval.

(b) Cost incurred for the 3 November 1999 meeting were \$48.90, moved Coll, seconded Mucalo.

(c) Costs incurred for the 1999 AGM were \$28.95, moved Coll, seconded Mucalo.

(d) Costs incurred for 1999 auditing of accounts were \$124, moved Henderson, seconded Mucalo.

Contribution to NZIC from recent ICP conference run by Peter Robinson

Peter Robinson will provide a check for \$3,500 (remaining funds from the recent ICP conference held in Hamilton) to the Waikato branch of the NZIC. Investment returns may be used to pay for expenses for speakers at branch meetings. Capital may only be used to pay expenses for a speaker on trace element analysis preferably by ICP for a conference which is held in Hamilton (Waikato).

MANAWATU

November Branch Meeting - Professor Alex Glazer

Professor Alex Glazer, Professor of the Graduate School at the University of California at Berkeley, USA, and Co-chairman of the Department of Molecular and Cell Biology, spoke at a joint meeting of the Branch and The Science Centre & Manawatu Museum on Thursday evening 11th November. His lecture 'To Know Ourselves. The Human Genome Project' was held at the Science Centre and was advertised as a public lecture because of its general interest.

It attracted an audience of about 100 people. Before the talk, Associate Professor Roger Reeves of the Institute of Fundamental Sciences-Chemistry, Massey University, was presented with a New Zealand Science and Technology Bronze Medal by Professor Sir John Scott, President of the Royal Society of New Zealand (this award was reported in *Chemistry in New Zealand* 63, 2, (March/April 1999)). The Medal was awarded in recognition of research achievements in analytical chemistry, especially its application to problems in environmental chemistry and plant ecology, and for pioneering professional education of analytical chemists in New Zealand.

Professor Glazer started his discussion of the Human Genome Project by outlining the basic biology of DNA and genetics. There are about three billion bases (nucleotides) which make up the human genetic script, encompassing about 140,000 genes and 46 chromosomes in each human cell (of which there about 100 trillion in the body!). A huge cooperative effort is underway by genetic specialists worldwide, attempting to sequence all the DNA in each of the 46 chromosomes and to make the data available by putting it into electronic databases accessible through the internet.

The US Department of Energy has described the Human Genome Project as a visionary effort meriting comparison with the Apollo space program and the Manhattan atomic bomb project. Professor Glazer estimated that within five years, perhaps within three, the project will have completed the DNA sequencing (about 13% is complete so far). His own research contributed to the technology which has enabled the recent explosion in data from genome sequencing. He is an international consultant on applications of biological and genetic processes to industry.

Unlocking DNA sequences will shed light on many current medical mysteries as a single base error in the genetic script can be ultimately fatal. The genome research will be valuable in disease prevention and treatment and also give the ability to predict the likely severity of genetically-related diseases. It has implications for the pharmaceutical industry in terms of drug efficacy in relation to the varying genetic makeup of individuals. The information from this project may well affect the daily lives of all of us and Professor Glazer concluded his address by discussing the various issues associated with genetic research as well as steps being taken by government to address the issues. Genetic counselling will become a growth area, with experts giving advice about unborn children whose DNA

indicates potential health problems. There are complex issues of human individuality in the face of genetic research. It may not be up to us to decide which genes are desirable in our gene pool!

Manawatu Branch AGM

The Manawatu Branch AGM was held in the Cafeteria, New Zealand Dairy Research Institute, on Monday 6 December 1999. At the AGM, Branch Chairman Stephen Van Eyk reviewed a very successful year of scientific and social meetings (12 in total). One of the directions taken this year was to move a number of the meetings further into the public arena, and involve the local branch of the Royal Society of New Zealand, teachers groups, and the Science Centre. As a result, the most popular meetings were attended by more than 100 people. The Branch was able to draw on excellent local speakers as well as two national and four international speakers, possible because of being able to share costs with other branches and organisations.

The following Officers and Committee for 2000 were elected:

Chairman: Dr Stephen Van Eyk, NZ Pharmaceuticals Ltd
Secretary: Dr Richard Haverkamp, Institute of Technology and Engineering, Massey University

Treasurers: Dr Robert Norris and Mr Grant Boston (Immediate past-Chairman), New Zealand Dairy Research Institute

Branch Editor: Dr Jeremy Dombroski, HortResearch

Council Delegate: (to be appointed from the committee)

Committee: The following committee members were re-elected:

Dr Justin Bendall, New Zealand Dairy Research Institute
Professor Andrew Brodie, Institute of Fundamental Sciences-Chemistry, Massey University

Mrs Kath Fletcher, Central Hawke's Bay College (Hawke's Bay representative)

Mr Laurence Scott, Contact Energy (Taranaki sub-branch representative)

Dr Tony Wright, Institute of Fundamental Sciences-Chemistry, Massey University

In addition four new committee members were elected:

Mr Peter Ellingham, John Morris Scientific

Dr Nick Robinson, New Zealand Dairy Research Institute

Mr Barry Scott, BDH Chemicals, Palmerston North

Dr David Shillington, Universal College of Learning, Palmerston North

Two 1999 Committee members did not stand again and the AGM attendees acknowledged the work of these previous members, that of Dr Mark Patchett, Institute of Molecular Biosciences, Massey University, who was the mainstay of the Manawatu Branch Schools Quiz (see below) for many years, and Dr Harry Percival, Branch Editor.

The AGM was followed by a BBQ and then the Chairman's Address on 'Nutritional Supplementation - The Good The Bad & The Ugly Science' from the re-elected Chairman

Stephen Van Eyk. Stephen discussed his interests in the science of nutritional supplementation, particularly vitamins A and E, and various herbal extracts.

1999 Manawatu Branch Chemistry Quiz for Schools

The quiz again proved popular and attracted a number of entries from other parts of New Zealand as well as the Manawatu Branch region. A record 2145 students from 53 schools sat the quiz (last year 2071 students from 63 schools). Both the Senior and Junior quizzes were harder this year with a median mark of 50%. In keeping with the stated aim of encouraging students in their study of chemistry, all students who scored 13 or above obtained a certificate marking their achievement. This meant that 65% of students were so recognised. Prizes recognising schools participation were awarded on the basis of published 1999 roll numbers. These prizes were awarded to New Plymouth Girls' High School (23.3% of roll), Central Hawkes' Bay College (18.0%), and Taradale High School (17.6%). Samuel Bruere and James Tinsley, both of Central Hawkes Bay College, had the highest Junior mark of 29/30. Brian Hsu of Takapuna Grammar School had the highest Senior mark of 29/30. \$1500 of the proceeds from this year's quiz was donated to the Manawatu Chemical Education Trust.

Branch Editor Comments

This is my farewell Branch news as I have stood down from the committee (see above). I have enjoyed my time as a committee member for the last five years and as Branch Editor for the last four years. I have found the Branch to be a very active one with many and varied Branch meetings involving substantial interactions between chemists from University, Crown Research Institute, teaching, and industrial organisations. All of these organisations have been represented on the energetic and active Branch committees that I have been associated with in the past five years since moving from the Wellington region. The Branch chemistry quiz for schools has been particularly well done over the years to the point of attracting interest from schools well outside the Manawatu Branch region. All of the Branch Chairmen I have known have done impressive jobs, well backed up by committee officers. The saddest moment for myself and other committee members was the early death of the 1994 Chairman Alan Furness from cancer in 1996 [obituary reported in *Chemistry in New Zealand* 60, 4, (July 1996)] who had been such an energetic figure for the Branch on the committee and in his teaching career. I will continue participating in Branch activities so as to further enjoy the fellowship of the Branch members.

Harry Percival

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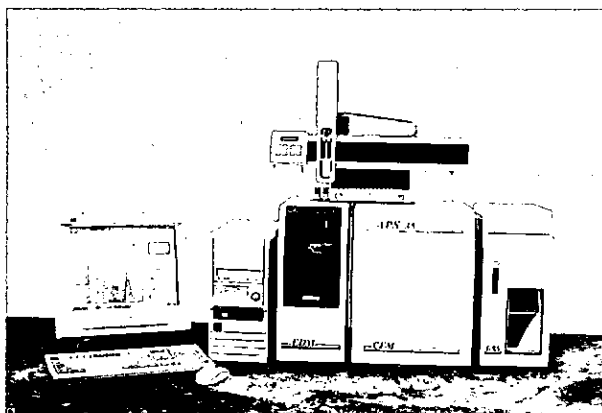
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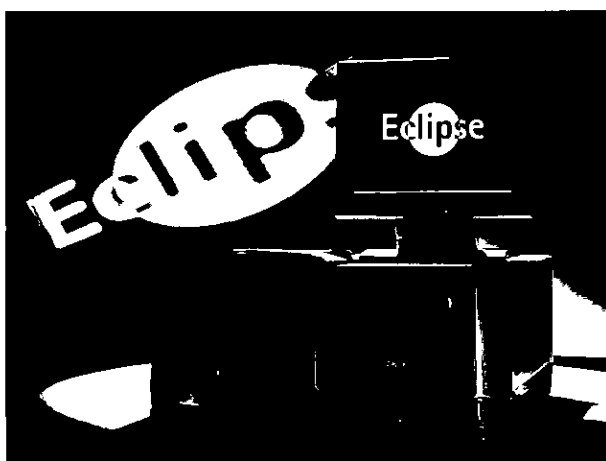
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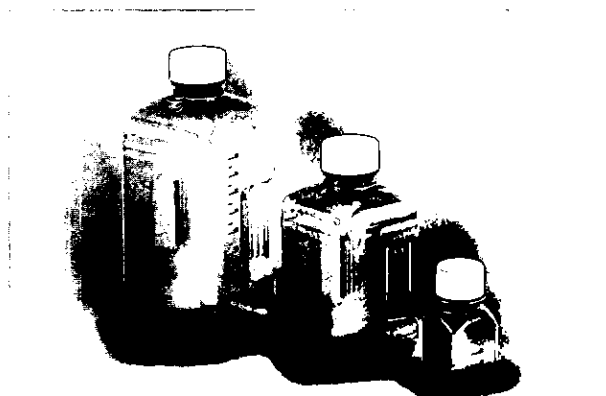
NEW VARIAN FLUORESCENCE SPECTROPHOTOMETER FOR LIFE SCIENCE, CHEMICAL AND INDUSTRIAL APPLICATIONS



Ai Scientific announces the release of the Varian Cary Eclipse fluorescence spectrophotometer. The Cary Eclipse was designed from the ground-up using modern hardware components and easy-to-learn Windows-based software. With the Cary Eclipse the user chooses collection mode - fluorescence, phosphorescence and chem/bio luminescence - for the ultimate in measurement flexibility. An intense Xenon flash lamp coupled with Schwarzschild collection optics is used to send a huge amount of light through the sample. The result is excellent measurement sensitivity across the entire wavelength range. The Cary Eclipse limit of detection of fluorescein in a 40 μ L cell is less than 10 pM. The Cary Eclipse offers the fastest data collection rates in its class. It collects data at up to 24,000 nm/min without peak shifts, with a full range scan taking less than three seconds. Fast kinetics measurements are achievable with rates up to 80 points/sec. Cary Eclipse software applications include wavelength and wavenumber scanning, concentration, kinetics, lifetimes, simple reads, advanced reads and 3-D graphics and contours. Power users will benefit from built-in ADL spectroscopy language. Fluorescence spectroscopy is used for a number of life science applications including combinational chemistry, molecular probes and DNA thermal denaturation/renaturation. The speed and sensitivity of the Cary Eclipse is ideal for these measurements. The Cary Eclipse is complimented by several "plug and identify" accessories. For combinational analyses, a 384-well microplate reader offers the highest throughput without compromising sensitivity.

Contact: Mark Albertson
A.i. Scientific (NZ) Ltd
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circle number 22 on the reader reply card

NALGENE UNITARY WASH BOTTLES ARE NOW AVAILABLE IN A CONVENIENT COLOUR-CODED ASSORTMENT



Nalge Nunc International announces the availability of 500 mL Nalgene Unitary Wash Bottles in a convenient, pre-packaged, four-unit assortment that includes four colour-coded caps - one each in red, blue, white and yellow. All

NEW PRODUCTS

Nalgene Unitary Style Wash Bottles, with a wide mouth that makes filling and refilling easy, include a built-in dispenser that won't get lost or contaminated during refilling.

The new Nalgene Unitary Style Wash Bottle assortment also includes a valuable sample Nalgene Polypaper RTK Custom Label with a mylar overlay, which makes it easy to customise any bottle with appropriate safety information.

Contact: NNI Documentation Centre
Sevenoaks, TN 14 5XA, United Kingdom
Fax: (+44-1732)-453166
circle number 23 on the reader reply card

VARIAN LAUNCHES WWW.EVARIAN.COM FOR VACUUM PRODUCTS

Varian recently launched www.eVarian.com, a new e-business site offering customers a fast, convenient, and friendly online experience for selecting and purchasing vacuum technology products. While the Vacuum Technologies business storefront is the first to go online, Varian intends to expand the business-to-business site to include scientific instruments and consumable laboratory supplies.

IBM served as Varian's key development partner for the e-business site, providing customer experience. IBM integrated the e-commerce site with Varian's back-end SAP business system. This is one of the earliest e-business-to-SAP links for a discrete manufacturer's site. Through this integration, a customer can order a product over the Web, and check availability, pricing, and delivery information in real-time.

"The goal for Varian's e-business site is to be the world's easiest-to-use, most complete electronic sales and support resource for our vacuum customers today, and for our scientific instrument customers in the future" says Allen J Lauer, Varian President and CEO.

"By personalising online interactions, www.eVarian.com will delight customers, and build loyalty, while reducing our transaction costs. This should contribute to improved financial performance and shareholder value," Lauer concludes.

"Our strategic relationship with Varian has culminated in an e-business site that will be a benchmark for business-to-business implementations," says Art Martin, Vice President of IBM Industrial Sector. "Customers will be able to use the Internet for real-time ordering and receive immediate confirmation of availability and shipment schedules. Our e-business development capabilities were critical for linking IBM's Net.commerce server to the SAP back-end systems.

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DESCRIPTIVE LITERATURE FOR THERMOMICROSCOPE'S NEAR-FIELD SCANNING OPTICAL MICROSCOPES NOW AVAILABLE



ThermoMicroscopes, a leading designer and manufacturer of scanning probe microscopes, announces the availability of literature describing its Aurora near-field scanning probe microscope (NSOM) for optical and spectrographic imaging at a sub-diffraction limit scale. Applications include analysis of thin films using fluorescence, polarisation or Raman IR spectroscopy imaging, magneto-optical analysis in Kerr and Faraday modes, and characterisation of solid-state lasers, optical fibres, and waveguides. By circumventing the diffraction limit of conventional microscopes, NSOM can provide optical images and chemical information with sub-micro spatial resolution. Now the Aurora offers dramatic improvements in the reliability and ease of use of the technique as well. The Aurora was the first and is still the leading commercial NSOM system.

Contact: ThermoMicroscopes
1171 Borregas Avenue, Sunnyvale, California 94089, USA
Phone: (+1-408) 7471600, Fax: (+1-408) 7471601
circle number 25 on the reader reply card

ALLTECH EPC 1000 - ADDS ELECTRONIC PRESSURE CONTROL TO YOUR GC

EPC reduces: analysis time, column bleed, sample decomposition and discrimination. EPC increases: accuracy, precision and column life. Free EPC Software interfaces the EPC 1000 to your PC. This enables you to save, recall, edit or download pressure programs to the EPC 1000. It can automatically calculate the appropriate

NEW PRODUCTS

pressure program to maintain constant flow throughout your analysis.

Contact: Alltech Associates Inc.
P O Box 100352, NSMC, Auckland
Phone: (09) 4443230, Fax: (09) 4442399
Freephone: 0800 652766
circle number 26 on the reader reply card

CARL ZEISS MCS 500: THE HOT LINE TO THE PROCESS

With its multichannel spectrometer series MCS 500 covering a spectral range of 215-1100 nm, Carl Zeiss brings high-precision analytical technology to where the process is. Used with a variety of measuring cells and probes, MCS 500 instruments can monitor concentrations in liquids, ascertain surface qualities of solids, powders and pastes, and register the thickness of an optically-transparent film or coating at millisecond intervals. The data obtained can be used for process control, continuous product inspection or product quality documentation.

The MCS 500 series features the well-known unique design principles of permanently adjusted and fixed Zeiss polychromators. Those of high-resolution instrument configurations (scan point interval 0.8 nm) are inside a ceramic housing, while those configured for medium resolution (scan point interval 3 nm) are enclosed in a miniaturised monolithic quartz block. Common to both types is extreme sturdiness, which withstands rough process environments without ever needing readjustment of the spectrometer module.

Uncompromising modularity is another innovation incorporated in the MCS 500 series. Carl Zeiss will assemble the very configuration required for the user's application, in a manner that eliminates any maintenance problem. Compatibility with standard interfaces has been a major design concern. The MCS 500 series is compatible with such newly available spectrometer computer interfaces as RS 422 link, RS 232 C, IEEE or IEC bus, which allow smooth data transmission to remotely located control stations. Full compatibility is also ensured with the software interfaces of the modular programs compiled under Windows. Together with the extremely powerful transputer hardware, the software makes it possible to configure systems with decentrally distributed intelligence and continuously feeds data to SPS interfaces and LIMS systems.

Some interesting design details add to the utility and reliability of the MCS 500 modules: Optical cross-section converters and automatic integration control serve to ensure high light throughput and a good signal-to-noise ratio. The dark current is highly constant thanks to the electronic and optical system being located separately from each other.

An automatic shutter control feature protects the sample against unnecessary irradiation and corrects the system's

drift behaviour. Autocalibration and diagnosis programs register equipment status trends and thus help to avoid failures.

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Suite 2, 7 Ward Street, Lower Hutt
Phone: (04) 5667601, Fax: (04) 5667501
Email: info@zeiss.com.au
Website: <http://www.zeiss.de>
circle number 27 on the reader reply card

HAMILTON DIGITAL SYRINGES

Hamilton Digital Syringes provide autosampler accuracy and precision from a manually operated syringe for a fraction of the cost of an autosampler. An easy-to-read LCD screen displays volumetric information in microlitres with twice the accuracy of manual syringes. Fine volume adjustment, plunger drag adjustment, a plunger brake and plunger stop, ensure accurate repetitive injections every time. NIST traceable calibration certification is provided.

Contact: Alltech Associates Inc.
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FROM CARL ZEISS, THE NEW MMS UV - PRESENTING NUMBER THREE ...

Another member has been added to the family of MMS Spectral Sensors. Following the MMS 1 and the MMS UV-VIS, we are now offering a special version for the UV range.

It features the same compact and sturdy design as the other MMS Spectral Sensors and also provides all their other benefits. The MMS UV is small, thermally stable, permanently adjusted and flexible in application. This makes it ideal for field use in environmental protection, but also as an HPLC detector.

The basic design of UMM UV resembles MMS UV-VIS. Its centerpiece is a blazed flat-field grating for light dispersion and imaging. The spectral range extends from approximately 200 nm to 400 nm. The overall configuration yields spectral pixel spacing of 0.8 nm/pixel, resulting in a spectral resolution of less than 3 nm according to the Rayleigh criterion. The dynamic range is 14 bit, and the minimum integration time shorter than 1 ms, depending on the electronic system used.

An SMA connector with a mounted fibre cross-section converter serves as an optical input. As in the other models, the diode array detector used provides optimum efficiency in the UV range - without the need for additional cooling or phosphorus coating.

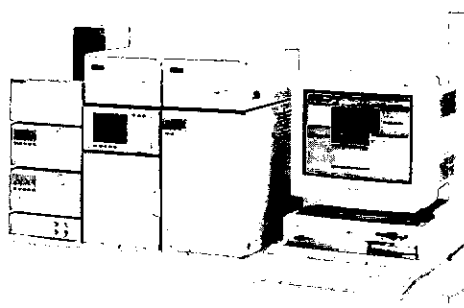
NEW PRODUCTS

All the described components are permanently cemented in a titanium body. This quasi-monolithic technology provides high wavelength stability of the spectrometer modules and far-reaching insensitivity to vibrations.

All these features open up a multitude of applications such as HPLC, gas or lamp monitoring (for ageing), for example. In addition, the modules can of course be used for classical analytical measurements such as concentration analyses of fluids. But it is online process measurement where the modules really show their strength.

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Email: info@zeiss.com.au
Website: <http://www.zeiss.de>
circle number 29 on the reader reply card

SHIMADZU SUPPRESSOR ION CHROMATOGRAPH



Shimadzu have released a new suppressor type high sensitivity ion chromatograph, the HIC-SP. The suppressor of the HIC-SP is a self-regenerative type, and does NOT require a regeneration system or reagents. The HIC-SP is suitable for trace (ppb level) analyses of, anions such as; fluoride ions, chloride ions, bromide ions, nitrate ions, nitrite ions, sulfate ions and phosphate ions, and cations such as; lithium ions, sodium ions, potassium ions, calcium ions, magnesium ions, and ammonium ions.

Compared to competitor systems the HIC-SP offers high sensitivity, precise temperature control of the suppressor module, a superb solvent delivery unit, comprehensive validation support.

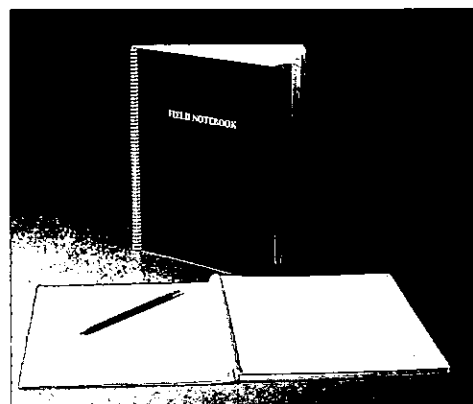
The HIC-SP is an ideal system for environmental analysis, pharmaceuticals, general chemical industry and electronic device and component manufacturing, where ppb level or lower analyses is desired.

Shimadzu also has non-suppressor type ion chromatograph systems, with the LC-10AVP series and the PIA-1000 portable ion chromatograph.

Contact: Clare Hodgson, Shimadzu New Zealand
Phone: 0800 735725, Fax: (09) 8367757

Email: clareh@shimadzu.co.nz
circle number 30 on the reader reply card

DURABLE, NEW NALGENE FIELD NOTEBOOK FOR RECORD-KEEPING IN WET OR HARSH WORKING ENVIRONMENTS



Nalge Nunc International announces the availability of the new Nalgene Field Notebook, designed for record-keeping in harsh or wet environments where paper notebooks would simply be impractical.

Each Nalgene Field Notebook includes a generous complement of 96 moisture-resistant Polypaper plastic pages with 1/4 inch grid lines, to provide ample space for field notes and drawings. Durable plastic Nalgene Field Notebook covers provide a permanent binding that makes records virtually indestructible, and all Nalgene Field Notebooks are spiral bound, so pages lie flat to make record-keeping easier and more convenient.

Nalgene Field Notebooks include a title page, instructions for keeping research records, and Table of Contents pages to help make retrieving information easier and faster.

Nalgene Field Notebooks are available as Nalge Nunc International Catalogue Number 6303-1000.

Contact: NNI Documentation Centre
Sevenoaks, TN 14 5XA, United Kingdom
Fax: (+44-1732)-453166
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FIBRE OPTIC PROBES FOR SPECTROMETRY

Hellma has recently released a full range of fibre optic probes compatible with most brands of UV-visible and NIR spectrophotometers.

These can be used for online and external sample measurements as well as being used in place of a sample sipper unit for viscous samples.

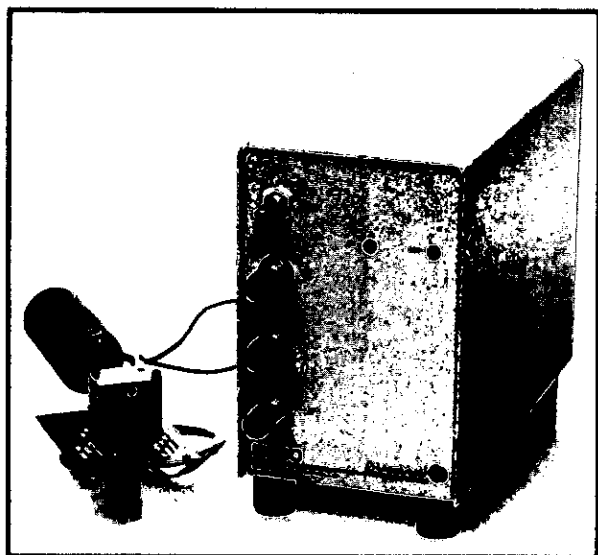
Chemical and temperature resistant probes are available.

Contact: Shimadzu New Zealand
Free Phone: 0800 735725, Fax: (09) 8367757

NEW PRODUCTS

Email: sales@shimadzu.co.nz
circle number 32 on the reader reply card

PULSED FLAME PHOTOMETRIC DETECTION: SIMULTANEOUS SULFUR AND HYDROCARBON CHROMATOGRAMS USING GAS CHROMATOGRAPHY



The OI Analytical Model 5380 Pulsed Flame Photometric Detector (PFPD) is the latest advance in flame photometric detector design. The PFPD uses a flame that is repetitively ignited and extinguished instead of continuously burning. This adds a time dimension to the flame photometric analysis that enables peaks for elements of interest to be generated without interference from other elements. Quenching is also reduced allowing a lower split ratio to be used during sample injection than is possible using a standard Flame Photometric Detector (FPD).

Compared to standard FPDs, the PFPD offers a significant enhancement in selectivity for sulfur and phosphorus compounds, as well as improved sensitivity; it uses only 10% of combustion gas required for standard FPDs. Two analog outputs for each separate element being analysed permit simultaneous S and P, S and hydrocarbon, or many other dual element outputs. The WinPulse software program included with the PFPD permits ease of use and optimisation of the PFPD operational parameters. The PFPD can also be optimised for the selective detection of 28 different elements (not simultaneously). The PFPD is available with either manual flow control or Electronic Flow Control of detector gases.

Applications include:

- Sulfur in petrochemical applications
- Sulfur and nitrogen in pharmaceuticals
- Phosphorous and sulfur in pesticides
- SO₂ and NH₃ in beverage grade CO₂
- Various organometallic detections
- Explosives

Contact: Shimadzu New Zealand
Chris Nipper, Phone: (09) 8367752 or
Bruce Fraser, Phone: (03) 5456016
Fax: (09) 8367757 or Email sales@shimadzu.co.nz
circle number 33 on the reader reply card

J&W'S NEW GC COLUMNS, POINT OF OPERATION PANELS, FLOWMETERS, AND SYRINGES TO BE FEATURED AT PITTCON 2000

J&W Scientific, the world's largest manufacturer of high resolution capillary GC columns, will present an extensive exhibit of laboratory products and services at the Pittsburgh Conference in New Orleans, Louisiana, March 13-17, 2000, booth #'s 744, 745. Included in the product offering are J&W's superior GC columns. Other related products to exhibit along with J&W are R&D Separations gas purifiers, Humonics flowmeters, Unimetrics sampling syringes, and various accessories. Some of the products featured:

GC/MS columns - J&W's family of research grade low bleed columns specifically engineered for trace analysis.
DB-1ms columns - equivalent selectivity to DB-1 with low bleed, incredible inertness, and a higher temperature limits than DB-5ms.

DB-RFA columns - A new GC column designed and configured for Reformulated Fuel Analysis.

High purity single isomer sulfated cyclodextrins - For CE chiral separations of neutral, basic, and weakly acid compounds of pharmaceutical interest.

PureFit Point-of-Operation Panel - R&D Separations' latest innovation in gas purification systems.

VeriCal flowmeters - new flowmeters available for GC and industrial hygiene professionals.

Unimetrics Autosampler Syringes - syringes for GC autosamplers at an affordable price.

Also at Pittcon 2000, J&W will present several free Technical Seminar sessions on gas chromatography. Popular titles include - *Care and Maintenance: How to Maximise Capillary Column Life, Method Development for Capillary GC Systems, Troubleshooting: When it is the GC Column's Fault, and How to Select Column Phases and Dimensions to Improve Your Separation*. Three new topics added this year include - *Advanced Injection Techniques, Fast GC Analysis, and High Temp GC Analysis*. All held in seminar room #8. J&W's experienced technical support chemists will present practical, informative material for advanced and beginning chemists alike. Visit J&W's website at www.jandw.com for more detailed exhibit and seminar information.

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Phone: (+1-916) 9857888, Fax: (+1-916) 9851101
Website: www.jandw.com
circle number 34 on the reader reply card

NALGENE BIOTAINER BOTTLES ARE IDEAL STERILE FREEZING BOTTLES



Sterile Nalgene polycarbonate Biotainer Bottles from Nalge Nunc International are ideal for low temperature freezing of biological materials and reagents.

Nalgene Biotainer Bottles in 125 mL, 1 L and 2 L sizes have a square footprint for efficiency in freezer storage. A convenient ribbed hand-grip allows secure handling even for gloved hands. Wide necks provide easy filling and access for large pipettes. Metric graduations, the manufacturer's lot number and expiration date are printed on each bottle in easy-to-read black.

Polycarbonate Biotainer Bottles were tested to meet USP Class VI criteria. Sterilisation is by gamma irradiation to an SAL of 10^{-6} with certification of sterility for the user's GMP records.

Nalgene Biotainer Bottles are also available for non-sterile applications requiring durability in rough use or steam autoclaving.

Contact: NNI Documentation Centre
Sevenoaks, TN 14 5XA, United Kingdom
Fax: (+44-1732)-453166
circle number 35 on the reader reply card

ELECTROCHEMICAL DETECTORS



The Antec Leyden range of Electrochemical Detectors for HPLC is now available in New Zealand. Two models are available to suit a variety of applications.

Chromatography

Varian Saturn 2000 benchtop GC/MS.
A GC, MS and MS/MS for the 21st century.



- Unequalled library search performance
- EI, CI and MS/MS from one injection

VARIAN

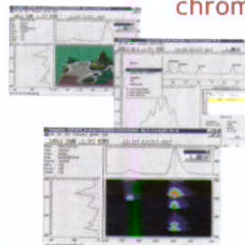
At last a better choice for HPLC.
Dionex SUMMIT HPLC.



- Advanced pumps
- High performance autosamplers
- High sensitivity detectors

DIONEX

Chromeleon - the next generation chromatography software.



Monitor and control all your GCs and HPLCs. Unequalled flexibility, performance and ease-of-use.

DIONEX

Determine Amino Acids by direct injection.
AAA-Direct from Dionex.



- No pre- or post-derivatisation
- High sensitivity
- Minimal sample preparation

DIONEX

Chrompack GC and HPLC chromatography columns and accessories.



VARIAN

Get higher performance from your chromatography system with Varian-Chrompack GC/HPLC columns and accessories.

Making on-line eluent generation even more accessible - DX-320.



Organic & inorganic ions determined in a variety of matrices in less than 10 minutes, over 4 orders of magnitude.

High purity eluents generated on-line from DI water.

The choice is yours

A.I. Scientific

Phone: 0800 95 10 10
for more information

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NEW PRODUCTS

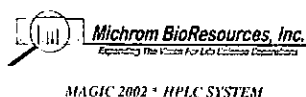
Top-of-the-range is the DECADE, a fully featured Digital Electrochemical Amperometric Detector equipped with DC, pulse and scan modes. Included is the ability to time program events, full control from a PC is available as an option.

A more basic system known as the INTRO is available and is suitable for applications requiring only DC amperometric detection.

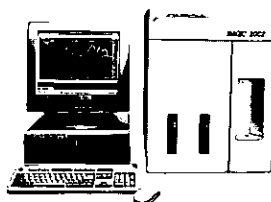
Both models incorporate a highly stable Faraday-shielded oven compartment accommodating the analytical column and detector flowcell for maximum baseline stability. A feature of their VT-03 flowcell is that it has been developed for ultra-trace analysis in standard, microbore and capillary LC-EC. This flowcell permits unusually short stabilisation times, trace analysis within half an hour after start-up is claimed by the manufacturer.

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Bruce Fraser, Phone: (03) 5456016
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circle number 36 on the reader reply card

MAGIC 2002 HPLC SYSTEM



MAGIC 2002 HPLC SYSTEM



The Michrom BioResources MAGIC 2002 is a fully integrated HPLC system. The MAGIC 2002 is a fully integrated system with optional flow detectors to allow high speed and high sensitivity monitoring of gradient methods for capillary, microbore and standard HPLC applications. The MAGIC 2002 dual pump, high pressure binary gradient solvent delivery system can deliver solvent gradient flows from 100 nL/min to 8.0 mL/min. The built-in 16-port autosampler for client, conventional loop injection or on-line concentration, enabling method development to substrate concentration and method development. The MAGIC 2002 column oven will accommodate a wide range of columns from 10 µm to 10 µm and from 10 µm to 10 µm in length, while accurately controlling mobile phase, injection, column and UV flowcell temperature from ambient to 100°C. The built-in programmable dual UV detector has bandwidth of 200-800 nm and 2.0 µm to cover the entire flow range. Auxiliary detectors including fluorescence, electrochemical, and mass spectrometry can readily be added with a minimum impact on system performance. The entire system, from reagenting to fraction collection, can be controlled from the MAGIC 2002 software (Windows 95/NT) with integrated data acquisition and analysis or single connected to many other HPLC and MS data systems.

A brochure from Michrom BioResources, Inc describes the company's fully integrated MAGIC 2002 HPLC System. The publication details the versatility of the MAGIC 2002 HPLC System and the simplicity of interchanging between analytical, microbore, capillary, and/or high throughput applications. The 8-page brochure provides information regarding the optimisation of flow dynamics that provide high speed and high sensitivity chromatography. Further information is provided within the brochure regarding applications in LC/MS, proteomics, combinatorial chemistry, pharmacokinetics and drug metabolism.

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VARIAN'S VISTA ICP-AES WINS ENGINEERING EXCELLENCE AWARD

Australia's Institution of Engineering recently honoured Varian, Inc's Vista ICP-AES for innovations that provide substantially increased productivity for users. Varian received one of only twelve 1999 Engineering Excellence Awards at the biennial awards ceremony held in Melbourne, Australia in October 1999.

The judges praised Varian for identifying the technological shift toward emission spectrometry and capitalising on that trend to satisfy a growing market need for simultaneous measurements. Vista's ability to concurrently measure both trace and major concentrations with alternate wavelengths translates into significant productivity gains for users.

The Vista CCD Simultaneous ICP-AES is the world's fastest instrument of its kind, featuring next-generation charge-coupled device (CCD) technology. Vista uses Varian's patented VistaChip detector technology to measure 73 elements in just 35 seconds, with a detector readout speed up to 80 times faster than competing instruments.

Approximately 100 entries were judged on each product's individual merits and on the extent to which they met the following mandatory criteria: use of sound engineering practices and principles; originality and ingenuity of the solution; benefit to the community; skills formation; adherence to the budget and program; and quality of business case.

The last awards ceremony occurred in 1997, at which Varian was honoured for its Cary 50 UV-Visible Spectrophotometer and SpectraAA-220 Fast Sequential Atomic Absorption Spectrometer. Varian was the only company to receive awards at two consecutive ceremonies.

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CONCENTRATING INLET FOR GC AND GC-MS

The Dynatherm ACEM 900 Thermal Desorption System from Alltech functions as a concentrating inlet for GC and GC/MS. This microprocessor controlled inlet system can be retrofitted to any existing GC. Cryogenic focussing is not needed, as samples are transferred to a smaller focussing trap that allows desorption directly to a capillary column at normal capillary flow rates. Applications include air monitoring, volatiles from drugs or packaging, and industrial hygiene for workplace sampling, and it interfaces with collection bags and summa canisters.

NEW PRODUCTS

Contact: Alltech Associates Inc.
P O Box 100352, NSMC, Auckland
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Freephone: 0800 652766
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READY FOR PICKING IN 2000

Over the past months we have been working hard to select the right quality training courses for 2000. And the crop is looking good. This Course Calendar 2000 presents the full array which, as in past years, provides hardy perennials along with new courses that embrace the most recent changes in the marketplace.

Foremost in the new offerings is *Investors in People*. This international standard for the way people are managed and developed to deliver organisational goals is very successful in the UK. It was launched to New Zealand businesses during 1999 and is expected to attract considerable attention in 2000. The NZ Quality College has secured the training rights for this exciting new programme and will provide introduction and facilitator training courses throughout 2000.

Another new offering is a course on *Inspection Body Accreditation*. Deregulation in the inspection area is creating a new competitive industry where accreditation by International Accreditation New Zealand can be a prerequisite for entry. Those in the inspection business who wish to gain the advantage of being accredited by IANZ are strongly encouraged to attend this one day introduction course.

New in the marketplace is the regulatory framework for *hazardous substances*. For those organisations needing to get to grips with the *Hazardous Substances and New Organisms Act*, we provide basic and advanced training courses for the first time in 2000.

All organisations are highly conscious of their role in maintaining sound *Occupational Health & Safety* procedures and practices. The newly published NZS 4801 (Int) Standard is now incorporated in *Implementing OH&S Management System* and the *OH&S Management System Auditor* courses. Organisations wishing to improve their health and safety management will find these courses extremely helpful.

If you would like further information, please call Claire Templer or Nigel Axford on (09) 5256633 or free phone 0800 900099, or email nzqc@ianz.govt.nz
circle number 40 on the reader reply card

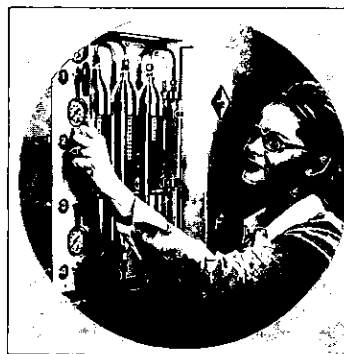
PYROLYSIS INLET FOR GC AND GC-MS

The Pyrola 2000 system is a filament pulse pyrolyser for qualitative and quantitative analysis of non-volatile substances. It has outstanding reproducibility and an extremely short temperature rise time. The Pyrola 2000 is controlled by Windows-based software. Features include

automated sequential and fractionated pyrolysis, a programmable temperature ramp, a special valve for elimination of oxygen, a known Temperature Time Profile (TTP), and fast temperature rise time ($\leq$ ms to 1400 °C).

Contact: Alltech Associates Inc.
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R&D SEPARATIONS RELEASES NEW POINT-OF-OPERATION PANELS BROCHURE



R&D Separations, first to introduce the all-metal cartridge model gas purifier to the gas chromatography market, has released a new brochure for Point-of-Operation Panels. The brochure offers three distinct styles of panels designed to be installed at your GC: namely the original, Quick Change panel; the Quick Change Plus (QC+) panel; and the new, PureFit Modular System. Each are the efficient solution to minimise downtime, offer convenient "Quick Change" installation, and eliminate infusion and signal noise associated with inferior components. All styles are offered in 2-, 3-, and 4-head panels.

The brochure also offers replacement cartridges, regulators, and Spectra-Link. Regulators help extend the life of gas purifiers with high intensity gas delivery components that improve GC analysis. Two-stage, stainless steel diaphragm (SSD) regulators for high purity gas delivery and single-stage regulators with SSD quality available to maintain precise control of gas pressure for virtually the entire content of a gas cylinder.

Spectra-Link eliminates the largest contamination source in a GC. It combines the integrity of stainless steel construction with the flexibility normally only associated with soft plastic tubing. This creates a highly inert, totally stainless steel gas line that eliminates the introduction of airborne contaminants into the gas stream when changing cylinders.

Contact: Barbara Bogue, J&W Scientific
91 Blue Ravine Road, Folsom, CA 95630, USA
Phone: (+1-916) 9857888, Fax: (+1-916) 9851101
Website: www.jandw.com
circle number 42 on the reader reply card

NEW PRODUCTS

NEW UV MINI 1240 SPECTROPHOTOMETER FROM SHIMADZU



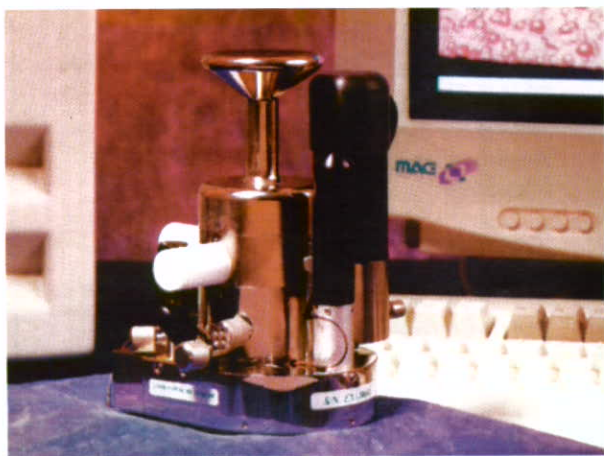
Various applications from simple colorimetric analyses to high level quantitative measurement and spectrum measurement are made possible by the UV mini-1240. Photometric measurements, spectrum measurements and quantitative measurements are all included as standard.

Measurement results are shown on a 6-inch back-lit liquid crystal display. Output to a printer or RS232C is also included in the standard package and the screen copy can be executed using a commercially available printer. Measurement results can be stored in the internal memory of the main unit or in an optional data pack. The optional UV data manager software can be used for archiving and managing methods and results via a PC.

Many diverse applications are possible using the UV mini's abundant hardware and software accessories.

Contact: Shimadzu New Zealand
Free Phone: 0800 735725, Fax: (09) 8367757
Email: sales@shimadzu.co.nz
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DESCRIPTIVE LITERATURE ON THERMOMICROSCOPE'S EXPLORER SERIES SCANNING PROBE MICROSCOPES NOW AVAILABLE



ThermoMicroscopes, a leading designer and manufacturer of scanning probe microscopes (SPM), announces the

availability of literature describing its Explorer series of instruments. The Explorer series provides a versatile platform for high-resolution SPM imaging in multiple modes over a broad range of applications. Compact design and open hardware and software architecture provide easy adaptability to specific applications. All systems include patented TrueMetrix real-time, closed-loop scan linearisation to ensure scanner accuracy, and Scanning Tip Technology to permit imaging any size sample in practically any environment, air or liquid. Dedicated Explorer SPMs are also available for polymer and life science applications.

Contact: ThermoMicroscopes
1171 Borregas Avenue, Sunnyvale, California 94089, USA
Phone: (+1-408) 7471600, Fax: (+1-408) 7471601
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RAPID, ACCURATE MOISTURE/SOLIDS ANALYSIS FROM CEM



Ai Scientific introduces the compact new SMART system 5 from CEM. Many process companies require rapid moisture/solids analysis to maximise production profitability and to control product consistency and quality. The SMART System 5 provides automated microwave moisture/solids analysis in under two minutes. The sample is continuously weighed during the drying process to ensure complete dryness and exact end-point detection. Utilising temperature feedback and built-in power control, the SMART System 5 maximises microwave power to shorten drying times without overheating the sample, providing reproducible results and ensuring repeatable conditions for every test. User-friendly software provides pre-programmed methods and help screens to guide the operator through development of their own methods. Results (including statistical analysis of trends) are printed on the integral impact printer and can be exported to an Information Management System via the serial port.

Contact: Mark Albertson
A.i. Scientific (NZ) Ltd
P O Box 35579, Browns Bay, Auckland
Phone: (09) 4781351, Fax: (09) 4781360
Email: aiscinz@ihug.co.nz
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Alltech

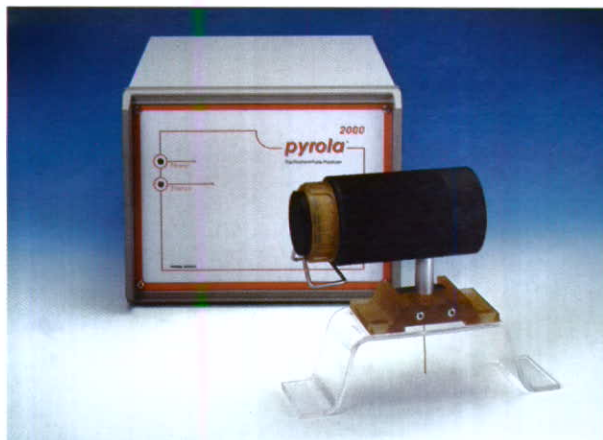
ENVIRONMENTAL ANALYSIS



Concentrating Inlet for GC and GC-MS

The Dynatherm ACEM 900 Thermal Desorption System from Alltech functions as a concentrating inlet for GC and GC/MS. This microprocessor-controlled inlet system can be retrofitted to any existing GC. Cryogenic focussing is not needed, as samples are transferred to a smaller focussing trap that allows desorption directly to a capillary column at normal capillary flow rates. Applications include air monitoring, volatiles from drugs or packaging, and industrial hygiene for work place sampling, and it interfaces with collection bags and summa canisters.

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Pyrolysis Inlet for GC and GC-MS

The Pyrolysis 2000 system is a filament pulse pyrolyser for qualitative and quantitative analysis of non-volatile substances. It has outstanding reproducibility and an extremely short temperature rise-time. The Pyrolysis 2000 is controlled by Windows-based software. Features include automated sequential and fractionated pyrolysis, a programmable temperature ramp, a special valve for elimination of oxygen, a known Temperature Time Profile (TTP), and fast temperature rise-time (≤ 8 ms to 1400°C).

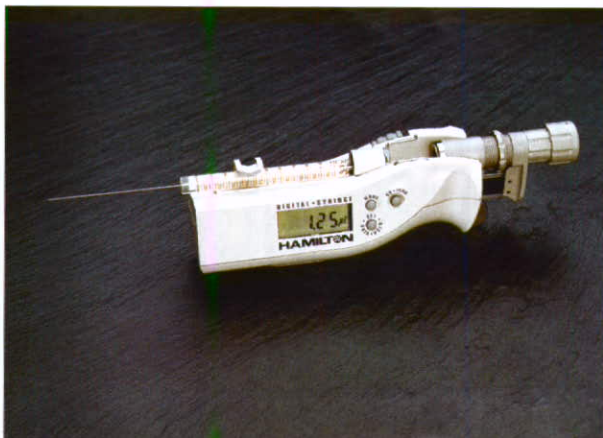
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Alltech EPC 1000 - Adds Electronic Pressure Control to Your GC

EPC reduces: analysis time, column bleed, sample decomposition and discrimination. EPC increases: accuracy, precision and column life. Free EPC Software interfaces the EPC 1000 to your PC. This enables you to save, recall, edit or download pressure programs to the EPC 1000. It can automatically calculate the appropriate pressure program to maintain constant flow throughout your analysis.

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Hamilton Digital Syringes

Provides autosampler accuracy and precision from a manually operated syringe for a fraction of the cost of an autosampler. An easy-to-read LCD screen displays volumetric information in microlitres with twice the accuracy of manual syringes. Fine volume adjustment, plunger drag adjustment, a plunger brake, and plunger stop ensure accurate repetitive injections every time. NIST traceable calibration certificate is provided.

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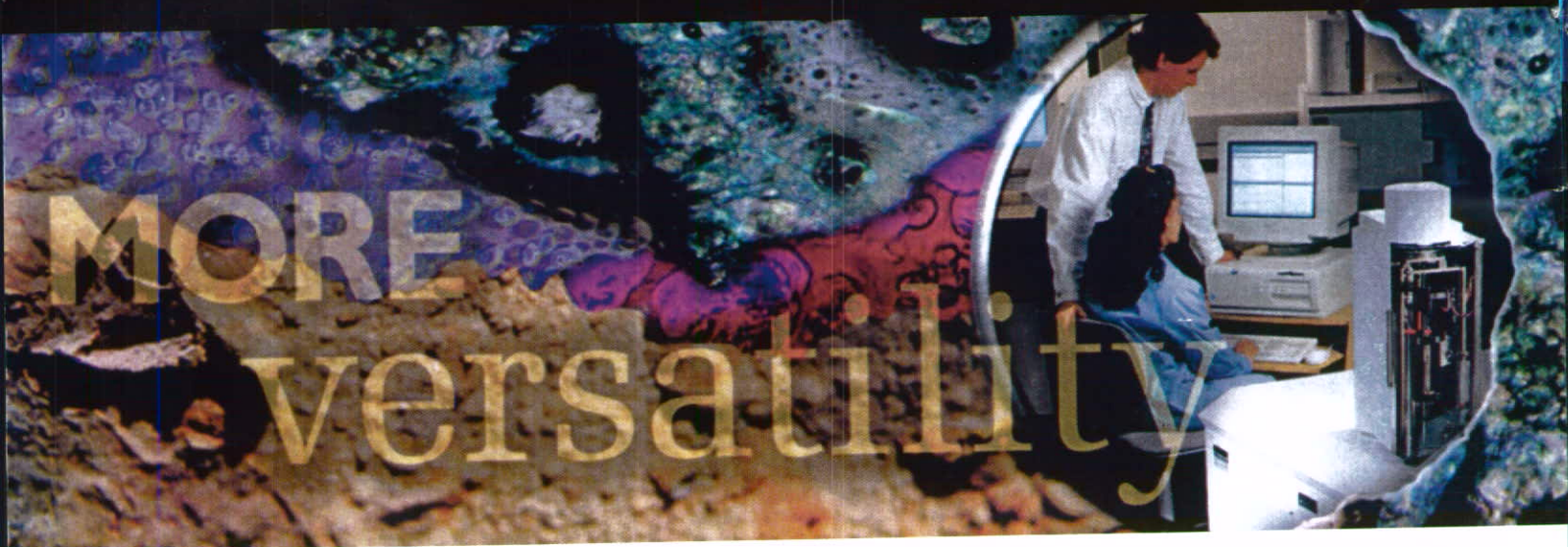
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EVERYTHING FOR CHROMATOGRAPHY

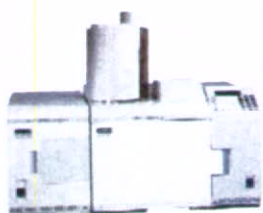
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3. WHAT EQUIPMENT/TECHNIQUES DO YOU USE? (please tick) <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">GC/GC-MS</td> <td style="width: 5%; text-align: center;">☐</td> <td style="width: 50%;">HPLC/LC</td> <td style="width: 20%; text-align: center;">☐</td> </tr> <tr> <td>UV/VISIBLE SPECTROSCOPY</td> <td style="text-align: center;">☐</td> <td>FLUORESCENCE SPECTROSCOPY</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>AA SPECTROSCOPY</td> <td style="text-align: center;">☐</td> <td>ICP, ICP-MS</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>NMR</td> <td style="text-align: center;">☐</td> <td>POLYMERASE CHAIN REACTION</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>THERMAL ANALYSIS</td> <td style="text-align: center;">☐</td> <td>FTIR/IR SPECTROSCOPY</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>MICROSCOPY</td> <td style="text-align: center;">☐</td> <td>ELEMENTAL ANALYSIS</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>pH/ELECTROCHEMISTRY</td> <td style="text-align: center;">☐</td> <td>PARTICLE SIZE ANALYSIS</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>CENTRIFUGES</td> <td style="text-align: center;">☐</td> <td>MASS SPECTROSCOPY</td> <td style="text-align: center;">☐</td> </tr> <tr> <td>XRF or XRD</td> <td style="text-align: center;">☐</td> <td>OTHER (please specify)</td> <td style="text-align: center;">☐</td> </tr> </table>	GC/GC-MS	☐	HPLC/LC	☐	UV/VISIBLE SPECTROSCOPY	☐	FLUORESCENCE SPECTROSCOPY	☐	AA SPECTROSCOPY	☐	ICP, ICP-MS	☐	NMR	☐	POLYMERASE CHAIN REACTION	☐	THERMAL ANALYSIS	☐	FTIR/IR SPECTROSCOPY	☐	MICROSCOPY	☐	ELEMENTAL ANALYSIS	☐	pH/ELECTROCHEMISTRY	☐	PARTICLE SIZE ANALYSIS	☐	CENTRIFUGES	☐	MASS SPECTROSCOPY	☐	XRF or XRD	☐	OTHER (please specify)	☐	4. I WOULD LIKE TO KNOW MORE ABOUT BECOMING A MEMBER OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY. PLEASE SEND ME DETAILS. Please tick ☐																										
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