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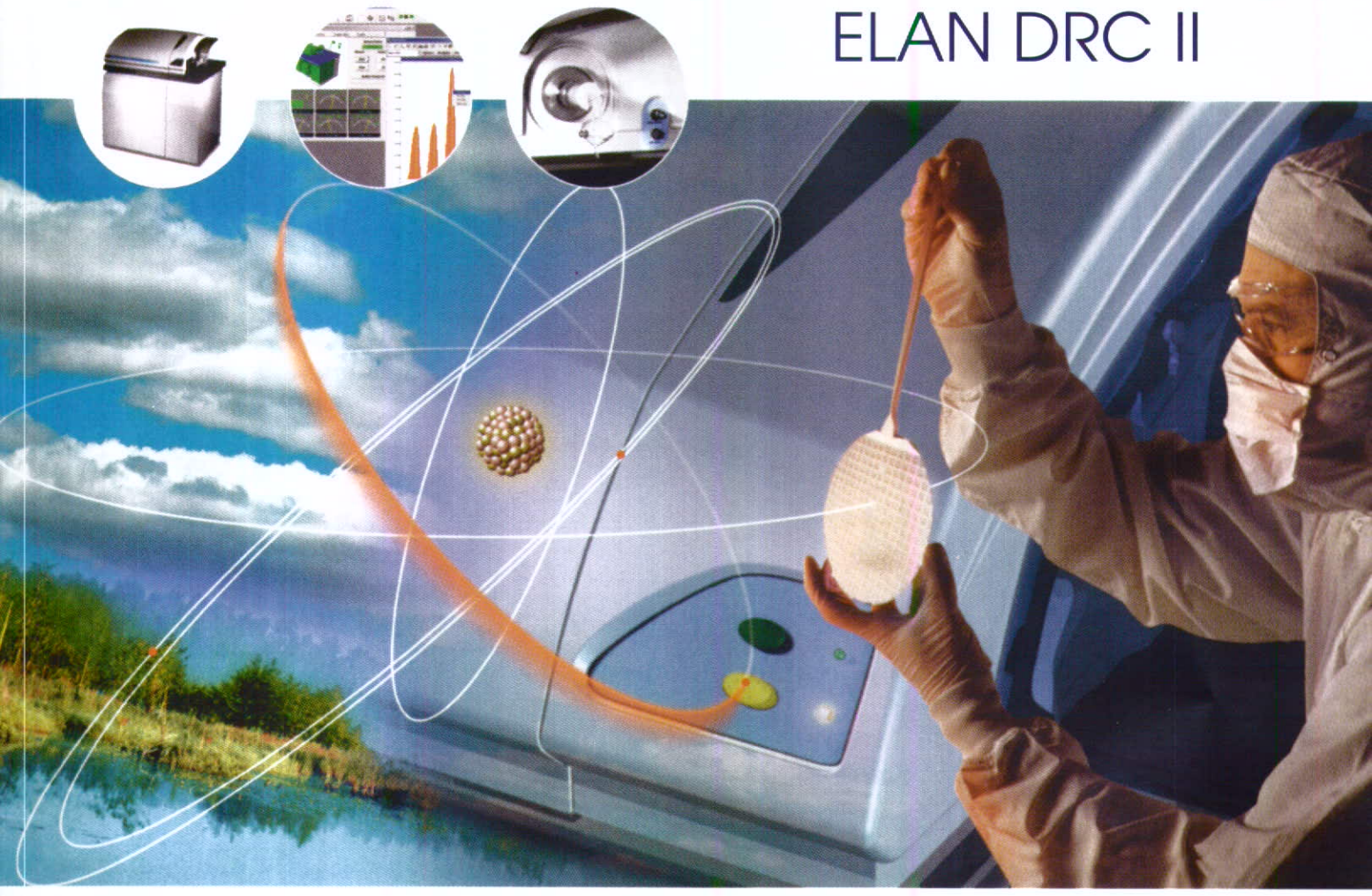
▲ ICP Mass Spectrometry



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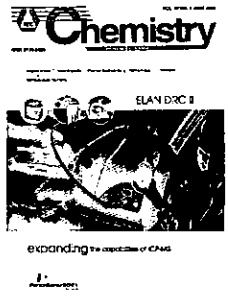


On the cover ...

PerkinElmer SCIEX ELAN DRC II expanding the capabilities of ICP-MS **2**

COVER STORY

PerkinElmer SCIEX ELAN DRC II expanding the capabilities of ICP-MS

ELIMINATES INTERFERENCES COMPLETELY

When your applications extend beyond the capabilities of conventional ICP-MS, you need the power of the innovative ELAN DRC II. The DRC II combines the power of patented Dynamic Reaction Cell (DRC) technology (Figure 1), with performance -enhancing Axial Field Technology, providing uncompromised sensitivity and performance in all matrices for even the toughest applications. Unlike collision cell, high-resolution, or cold plasma systems, the DRC II completely eliminates polyatomic interferences providing ultratrace-level detection limits.

The DRC II uses chemical resolution to eliminate plasma-based polyatomic species before they reach the quadrupole mass spectrometer. This ion-molecule chemistry uses a gas to "chemically scrub" polyatomic or isobaric species from the ion beam before they enter the analyzer, resulting in improved detection limits for elements such as Fe, Ca, K, Mg, As, Se, Cr, and V.

Unlike more simplistic collision cells, patented DRC technology not only reduces the primary interference; it eliminates sequential side reactions that create new interferences. Unless kept in check by DRC technology, these uncontrolled reactions increase spectral complexity and create unexpected interferences.

Leaves cool plasma out in the cold

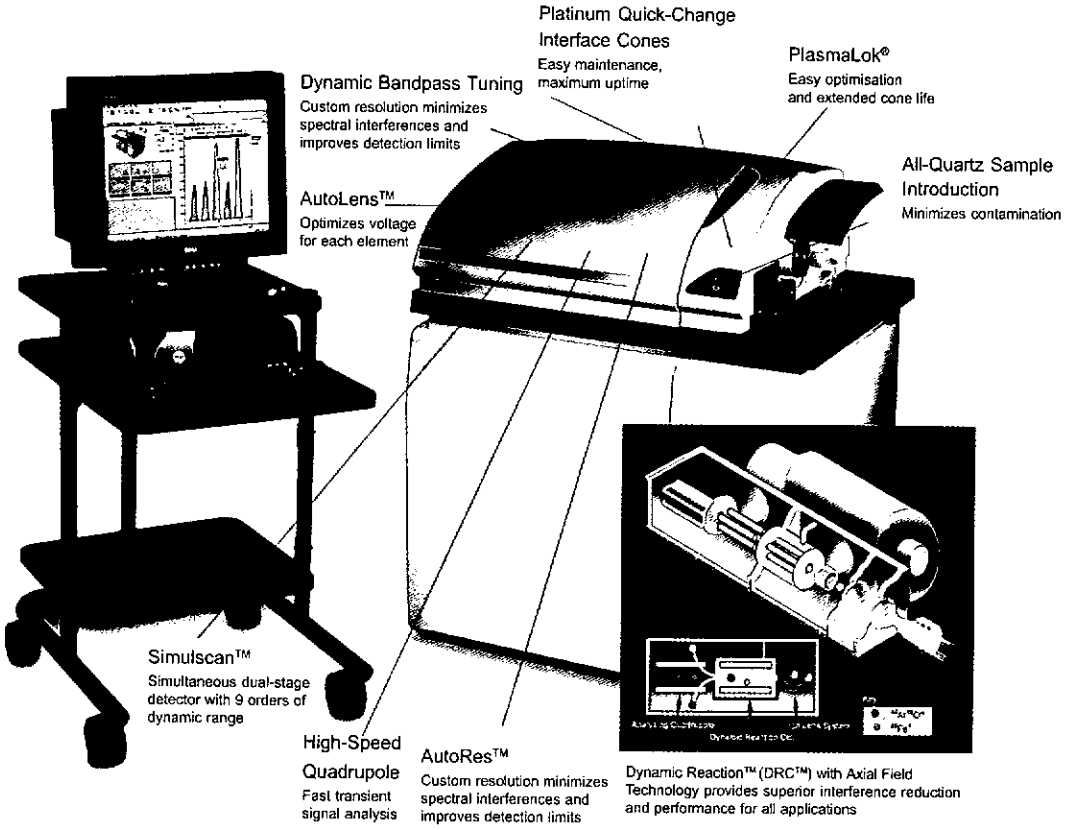
DRC technology always uses a high temperature or "hot" plasma for analysis, eliminating the recognized drawbacks of cool or warm plasma approaches. Cooler temperature plasmas have limited ability to ionize all but the most easily ionizable elements. Cool plasmas also suffer from severe suppression of the analyte signal by matrix constituents and often require the use of standard additions calibration. This decreases sensitivity and degrades detection limits for elements with high ionization potentials and limits the number of interferences that can be removed.

Using the cool plasma approach, cool plasma condition elements must be run in a separate analysis from normal plasma elements, requiring each sample to be run twice. The DRC II can run all these elements in the same run, increasing productivity. And, the DRC II provides interference-free determination of elements that cold plasma can't, such as Cr, V, As, and Se.

The lowest detection limits

The superior interference reduction and maximum analyte transmission provided by the ELAN DRC II produces excellent signal-to-background ratios. Background levels measured on-peak are typically less than 1 count per second - 50 to 150 times better than those reported by users of collision cell-based systems.

Lower on-peak background levels mean a lower **Background Equivalent Concentration (BEC),** the real measure of detectability. If the signal falls below the BEC, it is masked by the background. In situations where ultratrace measurements are made, the BEC actually limits the analysis, not the detection limit. Lower BECs mean that ultra trace level scan be accurately quantitated, not just detected.



Dynamic Reaction™ (DRC™) with Axial Field Technology provides superior interference reduction and performance for all applications

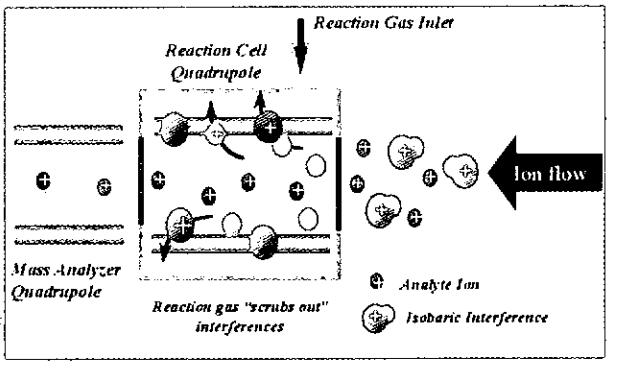
***Figure 1:* How does the DRC work?**

The DRC is located between the ion optics and the mass analyzer quadrupole. It consists of a quadrupole placed inside an enclosed reaction chamber. This quadrupole eliminates polyatomic interferences caused by the combination of plasma gases and sample matrix constituents before they can enter the analyzing quadrupole.

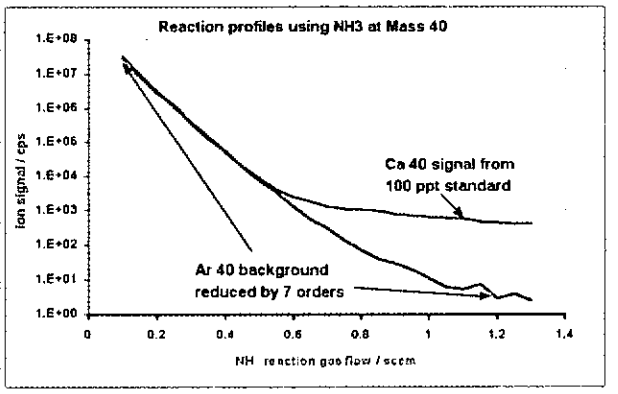
Gas inlets pressurize the chamber with a low volume of reaction gas, such as ammonia, methane, or other gases. The reaction gas is selected based on its ability to undergo a gas phase chemical reaction with the interfering species and remove the interference. When analyte and interfering ions from the ICP enter the DRC, the reaction gas combines with interfering ions, creating a non-interfering reaction product at a different mass. The ions inside the cell offer predictable, reproducible, and transferable chemistry, facilitating efficient interference removal.

Unlike simple collision cell instruments, which pass all the reaction products into the analyzer quadrupole where they may cause interferences for other analytes, the DRC eliminates reaction by-products using the Dynamic Bandpass Tuning (DBT) mechanism. The DBT function ejects the precursor ions that would otherwise react to form new interferences.

The ELAN DRC II is able to eliminate interferences by up to nine orders of magnitude. This provides exceptional detection limits and the ability to use ICP-MS to determine more elements than previously thought possible.



The Dynamic Reaction Cell



DRC can eliminate Ar^+ interference on ^{40}Ca.

THE DRC II PROVIDES UNEQUALED PERFORMANCE

In addition to eliminating interferences in traditionally unmeasureable elements, the ELAN DRC II system provides the highest performance of any ICP-MS. It has unequaled detection limits, specificity, and sensitivity.

The ELAN DRC II features platinum cones and an all-quartz sample introduction system to further enhance sensitivity and reduce contamination.

DBT optimizes chemical specificity

Differentiation between the analyte and the interfering species is critical to success in ICP-MS. The DRC II provides greater accuracy by eliminating false positives due to interferences. The presence of an isobaric or molecular interference can lead to an elevated signal at the analyte mass. For example, ArCl at mass 75 interferes with As. In some cases, these interferences are extremely difficult to resolve, either because the analyte is monoisotopic or the interference is too large. The DRC II allows the interference to be removed, giving you confidence that the correct results for the analyte and not a matrix interference are reported. Using the DRC II, molecular interferences that have plagued trace-level determination of many elements by ICP-MS can be completely eliminated. Also, the superior specificity achieved with the DRC II through the use of **Dynamic Bandpass Tuning** (Figure 2), means reaction byproducts are eliminated.

Left unchecked, these by-products can produce new interferences, compromising results.

Automated method development within the DRC II software determines the best flow conditions and sets the DBT for each analyte mass, making the system easy to use. Additionally, the ELAN DRC II system allows you to use the most effective reaction gas for your application, including NH_3, CH_4, and O_2 as well other gases, providing superior interference reduction and improved detection limits.

In simple collision cell instruments, gas selection is restricted in order to reduce formation of reaction by-products.

DRC gets the right answer, faster

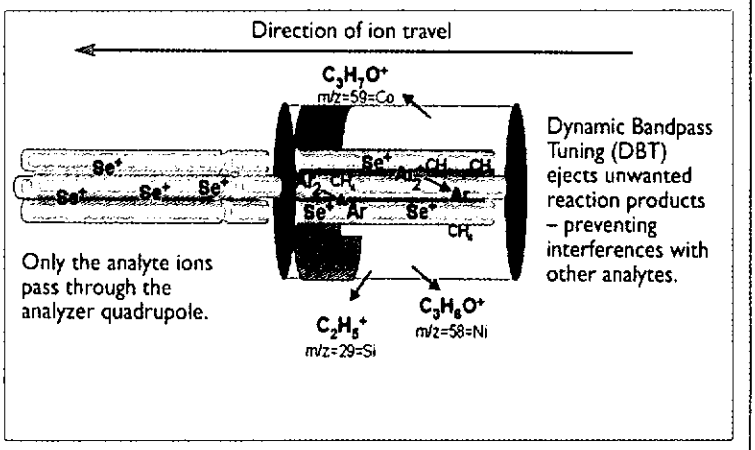
Unlike "cool plasma" and high-resolution analyses where optimization of analytical conditions is done for each analyte and multiple runs are required to determine several analytes,the DRC II removes multiple interferences during the same analytical run. The DRC II significantly improves productivity by reducing the number of runs required. You can combine different sets of DRC conditions for different elements in the same analytical method along with conditions for elements run in standard mode, providing faster, more accurate results.

Improved sensitivity and precision

The DRC II offers exceptional sensitivity and stability. Using collisional focusing (Figure 3), sensitivity can be enhanced by up to five times, when compared to a standard ICP-MS.

***Figure 2:* Dynamic Bandpass Tuning**

Unlike simple collision cells that use hexapoles and octapoles as ion guides, the quadrupole used in the DRC provides both a high mass cutoff and a low mass cutoff. Thus, the DRC quadrupole defines a precise mass bandpass window. The mass bandpass window ejects all ions with masses outside the window as they are formed. The bandpass window is selected based on the specific chemistry that needs suppression or promotion. And, since a specific bandpass range is selected for each analyte, the bandpass filter is dynamically tuned to best suit the analyte of interest. As a result, interferences falling outside of the analytical bandpass are completely eliminated.



In this example, the DRC removes the Ar_2^+ interference by converting it to neutral Ar and CH_x^+ using methane as the reaction gas.

Collisions with the reaction gas allow ions to spend more time in the DRC, reducing short-term signal fluctuations. This lowers plasma noise, leading to improvements in short-term precision.

This excellent short-term precision dramatically improves isotope ratio measurements performed on the DRC II. Relative standard deviations for isotope ratios of less than 0.03% are achievable.

Axial Field Technology maximizes performance for all matrices

Innovative new Axial Field Technology applies a linearly accelerating axial field to the Dynamic Reaction Cell. This technology decreases matrix effects, improves stability, and increases the speed of the DRC. This makes the DRC II the ultimate analytical tool for all applications including environmental, clinical, and geochemical, where optimal performance in challenging matrices is required.

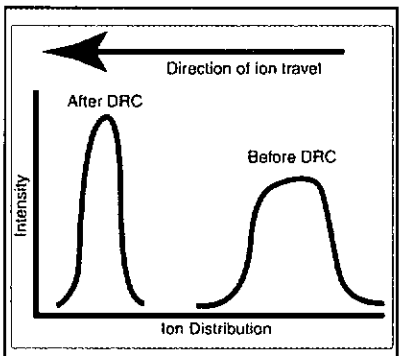


***Figure 3:* Collisional Focusing**

In the DRC, the ions collide with the reaction gas, causing them to lose energy and focus their motion on axis. This allows the ions to spend more time in the DRC reducing short-term signal fluctuations. This collisional energy damping reduces the energy spread, while collisional focusing (migration of ions towards the quadrupole axis) results in improved ion transmission and sensitivity.

Proven ELAN technology

Not only does the ELAN DRC II include the industry's most effective method of reducing interferences, it features a wealth of proven capabilities that make it superior to other ICP-MS solutions.

• *Quick-change cones*

The interface cones use large diameter orifices to resist clogging and signal drift. Their easy-in, easy-out design makes routine maintenance simple.

• *The industry's only single ion lens*

Competitive systems have 30 to 40 pieces, making them very difficult and time-consuming to clean and reassemble. Changing the exclusive **SwiftMount™** single ion lens is as easy as changing a light bulb. In fact, the process takes less than 3 minutes. The lens is also inexpensive, making replacement an affordable option.

• *Integrated peristaltic pump with tubing saver*

The sample introduction system uses an integrated peristaltic pump to dramatically reduce sample uptake time. Tubing saver ensures optimum measurement precision and prolongs peristaltic tube lifetimes.

• *One-touch ion lens adjustment*

Unlike other systems, which require iterative adjustments to the ion optics, the ELAN single ion lens is adjusted automatically with the single touch of a button. For both DRC and standard mode analysis, the unique **AutoLens** lens adjustment system dynamically adjusts the lens system to the optimum voltage for each element while the quadrupole is scanned.

• *Simultaneous dual detector*

The **SimulScan** dual-stage detector measures both high- and low-level analytes simultaneously. This conserves valuable or limited samples, eliminates the need to perform time-consuming sample dilutions, and allows you to quickly identify uncharacterized samples.

• *Heat exchange based cooling system*

A unique combination of components permits use of a heat exchange based cooling system, replacing expensive and unreliable chillers without compromising speed or sensitivity.

For more information on the ELAN DRC II or other Perkin Elmer instruments contact:
NZ Scientific Ltd
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Email: perkin-elmer@clear.co.nz
circle number 1 on the reader reply card.

Patent Proze

by Jane Calvert and Helen Palmer

AMENDMENT TO THE PATENTS ACT 1953

Just before Christmas last year, the New Zealand Government passed an amendment to the Patents Act 1953. The amendment has important implications for owners of patent rights operating in industry sectors where marketing approval is required to market a new product.

A new section has been inserted into the Patents Act, which reads:

> ***Regulatory review exception***
> *It is not an infringement of a patent for a person to make, use, exercise, or vend the invention concerned solely for uses reasonably related to the development and submission of information required under New Zealand law or the law of any other country that regulates the manufacture, construction, use, or sale of any product.*

The primary purpose of the amendment is to allow so-called "spring boarding" into pharmaceuticals markets where drug trials are conducted by a generic manufacturer while a patent for the drug is still in force. The New Zealand Court of Appeal, through case law, had previously protected the rights of patentees by restricting the activities of generic manufacturers until relevant patents had expired. Drug trials required for launching a product onto the market were considered patent infringement.

Under the new statutory law, a generic drug manufacturer will be able to embark on trials prior to expiry of the patent covering the drug. This would enable the generic manufacturer to achieve marketing approval earlier than before.

Interestingly, the new provision states that use [of a drug] related to the development and submission of information required under New Zealand law *or the law of any other country* is not infringement. In essence this means that a generic drug manufacturer could conduct drug trials in New Zealand for the purposes of spring boarding in other countries where a patent is also in force.

Other countries, such as the US, have similar provisions (often called "Bolar provisions") as part of their patent legislation. However, spring boarding legislation tends to be available only in those countries where patent terms for pharmaceuticals can be extended. New Zealand patent law has no such extension of term provision. The Government has intimated that the issue of extending the term of pharmaceutical patents will now be considered as part of the Patents Act review.

There may be a question mark over whether this latest amendment to the Patents Act means that the Act is no longer fully compliant with the TRIPs Agreement. However, a WTO panel decision (*EU v Canada*, 17 March 2000) upheld the right of pre-patent expiry development work, and stated that Bolar provisions are compatible with obligations under the TRIPs agreement.

Clearly this amendment to the Patents Act is controversial. Furthermore, it was introduced by way of a Statutes Amendment Bill, rather than as part of the Patents Act review. However, the amendment has been made, and with no foreseeable reversal, it is now hoped that extensions of patent terms will become possible once the Government has completed its review of the Patents Act. This will at least mitigate the possibility of a reduced effective patent life for a significant number of pharmaceutical patents in New Zealand.

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

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Jane Calvert

Jane Calvert and Helen Palmer of Baldwin Shelston Waters specialise in chemistry and biotechnology patents. Jane is a patent attorney and solicitor. She joined BSW after completing a PhD in chemistry at the University of Canterbury in 1994. Helen joined BSW in 2000. She has a PhD in chemistry from The University of Auckland, and has had postdoctoral research experience in the USA and New Zealand.

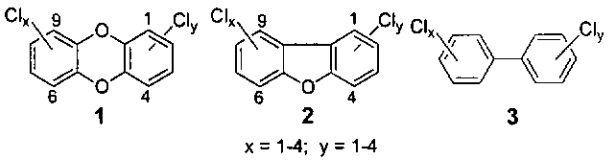
Helen Palmer

Organochlorine Trends In The New Zealand Environment

Barbara Thomson
Institute of Environmental Science and Research Ltd (ESR), P O Box 29-181, Christchurch

Introduction

Organochlorine (OC) contaminants are organic chemicals that are environmentally persistent, bioaccumulative, toxic, and are transported by natural and meteorological processes over long distances. OCs comprise three groups of compounds namely, dioxins (**1**) and dibenzofurans (PCDD/DFs) (**2**), polychlorinated biphenyls (PCBs) (**3**) and OC pesticides, such as DDT and dieldrin (see Chart II). OCs have been linked to a variety of health problems including reproductive, developmental, and immune disorders, and some cancers, and are the subject of an international effort for global regulation.



The chemicals and their origin in the environment

Dioxins

Dioxins (**1**) or PCDD/DFs (**2**) are tricyclic compounds, comprising two benzene rings joined by either two or one oxygen atoms, respectively. Both groups of chemicals may have up to eight chlorine atoms bonded to the benzene rings with each specific combination known as a congener. Thus there are 75 possible dioxin congeners and 135 furan congeners.

Congeners containing one, two or three chlorine atoms are thought to be of no toxicological significance. However, congeners with 2,3,7- and 8-chlorine substitution are thought to pose a risk to human and environmental health. The most widely studied of all the PCDDs and PCDFs is 2,3,7,8–tetrachlorodibenzo-*p*-dioxin (TCDD) (Scheme 1).[1]

Toxicological effects of 2,3,7,8-TCDD include dermal, immune, cancer, reproductive development, and endocrine disruption. It has been classified by the International Agency for Research on Cancer (IARC)[2] as a human carcinogen. It is an extraordinarily potent carcinogen, more so than the toxin (aflatoxin) from peanuts or the pesticide DDT. To illustrate this, the doses at which 50% of test rats developed tumours (TD_{50}) are 0.00000667, 0.000937 and 57.2 mg/kg of body weight/day for 2,3,7,8-TCDD, aflatoxin B1, and DDT, respectively.[3] Perhaps of more concern are the effects 2,3,7,8-TCDD has on endocrine function that are mediated via binding to the aryl receptor. Animal studies suggest that the most sensitive endpoints of exposure to 2,3,7,8-TCDD are decreased sperm count, genital malformations in offspring, immune suppression, and neurobehavioural effects in offspring.[4] Concern for humans was illustrated for example, in a study published in *The Lancet*,[5] where low sperm count and quality was found in young men who had been exposed, *in utero*, to dioxins in contaminated rice oil in 1978-79, 20 years previously .

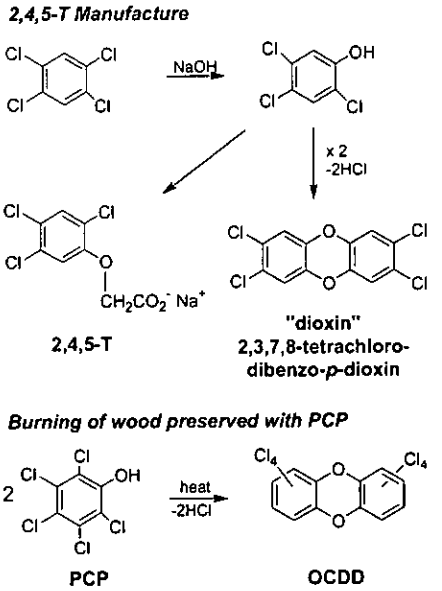
Dioxins have entered the New Zealand and global environments as unwanted biproducts of manufacturing and combustion processes.[6] For example:

· in the manufacture of the pesticide 2,4,5-T (2,4,5-trichlorophenoxyacetic acid). In this process, trichlorophenol is formed by reacting tetrachlorobenzene with sodium hydroxide. A small proportion of the trichlorophenol condenses to 2,3,7,8-TCDD, the amount depending upon the concentration of trichlorophenol and the temperature (Scheme 1). The dioxin content can be minimised to about 0.1 ppm by controlling the reaction conditions. Agent Orange, used as a defoliant in the Vietnam War, was a 1:1 mixture of 2,4-D and 2,4,5-T with dioxin levels of about 10 ppm.[7]

· in the treatment and burning of treated timber. Pentachlorophenol (PCP) used for timber treatment in New Zealand contains low levels of a wide range of mainly PCDF compounds and when wood containing PCP is burned, such as in domestic fires, dioxins may be formed (Scheme 1).

· as by-products from the pulp and paper bleaching process.

Scheme 1. Dioxin formation in manufacture of 2,4,5-T and from burning PCP preserved timber.



· from industrial, natural and domestic fires where organic matter is burned.
· from vehicle emissions where chlorinated lead scavengers have been added to leaded petrol.
· in iron, steel, and aluminium production.

The relative importance of these sources in the New Zealand environment has been assessed by the Ministry for the Environment[6] and are shown in Figure 1. The major sources of dioxins identified in this study were emissions to air from uncontrolled landfill fires and the amount contained in residential and industrial waste deposited in landfills.

PCBs

The second group of organochlorine compounds are the PCBs. These contain a biphenyl framework with up to 10 chlorine atoms bonded to the benzenoid rings and result in up to 209 different congeners as illustrated by **3**.

Like the PCDD/DFs, the biological and toxicological effects of the PCBs are highly dependent upon the degree and position of chlorination. For example, PCB#126 is ten times more toxic than PCB#169 which, in turn, is 100 times more toxic than PCB#77 despite apparently small structural differences (Chart I).[8] Certain PCBs (those without chlorine atoms in the *ortho* positions) appear to elicit dioxin-like toxic responses. PCBs are less potent carcinogens than dioxins and have been classified by IARC as probable human carcinogens.[2] Some PCBs are estrogenic, that is they initiate a hormonal response by binding to the estrogen receptor.[9]

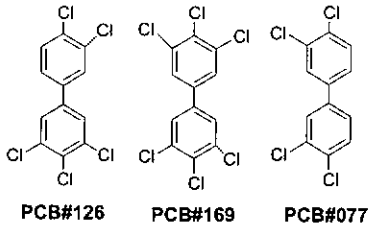
PCBs are chemically inert liquids, difficult to burn and excellent electrical insulators. Because of these properties they were synthesized purposely from benzene (Scheme 2) for commercial use in a range of applications that include: coolant fluids in power transformers and capacitors, plasticizers in paint, in copy paper, kiss-proof lipsticks, and heat transfer fluids. Careless disposal led to release of these chemicals into the environment.[7]

OC pesticides

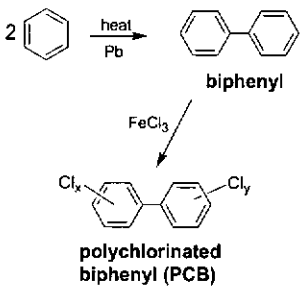
The third group of organochlorine compounds are pesticides. A number of organochlorine pesticides have been registered for use in New Zealand (Chart II). The most reknown of these is DDT, discovered to be pesticidal in 1939 by Paul Muller, a chemist working for the Swiss firm Geigy. In 1948, Muller was awarded the Nobel Prize in medicine for the lives saved by DDT following World War II. However, less than 15 years later, in 1962, DDT was termed '*the elixir of death*' by Rachel Carson in her pivotal book, *Silent Spring* because of its link with declining wildlife populations.[7] DDT was used extensively in New Zealand for control of the grass grub. In fact, New Zealand led the world in the aerial application of DDT from the mid-1950s until application to pasture was banned in 1970 following evidence of bioaccumulation and persistence.

Pesticides have accumulated in the New Zealand environment from their extensive use in agriculture. In addition, it is likely they were employed for public health reasons to control mosquitoes, lice, and fleas which are vectors for malaria, yellow fever, typhus, and plague.

Chart I.



Scheme 2. Synthetic pathway for PCBs - see reference 7.

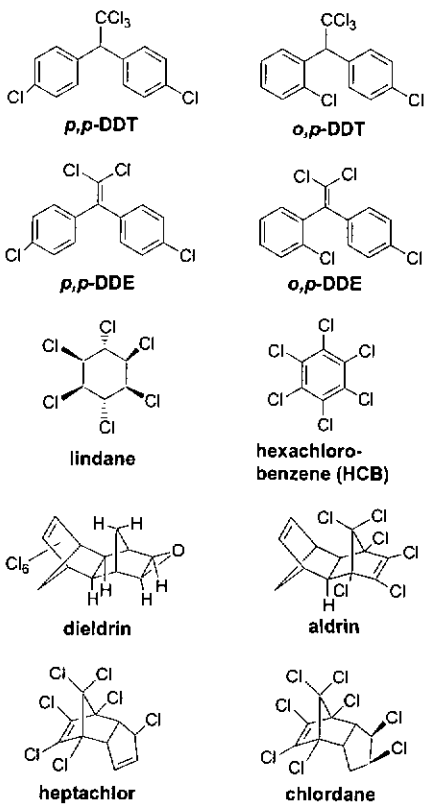


Reduction of OC contaminants in New Zealand

In line with global efforts, there have been a number of policy and regulatory initiatives to reduce the occurrence and therefore the exposure to persistent organochlorine compounds in New Zealand:

· Cessation in 1987 of the manufacture of the widely-used herbicide 2,4,5-T, which was contaminated by low levels of 2,3,7,8-tetrachloro-*p*-dibenzodioxin.
· Restriction in 1991 of the timber treatment agent pentachlorophenol (PCP) to use on export dressed timber.
· Stepwise removal of lead from gasoline, beginning in

Chart II. Organochlorine pesticides (or metabolites) previously registered for use in NZ.



1987, was complete for all grades of gasoline in general retail use in 1996.

· A move away from the use of elemental chlorine to considerably reduce emissions of PCDD/DFs from New Zealand's two Kraft pulp and paper plants.

· Decommissioning of a number of old medical waste incinerators and metal smelters likely to have been a major historical source of PCDD/DF emissions.

· Prohibition of importation of PCBs to New Zealand from December 1986 and prohibition of PCB storage since January 1995.

· Deregistration and voluntary withdrawal of the organochlorine pesticides: heptachlor voluntarily withdrawn (1971), HCB deregistered (1972), aldrin voluntarily withdrawn (1985), DDT deregistered (1990), dieldrin deregistered (1990), lindane deregistered (1990), chlordane deregistered (1992).

Measurement of human exposure trends

The effectiveness of the initiatives to reduce organochlorine compounds in the environment can be seen by comparing the results of organochlorine levels in two New Zealand breast milk studies which were undertaken in 1988 and 1998.[10,11] Organochlorine compounds are concentrated in adipose tissue and in the fat fractions of serum and milk. Breast milk was chosen for the measurement of organochlorine body burden as milk contains a high fat content (relative to serum) and samples can be obtained non-invasively. In addition, there is international comparative information for organochlorine compounds in breast milk.

The two New Zealand studies recruited participants from two urban (Auckland, Christchurch) and two rural (Northland, North Canterbury) areas of New Zealand. As organochlorine compounds accumulate over a lifetime an older person will have a higher body burden than a younger person. Organochlorine compounds are excreted in breast milk such that the milk of a first pregnancy will contain higher concentrations than the milk of subsequent pregnancies. Because of these factors, participants had to comply with strict World Health Organisation selection criteria so that the results could be compared between studies within New Zealand and internationally.

These criteria included:

· Age of mother - 20-30 years
· First time mothers (*primiparae*), one child only
· Breast feeding only
· Sample collection between weeks 5 and 8 after birth
· Residence time of at least 5 years in either the rural or urban region.

Applying these criteria, the following sample numbers were achieved: Northland (10,16), Auckland (11,20), North Canterbury (8,2) and Christchurch (9,14) for 1988 and 1998, respectively.

Participants each completed a questionnaire and provided a milk sample which was analysed for PCDD/DF and PCB congeners, and OC pesticides. The 1988 study included 44 analytes. The 1998 study included 72 analytes. Dioxin concentrations are incredibly low and at the picograms (10^{-12} g) level per gram of body fat. Because of the low concentrations detected, great care had to be taken to avoid contamination of glassware and extracting reagents. Isotopically labelled standards were added at the beginning of the extraction to account for losses in the multistep process. Samples were extracted, fractioned, and cleaned on various solid phase columns before analysis by gas chromatography with mass spectrometry (gc-ms). Quality

Table 1. Toxic equivalent factors for individual dioxin and PCB congeners - see ref. 7.

Dibenzo-*p*-dioxins	**TEF**	**Non-*ortho* PCBs**	**TEF**
2,3,7,8-TCDD	1	PCB 77	0.0001
1,2,3,7,8-PnCDD	1	PCB 81	0.0001
1,2,3,4,7,8-HxCDD	0.1	PCB 126	0.1
1,2,3,6,7,8-HxCDD	0.1	PCB 169	0.01
1,2,3,7,8,9-HxCDD	0.1		
1,2,3,4,6,7,8-HpCDD	0.01		
OCDD	0.0001		
Dibenzofurans		**Mono-*ortho* PCBs**	
2,3,7,8-TCDF	0.1	PCB 105	0.0001
1,2,3,7,8-PnCDF	0.05	PCB 114	0.0005
2,3,4,7,8-PnCDF	0.5	PCB 118	0.0001
1,2,3,4,7,8-HxCDF	0.1	PCB 123	0.0001
1,2,3,6,7,8-HxCDF	0.1	PCB 156	0.0005
1,2,3,7,8,9-HxCDF	0.1	PCB 157	0.0005
2,3,4,6,7,8-HxCDF	0.1	PCB 167	0.00001
1,2,3,4,6,7,8-HpCDF	0.01	PCB 189	0.0001
1,2,3,4,7,8,9-HpCDF	0.01		
OCDF	0.0001		

control procedures included a replicate sample and a blank analysed with each run of samples, reanalysis of three samples from 1988, and analysis of three samples by an international laboratory.

Because different PCDD/DF and PCB congeners have different toxicities, and a measure of total toxicity is usually required, a system of Toxic Equivalent Factors (TEF) has been developed to facilitate risk assessment and regulatory control of exposure to mixtures of compounds.[8] Each congener is assigned a toxicity weighting relative to the most toxic congener (2,3,7,8-TCDD). This is considered scientifically valid if the compounds to be combined:

· are structurally related

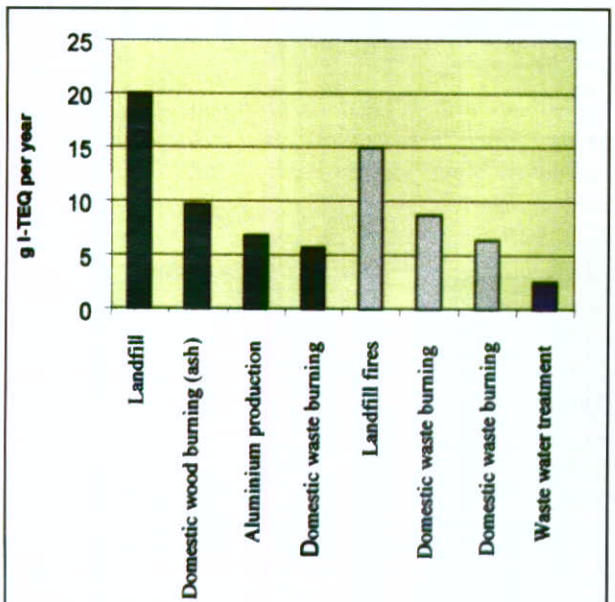


Figure 1. Major sources of dioxin emissions (1998) to New Zealand land (green), air (grey) and water (red) - see reference 6.

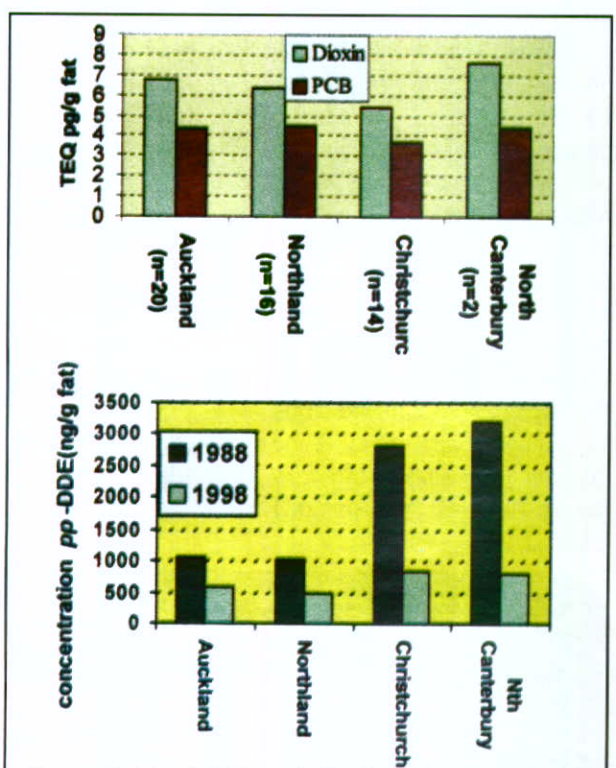


Figure 2. Total PCB and dioxin equivalents (TEQ) and *p,p*-DDE across study areas for 1988 and 1998.

· act via a common mechanism

· elicit a biochemical and toxicological response via this mechanism

· have similar physiochemical attributes, *e.g.* persistence in the environment and accumulation in the foodchain.

Several TEF schemes have been developed for PCDD/DFs and dioxin-like PCBs with the most recent re-evaluation occurring in 1997. The toxic equivalent (TEQ) value for

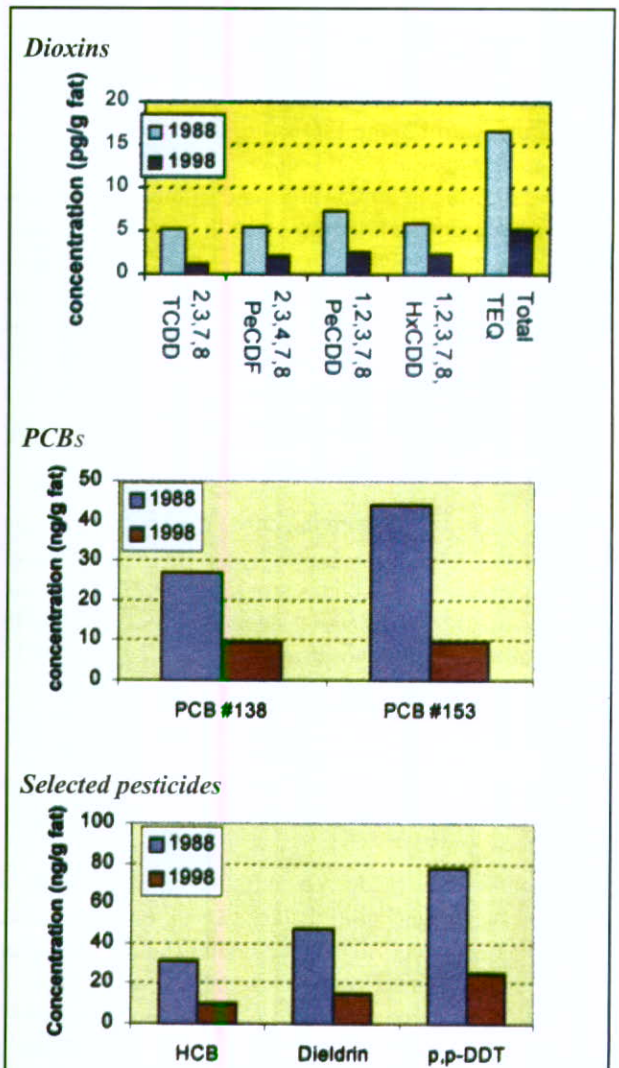


Figure 3. Decreasing trend of selected OC compounds in New Zealand breast milk.

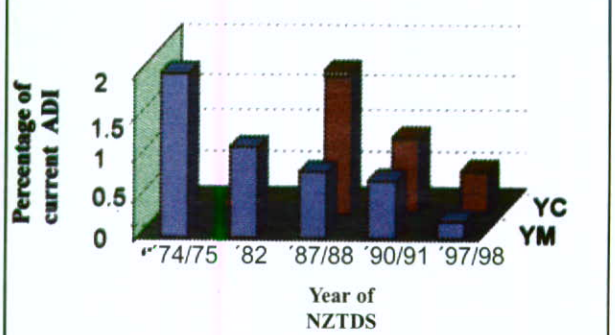


Figure 4. Estimated daily dietary exposure to total DDT for a young male (YM) and a young child (YC) in successive NZ Total Diet Studies as a proportion of the allowable daily intake (ADI) - see reference 13.

a congener is its concentration multiplied by its TEF. Total TEQ is the sum of all congener concentrations weighted by their corresponding TEF values. The TEF values for PCDD/DFs and PCBs are shown in Table 1.

Results

There was little regional difference in total PCB and dioxin equivalents across the four areas studied in 1998. However, marked differences in concentrations of the *p,p*-DDT metabolite, *p,p*-DDE (Chart II) were observed for the North Island compared with the South Island, both in 1988 and 1998. This reflects the high use of DDT in Canterbury for grass grub control in the 1960s (Figure 2).

Figure 3 shows the downward trend in dioxin, PCB and pesticide concentrations in breast milk between 1988 and 1998. Dioxin and PCB congeners shown are limited to those that were measured and detected in at least 95% of the samples in the two studies. For dioxins, concentrations of the two congeners 1,2,3,4,6,7,8-HpCDD and OCDD were not included because they were off the scale of the graph, but their small contribution to total TEQ is included in the "Total TEQ" value.

PCBs #138 and #153 were the only PCB congeners to be detected above the limit of detection in more than 75% of the samples analysed in both studies. The DDT metabolite *p,p*-DDE also showed a 67% reduction in concentration in breast milk, but the concentrations found [1929 and 626 ng/g fat (1 ng = 10^{-9} g) for 1988 and 1998, respectively] were outside the scale of the other pesticides shown in Figure 3. There is clear evidence that the concentration of each group of organochlorine compounds has decreased by about 70% over the ten year period from 1988 to 1998.

The decline in pesticide concentration in breast milk is mirrored by the declining dietary exposure to pesticides estimated from successive New Zealand Total Diet Studies (TDS), as exemplified by DDT (Figure 4). Although DDT was not deregistered for use in New Zealand until 1991 extensive use on pasture stopped in about 1970. Yet DDT, or its metabolites, were detected in 45 of 76 foods analysed 27 years later in the 1997/98 TDS. These analyses included all butter, cheese, fish, and meat samples, and demonstrated the persistence of the chemical in the environment.[12,13] Despite the general occurrence of DDT (or its metabolites) in food samples, dietary exposure is low compared with the presumably safe level defined as the Allowable Daily Intake (ADI).

The breast milk and dietary exposure trends provide evidence that the measures to reduce emissions of organochlorine compounds in the New Zealand environment have been successful.

Conclusions

Robust analytical data of breast milk show that exposure to dioxins, PCBs and OC pesticides in the New Zealand environment has decreased by approximately 70% over the ten year period 1988 to 1998. This is good evidence that policy measures to reduce the use, and formation of these contaminants, have been effective.

Currently there are a number of initiatives underway to ensure an ongoing improvement in environmental status of OC contaminants in New Zealand. These initiatives are driven by community concern, such as the investigation of contaminated sawmill sites, and occupational exposure of sawmill workers. In addition, there are activities in response to international directives, such as the collection and disposal of residual PCBs and OC pesticides. Continued vigilance is prudent given the extreme toxicity and potentially long term effects of this group of chemical contaminants.

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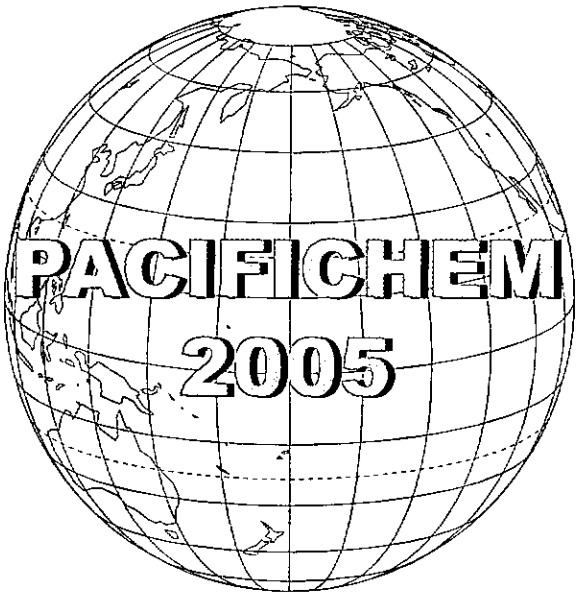


PACIFICHEM PROGRAMME PLANNING

The second meeting of the Pacifichem 2005 committee was hosted by the Chemical Society of Japan at their headquarters in Ochanomizu, Tokyo, in late May. While the critical financial considerations and appropriate protocols for an international meeting of this type kept the financial and protocol sub-committees busy (it is hoped to keep registrations to about $US415 and a 2005 Pacifichem Lecture is planned), it was the Programme sub-committee that had the lion's share of work to do by way of assessing the 155 proposals that had been received to organise Congress Symposia from the first round of submissions. The deliberations were greatly facilitated by the work done by the area co-ordinators in the various sponsoring society countries and the numbers symposia accepted for the Congress thematic areas are listed below. The details of the symposia themselves will be available from the Pacifichem website once the organisers have been informed of the decisions, likely by the time this is in print. The full list of symposia accepted and their titles and organiser(s) can be found at: htpp://www.pacifichem.org

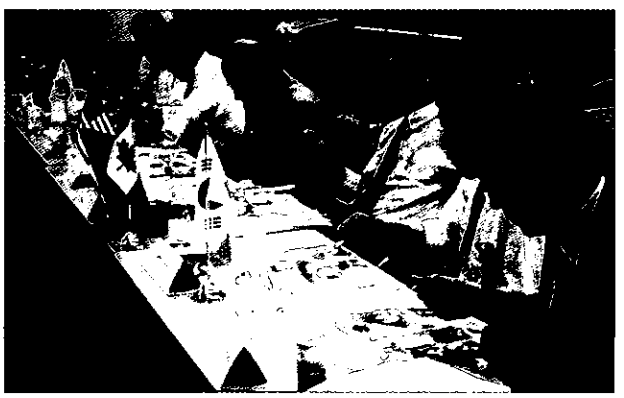
A good number of symposia were deferred from formal acceptance for a range of reasons and the organisers of the proposed symposia have been asked to revise their proposals, combine them with those from others *etc.* and resubmit them to the group by mid-September for reconsideration. One symposium proposal that did not comply with the requirements of the Congress and was declined as inappropriate.

Because of the endeavours of the sub-committee there is no longer any need for a meeting late in 2003. Consequently, the expenses of one programme sub-committee meeting are saved and the ***deadline for the second round of symposium proposal submissions has been extended to:*** **Second round proposal submissions close 1 March 2004. Details at: http://www.pacifichem.org**

The advances in projection technology and computer interfacing have resulted in the committee agreeing to provide computer projection facilities in all congress symposia venues. Overhead projection will also be available but the provision of 35 mm slide projectors is not possible within the congress budget. Anyone (perhaps the older generation typified by the writer) requiring a 35 mm projector will need to meet the cost him/herself.

In total some 65% of the available mornings and afternoon sessions for Pacifichem 2005 were committed at this meeting. It is now essential that areas such as AGROCHEMISTRY, CHEMISTRY AND THE COMMUNITY, and MEDICINAL CHEMISTRY be strengthened - and here members of the New Zealand community are more than able to assist. In addition, the remaining areas will need additional symposia to provide a balanced programme, so why not use the web to see what is missing in your own area with a view to organising a symposium for us.

In assessing the various proposals it was pleasing to see a good number of NZIC members identified as symposium co-organisers and as possible congress speakers. However, the response to organise a symposium was disappointingly low! Further information about Pacifichem 2005 can be obtained from Brian Halton, Pacifichem Representative,
Email: brian.halton@vuw.ac.nz



Above: **Pacifichem 2005 - working lunch at CSJ headquarters, 21 May 2003.** (L to R: Brian Halton (NZIC), Shinji Murai (Congress Chair, CSJ), Stan Israel (Congress V-P & Finance Chair, ACS), Rich Oakley (Congress V-P & Protocol Chair), Boon Chung (KCS), and Katz Tatsumi (Program Chair, CSJ).

		Submitted	*Accepted*
1.	**AGROCHEMISTRY**	6	3
2.	**ANALYTICAL CHEMISTRY**	12	10
3.	**BIOLOGICAL CHEMISTRY**	11	8
4.	**CHEMISTRY AND THE COMMUNITY**	3	2
5.	**ENVIRONMENTAL/GREEN CHEMISTRY**	12	10
6.	**INORGANIC CHEMISTRY**	24	20
7.	**MACROMOLECULAR CHEMISTRY**	21	15
8.	**MATERIALS CHEMISTRY/NANOTECHNOLOGY**	17	15
9.	**MEDICINAL CHEMISTRY**	3	3
10.	**ORGANIC CHEMISTRY**	23	19
11.	**PHYSICAL/THEORETICAL CHEMISTRY**	22	15

Cosmetics Ingredients Derived From Pure New Zealand Wool

Alisa Roddick-Lanzilotta, Rob Kelly, and Bruce Foulds
Keratec New Zealand Ltd, Private Bag 4749, Christchurch (www.keratec.co.nz)

The proteins and lipids that nature combines to create wool have strong biological similarities to the components of human hair and, in some respects, skin. The role that these biological molecules play within the wool fibre, for example, providing structure, tensile strength, flexibility and moisture regulation, are areas that many cosmetics preparations attempt to influence.[1] The molecular components of wool are ingredients that present a cosmetics formulator with a range of opportunities to impart specific activity to a formulation. When isolated from pure New Zealand wool, a source with a biosecurity status that can offer safety guarantees not available in many other parts of the world, using a process in which the animals are unharmed and the environment is sustained, then the opportunity extends from the formulation chemist to the marketer of new cosmetics products.

Keratec New Zealand Ltd is a new biotechnology company established to commercialise keratin technologies developed through an extensive research and development programme carried out by the Wool Research Organisation of New Zealand Inc., a world leader in keratin and fibre science for over 40 years. The technologies developed are creating product opportunities across a range of high added value sectors, including cosmetics, nutraceuticals, medical materials, specialty fibres, and biopolymers. Keratec® launched its first products to the global market in Paris, in April of this year at *In Cosmetics*, the premier trade show in Europe for cosmetics ingredients.

Above: The Keratec® stand at the *In Cosmetics* trade show.

Keratec® Cosmetics Ingredients

Keratins have been used in cosmetics formulations, particularly shampoos and conditioners, for some time. These keratins are typically in the form of low molecular weight protein hydrolysates produced by degradative methods that cleave peptide bonds and can irreversibly damage the amino acid residues (particularly cystine) that lead to keratin's unique characteristics. The proprietary process used by Keratec® isolates specific protein fractions from wool in a way that maintains their core characteristics, such as molecular weight and amino acid composition. This leads to the generation of completely novel raw materials for use as cosmetics ingredients. Figure 1 illustrates the regions of the wool fibre from which the different Keratec® products originate.

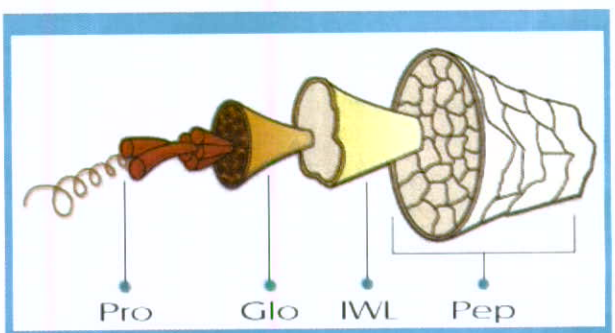


Figure 1. Schematic diagram showing an exploded view of each component of the wool fibre illustrating regions where Keratec® product fractions originate.

Keratec Pro™ is a highly purified form of the high molecular weight (40-60 kD) intermediate filament proteins present in wool. These are the fibrous proteins which give wool its characteristic strength. The structure and intact nature of Keratec Pro™ result in excellent film forming properties, an important attribute in hair conditioning. The characteristics of Keratec Pro™ also lead to activity in the areas of hair strengthening and repair, as well as moisture regulation in hair, skin and nail care formulations.

Keratec Glo™ is a purified form of the medium molecular weight (10-30 kD) globular matrix proteins which bind the components of wool together. It is rich in cysteine

functionality and this provides the potential to react with components of hair leading to repair and long term conditioning.

Keratec Pep™ is a protein hydrolysate of molecular weight <1000 D able to penetrate hair cuticle and bind to hair keratin through the prevalence of a reactive form of cystine.

Keratec IWL™ is a natural lipid mixture isolated from the cell membrane complex of the wool fibre. Keratec IWL™ contains ceramides, cholesterols and other lipids, and has an overall composition similar to that of the stratum corneum of human skin.

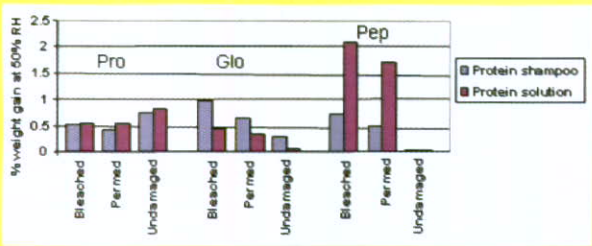


Figure 2. Weight gain at 50% relative humidity of undamaged, permed damaged, and bleached hair after treatment with 0.5% active Pro, Glo, or Pep from an aqueous solution and a non-conditioning shampoo.

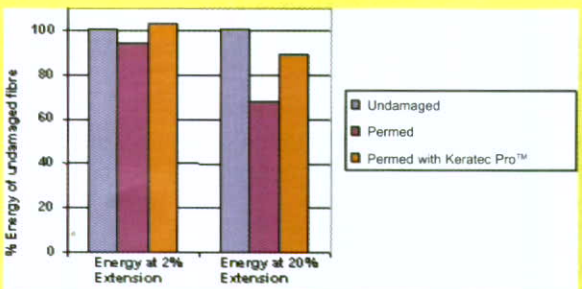


Figure 4. Energy required to extend permed hair fibres by 2% and 20% with and without application of a 0.5% active solution of Keratec Pro™.

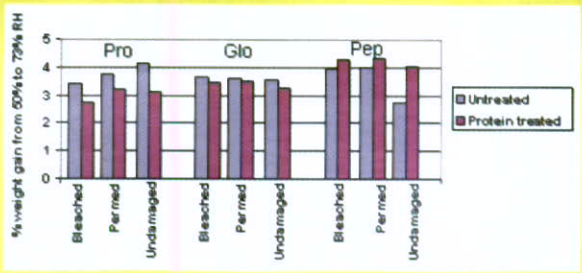


Figure 5. Weight increase after 24 hours when untreated and protein treated undamaged, bleached, and permed hair swatches were moved from 50 to 73% relative humidity. Treatment was with 0.5% active aqueous solution followed by rinsing.

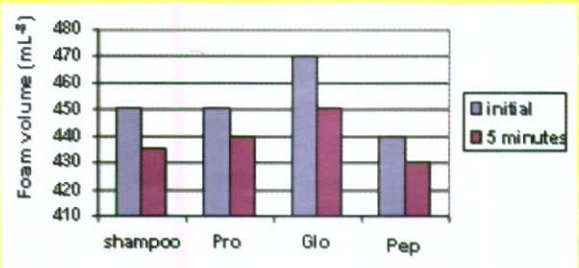


Figure 6. Foaming results for shampoo with and without 0.5% active protein added.

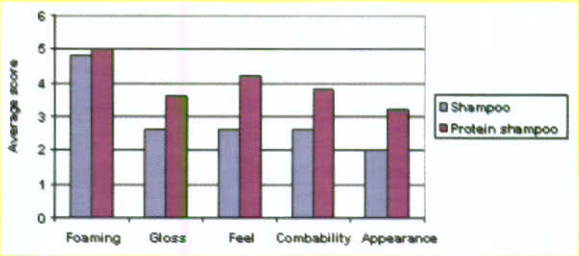


Figure 7. Results of human volunteer evaluation of shampoo with and without Keratec Pro™. An increased score indicates a perceived improvement in performance.

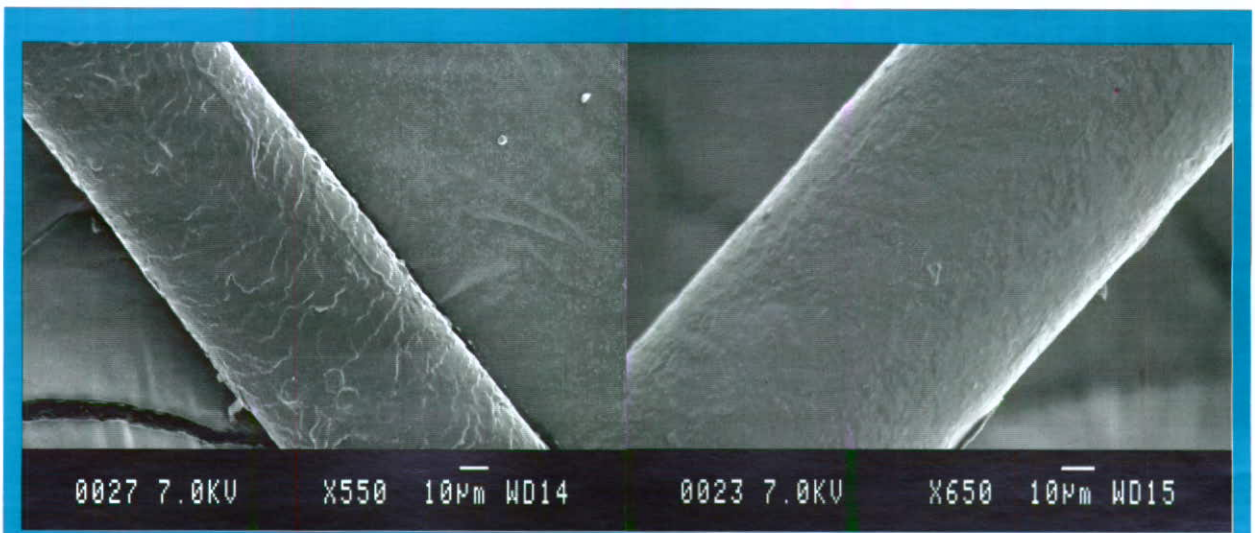


Figure 3. SEM images of hair before (left) and after (right) treatment with Keratec Glo™ shampoo.

Cosmetic Activity of Keratec® Proteins

Substantivity

Substantivity is a measure of the amount of material remaining on or in the substrate (in this case hair) after application.[2] Human hair swatches which were either undamaged, or subjected to perming and bleaching protocols,[3] were weighed at 50% relative humidity (RH), treated with the protein, rinsed thoroughly, dried and reweighed at the same (50%) RH. The weight increase at constant humidity and temperature gives an indication of the substantivity of the protein. Keratec® proteins were shown to bind to hair when applied from a protein solution and also from a shampoo formulation (Figure 2). It is notable that Keratec Pep™ had a much greater substantivity when applied to damaged hair from a protein solution as compared to a formulation. This may be due to the fact that Pep has a low molecular weight and is susceptible to the solubilisation effects of the surfactants present in the shampoo. Keratec Pro™ and Glo are larger and have a greater ability to form adsorbing layers on the hair surface. Keratec Glo™, in particular, appears to have greater substantivity from a surfactant-rich formulation. This may be due to the effect of surfactants opening up the structure of this globular protein and exposing a greater number of sites capable of positive interaction with the hair surface. Figure 3 shows scanning electron microscopy images of hair before and after treatment with Glo shampoo.

Repair

Keratec Pro™ has been shown to have a strengthening effect on human hair that has been systematically damaged by a perming process (Figure 4). In this test the energy required to extend fibre by 2% and 20% is measured on a series of wet hair fibres using an Instron tensile testing apparatus. The impact on energy for extension of typical cosmetic treatments, such as perming and bleaching, is determined. Applying, and then rinsing off a solution of Keratec Pro™ results in an increase in the energy for extension for perm damaged fibres. This increase in strength originates from the ability of the Pro biopolymer to react with the reducing functionalities generated in the damaged fibres as part of the perming process, so forming a reinforcing network on parts of the fibre.

Moisture regulation

The ability of materials to increase, maintain, or decrease the uptake of moisture is an important property in cosmetic formulations.[2] For example, for skin creams, a barrier action which prevents moisture loss from the skin surface maintains a healthy skin appearance. Similarly, when hair is subjected to large variations in humidity, which may occur when entering and leaving air conditioned rooms in a humid country, the control of moisture uptake will prevent hair limpness and loss of body. Conversely, when hair is dry and brittle, enhancing moisture uptake is desirable as this increases the flexibility and improves the appearance.

The moisture regulation properties of Keratec® proteins when the relative humidity is changed from 50% to 73% were measured on undamaged, bleached, and permed hair and results are summarised in Figure 5.

Keratec Pro™ was shown to have a barrier effect, decreasing the moisture uptake relative to hair with no protein applied. This is consistent with the film-forming ability observed for Keratec Pro™, and the high molecular weight character, leading to an effective surface covering of hair fibres. Keratec Glo™ gave moisture uptake similar to the non-protein treated hair, suggesting that any surface coating of the fibre by the medium molecular weight protein was highly permeable. Keratec Pep™ increased the moisture uptake, particularly of undamaged hair, consistent with observed properties of traditional protein hydrolysates, with increased hydrophilicity generated by peptide bond cleavage.

Keratec® Proteins in Formulations

The impact of active ingredients on a formulation is of considerable importance to the cosmetic chemist. A fine balance of ingredients is used to achieve desirable characteristics associated with both appearance and activity. Compatibility of any new active ingredients with commonly used products and thickening systems can have a significant impact on the ease and cost of formulating. Keratec® ingredients have been used to formulate a range of cosmetic products, including shampoo, conditioner, styling gel, skin cream, and nail care products to demonstrate their compatibility. One property often compromised by proteins and protein hydrolysates in hair care formulations is foaming. One method for determining foaming properties is the Waring blender test.[4] In this test, a 5% aqueous solution of the sample is blended in a Waring blender for 5 minutes, the volume of foam is recorded immediately, and then after 5 minutes.

Figure 6 shows that in the absence of protein, a typical shampoo formulation gives a foam volume of 450 mL which decreases to 435 mL after 5 minutes. Although the addition of Keratec Pro™ did not affect the foam volume, it did increase the stability. Inclusion of Keratec Glo™

had a foam boosting effect, whereas Keratec Pep™ suppressed foaming, as is observed with most hydrolysed keratins presently available commercially.

Volunteer Observations

The ability of the ingredient to impart the claimed benefits, in what is often a very complex mixture of chemicals, is an important factor. There are various ways in which efficacy can be tested, one of which is to use subjective observations from volunteers. A human volunteer study was performed to test the effect of adding Keratec Pro™ to a non-conditioning shampoo. Subjects were given two (unlabelled) shampoos, one of which was the control and the other containing 0.5% active Keratec Pro™. They were requested to use each shampoo for one week, washing as many times as they usually do, and then complete a questionnaire ranking each formulation; a low score indicates an undesirable effect and a high one a beneficial effect. Figure 7 gives the averages of the scores. Overall, volunteers could not distinguish a difference in foaming (consistent with foaming tests for Pro) but they did register a perceived improvement in the gloss, feel, combability, and appearance of their hair when the Keratec Pro™ shampoo was used.

Summary

A range of new cosmetics ingredients has been developed from New Zealand wool. Initial tests indicate that these materials have properties that are desirable across a range of cosmetic formulations, and work is ongoing to determine a full range of efficacy data for all the materials presented. This development presents the formulators and marketers of cosmetic products with new opportunities stemming from the technical nature of the materials, as well as their source and country of origin.

Acknowledgements

The development of keratin technologies has been supported by the wool growers of New Zealand, through the New Zealand Wool Board, and by the Foundation for Research Science and Technology.

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4. see: http://www.chrysanindustries.com/lab_tests/L101.htm

NEW BOARD MEMBERS FOR RESEARCH FOUNDATION

Minister of Research, Science and Technology Pete Hodgson has appointed three new Board members to the Foundation for Research, Science and Technology.

The new members are Dr Ken Taylor, Professor Tom Barnes and Dr Grant Ryan. In addition, Dr Andy Pearce has been reappointed for another term.

Mr Hodgson said all the appointees were highly respected in their professions.

"They are highly experienced specialists who bring to the Foundation a wide range of skills and experience in research, science and technology from both the private and public sectors.

"The blend of business leadership, research expertise and academic brilliance they offer, combined with their extensive international experience, will be invaluable to the Foundation's work."

The Foundation invests nearly $400 million annually in a wide range of research, science and technology initiatives with economic, social and environmental benefits for New Zealand.

Mr Hodgson also paid tribute to Maxine Simmons who is retiring from the Board after 3.5 years.

"As the chief executive of a biotechnology company, Maxine's knowledge and expertise has been very useful to the Technology New Zealand investment committee. Technology New Zealand invests in businesses to increase their technological abilities in order to benefit New Zealand and Maxine chaired the investment committee for the last 2.5 years."

Biographical details of the new appointees are given below.

Dr Ken Taylor

Dr Ken Taylor is currently chief executive officer of Antipodean Biotechnology Limited, a venture capital firm based in Auckland. He holds honours and doctorate degrees in pharmaceutical chemistry from the University of Otago. He has held positions at Johns Hopkins University, Princeton University and the Squibb Institute of Medical Research. In 1975 he joined Roche in Sydney and in 1981 he was appointed Medical Director for Roche in New Zealand while concurrently holding a professorship in clinical pharmacology at the University of Auckland School of Medicine. In 1986 he was appointed Managing Director for Roche in New Zealand and later became Managing Director of the Roche UK affiliate based in Welwyn Garden City, before moving to California in 1994 to convert Syntex from a corporate pharmaceutical company to Roche Bioscience, a research centre. In 1996 he returned to New Zealand to reassume management of the Roche affiliate.

Professor Tom Barnes

Tom Barnes is Deputy Vice-Chancellor (Research) of the University of Auckland and Professor of Physics. After completing a PhD in the UK, he worked in the fluid dynamics field. He came to New Zealand in 1981 to join the DSIR in the Physics and Engineering Laboratory, in charge of the optical manufacturing workshop. From 1987 to 1991 he worked in Japan on optical research. Since 1991, he has progressed from Lecturer to Professor at the Physics Department at the University of Auckland. Professor Barnes holds several patents and collaborates in research with Industrial Research Limited and universities in New Zealand, the UK and Japan.

Grant Ryan

Dr Grant Ryan has a Degree in Mechanical Engineering from the University of Canterbury and PhD in Chemical and Process Engineering. He worked for two and a half years as a scientist for Industrial Research Limited. He also led a research project into impediments to the uptake of new and emerging technologies. He has been involved in numerous international research projects, including three months at the Universite de Versailles in Paris on an EC research project modelling pollution flows in European economies. Dr Ryan also has extensive business experience. He is the originator of the internet search technology that led to the formation of Global Brain in March 1998 and is currently CEO of RealContacts Ltd. He is also on the board of the Venture Investment Fund.

Andrew Pearce

Dr Andrew (Andy) Pearce is Chief Executive of Landcare Research Ltd, a Crown Research Institute specialising in environmental research. He has held that position since 1992. He has authored numerous articles on land erosion and forest water use.

APEC SCIENCE MEETING TO FOCUS ON CAPACITY BUILDING FOR SUSTAINABLE GROWTH

Seventeen of 21 APEC economies met in Rotorua on 27 May to undertake planning for the next APEC Science Ministerial Meeting in March 2004 in Christchurch. Rotorua was chosen at short notice for the meeting, jointly hosted by New Zealand and Australia after the scheduled Singapore meeting was relocated due to the SARS outbreak.

Dr Wynn Ingram, head of the New Zealand delegation, said the member economies had agreed that the main theme for the March meeting would

be 'enhancing the capacity of science, technology and innovation to deliver sustainable growth' across the APEC region.

"The Ministerial meeting in March 2004 will be a significant event, defining the future direction of RST cooperation among APEC economies." Dr Ingram said.

The Ministry of Research, Science and Technology has taken the initiative to also hold in Christchurch in March, alongside the Ministerial, an Innovation Showcase where the selected leading edge science and technology enterprises from New Zealand and the APEC region will be promoted through an exhibition, business exchanges, company visits and symposia.

Public and private sector research and development leaders from the 21 APEC economies will also be involved with a 2-day conference and workshops exploring the theme "capturing value from science." The theme will consider social, economic and environmental values and how these can be enhanced by science through improving the management of tensions in a knowledge society, improving the management of intellectual property and new scientific opportunities.

$15M FOR INVESTMENT IN BIOTECHNOLOGY

The New Zealand Venture Investment Fund is to establish one or more new seed funds targeting biotechnology. The fund or funds will have at least NZ$15 million to invest.

Minister of Research Science and Technology Pete Hodgson said the new fund would provide much-needed capital for New Zealand's biotechnology sector and encourage more private sector investors to get involved.

"The Government recognises that access to capital is a key step in the development of any new company – that's why we established the Venture Investment Fund in the first place," said Mr Hodgson.

"Through engaging with the venture capital industry and people involved in biotechnology, the Fund has seen an opportunity to help address the sector's unique challenges in raising capital. The new seed fund will help grow more New Zealand businesses based on our world-class biotechnology research."

Over the next few months, the VIF Board will determine the process and timing for the consideration of proposals from potential VIF Seed Fund managers.

The Government's Growth and Innovation Framework identifies biotechnology as a key growth sector deserving special attention and support. The recent report of the Biotechnology Taskforce identified access to capital as a key factor in growing the sector.

The New Zealand Venture Investment Fund (VIF), established in 2001, is a programme of equity investment designed to accelerate the development of the venture capital market in New Zealand. Through VIF the Government is investing up to NZ$100 million in innovative New Zealand businesses with high growth potential.

The Fund invests through individual investment funds (VIF Seed Funds) operated by private sector fund managers appointed by VIF. These funds include capital raised from the private sector to at least twice the level of the VIF contribution.

GENETIC MODIFICATION: A RESOURCE FOR SCHOOLS

Since the discovery of DNA, the resultant pace of genetics research has generated a variety of issues that have provoked much social comment. Recent decades have seen the application of genetic research into two main areas of our lives: food and medicine. Both areas generate questions and debate about the 'right' we may or may not have to pursue these types of research. There has also been a corresponding increase in the level of public interest in the use of scientific research. The availability of information for public consumption on many of these issues has, however, often been less than consistent, balanced, or without bias.

This resource for Year 10 classes is set within the context of the controversy surrounding the introduction of genetically modified (GM) crops and approaches this debate in such a way as to help develop those skills and attitudes that allow us to construct an informed, reasoned viewpoint. It is also intended that the skills that will be learnt will be readily transferable to any issue requiring critical thought, be it cloning, sewage treatment, transport, or any of the myriad of issues that face people.

This resource has been written in such a format as to provide templates to facilitate learning about the processes of critical thinking. It has been produced with Year 10 pupils in mind, but could be easily used with young people at any level above NCF Level 3. Copies have been supplied to HoD Science and HoD English at all New Zealand schools with Year 10 classes. Further copies may be obtained from Dr Jack Richardson, Executive Director, Agcarm Inc., P.O. Box 5069, Wellington; Facsimile: (04) - 499 4223; Email: jack@agcarm.co.nz or from http://www.rsnz.org/education/learning_resources/crithink.pdf

SEPARATE POLYTECHNIC PBRF PROPOSAL?

The Association of Polytechnics of New Zealand, concerned that the Performance Based Research Fund (PBRF) may leave them with less money and a diminished status, has mooted the idea of a separate performance-based research fund exclusively for them. Polytechnics claim that the PBRF is designed to reward research using university measures and would force polytechnics to behave like universities.

While it has been reported that Associate Education Minister Steve

Maharey described talk about the development of an alternative fund as "unwise, premature speculation", the Tertiary Education Commission (TEC) and the Ministry of Education are preparing a paper on the subject.

The Association of University Staff has expressed concern about the proposal, with National President Dr Bill Rosenberg saying that the establishment of the PBRF acknowledged the significant additional costs faced by universities running research programmes, including applied research, and the infrastructure to maintain them. He said that creating another new fund would defeat the government's intention of differentiating the sector and would leave universities exposed to the high compliance costs of the PBRF with little extra funding to show for it. New Zealand Vice Chancellors Committee chair Dr John Hood also criticised the move strongly.

FRST SCHOLARSHIP AWARDS

PhD student Wendy Brooks has won the South Island section of the FiRST Scholarship Awards sponsored by the Foundation for Research, Science and Technology, for her research on Alzheimer's Disease.

Wendy, who is currently completing her PhD at the University of Cambridge, England, is looking into the potential genetic and environmental influences leading to Alzheimer's Disease, which affects 47% of people over 85 years.

The annual FiRST (Fellows in Research, Science and Technology) Scholarship Awards are open to recipients of the Foundation's five scholarship schemes.

Other South Island winners are: Verne Pere, who is currently studying for his Masters in Science, is the South Island Winner for the Tuapapa Putaiao Maori Fellowship scheme with his poster on the formation of a landslide dam near Ngatapa, Gisborne. Andy Van Houtte is the South Island Winner for the Technology for Industry Fellowship scheme with his poster on the Innovative Connections in Laminated Veneer Lumber using Expoxied Steel Rods. Li Hong is the South Island Winner for the Enterprise Scholarship scheme, with her poster on the immunity to *Salmonella brandenburg* in sheep using a new attenuated vaccine. Dr Martin Jarvis is the South Island Winner for the NZ Science & Technology Post-Doctoral Fellowship scheme, for his study on the expression profiles of novel cardiovascular hormones in ventricular remodelling in ovine models of myocardial infarction and heart failure.

QUEEN'S BIRTHDAY HONOURS

Science has been well recognised in this year's Queen's Birthday Honours list. Those named in the list include:

The Order of New Zealand to be an Honorary Member of the said Order: Dr William Hayward Pickering KBE, Flintridge, California.

The New Zealand Order of Merit To be Officers of the said Order: Professor William Alexander Denny, of Auckland for services to cancer research. Dr Roma Mere Roberts, of Auckland for services to Maori and science. To be an Honorary Officer of the said Order: Professor (John) Frank Thomas Griffin, of Dunedin for services to science. To be a Member of the said Order: Professor Emeritus Graham Alfred Nuthall, of Christchurch for services to education. To be a Companion of the said Order: Dr John Clarence Hinchcliff, O.N.Z.M., of Pukekohe for services to education.

The Queen's Service Order: To be Companions of the said Order for Public Services: Dr Anisur Rahman, of Hamilton and Dr Brian Anthony Tapper, of Palmerston North.

DEER SCIENTIST HONOURED

AgResearch manager Dr Jimmy Suttie has been bestowed with the New Zealand deer industry's top honour recently. Dr Suttie was presented with the Deer Industry Award at the Deer Industry New Zealand conference in Timaru, for an outstanding contribution to the deer industry. He was recognised for his personal commitment to the deer industry, and in particular his work on the properties of velvet as a natural health product.

Manager of AgResearch's Food Science group, Dr Suttie has been a strong advocate for deer antler research and development, which started with studies of the physiology of antler growth many years ago. He and the Invermay deer team have made major contributions since then to the global scientific knowledge on deer antler, including research objectively measuring therapeutic benefits of antler used in traditional Oriental medicines. Research now is focusing on developing and commercialising nutraceuticals from velvet antler extracts. He is also involved in an innovative new project looking at the development of rapidly growing regenerating tissues using the antler as model, which has positive implications for wound healing.

2003 ACADEMY MEDALS AND AWARDS: CALL FOR NOMINATIONS

The Academy suite of medals and awards available for 2003 are:

- Hector Medal-Physical Sciences
- Te Rangi Hiroa Medal -Current issues in cultural diversity and cohesion
- R. J. Scott Medal-Agricultural, electrical, electronic, information and mechanical engineering
- Hamilton Memorial Prize for beginners in scientific or technological research in New Zealand
- Hatherton Award for the best scientific paper by a PhD student at any New Zealand University in physical sciences, earth sciences and mathematical and information sciences.

Electronic copies of the information and application forms are available from awards@rsnz.org; copies are also available on the Society's web site http://www.rsnz.org/awards/

academy_awards/forms.php . The closing date for applications and nominations is 1 August 2003.

NEW ZEALAND ASSOCATION OF SCIENTISTS 2003 AWARDS AND MEDALS

Science Communicator Awards

The New Zealand Association of Scientists invites nominations from New Zealand science organisations, scientific associations and individuals for this year's Science Communicator Awards.

The awards are given to encourage scientists to communicate their work to the wider community, hence to promote an awareness and appreciation of the methods and achievements of science.

One or more Science Communicator Awards will be made to practising scientists for excellence in communicating any area of science or technology to the general public, through print, broadcast, public lectures or other media.

Nominations should be signed by one or more sponsors, and should include a citation, in a style suitable for the general public, that explains the nature and extent of the nominee's contribution to science communication.

Medals

Marsden Medal

The Marsden Medal is awarded for a lifetime of outstanding service to science in New Zealand, in recognition of service rendered to the cause or profession of science in the widest connotation of the phrase.

Shorland Medal

The Shorland Medal is awarded in recognition of a person's major contribution to basic or applied research that has added significantly to scientific understanding, or resulted in significant benefits to society.

Research Medal

The Research Medal is awarded for outstanding fundamental or applied research in the physical, natural or social sciences published during the year of the award or in the preceding three calendar years. Nominees must be under the age of 40 on 1 January of the year in which they are nominated except that, where a scientist has had an interrupted career, the age limit may be extended to a maximum of 45.

Nominations for each of the medals should be accompanied by a curriculum vitae and a citation signed by one or more sponsors. The citation should be written in a style suitable for the judges and the general public, and should explain the significance of the nominee's contribution.

All nominations should be mailed to The Secretary, New Zealand Association of Scientists, P O Box 1874, Wellington, by 31 August 2003.

GRADUATE CERTIFICATE IN ANTARCTIC STUDIES 2003-2004

To find out more about the contemporary issues facing Antarctica today, apply for a place on the Graduate Certificate in Antarctic Studies at the University of Canterbury, Christchurch. The Graduate Certificate is a 14-week intensive course in the history, science, political discourse, environmental concerns and future challenges of Antarctica and the Southern Ocean. The course, which includes a 10-day study visit to Antarctica, is run jointly by the University of Canterbury and Antarctica New Zealand with significant input from government agencies and the wider international community. The multidisciplinary perspectives, along with the vigorous debate and a broad based critique of the issues that Antarctica faces, have resulted in a Certificate that is unique in its focus. The Certificate provides a platform and a starting point for participants to become involved in Antarctic research and scholarship.

The closing date for applications is 01 August 2003. Further details and application forms are available on the Gateway Antarctic website http:// www.anta.canterbury.ac.nz or contact Susannah Hawtin, Administrator, Gateway Antarctica, Phone (03) 364 2136. Gateway Antarctica is the Centre for Antarctic Studies and Research at the University of Canterbury, Christchurch.

TWO NEW ZEALAND SCIENTISTS ELECTED ROYAL SOCIETY FELLOWS

Professor Alan MacDiarmid and Professor Richard Sibson have joined the prestigious circle of New Zealand scientists who have been made Fellows of the Royal Society of London. There are now 39 New Zealand scientists, including Ernest Lord Rutherford, to have received this title.

Alan McDiarmid is the Blanchard Professor of Chemistry at the University of Pennsylvania. Professor MacDiarmid was jointly awarded the 2000 Nobel Prize in Chemistry with two other colleagues for his work on conducting polymers following the discovery that plastics could be made to conduct electricity. He was elected an Honorary Fellow of the Royal Society of New Zealand in 2001.

Professor MacDiarmid's current scientific interests are centred on the most technologically important conducting polymer, polyaniline, and its oligomers with special interest in those isomeric forms which might contribute to the greatest degree in promoting high conductivity and enhanced mechanical properties in polyaniline.

The University of Otago's Richard Sibson has made advances in understanding earthquake faulting that have made him a world leader in his field. He was educated at King's College, Auckland, and studied geology at the University of Auckland. He received his PhD from Imperial College, University of London, in 1977. He was elected a Fellow of the Royal Society of New Zealand in 1993.

His work on an ancient fault zone in Scotland's Outer Hebrides islands

convinced him there was an integral relationship between structural geology and seismology. He went on to study earthquakes in California in the 1980s before returning to Otago in 1990, where he became Professor of Geology and Department Head for six years.

CALL FOR NOMINATIONS: TYLER ENVIRONMENTAL PRIZE

Nomminations are now being sought for the 2004 Tyler Prize for Environmental Achievement. The US$200,000 award, administered by the University of Southern California, is given for the protection, maintenance, or improvement of an ecological or environmental condition; the discovery, further development, improvement, or understanding of known or new sources of energy; or medical discoveries or achievements with such worldwide implications that they significantly benefit environmental aspects of human health. Self nominations are not accepted, and all nominations are due on 15 September 2003.

For more information see http://www.usc.edu/tylerprize/ or email: tylerprize@usc.edu

BUDGET 2003

The government will invest $139 million of new funding in research, science and technology (RS&T) over the next four years.

For 2003-04 new funding is $33.5 million, a boost of over 6 percent. The increase brings the total public investment in RS&T for 2003-04 to $557 million.

"This is a government that means what it says about building a knowledge economy," said Research, Science and Technology Minister, Pete Hodgson.

"Increasing New Zealand's knowledge base by investing more in research has consistently been a high priority for this government. Science drives innovation. It generates new ideas and concepts that change our economy and society."

Funding for the new and very successful Research Consortia programme is being increased by $34.2 million over four years. The funding supports research projects developed by science providers and users working cooperatively and will be matched or surpassed by partnership investment from the private sector. The extra $8.55 million a year takes funding for 2003-04 to $14.69 million.

The New Economy Research Fund increases by $27.2 million over four years. The fund supports new areas of research with an identifiable potential to create new types of business for New Zealand. Funding will total $63.88 million for 2003-04, with much of it expected to go to biotechnology.

The Marsden Fund increases by $3.8 million over four years. It supports curiosity-driven research at the frontiers of knowledge that has the potential to be of international significance. Funding for 2003-04 totals $32.79 million.

Funding for Maori Knowledge and Development research increases by $1.94 million over four years. The new funds will build a credible growth path for Maori research, including new capacity and capability building. Total funding for 2003-04 is $5.48 million.

Social Research funding increases by $9.02 million over four years. The extra $1.455 million for 2003-04 raises the total to $6.59 million, an increase of 28 percent. These funds will be used to address whole of government issues

including housing, family structures, socio-economic determinants of well-being, and migration.

Funding for Health Research, primarily focusing on biomedical research and the Health Research Council's partnership programmes, increases by $6 million over four years. The extra $1.5 million a year takes the total for 2003-04 to $42.23 million.

Environmental Research funding increases by $4 million over four years, with the additional $1 million a year to be directed towards developing alternative possum control methods. Total funding for 2003-04 is $88.62 million.

Mr Hodgson said the government was also increasing support for talented New Zealanders with funding of over $9.78 million over four years for a range of fellowships and scholarships.

A further $8 million over four years will be invested in strengthening strategically important international linkages, particularly New Zealand's science presence in the European Union and the United States.

INTERNATIONAL SCIENCE AND TECHNOLOGY (ISAT) LINKAGES FUND

The first round of 2003-04 applications is now being called for under the Contestable Bilateral Research Programmes of the ISAT Linkages Fund.

Funding has been specifically dedicated to research collaborations involving Australia, France, Germany, Japan, Korea, Latin America, the USA, and the United Kingdom, but funding for research collaborations involving all other economies is also available. Please note that the former Bilateral Research Activities Programme (BRAP), NZ/USA STC Cooperative Science Programme (NZ/USA CSP) and the NZ/FRG Scientific and Technological Co-operation (STC) Agreement Programme are now incorporated into the one set of guidelines and application forms.

Applications are for activities that begin after 1 July 2003 and before 30 June 2004. Applications close with the Manager, ISAT Linkages Fund, Royal Society of New Zealand, 4 Halswell Street, Thorndon, Wellington at 4.00 p.m. on Tuesday 10 June 2003. No late applications will be accepted.

Guidelines and application forms are available for downloading from the Royal Society's website at http://www.rsnz.org/funding/isat

It should be noted that as these programmes are subject to 2002 Budget decisions, no particular level of funding is guaranteed and all commitments made or implied in the guidelines are subject to suitable appropriations being made by the New Zealand Government.

Potential applicants should contact their institutional ISAT coordinators for further details.

SCIENCE AND TECHNOLOGY PROMOTION FUND 2003/04

The Science and Technology Promotion Fund has been made available by the government to support activities that make people enthusiastic about science, mathematics, social sciences and technology and excite a desire to find out or experience more. Funds are allocated to projects which demonstrate that they have been developed to achieve this promotion in interesting, creative and innovative ways and impact on an audience that has yet to develop positive attitudes and values to science and technology.

The 2003/04 round of funding from the Science and Technology Promotion Fund is now open. Application forms and guidelines are available on the Royal Society website on http://www.rsnz.org/funding/st_promotion . Please note that the application procedure has been updated to an electronic version. If you are unable to access the forms, please contact the Fund Manager, Faith Atkins, on (04) 470 5781 (faith.atkins@rsnz.org) for assistance.

JAMES COOK RESEARCH FELLOWSHIPS: CALL FOR APPLICATIONS

The James Cook Research Fellowships are administered by the Royal Society of New Zealand on behalf of the Government. They are awarded to researchers who are recognised leaders in their respective fields, have the requisite qualifications and experience, and are able to demonstrate that they have achieved national and international recognition in their area of scientific or technological research.

Applications are now being sought in the following two research categories:

- Physical Sciences
- Research of relevance to the peoples of New Zealand and/or the South West Pacific

The primary intention for the award of Fellowships is the recognition of sustained excellence in research. The normal term of a Fellowship is 2 years and the stipend offered for those awarded in this round will be NZ$110,000 inclusive of GST per year. This increased stipend will hopefully make tenure overseas for all or part of the Fellowship more viable. Reimbursement of relevant expenses to a maximum of $10,000 annually will also be offered. Those appointed will be required to take up their Fellowships by March 2004.

Eligibility: New Zealand citizens or permanent residents.
Host Institution: Fellowships will be tenable in a location and institution of the applicant's choosing, whether in New Zealand or overseas.
Closing date for application:
1 September 2003.

For further information, please contact: Executive Officer - Awards (awards@rsnz.org) or see http://www.rsnz.org/awards/james_cook/index.php

PRIMARY RESOURCE FORUM 2003 - FIFTY YEARS ON

Amendments To The HSNO Act

The New Organisms and Other Matters Bill was introduced to Parliament on 29 April 2003. The Bill amends the HSNO Act and makes significant changes to the Act. The Bill will have its first reading in May and will then be referred to a Select Committee. The Committee is likely to call for public submissions. The Bill is now available from Government bookshops.

This is an important Bill for the New Zealand science community and in particular all those who use GM technology in the laboratory or intend to use it in the field.

The Bill is a complex piece of legislation containing some 40 pages of amendments to the HSNO Act. These amendments cover a very wide range of issues arising from the government's decisions following the recommendations of the Royal Commission.

It will be important for you to find out which parts of the Bill are important for you and what effect the proposed amendments will have on you and your organisation. You may want to make a submission to the Select Committee when it calls for submissions.

Further information on the Bill will be available on the MoRST website at http://www.morst.govt.nz

UNIVERSITY OF AUCKLAND RESEARCHER INVITED TO PRESENT PRESTIGIOUS LECTURE

Multinational pharmaceutical company Novartis, has invited a University of Auckland researcher to share her research on the synthesis of novel drug candidates at its prestigious biennial lecture series.

Professor of Organic and Medicinal Chemistry, Margaret Brimble is the first Australasian researcher to become a Novartis Chemistry Lecturer and the invitation recognises her 15-year career in the field of synthetic organic chemistry and medicinal chemistry.

The chemical synthesis of natural products forms the basis of the billion dollar international pharmaceutical industry. The Swiss-based company has research and development centres around the world and Professor

Brimble will be speaking at its sites in Switzerland, the United Kingdom, the United States and Japan.

"It isn't something I applied for, but was contacted by Novartis on the basis of my published research," she says. Professor Brimble's research focuses on making and modifying naturally occurring bioactive compounds from plants, animal tissue, marine and soil organisms. She has a specific interest in developing drugs from shellfish toxins.

"These compounds are a source of diverse chemical structures and could potentially lead to the development of drugs for neurological disorders, new generation antibiotics as well as anticancer and antiviral agents," she says.

Professor Brimble joined the Faculty of Science at The University of Auckland in 1999 as the Chair of Organic and Medicinal Chemistry.

She has also held senior positions at the University of Sydney and the University of California, Berkeley. During her career, Professor Brimble has received many awards for her research, and in 2002 was the Chair of the 14th International Conference on Organic Synthesis.

Professor Brimble will spend about three weeks on the lecture circuit later this year.

ACCELERATING GROWTH FROM PUBLICLY FUNDED R&D

The government is creating a new fund to accelerate the commercial development of innovations in publicly funded research.

The Pre-Seed Accelerator Fund will have more than $19 million over the next four years to invest in pre-seed projects – those that fall between grant-funded research and the seed stage of development, where venture capital and other sources of private sector funding cut in.

Pre-seed development typically includes activities such as experimental development, intellectual property protection, market validation and business case development.

"The government has been looking closely at the internationally-recognised problem of getting innovations through the 'valley of death' between discovery and investment readiness," Research, Science and Technology Minister Pete Hodgson said. "In discussions with leaders in research and development finance we have found widespread agreement that there is a funding gap at the pre-seed stage of R&D — in both the public and the private sectors.

"The private sector pre-seed gap will largely be dealt with by extending eligibility for the Technology for Business Growth Scheme, which is managed by the Foundation for Research, Science and Technology. The Pre-Seed Accelerator Fund is designed to address the public sector pre-seed gap. It will be open to Crown Research Institutes, tertiary education institutions and their subsidiaries.

"We expect this fund to encourage an increase in the skill and focus that public research institutions apply to commercialisation, as well as increasing the finance available. Partnerships are the key and the Pre-Seed Accelerator Fund will build them by providing grants to cover a third of the cost of pre-seed projects, the remainder to come from any suitable combination of private sector co-investment and research provider funds."

Budget 2003 also includes a capital provision of $12 million that will be available to public research institutions to support investment in commercialisation of publicly funded R&D.

NEW COMPANIONS OF THE ROYAL SOCIETY ELECTED

At its Council meeting on 12 June, the Royal Society of New Zealand acknowledged the achievement of four of the country's passionate advocates for science and technology by electing them as Companions.

They are:
Professor Tony Conner, scientist, NZ Institute of Crop and Food Research; Dame Elizabeth Hanan, science educator, Dunedin; Mr George Jones, President, Wellington Branch of the Royal Society; Emeritus Professor Tony Taylor, formerly Professor of Clincial Psychology, Victoria University of Wellington, now of Waikanae Beach.

Science promotion has always been a major activity of the Royal Society but, unlike research, which has been encouraged and honoured by the Fellowship, promoting science did not have formal recognition in the society structure until 1997.

The 1997 legislation, which defines the Royal Society's functions, provides for the class of membership to recognise achievements and encourage activities in the advocacy of science and technology. Including these four new Companions, there are now 17 Companions of the Royal Society of New Zealand.

DR JOHN HOOD TO HEAD OXFORD UNIVERSITY

Current University of Auckland Vice-Chancellor, Dr John Hood, has been appointed as the next Vice-Chancellor of England's Oxford University. He is the first person in the 900 year history of the University to have been selected from outside the institution and will take up his appointment on 1 October 2004. The initial period of appointment is five years with the possibility of renewal for a further two years.

Dr Hood will remain in his current position until "close to that time" and, in the interim, the University's Council will undergo a process to appoint a successor. Dr Hood's appointment was approved by the University of Oxford Congregation, a committee of around 3,000 academic, senior research, library, and administrative staff which has the final say on all legislative decisions at Oxford University.

Treated Timber In New Zealand – The Debate Continues

Since we went to press with the March issue, the debate concerning the use of treated timber in this country has continued. Not only has there been further pressure on Government by the environmental movement but the call to regulate against the use of chrome arsenate treated timber in playgrounds and on home decks continues. The Environmental Risk Management Authority has addressed the issue and a synopsis of the report with commentary appeared in the *Dominion Post*. This piece by Chris Mirams appears below (with permission) and is followed by our second article on the subject, this time by US-based by Dr. Rick Maas of the Department of Environmental Studies, University of North Carolina - Asheville.

Brian Halton (Editor)

CCA timber okay, says ERMA*

Chris Mirams

*Reprinted with permission from *The Dominion Post*, Saturday May 2, 2003 A2.

Arsenic-treated timber can continue to be used safely, an Environmental Risk Management Authority report says. But its future use in playgrounds, childhood centres and public parks now rests on a Building Industry Authority report and a Health Ministry cancer incidence study of builders.

The author of the Erma report, Deborah Read, has made seven recommendations. These include better monitoring of treatment plants; branding or labelling of timber treated with chromated copper arsenate; point-of-sale information; and having new playground equipment in schools, early childhood centres and public parks built of alternative materials to restrict public "involuntary contact" with CCA-treated timber.

The recommendations were endorsed yesterday by Erma chairman Neil Walter, who said he would be "disappointed if there is not rapid follow-up by Government". Erma will look at the findings of the building authority's review of all treated timber – being done as a result of the leaky homes scandal – in deciding whether to take further action against the preservative. The report is due early next month. However, critics say the suggested action plan bears little resemblance to Dr Read's recommendations. The action plan was put together by Erma in conjunction with 10 Government departments and two local authorities.

The plan has no time-lines, much softer language than the report, and only the cancer study research has been assigned to a Government department, the Health Ministry. Rick Maas, the American scientist whose report on cancer risks associated with CCA triggered Erma's review, said Dr Read's work was balanced but the action plan was "weak". "It seems as though their health assessment was relatively objective but the policy conclusions are not consistent with that," he said.

The plan suggests that the Government study the environmental effects of CCA, health risks to industry workers and builders, and availability and suitability of alternatives.

The timber industry said its product was vindicated by the report. The Timber Industry Federation said the review backed its belief "that CCA timber is a safe product". Building Industry Federation chairman Richard Carver said: "It is the industry view that there are no comparable products currently available in terms of cost-effectiveness, proven performance, and flexibility for a wide range of domestic and commercial uses."

Child Safety Foundation chief executive Gael Brooks and Green Party health spokeswoman Sue Kedgley, both campaigners against CCA, were disappointed by the action plan. "Given the uncertainty and risks surrounding CCA-treated timber, New Zealand should take a precautionary approach and ban it in all at-risk play equipment in schools, early childhood centres, and public parks," Ms Kedgley said. Ms Brooks said she could see little linkage between Dr Read's recommendations and the action plan.

➤ TREATING WOOD

Dr. Read's recommendations

- Having new playground equipment in schools, early childhood centres, and public parks built of alternative materials
- Sealing recently constructed CCA playground equipment in schools, early childhood centres and public parks
- Greater dissemination of precautionary health advice to the public and builders
- Research – cancer and mortality analysis for builders, and a urinary biomonitoring study of children or builders
- Enhanced monitoring of treatment plants to ensure "best practice"
- Branding or run-on printing of each board and/or labelling of CCA wood
- Consumer information at point of sale

➤ ERMA'S PLAN

- Await Building Industry Association's review of all treated timber before looking at whether to ban use of CCA in playgrounds and domestic use.
- Local councils can decide if to seal CCA wood in public areas
- Health Ministry to put Q & A sheet on website
- Health Ministry to conduct cancer study among builders
- Firmer action should be taken to monitor best practice in industry
- "Desirable" that CCA wood is labelled
- Desirable for industry to provide information and alternatives at point of sale

Research Update On Health Effects Related To Use Of CCA-Treated Lumber

Rick Maas, Steven Patch, and Jacob F. Berkowitz
University of North Carolina - Asheville, Environmental Quality Institute, Asheville, NC, USA

Background and Introduction

Lumber that is treated with copper chrome arsenate to resist insect and fungal decay has been used extensively world-wide for about 30 years for outdoor use. It was recognized from the onset that arsenic would be leached from the wood over time and result in some level of either relatively direct exposure from skin contact, or more indirect exposure from arsenic-contaminated soil, groundwater, or surface water. While arsenic was already a well recognized toxin with various chronic health effects even from low level exposure, *e.g.* skin lesions, cardiovascular effects, lung, skin, bladder, kidney, and liver cancers,[1] during the mid-1990s epidemiological evidence began to surface which indicated that arsenic was a far more powerful bladder, lung and kidney carcinogen than previously believed.[2,3]

The reason the highly potent human carcinogenicity of arsenic went unnoticed for so long is because it has turned out to be one of those rare carcinogens that has much less cancer effect in laboratory test animals than in humans.[4] Recent epidemiological studies in Taiwan, Chile, and Bangladesh, in which various villages with otherwise similar environmental conditions had widely varying elevated concentrations of arsenic in drinking water, have established the unfortunate fact that arsenic is an approximately 100-200 times more potent human bladder, lung and kidney carcinogen than previously extrapolated from laboratory animal exposure studies.[1-3]

It is this recent new epidemiological evidence that has triggered the sudden new concern and updated assessment of CCA-treated lumber world-wide. Especially concerning is the publication of a recent medical study by Moore and coworkers,[5] which strongly suggests that, in addition to being a strong human carcinogen itself, exposure of cancer patients to even slightly elevated levels of arsenic causes existing tumors to grow more rapidly and aggressively.

In response to these recent findings, many countries of the developed world including the United States, the entire European Union, Japan, and Canada have either discontinued or announced decisions to discontinue production of CCA-treated lumber by mid-2004. Recently ERMA-New Zealand released their official report on CCA-treated lumber.[6] In this extensive review of available information on CCA lumber, they summarize risk estimates from five studies conducted subsequent to the most currently accepted arsenic human cancer potency factors developed by the US National Research Council, National Academy of Science.[3] The risk estimates of these five studies are as follows: Roberts and Ochoa (2001)[7] estimate 502 per million population for skin cancer only; the Gradient Corporation (2001)[8] estimates 1 per million population for skin cancer only; Sharp *et al.* (2001)[9] estimate 2000 per million population for lung and bladder only; Maas *et al.* (2002)[10] estimate 1000 per million population for lung/bladder cancers only; and the US Consumer Products Safety Commission (2003)[1] estimates 51 lung/bladder per million population.

All the previous recent studies, including our own at the Environmental Quality Institute (EQI),[10] have had the limitations that i) either new CCA lumber or a relatively small number of outdoor-aged lumber surfaces from one or a few very geographically proximate sites were used to determine the dislodgeable arsenic, ii) the mid- and long-term effectiveness of various stains and sealants has not been thoroughly investigated, and iii) with the exception of the Consumer Product Safety Commission study,[1] measurements of dislodgeable arsenic have been made using various wiping methods as opposed to more realistic actual hand contact. Thus there has been almost no data from which to correlate arsenic exposure/risks calculated from wipe data to actual exposure/risks from true hand/skin contact.

Since our initial published work on CCA-treated lumber over the past year,[10] we have focused our continuing research on addressing these three limitations. Specifically, we have conducted a large nationwide field wipe study of dislodgeable arsenic including nearly 800 sites across the United States, and we have attempted to combine these field wipe data with experiments that compare arsenic wipe results with actual hand contact/wiping of CCA lumber surfaces. This work is still in progress, but we are pleased to be given the opportunity to share our most current information in this publication.

Methods

As noted above, this EQI research update includes two types of experiments: a) a nationwide study of actual in-service residential CCA-lumber arsenic release with samples collected by US residential volunteer participants using a standard wipe-sample kit with sampling instructions developed by our research team, and b) a series of controlled experiments comparing arsenic dislodgement on standard wipes versus actual hand contact by the authors Maas and Patch themselves, under different hand moisture and wood-surface moisture conditions.

The residential volunteer arsenic surface sampling kit consists of a thin plastic template which, when taped to a CCA-lumber surface, exposes an exact 100 cm^2 area (5 cm x 20 cm) for wiping with a standard laboratory wipe. Also included in the research kit are disposable laboratory gloves, a laboratory hot-block vial for the wipe, labeling

materials, detailed sampling instructions, and a research questionnaire upon which the volunteer participant records data including type of surface, *e.g.* deck, playset, picnic table, *etc.*, service-age of surface, treatment/sealant history, geographic location, moisture condition of the board surface at the time of sampling, *etc.* Wiping of the standard 100 cm^2 surface area was performed by the US EPA/HUD method for lead dust-wipe clearance testing. This involves wiping across the test surface with three horizontal and three vertical "S" patterns, folding in the wipe after each "S" wipe. All samples were returned directly to the EQI laboratory where the sample vials were placed directly into the hot block and heated with nitric acid and hydrogen peroxide for digestion and subsequent analysis by graphite furnace atomic absorption spectrophotometry.[11]

Our on-going experiments to correlate arsenic released to wipes with arsenic released to hands have involved taking new or outdoor-aged CCA boards and marking off randomized pairs of immediately adjacent surface areas. These were then wiped, one template-marked section by the US EPA/HUD method and the other with a single pass of one of our hands. We then immediately removed the dislodged arsenic from our hands by wiping them thoroughly with a clean laboratory wipe followed by a final rinsing with 5% acetic acid and combining the rinsate with the wipe as a single sample for digestion. Repeated post-wipe and rinse testing has documented that this procedure removes at least 98% of the arsenic from our hands with virtually no arsenic carryover to the next hand-wipe test.

Statistical analysis of the field data consisted of applying a general linear model to the log-transformed arsenic values to examine which of the factors mentioned above are statistically significant in the presence of all the other factors. Confidence intervals for the median arsenic amounts for each level of each factor were calculated by reverse-transforming results from the linear model back to the original units. Statistical significance for a given factor is declared when the individual p-values from the linear model are less than 0.05.

Results and Discussion

The mean arsenic wipe transfer calculated across all surface types, service ages, geographic areas, and treatment types, is 63.6 μg/100 cm^2. The corresponding median arsenic transferred to wipe is 12.5 μg/100 cm^2.

The percentages of arsenic for the different condition of CCA lumber that fall into designated arsenic-amount categories are shown in Table 1. Each of these proportions

Table 1. Arsenic amounts on wipes by types of sample for field study.

			Percent of samples with given arsenic amount		
		n	0-10 μg/100 cm^2	10-50 μg/100 cm^2	> 50 μg/100 cm^2
Age	0-1 years	130	50.0	31.5	18.5
	1-5 years	311	45.0	27.7	27.3
	> 5 years	316	44.6	34.1	21.1
Treatment & Years Since	None	493	39.8	32.3	28.0
(WS= Waterseal)	WS 0-0.5	28	78.6	17.9	3.6
	WS 0.5-2	81	44.4	30.9	24.7
	WS 2+	48	29.2	45.8	25.0
Other = Paint, Stain, PolyUr., *etc.*	Other 0-0.5	20	85.0	5.0	10.0
	Other 0.5-2	50	76.0	20.0	4.0
	Other 2+	26	42.3	42.3	15.4
Item	Deck	289	48.4	29.8	21.8
	Play Set	338	47.3	32.3	20.4
	Picnic Table	39	56.4	23.1	20.5
	Other	135	37.0	28.2	34.8
Sun Exposure	0-33%	150	49.3	30.7	20.0
	34-66%	236	47.9	30.1	22.0
	67-100%	353	43.1	30.9	26.1
Region	Northeast	255	54.9	28.6	16.5
	Northwest	182	31.9	35.2	33.0
	Southeast	176	50.6	31.3	18.2
	Southwest	175	45.7	25.7	28.6

for a given level of a given factor is aggregated over all levels of all the other factors. For example, the 130 samples of 0-1 year-old wood given on the first row of the table include wood in that age range having various treatments, regions, *etc*. Estimated medians for each level of each factor found to be statistically significant by the linear model are shown in Figure 1 and Figure 2. As with Table 1, these estimates are not adjusted to correct for the fact that survey is unbalanced, *i.e.* some combinations of levels are more prevalent than others. Thus for example, the result that Northwest samples have a higher estimated median and a higher percent more than 50 mg/100 cm^2 than other

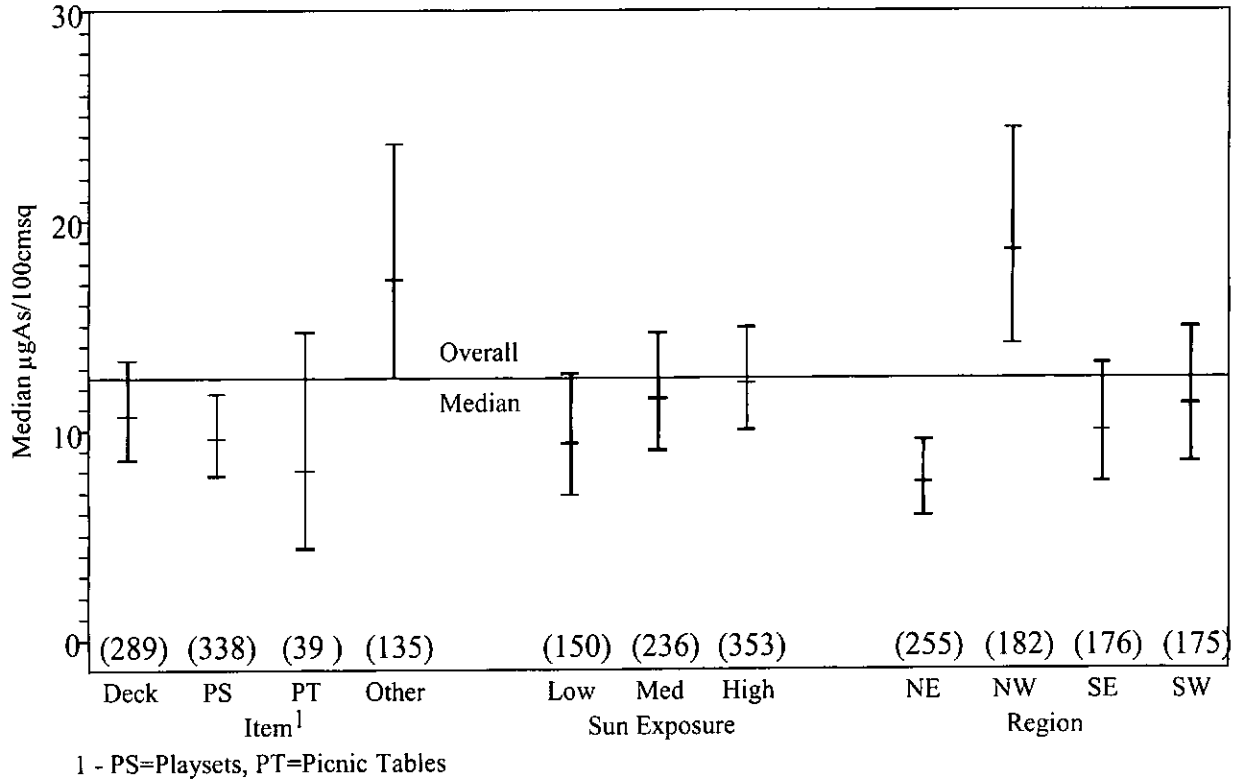

Figure 1. Estimated median arsenic per 100 cm^2 and 95% individual confidence limits for significant effects with sampling sizes (in parentheses).

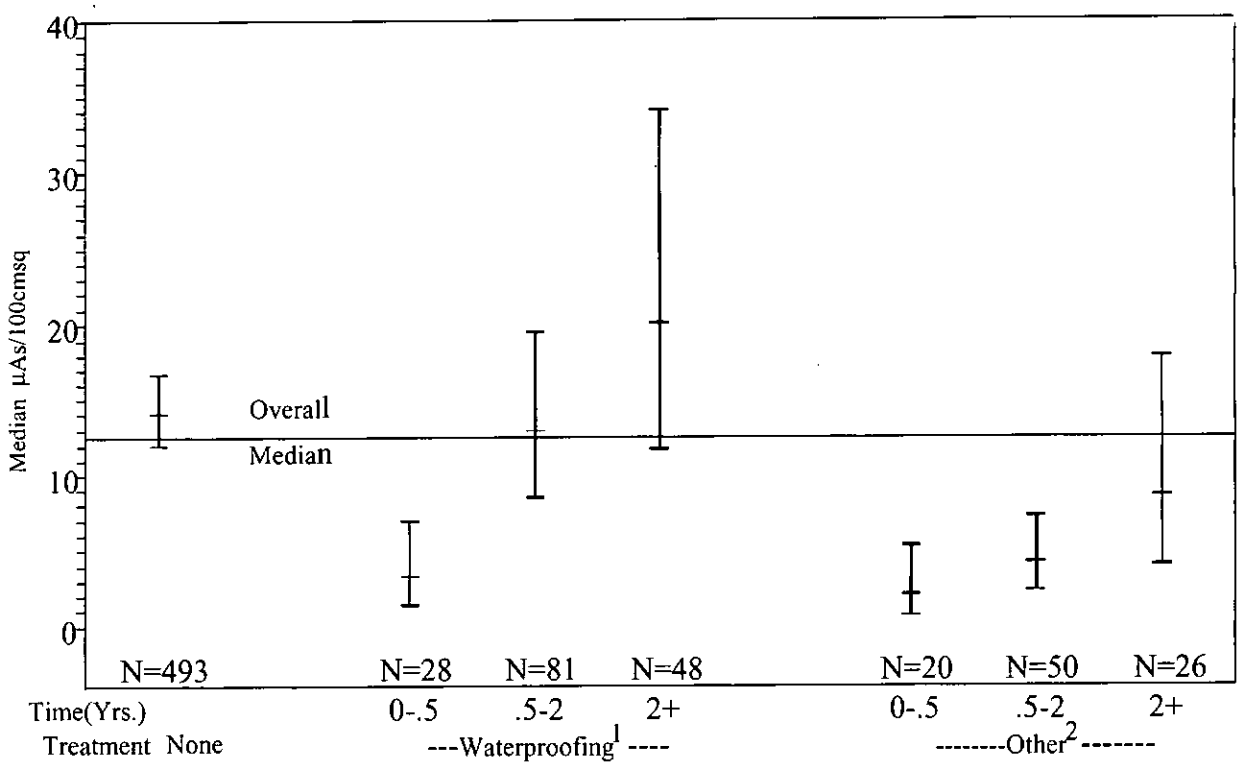

Figure 2. Estimated median arsenic per 100 cm^2 and 95% individual confidence limits for different treatments and time since.

regions might be at least partially due to some other confounding factor such as type and time of treatment.

The linear model analysis indicated that the type of item is significantly related to arsenic ($p = 0.012$). Figure 1 and Table 1 show that playsets were slightly lower than the median while only CCA lumber items in "other" categories, *e.g.* garden boundaries, building structures, landscape timbers, discharged significantly more arsenic than the median.

The arsenic wipe levels were significantly associated ($p = 0.006$) with sun exposure. Figure 1 and Table 1 indicate that higher sun exposures tend to have greater arsenic levels. The geographical area of the US was a very significant variable associated with arsenic release ($p = 0.0003$), with CCA lumber surfaces in the Northwest US releasing much higher amounts of arsenic than the remainder of the country. This observation may have particular significance for New Zealand since its moist temperate climate is similar to the Pacific Northwest of the US. It is also possible, however, that more spruce lumber is used in the Northwest US, which is softer and more porous, thereby possibly absorbing more CCA during pressure treatment than the yellow and white pine used more extensively elsewhere in the US.

One clear finding of this research is that the service age of the lumber is not at all associated with arsenic release to wipes ($p = 0.36$). Also, as can be seen from Table 1, the percentage of samples in the low, medium and high arsenic categories is roughly the same for the three age groups. As illustrated by Figure 2, arsenic wipe levels are statistically much lower for the first six months following either water seal or stain/paint type treatments. Figure 2 shows, however that after six months the arsenic-reducing effects of water sealants are no longer observable, while stains and paints continue to show some arsenic reduction effect for at least two years. These results show that conventional CCA lumber water sealants would need to be reapplied more frequently than every six months to provide a significant amount of protection. The data in Figure 2 also suggest that, once the water sealant wears off, pent-up arsenic release levels may be even greater than lumber which was never sealed. Stains and paints are obviously effective for longer periods, but our sample size for these treatments is relatively small. Therefore different treatments were lumped together. These results agree with those of Stillwell and Gorny,[12] who found no statistical differences between arsenic dislodged from CCA lumber treated with water repellents and CCA lumber with no treatment when samples were taken one year after treatment. However, there were dramatic reductions in dislodgeable arsenic from CCA wood surfaces treated with polyurethane, varnish and oil-based stain. Clearly much more research and probably product development is needed to adequately understand and address the critical issue of whether arsenic leaching can be sufficiently contained by some form of treatment on existing CCA lumber structures.

Over the past year we have conducted numerous experiments to try to determine the relationships between arsenic dislodgement and transfer to wipes as compared to actual hand contact. Unfortunately the relationships are proving to be much more complex than we anticipated, and they appear to be significantly influenced by hand moisture levels, board surface moisture levels, and even the amount of board surface area contacted. It seemed clear from the beginning that the wet laboratory ghost wipes being rubbed over the board surface multiple times, *i.e.* 20 times for the CPSC method and 6 times for the EPA/HUD method, would probably pick up much more arsenic than a single hand pass. In preliminary studies we conducted a paired comparison of the amount of arsenic dislodged by hands versus that dislodged by the CPSC method, and a similar study of the amount of arsenic dislodged by the CPSC method to that of the EPA/HUD method. We estimate the ratio of CPSC to hand arsenic to be approximately 8.1 for dry hands and 3.6 for wet hands. Similarly, we estimate the ratio of EPA/HUD to CPSC arsenic to be approximately 1.9. Thus we estimate the ratio of EPA/HUD to hand arsenic to be approximately 15.6 for dry hands and 6.9 for wet hands. This clearly represents a very lower end boundary to the relationship for the dry hands, especially given that unavoidably the repeated wiping and washing of our hands with acetic and nitric acid before and during the experiments resulted in an extreme level of unnatural skin dryness. Obviously, over months and years of actual hand contact with CCA lumber, there will be some mix of wet and dry hand and board surface conditions depending on climate patterns and structure locations. This is especially true for an infant or a young child who is exposed to a mix of moist and dry hand conditions depending primarily on the frequency of hand-to-mouth activity. Establishing this complex relationship of *wipe* versus *hand* contact more quantitatively will be important in developing more accurate estimates of actual arsenic exposure from CCA lumber.

Example Health Risk Calculations

Obviously most people have had occasional contact with CCA lumber throughout their lives. At some period of their lives this contact might be rather intermittent, *e.g.* occasional visit to a park or visit to friends home with CCA deck, *etc.*, while during other periods there may be relatively constant and intense contact with CCA lumber, *e.g.* a CCA lumber railing outside the front door, children playing almost daily on a CCA deck or public CCA playset. It is also obvious that there will be tremendous variability between individuals in the amount of contact they have with CCA lumber over their lifetimes, and thus some individuals will experience a high cancer risk from CCA lumber contact, while for others it will be virtually nonexistent.

The most recent CPSC risk calculations[1] were based on a conclusion that hands reach a saturation point of approximately 7.6 μg arsenic. Those results were based on performing a study where participants rubbed a 700 cm^2 section of board 10 times and an adjacent 700 cm^2 section of board 20 times, and noting that the two results were not significantly different. In a preliminary study of ours, however, we rubbed different areas of boards with one pass of a hand and found that the ratio of arsenic per

100 cm^2 did not significantly decrease as area rubbed increased over the range (542 cm^2 to 2168 cm^2). Hence, the amount of arsenic dislodged on the hands appears to increase linearly with surface area touched over that range. Thus, the 2003 CPSC study[1] may seriously underestimate risk for people who make several hand contacts on fresh surfaces each time.

The cancer risk examples below represent examples of a potential exposure to arsenic from contact with CCA lumber for an individual at various stages of life. At each stage we suggest a possible scenario of a person who has above average, but not extreme, contact with arsenic from CCA lumber. We use the average CCA lumber arsenic of 63.6 µg per 100 cm^2 from the survey discussed for scenarios that are not based heavily on playset exposure. Because there is an indication that playsets have lower arsenic dislodgement than other items we use the mean arsenic for playsets only of 49.6 µg in those scenarios. We multiply the appropriate mean for HUD samples by the appropriate multiplier of between 9.6 and 15.6 to convert to hand arsenic loads. We use the methodology and assumptions of the 2003 CPSC study[1] for all other calculations of risk, replacing their 7.6 µg arsenic per day of contact with the amount we estimate would occur from the assumed contact in the scenario based on the studies reported above. In particular, we use the formula for Lifetime Average Daily Dose (LADD) used in the original CPSC staff assessment.[13] (see Equation 1).

We then calculate risk the same way as did the 2003 CPSC study[1] by multiplying the LADD by the unit cancer risk, which they calculate to be 0.023 µg kg^{-1} day^{-1}. The unit risk represents the US lung or bladder cancer for males and females combined and is extrapolated from the findings of the NRC study.[3] The primary differences between our risk calculations and those of the recent CPSC study[1] are that we consider potential exposure at various stages of life while they only consider exposure to children playing on play sets. Moreover, we consider the daily amount of arsenic on hands to be a linear function of how much contact the person has had with pressure-treated lumber while they assume the daily amount to be equal to 7.6 µg no matter how much contact was made during the day. The formula that we use to calculate the daily amount of arsenic on hands is given by Equation 2.

For all of the scenarios we use the CPSC assumed value of lifetime of LT=25,550. For the scenarios involving children under 6 years of age we use a hand-to-mouth transfer efficiency estimated by CPSC to be HT = 0.43. For older persons, we assume lower values. We now consider four exposure scenarios and calculate the additional bladder or lung cancer risk for each.

A. **Toddler**: As a toddler averaging 7 kg from the ages of 6 months to 18 months, a baby with typical hand-to-mouth activity plays on a deck three days per week for 40 weeks a year, making 50 hand contacts at 40 cm^2 contact per day of contact. We assume that 2/3 of the contact is with dry hands and 1/3 is with wet hands (primarily due to contact with mouth) leading to a HUD-to-hand conversion factor of (2/3) x 15.6 + (1/3) x 9.6 = 12.7. Then:

$$LADD = \frac{\left(\frac{50\times 40\times 0.636}{12.7}\right)\times 0.43\times(3\times 40)\times 4}{7\times 25{,}550} = 0.029$$

$$and\ Risk = 0.023\times 0.029 = 6.6\times 10^{-4}.$$

B. **Young Child**: As a child averaging 16 kg from the ages of 3 years to 6 years, this person typically played on a CCA playset and sometimes a deck making 30 hand contacts at 60 cm^2 contact per day, 3 days a week, 40 weeks a year. We assume that 4/5 of contact is with dry hands and 1/5 is with wet hands leading to a HUD-to-hand conversion factor of (4/5) x 15.6 +(1/5) x 9.6= 14.4. Then:

$$LADD = \frac{\left(\frac{30\times 60\times 0.496}{14.4}\right)\times 0.43\times(3\times 40)\times 4}{16\times 25{,}550} = 0.031$$

$$and\ Risk = 0.023\times 0.031 = 7.2\times 10^{-4}.$$

C. **Older Child**: As a child averaging 32 kg from the ages of 7 years to 13 years, this person typically played on a CCA playset and sometimes a deck making 20 hand contacts at 80 cm^2 contact per day, 2 days a week, 40 weeks a year. We assume that all of the contact is with dry hands. We also assume that the hand-to-mouth transfer efficiency is 0.2. Then:

$$LADD = \frac{\left(\frac{20\times 80\times 0.496}{15.6}\right)\times 0.2\times(2\times 40)\times 7}{32\times 25{,}550} = 0.0069$$

$$and\ Risk = 0.023\times 0.0069 = 1.6\times 10^{-4}.$$

D. **Adult**: As an adult weighing 70 kg this person has a new CCA deck and picnic table built and it lasts for 20 years. He touches the deck incidentally while using the railing to climb stairs, standing by the railing or playing

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Equation 1.

$$LADD\left(\frac{\mu g}{kg\cdot day}\right) = \frac{C\left(\frac{\mu g}{handload}\right)\times HT\left(\frac{Handload}{day}\right)\times EF\left(\frac{days}{year}\right)\times ED(years)}{BW(kg)\times LT(days)}$$

where C=daily amount of arsenic on hands, HT = proportion of arsenic on hands that becomes ingested (or hand-to mouth transfer efficiency), EF = exposure frequency, ED = exposure duration, BW = body weight, and LT = lifetime.

Equation 2.

$$C = \frac{(number\ of\ hand\ contacts)\times(hand\ surface\ area\ in\ cm^2)\times(survey\ mean\ As/cm^2)}{HUD\ to\ hand\ conversion\ factor}$$

with children and eats on the picnic table occasionally. We assume 5 hand contacts at 100 cm^2 contact per day, 5 days a week, 40 weeks a year. We assume that all of the contact is with dry hands. Then:

$$LADD = \frac{\left(\frac{5\times100\times0.636}{15.6}\right)\times0.1\times(5\times40)\times20}{70\times25{,}550} = 0.0046$$

$$and\ Risk = 0.023\times0.0046 = 1.0\times10^{-4}.$$

It should be noted that each of these risks is calculated assuming that the individual had the exposure given in that scenario and no other exposures in their life to arsenic. The risk associated with an individual exposed to more than one scenario can be calculated by adding the corresponding risks. For example, if an individual had the given exposure scenarios as a toddler, young child, and an older child, but no arsenic exposure as an adult, then their estimated risk would be $6.6 \times 10^{-4} + 7.2 \times 10^{-4} + 1.6 \times 10^{-4} = 15.4 \times 10^{-4}$ or 1,540 per million. It also should be noted that these risks do not include exposure from other routes such as exposure to soil surrounding decks, eating vegetables grown near CCA lumber borders, exposure from dermal contact, *etc.* The risks also do not include effects other than bladder or lung cancer, such as skin cancer, liver cancer, and other adverse effects of arsenic exposure. On the other hand, the risks do assume each contact with the wood is in a location that has not been contacted recently. If many of the contacts assumed in the scenarios were repeated over the same location the corresponding risks for the scenarios would be somewhat lower. Another potential issue with the risk calculations is related to hand size. While our research has found that there is no saturation effect evident for adult-size hands contacting CCA lumber in areas hypothesized in the scenarios discussed above, it is possible that smaller hands could begin to experience a saturation effect over the contacted areas. Because the children with smaller hands also exhibit the most hand-to-mouth behavior however, they are probably transferring some arsenic from their hands to their mouth and thus minimizing the potential for saturation. Lastly, it should be noted that all of the scenarios assume a relatively casual use with CCA lumber. Some individuals will be exposed to much greater risks than those hypothesized above. Clearly, for example, long-term builders working regularly with CCA lumber might be exposed to much greater risks than in any of the scenarios presented here.

Summary and Conclusions

It has been discovered over the past seven years that arsenic is a much more potent human carcinogen than was previously predicted from animal exposure tests. Why arsenic is so much more potent a human carcinogen as opposed to animal carcinogen is unknown, but this finding has greatly increased public health concern about exposure to arsenic, especially from the common exposure routes of drinking water and CCA lumber world-wide. Most developed countries have responded by lowering drinking water standards for arsenic and phasing out the use of CCA lumber for public contract uses.

Because of the complexities and variation of human contact with CCA lumber no one will ever be able to determine the true lung and bladder case risk with any certainty. In our research, we have tried to address some of the previous experimental limitations, namely lack of data from actual residential sites, and of the relationship between arsenic wipe transfer and actual hand contact.

From these experiments we have learned:
1) The amount of arsenic transferred to wipes from CCA lumber surfaces decreases substantially over the first few months of outdoor service, but then remains relatively constant (median: 10 μg/100 cm^2; mean: 63.6 μg/100 cm^2) over the remainder of its service life.
2) Water sealant treatments initially lower arsenic dislodgement, but after six months the effect is no longer observed.
3) Stains and paints are effective for somewhat longer time periods, up to about two years or more.
4) Much less arsenic actually comes off onto hands as opposed to damp laboratory wipes, although the interplay of hand moisture and board surface moisture conditions are important factors.

It is clear from nearly all of the studies conducted over the past few years that CCA lumber will expose people who come in contact with it to significant amounts of arsenic. Given that most existing CCA structures will probably not be dismantled, there is an important need for the following:
a) Effective public education programs to make people aware that, after they or their children touch CCA-treated lumber, the level of arsenic on their hands could be a long-term health concern. Widespread awareness of this basic fact would presumably lead to established behaviour patterns such as washing hands after CCA contact, instructing children not to put hands in mouth while playing on CCA playsets, decks, or railings, and keeping food off of CCA lumber surfaces. These education/behavioural actions alone could probably prevent at least half of current CCA-related arsenic ingestion.
b) Intensive, independent research to determine the effectiveness and longevity of particular stains/sealants in preventing arsenic release and the development of coatings/sealants that will prevent arsenic release for much longer time periods.

Ours and most others' research on this issue indicate that the cancer risk from contact with CCA lumber is great enough to be a significant public health concern. Non-toxic or much less toxic alternatives to CCA treatment now exist, *e.g.* ammonium copper quaternary (ACQ), copper azole (CuAz) and recycled plastic/wood chip composite lumber. All of these appear to work about as well as CCA and, in fact, the plastic/sawdust composites are believed to have much more extended decay-prevention properties. All three should achieve retail prices comparable with current CCA lumber once they are manufactured on a large scale.

The recent ERMA report[6] gives an excellent summary of current knowledge about CCA lumber and related arsenic exposure. It acknowledges the known cancer risks associated with arsenic exposure from CCA lumber and recommends many good precautionary measures for

minimizing the risk from contact. However, somewhat surprisingly, it stops short of recommending that New Zealand follow the lead of most other developed countries and immediately phase out the future use of CCA lumber for uses associated with human conduct. Based on the increasing evidence of substantial cancer risks and the now increasing availability of equally effective non-toxic alternatives, we would encourage the people of New Zealand to insist that such as phase-outs be initiated.

Finally, we mention that the field testing kit we used in our research, has enabled us not only to obtain important research data on arsenic release from CCA lumber, but also it has enabled each family using it to assess for themselves the arsenic exposure danger of their own particular CCA lumber structure. This is very empowering information that will enable these families to either greatly reduce their arsenic exposure, or in many cases to be relieved of worry about their particular CCA structure. We offer this test kit to the people of New Zealand through the following website: 'leadtesting.org', to provide a way to empower New Zealand families to assess the risk from their structures, and hopefully also to obtain a database from which CCA lumber health risks in New Zealand can be better understood.

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1-3 July 2003
Industrial Mathematics Initiative 2003
Korean Advanced Institute of Science and Technology (KAIST), Taejon, South Korea
http://parter.kaist.ac.kr/imi/

2-4 July 2003
New Zealand Statistical Association 2003 Conference "Abandoning Independence"
Massey University, Palmerston North
HedderleyD@crop.cri.nz
http://www-ist.massey.ac.nz/stats/nzsa2003

3 July 2003
FiRST Awards
Waipuna Hotel and Conference Centre, Auckland
http://www.frst.govt.nz

6-9 July 2003
ChemEd03, Conference For Teachers Of Chemistry
Victoria University, Wellington
Convenor: Suzanne Boniface: boniface@paradise.net.nz

6-9 July 2003
18th New Zealand Geochemical Group Conference
Edward Percival Field Station and Teaching Laboratory Kaikoura
http://www2.auckland.ac.nz/glg/nzgg/index.htm

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

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

8-10 July 2003
Biolive03, Conference For Teachers Of Biology
University of Waikato, Hamilton
Convenor Roger Cox: cox.clan@clear.net.nz

9-11 July 2003
The New Zealand Insitute Of Physics Conference and Physikos 2003
Massey University, Palmerston North
http://nzip.rsnz.govt.nz/NZIP2003/welcome.htm

13-18 July 2003
The 12th Internatinal Conference On Perception And Action (ICPA)
Gold Coast, Australia
http://www.int.gu.edu.au/%7Es227447/ICPA-conf/index.htm

31 July 2003
State Of New Zealand Environment Lecture
By Barry Carbon, CEO Ministry for the Environment
4.30 pm, Lincoln University, Christchurch

10-14 August 2003
International Geoscience Education Conference GeoSciEd IV
Calgary, Canada
www.geoscied.org

17 - 22 August 2003
21st IIR International Congress Of Refrigeration
Washington DC, USA
joanna@airah.org.au or www.airah.org.au

18-19 August 2003
ANZCCART Conference
Christchurch
anzccart@rsnz.org

21-22 August 2003
ANZLAS Conference
Christchurch
jschofield@las.otago.ac.nz

24-27 August 2003
13th Annual Queenstown Molecular Biology Meeting - "Value From The Genomes"
Rydges Hotel, Queenstown
Convenor: Dr Warwick Grant, AgResearch
warwick.grant@agresearch.co.nz
http://www.qmb.org.nz

25-29 August 2003
International Geological Correlation Programme #464 Conference
Museum of New Zealand Te Papa Tongarewa, Wellington
Contact: Diane Tilyard, d.tilyard@gns.cri.nz
http://www.gns.cri.nz/news/conferences/igcp/index.html

30 August-3 September 2003
The 21st International Australasian Winter Conference On Brain Research (AWCBR)
Queenstown
Contact Gordon Purdie: purdie@wnmeds.ac.nz
http://www.awcbr.org

30 August-3 September 2003
New Zealand Psychological Society Inc., Annual Conference
Massey University, Palmerston North
http://www.psychology.org.nz

1-5 September 2003
The 18th International Radiocarbon Conference
Te Papa, Museum of New Zealand, Wellington
www.14Conference2003.co.nz

11 September 2003
Functional Foods: Solutions To Obesity?
Sheraton Hotel, Auckland
Contact: Lynn Ferguson: l.ferguson@auckland.ac.nz
or Laurie Melton: l.melton@auckland.ac.nz
www.cce.auckland.nz/ffood

11 September 2003
Royal Society Council Meeting
Dunedin

28 September-1 October 2003
SETAC Asia/Pacific - ASE Conference: Solutions To Pollution
Convention Centre, Christchurch
http://www.ecotox.org.au/ASEconference.html

28 September-1 October 2003
ComBio2003 conference
Melbourne Convention Centre, Melbourne, Australia
http://www.asbmb.org.au/combio2003

2-3 October 2003
Scitech03, Conference For Laboratory Technicians
Eastern Institute of Technology, Taradale, Hawke's Bay
Convenor Kay Memmott: Kay@hnhs.school.nz

13-15 October 2003
5th Annual Conference Of The Australasian Research Management Society
Sheraton Hotel, Auckland
Contact Greg Pringle: gpringle@unitec.ac.nz

16 October 2003
Commonwealth Study Conference In Australia And New Zealand
www.csc2003.org

20-23 October 2003
Tenth Asian Chemical Congress (10 ACC 2003) Joint Conference With Eighth Eurasia Conference On Chemical Sciences ($EuAsC_2S$-8)
Hanoi, Vietnam
Contact: Professor Dr Huynh Van Trung

22-24 October 2003
Greening The City: Bringing Biodiversity Back Into The Urban Environment
Conference Of The Royal New Zealand Institute Of Horticulture (In Association With the CCC, ECan, Landcare Research and PGG)
Chateau on the Park, Christchurch
d&amoyle@xtra.co.nz
http://www.rnzih.org.nz/pages/conference2003.htm

12 November 2003
Royal Society Of New Zealand Fellows' Annual General Meeting, New Fellows' Seminar, and Fellows' Dinner
Auckland
gill.sutherland@rsnz.org

13-14 November 2003
"Fresh Water New Zealand: Problems, Processes And Priorities."
Royal Society of New Zealand Conference, AUT
Auckland
gill.sutherland@rsnz.org

14 November 2003
Royal Society Of New Zealand Conference
gill.sutherland@rsnz.org

13-15 November 2003
Conference In Honour Of Keith Pavitt "What Do We Know About Innovation"
University of Sussex, United Kingdom
http://www.sussex.ac.uk/spru/events/KP_Conf_03/

17-19 November 2003
Sustainable Business Network Conference
Aotea Centre, Auckland
See http://www.sustainable.org.nz/conference2003

18-21 November 2003
New Zealand Hydrological Society Annual Conference
Taupo, New Zealand

23-27 November 2003
Fourth Southern Hemisphere Symposium On Undergraduate Mathematics Teaching, Delta '03
Rydges, Queenstown
igoodwin@maths.otago.ac.nz
http://www.maths.otago.ac.nz

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

11 December 2003
Royal Society Council Meeting
Wellington

19-23 January 2004
The Fourth Southern Connections Conference
Cape Town, South Africa
Contact: Mrs Elizabeth Danckwerts (Secretariat)
SC2004@botzoo.uct.ac.za
http://www.uct.ac.za/conferences/sc2004

26-30 January 2004
Mathematics In Industry Workshop
The University of Auckland (City campus), Auckland
g.c.wake@massey.ac.nz

19-23 April 2004
The 4th International Conference On "Applications Of Stable Isotope Techniques To Ecological Studies"
Museum of New Zealand Te Papa Tongarewa, Wellington
See http://207.195.94.13/isoecol/

7-9 July 2004
Sustainability, Engineering And Science Conference
Auckland
Contact: Vicky Adin, Conference Manager
Conference SES, P O Box 272.1460, Papakura, Auckland
Phone: (09) 299 7538

OBITUARY

CUTH WILKINS:THE 'FATHER' OF INORGANIC CHEMISTRY AT THE UNIVERSITY OF CANTERBURY

*David A. Buckingham**
186 Warren Street, Wanaka

**David Buckingham was a former research student with Cuth Wilkins, and until recently, a Professor in the Chemistry Department at the University of Otago.*

Introduction

Emeritus Professor Cuthbert John Wilkins died peacefully in Christchurch on November 12th of last year, at the age of 85. 'Dr. Wilkins', as he was known to his early students, entered the New Zealand university system at a time when teaching and research were undergoing slow but unmistakable change. Prior to the Second World War most Chemistry Departments consisted of a single Professor and his assistant, and they were expected to "do everything". The Professor had to have wide-ranging interests, and research usually meant investigations into natural resources and applied chemistry. After the war increasing student numbers and the need to have a more fundamental approach coming out of the new knowledge of chemical bonding and ways of looking directly at molecules, led to the appointment of 'specialists'. Cuth was one of these, although his interests, especially in teaching, remained widely based throughout his career. He came to the University of Canterbury with youthful energy and enthusiasm, eager to transmit the new ideas, and over the next 38 years built up an enviable record in the teaching of general and inorganic chemistry, and an impressive record in research, particularly of the p-block elements. During this time he guided the developing careers of a large number of students, who are now spread throughout the world in many successful endeavours. They attribute much of their success to Dr. Wilkins' initial training and influence, especially his attention to detail and his quiet but firm insistence on seeking and communicating the truth. This article overviews a life dedicated to the teaching of chemistry and to chemical research.

Above: Emeritus Professor Cuth Wilkins

The Early Years

Cuthbert John Wilkins was born in Christchurch on February 9, 1917, of New Zealand parents. His grandparents had emigrated from England in the 1870s, his grandfather on his father's side having been a cabinet maker in Cheltenham, Gloustershire, and on his mother's side coming from a bootmaking family in a mining village in Cornwall (tin, copper, pyrites). Cuth recalls *"they were hard-working people, well suited to starting a new life in a young country"*. His father had no opportunity for a higher education and was accepted as a High School pupil-teacher, but with perseverance found his way as a part-time student to a BA degree, advancing in geology. He then became a school master at Waddington and Pleasant Point (headmaster) Primaries. His mother gained a Gammack Scholarship to Canterbury College and took a MA degree in French and Latin. It can be seen that both Cuth's parents were reliant on education to gain opportunity, and that was far from easy at the beginning of the century. Cuth has no doubt that this background was the genesis of his inclination towards taking up teaching as a career, perhaps, if possible, at university level.

Cuth was the elder of two children. His sister, first also a high-school teacher, used geographic leanings towards town and country planning. Cuth himself went to Elmwood and Pleasant Point Primaries, gaining a scholarship to St. Andrews College. He never felt comfortable there, and his only comment to me was that *"cricket was a waste of time"*. He enrolled at Canterbury University aged 16, taking the usual Chemistry, Physics, Maths, for a BSc degree. His fourth MSc year (1936) was nominally under the supervision of Henry Denham, then Professor of Chemistry. But Denham went on leave and the research topic proved not viable. This led to frustration, near despondency, and cost a year, but Cuth found his way to an alternative topic. However, in the longer term he felt nothing but gratitude for the opportunities coming his way. Denham and John Packer recommended he apply for a John Edmond Fellowship at Otago, which he was duly awarded, and he spent 1938 working with Frederick Soper on the reduction of nitrosylsulfuric acid by "sulfur monoxide" (now believed to be S_2O). Cuth found Soper *"an inspiring supervisor"* and credits much of his subsequent interest in main-group chemistry to this year

at Otago. He recalls that in New Zealand at the time L.H. Briggs (Auckland), P.W. Robertson (Victoria), J. Packer (Canterbury) and C.L. Carter (Otago) were all prominent in natural products or physical organic chemistry. There were oases of physical chemistry at Auckland (R.A. Robinson) and Canterbury (H.N. Parton), but inorganic chemistry needed some development. His work with Soper resulted in his first two professional publications, the second demonstrating that possible intermediates in the production of N_2, such as NO, N_2H_4, NH_2OH, were not involved. He also took the first-year geology course at Otago (instructed by F.J. Turner and W.N. Benson), taking the final exam. This must have been the start of his life-long interest in mineral chemistry. Soper suggested he go to England for further study and with the help of private funds Cuth set sail for London in 1939 to study under H.V.A. Briscoe at Imperial College. Briscoe, as Professor of Inorganic Chemistry and Director of the Physical and Inorganic Laboratories, put Cuth to work with H.J. Emeleus, who was the remaining 'younger-blood' on the inorganic staff (J.S. Anderson having left for Melbourne). The Second World War had begun, and war needs were much to the fore. Alexander Todd (at Manchester) was a chemical advisor to the British Government, and was often on the telephone to Emeleus exchanging information on reactions and compounds, especially those containing fluorine because of their volatile nature. There was a good supply of Si_2Cl_6 (b.p. 146 °C) on the shelf and so *"after a week or two knocking around London waiting for the lab to re-open"* Cuth began work on attempts to make fluorine analogues of the chlorosilanes. Si_2F_6 was already known, but little was known about silicon fluorides in general, other than that they were more volatile than their chlorides. Cuth recalls that Emeleus was *"a stimulating and enthusiastic man"*, born of a Finnish father and having worked with Stock in Karlsruhe on silicon hydrides, and in the USA on the oxidation of phosphine. Equipment *"such as ground glass joints"* was readily available, and the whole set-up of a modern chemical laboratory geared for basic research was a new experience. By this time Cuth had acquired copies of Emeleus and Anderson's *Modern Aspects of Inorganic Chemistry* and Pauling's *Nature of the Chemical Bond*, and these new texts influenced him greatly. Now, not only were the preparations of new compounds important, but their molecular weights, stabilities (*e.g.* how could the likes of PMe_3, PF_3 be stored?), structures and bond strengths, dipole moments, and vapour pressures were of interest. The handling of volatile and toxic compounds required the use of all-glass equipment and vacuum lines, and Emeleus' background with Stock was of value here. Infrared spectrophotometers were not yet available, and Cuth's job was to identify and then characterise these new silicon fluorides by whatever means possible. His PhD thesis, entitled *The Fluorination of Silicon Chlorides including the more general applicability of Ammonium Fluoride for Fluorination*, was never properly bound, but resulted in an important publication. Subsequently he was to use NH_4F to fluorinate other group-IV and group-V halides.

Cuth's PhD research resulted in several useful general advances. For example, replacing a Si-Cl bond by Si-F was shown to lower the boiling point by *ca.* 40 °C, and the resistance to hydrolysis increased markedly with the number of organic groups attached. He considered his time at Imperial College " *a diverse experience in preparative inorganic chemistry and physical measurement"*, and he was *"grateful for the background he had had with Fred Soper"*. Due to the blitz, graduates of the time were advised, by letter, of their degree, and there were no formal ceremonies. There was, however, a fifty-years-on sequel (June 1992) in the form of a catch-up ceremony for the presentation of commemorative certificates to (surviving) graduates of those times who cared, or managed, to be present. It was presided over by the Princess Royal, as Chancellor of the University of London. Cuth got there, and recalls that *"the atmosphere was something special, with full academic pagentry and a certain degree of protocol associated with Princess Anne being at centre stage"*. One unusual, and emotional, moment came following the award of an Hon. Master of Music degree to Dame Vera Lynn when, at 75 years, she sang her famous wartime hit *The White Cliffs of Dover*, and as encore *We'll Meet Again*.

Following his PhD, Cuth had a short posting in London, and was then attached to the Pyrotechnics Section of the Armament Research Department. This provided contacts with industry, which he came to value all the more as providing a balance to subsequent academic work. However he considered himself *"a nostalgic Kiwi"*, and was ever on the lookout for a job closer to home. Possibilities arose both at Auckland and in Australia, and while he had no strong desire to return to Christchurch Briscoe recommended him for a Lectureship at Canterbury, which he duly took up at the beginning of 1945.

Teaching and Other Duties at Canterbury

Those early years in the Chemistry Department were very much "teaching oriented". John Packer now held the Chair, and Cuth's first responsibility was to first-year laboratories and to modernise the existing laboratory course. This provided his first contact with (the late) Max McGlashan, who was a final-year BSc or MSc student of Parton's. Max immediately informed Cuth *"that he was the demonstrator here"*, to which Cuth replied *"well, how are you getting on?"*, or words to that effect. But this rather abrupt first encounter led to a life-long friendship, and to the joint writing of the monograph *Intermediate Laboratory Course in Chemistry*, which is noted for its simplicity and clear instruction on practical chemistry, and which was a compulsory purchase for first-year students on enrolment. To this day it remains a useful guide to the identification and separation of inorganic anions and cations. It was said that its writing was punctuated by very audible, and at least on one occasion violent, discussion on the stairwell of the old Chemistry Department in Hereford Street, with neither Max nor Cuth willing to give way on points chemical or grammatical. First-year laboratories took up much of Cuth's time, and with the added job of beginning a new advanced inorganic course, and then taking on Parton's second-year class in structural chemistry and electrochemical methods, there was little time for research.

The laboratory course consisted of three streams of two periods each per week with Cuth giving a 20-30 minute introductory talk at the start, sometimes with a demonstration. These were excellent introductions to practical chemistry. In later years they were taken over by senior students, but Cuth always retained a guiding hand. He also built up second- and third-year practical courses, which he thoroughly enjoyed supervising, and at which all got to know him better at the personal level. Some three or four years elapsed before Cuth was called on to take over lecturing one of the two first-year streams (previously the domain of Packer and Parton), but from then on until his retirement these classes remained Cuth's forte. He took junior teaching very seriously, and his lectures were always well prepared, informative, and clearly delivered at the appropriate level. Perhaps their over-riding feature was how he stressed general relationships and how he managed to tie disparate parts of the subject together. He thought of chemistry *"as an experimental subject"*, and the excitement and uncertainty of discovery was always there. Chemistry was all about molecules, which had size, shape, and individual 'colour'. He considered himself *"a general-purpose bloke with no specialties"*, but his success as a teacher required a man of wide knowledge, and with the ability to put this across to a sometimes not-too-interested audience. He lectured on everything in general chemistry; the p-block elements, the solid state and ionic lattices, electron diffraction and structural methods. During study leaves (normally considered times for research), he sought every opportunity to develop his teaching skills and to find out about laboratory courses (Ohio State 1963-4; Oregon State, 1972); he says he learnt much from these visits. Not only did he give a solid grounding to junior classes, but also he was always ready to introduce new ideas at the advanced level. I well remember a somewhat out-of-context lecture being devoted to Sharpe's just published article in *Quarterly Reviews* on 'Fluorine Chemistry', and it appearing as first question on my final year MSc paper. Gordon Rodley likewise remembered the introduction of Leslie Orgel's 'Ligand Field Theory'. White chalk and a blackboard were the order of the day then, and Cuth was the master at using blackboard space, and of not going too fast. There was no excuse for poor note-taking. In earlier years he used 4-inch glass slides, which were carefully prepared in his own hand. Jack Fergusson tells that on dividing up lecturing duties for the inorganic staff, Cuth inevitably ended up with the heaviest load.

Following lectures 'Dr. Wilkins' was approachable without being familiar; but for most, we did not really get to know our lecturers until our final BSc or MSc Hons. year. Then those who chose to work with Cuth found him the ideal supervisor. Not interfering too much, but always ready with good suggestions. His mannerisms of under-statement and questioning allowed you to experiment and develop your own skills, so that research was a succession of successes and failures always in need of explanation to Cuth. He held the overall brief. In writing ones research report and in the writing articles for publication Cuth was meticulous; correct and simple English was required, and one was not to overstate the obvious, or to repeat one's self. We all learnt a lot about scientific writing under his tutelage.

In the late 60s Cuth gave an early morning (8.00 a.m., mid-winter) lecture course to secondary school teachers, and he and Alan Wooff spent many hours on a major revision of the University Entrance/Bursary Chemistry syllabus. Alan recalls Cuth's involvement as being taken very seriously, and that *"his influence was substantial but benign"*. He also contributed to a world-wide IUPAC publication, *Survey of Chemistry Teaching at the University Level*, summarising the New Zealand scene, and he took his turn as Chairman of the local Branch of NZIC at the time of a Pan Pacific Conference in Christchurch. He was on the governing Board of Shirley Boys' High School on two occasions in the 1960s, the second as Chairman, and he was on the Board of Riccarton High in its early years. His lifelong interest in steam locomotives began when he was a young boy (4-5 years) living near the main north line. He recalls that the signalman at the Fendalton Road crossing used a red flag, and that he used to rush out to watch whenever trains were approaching.

Research Contributions

When Cuth did get his research going it was to continue his investigations into silicon halides, and to expand this to organo and sulfur derivatives, then to other group-IV analogues. These studies required all-glass equipment and a good vacuum line. The appointment of Fred Downing as glass blower in 1947 (from General Electric, Wembley) *"made a heck of a difference"*. Fred was an expert in metal-to-glass seals, and together with Dick Nokes (in the machineshop) they made a major contribution to the research effort of the Department as a whole (which was to continue for nearly 40 years). Cuth, initially, was the only inorganic staff member; then Bruce Penfold arrived (1953), and subsequently Jack Fergusson (1960) and Gordon Rodley (1964). As a colleague, Cuth was always ready to share students with new staff, recognising their abilities and strengths, and always having the well-being of the student at heart. This led to many joint investigations, especially in later years with Ward Robinson and Vickie McKee. In later years he returned to his interests in geochemistry and geomorphology and, following retirement was often found visiting the West Coast pursuing his interests in gold, greenstone, and ironsands.

Postscript

Cuth supervised 53 student to BSc (Hons.), MSc, and PhD degrees. The results of this and his own studies gave rise to 76 chemical-based publications in the international journals and an additional 5 on diverse topics. In quoting these statistics I do this with some trepidation as Cuth once wrote me saying *"amongst my many short-comings there has been a failure to get into print quite a lot of good work done by excellent research students"*, and *"if, or when, I do get a bit of what is in the pipeline accepted for publication I'd feel better"*. This gives some appreciation of the man. He took considerable pleasure in the subsequent exceptional achievements of some of these people and was always keen to talk about them. He remembers his research students as *"dedicated and hard-working men and women with whom* [he] *was proud to be associated"*. We his research students likewise remember Cuth with affection. He was a wise and good friend, who taught us to seek out the truth and not to sacrifice honesty.

NZIC CHEMICAL EDUCATION TRUST

The accounts for the NZIC Chemical Education Trust appear below. As reported earlier grants to schools were made following a call for applications in accord with the Trust policies (see: *Chemistry in New Zealand*, **2000**, *66*(4), 48)

NEW ZEALAND INSTITUTE OF CHEMISTRY
CHEMICAL EDUCATION TRUST

INCOME/EXPENDITURE TO 31 MARCH 2003

				02/03	01/02
Income					
	Interest				
		Cheque	17		
		Call	98		
		Kiwi Nest	1,944		
		Term Deposit	1,212	$3,271	$2,669
	Equiticorp				$8,532
	Donations			$1,570	
			Total Inc.	$4,841	$11,201
Expenditure					
	Grants			$1,650	$2,609
		Net Income		**$3,191**	**$8,592**

BALANCE SHEET AT 31 MARCH 2003

Trust Funds			
	Opening Balance	$65,376	$56,784
	Net Income	$3,191	$8,592
		$68,567	$65,376
Represented by			
	Current Assets		
	BNZ Cheque Acct	$514	$830
	BNZ Call Acct	$6,617	$5,029
	Investments		
	Kiwi Nest Egg	$32,559	$30,615
	Term Deposit	$28,877	$28,902
		$68,567	$65,376

B. Halton, Treasurer – Trustee, 14 April 2003

AUDITOR'S REPORT ON THE CHEMICAL EDUCATION TRUST OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

I have examined the books and records of the Chemical Education Trust of the New Zealand Institute of Chemistry for the year ended 31 March 2003.

In common with other organisations of a similar nature, control over income prior to its being recorded is limited and there are no practical audit procedures to determine the effect of this limited control.

Subject to the possible effect of the limited control over income referred to in the preceding paragraph, in my opinion the financial statements give a true and fair view, under the historical cost basis, of the financial position of the Trust as at 31 March 2003 and of the results of its activities for the year ended on that date.

R J Furkert
13 May 2003

NEWS

CHEMICAL EDUCATION TRUST 2003 DISTRIBUTION

Applications are invited from secondary school chemistry teachers (senior chemistry teachers via Head of Science) for grants from the NZIC Chemical Education Trust to promote the teaching of chemistry in their school. For the 2003 distribution grants of about $400 are envisaged but greater or lesser amounts can be applied for.

Applications should be received no later than 1 September 2003 and be addressed to:
Dr. P. T. Holland
NZIC Chemical Education Trust
Cawthron Institute
Private Bag 2
Nelson

The 2003 financial accounts for the NZIC Education Trust appear on the previous page

NZIC Branch News

AUCKLAND

Congratulations from the Institute and the Branch to **Professor W.A. (Bill) Denny** [Director, Auckland Cancer Society Research Centre (ACSRC)] on being made an Officer of the New Zealand Order of Merit, in the Queen's Birthday Honours List. Bill's award is for services to cancer research, although he has been just as active in his services to chemistry, being both a Past President of the NZIC, and a former Chair of the Auckland Branch.

Three recent arrivals to join Bill in the Chemistry section of the ACSRC are **Darby Brooke, Jackie Kendall** and **Chris Richardson**. They are working on a Pfizer funded antibacterials project. Darby is a recent PhD graduate from Canterbury, where he worked with **Jonathon Morris**. Jackie, originally from Auckland, gained her PhD from the University of Nottingham in the U.K., and has spent the last three years working for Pfizer in the U.K. Chris obtained his PhD from Canterbury with **Peter Steel**, and has spent the last three years at the University of California - Riverside where he worked with New Zealander **Chris Reed**.

CANTERBURY

After the informality of the BBQ, the first speaker of the 2003-year was **Mark Hampton**, from the Free Radical Research Group at the Christchurch School of Medicine; he spoke on *The friendly toxins: why fruit and vegetables are good for you*. Mark's talk centred around the idea that many of the plants we consume produce reactive chemicals to scare away animals attempting to eat them although, in most cases, these chemicals are not produced in large enough amounts to harm humans. He outlined how the cells in our body respond to these low-levels of the toxins by increasing their protective defences, and he went on to explain that this adaptive response is why diets high in fruit and vegetables are able to help keep us healthy. Mark's talk was well attended by members and interested parties from the science centres at Lincoln University.

Chemistry Through The Looking Glass was the title of the seminar given by **Richard Keene** (James Cook University, Townsville, Australia) later in the same month. Richard was a previous Erskine visitor to the Chemistry Department. His talk delved into the property of chirality, or handedness, in objects encountered in everyday life, biology and chemistry, and the importance of this phenomenon. Richard's lecture was a general and sometimes light-hearted look at chirality, which appealed to a wide audience. Following the seminar many in the audience may have ended-up re-evaluating Lewis Carroll's book, *Through The Looking Glass*.

Prior to Richard Keene's seminar, the Canterbury Branch ran a raffle to supplement our contribution for the local students attending the International Chemistry Olympiad. ESR kindly sponsored the first prize of a $100 meal voucher to the restaurant of the winner's choice. Geoff Speer of the Chemistry Department Mechanical Workshop won the raffle, drawn on Wednesday night following Richard Keene's seminar, and chose to use the dinner voucher at the Hotel Grand Chancellor. Geoff selected his number because it was the age he was going to be soon after the raffle; the winning number was 64 (sorry Geoff)! The efforts of **Rebecca Hurrell** and **Cassandra Hinton** were instrumental in the success of this raffle.

The May Branch meeting saw teams of three do battle in the second NZIC Trivia and Truffles Evening. Following on from the success of last year's event, twelve teams weighed their general (and in some cases very specific!) chemistry knowledge against that of the comperes, **Michael Edmonds** and **Rebecca Hurrell**, and the opposing teams. In a close, and at times tense battle, the *Methyl Ethyl Turtles*, consisting of **Sean Devenish, Warren** and **Missy McLean**, took out the first prize of UBS vouchers and the coveted title. The *ANZUK Alloys* and the *Sultanas* followed in second and third places, respectively. Thanks to UBS, the Christchurch Polytechnic Winery, and Café 101 for the prizes. The questions required an eclectic range of knowledge, with anything from knowing which two Christchurch night-clubs had the names of elements to the contents of air bags. A particularly popular exercise was to create the best 'chemistry' pick up line but this could never be published here! In another task, the teams had to

put names to nine chemistry faces. One of the 'famous faces' was **Dennis Hogan**, who had to work surprisingly hard to convince his teammates that the picture in question was of him. Throughout the evening delectable truffles, caringly prepared by the Canterbury Branch Committee, and a selection of wines were on hand to refresh and revive the teams.

The prize for the best final year Polytech student 2002 was finally presented to Andrew Howe (see: *Chemistry at Christchurch Polytechnic Institute of Technology* in this issue).

ESR

Chris Nokes (Water Group) has recently returned from presenting an invited paper to a meeting on risk management for water supplies in Berlin, jointly organised by the German Federal Environment Agency and the World Health Organisation (WHO). WHO is preparing guidelines to assist water suppliers in the development of risk management plans; the meeting aimed to provide a forum for discussing possible frameworks for plan development. The approach presently being supported by WHO is firmly based on the HACCP (Hazard Analysis Critical Control Point) framework widely used in the food industry, and many of the presentations focussed on this system. New Zealand is regarded as being well advanced in the implementation of risk management in water supplies, but the New Zealand framework, developed by an ESR team headed by Chris, deviates from HACCP methodology. The New Zealand contribution to the meeting was therefore requested so that this alternative path, and the reasons for it, could be presented. The New Zealand paper was well received, and interest was shown by participants who either had concerns about the possible shortcomings of HACCP when applied to water supplies, or who were interested in the emphasis placed in the New Zealand model on assisting small supplies.

University of Canterbury

Professor Richard Keene is visiting from James Cook University in Townsville, Australia, to work with **Peter Steel** until the end of June. **Tom Morton** is visiting from University of California at Riverside. He is a physical organic chemist and will be working with **Murray McEwan** exploring issues related to conjugation and aromaticity in gaseous cations.

After being interviewed in Wellington last week by a panel that included the Governor General and a judge from the Court of Appeal, **Ben Perston** has been awarded a William Georgetti Scholarship. These prestigious scholarships are administered by the NZVCC and are not restricted just to science students. **Brett Davis** has been offered a three-year TIF (Technology for Industry) Fellowship for PhD study involving a three-way tie-up between the University of Canterbury, Syft Technologies Ltd., and the New Zealand Olive Oil Industry.

Alison Downard has been granted an Erskine Fellowship for the period 31 May - 9 July of this year. **Darby Brooke** has gained his PhD in synthesis and has taken up a position at the Auckland Cancer Institute. Darby's PhD work was completed under the supervision of **Jonathon Morris** on the total synthesis of hydroxystrobilurin A. Recently, **Jeremy Harrison** successfully negotiated his final seminar and oral examination and also qualified PhD. Jeremy worked with **Bryce Williamson** working on the matrix isolation and magneto-optical spectroscopy of diatomic radical monohydrides.

The Chemistry Department welcomes **Jonathan Slater** from the UK to take up a two-year University postdoctoral fellowship working with **Peter Steel**. Jon worked on the synthesis of cyclometallated compounds with potential application as liquid crystals during his PhD, which was completed at Warwick University. Another Postdoc, **Christine Le Sann** recently departed after about two years in the department. We enjoyed her stay here and hope she has found the experience rewarding.

Branch Chairperson, **Jan Wikaira** together with **Richard Hartshorn** gave their *Thoughts on Teaching and Learning in Science* recently in a Departmental seminar. This seminar summarised some of the insights they gained from the recent conference of the RACI Chemical Education Division. Richard Keene also gave a departmental seminar on *Dinuclear Ruthenium Complexes as Sequence- and Structure-Selective Binding Agents for DNA*.

Another paper from the Department has been selected by the web-based magazine *The Alchemist* as one of 'this week's Hot Papers'. It was published in *Tetrahedron* and describes new multi-armed molecules synthesised recently by **Dave McMorran**, who is now at the University of Otago.

MANAWATU

Above: From left to right, **John Ayres**, **Mike Boland**, **Barry Scott** and **Nigel Kerr** enjoy the meal at the BBQ and Quiz Night (Photo credit: Justin Bendall).

The year got off to a great start for the Manawatu Branch with a Barbeque and Quiz Night on 27 March at the Fonterra Research Centre. Quizmaster, **Mike Boland** (FRC) kept everyone on their toes with his esoteric questions. A good turn-out by members and students (prospective members?) made the evening enjoyable and successful.

On 15 April, **Sean Bearsley** from Higgins Construction, spoke on *The Chemistry of Roads*. This was a truly chemical analysis of the components of roading materials, particularly bitumen, and a chemical approach to problems arising in New Zealand roading. Sean is in a small, highly specialised occupation which relies heavily on his background in chemistry. He will be contributing a written account of his work for *Chemistry in New Zealand* later in the year. *Intellectual Property and Why it Matters to Researchers* was the topic of **Jane Calvert's** (Baldwin Shelston Waters) talk on 15 May. This drew a large and diverse crowd – from students through to people responsible for IP in their organizations. Jane gave an excellent presentation and was frequently interrupted with questions. The meeting was preceded by wine and cheese.

New Zealand Pharmaceuticals Ltd (NZP)

Selwyn Yorke reports that in spite of the rising dollar affecting the profitability of the exporting sector, NZP as an exporter of biochemicals (www.nzp.co.nz) remains in a positive and expansionary mode. The company recently licensed the manufacturing rights for *N*-acetylmannosamine (ManNAc) from Industrial Research Ltd. This chemical is a synthetic precursor required for the manufacture of sialic acid. Sialic acid is one of the "monosaccharides of the moment" as it is involved in a wide range of biological processes. Consequently, key players in the biotechnology industry are focussing on the role of sialic acid and ManNAc in the treatment of disease. NZP is developing a number of new commercial relationships in the biotechnology sector based on the production of ManNAc. NZP's parent company NZP Holdings and Just the Berries Corporation (JTB) have formed a new joint venture company, Just The Berries Ltd. (htpp://www.justtheberries.co.nz). This new company will develop products based on blackcurrants. The goal of JTB is to produce a range of products including juices and dietary supplements based on the anthocyanins, the coloured compounds found in the blackcurrant skins. Another range of cosmetic and dietary supplement products will be manufactured from the blackcurrant seed oil.

Fonterra Research Centre

Jeremy Hill (General Manager, Research and Technical Operations) has announced a number of appointments at the Fonterra Research Centre. These include **Mike Boland**, to Research Partnerships Manager, **Nick Robinson**, to Technical Manager - Nutrition and Milks, and **Buck Rogers**, to Technical Manager - Food Systems.

Merck Ltd

Barry Scott says that *Merck Ltd* has a New Zealand website at www.merck.co.nz that contains the latest news and product information. It is also useful for linking to 'ChemDat' which is the Merck on-line chemical database. This is where you can find Material Safety Data Sheets (MSDS), Technical Data, Safety Information, and Certificates of Analysis. They have also included some staff profiles and contact information. Future developments to the site will include an *e-commerce* capability.

Landcare Research

Benny Theng is finishing his "second term" in France. During the four months there, Benny was involved in writing and editing manuscripts for the *Handbook of Clay Science* in collaboration with Faiza Bergaya (CRMD-CNRS-Universite d'Orleans, France) and Gerhard Lagaly (University of Kiel, Germany). The final "compuscripts" are to be submitted to Elsevier at the end of January 2004. Benny will have attended the *Euroclay2003* conference in Modena, Italy in late June before this is printed and before returning to Palmerston North in early July.

Massey University

The work of the Branch's previous chair **Richard Haverkamp** (Institute of Technology and Engineering) has been recognised by the Institution of Professional Engineers of New Zealand with his election as a Fellow of the professional industry group. Richard has been recognised for his research contribution to improving aluminium smelter technology and his dedication to developing the Institution to meet the needs of young people wishing to pursue careers in engineering and technology. He has developed, patented, and sold a technology for improving smelting, for which he has received international recognition. Richard, who is also an FNZIC, has recently been appointed to the Standards and Accreditation Board of IPENZ Engineers New Zealand. This board is charged with the accreditation of four year and some three year engineering degrees in New Zealand.

Massey University has just taken delivery of their MacDiarmid Institute for Advanced Materials and Nanotechnology funded scanning probe microscope. The instrument is an Asylum Research MFP3D instrument which, according to Richard Haverkamp, is the latest and best SPM technology and is mounted on a Nikon inverted optical microscope. Once the instrument is fully installed and tested it will be used by a number of researchers from the MacDiarmid Institute on a range of materials and nanotechnology projects. Richard recently obtained a Technology New Zealand TIF award with Novozone NZ Ltd in Auckland to work on understanding and improving ozone generators. He is now looking for an able science, technology or engineering graduate to work on this for a Masters degree.

Recently the two new professors, **Geoff Jameson** and **David Officer** delivered their inaugural professorial lectures to capacity audiences. Geoff spoke on the topic *Driven to Diffraction: Chemistry and Biology in Three Dimensions,* and David's lecture was entitled, *Small is Beautiful: Nanoscience for a Brave New (Sustainable) World.* NZIC members will have the opportunity to hear Geoff when he visits Branches later in the year as part of the Royal Society of Chemistry Australasian Lectureship. **Len Blackwell,** who arrived at Massey University in 1968, has now formally retired. He reflected on the many twists and turns in his career in his valedictory lecture *From the Hammett Equation to Eavesdropping on the Ovary.*

Teachers from as far a field as Wairoa, Wainuiomata and Terasaki, as well as locals, gathered on Friday 9 May for a Chemistry Teachers Evening entitled *'A Kaleidoscope of Chemistry'*. The afternoon session started with a taste of current research by postgraduate students. **Amy Watson** presented a synopsis of her research for her masters thesis on the chemical pathways used by fungi that produce toxins in pasture. Amy described her work on synthesis of the aromatic fragment of the toxin. **Susan Habas**, a Fulbright scholar doing her masters in the Nanomaterials Research Centre, described her work with carbon nanotubes. In particular, Susan touched on the addition of useful functionalities to single-wall nanotubes. **Andrew Brodie** provided a short, but timely commercial illustrating the quality of chemistry at Massey. The research topics were followed by a brief skirmish with the chemistry of *Weapons of Mass Destruction*, provided by **Trevor Kitson**. Fortunately all the chemicals were kept safe on paper or OHP. After dinner, the group reassembled in the first year labs for a look at experiments using colourimetric analysis. Colourimetry forms one of the NCEA level 2 achievement standards, *i.e.* year 12. The measurement of thiocyanate can be linked to its presence in human saliva as a result of detoxification by the body; smokers have higher levels than non-smokers! Colour in drinks and sweet foods proved a popular topic. Food colouring bought off the shelf of a supermarket is a convenient source for a standard solution to use in measuring levels in coloured drinks. The laboratory session was run by **Adrian Jull**, who then coaxed the group down to the staffroom for a final discussion on *NCEA and entry to University*. This proved a lively topic, but one that will need revisiting as the first students with the new qualification arrive in 2005.

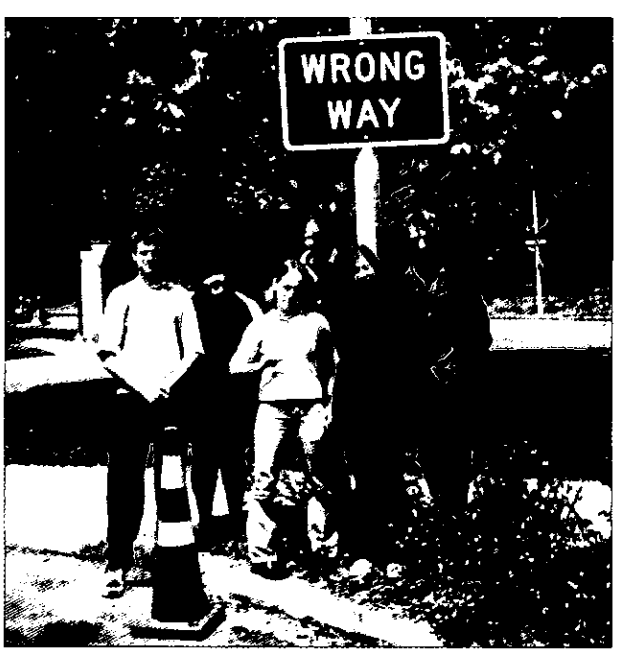
Massey News reports that "For the past 30 years Massey has pioneered in the field of protein X-ray crystallography and DNA sequencing in New Zealand". The commissioning of two new pieces of equipment worth $2 M will enable the University to power into the future. At the official commissioning of ABI 3730 DNA Sequencer and Rigaku Protein X-Ray Diffraction Equipment, the Head of the Institute of Molecular BioSciences, **Pat Sullivan** said "it's not every day the University gets to celebrate such a large investment in science research". The purchase of the equipment has been made possible largely through funding made available from the Allan Wilson Centre for Molecular Ecology and Evolution, who will be the main users of the equipment. Co-director of the Allan Wilson Centre, **David Penny**, says the DNA sequencer is a great asset for the whole University: "We're expecting it will make a contribution across the University and eventually be used by people all around the country." Professor **Geoff Jameson**, the 'master' of the X-ray crystallography machine, says he hopes the machine will be used by as many people across the University as possible. Vice-Chancellor **Professor Judith Kinnear** was given the task of declaring the machines officially 'opened' although they have been in use for some weeks. Taking a term from her horse-racing ancestors, she called the acquisition of the two machines a 'quinella' when teamed with DNA and proteins, which the two machines process. She congratulated the staff on gaining the funding to purchase the new equipment, which she said will provide the infrastructure to underwrite the strength of science research at Massey."

Above: **Geoff Jameson** shows Vice-Chancellor **Judith Kinnear**, the new X-ray equipment. (Photo credit: *Massey News*).

Andrew Sutherland-Smith, a protein crystallographer, has recently been appointed as lecturer in biochemistry in the Institute of Molecular BioSciences but he will also be part of the Centre for Structural Biology using the new X-ray equipment. Andrew is a Massey graduate who has spent the last four and a half years at the Medical Research Council Laboratories (Cambridge, UK) undertaking structural studies on actin associated proteins and proteins involved in muscular dystrophies.

Above: New lecturer, Andrew Sutherland-Smith (Photo credit Massey University).

Tobias Broger recently spent two months working in **Carol Taylor's** laboratory producing gram quantities of important amino acid and peptide building blocks for the "sticky protein" project. Tobias was an apprentice in analytical chemistry at the EMPA (Swiss Federal Materials Lab.). However, he will be pursuing tertiary education on his return to Switzerland and has decided that he likes "to build molecules!" Carol will finally travel to the UK in October as part of the 2001 *Easterfield Award*. She will be at the disposal of the Royal Society of Chemistry from 20-31 October and will visit the Universities of Bristol, Oxford, Manchester, Nottingham, York and Edinburgh on her travels. She promises a full write-up on her return.



Above: Members of Carol Taylor's group hope she will not go the "wrong way" during her travels. (Photo credit Carol Taylor).

Following two years at Massey University, Marsden Postdoctoral Fellow, **Andreas Derwhal** has left the group of **Eric Ainscough** and **Andrew Brodie** to return to Germany. Andreas was working on the metal binding properties of tetracyclophosphazenes. **Adrian Chaplain** has joined the group for five months before he leaves to undertake PhD studies in Switzerland. Adrian spent the summer at Massey's Albany Campus, working with **John Harrison** learning how to apply quantum chemistry calculations to phosphazenes that Andreas prepared.

OTAGO

The first Otago Branch NZIC outing for the year involved dinner at the Joseph Mellor Restaurant followed by a talk on art forgery by **Ross Grimmett**. Ross has himself attained the status of an "old master" and gave a fascinating account of fraud and deceit in the art world through the ages. Imidazoles were not mentioned!

Tony Manning who has been with the **Robinson/Simpson** group for three months has returned to Dublin, but not before buying a house in Dunedin. He says that Dunedin is a fantastic place to live and he plans to spend at least three months in New Zealand over the summer. This will continue the Dunedin/Dublin collaboration on NLO and molecular wire compounds funded by an EU grant.

In between PBRF, auditing and terrorist activity, **Jim Simpson** and **Brian Robinson** have been writing papers trying to catch-up on the backlog. **John McAdam** is now studying for a PhD and is working on organometallic fluorescent materials. He is also practicing assiduously for the national brass band competitions. **Joy Morgan** has returned to sugar chemistry and is attempting to make compounds for biological workers. **Bogdan Dana** has finished his experimental work for his PhD and is working for Resene Paints.

Henrik Kjaergaard, in collaboration with **Professor Veronica Vaida** and **Paul Hintze** (University of Colorado - Boulder) and **Professor Jamie Donaldson** (University of Toronto), has proposed a new mechanism for the way in which sunlight interacts with sulfuric acid in the atmosphere. It is proposed that photolysis of sulfuric acid in the stratosphere takes place via absorption of visible sunlight in the OH-stretching overtone vibrations rather than direct photochemistry via absorption in the electronic transitions, as had been previously thought. The research will change our understanding of the atmosphere and is likely to affect climate modelling, and our planet's energy budget. The research was published in the March 7 issue of *Science*. Henrik's PhD student **Daniel Schofield** has been awarded a Bright Future scholarship for the project "Hydrated complexes in the Earth's atmosphere".

Jim McQuillan has recently taken a biological turn in some of his research with bacterial adhesion to metals being the subject of NERF/IRL work and a recent Marsden grant. This direction will be strengthened by his involvement in a recently-announced NERF Biotechnology grant, led by **Chris Daughney** of GNS, to develop metal sequestration of metal ions by extremophilic microorganisms.

Drs. Graham Motson and **Katie Heslop** (ex-Bristol University) have returned to the UK, Graham having completed his one year Royal Society Postdoctoral Fellowship on "Lanthanide complexes as luminescent biolabels" with **Dr. Sally Brooker**. **Tanya Ronson**, (BSc(Hons) with Sally last year), has returned as an RA on the lanthanides project and has been joined by **Dr. Wolfgang Mohr** (ex-University of Erlangen-Nurnberg). **Professor Annie K. Powell** (University of Karlsruhe) visited from late February to Easter. **Dr. Carsten Brandt** (ex-University of Wurtzberg) joined Sally's group, as a Marsden postdoctoral fellow, on 1 April. He is working on the "Transition metal compounds as potential nano switches and memory devices" project, replacing **Dr. Udo Beckmann** (ex-MPI für Strahlenchemie) who returned to Germany on 1 May having completed his year with us. **Professor Keith Murray** (Monash University) visited us briefly as a side-trip from his extended Auckland visit. In October Sally will travel to Hanoi to present a lecture and receive the FACS Distinguished Young Chemist Award.

WAIKATO

On Wednesday 21 May the Waikato Branch and the University of Waikato Chemistry Department held a Chemistry quiz night "Chemistry Masters of the Universe". This proved to be a very successful evening with an excellent turn out of teams (with very varied backgrounds) ranging from local secondary school teachers (some came from as far away as Kati Kati), to University staff and students, to teams from local industries such as Fonterra. Participants deliberated over four rounds of questions, presented by Richard Coll and **Michèle Prinsep**: *Periodic Puzzlers, The Senses (smells and music), The Wide World of Chemistry* and the *Demo Demons*. An enjoyable night was had by all and the eventual winners were as follows:

> ***First Prize:*** Dinner for five at a local restaurant was won by *The League of Extraordinary Gentlemen* - (University of Waikato staff and students).
> ***Second Prize:*** Five bottles of good wine went to *Kneewartz* (NIWA),
> ***Third Prize:*** Five bottles of really awful wine was given to *Goldilocks and the Three Moles* (Hamilton secondary school teachers), and finally
> ***Fourth Prize:*** Peanuts and Cola went to the *Hilltribe* (Hill's Laboratories).

Numerous spot prizes were also given out and the success of the evening will no doubt see it becoming an annual event. A number of people contributed to the success of the occasion: **Richard Coll** and **Michèle Prinsep** for organisation and presentation, **Annie Barker** for organising demonstrations and general assistance, **Michael Mucalo** and **Brian Nicholson** for organisation and marking, and **Tony Cartner** for organisation and general assistance. The financial support of the Waikato Branch of the NZIC and the Chemistry Department of the University of Waikato is gratefully acknowledged.

Jacinta Dalgety has successfully defended her PhD thesis. The oral was held in the UK at the University of Leicester (where one of her examiners was located) as Jacinta is currently working at the Institute of Policy Studies in Education at the London Metropolitan University.

DEC International NZ Ltd

It has been a busy start to the year for DEC International NZ Ltd. The successful registration and launch of our patented controlled release progesterone insert (CIDR insert) in the US has meant rapid growth for DEC Manufacturing. Four University of Waikato graduates (**Brendon Reardon, Nathan McClunie, Richard Gilkison** and **Aaron Clarke**) and one Otago graduate (**Brenda Ponder**) have joined the DEC Manufacturing Laboratory Team this year.

The beginning of 2003 has been a busy time for company acquisitions. Recently DEC International has acquired major shareholdings in ICPbio (manufacturers of hormonal and other biotech products) and Millennium Plastics (a thermoplastic moulding company). Furthermore, the company has recently won the 2003 Inaugural Waikato Agritech Innovation Award for being the first New Zealand company to gain US FDA approval for a new animal drug product developed and manufactured exclusively in New Zealand.

NIWA, Hamilton

Craig Depree attended an environmental contamination conference in Quebec recently and presented a paper entitled *Distribution of polycyclic aromatic hydrocarbons (PAHs) in an urbanised estuary and possible implication for source apportionment.* **Trevor Mathieson** completed specialist training for Ion Trap Mass Spectrometry last month at Thermo-Finnigan in London. **Sue Clearwater** recently joined NIWA after several years of environmental chemistry research in the USA. She is currently studying zinc accumulation in food chains and the Biotic Ligand Model. The multi-talented NIWA team of **Michael Ellwood, Michael Ahrens, Sam Whitley, Doron Hickey**, and **Russell Adams** proved there is some chemistry in every scientist by placing second in the recent NZIC/University of Waikato ChemQuiz. Whether first or third place would have resulted had some of NIWA's more established chemists participated is still being discussed.

Waikato University

Richard Coll's recent research on scientists beliefs and views of common superstitions and new age beliefs has attracted wide interest in the media with interviews with all main radio stations and on TV for Pam Corkery and the Breakfast Show. Articles have also appeared in the *New Zealand Herald, Waikato Times*, and the *THES*.

On Friday 6 June, **Dr. Neil Ward** of the University of Surrey paid one of his semi-regular visits to the University to give a seminar entitled *Selenium Speciation Analysis in Biological Fluids: An Analytical Approach.*

WELLINGTON

The March Branch meeting was addressed by **Dr. Mick Hedley**, (Group Leader, Wood Performance Enhancement, Forest Research, Rotorua) on *Issues Facing Wood Preservation in New Zealand Today.* The widespread failure through decay of untreated kiln-dried radiata pine framing in constructions with monolithic or face-sealed claddings caused by rain penetration through the claddings – ***Leaky Building Syndrome*** – was discussed, and the types of research underway to identify better ways for preservative treatments to protect framing from decay when subjected to limited rain wetting were presented.

A detailed consideration of the types of wood preservatives, their lifetimes, and their efficacy in various user situations comprised the bulk of Mick's presentation and this was particularly apt in light of regulation changes in the US and Europe (see M. Hedley, *Chemistry in New Zealand,* **2003**, *67*(1), 10-13) regarding use of copper-chrome-arsenate (CCA)-treated timber in situations such as decks and playground equipment.

Mick is Chairman of the New Zealand Timber Preservation Council Technical Committee and a member of the Board of the Timber Preservation Council; a member of the Standards Australia Wood Preservation Committee TM6, and the Standards New Zealand Wood Preservation Committee; Chairman of the Australasian Wood Preservation Committee and a member of the International Research Group on Wood Preservation. His address was much enjoyed by the diverse audience and drew wide-ranging discussion.

The April Branch meeting was addressed by **Professor Lovat Rees** (Emeritus Professor, Imperial College, London) on *Studies of Adsorption, Diffusion and Molecular Simulations of Cyclic Hydrocarbons in MFI Zeolites.* Isotherms of benzene, toluene, ethylbenzene, *p*-xylene, *p*-dichlorobenzene, cyclohexane, *cis*- and *trans*-1,4-dimethylcyclohexane were presented and the effects of hydroxyl nest defects on the adsorption of benzene shown. Simulations of the packing of benzene and *p*-xylene indicate the preferred sites for these molecules up to saturation loadings. The preferred sites for the cyclohexane, cis- and trans-1,4-dimethylcyclohexane were also shown and the frequency-response diffusion studies of *p*-xylene, benzene and cyclohexanes compared. The lecture was elegantly presented in a way that even the least physically-orientated could follow.

Professor Lovat Rees, a graduate of the University of Aberdeen, was for many years Professor of Physical Chemistry at Imperial College, London. He is now active in research as Professor Emeritus in the Department of Chemistry at Edinburgh University. He is a Fellow of the Royal Society of Edinburgh and the Royal Society of Chemistry. He has had a leading role in the development of zeolite chemistry, publishing many definitive papers and monographs, and editing the journal *"Zeolites"*. He has been associated with many international groups, conferences, etc, concerned with zeolite chemistry.

The May meeting compromised a site visit, this time to 'the newly' established on the Wellington waterfront. the topic *Beer* was presented to a good-sized group of members and guests by the brewery manager **Colin Page** with **Simol Taylor**. After a tour of the new site, the biochemical processes involved in conversion of the starch in the raw materials to sugars, and their fermentation, which occur in beer making was described. The ways the starting materials: malt, hops, yeast and water, affect the quality of the beer, and how the brewer must understand these ever-changing organic compounds in order to consistently brew quality beer was appropriately explained. The evening concluded (not surprisingly) with a tasting of the beers produced as well as suitable finger-foods. Manager **Colin Page** has an Honours degree in Brewing and Distilling from Heriot Watt University (Edinburgh) and has worked at Hopback Brewery in Salisbury, Fullers Brewery in Chiswick and more recently Waiheke Island Brewery. **Simon Taylor** with a BSc in Plant and Microbial Science and BCom from the University of Canterbury, and Master of Business and Technology degree from the University of New South Wales, trained at Speight's in Dunedin and then Canterbury Breweries before becoming project manager for the construction of the Wellington Brewery. A more than pleasant evening was had by all!

BRANZ

Adrian Bennett has been working primarily at Building Industry Authority on secondment for the past three months, assisting them with finding a satisfactory path to creating appropriate durability and 'weathertightness' building controls, in the wake of the 'leaky buildings' concerns. **Dr. Larry Jordan** won a BRANZ Study Award to spend a period at University of Wales at Bangor in late 2002 studying the chemistry of wood and potential effects on its corrosivity to metals. Larry has returned to BRANZ, and has been pursuing his FRST-funded work on corrosion of metals in treated timber, but will leave BRANZ in July.

Dr. Neil Lee has been examining the applicability to New Zealand uses of supercritical CO_2 injection into concrete, using very high pressures. This has the environmental advantage of sequestering CO_2. He has found that total carbonation and conversion to amorphous silica can be achieved, producing a modified concrete with very low porosity, but the economics of the process are poor using the techniques so far. The next step could be to try to find methodologies which are more cost effective, perhaps by using lower-pressure systems.

Cawthron Institute

Cawthron Institute is hosting the **HABTech 2003 Workshop/Conference** on technologies for monitoring of harmful algal blooms and marine biotoxins between November 26 and 30 ahead of the NZIC Conference in Nelson set for December 1-4. The workshop has APEC and MoRST as main sponsors and features an outstanding programme of overseas experts, a poster forum and intensive hands-on demonstration sessions. Programme and Registration forms, with full details on how to register are available on the HABTech 2003 website: http://www.cawthron.org.nz/habtech03

Dr. Jenny Smith has moved positions from Cawthron Institute where she has been working on marine sources of alginate degrading enzymes, to the Seafood Centre of Crop & Food Research in Nelson. **Dr. Hitoshi Ishida** (Department of Pharmaceutical Chemistry, University of Shizuoka, Japan) visited Cawthron Institute for three weeks, joined for one week by his student Akira Nozawa. They worked with the HAB and Biotoxins teams on shellfish feeding experiments with toxin algae and on LC-MS of brevetoxins. He gave seminars on his research into the metabolism of brevetoxins in shellfish at Cawthron and at the 19th Marine Biotoxin Science Workshop in Wellington in early April.

Professor William Cooper (Department of Chemistry, University of North Carolina-Wilmington, US) and **Dr. Barry Peake** (University of Otago) visited Cawthron to work with **Lesley Rhodes** on production of oxidative species by phytoplankton. Bill also gave a seminar on a major US project into the use of hydrogen peroxide for disinfestation of oil tanker ballast water. **Dr. Patrick Holland** attended the meeting of the ICES/IOC working group on hazardous algal bloom dynamics held in mid-March in Aberdeen, Scotland. He presented results of New Zealand research in this area and recent advances at Cawthron in detection of toxic phytoplankton and the LC-MS analysis of marine biotoxins.

Industrial Research (Gracefield)

Dr. David Bibby [General Manager (Science)] left IRL in May to take up his position as Dean of Science (and Dean of Architecture & Design) and Pro-Vice-Chancellor at VUW. There have been several other departures to University positions over the last six months including **Dr. Neil Milestone** (to Sheffield, UK), **Dr. Clive Davies** (Massey, Palmerston North) and **Dr. Rod Vaughan** (Simon Fraser, Canada).

Dr. George Slim (formerly Team Manager Bioprocessing) has joined Industry New Zealand in a job about maximising value for IP generated in New Zealand with a speciality in the biotechnology sector. The new Bioprocessing team leader is **Jens Sommer-Knudsen** whose previous position was with Gradipore in Sydney.

Dr. Mark Waterland has announced his departure from IRL to take up the position of Lecturer in Chemistry at Massey University from early September and will be based in Palmerston North. We wish him well.

Dr. Ian Brown undertook a BRAP-funded travel award to Japan in May, working for two weeks with **Professor Shiro Shimada** (Engineering School, Hokkaido University, Sapporo). Ian was undertaking studies of high temperature oxidation processes in Fe-TiC ceramic-metal composite bodies using specialist facilities at the Hokkaido laboratory. These composite bodies have engineering performance attributes that make them strong candidates for new cutting tool materials. Ian then spent an additional week visiting key AIST and University laboratories and commercial partners in the Tokyo and Osaka regions.

FRST has announced investment of $1 M p.a. for 6 years in the geopolymer materials research led by **Dr. Catherine Nicholson** (neé **Dickson**). The focus of the FRST-funded project will be on the use of geopolymers for the construction industry through development of high-value products for use in aggressive environments. Another area of interest is in the application of geopolymers to remediation of industrial and nuclear wastes. Catherine hosted **Drs. Dan Perera** and **Lou Vance** of the Australian Nuclear Science & Technology Organisation, Sydney, on a 3-day visit of IRL in late March. An on-going collaborative project is investigating the use of geopolymers synthesised from New Zealand-sourced raw materials as novel encapsulants for radioactive wastestreams.

FRST has awarded IRL funding for their Carbohydrate Nanotechnology programme of $1.2 M p.a. over five years. This contract involves the preparation of carbohydrate functionalised dendrimers and immune stimulatory complexes (ISCOMs) functionalised to achieve active targeting for potential therapeutic and vaccine applications. Collaborators in the contract include the School of Pharmacy, University of Otago (ISCOM preparation and immunology), the Cawthron Institute (enzymes from natural sources to prepare complex carbohydrates), and Starpharma (an Australian biotechnology company who will supply the dendrimer technology). **Dr. Phillip Rendle** will be the IRL programme leader.

Research student **Gabriel Ossenkamp,** (VUW/IRL) completed his PhD thesis on surface treatments of silica and is now back (somewhere) in Europe!

IRL's cGMP pilot plant was officially opened by the Prime Minister, Rt Hon. Helen Clarke on March 26. The 300 m^2 flameproof facility is designed to carry out concurrent cGMP processes and will include a 250 L glass lined reactor, 50 L Buchi Rotavapor, 50 L hydrogenator/ cryogenic reactor, 100 L filter dryer, and a single fluid heating/cooling system rated from –70 to +200 °C. Forming an integral part of this facility is a HEL SIMULAR reaction calorimeter, which will enable the safe translation of potentially hazardous lab scale chemical reactions through to the facility. The facility coupled provides a unique resource in New Zealand, and is designed to help facilitate the development of candidate drugs from a research level to the production of multi-kilogram cGMP quantities for up to and including FDA approved Phase I clinical trials.

Considerable effort is taking place to re-focus and develop technology platforms for IRL's future R&D. These platforms will provide the basis for bids for the 2004 PGSF funds.

Victoria University

Dr. Annie Powell of Karlsruhe University visited the Inorganic Group and gave a fascinating lecture on polymetal-oxo cluster aggregates, their structures and those of supramolecular arrays that they can be induced to crystallize into.

Dr. Colin Bain, a Royal Society of Chemistry – New Zealand Institute of Chemistry Exchange Lecturer, visited in early April and gave a talk entitled Pouring Oil on Troubled Water: Wetting and Phase Transitions in Surfactant/Alkane/Water Systems. As the physicists felt this more to their liking the lecture was scheduled so that the senior chemistry academics could not attend!

Dr. David Bibby (NZIC President) appears to have settled well to the University as Dean of Science (and Architecture and Design) and Pro-Vice-Chancellor ... and he has inherited the characteristics of the senior administration by not eating lunch in the staff club. On a separate note The School of Chemical and Physical Sciences has almost completed its search for a new physical chemist having made a number of appointments in the Physics areas. The impact of the MacDiarmid Institute is becoming evident from the amount of new equipment that continues to arrive. As we go to press **Dr. John Hoberg** has just announced his resignation to take up an appointment at the University of Wyoming.

The Royal Society of Chemistry Retrodigitisation Project

The Royal Society of Chemistry is pleased to announce that its Retrodigitisation Project is underway. The backfile will contain all articles published by the Royal Society of Chemistry (and its forerunner societies) from 1841 to 1996. It is estimated the backfile will contain 200,000 articles in 1,200,000 pages.

The articles will be available via issue contents lists. They will also be accessible from full-text (unspecific) searches of the PDFfiles and by more specific searches of the bibliographic information and (from 1966 to 1996) abstract. A Digital Object Identifier (DOI) will be assigned to each article. This will allow the DOI to be used as another access route to the article.

In addition, the references in the 1990-1996 articles will contain "reference links" to full text and CAS abstracts, where available, similar to that now offered for the 1997-2003 articles.

The articles in the backfile will be delivered to customers on the web in the same way, using the same system, as the "current data" (1997 onwards).

It is planned that the project will be completed during the course of 2003.

For further information (and for those who wish to keep abreast of how the RSC Retrodigitisation Project is progressing by registering for e-alerts), please visit www.rsc.org/retrodigitisation

Chemical Contamination Of Groundwater: Modelling Heavy Metal Contaminant Transport Under Laboratory Conditions*

Hilary Michie and Liping Pang
Institute of Environmental Science and Research Ltd, PO Box 29 181, Christchurch

* This article is adapted by the authors from the original publication by Pang, L, *et al.* in the *Journal of Contaminant Hydrology* (**2002**, *57*, 241).

Introduction

When rainfall soaks into the ground plants may absorb it, or it may seep into streams or seep further into the ground to become groundwater. The underground areas where groundwater collects are called aquifers These groundwater reserves represent an important water supply for regions that are prone to water shortages or seasonal fluctuations in river flows and rainfall. Indeed, approximately 40% of New Zealand's city or town water supplies are now drawn from groundwater.

Groundwater is affected by the activities that take place on the land above it — toxic chemicals, disease-causing micro-organisms and nutrients can leach from the land surface to degrade the quality of the groundwater contained within aquifers. Alluvial gravel aquifers are one of the most common types of aquifer in New Zealand and they are extremely vulnerable to contamination by chemicals and microbes because they are highly hydraulically conductive.

Groundwater contamination by heavy metals occurs in many countries throughout the world, including New Zealand. Heavy metals can be detected in groundwater that has been contaminated by seepage of water from contaminated industrial sites, timber processing sites, mining, rubbish tips, weathering of rocks and minerals, and soil run-off. For example, at the former Tui mine in the Te Aroha area of the Coromandel where lead, zinc and copper were once extracted and processed on site, water from the Tui stream, which fed into the town's water supply, was found to be contaminated with heavy metals four years after the mine had closed. Large amounts of these metals can reach toxic concentrations in groundwater. Therefore, it is essential to be able to predict the movement of these contaminants in groundwater. The reliable prediction of metal movement within groundwater requires an understanding of the way metals interact with aquifer materials.

Any recognition of the problem of contaminated groundwaters is linked to a specialized area of chemistry that examines and models the processes of contaminant attenuation and transport in the subsurface environment. The use of models of transportation is of great importance in increasing our understanding of the processes that govern the movement and fate of contaminants at the subsurface. This in turn will increase the chance of protecting the environment and humans from the effects of these contaminants.

Transportation of Metal Contaminants in Groundwater Systems

The transport of chemical contaminants in groundwater systems is complex and may be affected by physical non-equilibrium processes, for example, that caused by aquifer heterogeneity, preferential flow and kinetic diffusion, and/or chemical non-equilibrium processes, *e.g.* caused by kinetic sorption/ion exchange. Local equilibrium establishes only when solute transport is under simple and ideal conditions, for example, when sorption is linear, instantaneous, and reversible. The effect of pore-water velocity on contaminant transport, particularly on sorption/desorption, is receiving increased interest. It has been reported that pore-water velocity influences kinetic sorption/desorption,[1-3] but it does not influence sorption/desorption under equilibrium conditions.[4]

Kinetic sorption/desorption is commonly described by a two-site model that assumes that the sorption sites can be partitioned into instantaneous sites and kinetic sites.[5] Most studies have focused on the evaluation of the effect of pore-water velocity on the rate of mass transfer between the two sites, and a positive relationship between the two parameters is commonly reported.[3,6] However, less is known about the effect of pore-water velocity on other non-equilibrium parameters.

Parameter relationships relate to the experimental conditions. The pore-water velocities reported in the literature are generally low (predominantly <1 m/day) as fine materials (sand and silt) are usually used in these experiments. The findings derived from such conditions cannot be applied to coarse aquifer materials such as alluvial gravel that commonly makes up aquifers in New Zealand. Pore-water velocities in alluvial gravel groundwater systems are higher than the velocities reported in most studies in the literature, and velocity variations in alluvial gravel systems are typically large, varying between 5 and 104 m/day.[7]

Most studies on the effect of pore-water velocity on sorption/desorption have investigated the transport of organic contaminants.[1-4,6,8] Few have investigated the effect of pore-water velocity on non-equilibrium transport of heavy metals even though contamination of groundwaters by heavy metals occurs in many countries worldwide. The reliable prediction of metal movement in groundwater requires an understanding of the sorption/desorption of metals with aquifer materials. Some studies have

reported that rate-limited sorption is observed for cadmium,[9,10] zinc,[11] and lead[12] in porous media. Such rate-limited sorption is characterised by rapid initial sorption followed by slow uptake.

Scientists at ESR in Christchurch are involved in modelling the attenuation characteristics of chemical contaminants to gain a better understanding of the factors that control attenuation and migration of contaminants in groundwater. In particular, gaps in our knowledge of metal contaminant movement through columns containing heterogeneous aquifer material can be assessed by investigating the effect of pore-water velocity on rate-limited sorption/ desorption of Cd, Zn and Pb in an alluvial gravel aquifer, under laboratory conditions of chemical non-equilibrium.[13] This work will contribute to better predictions, management and minimization of groundwater contamination.

Overview of Methods

The aquifer material used in the column experiments was taken during well-drilling from below the water-table at Burnham, Canterbury — the same field site used in the 1999 study by Pang and Close.[7] The columns used were 18 cm long acrylic tubes with an internal diameter of 10 cm. They were packed with the aquifer material and flow was supplied to remove trapped air and to minimize the possibility of preferential flow; the experiments were conducted at room temperature. Untreated tap water, sourced from groundwater in Christchurch gravel aquifers, was used as the water source.

To examine the influence of pore-water velocity on metal transport, low, intermediate, and high flow rates, ranging from 3-60 m per day, were applied to the columns. The columns were first flushed with tap water at the selected flow rate, then a pulse of chemical solution containing a metal and tritiated water (^3H_2O), was injected into the columns followed by flushing with tap water again. The use of ^3H_2O was to provide a conservative tracer that allowed for an independent estimation of pore-water velocity and dispersion, and to examine any physical non-equilibrium processes in the system.

The metal samples derived from the column effluent were acidified and analysed using a flame atomic absorption spectrometer; all ^3H_2O samples were analysed using a liquid scintillation counter. A flow-interruption method[14] was used to determine non-equilibrium conditions during solute transport.

Breakthrough curves (BTCs) were generated by plotting the concentration at time, t, over the initial concentration (C/C_0) versus time, t. Once the BTCs from the column experiment were generated, they were analysed using a two-site sorption-desorption model,[15,16] and the CXTFIT programme was used to estimate transport parameters.[17]

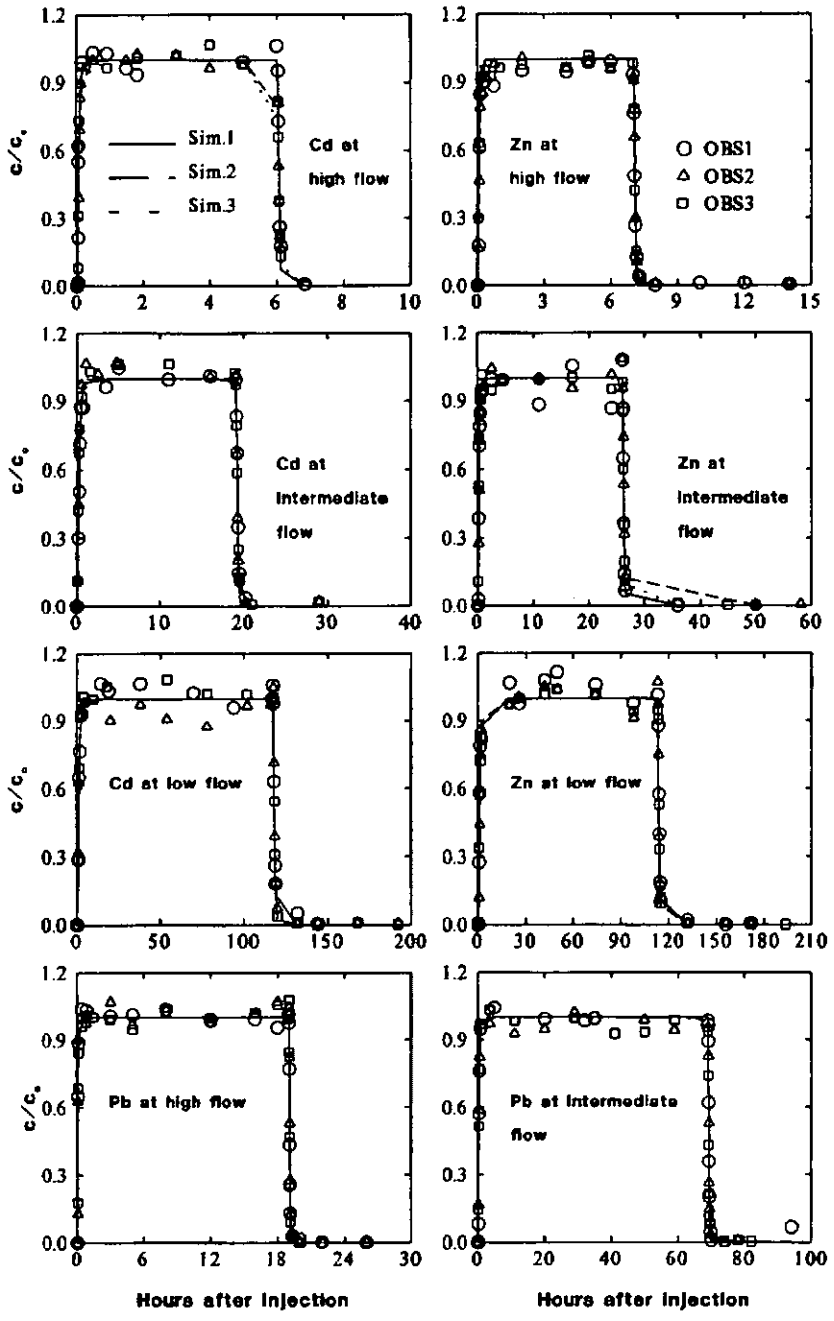


Figure 1. Observed (OBS) and CXTFIT-simulated (SIM) concentration breakthrough curves of ^3H_2O for the triplicate columns.

Results and Discussion

The study investigated the non-equilibrium transport of heavy metals. Non-equilibrium transport refers to transport that is impacted upon by kinetic, *i.e.* rate-limited, physical and/ or chemical processes due to different time-scales between the processes.

The results obtained from the two-region model (incorporated in the CXTFIT programme data) for any physical non-equilibrium processes in

the system suggested that all the water in the system was essentially mobile and that the equilibrium model should be used for analysing the ^3H_2O data. The absence of physical non-equilibrium is shown by the symmetry of the ^3H_2O BTCs of Figure 1. Further evidence of equilibrium ^3H_2O transport could be seen from the results of the flow interruption experiments. After flow interruption, ^3H_2O concentrations were the same as those prior to flow interruption, indicating equilibrium transport.

Transport with a non-equilibrium component causes the observed BTCs to exhibit early breakthrough and long tails, both of which cannot be adequately described by traditional local-equilibrium models. Figure 2 shows observed and model-simulated BTCs of Cd, Zn and Pb at three pore-water velocities. All completed metal BTCs showed significant tailing indicating that chemical non-equilibrium processes affected their transport through the column. This was further supported by the decreased metal concentrations observed during flow interruption.

From the modelling, the transport of Cd, Zn and Pb through alluvial gravel columns was dominated by first-order rate-limited sorption and desorption. Pore-water velocity played a very important role in this process – as pore-water velocity increased, sorption and desorption rates increased, the number of sorption sites in equilibrium phases increased, and the metals were less retarded. Model results suggest that Cd and Zn behave similarly, while Pb is much more strongly sorbed. At input concentrations of about 4 mg/L and pore-water velocities of 3-60 m/day in the groundwater within alluvial gravel, the relative velocity of the heavy metals compared with the conservative tracer ^3H_2O, expressed in terms of retardation factors, were as follows: Cd, 26-289; Zn, 24-255; Pb, 322-6377.

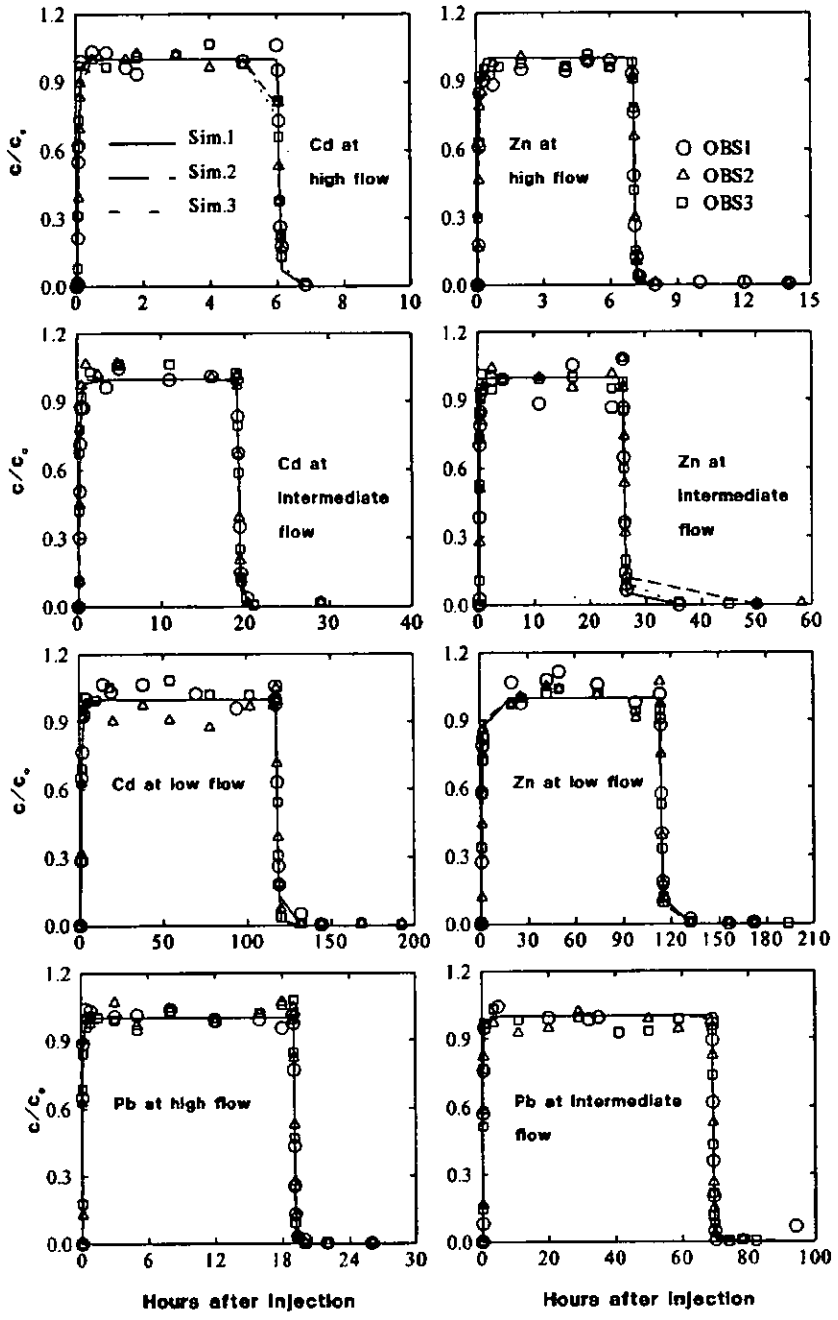


Figure 2. Observed (OBS) and CXTFIT-simulated (SIM) concentration breakthrough curves of Cd, Zn and Pb for the triplicate columns. Plots in the small boxes show concentration change during flow interruption.

Modelling non-equilibrium transport is a valuable tool for the design of remediation operations and monitoring programs because non-equilibrium conditions exist in the natural environment. Since the concentrations of a contaminant during its release at a particular time will be higher under non-equilibrium conditions than equilibrium conditions, rate-limited processes must be taken into consideration. If not, the selected remediation system may be unable to achieve desired standards of groundwater treatment and this will impact directly on the water quality.

Acknowledgement

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NEW ZEALAND
NATIONAL CRYSTAL GROWING COMPETITION 2003

The New Zealand Institute of Chemistry is sponsoring a crystal growing competition, in conjunction with the Chemistry Department of the University of Waikato. The competition is **open to all primary, intermediate and secondary school students** in New Zealand.

To enter the competition, students should grow the best crystal that they can, of any non-toxic substance (for further information see *Safety in Science: a guidance manual for schools*; Ministry of Education). The crystals will be judged based on size, clarity, presence of flaws, formation of good crystal faces etc.

Prizes, provided by the New Zealand Institute of Chemistry, are as follows:

Primary and Intermediate competition:		**Secondary competition:**	
First prize	$60	First prize	$60
Second prize	$50	Second prize	$50
Third prize	$40	Third prize	$40
Fourth prize	$30	Fourth prize	$30
Fifth prizes (3)	$10 each	Fifth prizes (3)	$10 each

An entry form is provided, and the deadline for receipt of crystals is Friday September 5th 2003. Further details can be found on the Waikato University (School of Science & Technology) website:
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If you have any questions, contact Associate Professor Bill Henderson at w.henderson@waikato.ac.nz or phone (07) 8384656.

The University Of Canterbury Science Outreach Programme For Schools

Richard Hartshorn and Rebecca Hurrell
Department of Chemistry, University of Canterbury, Private Bag 4800 Christchurch.

The Birth

The germ of the idea that led to the Science Outreach Programme for Schools can be traced back to early 1999. The Chemistry Department held a retreat at that time in preparation for the external review that was held later in the year. During discussions on the future of the Department, recurring themes were the need to increase the number of students coming into the Department and the need to address the negative image of chemistry in society. There was a widely held view that what was needed was to promote ourselves and the things that we do, particularly in schools. Equally important was the clear willingness of everyone in the Department to contribute to such activities.

Over the succeeding months the idea of taking presentations on topical issues in science out into schools began to take shape. This idea was based on a small scale operation that one staff member had seen in operation at the University of Melbourne. The fact that the staff and students of the Department were prepared to give their time to activities of this kind was clearly vital to the operation of such a scheme, but the practicalities of implementing such a programme were such that it could not operate reasonably without employment of a coordinator. Producing talks, organising presenters, and liaising with school teachers all promised to be very time consuming and incompatible with a 'spare time' activity, let alone something taken on in competition with the increasing demands of teaching, research, and administration.

At about this time, the then newly appointed Vice-Chancellor, Professor Le Grew, announced the establishment of the Vice Chancellor's New Initiatives Fund. Our application to this fund was successful, as was a similar application to the Science and Technology Promotion Fund that is administered for the Government by the Royal Society of New Zealand. Put together, these grants allowed us to appoint two half-time coordinators for the programme - we were up and running.

The programme began with a focus on chemistry, but during our first year of operation (2000), it became obvious that the programme needed to expand to cover other subjects. The topical issues we wanted to address often crossed subject boundaries and the teachers we were working with were keen for us to contribute in other curriculum areas as well. We now have strong collaborations with a number of University departments and presentations in the areas of physics, biology, geology, earth sciences, and engineering, as well as chemistry.

The Aims

The aims of the Programme are:
· To encourage an appreciation of the pivotal place that science holds in modern society.
· To describe how scientific research has the potential to solve some of the really big problems in our modern world.
· To persuade young people that the study of science is rewarding and worthwhile.
· To improve the communication skills of our graduate students.

The principal focus of the Outreach Programme is overseeing the preparation and organising the delivery of 30-45 minute presentations on topical issues in science. The target audiences are Year 11(formerly Form 5) classes in high schools and area schools in our region. We hope to persuade these students to do more science subjects to a higher level at school. This will increase the pool of students eligible to study science, engineering, and related subjects at university level. The presenters are enthusiastic students who are conducting research towards MSc and PhD degrees. They are excellent role models for the young people in the audience and outstanding ambassadors for science. Currently approximately 45 research students are involved in our programme.

In order to complement the presentations, we are endeavouring to provide assistance to teachers through the provision of web-based resources and e-mail hotlines, e.g. hotline@chem.canterbury.ac.nz. The programme has also prepared and run a range of workshops for science teachers. Most notably, we obtained funding from the Science and Technology Promotion Fund to run a series of professional development workshops in geology and earth science, and the Community Trust supported a series of workshops in chemistry.

Our core activities are structured in such a way that we will be encouraging more students to take science subjects in their senior years at school (through the presentations) and then giving them a better experience by supporting, up-skilling, and enthusing their teachers (through the workshops, hotlines, and resources).

We are now moving to promote science and scientific research in the wider community beyond schools. We have recently established a Community Programme, funded by the Royal Society, in which we have modified some of our presentations in such a way as to make them suitable for community groups, e.g. Rotary Clubs. We have also been contracted to organise other speaking engagements as part of the Royal Society Science Communicators Programme.

The Presentations

The latest count gave 16 presentations available to schools, with another 18 in various stages of preparation. Of the completed presentations, three (The Visible Atom, Issues in the Atmosphere, and Science of Fire) are primarily focused on chemical topics and, where possible, linked to

achievement standards in chemistry. A number of others are closely tied to chemistry, e.g. Medical Imaging, Antibiotic Resistance, Genetic Engineering, and Is Eating A Dangerous Occupation?. We also have a number of chemistry oriented talks in preparation (Roid Rage - Drugs in Sport; Fuels and Energy; Nanotechnology; Green Chemistry; Elements of the Universe), and plans for talks on Polymers, Materials Science, Radioactivity, and Forensic Science. Additional details on our presentations and our other activities can be found on our website: www.outreach.canterbury.ac.nz

The NZIC and the Programme

We have been very fortunate to have had excellent support from the NZIC, right from the early stages of the programme. Our first visit to the Nelson region was funded through a special project grant, the local Branch has made regular contributions to the costs of developing and delivering presentations, and we have collaborated on the organization and promotion of public lectures. NZIC members regularly help us with the development and evaluation of presentation content, and the NZIC has sponsored our Bursary examination review evenings, which we run in collaboration with the Canterbury Science Teachers' Association. We look forward to on-going cooperation with the NZIC as we have many goals in common.

The Achievements

We believe that the statistics of the programme speak for themselves. In each of the last two years we have given more that 300 presentations at over 50 high schools and area schools in our region. We are particularly proud of the fact that we visit schools outside of the main centres, so that they too have some contact with a university.

Aside from the core programme of presentations, at various times we have hosted more than 150 teachers at multi-day professional development workshops, and many others to shorter sessions on particular topics. A large number of presentations have been prepared, more are in preparation, and we are in the process of developing web-based resources to complement our presentations. At this stage these will be focused on chemistry and geology-earth science, but we anticipate expanding to other subject areas as well in the future.

Above: A workshop for secondary school teachers.

The People

The Science Outreach Programme, like any organization, relies on its staff. It was a major step forward in securing the future of the programme when the coordinator position was established as a full-time, centrally funded position.

Rebecca Hurrell, the Programme Coordinator, has been with the programme since the beginning, initially half-time and now full-time. She is the first point of contact for teachers, academics, presenters, and anybody else who wants to be involved with the programme in some way. Rebecca is a member of the local NZIC Branch Committee, and has played an active role in the organisation of education conferences (ChemEd 2001, SciCon 2004) and the local science fair; she also prepares some of our funding applications.

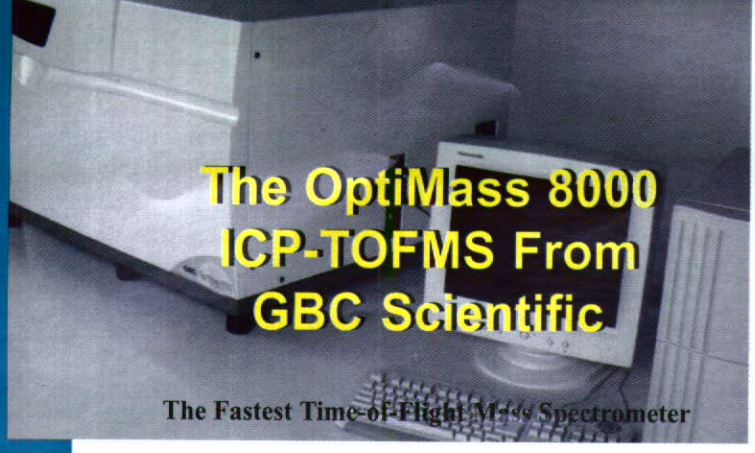
Recently, we have been fortunate enough to put together sufficient funding to allow the employment of another staff member. Nick Ford has been working with us on a casual basis since completing his teaching diploma. He has now joined us full-time as part of our expansion into the area of physics and engineering. It is his task to oversee the development of new presentations and workshops for physics classes. This will entail a particular emphasis on real life problems in engineering as examples of physics principles that are developed in school classrooms.

Richard Hartshorn is the figurehead who gets to bask in the reflected glory of the hard work done by the others. Occasionally reports need to be written or funding obtained, in which case the word processor is dusted off.

The Future

The Science Outreach Programme will get bigger. The expansion will occur both geographically and academically as we take our talks to schools throughout the South Island and perhaps also to parts of the North Island. We are in the process of including topics in engineering in our offerings. Other subject areas are to be included, and we are expanding the target audience as we find topics and material that are suitable for senior classes. There is also scope for producing material suitable for junior classes, and there is much more that we could do in terms of offering web-based resources and curriculum-based material to support the presentations that we offer. Our community programme will be expanded, and we anticipate offering more professional development workshops for teachers. We have many more ideas than we have resources with which we can implement them!

The existing programme and the new initiatives all cost money. Our current funding is derived principally from university sources, but we do obtain significant amounts from external organizations such as the Community Trust, the Brian Mason Scientific and Technical Trust, and the Royal Society of New Zealand. We are currently investigating the possibility of obtaining corporate sponsorship for the programme. Feel free to get in touch if you would like to make a financial contribution to the programme!



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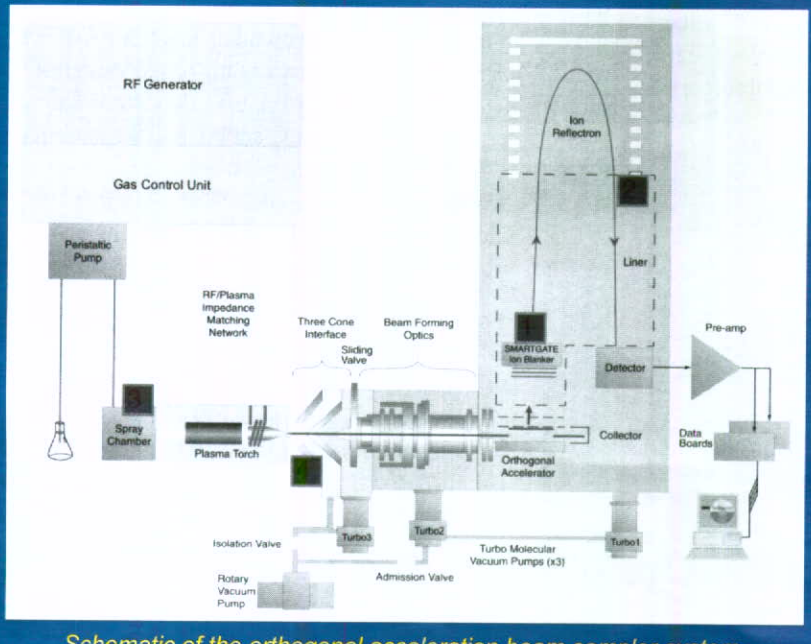

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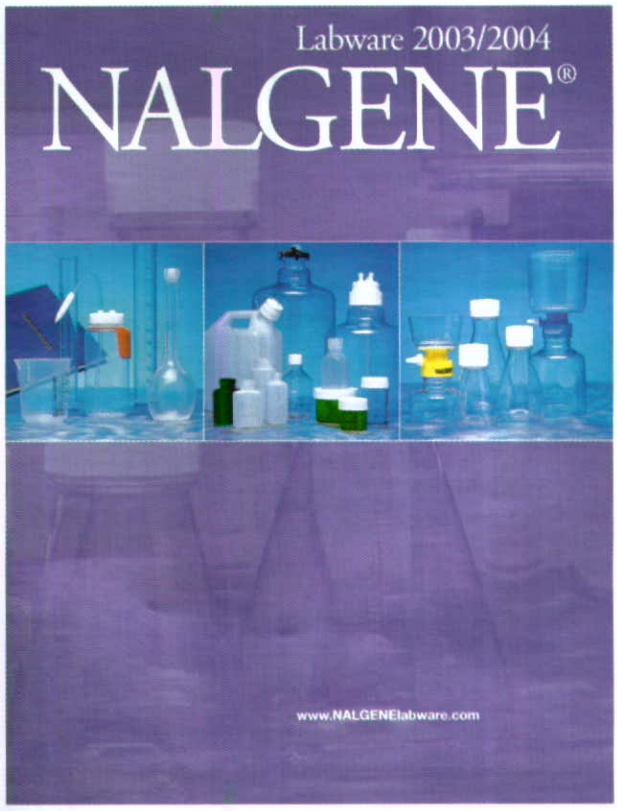

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Greatly enhanced sensitivity has been achieved with the development of a newly designed high luminosity ion source and ion optical systems. Other innovations include front ion source access for easy maintenance to minimize downtime and direct probe for flexibility. Pump down has been reduced to under 4 minutes and input up to 15 mL/min flow into the ion source. High expandability is achieved with dual differential turbo molecular pumps allowing extended range applications. System checking software verifies the instrument operation and maintenance reminders are built in. The GCMS solution software has a graphical "Assistant Bar" and wizards to facilitate the complicated job of inputting analysis conditions, making it easy for even the first-time user. Pre-treatment devices, such as the headspace sampler, can also be controlled, allowing continuous automatic operation. Free formatting of analysis result reports, with functions similar to MS Word, allows easy and efficient creation of custom reports.

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AGILENT TECHNOLOGIES INTRODUCES BREAKTHROUGH ION TRAP MASS SPECTROMETER FOR PROTEOMICS AND TRACE COMPOUND ANALYSIS

Agilent Technologies Inc. recently introduced an ion trap mass spectrometer that is approximately 10 times more sensitive than its predecessor. The increased sensitivity, resolution and scan speed of the Agilent 1100 Series LC/ MSD Trap XCT promise improved performance for many applications such as the identification and characterization of biologically significant, low-abundance proteins for disease research.

High Capacity Ion Trap Improves Sensitivity, Resolution and Scan Speed

A limitation on the performance of any quadrupole ion trap mass spectrometer is trap capacity. Careful changes to trap materials and geometry and new scanning algorithms for Agilent's non-linear ion trap have improved trap capacity by four to eight times. This increase in trap capacity translates directly into increased sensitivity. The improved ion trap and new scanning algorithms also improve mass resolution and scan speed.

"We're extremely pleased to be able to offer this advanced ion trap technology to our customers," stated Ken Imatani, product marketing manager for Agilent's ion trap mass spectrometers. "Mass spectrometrists who work with extremely small sample amounts or highly charged ions should especially benefit."

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SHIMADZU LC-MS

Shimadzu's LCMS-2010 provides a compact benchtop platform for high sensitivity detection. The ion optics offer high levels of response at trace concentrations. Productivity is enhanced in Multi-Sequence Mode. Structural information is maximized by rapid polarity switching and supporting fragmentation studies in a single run. The LCMS-2010 is designed for robust use with minimal source maintenance, reliable stable performance over a range of LC operating conditions, rapid source switching and cleaning.

The Shimadzu LCMS Solution software has fully integrated control of the HPLC and LCMS. This provides a one-click approach to maximize sample throughput using preconfigured methods and reporting templates. Automatic status check of the LC and MS, together with autotuning, simplifies operation and maintenance. The integrated software control for LC and MS systems ensure data integrity and error checking.

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AGILENT TECHNOLOGIES INTRODUCES NEW ZORBAX SOLVENT SAVER COLUMNS TO REDUCE LABORATORY WASTE, SOLVENT COSTS

Agilent Technologies Inc. recently introduced a variety of new ZORBAX Solvent Saver columns to help reduce solvent purchase and waste disposal costs in liquid chromatography (LC) and LC/MS (mass spectrometry) applications. Now available, the Agilent ZORBAX Solvent Saver (5 µm) and Solvent Saver Plus (3.5 µm) can be easily applied to new or existing HPLC methods.

Agilent's 3.0 mm internal diameter (i.d.) Solvent Saver columns provide significant advantages over the larger 4.6 mm columns, reducing mobile phase usage and waste by 60 percent and improving signal-to-noise ratio by two-to-three fold while still delivering the same resolution and selectivity. The flow rate for 3.0 mm columns are 40 percent of the flow rate of the 4.6 mm i.d. columns at the same linear velocity; this decreases solvent purchase and waste disposal costs at the same linear velocity.

The ZORBAX Solvent Saver columns deliver optimal performance at intermediate flow rates effective for common MS interfaces such as electrospray, atmospheric pressure chemical ionization (APCI), and atmospheric pressure photo ionization (APPI) sources. This enables scientists to conveniently switch between sources without changing the column or method conditions.

For further information on the columns, request application note "Cost Savings and LC/MS Compatibility," publication number 5988-8692EN. This note is available without charge from any Agilent sales agent or the Agilent Web site at www.agilent.com/chem

Agilent ZORBAX Solvent Saver and Solvent Saver Plus columns are now available for order in new configurations and phases including SB-C3, SB-Aq, Bonus-RP, Extend-C18 and Rx-C18. To order:

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NEW AGILENT 1100 SERIES MICRO FRACTION COLLECTION SYSTEM

Agilent Technologies has introduced a new separation system for proteomics researchers, which allows single and multi-dimensional chromatographic separation of complex peptide and protein mixtures. With limited samples amounts the challenge is to provide a separation tool, which can be used for subsequent high sensitivity mass spectrometric detection. This requires a system that is specifically designed for one- or multi-dimensional chromatographic separation of small sample amounts at low flow rates and allows the subsequent collection of very small fraction volumes.

Multi-dimensional Chromatography
The Agilent micro fraction collection system gives researchers the flexibility for multidimensional chromatography online through column switching using the Agilent 1100 Series micro valves offline by collecting the desired fraction for subsequent dimensions.

Furthermore, it allows researches to perform enzymatic or chemical modifications of the fractions between the separation runs.

Features:
· Complete, software controlled one vendor solution from capillary pump, micro fraction collector to capillary columns for fast protein/peptide separations
· Capillary pump system with electronic flow control (EFC) and active feedback for unprecedented flow stability
· Lowest fraction delay volume (down to 0.25 µL) for highest chromatographic resolution
· Fraction cooling prevents evaporation and thermal decomposition
· Liquid contact control mode allows the reproducible collection of small fraction volumes
· Flexibility for collection in different 96- and 384-well plates or Eppendorf tubes
· High fraction collection capacity (4 well-plates, extendable by using two fraction collectors in parallel)
· For highest reliability sensor pad controls the needle position
· Fraction collection based on time and/or peak.

NEW PRODUCTS

Availability:
The first shipments are planned for August 2003. Further information can be obtained from the New Zealand distributor.

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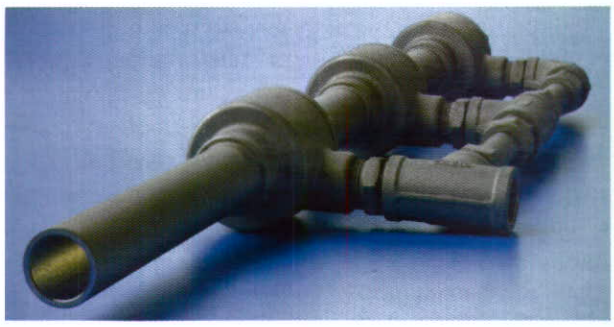
MIXING HYDROPHOBIC MATERIALS – NO FEAR

Many substances such as sulfur, powder activated carbon, fumed silica and others, are termed as hydrophobic (meaning fear of water), because they do not mix well into liquid. This phenomenon creates many problems for most sectors of industry as thorough mixing is integral to their process.



J S Melbourne Controls which is highly regarded by industry for providing innovative solutions to their problems (recently inaugurally inducted into The Manufacturing Hall of Fame), has again provided an efficient solution based on their Hydro Shear Mixer.

Managing Director John Melbourne said, "we were approached by several industries for a mixing device that provided complete and thorough mixing of hydrophobic materials. Preliminary research indicated that the basic principle of our Hydro Shear mixer could be applied. Through redevelopment we designed a Super Hydro Shear mixer, which we refined after much testing, and now offer what we believe to be the world's most effective method of mixing these kind of materials".

Melbourne is now developing a full range of the Super Hydro Shear mixers to suit food, pharmaceutical and industrial applications in 25, 38, 50, 75, 100 and 150 mm sizes. 304 and 316 stainless steel industrial versions are also being added to the range.

In keeping with the philosophy behind the Melbourne product range, the new Super Hydro Shear mixers provide exceptional worker safety as all product being mixed is enclosed in pipe which means there are no toxic dust particles released into the air to contaminate worker's lungs. Back injuries are also minimised as the units eliminate lifting of heavy drums and packs because product can be drawn directly from their original containers.

With no moving parts, the new Super Hydro Shear mixers require virtually no maintenance and provide effective full bore operation.

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NEW NALGENE® ADJUSTABLE TEFLON WASH BOTTLES ARE A SAFER CHOICE FOR AGGRESSIVE SOLUTIONS AND HIGH PURITY APPLICATIONS

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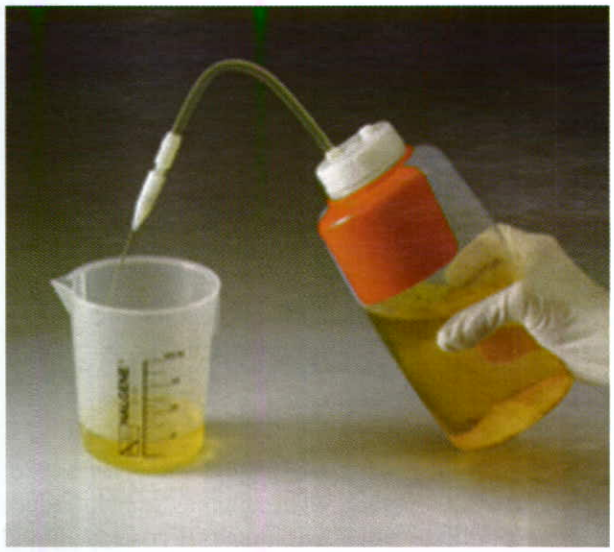

The new NALGENE Adjustable Teflon Wash Bottles offer excellent chemical resistance over a broad temperature range and are ideal for aggressive solvents and high purity applications. Both the 500- and 1000-mL wash bottles have colourful polypropylene hang tags that accept standard size labels and can be written on for easy identification.

The autoclavable bottles' nozzle, stem and closure assemblies are Tefzel ETFE, the bottle is Teflon FEP and the nozzle O-ring is fully synthetic EPR. All materials are low in extractables for high-purity applications.

The adjustable ETFE nozzle comes to a full stop position and provides a steady stream without sputtering, reducing the potential of splashing.

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Update

Metallosupramolecular Chemistry – What is it?

Peter J. Steel
Chemistry Department, University of Canterbury, Private Bag 4800, Christchurch, New Zealand

The term *supramolecular chemistry* was first introduced by Nobel laureate Jean-Marie Lehn, in 1978, to describe the "chemistry of molecular assemblies". Whereas traditional chemistry involves the study of molecules consisting of atoms held together by *strong* covalent bonds, supramolecular chemistry uses molecules as the basic building blocks for the construction of larger aggregates. These are held together by *weak* interactions, such as hydrogen bonds, electrostatic interactions, van der Waals interactions, or the stacking of aromatic rings. Although these interactions are individually much weaker than the covalent bonds in organic molecules, by employing large numbers of them very robust assemblies of molecules can be formed. In a similar way, nature uses weak bonds to hold together the strands of DNA, protein assemblies, and the majority of cellular machinery.

One of the most versatile ways to build such assemblies is to make use of interactions between metal ions (M) and donor groups in organic molecules (ligands, L), as has long been exploited in traditional coordination chemistry. By employing ligands that bridge more than one metal centre it is possible to construct one-, two- or three-dimensional architectures, based on M-L interactions.[1] This is *metallosupramolecular* chemistry, a term introduced by Constable in 1994, wherein the metals act as a type of "glue" to hold together assemblies of organic molecules. The magnitude of such M-L interactions varies from very weak to very strong, depending on the nature of M and L.

The beauty of this chemistry lies not only in the diverse range of supramolecular topologies possible, but in the simplicity of their preparation. Traditional organic syntheses involve the stepwise construction of molecules through sequences of chemical reactions, frequently requiring tedious manipulation of the various functional groups, and often in low overall yields. In contrast, metallosupramolecular syntheses utilise *self-assembly* processes, in which simply mixing together metal and ligand building blocks yields the desired product, in a single process in high yield. This spontaneous self-organisation of a number of molecular components into a single aggregated structure occurs through *molecular recognition*, in which structural information encoded into the precursors leads to their self-assembly. Through reversible processes that explore all the possible structures, the single most stable product is obtained.

Thus, the building blocks for a metallosupramolecular synthesis are simply metal ions and bridging organic ligands. Control over the self-assembly process is based on the coordination requirements of the metals employed and the relative positions of the donor atoms in the bridging ligands. Figure 1 shows a selection of metals with different coordination numbers and geometries, along with a few commonly employed bridging ligands. Nitrogen-containing heterocyclic ligands are by far the most commonly used. The ligands are characterised by the number of donor atoms (denticity) and the number and relative (angular) orientations of the metal binding domains. Additional stabilisation can be provided by chelation.

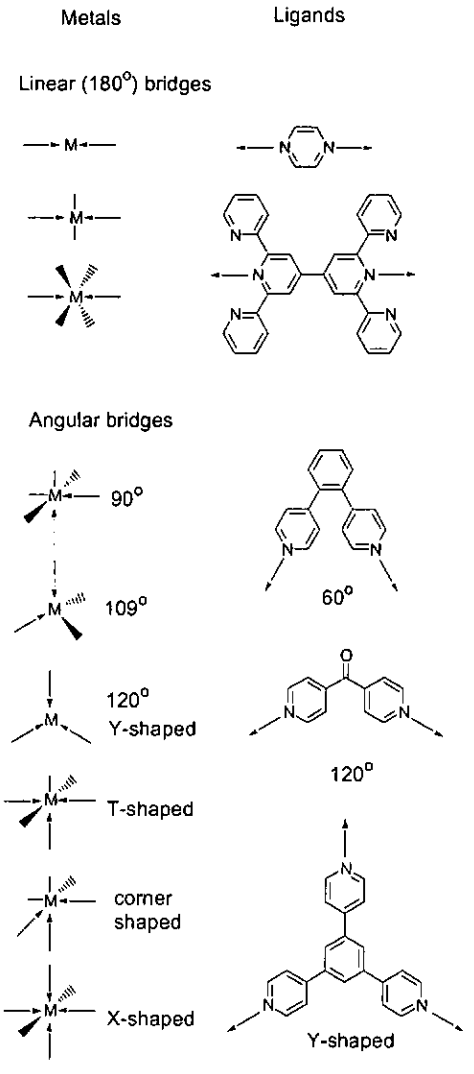


Figure 1. Some typical building blocks.

The simplest metallosupramolecular architecture is that found in a *linear coordination polymer*.[2] This is obtained from the combination of a linear bridging ligand and linear bridging metal, each of which provides 180° linkages between the components, leading to extension of the polymer in one dimension only as shown in Figure 2.

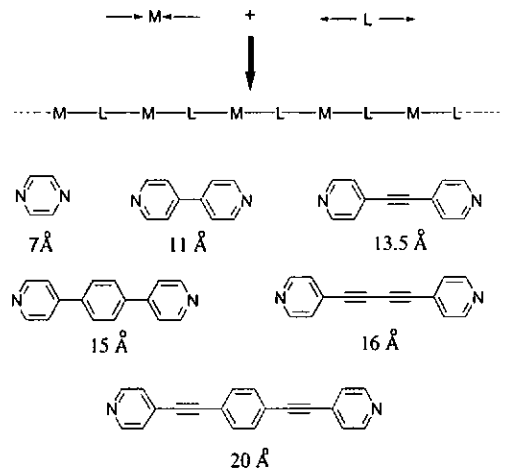


Figure 2. Coordination polymers and M-M separations.

Control of the structure and properties of such compounds is available through ligand design (see Figure 2), where the different ligands shown bridge metals separated by distances ranging from 7 to 20 Å. The linear metal linkage is provided typically by a two-coordinate metal such as silver(I), *trans*-coordination of a square planar metal such as palladium(II), or *trans*-coordination of an octahedral metal such as iron(III). Non-linear bridging ligands lead to related zig-zag coordination polymers.[2]

Two-dimensional polygons are popular targets for metallosupramolecular synthesis. The simplest of these are *molecular squares*. Since a square consists of four sides and four corners, these can be easily assembled from the combination of a linear bridging ligand and a metal that provides a 90° bridge, *e.g. cis* coordination of a square planar or octahedral metal. The first example of these was reported by Fujita[3] using 4,4′-bipyridine for the sides and Pd(en) for the corners (Figure 3, M = Pd). Such a species is favoured over a zig-zag coordination polymer on thermodynamic grounds. One can control the size of such squares simply by varying the length of the bridging ligand. Less symmetrical *molecular rectangles* require the use of two bridges of different lengths.

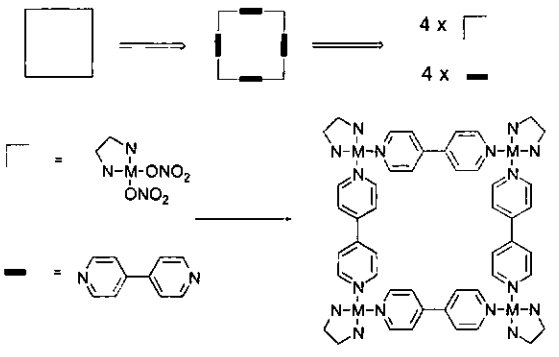


Figure 3. A molecular square.

Other symmetrical polygons (Figure 4) are available using a similar approach.[4] Molecular hexagons require 120° angular bridges, which can be either trigonally coordinated metals, or, more commonly, ligands based on an sp^2-hybridised carbon (such as a ketone) to provide the required angle. Pentagons require a 108° corner, which is conveniently approximated by the tetrahedral angle. Triangles provide an interesting challenge[5] as a metal cannot routinely supply the requisite 60° angular component, and hence an angular bridging ligand is used in combination with a linear metallic bridge to generate the desired geometry.

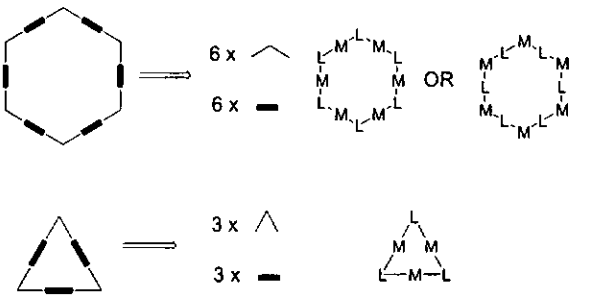


Figure 4. Molecular hexagons and triangles.

Molecular squares can be combined to form species of higher dimensionality. Figure 5 shows the schematic retro-synthesis of a *molecular window*. This requires twelve linear components, four 90° corners, four T-shaped linkages, and a central X-shaped bridge. In a spectacular example of self-assembly, Drain[6] reported the preparation of such a species using *trans*-$PdCl_2$ as the linear bridge and three different porphyrin-based ligands as the three angular components.

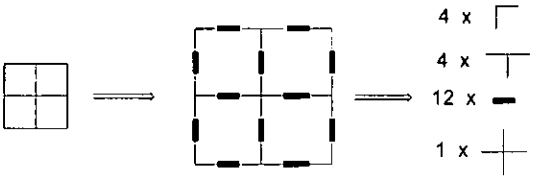


Figure 5. A molecular window.

Squares can be assembled into one-dimensional polymeric aggregates. When joined at their corners this leads to *molecular lattices*. Figure 6 shows how these consist of 90° angular bridges linked by X-shaped components, in a 2:1 ratio, respectively. As is often the case in metallosupramolecular chemistry, two synthetic approaches to such compounds are possible: the metal can be used as the right-angular bridge with an organic ligand providing the X-shaped component (Figure 6a) or *vice versa* (Figure 6b). Similarly, squares can be joined at the sides to form *molecular ladders*, which comprise linear components as rungs and sides linked together by T-shaped components, this time in a 3:2 ratio. Once again, the organic ligand can be either the linear bridge (Figure 6c) or, less commonly, the T-shaped component (Figure 6d). This concept can extended into the second dimension to form a two-dimensional *square tile* pattern which consists of a 1:1 ratio of linear bridges (usually the organic ligand) and X-shaped components (Figure 6e). Logically, the size of this tiling system is controlled by the lengths of the sides, which is readily controlled by means of ligand design.[7]

The examples given above all represent zero, one- or two-dimensional architectures. The principles involved can further be extended into three-dimensions. For example, *molecular cubes* require eight corners and twelve linear edges. (Figure 7). The first such cube was assembled using

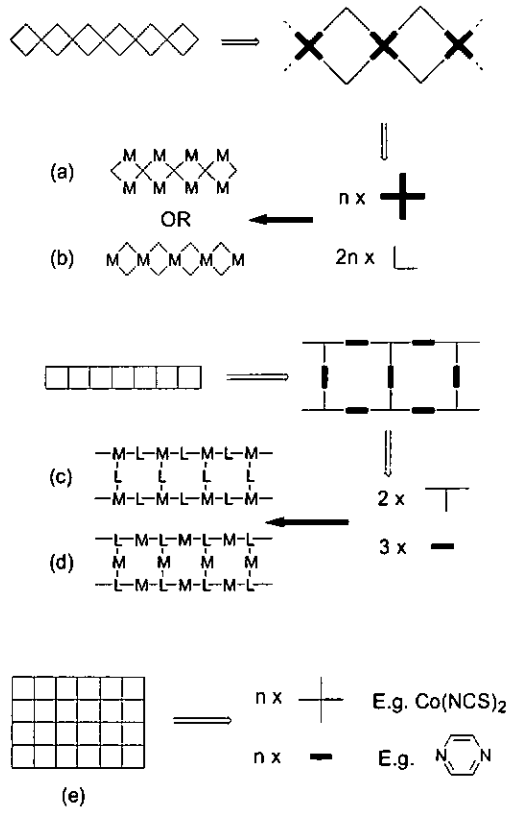


Figure. 6. Molecular lattices, ladders and square tiles.

4,4′-bipyridine as the linear bridge with facially coordinated ruthenium atoms to provide the corners.[8] Inversely, a cube has been constructed using an organic ligand as the corners and linear two-coordinate silver atoms as the edges.[9]

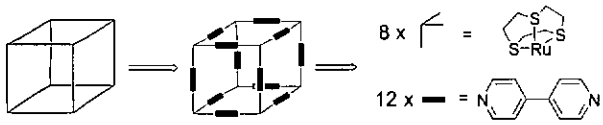


Figure 7. A molecular cube.

Because adamantine, $C_{10}H_{16}$, is the most stable and simplest three-dimensional hydrocarbon, octahedral *adamantanoid cages* (Figure 8) represent the most readily accessible symmetrical three-dimensional structures. These have the same symmetry and topology as adamantane and are assembled from ten components, namely six two-connector groups and four three-connector groups. Of the two possible approaches to such entities, the M_6L_4 option is the more common. The earliest of these used palladium as the two-connector component, either in a *cis*-[10] or *trans*-[11] coordination mode. In an intriguing series of experiments, Fujita[12] has described the use of one such cage as a molecular-scale flask in which chemical reactions were carried out in the internal cavity of the cage and the products confined therein. Raymond has used the inverse approach to prepare various M_4L_6 cages, one of which has recently been shown to exhibit interesting memory effects.[13]

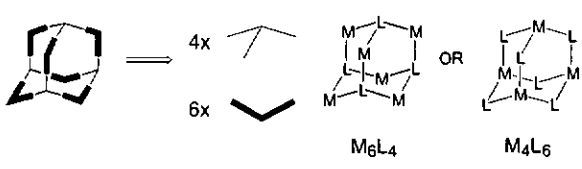


Figure 8. Adamantanoid cages.

In one of the most remarkable reactions ever reported, Stang described the formation of a *metallosupramolecular dodecahedron*.[14] This Platonic solid consists of thirty edges and twenty vertices. Simply by combining a 3:2 ratio of an organometallic linear bridge with a tripodal Y-shaped ligand, a dodecahedral structure self-assembled from the fifty components with the formation of sixty M-L bonds (Figure 9) — and all this happened in quantitative yield! Contrast this with the first synthesis of the corresponding hydrocarbon dodecahedrane, $C_{20}H_{20}$, which took twenty years, twenty three laborious steps and gave an overall yield of <0.1 %.[15]

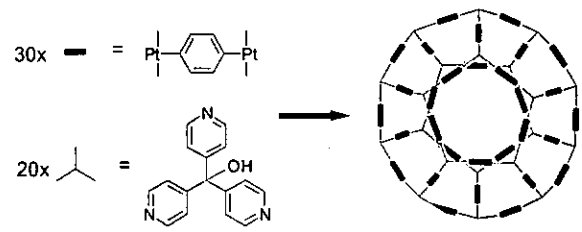


Figure 9. Self-assembly of a dodecahedral cage.

Among the most popular topologies studied in this area are *helicates*, which represent some of the earliest examples of rationally designed metallosupramolecular species.[16] These are obtained by wrapping strands of organic ligands around metals in a helical fashion (see Figure 10). Early examples by Lehn and by Constable used ligands containing multiple pyridine rings to prepare double-stranded helicates containing up to five metals. In one notable experiment, Lehn described how a mixture of four different ligands was reacted with copper(I) ions to produce four discrete double helicates, rather than a complex mixture of products. This is a concept that has recently been referred to as *self-sorting*,[17] wherein complex mixtures of compounds are able to use molecular recognition principles to sort themselves into self-complementary arrays. Triple-stranded helicates have since become well-studied[16] and, more recently, a quadruple-stranded helicate reported.[18] Circular helicates are also known.[16]

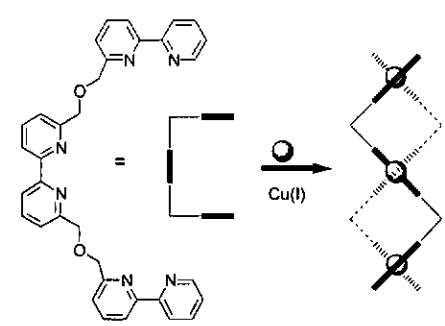
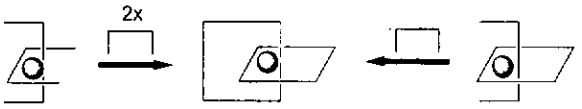


Figure 10. Self-assembly of a trinuclear double helicate.

Another area of intense interest has been that of *catenates*. Catenanes are molecules that consist of two or more interlocked rings. These rings are not chemically bonded, but cannot be separated without cleaving one of the rings. The earliest catenates used metal ions as templates to hold together acyclic precursors suitably oriented for the formation of interlocked rings (Figure 11).[19] More recently,

Fujita has described the self-assembly of catenates by utilising stacking interactions between aromatic rings in polar media as an external driving force for their formation.[20]

Figure 11. Template syntheses of catenates.



The examples discussed above represent just a few of the many fascinating supramolecular architectures that have been reported over the past decade or so. No doubt many other even more interesting structures are yet to be described, perhaps by replacing the *rigid* synthons described above with more *flexible* M and L components, so as to provide access to structures not available to the rigid precursors. It remains to be seen whether the many claims that these metallosupramolecular species will find useful applications in the highly topical areas of material science and nanotechnology will be fulfilled.

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See conference website for details and registration package:
http://www.chem.canterbury.ac.nz/nzicconf03.htm

Approximately every two years the New Zealand Institute of Chemistry (NZIC) holds its national conference and this provides a wealth of outstanding science that encompasses all aspects of chemistry. Topics covered include biological chemistry, synthesis, materials science, computational chemistry, spectroscopy, chemical technology, natural products, medicinal chemistry, and much more. This year we are particularly fortunate in that the NZIC Conference is to be held in Nelson, a gateway to some of New Zealand's best vineyards, arts, and the world-renowned natural beauty of the Abel Tasman National Park. The dates for the conference are set for November 30 until December 4, a very good time to be in this part of the world.

The theme for this year's meeting, ***Chemistry at the Interface***, will provide an opportunity for practising chemists from a range of backgrounds to observe first hand how our discipline is evolving and where we may be heading in the future. A number of sessions on the interface of chemistry with other disciplines, and the commercial sector, are planned (see details below). Within this framework will be feature lectures from an outstanding, and growing list of international speakers, some of New Zealand's best chemists, and the recently established Centres of Research Excellence (CoRE) groups. We are particularly fortunate in that **Paul Clemons** (Head of Systematic Chemical Genetics) and **John Tallarico** (Head of Chemical Technology) at the Harvard Institute of Chemistry and Cell Biology (CCB) will be attending. The CCB is currently pioneering a new and exciting chemical discipline known as 'chemical genetics', which operates at the interface of chemistry, biology, technology, and the commercial sector. Regular events such as student competitions and the Easterfield address are also programmed.

In addition, a MacDiarmid Institute Industry Forum will be held in conjunction with the NZIC Conference on Wednesday December 3 and Thursday December 4 at the Rutherford Hotel. The title for the forum will be *Smart Materials and Smart Materials Technologies*. Smart materials and smart materials technologies add value to many industries, and are areas where rapid advances are continually being made. The MacDiarmid Institute for Advanced Materials and Nanotechnology (a National Centre of Research Excellence) is organising a two-day Industry Forum on these subjects alongside the NZIC conference. This forum is designed to foster exchanges of ideas between industry, academia, and Crown Research Institutes, and to build an awareness of the activities in these (sometimes diverse) sectors.

Participation is welcomed from anyone with an interest in how materials or materials technologies could be made smarter for their applications. Submissions in the form of a one-page abstract are welcome, and should be sent in electronic form to **Dr. Richard Blaikie** (University of Canterbury: r.blaikie@elec.canterbury.ac.nz).

Topics of particular interest for the workshop are (not exclusively):

- materials for electronics and optics industries
- functional materials
- soft materials
- materials characterisation technologies
- metals and metal alloys
- commercialisation of new materials technologies
- opportunities for funding new developments

Further information about this workshop will be posted on the MacDiarmid Institute web site <www.macdiarmid.ac.nz>.

Preliminary Conference Program (subject to change):

Sunday
Opening plenary lecture followed by conference mixer.

Monday -Interface of Chemistry with Biology, and Evening Poster Session
Topics to be covered include: Synthesis, Biosynthesis and Natural Products, Biotechnology, Food and Health, Bioactives and Pharmaceuticals, Environmental Chemistry, Molecular Biology, Green Chemistry, Carbohydrates.

Tuesday AM - Techniques and Technologies of Chemistry at the Interface
Topics to be covered include: Spectroscopy, Separation Science, Proteomics, Biological Activity Screening, Chemical Genetics, Synthesis, Modeling, Electrochemistry, Mass Spectrometry, X-Ray Crystallography, Synthesis, Automation in Synthesis, Human Interface Technologies.

Tuesday PM - Interface of Chemistry with the Commercial Sector
Topics to be covered include: Intellectual Property, Setting up a Chemical Company, New Zealand Industry, Role of Government, Venture Capital, Primary Produce Value Added Industries.

Tuesday evening - Conference Dinner

Wednesday - Interface of Chemistry with Materials and Nanotechnology
Topics to be covered include: Supramolecular Chemistry, Polymer Chemistry, Smart Materials, Catalysis, Synthesis, Bioengineering.
MacDiarmid Industrial Forum: Smart Materials and Smart Materials Technologies

Thursday - MacDiarmid Industrial Forum: Smart Materials and Smart Materials Technologies

Invited Speakers (others yet to be confirmed)

(web links can be found at:
http://www.chem.canterbury.ac.nz/)
Dieter Seebach (Eidgenoessische Technische Hochschule, Zuerich), David Fairlie (University of Queensland), Chris Abell (University of Cambridge), Craig Hawker (IBM Almaden Research Center), Andy Phillips (University of Colorado), Cameron Kepert (University of Sydney), Vickie McKee (Loughborough University), John Tallarico (Institute of Chemistry and Cell Biology, Harvard), Paul Clemons (Institute of Chemistry and Cell Biology, Harvard), Ted Baker (The University of Auckland), Mike Bolland (Fonterra Research Institute), Margaret Brimble (The University of Auckland), Paul Callaghan (Victoria University), Bill Denny (The University of Auckland), Gary Evans (Industrial Research Limited), Shaun Hendy (Industrial Research Limited), Murray McEwan (University of Canterbury), Kathryn McGrath (University of Otago), Quentin McDonald (Q-BitNZ), Brian Nicholson (University of Waikato), Warren Roper (The University of Auckland), Ian Shaw (ESR), Rob Smith (University of Otago), Peter Steel (University of Canterbury), Carol Taylor (Massey University), Selwyn York (NZ Pharmaceuticals Ltd).

Chair
Associate Professor Andrew Abell, Department of Chemistry, University of Canterbury.

Committee
Dr. Owen Curnow, Department of Chemistry, University of Canterbury.
Professor Jim Coxon, Department of Chemistry, University of Canterbury.
Dr. Greg Russell, Department of Chemistry, University of Canterbury.
Dr. Pat Holland, Cawthron Institute, Nelson.
Dr. Bill Swallow, ESR, Christchurch.
Dr. Jan Wikaira, Department of Chemistry, University of Canterbury.
Dr. Andy Pratt, Department of Chemistry, University of Canterbury.

Chemistry At Christchurch Polytechnic Institute Of Technology

Michael Edmonds
Senior Lecturer, School of Applied Science, Christchurch Polytechnic Institute of Technology

Introduction

Christchurch Polytechnic Institute of Technology (CPIT) has a proud history of providing vocational tertiary education in a wide range of areas. Polytechnics are often thought of as places for training in "the trades" and professions such as nursing, quantity surveying, architectural drafting, and the various hospitality specialisations. However, in recent years CPIT has expanded beyond these traditional areas to include new vocational degree qualifications in areas as diverse as nursing, broadcasting, art and design and Japanese language. In the School of Applied Science this has involved the addition of Bachelor of Applied Science and Graduate Diploma in Laboratory Technology programmes. As part of offering a Degree programme the number of staff actively carrying out research has also increased. This article serves to introduce the chemistry that is going on at CPIT.

Programmes

The School of Applied Science offers science programmes to suit the full range of student needs and academic background. Chemistry courses are taught from Level 2 (foundation level) to Level 7 (equivalent to the 3rd year of a university degree). A list, and brief description, of chemistry related courses, follows. Most of these courses can be studied either on a full-time or part-time basis.

A. Certificate in Science

The Certificate in Science is for students who have done little or no science but wish to pursue a career in a science related area such as nursing, animal care, veterinary nursing, or medical imaging. Courses available include chemistry, biology, physics, computing, mathematics, study skills, and communication.

B. National Diploma in Science

The National Diploma in Science is primarily for students who want to work as laboratory technicians. It is the modern incarnation of the proven NZCS (New Zealand Certificate in Science). Chemistry courses in the NDS cover levels 4 to 6 with a strong emphasis on analytical chemistry and practical laboratory skills.

C. Bachelor of Applied Science

The Bachelor of Applied Science degree is offered in association with Auckland University of Technology. It gives students the chance to extend beyond the NDS programme by studying additional Level 6 and Level 7 papers and a one year (300 hours) research project is a major component of the course. As the name of the degree suggests the focus is on developing laboratory skills and practices along with the knowledge and analytical skills expected at degree level. Chemistry courses include – Natural Products, Environmental Chemistry, and Analytical Chemistry. Courses in quality assurance and environmental law are also available, along with other disciplines such as microbiology and molecular biology.

D. Graduate Diploma in Laboratory Technology

This is a diploma programme for those who hold a BSc (or equivalent) degree and want to extend their practical and other skills in order to work in a science laboratory or in science fieldwork. Courses are designed to augment the student's existing qualification with subjects such as Laboratory Standards and Practice, Quality Assurance, Research Methods, and Communication.

Research Activities

Several staff members in the School of Applied Science are actively involved in research that covers a fascinating range of areas that include biosensors, environmental chemistry, asymmetric organic synthesis, and biotoxins. Currently, CPIT has two chemistry lecturers who are both involved in research (Michael Edmonds and David Hawke). However, several others on the lecturing staff are also involved in chemistry-related research. Currently details of research publications and activities are on the staff pages of the CPIT website www.cpit.ac.nz/research/

Dr. Michael Edmonds (Senior Lecturer)

Following a postdoctoral fellowship with Professor Ari Koskinen (University of Oulu, Finland) working on the synthesis of enzyme inhibitors, Michael received a FoRST postdoctoral Fellowship to work on the design and synthesis of HIV protease inhibitors with Associate Professor Andrew Abell at the University of Canterbury. At the end of this fellowship he moved to CPIT and continued his research collaboration with Abell. Although he is still interested in the design and synthesis of enzyme inhibitors, his current focus primarily is on the asymmetric synthesis of highly functionalised compounds containing an optically active fluorinated quaternary carbon atom. In addition, he is also involved in research utilising GC and HPLC to monitor the levels of organic acids in wine.

Dr. David Hawke (Principal Lecturer)

David joined CPIT in 1995 following postdoctoral research with Professor Kip Powell (University of Canterbury) and Professor Frank Millero (University of Miami). David's research interests are in environmental chemistry, particularly soil chemistry. Research collaborations with ecologists Dr. Jon Harding and Professor Mike Winterbourn (University of Canterbury), Dr. Richard Holdaway (Palaecol Research), and Dr. Henrik Moller

Winterbourn (University of Canterbury), Dr. Richard Holdaway (Palaecol Research), and Dr. Henrik Moller (University of Otago) involve applications of stable isotopes. These studies use natural abundance ^{13}C and ^{15}N to evaluate the significance of a 'marine nutrient subsidy' from breeding seabirds to a variety of New Zealand terrestrial environments. A spin-off from this research has been the use of soil chemistry to validate archaeological radiocarbon dates from muttonbird activities on the Rakiura Titi Islands. Other research focuses on contributions of pre-European seabird breeding to present day soil fertility in mainland New Zealand.

Keith Baronian (Acting Dean of Research)
Keith is a member of the NERF funded 'IDEA' biosensor consortium between Lincoln Ventures Ltd., Landcare Research Ltd., Lincoln University, The Cawthron Institute, and University of Waikato. They are investigating the use of immobilised cells and enzymes as biosensors for specific environmental contaminants. Keith's role is two-fold. The first is to provide appropriate cell immobilisation techniques for the group. Immobilisation permits multiple uses of the same cells over a period of months. The present technique involves the immobilisation of cells in PVA hydrogel discs, but future needs will probably include the immobilisation of cells directly onto a biosensor transducer surface, *e.g.* the working electrode of an electrochemical cell. Keith's second role is to investigate the use of yeast as the sensing element. A double redox mediator system is used to electrochemically detect the cells catabolic processes. Changes in these processes in response to the presence of a specific molecule are quantified to give a measure of the concentration of that molecule. Keith also has an active research collaboration with Professor Gotthard Kunze (Head, Yeast Genetics Group, Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany) where he is comparing the performance of two transducer technologies in wild type and genetically modified yeast environmental biosensors that detect biochemical oxygen demand (BOD), copper and cadmium.

Dr. Barbara Dolamore (Senior Lecturer)
Barbara has been teaching at CPIT since 1994. Prior to this she was employed for five years at the Christchurch Clinical School investigating the role of low antioxidant levels in sudden infant death syndrome (SIDS) and heart disease. She has recently returned to research and is now working on the identification, and screening for toxicity, of dominant cyanobacterial species in Canterbury waterways. At present fresh water mat-forming oscillatorialean cyanobacteria from Selwyn River are being studied in collaboration with Dr. Paul Broady (University of Canterbury) and Frances Wall (CPIT). Barbara has a particular research interest in Lake Forsyth, a brackish water body of significant cultural importance to the Ngai Tahu people. Seasonal blooms of planktonic cyanobacteria *Nodularia spumigena* cause the lake to become highly toxic due to production of the hepatotoxin nodularin. There have been a number of reported deaths of livestock (and dogs) after ingesting this water during the bloom period. It is not known if the toxins enter the food chain and have an effect on people who eat fish from the lake; Barbara's long term aim is to investigate this.

Chemistry Related Events at CPIT

The School of Applied Science runs a number of events designed to encourage interest in chemistry and science. These include a Year 11 Chemistry Competition, where teams from schools around Christchurch compete in a series of practical tests requiring good laboratory skills and chemistry knowledge, and a Year 10 Science Competition with teams from schools around Christchurch competing in a general knowledge science quiz.

A series of ***STAR*** courses provide an opportunity for senior school pupils to complete sections of current NZQA unit standards using facilities at the Institute. These are offered as one-day courses and are taught by CPIT lecturers. The chemistry staff offers natural products chemistry and food chemistry courses.

The NZIC Canterbury Branch also sponsors a prize for the Top Level 5 chemistry student at CPIT. The prize for 2002 was awarded to Andrew Howie (see picture below).

IC-03 Conference
University of Melbourne
February 2003

In 1999 one of the regular joint meetings of the Inorganic and Organometallic Specialist Group of the NZIC and the Inorganic Division of the Royal Australian Chemical Institute was held in Wellington. Profits from that conference were invested, and it was the decision of the conference organisers that the funds be used to help New Zealand graduate students attend future conferences. Last year, applications for assistance in attending the IC-03 meeting (to be held in Melbourne in February 2003) were called for. The conditions required the applicant to be a graduate student undertaking either a PhD or MSc degree in New Zealand, a member of the NZIC, and presenting results of their research at the conference. Fortunately, we were able fund all the qualified applicants. Scholarships were awarded to David Cordes (Otago), Victor Fester, (Waikato), Julia Hausmann (Otago), Ali Hosseini (Auckland), Sarah Howell (Otago), Marco Klingele (Otago), Yanhua Lan (Otago), Wade Mace (Waikato), and Christopher Sumby (Canterbury). In addition to the money they received from the specialist group many also received financial support from their local Branch of the NZIC and their University.

About 220 delegates attended the conference, mostly from Australia and New Zealand, but with a good representation from other parts of the world. All of the students presented their work in the form of posters. Sarah Howell and Christopher Sumby were both asked, by the conference organisers, to also give brief oral presentations on their work as part of the Stranks Award Symposium. This award is a competition for the best student presentation and it honours the late Professor Don Stranks. Thus, two of the six competitors were from New Zealand and one other student making an oral presentation was New Zealand born. While neither was successful in winning the Award they presented New Zealand chemistry and themselves with distinction.

The students were also required to provide a report on their experiences at the conference and what follows has been taken from those reports. Unfortunately the reports are too numerous to be presented in full.

The opening reception, held on the first evening, was felt by many to have been too short. There was insufficient time to meet everyone before the bar closed! The conference dinner, on the final night, was generally agreed to have been a great success. There was also general agreement that the timing of the poster sessions, between morning tea and lunch was excellent—most delegates were still awake at that time—but the somewhat cramped venue was a hindrance to proper scientific discourse.

This was Sarah Howell's first conference and she gained a "better appreciation of the wide range of work carried out in the field of inorganic chemistry" and "how people were incorporating the results of computational chemistry into their research". Victor Fester also appreciated the opportunity to learn about current trends in inorganic chemistry world-wide, and in Australia and New Zealand in particular.

For Wade Mace and David Cordes the highlights were the plenary and session lectures. Judging by their reports the lectures that were particularly enjoyed by the students were those given by Makoto Fujita (Japan), Terry Collins and Nicholas Farrell (USA), Ed Constable (Switzerland), and Keith Murray and Cameron Kepert (Australia).

This was Marco Klingele's first conference at which he presented his research. He felt he received lots of encouragement from the viewers of his poster. He also noted that large numbers of the delegates were fellow graduate students. He felt it was great to meet so many of them and to swap experiences.

Julia Hausmann thought that the poster sessions were the highlight of the conference, but also she enjoyed meeting people and being able to put names and faces together. She also wrote the most original and evocative report with descriptions of cold grey days in Dunedin contrasted with the warm sunny days and the bushfire smoke filled air of Melbourne. Chris Sumby, who is approaching the end of his PhD, appreciated the opportunity to meet with attendees from other Universities and to introduce himself to "important academics".

Some of the group from Otago used the day after the conference to visit Monash University, and they enjoyed the chance to meet the people they have been sending their hard won crystals to for the magnetic measurements.

David Weatherburn,
Chairperson, Inorganic and Organometallic Specialist Group

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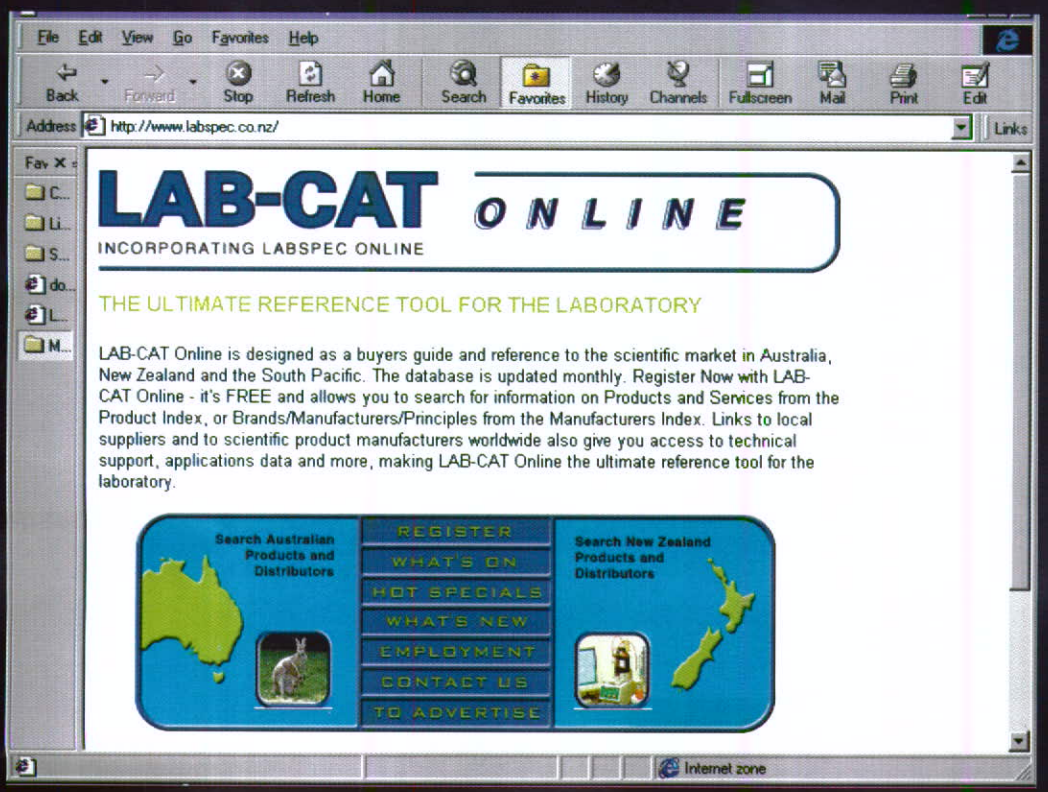

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