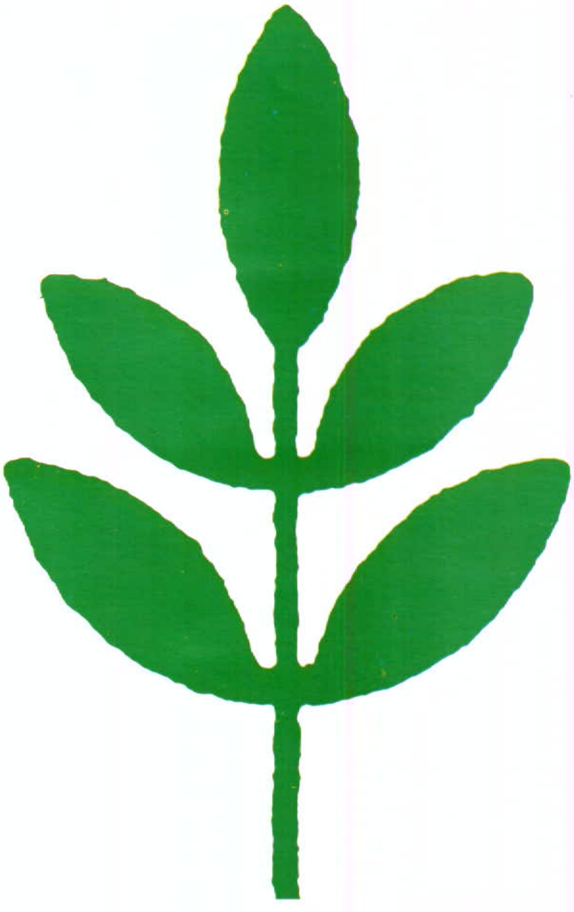
April 1980 Vol. 44 No. 2

Chemistry in new zealand

Official Journal of the New Zealand Institute of Chemistry, P.O. Box 1926, Christchurch.

Agricultural Chemicals — Vital to NZ.



INSIDE: Integration of Biological, Chemical Control; Modern Contact Sulphuric Acid Process; University-Industrial Interactions In Chemistry; Marine Natural Products Research; Coal in NZ.

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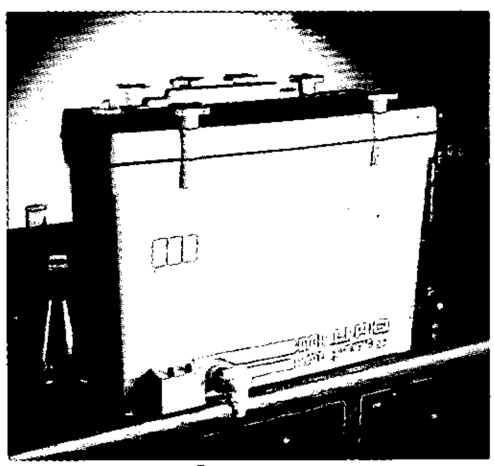

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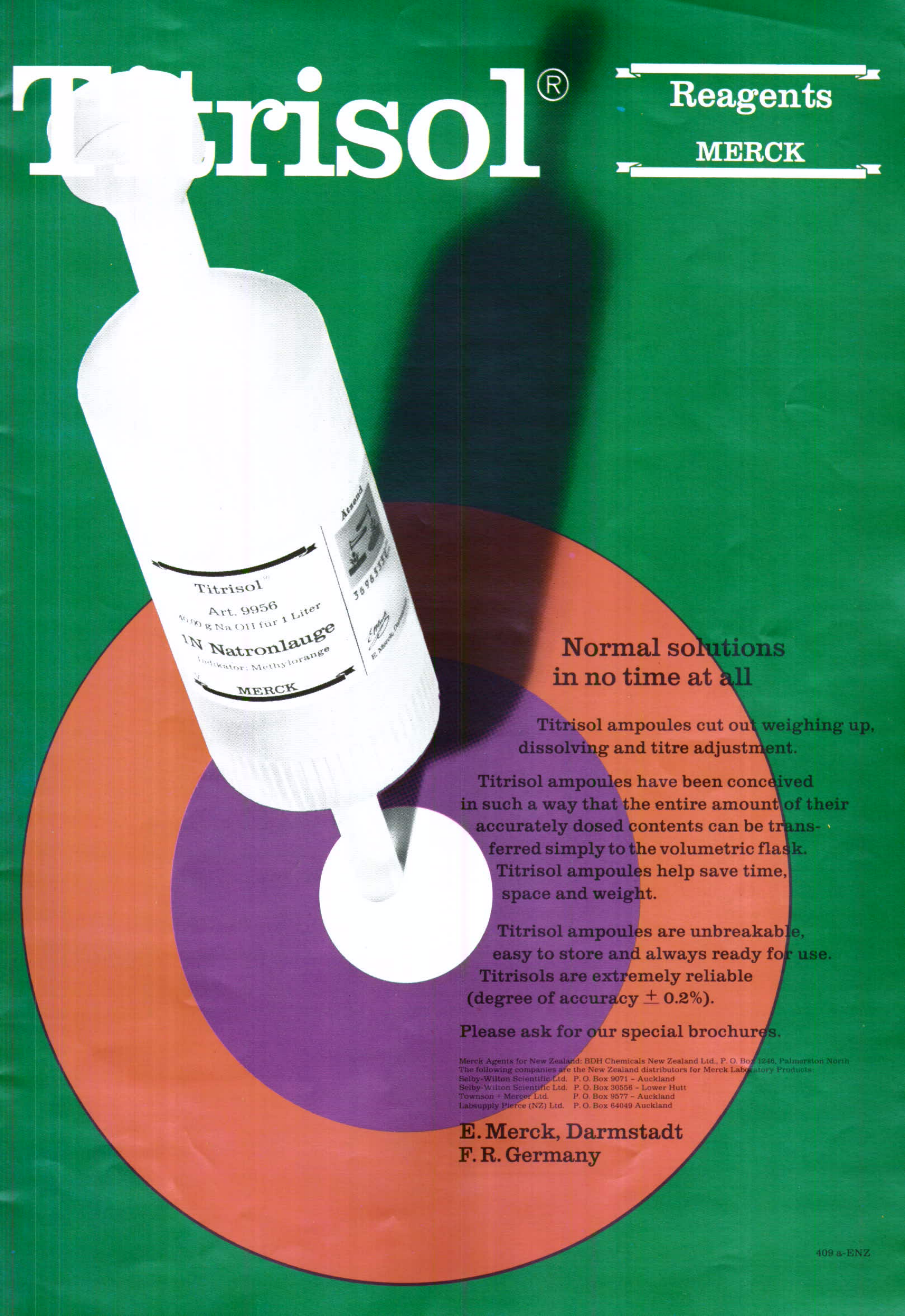
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CONTENTS

STOP PRESS

FUTURISTS WANTED

The Commission for the Future has asked the NZIC to nominate members who are interested in evaluating possible scenarios, identifying major choices and establishing goals for NZ. Anyone interested is asked to contact the General Secretary, Gavin Fletcher.

Guest Editorial

Agricultural Chemicals: Proper Use Is Vital

The proper use of agricultural chemicals is a subject of vital importance to NZ because the bulk of our overseas funds still come from the land. Broadly the chemicals used in farming can be divided into three groups — fertilisers, animal remedies and pesticides — by far the greatest of these being fertilisers. Practically all these chemicals are imported and they are expensive. Why then are they used so extensively? Simply because practical experience, backed by an extensive research programme, has shown that all three types of chemicals are essential to achieve economic agricultural production.

All but our most fertile soils are markedly short of phosphate, while many of them have a great capacity for fixing added phosphorus, yet this element is absolutely essential for plant growth. Thus we must continue to use it at an annual rate of some 165,000 tonnes of elemental phosphorus. As the phosphate levels are raised potash becomes a limiting factor, and the country is now using about 125,000 tonnes annually of elemental potassium. Most of our need for nitrogen is supplied by the legumes in pasture, but as arable farming and horticulture increase the need for added nitrogen will increase steeply. Localised areas are deficient in boron, magnesium, molybdenum or zinc for plant growth and cobalt, copper, or selenium for animal health. These are absolute shortages and must be made good from outside sources, but they are truly trace elements being required in only minute quantities, e.g. some 17g of sodium molybdate per hectare on molybdenum deficient soils, and over-dosing quickly produces toxic effects. Addition of trace elements must therefore by under strict scientific control.

Over the years we have imported many parasites and diseases with our domestic animals. These must be kept in check or the production of our flocks and herds would dwindle to vanishing point. To achieve this animal remedies are as essential as pharmaceuticals are for human welfare.

Similarly diseases and pests attacking crops and forests must be controlled if economic returns are to be obtained. Wherever possible predators or parasites are imported to curb insect pests, and a vast effort has been put into breeding plant varieties resistant to disease. But because the world's markets demand blemish-free produce, completely free of most insect pests, biological control methods alone are insufficient, and some pesticides are essential. Great care must be exercised to ensure that residues on food are kept below internationally accepted tolerances.

Traditional methods of controlling weeds with horse drawn implements or hoes are no longer economic, and have been replaced by herbicides. Properly used these are most effective chemicals, but in careless hands they can cause extensive damage to valuable crops outside the target area.

Considerable opposition to the use of agricultural chemicals is expressed by environmental groups and these people have played a useful role in drawing attention to certain undesirable practices, such as the continuing use of lead, arsenic and mercury as pecticides. These three elements have now been replaced by less toxic materials. However, if we are to remain competitive on international markets there is no doubt that NZ must continue to use large volumes of agricultural chemicals.

But we must always maintain an extensive educational programme on the safe use of these materials and prosecute a continuing search for better ways of producing food and clothing.

Dr. J. D. Atkinson
Formerly Director, Plant Diseases Division, DSIR.
Member, Agricultural Chemicals Board.

Comment

Polemics From The Pulpit

Though breathing an ecclesiastical atmosphere, we make no claim for inerrancy in our utterance such as some of our brethren do for the holy scriptures, but the number of glosses in our Polemic for October pained us and must have done so to many of our readers. We do wonder how many read it through to the end since no one has offerred to assist the Editor in the autumn of life to invigorate himself in the waters of the Mediterranean. Though saddended by this we carry on in the spirit of Tennyson in the hope that " . . . something ere the end, some work of noble note may yet be done . . ." and that there may be some pricking of conscience among readers if we suddenly have to be replaced.

Speaking of death, we learn from "Nature" that the Dead Sea has become deader; it has dried up at its narrowest point, so that, if it were not for the restraint of the military forces, it would be possible to walk across it. Also the level of the Sea of Galilee has fallen dangerously low, following the worst drought in the history Of Israel. A savant named Lowdermilk has given the Israelis an eleventh commandment, "Thou shalt safeguard thy fields from erosion and thy living waters from drying up." Strangely enough part of the problem is due to the planting of trees on the Israeli side, which has reduced the run-off into the lake.

It is appropriate here to refer to our efforts to keep the organisers of the 1981 Golden Jubilee Conference in touch with the eternal verities; we attached ourselves to the organising committee for this auspicious event, and because of our evangelising zeal we were appointed to the publicity section. We were therefore delighted to see in the "New Scientist" a full guide for the running of Conferences by Prof. Hector McDoom, Director and Sexton at the Centre for Terminal Studies at Cape Farewell (NZ). We confess that we had not previously heard of the Professor, but his instructions seem to us to be canonical, and his reference to terminal studies seems appropriate to use in the autumn of life. One of the fine things in Prof. McDoom's arrangements is that no publicity of any kind is called for, so we can quiety withdraw.

We are intereSted to learn that the Award for Experimental Mediocrity at the University of Cape Farewell has been awarded to Dr Hades, who has worked out on theoretical grounds that there are no thermometers in Hell, since a few degrees either way makes no difference to the eternal bonfire.

S.G. Brooker.

What's Happening

DNA Advances: We heard the other day from our erstwhile Associate Editor, **Bill Denny,** now at Pomona College, Claremont, California. He says "Some of the advances in DNA chemistry are tremendous. Heard a talk from a group who had just achieved the first bacterial synthesis of insulin. They **synthesised** the gene!! then incorporated it into E. coli along with all the necessary operators to turn it on, and can get about 1mg of **human** insulin per litre of culture medium. That is already a commercial proposition, and will be in production in the middle of the year. No more bovine insulin! Others at Cal Tech have crystallised other genes such as the E. coli lac operon, and the structures are being solved now."

Mystery Solved?: The speculation about the cause of the death of **Isaac Newton** in 1727 could now be ended. A group of scientists from Duke University, USA, University of Cape Town, and at Aldermanston, UK suspected that Newton died of metallic poisoning due to his penchant for tasting and sniffing every compound that he worked on. This has now been confirmed by finding unusually high concentrations of Pb, Sb, and Hg in what has been claimed to be an authentic sample of the great man's hair.

Methanol Plant: As we go to press, both the Minister of Energy, **Mr Birch,** and his Under-Secretary, **Mr Brill,** have made public statements about the rival schemes for building plants to make methanol from Maui gas. The Petrocorp plan, in which Alberta Gas would hold a 49% share has a capacity of 1200 tonnes/day, while the BP consortium plan is for a 2000 tonnes/day plant. Basically they both use ICI technology. According to Mr Brill, the choice is between a smaller project "which is a sure-fire bet or a more ambitious one with elements of risk, but promise of greater rewards."

Act Reviewed: The Clean Air Act 1972 was reviewed at a workshop organised by the NZ branch, Clean Air Society of Australia & NZ, and held in Wellington late March. The Act is in the initial stages of revision and the workshop provided a forum for representatives from industry, Government departments, local authorities and other interested parties to discuss the continuing implementation of air pollution control in a cost effective manner.

Quality Conference: The NZ Organisation for Quality Assurance will holds its first Quality Conference at Canterbury University, May 21-23. It will feature workshop sessions by people active in the quality field. Further information is available from **Mr G. S. Whyte,** Box 2136, Christchurch.

KISS The Key: According to **Dr Bryan S. Finkle,** Director, University of Utah's Centre for Human Toxicology, simplicity is the key to modern analysis, which should be based on the KISS principle (Keep It Simple Stupid). He was talking at the 5th Analytical Chemistry Symposium of the RACI at Perth.

Support: As a result of good support from industry, the Royal Australian Chemical Institute (RACI) was able to send its President, **Prof. D. O. Jordan,** and its Executive Secretary, **Peter Woodhouse** to the inaugural meeting in Bangkok of the Federation of Chemical Societies. in August. The NZ representative of this new body is **Prof. Cambie,** Auckland.

Flood Damage: In the January flooding in Southland, water entered the NZ Paper Mill plant at Mataura to a depth of 30in. causing considerable damage. It also put the mill out of action for 8 days.

Contract Won: Alliance Freezing Co, Invercargill, have recently won a substantial contract to supply freeze dried organ and gland powders to USA. This order includes pancreas, brain, aorta and lung powders. Alliance Freezing have extended their development facilities by erecting a pilot plant to produce freeze dried haemoglobin and plasma powders from bovine blood. These two products are currently being marketed in Europe and USA to the food and pharmaceutical industries.

Safety Award: An NZ company specialising in the road transport of hazardous materials, Freightways Bulk Services Ltd., Lower Hutt, has won the international safety award presented by the National Tank Truck Carriers, USA.

In carrying off first placing in the international section of the NTTC's 1979 safety contest, Freightways in a sense have reaped what they have sown. As a long time member of the body, the company suggested the institution of the international award which, last year, attracted other entries from Europe, South Africa, Canada, Japan, Mexico, Brazil, Malaysia and Australia. In addition, Freightways also gained a special award for its performance in reducing accidents in 1979.

In 1978 the company won a safety improvement award from the NTTC.

Solar U/V Radiation Seminar: Two days of intense discussion for the 60 or so participants marked the solar U/V radiation seminar, co-sponsored by Ciba-Geigy NZ Ltd and the Meteorological Service and held in Wellington, March 26-27.

The wide-ranging topic list encompassed some 24 papers and a panel discussion. Because of the seminar's timing, it was not possible to include any papers in this issue, but it is hoped to publish some in future issues.

Papers presented were:

Basic science of solar radiation and its U/V components (Dr R. Basher, Meteorological Service).

Skin cancer in NZ (J. Simpson, Dept of Surgery, Wellington Clinical School of Medicine).

Other dermatology topics (Dr J. Adams, private practitioner, Wellington).

Solar U/V radiation in biology and agriculture:

- Bacteria (Prof. A.P. Mulcock, Agricultural Dept., Lincoln College).
- Fungi (Dr P. Brook, Plant Diseases Division, DSIR).
- Animals (Prof. D. Blackmore, Dept. Of Veterinary Pathology and Public Health, Massey University).
- Wool (Dr Ian Wetherall. Textiles Dept., Otago University).

Air pollution and solar U/V radiation. Ozone depletion. Urban smog (Dr C. Freeman, Chemistry Dept., Canterbury University)

Relevance of solar U/V radiation in NZ to:

- Paints, coatings and pigments (T. Bickerton, Ciba-Geigy Australia Ltd).
- Polymers (R. Wagenvoort, Hitchins Research Laboratories).
- Dyestuffs (A. Chisholm, Ciba-Geigy NZ)
- Bitumen (Dr G. Ball, Bitumen Laboratory, Ministry of Works & Development).
- Museum Artefacts (J. Fry, National Museum).

Cost of premature materials failure in NZ. Case studies on:

Conference News

All Institute members should now have received the first circular for this year's conference. This circular presents a brief introduction to the Conference and a tentative outline of the programme together with a call for specialist group papers. **THIS WILL BE HE ONLY CALL FOR PAPERS.** Early receipt of abstracts of papers by the organisers of the specialist sessions will be appreciated. The second circular, containing a registration form, will be sent to members early next month.

A full range of activities is being organised for this combined NZIC/NZBC Conference, which will include joint sessions with the NZ Society of Plant Physiologists and the NZ Branch of the Australian and NZ Society for Mass Spectrometry. Together with the Conference themes of Plant Biochemistry, Chemical Ecology and Chemical Instrumentation, an environmental symposium entitled "The use of Herbicides in Agriculture — The Dioxin and other problems" is being organised. Numerous speakers from parties interested in this area will be invited to participate. Further details of this symposium and other Conference activities together with autobiographies of the plenary speakers will be given in the next issue of Conference News.

•PVC (R. Compston, Nylex Fletcher Ltd).
Paint (G. Wright, Lusteroid Paints Ltd).
Printing Inks (K. Stampa and J. Fraser, Ashley Wallcoverings Ltd).
Dystuffs (A. Chisholm).

Materials science. Chemistry, radiation effects. (Dr. K. Martin, Div of Building Research, CSIRO).

Materials protection and testing methods (J. McKean, Ciba-Geigy NZ).

Research and services of BRANZ related to solar U/V radiation (Dr J. Duncan, BRANZ).

Measuring solar radiation in NZ (J. Collins, Meteorological Service).

Prospects for calculation of solar U/V radiation as an alternative to measurements (Dr R. Basher).

Research and services of DSIR's PEL in solar U/V radiation measurement (Dr J. Nicholas, PEL, DSIR).

Potential role of universities in researching problems associated with solar U/V radiation (Prof. P. Edwards, Physics Dept., Otago University).

Panel discussion: Where to next?

Hazardous Materials Transport: Meeting in December a SANZ working group decided to produce a draft in bibliographic form to incorporate all the transportation codes in use, including the IATA regulations, International Maritime Dangerous Goods Code and the UN Code for transporting hazardous substances. The difficulty in drawing up one all-embracing standard arises from the multiplicity of containers and chemicals in circulation. This is reflected in the fact that the project committee has had to be split into the two working groups — one to concentrate on bulk tanks, the second to cover all other containers.

The co-ordinating committee, consisting of the chairmen of the two working groups and SANZ staff, met in January to review progress.

It is proposed that the standard should specify the requirements for shipping, rail, road and air transport container safety in the one document, taking in account NZ regulations.

(Mr A. C. Kennett, chairman, NZIC's Hazardous Chemicals Committee, represented the Institute on one of the working parties).

Fuel Consumption: The SANZ technical subcommittee on the fuel consumption of motor vehicles met in December to consider two draft documents: one, a draft incorporating UK legislation, a UN paper, and ECE Regulation 15, the other, a South African Bureau of Standards (SABS) draft on the measurement of fuel consumption.

The committee felt the NZ Standard should provide details for both road testing and dynamometer testing. A composite document was reviewed by the sub-committee at its January meeting, when it was decided that further committee work is needed.

The standard aims to provide objective test data from which prospective buyers can gauge the comparative fuel economies of various makes and models of vehicles.

That's The Spirit! As from January the familiar 70° proof label on all bottles of spirit sold in Britain disappeared. From this date a new EEC directive was implemented which will require the strength of spirit to be expressed in terms of the percentage of alcohol by volume rather than the percentage over proof. Thus, a bottle of whisky will bear a legend indicating it is 40% alcohol by volume rather than the familiar 70° proof. Indeed, some manufacturers have already adopted the new basis, which is said not to alter the strength of the product!

pH Conference: An internationally representative meeting of specialists in pH matters is planned for Lisbon, Portugal, in June. Sponsored by IUPAC under the title "Harmonisation of pH Scale Recommendations" and expected to be held June 18-20, its purpose will be to seek worldwide agreement on the definition of pH scales. It is hoped that participating countries will send one but no more than 3 specialists of national or international standing. Futher details are available from **Dr. A. K. Covington**, Dept. of Physical Chemistry, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK.

BRANCH NEWS

Auckland

Brian Cavit has transferred from the Ministry of Agriculture and Fisheries at Mt Maunganui to the Health Dept. Environmental Laboratory, Auckland. He will be working on the air pollution monitoring programme and methods development.

NZ Fertiliser Manufacturers' Research Association. We note on other pages the retirement of **Dr John Rogers,** as Director, and the appointment of **Mr Des. Higgins** as his successor. Other changes are: **Dr Malcolm White** resigned as leader of the physical section to join NZ Farmers' Fertilizer Co. He has been replaced by **Dr Andrew Braithwaite,** a graduate of the University of Auckland with post-doctoral experience in UK and Switzerland. **Mr Richard Crump,** from Fison's Fertiliser Research Station, Levington, UK, has joined the technical staff at FMRA. We are pleased to know that **Mr Phil Gallaher,** who has been on extended sick leave, has returned to his position as Chief Chemist.

Auckland Technical Institute. Approval has been obtained from the Education Dept. for the establishment of a course in surface coatings to be run jointly with the Oil & Colour Chemists' Assn. (OCCA) and the chemistry staff at ATI. It will follow the same syllabus as a similar course being run in Sydney, leading to a Diploma qualification. Details from **Neil Edmonds,** Chemistry Dept., ATI, Wellesley St. The first course starts in May.

Manawatu

The first meeting for 1980 took the form of a morning visit on February 19 to the NZ Dairy Research Institute at Palmerston North. A tour of the Institute's laboratories and Pilot Plant was conducted by the Director, **Dr Peter S. Robertson** with **Dr Wayne B. Sanderson** (Assistant Research Director) and **Dr Laurie K. Creamer** (Senior Chemist in the Protein Chemistry Section). The main topics covered by this meeting were the production of butter and cheese, the development of the Institute and its interaction with various facets of the Dairy Industry in NZ.

Our next meeting will be an Energy Symposium on May 13. The Symposium will be addressed by the Minister of Energy, **Mr W. F. Birch** and spokesmen from the Liquid Fuels Trust Board and Mobil Oil Co. A meal has been arranged and further details of this meeting may be obtained from **Mr. M. Pritchard,** Grasslands Division, DSIR, Palmerston North.

The June meeting will be devoted to a Symposium on Methodology in Lipid Chemistry and Biochemistry. A wide range of interesting topics will be included for which further details may be obtained from **Dr J. Clem Hawke,** Department of Chemistry, Biochemistry and Biophysics, Massey University.

The 1980 Branch Lectures for 6th and 7th form students in the Hawke's Bay and Palmerston North areas will be presented by **Dr Robert R Brooks,** Department of Chemistry, Biochemistry and Biophysics, Massey University. The title of Dr Brooks' lectures will be "Environmental Chemistry". Further information on the Hawke's Bay lecture may be obtained from **Mr E. C. (Ted) Fletcher,** 1005 Plunket St, Hastings. The Palmerston North meeting will be held at the Boy's High School lecture theatre on June 10.

Wellington

"Give us this Day our Daily Lead" was the title of an entertaining address by **Dr R. R. Brooks** (Department of Chemistry, Biochemistry and Biophysics, Massey University) at the February meeting. His talk concerned the effect of lead from motor emissions on the environment, particularly in agriculture. The Wellington evening newspaper carried a prominently displayed article on the talk the following day.

The Wellington Branch prize for third year biochemistry has been awarded to **Miss Anne Thomas.**

Canterbury

The February meeting was held jointly with the Christchurch Branch of the NZ Biochemical Society and was addressed by **Prof. Hermann Lehmann,** FRS., retired Professor of Clinical Biochemistry at Cambridge University, who spoke on "Biochemistry in Germany and Cambridge before the War."

Waikato Branch Chairman

Dr Pat Holland graduated B.Sc. (Hons) from Canterbury in 1967, and Ph.D. from Queen's University, Kingston, Ontario in 1970. He did further research in high resolution mass spectrometry at the University of California at Berkeley before returning to NZ in 1972 to set up the Ruakaura GC/MS facility on which he contributed an article to "Chemistry in NZ" last August. He is retained by the University of Waikato to give a lecture course in mass spectrometry, and has undertaken joint research projects with the University, Waikato Hospital, and Forest Research Institute.

Pat is married with one small daughter, and his outside interests include the Film Society, of which he is a past-chairman, and he plays the classical guitar.

The March meeting of the Branch was addressed by **Dr Bruce Cain,** Research Director, Cancer Society of NZ who spoke on "New Drug Development — Logic or Serendipity".

Otago

A 3-day refresher course was held in the Chemistry Department in conjunction with the Department of University Extension and the Education Department. Fifty teachers from the Otago and Southland area attended. The course consisted of a series of lectures and practical periods. **Dr. George Burns,** Chemistry Department, Victoria University, and **Mr Ron Hickford** (South Island Secondary Schools Inspector) were involved in panel discussions of the 6th and 7th form curriculum.

A kitset scheme involving apparatus suitable for 6th and 7th form chemistry practical work was initiated. Enquiries should be directed to **Mr Jenner,** Science Centre, Dunedin Teachers College, Private Bag, Dunedin.

HPLC WORKSHOPS
AUCKLAND TECHNICAL INSTITUTE, AUCKLAND
May 12-14 and 14-16
Organised by the CHROMATOGRAPHY GROUP and VARIAN ASSOCIATES

A 2½ day course on High Performance Liquid Chromatography will be held twice during the week of May 12-16. Numbers particpating will be limited to a maximum of 5-6 per HPLC instrument and demonstrator. Equipment will include microcprocessor controlled pumps plus fixed and variable wavelength UV detectors, as well as R.I. and fluorescence detectors.

The five half-day sessions will each consist of a lecture plus a practical 'hand-on' session. Topics covered will include: basic aspects and equipment familiarisation; column selection and applications; column preparation and evaluation; separation systems and theory; detectors and quantitation.

Guest speakers during the workshop will include American and Australian experts and all demonstrators will be experienced chromatographers.

Some hostel accommodation will be available

For further information and registration forms contract:

Dr. J. A. Zabkiewicz, Forest Research Institute, Private Bag, Rotorua. (Ph: 82-179, Ext: 609)

University News

Auckland

Prof. T. N. M. Waters has been appointed Acting Vice Chancellor for Terms II and III, 1980.

Chemistry Department

Huang Zhen-dong, a Visiting Scholar from China, arrived in the Department in February to work with **Associate-Prof. P. S. Rutledge** on the synthesis of anthraquinone derivatives. Huang is a lecturer in organic synthesis in the Shanghai Industrial Hygiene Institute which is attached to the Shanghai First Medical College. In recent years he has been engaged in the synthesis of anti-radiation compounds and chelating agents for radioactive metals; he has synthesised a series of anthraquinone acrylic acid esters which are used as radio-protectants on experimental animals. Huang's visit to NZ has been arranged with the co-operation of the Ministry of Foreign Affairs. He will spend up to two years here.

Dr W. R. Roper recently visited Los Angeles to give the joint CalTech — UCLA — USC Inorganic Seminar. The title of his lecture was "New Organometallic Chemistry of Ruthenium and Osmium including Fischer-Tropsch related chemistry". While in USA he also visited and lectured at Stanford University; University of California at Berkeley; Central Research Department of Du Point; M. I. T; University of Wisconsin; Northwestern University; University of Illinois; and Colorado State University.

Prof. Brian Davis has recently returned from a year at Cambridge University working with **Prof. Raphael.** While there he actually got his hands dirty at the bench synthesising some optically active sulphoxides for use in asymmetric synthesis. While overseas, he met a number of former Auckland University Chemistry Department graduates — all doing well — **Dr Ken Baker** with Monsanto in Brussels, **Dr Clayton (Ru) Bennett** with Squibb, New Jersey, **Dr John Buchanan** in Zurich with B.P. (Switzerland), **Dr Noel Cusack** in Physiology at Cambridge, and **Prof. Philip Le Quesne** at Northeastern University, Boston.

Prof. A. L. Odell recently attended the XX International Co-ordination Chemistry Conference in Calcutta where he delivered a Session Lecture entitled "Metal Ion Catalysis of some Reactions of Co-ordinated Oxalate."

He also lectured at University of Liege; at the Commissariat a L'Energie Atomique, Saclay; at the State University at Stony Brook, Long Island; at the University of Alberta, Edmonton on "Some experiments in Tritium Labelling and Tritium N.M.R."

He also visited the factories of Bruker Spectro-Spin in Karlsruhe, Zurich, and Boston and the factory of Varian in Palo Alto where he discussed developments in "Super-Con" NMR systems.

Mr S. G. Brooker has been appointed as Honorary Lecturer in Chemistry. He will have an office on the fourth floor of the chemistry building. In addition to continuing as editor of "Chemistry in New Zealand" he hopes to take an interest in various aspects of the research work being carried out in the Department in Organic Chemistry. His long experience in fat chemistry should prove of value to the Radiochemistry group in their attempts to label fats in specific molecular sites while the Natural Products group will welcome him as an established author in this field.

In order to present an image more suited to his new academic role, Stan has recently sported a magnificent beard!

Massey

Prof. Keith Syers (Department of Soil Science) has recently returned from a 15-month sabbatical leave in South America, the USA and UK. During this time he was Visiting Professor in the Agronomy Department at the University of Georgia, USA and at the Grassland Research Institute, Hurley, UK. He also visited the phosphate deposits in the Sechura Desert, as a quest of Minero Peru, the North Caroline phospate deposits in the USA, and many research institutions involved in work relating to soil-plant relationships and fertilizer use.

Dr. Garth Wallace retired on January 31 after 24 years as a Senior Lecturer/Reader in Dairy Chemistry/Food Technology at Massey University. Garth graduated B.Sc from Victoria University in 1940 in Chemistry and Zoology and subsequently did a postgraduate year at Massey in 1949 and completed his Doctorate while on the staff at Massey. He has worked in the dairy, food and rubber industries and was an analyst/microbiologist in the food and water sections of the Government Analyst's laboratory of DSIR in Auckland for 6 years prior to his appointment to Massey College's Department of Agricultural Biochemistry.

Garth is looking forward to having a little more free time for his garden, hiking and fishing now that he has retired, but to maintain his interest in matters technical he has accepted a part time appointment as Programme Administrator for the Dairy Industry Graduate Training Programme and will be based at the NZ Dairy Research Institute. His part time job involves recruiting graduates in technology, science and engineering for the dairy industry and in arranging their post graduate training in the specialised areas of dairy science and technology.

(Dr Wallace was Associate Editor of the journal 1948-53 and Editor in 1954 — Ed.)

Canterbury

Prof. Alan R. Battersby, FRS, Professor of Organic Chemistry at Cambridge University was at Canterbury during February and March as a visiting Erskine Fellow. Prof. Battersby is noted for his studies in the elucidation of bio-synthetic pathways and enzyme reaction mechanisms.

The Visiting Lecturers in Chemistry for 1980 are **Dr Emilios Patsalides,** formerly at ANU, Canberra, and **Richard Rendle,** Head of Science, Kaiapoi High School.

Recently returned from periods of study leave are **Dr James Morriss Coxon** who was at York, England and **Dr Murray McEwan** who was at the Jet Propulsion Laboratory, Pasadena. **Dr Ward Robinson** recently attended conferences at Canberra and Sydney and **Prof. Leon Phillips** participated in an Atmospheric Chemistry Workshop at JPL., Pasadena.

Otago

Chemistry Department

Dr C. G. Pope has returned from sabbatical leave spent at the Department of Physiology, Cambridge, UK and the Institute of Surface and Colloid Science, Clarkson College, USA.

Dr R. F. Smith has returned from two terms sabbatical leave with **Prof. G. Bottomley,** University of Western Australia. **Dr. D. V. Fenby** has been promoted to Associate Prof. **Prof. A. D. Campbell** has been appointed the Dean of the Science Faculty for a three-year term. Visitors to the department have included **Dr. R. Chasselet,** Director of Research, Centre of Nuclear Science, Gif sur Yvette and **Dr. L. Mander,** A.N.U.

Dr. Jim McQwillan spent 3 weeks in the Chemistry Department, University of Newcastle, N.S.W. working with **Associate Prof. R. P. Cooney** on Raman Spectroscopy of electrode surfaces.

Biochemistry Department

Dr Ian Forrester has returned from study leave at the University of Wyoming where he has been examining aspects of calcium metabolism in mammalian sperm. In addition he has been investigating the feasibility of collecting and preserving semen from wapiti in USA for artificial breeding in NZ deer herds.

Prof. G. B. Peterson has been awarded a grant of $198,240 from the MRC for the study of 'Nucleic Acid Structure and Function'.

Integration of Biological And Chemical Control

C.H. Wearing, Entomology Division, D.S.I.R. Auckland.
(Based on a paper delivered at a symposium on Agricultural Chemicals organised by the Auckland Branch, NZIC October 3, 1979.)

Prior to the introduction of broad-spectrum agricultural chemicals a wide variety of biological methods of pest control were used in crop protection. These were largely forgotten during a period of dominance of chemical control but there is now an increasing realisation that the best present and future uses of agricultural chemicals will be by integration with biological control. Integrated pest control or pest mangement is the future framework and concept within which many agricultural chemicals will play a part and integrated control programmes are already in use throughout the world in a wide range of crops. Similarly, biological control research today is seeking not only alternatives to chemicals but is vitally concerned with promoting **rational** use of chemicals in fully integrated programmes of pest control. It is equally vital that the argicultural chemical industry recognises the value of integrating the various control options so that chemicals are used only when necessary and when most effective in relation to all pests and other controlling factors operating in a crop. It is significant that agricultural chemical companies are now making contributions to a number of integrated control programmes, for example in screening chemicals against important natural enemies of pests. There is increasing interest in assessing the impact of chemicals on beneficial parasites and predators, and in West Germany for instance, advertised claims that a chemical is selective in favour of a predator must be backed up with data sufficient to satisfy the regulatory authority that the claim is justified. This is a voluntary scheme at present (Franz pers. comm).

Natural controls are often extremely complex and their disruption can readily lead to pest outbreaks. Broad-spectrum pesticides have been instrumental in producing some major pest outbreaks. One of the classic examples of this is the rise in the pest status of spider mites on many crops following the introduction of organochlorine insecticides (and later organophosphates). Forty or so years ago spider mites were minor pests. Today they are among the most serious arthropod pests affecting agriculture world wide. In California in the early 1970's the annual cost from spider mites was estimated at $60 million. [1]. This increase in pest status was largely due to the destruction of the natural enemies of the mites by pesticides.

This can be well exemplified in NZ where in the early 1960's Dr Elsie Collyer demonstrated how organochlorines, used for control of codling moth and leafroller, destroyed the natural enemies of European red mite in apple orchards and led to mite outbreaks which had to be controlled with other chemicals. [3]. The new synthetic pyrethroids can produce similar effects in 1979 (Fig. 1).

This incompatibility between some chemicals and biological control is just one of the disadvantages of a purely chemical approach to pest control. The disadvantages may be summarised in 5 main categories:-

1. Pest resistance to pesticides. 2. Pest resurgence — the chemicals destroy natural enemies and diseases of the target pests which resurge quickly calling for repeated spray applications. 3. Secondary pests rise to prominence — e.g. spider mites from destruction of their natural enemies. 4. The toxic hazards to man and wildlife. 5. The rising dollar and energy costs of chemicals.

Modern development costs for new chemicals exceed $10 million and prospects of locating effective pesticides from chemical screening have fallen to 1 in 10,000 (e.g. Stevens [1]). The cost increases of petro-chemicals can be expected to accelerate with dwindling fossil fuels. The costs of many pesticides are already such that growers are increasingly concerned about ensuring that there is an economic return from each spray application. In the past and still today sprays are often applied by the calendar without regard to the pest population density or the economic justification for spraying.

Despite these disadvantages, pest control chemicals have brought tremendous benefits to agriculture and it must be emphasised that they are still our most powerful and dependable tool for the mangement of pest populations. They are often more effective and economical and can be more easily manipulated than any other control procedure.

The philosophy of integrated control which has developed since the 1950's is strongly opposed not to the use of chemical pesticides as such but to the **abuse, excessive use** and **wastage** of chemical control by the exclusion of other available methods and by the frequent failure to take advantage of biological information which would improve their effectiveness — for example timing applications against the most susceptible stage of the pest. Agricultural chemicals are so valuable as to deserve judicious use and shou not be squandered.

Fig. 1. Apple trees defoliated by European red mites following spraying with a synthetic pyrethroid which destroyed mite predators.

Integration (Cont)

Brader[2] defined integrated control as "The control of pests by employing all methods consistent with economic, ecological and toxicological requirements while giving priority to natural limiting factors and economic thresholds". This definition emphasises firstly, the need to understand the ecology of pests in order to develop rational control procedures.

Secondly, natural controls should be allowed to operate as much as possible before human intervention, and thirdly, artificial controls should be applied only when the economic threshold is reached i.e. when the cost of control is covered by increased returns from that action.

It follows that participants in integrated control programmes must have a fundamental philosophy that chemicals should be used only when absolutely necessary. "Maximum kill" would be rarely attempted but the pest would be permitted to fluctuate up to specified limits. Moreover, to help in decisions on when or whether to apply controls some form of pest monitoring system is needed. Integrated control offers a solution to the problems of purely chemical control by greatly reducing the probability of resistance, by preserving natural controls and by minimising costs.

There are many control options available for integrated control programmes. In brief these are natural enemies and diseases, host plant resistance, cultural control, physical methods, autocidal methods and quarantine. Chemicals may be used which are either physiologically or ecologically selective. "Third and fourth generation insecticides", such as insect growth regulators, offer further potential selective chemicals.

Many of these options are compatible with one another and the majority of problems of integration arise between the use of chemicals and predators and parasites. Chemicals with physiological or biochemical selectivity are not often available as yet because of the high commercial risks and costs of developing highly selective chemicals. However, chemicals are an essential ingredient in all integrated control programmes yet developed, so it is essential that we devise techniques for providing ecological selectivity of broad spectrum pesticides (Table 1).

Table 1: Techniques for obtaining ecological selectivity with broad-spectrum pesticides

1. Formulation e.g. granules, baits, encapsulation.
2. Low dosage application may allow sufficient predators or parasites to survive.
3. Systemics.
4. Application when natural enemy not exposed.
5. Application when natural enemy tolerant (e.g. stages differ in susceptibility).
6. Application to restricted part of the environment — alternate rows, spot spraying, seed dressing.
7. Timing of generations of pest and enemies in relation to 4, 5, 6 (e.g. use of chemicals in integrated mite control).
8. Preservation of reservoirs of natural enemies outside crops such as in hedgerows.
9. Making mass release of a natural enemy after residues of insecticide against other pests have disappeared.
10. Using chemicals after density dependent natural mortality has operated.
11. Taking care not to reduce the pest population so severely as to starve predators (e.g. in using selective miticides in integrated mite control).

The majority of Government research in agricultural entomology today is directed ultimately towards devising integrated systems of pest control. The demand for agricultural chemicals continues to rise while the problems inherent in purely chemical control do not change or diminish. These two circumstances and the rising cost of pesticides make it essential that we try to obtain maximum return from each pesticide application both in conventional chemical control as well as in integrated control programmes. This is in the best interests of the manufacturer, the farmer and the consumer. De Bach[4] estimated that in USA an average of at least 50 per cent of sprays have been wasted in traditional calendar schedules. Pest monitoring alone to guide spraying achieved reductions in spray applications of 50-80 per cent for grain sorghum pests and 67 per cent for grape pests. Similarly, Hall[5] conducted a five-year study of 100 cotton and citrus growers in the San Joachim valley of California which showed that integrated control was cheaper, less risky, and reduced pesticide usage by about 50 per cent.

The modern concept of integrated control originated in California in the 1950s but it is only recently that practical programmes have been implemented on a large scale. The slow progress reflects the complexity of the problems being tackled and the slow development of practical implementation methods. In NZ biological control, through the introduction of natural enemies from overseas, cultural control and plant resistance to pests have been used for many years. These techniques are increasingly being incorporated into integrated control programmes against for instance pasture pests, pests of lucerne and maize, and pests of horticulture. Integrated mite control has been implemented commercially on apples.

Successful commercial adoption of integrated control throughout the world has been consistently characterised by four main events.

1. The serious failure of existing control methods — growers and research workers were strongly motivated to provide a solution and to change.
2. Research and development planning involved the establishment of multidisciplinary research teams, well versed in all aspects of good crop production, and with a long-term commitment to the programme.
3. An effective implementation technology was established.
4. The new integrated control methods were competitive with existing methods on costs, risks of failure and safety to the user.

A fifth feature of the current successes is that they have not needed to use new highly specific selective chemicals for pest control but have been able to use existing materials and agents more efficiently. These points can be illustrated with reference to the NZ apple programme. Apple growers have been plagued for many years by the ability of mites, European red mite (ERM) and two-spotted mite, to develop resistance to miticides. Motivation was and is strong to find a more long-term method of control for mites. In addition, orchard leafrollers in NZ have in the past developed resistance to insecticides (Smith 1961). Failure of chemical control of leafrollers would present extremely serious marketing problems for export growers. The rising costs of pest control in recent years have caused growers to evaluate more carefully the economics of each spray application.

The research programme to develop an integrated control programme relies heavily on ecological studies of the key pests and has three main approaches to solving these problems: 1. In "supervised spraying", pest monitoring techniques are used to minimise spray applications e.g. sex pheromone traps to monitor codling moth have been recommended for use in gate-sales orchards in northern areas and similar methods are being researched for leafrollers and San Jose scale. 2. "Integrated mite control" has been implemented commercially following the discovery of a mite predator *Typhlodromus pyri* which had developed resistance to organophosphate insecticides[10]. This predator feeds on ERM and by taking regular leaf samples and counting the numbers of ERM and *T pyri*, a decision can be taken on whether application of a special selective miticide is necessary. The number of sprays required for mite control can be greatly reduced in this way (Fig. 2). Mite counting services have been established to implement the programme. 3. "Selective insect control" is the ultimate goal in which natural controls of all pests would operate as fully as possible and any intervention would be with selective methods. In this approach leafroller parasites have been introduced from Australia and viruses of both codling moth and leafroller have been evaluated as sprays. Selective insecticides have been tested against leafroller and codling moth[9] and sex pheromones are under investigation as a selective means of insect control.

In conclusion, the future for agricultural chemicals will be increasingly within integrated control or pest management programmes. There will be inevitably an increasing demand for selective chemicals for target pests, but, in addition, the need will grow to conserve our existing and future non-persistent broad-spectrum pesticides. This should be possible in part by improving application methods, formulation and ecological selectivity, as well as by using integrated control. Within this scenario the future for agricultural chemicals will require closer collaboration between Government and industry than has ever been the case in the past.. Moreover, Government subsidies to support pest monitoring schemes which improve pesticide usage will be infinitely preferable to pesticide subsidies which have only promoted their use in the past.

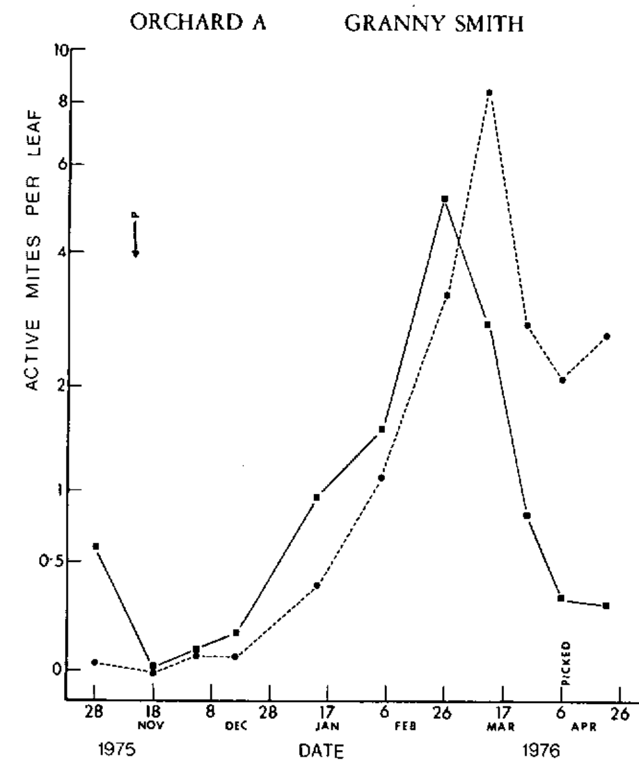

Fig. 2. Populations of Panonychus ulmi (■ — ■) and Typhlodromus pyri (● — ●) in a Nelson orchard 1975-76. P indicates that Plictran (cyhexatin) was applied (after Wearing et al. [10]).

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University-Industrial Interactions in Chemistry With Particular Relation To The Fertiliser Industry

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Approved professional practice for final year students in chemical engineering

SUMMARY

Industrial practical work is an essential component of the undergraduate courses in Engineering at Canterbury and Auckland universities. This work can be an effective means of establishing and maintaining contact between University and Industry. Some projects involving close collaboration between university staff and industry are described and it is suggested that a similar activity might make useful contribution to the training of chemists and to the improvement of contacts between academic and practising chemists.

(Although not primarily written from that point of view, it will be noted that the examples quoted fit in with the theme of agricultural chemicals — Ed.)

Introduction

In this case study, I wish to describe a particular form of University-Industry interaction which is built around the practical work requirements for the B.E. (Chemical) degree and which brings academic staff members into intimate contact with industry through their direct on-site supervision of student projects in industry.

I shall draw heavily on personal experience of this kind of work. Although my involvement is perhaps more extensive than that of many of our staff and is therefore perhaps not typical of the overall level of activity in this area, it does give a good idea of the range and nature of the interactions possible and of the benefits to the various parties involved, namely students, academics and industry.

I should add that, although the procedure I shall describe is one which is presently used in a chemical engineering degree, I see no reason why it should not be applied to a chemistry degree course. Moreover, as a former chemist converted to chemical engineering, I can see a number of advantages to chemistry graduates in receiving, during their undergraduate days, monitored practical training of the kind I shall describe.

Practical Work Requirements for the Degree of B.E. (Chemical) at Canterbury University

All students in the B.E. courses of the two engineering schools in NZ are required in the course of their studies to spend three periods, each of 60 days' duration, in industry. This practical work is carried out during the summer recess and therefore does not interrupt the students' normal full-time academic training. The specific requirements for the various practical work periods in individual degrees, such as mechanical, civil, electrical, and chemical engineering, differ somewhat. In chemical engineering they are:

1. **Approved Workshop Practice:** This time is spent in engineering workshop activities such as fabrication and machining. Its intention is to familiarise the student with common materials and machine tools, and to allow him to gain an appreciation of their capabilities in the hands of skilled tradesmen.
2. **Approved Engineering Practice:** This period is spent in a process industry, preferably as an assistant to the maintenance staff, where some direct experience of the influence of design on the operation of plant is gained.
3. **Approved Professional Practice:** This time is spent in a process industry working on a project designed to give the student an opportunity to apply to some real problem in the industry the things he has learned in his academic courses. Students are not permitted to embark on this period of practical work until after the third year of their four-year course, by which time they will have acquired a fair understanding of the basic principles of chemical engineering. This practical work is carried out under the supervision of appropriately qualified staff within the company. However, in some cases a member of the university staff is associated with the project and may be a joint supervisor with company staff.

It is with the third period of industrial practical work that the remainder of this paper will be concerned.

The Basis for Academic Staff Involvement in Student Practical Work

In the middle 1960s, when the numbers of chemical engineering students were growing very rapidly, we began to outstrip the ability of the relatively few, large, well-staffed process industries, such as the paper mills and oil refinery, to provide appropriate and appropriately supervised projects. There were, however, a good number of smaller industries operating chemical and related processes, such as fertiliser plants, wool scouring plants, abattoirs (with fellmongeries) and electroplating works which, while they had eminently suitable problems, either did not have the appropriate staff to supervise the projects or, if they had such staff, were unable to spare time for adequate supervision.

In an effort to surmount this difficulty, we decided to try an experiment in which, in consultation with the university staff, companies would select suitable problems and would then employ students to work on these problems. Instead of "in house" supervision, for which they felt they could not spare the staff, the companies would also provide for a member of the staff of the university chemical engineering department to spend some time at the factory working with the student and, for the remainder of the time, to supervise the project from a distance. The company technical staff did, of course, provide some assistance and advice to the student.

The first such experiment involved me initially in a two-day visit to the factory in August to select the project from a number nominated by the company. The student chosen joined the company in November (when the academic year had finished) and was left for about two weeks to find his way round the plant and to make a preliminary examination of the problem. I then joined the student at the plant for a week of intensive work, during which we defined the things which had to be done to complete the project and formulated a work plan for the remainder of the practical work period. I then returned to the University and followed the student's progress via weekly reports. Three weeks before the student was due to finish, I returned to the factory and spent another week of intensive work with the student, checking the results of the work done, preparing a draft of the final report to the company and defining the things which needed to be done to complete the project. The student was then left to complete the work required and prepare the final report.

We were, I think fortunate that the first trial of this scheme proved to be successful from every point of view. The student had a more carefully selected project, and more detailed supervision, than most. The company got, in addition to a student worker, an academic consultant for two weeks at a minimal costs and, as it turned out, a very profitable return from implementing some of the recommendations of the project. The academic staff member gained a great deal from his first-hand association with the factory and its problems and got to know and understand the attitudes of the staff.

The procedure described above has been repeated at that particular plant with only minor variations for the past nine years and, on a couple of occasions, the factory has had two separate projects involving two different academic staff members in the same year. Similar projects have also been carried out in other plants around NZ.

As a consequence of our assocation with industries through these schemes, a number of other forms of interaction, such as ad-hoc consulting and retained consultancies, have arisen. In some cases, problems raised or recognised in the course of the summer projects have led to more academic research projects carried out in the university.

A rapport has developed between the companies and members of the academic staff which has led to a much better appreciation by each of the expertise of the other. From the academic point of view, the direct contact with industry has given the teaching of undergraduates a spice which adds to its interest and effectiveness.

A. G. Williamson trained as a physical chemist at Canterbury and Reading Universities and taught chemical thermodynamics at Otago University before joining the chemical engineering department at Canterbury in 1967. His current research activities are thermodynamics of liquid and gaseous mixtures, industrial energy and conservation and solar energy recovery.

Kinds of Projects Undertaken

The range of projects undertaken by chemical engineers tends to be wider than might be offered to chemistry students, though many of those I have supervised would be within the capability of a good final year honours chemistry student and quite a number are mainly chemical in nature.

The first study we tackled was an energy survey of a sulphuric acid plant. The company had three plants running in parallel, each of 110 tons/day capacity. Heat recovered from the sulphur combustion.

$S + O_2 \rightarrow SO_2$

and from the conversion

$SO_2 + \frac{1}{2}O_2 \rightarrow SO_3$

is used to raise steam and, in the plants considered, three slightly different qualitities of steam were produced and combined in a common main which in turn supplied the process requirements (sulphur melter and deaerator) and the two turbo-alternators of combined capacity 1.75MW. As a result of the student study, the company was made aware of the reasons why their particular plant had a lower electrical power production than more modern plants of comparable acid production.

The steps necessary to improve the power production were examined and presented to the company as a table of options in increasing order of difficulty (and cost) of implementation, illustrated in Table 1. In the event, the company elected to implement only the first modification proposed at a capital cost of a few hundred dollars for which they received a return of over $10,000 per year (in 1968 dollars)! Other projects undertaken with this company include a study of the effluent disposal system from the fertiliser manufacturing plant.

The acidulation with sulphuric acid of phosphate rock containing small quantities of fluoride leads to the evolution of volatile fluorides, mostly in the form of HF and SiF_4. This is illustrated in Table 2 for various rocks. The air effluent from the system is treated by a water scrubber in which the phosphate dust is collected as a precipitate and the fluorides are dissolved. Large quantities of water are used in the scrubbers and the fairly dilute fluoride solution is discharged to the local river where it raises the fluoride level to about 1 part per million. It had been suggested that it might be possible to recycle the scrubber water and raise the fluoride level to the point where the solution could be sold as an additive to municipal water supplies.

Analysis of the effluent gas and detailed energy and mass balances over the scrubber system were necessary to provide the data for design study. It was necessary to carry out this study because the available concentration of H_2SiF_6 and the efficiency of the scrubbing are related to both the composition and the temperature of the scrubbing water. It was shown from the student's work that increased fluoride production could be achieved by adding siliceous material to the low silica rocks and that technically the production of a suitable fluoride solution could be achieved without loss of efficiency in the scrubbing (i.e. while still maintaining the effluent air quality). The project did not proceed to implementation on economic grounds.

TABLE. 2. Phosphate rock composition and fluorine evolution.

Source of rock	Composition of rock F	SiO_2	Fraction of available F evolved on acidulation
Nauru	2.6%	0.2%	4%
Christmas	2.1%	0.6%	7%
Florida	3.9%	8 %	25-30%

It is, however, interesting to note that, as a consequence of this study, a further design study was carried out in the university on the possibility of scrubbing fluoride as H_2SiF_6 from fertiliser plant effluents and further converting it to AlF_3 (for use as a flux in the aluminium smelter at Invercargill).

The third chemically oriented study carried out at the fertiliser plant was an examination of the production of nitric acid as a by-product of fertiliser blending. New Zealand has only a small market for nitric acid (a few hundred tons per year) and at the moment no ammonia production (because all of NZ's agricultural nitrogen fixing is done by white clover). It is therefore not economic to produce nitric acid in a large plant of the type which would be used in USA or Europe. However, in fertiliser works some imported potassium salts are added to fertiliser mixes. Although potassium nitrate can be more expensive than potassium chloride, one can use it to produce nitric acid via the reaction $KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$. The potassium bisulophate is an acceptable potassium additive to superphosphate and it thus becomes economic to produce nitric acid in this way. This project is still under examination.

The fourth project which I shall describe has now been taken to fruition via a sequence of student projects. This is the production of a solution of sodium bisulphite. Sodium bisulphite is used in wool scouring as a reducing bleach and pH controller. It can be made as a by-product of sulphuric acid manufacture through the reaction

$Na_2CO_3 + 2SO_2 + H_2O \quad 2NaHSO_3 + CO_2$

The physical chemistry of the process is interesting since, if saturated Na_2CO_3 is used there is the risk of precipitating $NaHCO_3$ by bubbling in SO_2. A student study of the chemistry produced the design data and operating conditions for a small plant which has now been built and commissioned, also by students. The plant now supplies bisulphite solution to several local

TABLE 1

Energy Survey of a Sulphuric Acid Plant.

Case	Potential power (KW)	(Probable) Actual Power (KW)	Steam flow (lb/hr)	Steam consumption (lb/KWh)
Existing arrangements of plants	1800	1500	35,700	24.4
Taking steam required for the deaerator from the saturated line	2030	1625	35,000	21.5
Putting a low pressure boiler in place of tertiary heat exchanger and SO_3 cooler in plant 1	2180	1745	40,700	23.3
Adding a new superheater in second pass of No. 1 plant and economiser to replace tertiary heat exchanger and SO_3 cooler. Also putting secondary heat exchanger in fourth pass of plant No. 2.	2780	2220	41,980	18.9

wool scourers and we are currently looking at the possibility of using it as a pilot plant for a study of the production of sodium sulphite. Laboratory studies have shown that it is possible to bring the system into the region of concentration of the various ions where it is possible to precipitate sodium sulphite.

These and several other projects of chemical interest which have been carried out are listed in Table 3.

Requirements for Student/Staff Training

The success of the programme depends on a number of conditions. The project must

(i) be defined clearly at the outset,
(ii) to be able to be carried out by the student in the allotted time,
(iii) be of potential use to the company,
(iv) be adequately supervised by the combination of intensive visits by University staff, weekly reports and advice from company staff.
(v) be known to company staff so that the student will get any necessary help from them and from departments other than that in which he is working.

We have kept to this pattern with fair success.

Other projects have been carried out under the supervision of other members of our staff and by staff of other universities and it is not possible to describe them all. Suffice it to say at this point that the notable feature of this aproach to projects involving students is that nearly all those we have chosen have been in the devĕlopment of new processes or products and that they have all been chosen in discussion with individual companies to fill a claimed interest of the company, and many are aimed at selecting chemical processes where there are advantages peculiar to the nature and scale of the local operations.

TABLE 3. Student projects in industry

	Project	Consequences
1.	Energy study of sulphuric acid plant	Some recommendations implemented
2.	Study of production of solution of H_2SiF_6 from superphosphate factory effluent	Technically feasible, not implemented on economic grounds. Follow up study of AlF_3 production at University.
3.	Study of nitric acid production from KNO_3 and H_2SO_4	Technically feasible, economically feasible, still under examination
4.	Study of production of sodium bisulphite	Technically feasible, economically feasible, implemented and plant running. Possible further development
5.	Effluent disposal from fellmongery. SO_4 removal and pH adjustment	Technically feasible, proposals now in progress of being implemented
6.	Control of anodising baths — problem of instability of colours	Proposals for analytical procedures and control strategy of bath composition partially implemented.

The Modern Contact Sulphuric Acid Process

D.J. Higgins. Director-Designate, NZ Fertiliser Manufacturers' Research Assn. Auckland.

Most chemists will be familiar in principle with the contact sulphuric acid process whereby sulphur dioxide is catalytically oxidised to sulphur trioxide. The process stems from a patent by Phillips dating from 1831, but commercial success was not achieved until the turn of the century since which time the process has steadily replaced the older chamber process and is now very much the dominant route to sulphuric acid.

Over these years a degree of uniformity of plant design developed until what might be regarded as a standard type of plant emerged in the 1960's. The basic plant using sulphur as raw material consists of in essence;-

1. A burner within which sulphur is oxidised usually in pre-dried air to produce sulphur dioxide.
2. Units for the purification of the burner gas and for recovery of some of the heat of combustion.
3. Catalytic reactions for the oxidation of the sulphur dioxide to sulphur trioxide almost always over vanadium pentoxide catalyst.
4. Coolers for the recovery of the heat of oxidation and preparation of the gas for absorption.
5. Absorbers for the production of sulphuric acid by absorption of the sulphur trioxide in sulphuric acid.

In a typical plant of a decade ago these steps would be accomplished along the following lines. The elemental sulphur is melted in vessels using waste steam from the process itself and in the melting also dried. The sulphur is filtered and stored molten in the dry clean state.

Air is drawn from the atmosphere by a centrifugal blower via a silencer and filtered before entering a drying tower of steel construction ceramic lined and packed. In the drying stage over 97 to 99% H_2SO_4 the moisture is reduced to very low levels and the air is warmed slightly and is then used as combustion air in the sulphur burner after suitable spray elimination.

Sulphur from the clean storage is pumped to the burner where it is atomised in the air stream to produce a sulphur dioxide stream of normally 7 to 11%. In the reaction, temperatures of over 1000°C are commonly reached in the brick lined burner and this gas stream is then cooled, typically to about 420°C in a waste heat boiler operating always above the dew point of the gases to obviate corrosion.

The cooled gas stream is then filtered in a hot gas filter packed with graded ceramics or stone and passed to the convertor at temperatures slightly above 400°C.

The convertor commonly consists of four fixed beds of supported vanadium pentoxide catalyst in the form of tablets or extruded pellets and the thermodynamics in the convertor are quite complex. The reaction $SO_2 + \frac{1}{2}O_2 = SO_3$ is now very well understood and the equilibrium constant

$$Kp = \frac{(PSO_3)}{(PSO_2)(PO_2)^{1/2}} (atm)^{-1/2}$$

is well determined under all conditions. This makes the design of practical convertors a precise operation since catalysts are now available of sufficient activity to permit close approach to equilibrium.

As would be expected in an exothermic reaction the equilibrium constant becomes more unfavourable as temperature increases and in a single adiabatic "pass" conversion is limited to 70 to 80% depending on gas concentration and entering temperature. In contrast to this effect, the activity of the catalyst increases rapidly with rising temperatures and these opposing effects must be balanced for optimum performance. Commercial vanadium catalysts are substantially inactive below 400°C and conversion is normally commenced slightly above this figure. The data then exist to plot the course of the reaction and it would be typical to proceed to about 75% conversion or about 600°C in the first pass after which the gas would again be cooled in a second boiler, or superheater on the steam from the first boiler, to about 420 — 440°C, after which the stream would enter the second pass of catalyst where a further temperature rise of about 45°C or 17% conversion would take place. The heat recovery after the second and subsequent passes is of course lessening and for economy of design the temperature reduction thereafter is often effected by dilution with dried air from the original drying tower. Each pass becomes less effective and there is little to be achieved after the fourth pass when conversion will be about 98.5% with good catalyst loading.

The gases leaving the convertor at about 420 — 440°C are cooled in an economiser (or sometimes an air preheater) to about 225°C. The economiser is fed with treated deaerated boiler feed water supplying the main boiler. These heat recovery measures are relatively efficient and total steam generation is often over 1.3 tonnes per tonne of acid produced of which the plant itself will consume less that 10%. This steam can be put to any economic use but in this country it is always fed to turbo alternators for electricity production which is used to power the motors in the plant, and the works of which it is a part, with some excess capacity often available for export into the national grid.

The cooled gas stream from the economiser passes to the final absorption tower where it is absorbed in 98% sulphuric acid over ceramic packing in a heavily recirculated system sometimes common with the acid recirculation on the drying tower.

After absorption the gas is filtered for spray and mist elimination in fibreglass, metal or ceramic filters before discharge via a stack. The acid circulation systems must be cooled and the acids ex the towers pass through cast iron pipe coolers irrigated by saline or recycled fresh water. No heat recovery occurs at this stage.

The process remained in this state for many years while the equipment and efficiency of operation was ever more refined and the main thrust of design was in the direction of lowering capital costs. Many NZ operational plants are still very much to this design.

About a decade ago however, partly as a result of the new awareness of environmental factors, new design ideas began to be introduced at many points of the process, until many modern plants have departed considerably from the former rather basic approach. The desire for higher conversions and thus lower atmospheric discharges has led to changes in the conversion techniques. It is obvious that if the gas stream enters the conversion stage at a lower temperature the reaction can proceed adiabatically to higher conversion levels before effective equilibrium is reached and therefore a catalyst which will "kindle" or start the reaction at lower temperatures will permit some increase in conversion.

Such catalysts have been eagerly sought and some progress has been made but the very nature of the physics of the reaction must limit the improvements which can be made since the oxidation involves a diffusion of the absorbed reactants to catalytically active sites and this migration becomes progressively slower with lower temperatures reducing the catalyst activity and increasing the quantities required.

It can also easily be seen from the nature of the equilibrium constant that a removal of the sulphur trioxide product at intermediate stages will allow more complete conversion. This has long been understood but practical difficulties primarily concerning corrosion have prevented effective commercial use of the technique.

The difficulties have now been overcome by using new materials of construction and a variety of other techniques, the discussion of which could provide a paper in itself and will not be dealt with further here.

Most plants now being constructed adopt this interabsorption or double absorption technique in which the reaction gases are removed from the convertor when the reaction is well advanced, cooled in heat exchangers and the sulphur trioxide removed in a secondary absorption tower. The gases are reheated in the heat exchangers and returned for further conversion in subsequent catalyst passes where the equilibrium is not suppressed by the sulphur trioxide product and the reaction can proceed more closely to completion.

These intermediate stages introduce a "wet" section into an area which was wholly dry in the older generation of plants and it was the problem of corrosion risk in these exchangers which delayed the improvement for so long. The new interabsorption plants easily obtain 99.5% conversion and conversions as high as 99.9%

Desmond Higgins has been appointed Director, NZ Fertiliser Manufacturers' Research Association, effective from May 31, 1980. He was born and educated in Christchurch, and graduated B.Sc. at the University of Canterbury, and was elected a Fellow of the NZIC in 1969. He is a Member of the Institution of Chemical Engineers, and of the N.Z. Institution of Engineers; he is also a Chartered Engineer (UK) and a Registered Engineer (NZ), and an Associate of the Institute of Management.

His working life has been spent in the fertiliser industry, being successively Works Chemist and Works Manager of the Hornby works of Kempthorne, Prosser and later Chief Production Officer and Works Superintendent for the Fertiliser Division of KP, and Deputy General Manager of the Group, as well as being a Director of the Dominion Fertiliser Co.

He has done more than usually well in his hobbies, being a past member of the Chess Council of NZ, and a contestant at world amateur level at billiards. His other activities include the Christchurch Regional Planning Authority, councillor of the Manufacturers' Association and the Clean Air Society of N.Z.

Des Higgins and his wife Aileen have two children.

Process (Cont)

have been claimed. These conversions naturally reduce atmospheric emissions to 20% or less of the former levels. While such plants are more costly to construct and somewhat more complex to operate there is a certain pay-back in more complete utilisation of the sulphur.

The interabsorption process increases the number of absorption towers from two to three and design economics in the absorption operation have also received attention.

The absorption tower is of course only a gas/liquid contacting device and many alternatives have been mooted of which one at least is in commercial use.

Many plants have now been built using venturis in place of packed towers in which the mass transfer resulting from large surface area provided by the packing in the towers is dealt with by the much higher mass transfer coefficient achieved in the high turbulence of the venturi. It may be expected that other contacting devices will appear in practical plants in the future.

Developments have also taken place in the sulphur burners which have borrowed ideas from oil technology and are now usually hollow furnaces of brick lined steel with spray injection of the molten sulphur. Some plants are using mechanically driven rotating cone burner guns which lead to very high flame intensities with resultant economies in burner size.

There is some interest in selected locations in using oxygen augmentation in the burners which would result in some economies in subsequent plant stages. Very high burner temperatures would result and continuous economic success has not yet been attained.

The traditional cast iron cascade coolers while still possibly the lowest cost alternative for acid cooling have numerous disadvantages. They use a large amount of land area and often create visible plumes of vapour which can be undesirable at some sites. In addition corrosion problems are often experienced whether using saline or fresh water, which leads to expensive and unpleasant maintenance. As a result numerous alternatives are now in use.

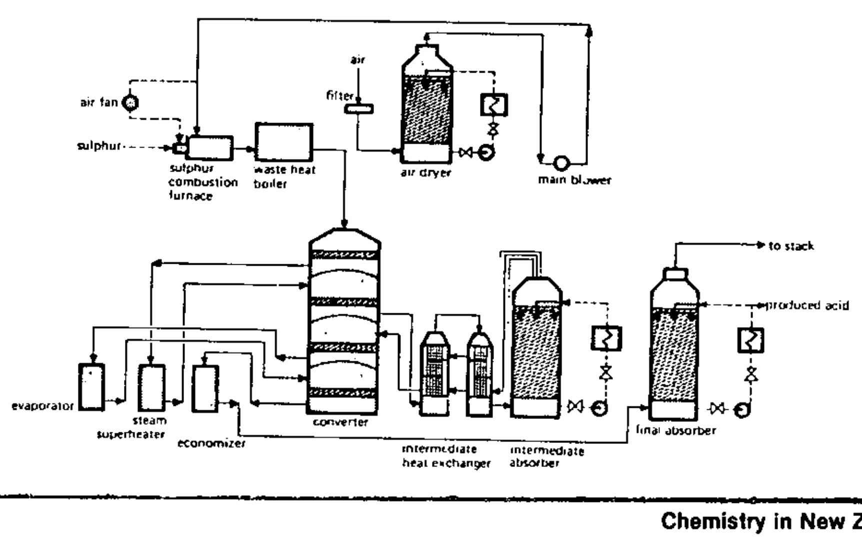
One system involves the use of air coolers in which the acid is pumped through banks of finned stainless steel pipe over which air is drawn by large fans. This system is very tidy and low in maintenance and occupies much less space than the older cascade coolers. The power for the fan motors of course comes from the acid plant power generation and the economics of the system depend very much on the overall works power situation. The ambient temperature conditions are a factor in the design and the concept is unattractive in hot climates because of the difficulty in obtaining sufficient temperature differential for adequate heat transfer. Very rigorous temperature control is necessary for corrosion protection and this is true of most of the newer cooler types which are much less tolerant of abuse than the older coolers. One air operated system is in use in NZ.

Other designers have looked to plate heat exchangers in advanced alloys such as Hastelloy. Several of these are in use in NZ and they have the advantages of extreme compactness, very good reliability and no pollution effects. They demand precision maintenance and must be protected from blockages because of the small internal tolerances. They also require fresh water of good quality and in situations where salt cooling water must be used secondary cooling systems must be provided where the fresh recycled water from the plate coolers discharges its heat load to the salt system via titanium exchangers which are also often of the plate type. Still another alternative now in use which is also represented in this country is the conventional shell and tube exchanger of stainless or similar alloy. These are very compact and convenient to install but their corrosion performance has been rather undependable. The new versions however are protected electrically by imposed potentials and in this form have proven very dependable although they are confined on economic grounds to rather large plants. Many other refinements have been added to the new generation of plants and more may be expected including certainly more energetic attempts for greater overall heat recovery which nowadays is naturally more attractive.

It will be observed that many of the refinements are borrowings from the organic heavy chemical industry and they reflect the fact that many of the designers and contractors are active across the whole spectrum of chemical industry.

It is interesting to speculate on what the next major advance in design may be since the world demand for sulphuric acid continues to increase without abatement. It is quite possible that this may be in the area of operation at elevated pressures as has been the case with so many other catalytic gas reaction processes. The concept has many attractions including much smaller plant component sizes, easily achieved high conversions and good catalyst economy. It also naturally holds out hopes of better utilisation of energy as the discharge gas could drive turbines improving the overall economy of operation. One such plant has been built in France but it operates at a few atmospheres only which is not sufficient for maximum economy. It is still too early to say if the high pressure process represents the future of the sulphuric acid industry but more attempts in this area are to be expected.

Typical flowsheet of sulphur burning double absorption sulphuric acid plant.



COAL IN NZ

P.A. Toynbee
Coal Research Association of NZ

The Energy Scene

New Zealand's problems for the future can best be summed up in the expression we hear so often these days — 'NZ has plenty of energy — it's just in the wrong form".

The problem lies in using the energy we have as it is, or else converting it into some form that the customer wants. Most of the indigenous energy we have is coal, which represents more than 90% of our fossil fuel. Coal utilisation is the most important field of research and endeavour with which we have to be concerned.

The attached table summaries the country's reserves and consumption of indigenous energy, the efficiency of various conversion processes, and our present distribution of coal usage.

There is far more natural gas than we can immediately use and we have coal in such quantities that it would last more than a thousand years at our present rate of consumption. Somehow we have to relate what we have to what we need. We have to take our indigenous resources (consisting mainly of coal) and select the ways in which we are going to apply them wisely to our needs. Currently, the most immediate and urgent need is obviously for transport fuels (123.8 PJ/annum). Our only indigenous source of petrol is the condensate associated with the natural gas, and this is in great demand.

The table of conversion efficiencies is vital to any consideration of converting coal and other energy to upgraded forms. If it is possible, it is better to use any energy in its natural form to avoid wastage in the conversion. If we have to convert, we need to select a process of acceptable thermal efficiency. Today however, when supplies of imported petroleum are limited and our balance of payment problems are so adversely effected by the purchase of transport fuels, the inefficiency in the conversion of indigenous fossil fuels to transport fuel is tending to become more-easily accepted.

Properties of NZ Coals.

The distribution of our coal reserves is shown in the attached map.

The first coals to be mined in NZ were the bituminous coals of the West Coast which were similar to those which the early settlers had known at home. Although West Coast coal production is still an important proportion of total production, the emphasis has gradually shifted to the North Island sub-bituminous coals which, today, are the coals of the greatest economic significance. In the long term, the lignite reserves of Southland are even more important.

Peter Toynbee has been Director of the Coal Research Association of NZ since its inception in 1967.

A chemical engineering graduate of Canterbury University, he joined the DSIR in 1947 as a fuel technologist.

As a National Research Fellow, he spent 1954-55 in Britain studying coal gasification and until appointed to his present position, he worked in Chemistry Division on matters relating to the gas and coal industries.

NZ ENERGY RESERVES AND CONSUMPTION

Non-renewable reserves of fossil energy are:
Condensate 650 PJ or 30 million tonnes of coal equivalent
Natural Gas 6,000 PJ or 270 mtce
Coal 65,000 PJ or 3,000 mtce

Annual production capacity for renewable electricity, and the potential for production, are as below:

	Present	Potential
Hydro electricity	63 PJ per year	209 PJ per year
Geothermal electricity	4 PJ per year	25 PJ per year

NZ's 1976 consumption of the various forms of energy, extracted from "Goals & Guidelines", is as follows:

Hydro & Geothermal electricity	59.7 PJ	18.5%
Coal	59.2 PJ	18.3%
Natural Gas	37.3 PJ	11.5%
Petroleum: Transport	123.8 PJ	38.3%
Non-transport	43.3 PJ	13.4%

EFFICIENCY OF CONVERTING FOSSIL FUELS

To Electricity	30 — 35%
To Petrol	45 — 55%
To Gas	75 — 80%

NZ CONSUMPTION OF COAL — 2.3 MILLION TONNES PER YEAR.

APPROX BREAKDOWN	
Power Generation	30%
Steel Manufacture	5%
Industrial	40%
Govt Buildings, School, Hospitals	10%
Domestic	15%

Over this range of rank, there are a wide range of coal properties. Generally, NZ coals are low in ash and sulphur and are highly reactive. Properly prepared to suit the modern sophisticated combustion systems, they are some of the best coals in the world.

Production

About two-thirds of our coal is mined by State coal mines, one-third by private mines. Some is mined underground, some by opencast methods — the ratio of opencast to underground coal has increased in recent years to about 2:1, but it is recognised that the ratio will fall below the present transient level. In many cases, the overburden ratio will be too high for opencasting — moreover, in the long term, we must be careful to retain and develop underground skills and experience for future expansion of underground mining.

Coal seams are generally very thick by overseas standards, and often faulted. Thick seams are not so advantageous in underground mining as in opencast operations because of the low percentage recoveries which are achieved. Opencast mining recovers virtually 100% of the coal. Recovery rates underground average about 35%, but it is anticipated that new developments in the mining of thick seams will, within the next decade or two, ensure recoveries up to 70%.

Utilisation

This paper is concerned mainly with coal utilisation — its importance has already been explained — and is divided into the two major parts, Conventional Combustion and Conversion Processes.

Coal

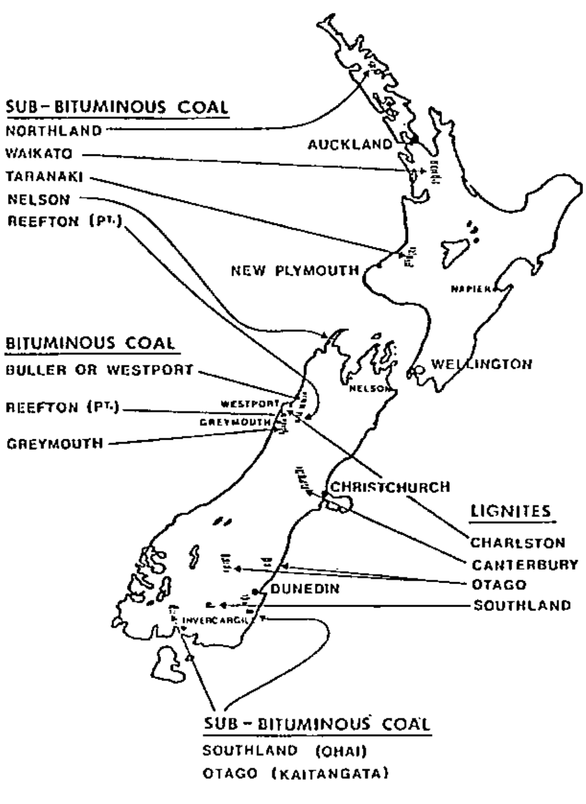
Conventional Combustion

Everyone is well aware of the poor image from which coal suffers as a dirty, inconvenient fuel — whether it is burnt in the home or in industry. No one can refute that the coal industry in the past has been very remiss in not doing more to correct these obvious faults. Improvements have been made in recent years, but despite these, the convenience of solid fuel simply cannot compare with that of oil or gas which comes in pipes, or with electricity. Handling the ash residue cannot be avoided.

The domestic use of coal shows signs of an upsurge as householders come to accept some of the disadvantages which steered them away from coal firing over the last 25 years. Today, there are modern coal-fired space-heaters, acceptable to clean-air authorities, and operating at efficiencies above 70%, which can supply a household's needs for space-heating and water-heating. They require daily charging with coal and daily removal of ash, a duty which is not too onerous.

On the industrial side, there are even more developments — with automatic, packaged, coal-fired boilers, and more especially, in the plulverised-fuel firing of industrial boilers. There are new improved methods of handling coal, automatic and low in installation cost, but this new equipment demands improved quality coal.

It was only a year or so after the Arabs first increased the price of oil, that the demand for industrial coal exceeded the industry's output. Many oil-burning factories were eager to convert, but coal was not available for all of them. It takes years to develop new mines and the increased demand was too sudden for an industry which over the years had run down. More recently, with the two large Huntly mines starting production, with the recent down-turn in demand for power station coal, and with its increased price production capacity is sufficient for the country's demands.



The industrial and domestic use of coal has a great future in the changed energy world, but coal's place will only be assured by an improved quality of the product and some improvements in the promotion and marketing side of the coal industry.

Two non-technical issues which will affect the future of industrial coal are its price and the competition from natural gas.

Despite the improvement in convenience and cleanliness with industrial coal firing, coal will always rely on a lower price to ensure its increasing popularity. It cannot be emphasised too strongly that industrial coal, in competition with cleaner and more convenient fuels, can have only the one attractive feature — its low price. The official energy pricing policy has so far rather failed to appreciate the extra capital costs and labour costs associated with the use of coal, but the need to offer it at a price which will overcome these disadvantages is becoming appreciated.

Competition with Maui Gas

There is a danger that industrial coal faces from natural gas in the North Island. New Zealand's urgent interest in the Maui field is in the condensate which amounts to about 10% of the total energy in Maui. The immediate danger to coal is that the field might be worked for this 10% which can provide petrol and as much gas as possible disposed of an an industrial fuel.

The example of waste of natural gas in industry and in power generation is obvious from recent events in America and Holland, and provides an important lesson to NZ so that similar mistakes are not committed here.

We have to use the natural gas quickly and we have a crying shortage of transport fuels. The obvious course is to convert the gas to transport fuels, or to use it as it is, for transport. We cannot afford to waste the gas as an industrial fuel when we have an indigenous alternative, coal, which is more than ten times as abundant as the natural gas. Again, if coal is to be encouraged as an industrial fuel in competition with natural gas, its price relative to natural gas would have to be the same as it is relative to fuel oil.

If all the Maui gas were devoted to the production of transport petroleum at a thermal efficiency of 50%, the reserves would supply our needs for only 22 years. The Maui reserves used similarly to provide NZ's present total consumption of petroleum would last only 14 years.

Coal Conversion Processes

It is generally accepted that any such commercial processes in NZ would be based on the abundant and cheaply-won lignites of Southland. The conversion processes — gasification and liquefaction — are considered here as they apply to Southland lignites.

Because natural gas is an alternative feed stock for conversion to transport fuels (by synthesis), gas must be included in any consideration of these conversion processes. The diagram "Conversion Processes" illustrates the processes, based on natural gas and coal, which might be applied here.

Gasification of Coal to Provide Synthesis Gas or Town Gas:

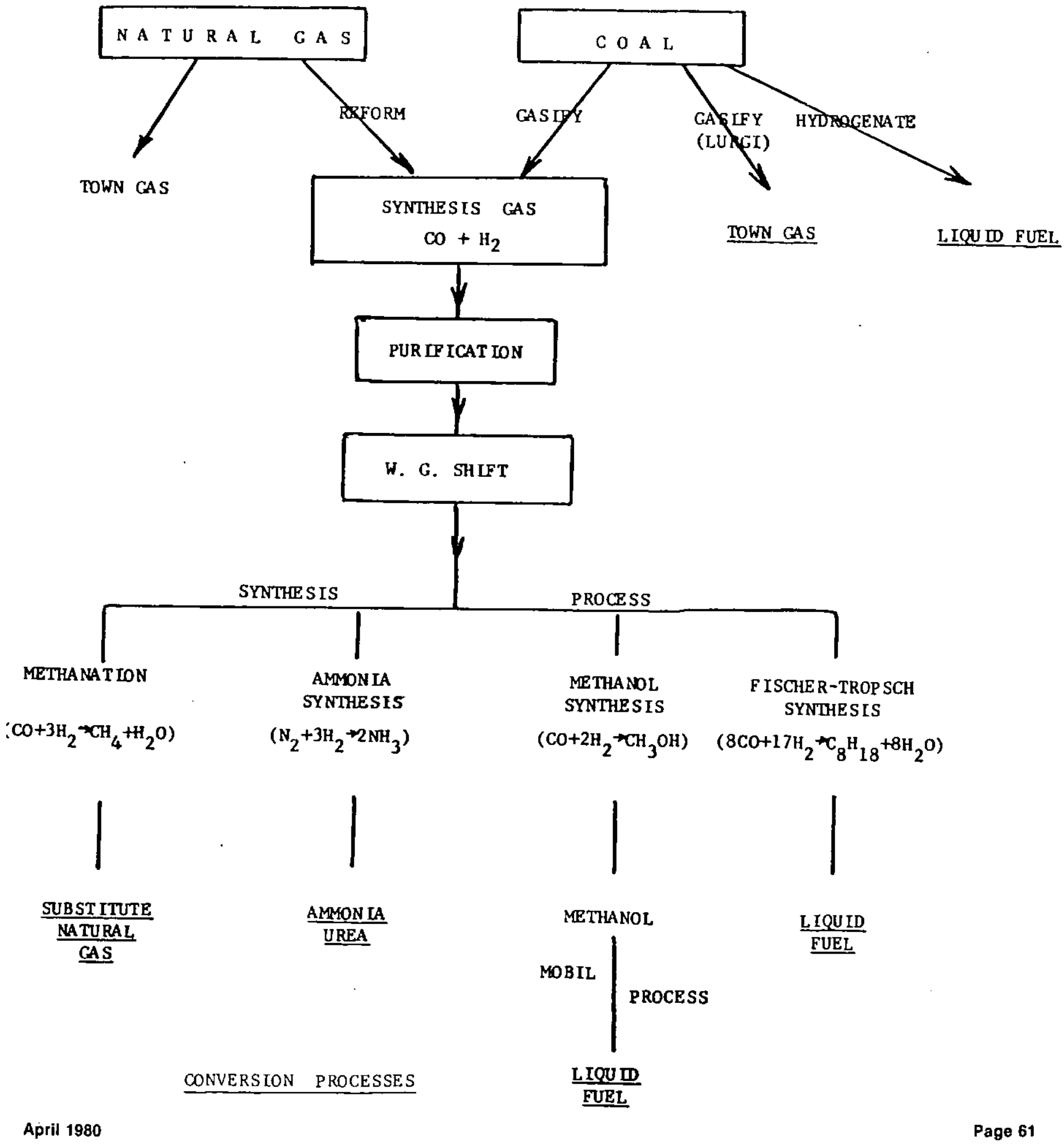
Any carbon containing fuel can be gasified by reaction with steam, to a mixture of carbon monoxide and hydrogen. Several gasification processes are available, the most likely being the Lurgi process, where coal is gasified at high pressure in a vertical shaft, with steam and oxygen passing up through the fixed bed. The gas from the Lurgi process contains up to 20% of methane — distilled from the coal or formed by reaction between carbon and hydrogen. Other gasification processes yield a methane-free gas, which has obvious advantages when the gas is used in systhesis processes.

It is worth stressing the difference between such gasification processes and the carbonisation plant used in our old gas works. Gasification converts the coal completely to gas, leaving only the ash. Carbonisation simply distils the gas from the coke, the major product from the process.

The gas from the Lurgi process, because of its methane content, has a heating value approximately the same as the town gas from carbonisation plant, and it could be used as a pipe-line gas. Alternatively, a pipeline gas, high in calorific value, can be produced by methanation-conversion of the synthesis gas to methane. In America, large-scale plans are well in hand for the replacement of the disappearing natural gas with substitute natural gas produced in this way from coal.

Our long-term needs are for a viable gas industry to supply a domestic fuel. Unfortunately, it does not seem that natural gas is going to be available in the South Island. Conversion of the Southland lignite into a pipeline gas is technically possible to supply fuel for domestic, commercial and perhaps industrial heating, the gas being piped up the East Coast between Invercargill and Christchurch. With the initial demand for gas only that of Invercargill, Dunedin and Christchurch, such an enterprise could not be launched without an inspired policy which accepted a considerable financial loss in the initial years before gas consumption and cash flows built up.

The necessary large scale of operation would preclude any production of substitute natural gas from serious consideration here, but the economic problem of initial operation might be reduced with a one-stage



CONVERSION PROCESSES

Coal (Cont)

(Lurgi) process to a point where this simpler process for pipe-line gas might be acceptable.

Synthesis Processes:
The carbon monoxide/hydrogen mixture from a coal gasification process is called synthesis gas, the building block for a variety of processes. The proportion of CO/H_2 can be adjusted in a "water-gas shift" process, and the reaction conditions and the catalysts are selected for the catalytic synthesis of methane (discussed above), ammonia, methanol, petrol and other hydrocarbons.

The only plant in the world producing petrol commercially from coal is in South Africa. This is based on the high-pressure gasification of coal in the Lurgi process to produce the sythesis gas, and subsequent Fischer-Tropsch synthesis of the carbon monoxide/hydrogen mixture to a variety of liquid hydrocarbons from which the various transport fuels are separated. The "Sasol" process has the disadvantage of producing a fairly-wide spectrum of hydrocarbons with considerable by-products other than petrol and diesel. It is often condemned for its low overall thermal efficiency of conversion, about 50%, but as yet, with no alternative processes operating commercially , there is no real yardstick for comparison.

The relatively-low thermal efficiency of the Sasol process is attributed partly to the presence of methane in the gas from the Lurgi gasifiers. (If there is no use for this methane, it has to be reformed and recycled — a major cause of the overall inefficiency.) If natural gas is not going to be available in the South Island, this methane might provide a substitute for a pipe-line enterprise supplying gas along the East Coast of the South Island. Integration of this gas production with the petrol production, would result in a considerable increase in the overall thermal efficiency and might overcome the scale-of-operation problems which so adversely affect the initial economics of a pipe-line-gas-from-coal project.

Natural Gas and Coal as Alternative Feedstocks for Liquid Fuels:
The synthesis of transport fuels from natural gas is basically in the same process as that used with coal as a feedstock. The difference is only the initial production of the synthesis gas — a gasification process with coal, reforming with natural gas. If there were a straight choice between coal and natural gas, we would weigh the lower price of the coal against the lower capital cost of the natural-gas reforming process and the more-ready availability of plant.

Natural gas seems likely to be the first feedstock to be used in NZ, because of the early availability of Maui gas, the capital invested in the Maui development, and the Government's need to develop a large consumption of Maui gas to meet its "take-or-pay" contracts and to produce as much as possible of the condensate associated with natural-gas production.

We have seen that Maui gas reserves converted to transport fuels would last NZ for only 22 years. The southern lignites would last about 160 years.

Another important issue which must be considered, is the promise of new technological developments (see below) in the hydrogenation of coal, a process which, promises considerable advantages over the synthesis route. Despite the present overseas efforts devoted to the development of these hydrogenation processes, the most optimistic estimate indicates that none are likely to be operating commercially before 10 to 15 years. So the initial use of natural gas in petrol production would provide some respite while decisions are taken as to the preferred method of converting coal to transport fuels.

Synthetic Petrol vs Synthetic Methanol:
The present dilémma as to the preferred end product — synthetic petrol or synthetic methanol — whether based on coal or natural gas, reflects the attempts to avoid the Fischer-Tropsch synthesis route. Methanol can be produced from the synthesis gas more efficiently, and the more product-specific process ensures a minimum of by-products. A 15% blend of methanol with petrol can be readily used in existing engines and without much change in the national distribution system. The use of straight methanol as transport fuel has many advantages and some disadvantages — a radical change in engine design would be required. The Mobil process is a recent development, still some years away from commercial operation, which converts the methanol directly to synthetic petrol, producing mainly high-octane petrol components with the minimum of by-products. The product can be used in conventional engines, but obviously the two-stage synthesis brings some reduction in overall thermal efficiency.

Hydrogenation of Coal:
The hydrogenation processes already mentioned, which are as yet only in the development stage, aim at the conversion of coal directly to liquid fuels as an alternative to the two-stage synthesis route. These hydrogenation processes are applied to coal and not to natural gas.

An essential property of liquid fuels as compared with coal is their higher ratio of hydrogen to carbon. With the synthesis processes already described, the gasification steam supplies the extra hydrogen. In the hydrogenation process, the coal is caused to react with hydrogen — the coal, in an oil slurry, is contacted with hydrogen at temperatures of the order of 450°C and pressures up to 250 atmospheres. The original German process was carried out batchwise, but today any commercial process would have to be a continuous one. Among the factors limiting progress in commercial development are three seemingly simple mechanical problems — the introduction of the coal/oil mixture into high-pressure reaction chambers, withdrawal of the material, and the final separation of the solid residue from the liquids.

Throughout the world, and especially in American, great effort is being expended in the development of hydrogenation processes — the US Department of Energy is currently spending over $100 million per year in coal liquefaction research. Much of the American work is concerned simply with the production of a low-sulphur fuel oil for boilers from high-sulphur coal — this would be of little interest to NZ.

The long-term potential of hydrogenation processes as a means of producing transport fuels in generally accepted, but it is also generally agreed that the realisation of a commercial process is still many years away. It will be a long time before commercial experience establishes that the hydrogenation processes are better than the synthetic petrol processes in respect to the thermal efficiency of the conversion and to selectivity of the products. If we had to make a decision today, to install plant to produce petrol from coal, to be commissioned in say 15 years' time, there would be no alternative to synthetic petrol or synthetic methanol based on an initial gasification process.

Meanwhile, with limited staff and facilities for research, NZ must keep abreast of the overseas research and development work in coal conversion, and develop a fundamental understanding of the techniques concerned and an ability to assess the various alternatives as they apply to our coals and as they affect the national economy.

Marine Natural Products Research — American Style

Murray H. G. Munro,
Chemistry Department,
University of Canterbury

Historically, the exploitation of marine natural products goes back to beyond 1000 BC with the extraction of Tyrian Purple from an Eastern Mediterranean mollusc. There are earlier reports of pharmaceutical uses of marine natural products by the ancient Chinese, but generally speaking, until recently man has not seen the sea as a source of fine chemicals. Interest in the potential of the sea to provide interesting compounds has come sharply into focus in the '70's with distinct commercial as well as academic interest in the marine natural products field.

Among the current leaders in the field is Prof. Ken Rinehart with the University of Illinois group which is interdisciplinary with chemists interacting with biochemists, phycologists, zoologists, and microbiologists. Their prime objective is the tracking down of biologically active material from marine sources and, following isolation and characterisation of the active component(s), carrying out mode-of-action studies and the synthesis of analogues. Among recent notable examples from this group has been the isolation and synthesis of the acarnidines (1), a new class of compound that exhibits very promising anti-viral and anti-tumour activities. In light of this pharmacological activity the synthesis of a variety of skeletal analogues (1) of the acarnidines is presently being undertaken in the Chemistry Department in collaboration with Prof. Rinehart.

More recently the Illinois group has announced the isolation and characterisation of two further compounds (3,4) that display similar pharmacological properties. It is interesting to note that unlike the majority of the natural products reported from marine sources these new classes of compound are not halogenated.

Thanks to the generosity of the University cf Canterbury and Prof. Rinehart I was able to join in an Illinois expedition to the US West Coast during summer 1977/78 and then later to the Western Caribbean. It was only after my arrival at Illinois that I was able to comprehend just how well the group was equipped for marine research. The School of Chemical Sciences has the usual array of modern instrumentation, but it is especially well off in the area of mass spectroscopy, which is a very necessary tool in marine natural products research. For instance the school has field desorption, field ionization and chemical ionization capabilities in addition to electron impact mass spectroscopy and all the various gas chromatography/mass spectroscopy (gc/ms) combinations. The other essential item the School has is a mobile laboratory. When the nearest coastline is at least 1600km distant wheels are a necessity. This mobile laboratory is in fact a converted mobile home and has an ample inboard water supply, its own 110V generator, a gas chromatograph, halogen analyser, HPLC, t.l.c. and liquid chromatography equipment. There is also a portable incubator, refrigerator and a lot of freezer space, plus many other items of laboratory equipment as well as room to sleep from 3-6 people in varying degrees of comfort. The boat, a 16-foot "Boston Whaler", is trailed along with all the necessary SCUBA gear stowed away. The only items that could not be stowed away were the air-compressor and a portable generator.

Murray Munro received his undergraduate training at the University of Otago, completing his Ph.D. there in 1965. After post-doctoral experience with Prof. Battersby he was appointed to the University of Canterbury where he is currently senior lecturer in marine natural products — an offshoot of leave spent with Prof. Rinehart at Illinois. Married, with three children, he has a passion for gardening.

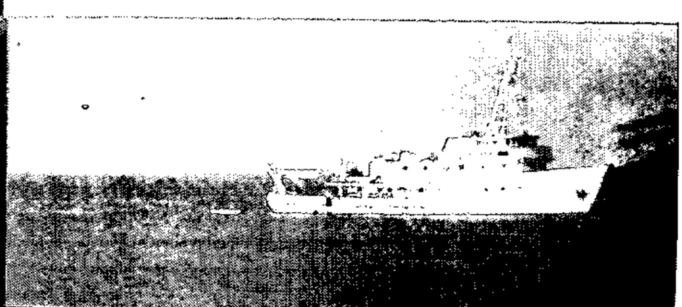
In addition to the normal range of equipment the mobile laboratory (the Orange Bus) was to be fitted with a gc/ms unit before carrying on to the selected collecting sites down the W. Coast and into Baja California. The Orange Bus and its three occupants left Urbana during a snowstorm and it was only after some initial difficulties that we reached Palo Alto 48 hours later and 3200km distant. There the HP-5992A desk-top gc/ms unit was installed in the bus and tested. The gc/ms was powered by the 4KW portable generator we had brought with us, but it also required a refrigerated water circulation system. A week was spent at the Hewlett-Packard factory fitting and testing the gc/ms before we could move to the first collecting site on the Monterey Peninsula. The installation of a mobile gc/ms unit was very much a novel and experimental idea and we were pleased to be able to demonstrate subsequently that it was possible to obtain excellent gc/ms data under field conditions. The prime objective, however, of the visit to the Monterey Peninsula was to collect a further sample of the red alga *Laurencia pacifica*. An earlier, routine collection of the alga had established that the particular variety of *Laurencia pacifica* growing at Stillwater Cove was unusually rich in isolaurinterol (5). As isolaurinterol is normally a minor component and had never been isolated and characterised from this alga, a bulk collection of this unique species was very desirable. Additionally, the extract from the Stillwater Cove *Laurencia* had shown up particularly well in the various screenings for biological activity. As isolaurinterol (5) was apparently a major component there was certainly more that one reason for recollecting this particular alga, and more than just a little interest . . .! We were fortunate in that we had an extremely low tide on the day we went searching. With remarkably little difficulty we were able to locate what we thought was that particular alga and made a bulk collection (ca. 1kg). Just a few hours later by using the gc/ms we were able to confirm that we had indeed collected the correct alga. Isolaurinterol has a characteristic fragmentation pathway and so was readily recognised.

The desk top gc/ms was used to examine many other samples that we collected around the Monterey region. Apart from the scientific benefits of having the Orange Bus fitted out with a gc/ms system the Illinois group had the opportunity of testing the suitability of the system for possible installation on the MV "ALPHA HELIX" for the forthcoming expedition to the Western Caribbean ("AHCE")

The Caribbean expedition was the second "ALPHA HELIX" expedition organised by Prof. Rinehart; the first being to Baja California ("AHBE") for a period of 8 weeks in 1974. On that occasion something in excess of 1000 marine samples were collected from as many phyla as possible. The aim of "AHBE" was to ascertain what marine animals and plants were most likely to contain biologically active compounds. They were able to correlate biological activity with organic halogen content and all extracts that had high organic halogen analyses were automatically analysed on the Varian MAT-111 gc/ms that had been installed on the "ALPHA HELIX". Over 100 new halogenated organic compounds were identified this way. This figure was the more remarkable in view of the fact that there were only 80 known halogenated organic compounds from marine sources at the time.

The aims of "AHCE" were a little different, in that by 1978 it had been well established by previous observations that fish, molluscs, crustaceans were less likely sources of biologically active compounds than eg sponges and red algae. In contrast "AHCE" aimed to collect as many samples as possible of a limited range of species. I should emphasise at this point that there are a variety of approaches to marine natural products — there are those that seek out new classes of compound, those that examine one phyla or family in great detail and finally those that search only for biological activity. The Illinois group falls primarily into the last category, although areas associated with chemotaxonomy also appeal.

Preparations for "AHCE" started some two years before the expedition actually departed with considerable effort going into assembling equipment, producing stores lists, testing out new procedures and making the general preparations necessary to co-ordinate the scientific effort. There were four distinct groups operating on board apart from the phycologist and marine zoologist who constituted the base group and identified the organisms recovered. Four persons



(Top left) Murray Munro (bearded) relaxes in Orange Bus with Guy Carter (lying down) and Mike Cheng. (Top right) "Alpha Helix". (Bottom left) The Orange Bus. (Bottom right) Preparing to load the gc/ms unit into the mobile laboratory.

Research (Cont)

were involved in the extraction, biological testing and chemistry of the extracts, while two biochemists examined the algal extracts for chloroperoxidase activity. The other two major tests, both firsts for shipboard testing, were screens for anti-viral activity and for neurotoxins.

The "ALPHA HELIX" sailed on the first leg of the expedition on February 20, 1978 and that evening passed through the Panama Canal into the Western Caribbean for the start of the expedition that was to extend as far North as Mexico. The collecting sites were all at small off-shore islands or reefs. The prime collecting area was along the Honduras Reef, the second largest reef structure in the world.

The "ALPHA HELIX" has been used for a wide variety of scientific expeditions, but its laboratory space can be quickly adapted to any particular use. She is some 133 feet in length with a wide beam, a relatively flat bottom and little keel. This enables her to go to Arctic waters, up inland rivers and through shoal waters. Despite these features we still managed to go momentarily aground when clearing the harbour at Isla de St Andre!

The "ALPHA HELIX" carries a crew of 12 plus a scientific technician who acts as liaison officer with the scientific crew of 11-12. A fair proportion of the ship is dedicated to the scientific effort with a lot of specialist equipment on board (eg high speed refrigerated centrifuge, autoomatic scintillation counter). There was also an excellent scientific library on board. The scientist is well catered for on this ship. During the expedition I was responsible for some of the gc/ms work, the HPLC examination of selected extracts and in a more general sense as a member of the group screening for biological activity. As well I was able to start off the isolation work on some of the more interesting appearing extracts.

There were seven SCUBA divers among the 12-strong scientific crew with the balance of us helping out with the shore collections. It was difficult to establish a work rhythm during the day as the duty schedule was never the same. All samples were sorted, identified and processed on the day of collection. This allowed the microbiological results to become available during the following day. This way if an exciting find showed and the ship was still in the vicinity it was possible to make a bulk collection. However, the ship's track was designed so that sites could be revisited if necessary.

The next days for me flashed by in a panorama of indigo water, golden sands, hot sunshine, desert islands and long hours of work in the laboratory as the samples were processed. Although final results are still not yet to hand some 45-50% of the samples showed significant biological activity (compared with only 15% in the less discriminating "AHBE") and some 25 samples showing anti-viral activity which was a particularly exciting result. As well a considerable number of the extracts tested showed significant activity as neurotoxins. Some in fact were as potent as black widow spider venom.

While it will be some time before all aspects of the expedition are tidied up, it is not too soon to say the "AHCE" was a success. Bulk collections were made of many of the more active extracts, especially those with anti-viral activity and there is an abundance of work assured for some years to come. It will only be after these extracts have been examined in detail, including anti-tumour testing, that the real success of this Caribbean expedition can be judged.

The Agricultural Chemicals Board: Its Functions, Activities

P. J. Clark, Chairman

The Agricultural Chemicals Board is a statutory body of which most people know little yet its functions, since it came into being in 1960 have been "to promote the welfare of the agriculture and horticulture industries by ensuring that any agricultural chemicals used in those industries are efficient and used safely". To achieve this the Government appointed a Board consisting of members who would be able to contribute from their intensive knowledge of matters relating to farming, fruit-growing, vegetable growing, manufacturing, distribution, health, science, grape growing and bee-keeping. An independent chairman is given the task of cementing this group of persons with so many diverse interests into a body which will make decisions not in any sectional interest but in the interest of NZ as a whole.

In addition to the Government-appointed members the Board has itself appointed several temporary members to aid in its decision making. These have been selected because of their specialised scientific knowledge of agricultural chemicals or because of environmental interests.

Even with this accumulated experience available, the Board still goes beyond its members to specialised committees and to technical experts to seek comment on almost all matters that may come before it. It has, through its Registrar, constant access to its counterparts in Australia, England and Canada and information from world sources is readily available. All this provides the background to the Board's work.

No agricultural chemical may be sold unless it is registered and within that registration procedure the Board exercises its control. Each proprietor is required to forward with the application for registration, detailed experimental evidence relating to efficiency for the purposes claimed. This is carefully studied and checked for adequacy by the Board's advisers. Toxicological information must also be provided sufficient to satisfy the Board and its advisers of the safety of the material when used as recommended. A label must be submitted which contains all information necessary for the user to control the pest, the crop, the dilution, the frequency of treatment, the safety precautions to be used, the waiting period between the last application and harvest and if required the action to be taken in the event of poisoning.

Currently there are over 850 fully registered products and additions and delections are constantly being made. But no decision is considered to be completely final. The developing experience with each product leads to new information and if necessary labels are revised.

Gone are the days when the few pesticide materials available could be used by anybody. Today the complex nature of the whole pesticide field requires that all users are well educated in their use. Some materials are so poisonous that they may only be purchased by the commercial applicator and the home gardener sees on the shelves only those materials that are relatively safe to use.

Some materials can only be applied after obtaining a permit from the Ministry of Agriculture and Fisheries.

The Board, being aware of the damage that can be done by an inexperienced operator, has encouraged the registration of applicators. This is a voluntary scheme and involves a person in the study of that aspect of agricultural chemicals in which he is interested. The study is followed by an examination which if it is passed and supported by evidence, on interview, of adequate experience in the field, entitles the person to registration. All hirers of pesticide operators are urged by the Board to engage the services of registered applicators.

The Board has over the years been very mindful of the environment and the need to be watchful that the use of every pesticide is in the interests of the whole environment. For example the effect of pesticides on worms is intensively studied. Wherever it is possible those materials that are very persistent in the environment are being phased out of use and their place is being taken by less persistent materials. Lead, arsenic and mercury compounds have already largely gone from use. DDT is now little used and is not permitted at all on farmland. The control of water weeds and those along banks of waterways has been a matter of special study and guidelines for the use of the proper materials have been promulgated thus putting into the hands of the users the knowledge which will achieve success without destroying useful vegetation.

As a generalisation it can be said that all agricultural chemicals are poisons and it is of concern to the Board whenever it hears that they are being used improperly. On every label there is sufficient information which if followed can ensure safe usage. But what if the label is not read? Shortcuts to achievement appeal to everyone but these risks must not be taken with agricultural chemicals and the full label should be re-read every season — labels **do** change. This watch cry "Read the label" has been constantly sounded and must continue to be so.

Damage to non-target crops by herbicides is another cause for concern to the Board and considerable time and effort is being expended in a search for ways of lessening such damage. We are well aware that it is possible for neighbours to grow diverse crops in close proximity and to avoid the problem of plant damage that spray drift could cause. But does the solution lie in more regulations? The Board prefers to operate through the process of education rather than through the force of regulations but it is a slow and continuing process.

But the Agricultural Chemicals Board's days are numbered. When the new Pesticides Act comes into operation all its functions, plus others, will be absorbed into the new Pesticides Board. The present staff, hardworking and dedicated, will service the new Board in the knowledge that their expertise and understanding has helped to weld past Boards into a body prepared to listen to all points of view and to seek the best solutions to what are quite complex issues.

Information Directory

Information is available from many sources but finding the best sometimes is difficult. The last edition of the Directory of Special Libraries and Information Centres has been a useful key to information resources but now it is so much outdated that a new edition is being prepared. The publisher (NZ Library Assocation) aims to include not only libraries but also specialist information centres, agencies and consultants. No charges are made for listings and questionnaires are available from: The Editor, DISLIC, DSIR Central Library, P.O. Box 9741, Wellington.

Chemical engineers have joined the civil and geochemical groups in promoting the export of technology to South-East Asia.

The NZ Farmers' Fertilizer Co. Ltd has joined with KRTA, Auckland, and TT Consult, Bangkok, both architectural and civil consultants, to provide chemical engineering expertise in the supervision of procurement, construction and commissioning of an integrated aluminium sulphate plant for the Thailand Government's Ministry of Industry.

The complex, to be located some 25km north-east of Bangkok, will produce 51,000 tonnes/annum of liquid alum, and 23,000 tonnes/annum of solid, with its own contact sulphuric acid plant. Raw materials will be imported elemental sulphur and bauxite.

As well as being experienced in contact sulphuric acid plant technology, the NZ Farmers' Fertilizer Co. is the sole manufacturer in NZ of both liquid and solid aluminium sulphate, having had over 30 years' experience in the operation and design of aluminium sulphate plants.

Recently, three of the company's chemical engineers spend a period in Thailand discussing plant details. The complex is expected to be operating in two years' time.

("Liquid" is the term used in the trade for the salts in solution, the concentration can vary from one place to another.)

NZFMRA Director To Retire

John Rogers' service as Director, NZ Fertiliser Manufacturers' Research Association, ends on June 9. In the last 14 years he has worked with many members of the NZIC and other sections of NZ's scientific community in guiding FMRA's research for the fertiliser industry - N.Z's biggest chemical one.

In addition to service as office holder in the Otago and Auckland Branches of the NZIC, John (foundation chairman of the NZ Geochemical Group, one of the NZIC's first specialist groups, chairman and local correspondent, Auckland, of the NZ branch of the Australasian Institute of Mining and Metallurgy and councillor for NZ on the Institute Council 1976-79, and as president of the Clean Air Society of Australia and NZ's branch in this country), has worked with scientists of many disciplines and others in the application of chemistry in agriculture and the mineral industries.

Working in the Physical Chemistry Section of the Division of Industrial Chemistry with the late **Dr Keith Sutherland** under **Sir Ian Wark** — well known to many NZIC members — at CSIR in Melbourne in 1941-45 developed his interest in surface chemistry.

Returning to this country in 1946 John pioneered work at the Soil Bureau, DSIR on the clay mineralogy of NZ soils before establishing a department of mineral processing at the University of Otago's School of Mines and Metallurgy, 1947-55. Research on flotation at the University of Cambridge 1955-57 sponsored by Australian and African mining groups was followed by industrial experience in 1957-59 at Copper Cliff, Northern Ontario, of the application of flotation theory to recovering and separating copper, iron and nickel sulphides from ores mined by the International Nickel Co. in Canada.

In 1966 John came to the Otara Research Station from Dunedin where, incidentally, sulphuric acid and superphosphate fertiliser were first made in 1881. In Otago he had worked in the high temperature-high pressure laboratory at the Chemistry Department as an officer of the NZ Geological Survey from 1959. **Hugh Parton**, with whom John studied for a MSc in electrochemistry in 1940 at Canterbury College, was the Professor there then.

From Otara, as well as visiting university, government and other laboratories and the 13 works between Whangarei and Bluff which currently produce about 2.5 million tonnes per annum of fertiliser in NZ, John travelled widely overseas in 1969 and 1974. These study tours renewed and extended contacts made as a Nuffield scholar and Fulbright grantee in Canada and USA in 1949-50 as well as in UK and Canada in 1955-59.

With Australian fertiliser manufacturers and CSIRO a close working relationship has been established based on research at Otara on the chemistry, physics and engineering of manufacture and granulation of superphosphate from Christmas Island phosphate, John's visit to all states, and the resulting participation of Australians in FMRA's technical conferences and research symposia.

In mid-April John and Molly Rogers begin a 3 month visit to Canada, USA, England and the Continent. This will combine more recreation with less business than previous ones. Calls will be made at Kew, Wisley and the Cambridge and Oxford University Botanic Gardens in preparation for assisting at the new botanic garden under development by the Auckland Regional Authority at Manurewa. Return will be via Tanzania — where their eldest son is leader of a NZ aid team establishing a dairy farming course in the agricultural training institute at Tengeru — the Seychelles and Singapore.

John is currently chairman of the Institute's membership committee and a member of the Council of the Auckland Institute and Museum. He expects soon after April 3 to be wondering how there ever was time to go to work!

People

Mr G. M. Denton has transferred from Massey High School, Auckland, to St. John's College, Hamilton. **Prof. J. I. Graham** (retired) is now living at 58 Aurora Terrace, Hamilton. **Mr Alan Swaney** is now with the Te Aroha-Thames Valley Dairy Co, Paeroa. **Mr S. D. Thomas** is now on the staff of Ashmead School, Reading, England. **Mr R. C. Leong** has been promoted to Works Chemist in the NZ Co-op Dairy Co. **Mr A. V. May** has been promoted to be Projects Superintendent at Rossing Uranium Ltd, Swakopmund, Namibia.

The President of the Institute, **Prof. Arthur Campbell** of Otago, has been appointed an Honorary Fellow of the Royal Australian Institute of Chemistry for the remainder of his period of office. This gesture by the RACI is much appreciated by all associated with Arthur and officials of the NZCI.

Dr R. A. Cartner, Research Fellow at the Australian National University, spoke at Waikato University in December on "Recent Advances in Lasar Raman Spectroscopy",

The British Prime Minister, **Mrs Margaret Thatcher**, who is a chemist by training and early experience, has been elected an Hon Fellow both of the Royal Institute of Chemistry and the Chemical Society. In her acceptance speech the P.M. said she was wholly committed to British science by inclination and by instinct.

The unification of the RIC and the CS., approved by a majority of members of both bodies, is now with the Privy Council. No firm date can be set for the final consummation, but it is hoped to have the first AGM in July.

Now enjoying a well-earned retirement after a notable research career spanning 40 years, is **Mr T. H. Kennedy,** formerly of the MRC Immunopathology Research Unit in Dunedin.

In 1942, a year earlier than similar disc- overies in USA, Mr Kennedy reported in **Nature** that thioureas inhibit thyroid hormone production, heralding the development of antithyroid drugs for the medical treatment of thyrotoxicosis. During a sabbatical year in **Sir Charles Harington's** laboratory in London, Mr Kennedy made the first synthesis of the second thyroid hormone, tri-iodothyronine. On returning to Dunedin, he developed chromatographic methods for the quantitation of the iodine-containing compounds in the thyroid gland, finding evidence that the increased secretion of tri-iodothyronine relative to thyroxine, which is an important defence mechanism against hypothyroidism due to iodine deficiency, is simply a function of the less complete iodination of the intra-thyroidal tyrosine molecules.

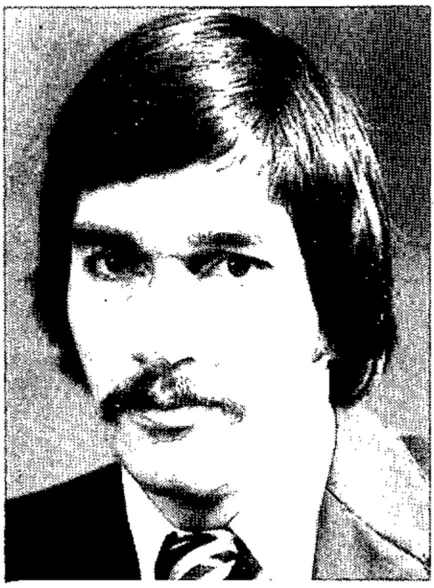
In 1962 Mr Kennedy began a long partnership with **Dr D. D. Adams,** during which the pathogenesis of thyrotoxicosis was solved after decades of uncertainty. First, Mr Kennedy showed that the mysterious agent in the blood of thyrotoxic people, long-acting thyroid stimulator (LATS), is an immunoglobulin. This suggested that LATS was an autoantibody, with thyroid-stimulating activity. After the two investigators had discovered LATS protector, Mr Kennedy showed that this agent, too, is an immunoglubulin. A precise technology was developed for the bioassay of immunoglobulin concentrates of LATA and LATS protector, eventually establishing these agents as thyroid-stimulating autoantibodies (TSaab), the causative agents of thyrotoxicosis.

A crucial parallel to the work on the TSaab was the determination of thyroid stimulating hormone (TSH) levels in the blood of patients with various thyroid disorders. Both the bioassay for TSH and the subsequently-developed immunoassay are insufficiently sensitive to measure TSH levels in the blood of normal people. Mr Kennedy developed a method for extracting TSH from blood which allowed 2.7 litres of serum to be reduced to 3.0ml of TSH concentrate, with 38% recovery, giving a true concentration of the hormone of 340-fold. This enabled the first demonstration that thyrotoxic people have below-normal levels of TSH in their blood, an essential step in the establishment of the pathogenesis of the disease.

Mr Kennedy's research contributions were based on his quite remarkable ability as a chemist and his unusually powerful scientific mind. His papers are characterised by being both highly original and highly significant for medical science.

We are sorry to hear that **Prof. R. B. Woodward,** described by **Sir Ewart Jones** as probably the greatest organic chemist of all time, died last year of a sudden heart attack at his home in Cambridge, Mass., at the age of 62. He was a tremendous leader in the fields of structural, synthetic and theoretical organic chemistry. He is said to have worked out the structure of quinine when he was only 12, and was granted a Doctorate by MIT at the age of 20. His synthetic achievements included quinine, chlorophyll, vitamin B_{12} cholesterol, reserpine, tetracycline and prostaglandin. At the time of his death, he was Donner Professor of Science at Harvard. He held numerous awards, and was an excellent lecturer. **Prof. R. C. Cambie** has a vivid memory of his lecturing for 3 hours in Prague on chlorophyll, illustrating his lecture with meticulous drawings on the blackboard. Prof Woodward's award of the Nobel prize in 1965 won universal acclaim.

John Wilson has joined Chemby Marketing Ltd (formerly Buckley & Young Ltd.), Auckland, as development officer in the general chemicals section. It is a new appointment reflecting the growth in demand for chemicals by NZ industry.



Mr Edgar Cone has retired after 26 years at the Chemical Service Laboratories, Johnsonville (known for many years as H. W. Lawrence and Son Ltd). **Mr Dennis Rogerson** is now factory manager of A. C. Hatrick, while **Roger Keen** is now a sales chemist for Mobil in Auckland after completing a short training course with the Mobil Oil laboratory in Lower Hutt.

ICI Tasman Vaccine, Upper Hutt have welcomed **Mr Derek Cooper** from their Seaview site, Lower Hutt and **Dr Geoff Bethel** from Massey University.

It has been drawn to our attention that the item on page 183 of our October issue referring to the Waitaki-NZR project at Nelson producing viscose resins, and the proposed fractionation of tall oil to produce resin acids by a joint venture between NZ Forest Products and Tasman P & P has confused some of our readers. The latter two companies are not linked with Waitaki-NZR, and the materials produced at Nelson are in fact cellulose ion exchangers. A full discussion on the development of the Nelson project may be found in our issue for March 1977 (Vol 41, 8); further information may be obtained from **Dr. M. J. Francis,** Research and Development Manager, Waitaki-NZR.

News From Govt. Departments

Chemistry Division DSIR

Dr Christine Saint-Joly, who completed her University studies at Toulouse University has been appointed to the Pharmaceuticals Section.

Miss Jennifer Mason, who recently completed BSc (Hons) in Chemistry at Victoria University has joined the Applied Chemistry Section.

Dr D. Bibby will be travelling overseas to Australia, South Africa and UK for 3 months to visit laboratories working on synthetic fuels.

Mr E. R. Cairns has taken a year's leave from the Toxicology Section to study for MSc in Pharmacology at Sydney University.

Dr P. L. Cropp, Forensic Section, visited Canberra during February to deliver a paper to the Australian Forensic Biology Conference.

Dr R. D. Crump, Natural Products Section, has a DSIR study award to study Pheremone Chemistry with **Prof. Silverstein** at Syracuse, New York.

Mr K. Balzell, Applied Chemistry Section, has been given study leave to attend the Institute of Chemistry and Metallurgy in Sydney to study surface coating technology. While in Sydney Mr Dalzell will also be working at PASCO Paints, a manufacturer with NATA approval.

Mr G. J. Dougherty, Applied Chemistry Section, will be visiting UK during March and April to attend the Aviation Fuels and Lubricants Conference. Mr Doughterty will also visit British Quality Assurance laboratories.

Dr. M. E. Eastwood, Forensic Section, has been given a DSIR study award to visit the Home Office Central Research Establishment laboratory in Aldermaston from 12 months.

Rev. J. Mabon, Director, Interchurch Trade and Industry Mission, has commenced duties as Industrial Chaplain to the DSIR Gracefield Campus.

Dr. R. W. Winchester, Food Section, leaves Chemistry Division during March to transfer to the Environmental Laboratory, Department of Health, Auckland.

Dr. R. Hemingway from the US Forest Service, Pineville, Louisiana is visiting Chemistry Division for 9 months to work with **Dr.L. J. Porter** on the structure of condensed tannins.

Dr Shiro Shimada, an NBAC Post Doctoral fellow from Hokkaido University is visiting Chemistry Division for 18 months to work with **Dr. K. J. D. McKenzie** on the synthesis of oxide semi-conductors for possible solar cell applications.

Prof. R. Axtmann, Professor of Chemical Engineer, Princeton University, is spending a sabbitical leave at Chemistry Division studying silica removal from Geothermal waters using fluidized beds.

Dr R. S. Babcock, University of Western Washington, is also spending a sabbatical leave at Chemisty Division working on the stability of thioarsenite complexes of Au (1) at high temperatures and pressures.

Mr J. Hedenquist, a Fulbright scholar doing Geochemical Research to complete a PhD at Johns Hopkins University, Balitmore, is associated with staff in the Geochemical and Geothermal Sections while he is working in NZ.

Soil Bureau

Dr. W. Bernard Healy has been appointed Scientific Adviser, NZ High Commission, London.

Dr P. L. Searle has just completed a MSc degreee in Soil Science from Reading University, England.

Plant Physiology Division

Dr. Grattan Roughan has returned to biochemistry group after spending the last 17 months in California. He spent 6½ months in **Brian Mudd's** laboratory at U.C. Riverside working on the role of chloroplasts in leaf lipid metabolism, 6 months in **Harry Beever's** laboratory at U.C. Santa Cruz working on aspects of the new scheme integrating the functions of chloroplasts and other cellular compartments in membrane lipid synthesis and 3½ months with the **Lyons/Briedenbach** group at U.C. Davis studying the relationship between fatty acid composition of individual lipids and chilling sensitivity in different ecotypes of tomato.

Applied Biochemistry Division

Dr. Rex Gallagher, left at the end of February to take up an appointment with the Ministry of Agriculture and Fisheries at the Ruakura Animal Research Station. Dr. Gallagher will be working on mycotoxin problems, especially in the areas of ryegrass staggers and facial eczema.

Central Institute of Technology

Dr Colin Hughes joined the Pharmaceutical Chemistry staff last year, having spent the previous 7 years at Squibb International Development Laboratories on pre-formulation work.

Dr Harry Rosenbury, Associate Professor of Biomedicinal Chemistry, University of Nebraska, is on sabbitical at the School of Pharmacy until August.

Dr Paul Fawcett has returned to lecturing after a period in analytical toxicology at Wallaceville and will be involved in Pharmaceutical Chemistry courses. His previous experiences at Auckland Technical Institute and in Toronto and McGill Universities will bring together teaching and research interests.

PACRA

Mr A. P. D. (Tony) Smith has joined the scientific staff as an analytical chemist. He was previously with the Wellington Regional Water Board.

Industrial Chemistry Prize: Applications or nominations for this prize, which recognises meritorious achievement in the field of industrial chemistry and which is sponsored by ICI Tasman Vaccine Ltd, are now being invited.

Valued at $200 and restricted to financial members of the NZIC of any membership grade, it can be awarded to an individual or shared between 2 or more members.

Applications should include a written statement of the industrial chemistry activities or achievements of the candidate, and their significance in terms of improved technology, new products, or other benefits to industry or the community. Supporting documents and publications may be submitted with the application and will be held to be confidential to the assessors. If possible the value of the work should be attested by an accompanying statement from the manager, or directors, or head of the organisation. There is no limit on the period of time over which the work was carried out.

Applications for the prize may be made by individual members, or nominations may be made by Branch Committees or by corporate members of the Institute.

Two or three assessors will be appointed by the NZIC Council to consider the applications and make recommendations. The final decision on the award will be made by the Council. Council reserves the right to make no award in the absence of a suitable candidate.

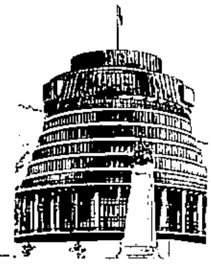
Applications or nominations must be submitted to the Administrative Secretary, NZIC, Box 1926, Christchurch, before April 30.

The prize is being serviced by the NZIC's Industrial Chemistry Specialist Group.

(This item, which appeared in our February, 1980, issue is being repeated at the request of the General Secretary.)

Parliamentary Point Of View

By Ian Shearer, MP



Who Gets What?

Although, to the casual observer, there appears to be very little activity at present in the Beehive, the truth is that the annual frantic exercise of budget preparation is well advanced. That's not to say that major decisions like taxation, farm subsidies, welfare benefits etc, are anywhere near finality but certainly many areas for emphasis will, by now, have been identified. There is no doubt, in my mind, having travelled recently to view the NZ Steel Mill at Waiuku, Petrocorp and the Maui Platform in Taranaki, and having discussed aluminium smelters with overseas specialists, that this country will have to invest more and more into science and scientific endeavours. Knowing the Minister of Science and Technology as I do, it is clear that he appreciates the enormous scientific demands our impending industrial and engergy developments will make on NZ researchers, and I know that he will be working for as large a portion of the budget pie as he can get.

Not that science has ever commanded a large percentage of total Government expenditure. As a scientist in politics, each year I dutifully prepare a 20-min burst on the science estimates for the debate, but, as the Opposition chose not to debate this topic, the notes invariably ended up in the waste bin.

Last year was an exception. The Opposition put up one speaker on the science vote but, unfortunately, the speaker dealt solely with the likely impact of the "chip" and so all the efforts of scientists throughout the country were largely ignored — again. The decade of the 80's in NZ, however, will, I am sure be the decade of science. On numerous occasions, the words "on the fringe of technology" or "at the very edge of our scientific knowledge" have been used in regard to Maui development. The methanol plant, petrol from methanol, petrol from coal, the list goes on. In the next decade I am sure that these will all be areas of major scientific endeavour.

Applied vs Basic Research

From time to time the question of the relative levels of support warranted by applied as compared to basic research arises. Lately, perhaps because it is budget preparation time, and because of NZ's current tight fiscal control, the topic has arisen on more than one occasion. I am one who firmly believes that the spin-off from much of the basic research effort fully justifies continued funding. Naturally, there are always those who feel that only research of an applied nature should be funded when finances are limited, so I was pleased to learn that about 50% of the Medical Research Council's support goes into the projects adopting the more fundamental approach. Perhaps a survey in some of the major Departmental employers of scientists would provide some equally interesting statistics.

"Agent Orange" And 245T

There seems to be widespread confusion in the press as to the effects of 245T and "Agent Orange" on humans and their offspring. Where the confusion appears to be worst is whether the two compounds are identical. It seems clear to me, from the small amount of detailed study I've conducted so far, that they are certainly not the same, that "Agent Orange" was some sort of herbicidal cocktail containing 245T and other chemicals, none of which were produced in NZ, and that locally produced 245T has a level of dioxin, the highly dangerous contaminant, much lower than the American product.

What this may mean therefore, is that the case against Agent Orange may ultimately be proven but that could not be interpreted as a conviction against locally produced 245T. I intend studying the matter further to determine whether I feel there is any case against our NZ produced weedkiller.

Growth Opportunities In NZ — The Document

Recently the Minister of National Development (W. F. Birch) released a rather unique document in which the future potential of this nation was outlined. What makes it unique is that it didn't arise out of a Commission of Enquiry, or as a result of a high powered departmental committee, or a seminar, but from a series of discussions between the Minister and Government members on the direction they thought the country could go. The task which now lies ahead of all interested New Zealanders is to grasp these opportunities and thereby assist in our future prosperity. In a way the document is very similar in concept to the French Government's "Strategy for Progress' and the Norwegian "Long-Term Programme 1978-81".

Books Reviewed

Received for review:
"Quantitative Analysis" by C. T. Kenner and K. W. Busch. "Introduction to Organic Chemistry" by A. Streitwieser and C. H. Heathcock. Both from MacMillan, supplied by Cassell Ltd., Auckland.

75 YEARS OF CHROMATOGRAPHY — A HISTORICAL DIALOGUE (JOURNAL OF CHROMATOGRAPHY LIBRARY v.17)

By L. S. Ettre and A. Zlatkis (Elsevier Scientific Publishing Co., Amsterdam, 1979) pp 502, hard cover

This volume, written in 1978 to mark the 75th anniversary of the description of chromatography by M. S. Tswett, has a somewhat inaccurate title. In contains nearly 1500 years of chromatographic expertise by 56 different authors whose individual articles range from the meticulously detailed to vague generalisations (do memories grow as dim as that?), brief to tedious, modest to blatantly self-congratulatory, but overall forming a fascinating pot-pourri of "behind-the-scenes" anecdotes on the evolution of a new scientific discipline.

Neither is this volume a dialogue in the strict sense. Thought-provoking, inspiring at times, amusing or highly dramatic (some authors are either immensely versatile or have missed their true calling), each short article reflects the author's character but it is left to the reader to judge and conclude without any further opportunity for interrogation. What a fascinating conference it would have been if all these authors could have been persuaded to present their recollections! This volume contains enough material for a dozen conversaziones. My one regret is that the editors did not see fit to re-publish a translation of Tswett's original work in this book and let that stand as his testimonial.

The sequence of articles is strictly alphabetical by author's name. A pity. A chronological sequence would have demonstrated more clearly the evolution of the need for chromatographic techniques. Whether it was for gas analysis, plant pigment identification, isotope separation or petroleum and lipid analysis, the cross-fertilisation of necessity and invention from such diverse fields as botany and biochemistry, human biology and medicine, physics and chemical engineering together with electronics produced the chromatographies that we now delineate as paper, column, thin layer, ion exchange, gas liquid and gas solid, and in turn their subsequent descendants of capillary gc, HPLC and HPTLC.

It is also intriguing to see how the initial concepts and early practices evolved largely in Europe and Britain and stayed there during the first half of this century, but when gas chromatography arrived on the scene (again principally from the same countries) American development and application kept pace right from the start. The power of modern communications! In fact this book leans heavily towards a 'history' of the evolution and development of gas chromatography and reflects the immense amount of pioneering work done by large chemical companies who needed better analytical methods for quality control in their plants. Biological applications came a very poor second! This trend is paralleled by the present day emphasis in the applications of HPLC. Pharmaceutical interests have been presented with the analytical answer to their problems, so inevitably the majority of instrumental developments and published work reflects their applications.

Despite numerous typographical errors, anyone who has used chromatographic techniques will find this book fascinating reading. An excellent source-book for "Mastermind" candidates! Where else would you learn how to gold plate brick dust; or that Synge worked at Ruakura in 1958; or that capillary gc was tried way back in 1954; the derivation of the name "Sephadex"; the function of Brockman dyes; that TLC was being used in 1939; who originated the use of syringes in gc; or that Golay stated that he had no confidence in capillary columns!

J.A. Zabkiewicz

J. A. Zabkiewicz is a scientist with the Tree Physiology Section, Forest Research Institute, Rotorua.

FUNDAMENTALS OF METALLIC CORROSION AND ITS PREVENTION

By L.H. Bulton and G. A. Wright Australasian Corrosion Assn; Auckland 1979. pp 31, $NZ3.50 plus postage.

If a person was spending 4% of his own income each year on something he regarded as undesirable, it is likely he would take steps to avoid whatever part of this expenditure he could. Yet when it comes to corrosion, it seems that nations all around the world, which finally comes down to people in their private and business capacities, ignore possibilities of avoidance of expenditure. The Hoar Report examined the cost of corrosion to the UK economy in 1969-70, and found that it cost 3.5% of the gross national product, of which about 23% should have been avoidable. A recent study by the National Bureau of Standards on the impact of corrosion in USA yielded values of 4.2% of GNP, of which 15% was avoidable expenditure.

It has been claimed at the ANZAAS Conference in Auckland, January 1979, by Dr A. J. Ellis that corrosion costs the NZ economy $50 million a year in avoidable expenditure. If the recent publication of a guide to corrosion and its prevention can help to save only a fraction of this sum, it will therefore have made a significant contribution to the NZ economy.

The authors state that their aim is to present principles of corrosion and its prevention at a Senior Secondary School student's level, with the hope that practising engineers and chemists would find it a useful introduction to the subject. The booklet is divided roughly into thirds, dealing with theoretical concepts, types of corrosion, and methods of prevention and case histories.

In a work of this length, it must always be possible for a reviewer to find areas where he feels more explanation might have helped. It is possible that parts of this booklet, especially sections on the double layer, Pourbaix diagrams, polarisation curves, and alloys, may not be sufficiently fully explained for some of its audience. The only technical point which I found on which the authors' approach might be questioned, is the use of E vs I rather than vs log 1 for labelling of polarisation diagram axes. The intended audience ought to be familiar with the concept of logarithms, and use of log 1 might have helped to emphasise the major effects that quite small changes in corrosion potential can cause.

These possible weak points are considerably outweighted by the strong points in my view. Every reader should be able to identify with the examples that the authors have chosen to illustrate their theoretical points. This is especially true when they examine the different types of corrosion as classified by Fontana, and when they discuss the screening of the metal from the electrolyte. In this respect, the booklet will perhaps be of greatest value to the practising engineer, architect or works chemist who wants a quick revision course in corrosion sitting on his shelf. At this price, however, it is to be hoped that teachers and lecturers will help it to find its way into the hands of pure and applied science students in large numbers, since everyone is affected by corrosion. A short bibliography lists most of the major reference works in the corrosion field for those who wish to explore further. As far as the practising engineer or materials scientist is concerned, the major omission is probably E. Rabald's "Corrosion Guide".

The overriding impression which emerges from this booklet is that the answers to corrosion problems are largely known already, if only the

The Fletcher Memorandum

In order to increase connection between officers of the Institute and members, the Editors have agreed to allow space for this column. Members are encouraged to respond to items appearing in it.

Council meets three times a year in May (to discuss general business) in August (to prepare for AGM and general business) and in November (to elect representatives and appointees). Because of the high cost of travel these meetings may be reduced to two per annum.

I found Energy Strategy '79 an interesting publication — a little short on alternatives for commerce and inspired thinking. It's available from the Government Printer.

"US Import Weekly" is the latest addition to the Bureau of National Affairs Inc. publications. Designed to be a single source for the basic facts on import law and policy, plus up-to-date information on current developments in legislation, regulatory, judicial and industry activities that affect US import policy, it should be of interest to NZ exporters. other BNA publications include; Chemical Regulation Reporter, Hazardous Materials Transportation, Water Pollution Control and 36 others! Available from BNA, 1231 25th Street, NW Washington DC 20037.

We have prepared two "Guidelines" pamphlets lately — one for Specialist Groups and the other for Annual Conference organisers. Copies are available from the Administrative Secretary.

We have suggested names to **Mr J. McLay**, Minister of Justice, for the members of the Commission of Enquiry into the A. A. Thomas case, and have made submission on two working party reports of the National Research Advisory Council viz "Research Contracts" and "Science Administration". Members may wish to comment on these papers individually as they are reasonably important documents. Copies available from me.

I would like to see some more entries for the Industrial Chemistry Prize (worth $200). Open to all industrial chemists who have "earned their salt." Details from **John Yolland**, Box 9001, Newmarket.

J. G. Fletcher

Books (Con't)

sufferer knew where to look or who to ask. It is to be hoped that the appearance of the booklet will alert its readers to this concept. Perhaps the advent of a clearing house, to put the people with problems in touch with the people who should have the answers, would be a suitable next step on the road to saving that avoidable 1% of the gross national product that NZ spends on corrosion.

J. R. Duncan.

Dr J. R. Duncan is with the Building Research Association of NZ.

C219 For further details, use Reader Service Card

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Yearbook Feedback Pleases Publishers

The publishers have been delighted with the feedback received directly and indirectly on the 1979 Chemistry Yearbook. We have been particularly grateful for the constructive comments received, both from readers and advertisers.

As a first-time venture, we realised there would be areas for improvement in subsequent editions and to ensure the 1980 edition incorporates as many improvements as possible, we shall be contacting selected readers and advertisers in the near future to obtain their comments and suggestions.

One of the earliest comments we received was a letter from NZIC General Secretary **Gavin Fletcher**, who described the publication as "a most satisfying and rewarding document", adding that he found the advertisements from a wide range of advertisers "particularly interesting".

Such comment is, of course, music to our ears and it is obvious that the publication has been well read because some errors and omissions were noted by eagle-eyed readers.

The most obvious omissions (in NZIC members' copies) were two sections from the membership lists, the result of a mechanical "hiccup" by our reproduction equipment. The two missing sections are reproduced here with our apologies to the members concerned for their apparent "banishment" from the NZIC!

Another misconception that requires clarification concerns entries relating to Warburton Franki Ltd. In the Yearbook's Services section (Page 19) this company is shown as a Systems Analyst and Systems Consultant.

This error occurred from our reading of the company's completed questionnaire. In fact, Warburton Franki Ltd., as we believe most readers would be aware, is a supplier to Analysts and Consultants. We apologise for the error and any inconvenience it may have caused. We also intend reconstructing our questionnaire to avoid any similar recurrence!

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PAGE, CAMPBELL THOMAS, BSC(HONS) PHD(CANTUAR), WOOL RESEARCH ORG. OF N.Z., PRIVATE BAG, CHRISTCHURCH. (SCIENTIST) M77.

PAGE, ROLAND FURNAND, AUCKLAND TECHNICAL INSTITUTE, WELLESLEY STREET, AUCKLAND 1. M59.

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Ontario Research: Contract Technology Is Its Business

Peter Reaves

Imagine an operation similar in concept to the DSIR's Industrial Development Divisions — but self-supporting and with a multi-million dollar annual turnover — and you may get an inkling of what the Ontario Research Foundation is all about.

Now in its 52nd year — it celebrated its golden jubilee in 1978 — Ontario Research is in the business of contract technology. Late last year, through the good offices of NZIC expatriate member **David Aston** (with Dearborn Chemicals Ltd., Mississauga, Ontario), I was able to visit the Foundation and briefly view some of its work.

The ORF, housed in a structure which dominates the Sheridan Park Research Community (which accommodates other private research organisations) is located at Mississauga, 17 miles from Toronto (and the site of the gas-leak scare late last year).

Its theme "Teamwork in Technology" reflects the Foundation's rational — a client with a problem can bring it to the ORF, whose staff will attempt to solve it, in conjunction with the client company's personnel.

That its 50th jubilee was marked, among other things, by the presentation of a plaque from the Canadian Manufacturers' Association and the Ontario Government, is indicative of its successful progress.

Its board of governors are drawn from provincial Government, private industry and universities; its activities are international, although the emphasis is on resolving Canadian problems.

Its operational brief ranges from energy to the environment, from materials to products and processes.

Operating departments cover applied chemistry, applied physics, engineering, environmental chemistry, glass and ceramics, industrial productivity services, materials chemistry, metallurgy, textiles, clothing and footwear.

So wide and diverse are the fields that it covers — and so integrated with private industry is it — that the ORF appears to be commonly used as an extension of private company resources for comparatively normal day-to-day checks — not just major problems.

Founded in 1928, the ORF was then a unique Canadian experiment designed to bring government support, industrial leadership and scientific imagination together to keep Ontario industry abreast of a massive scientific and technological revolution.

Funded initially by government and industry, it was to be — and has remained — independent of government in all major aspects. In its first year, with a staff of 10, its income was $C58,999; its 50th year income, with a 344-strong staff, was $C11,057,000!

ORF president, **W. R. Stadelman**, comments "While we are a not-for-profit contract research body, we have nevertheless produced a net income surplus in 34 of those first 50 years — despite the fact that we are in a business notoriously susceptible to market fluctuations, government policy shifts and unpredicatable variations in scientific ingenuity." In fact, only once have the Foundation's losses exceeded 4% of income — and that in its first year of operation.

Always a problem-solving resource for industry, the Foundation has developed many commercially viable new products and industrial processes since its inception. Not one year has passed without ORF adding to the registry of patents and inventions.

"Today" says Stadelmen, "our advanced equipment, ranging from our spectroscopy and electron microscopy laboratories to our pilot plant, has brought leadership not only in industrial creativity, but in scientific originality as well."

Ontario Research still views the needs of Canadian industry as its R & D focus, still sees adaptability and accurate prognosis of present and future scientific and technical trends as essential.

As it has done since 1928, the ORF will continue to focus its attention on tomorrow's industrial needs — and from my necessarilty brief view, its future looks assured.

Chemical Crossword

By Mike

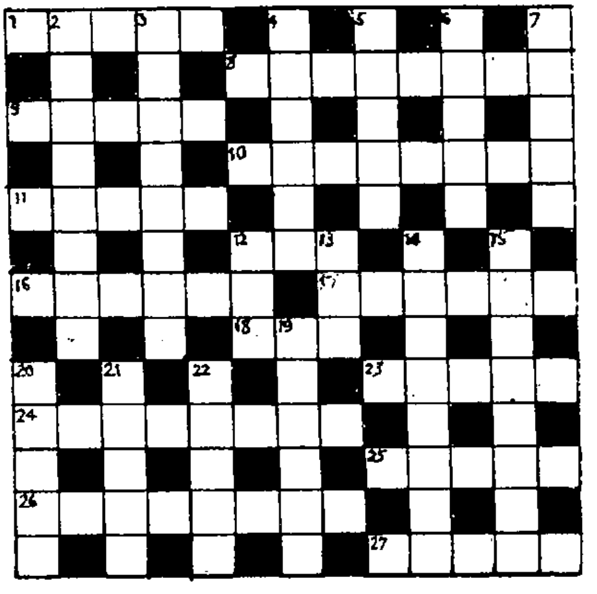
CLUES:

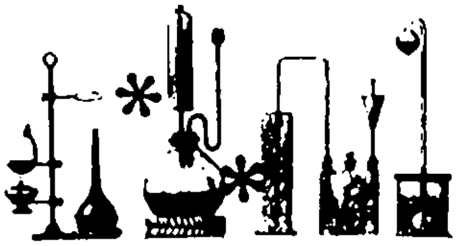
Across

1. e.g. 3, in some tall tales (5)
8. In which Lady Godiva lent two hands (8)
9. The holy man is not at home, perhaps drunk (broadly speaking) (5)
10. One in five products of development (8)
11. High pH computer language? (5)
12. Little red light (3)
16. Bring to accord-or eat nut perhaps (6)
17. Sometimes 22, never different (6)
18. Char (3)
23. e.g. 24 — of the elements (5)
24. Acid of occasional use (8)
25. An old-fashioned gas, — the town by the sound of it (5)
26. It's a confused matter to the Queen, a happy foursome! (8)
27. That is mad, is mad, as in peptide (5)

Down

2. Quotations from a soxhlet? (8)
3. U.S. 1, encountered in 1 (8)
4. Lacking concentration, less that 17 (6)
5. Nearly 600 ml about a coat (5)
6. — to end intentions? (5)
7. Canonized residue is hidden away (5)
12. Allowed following obstruction (3)
13. And its the stuff of life (3)
14. Life form of carbon chemistry? (8)
15. Two ways to go? No only one! (8)
19. Isomeric form caused by prime oriental chaos (6)
2]. Vessel in the vessel before the eyes of a chromatographer (5)
21. Teutonic filters? (5)
22. Biting concentration (5)

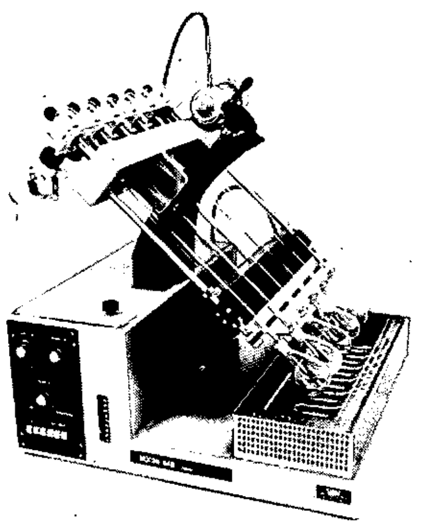




New Products, Services

DIGESTER DETERMINES TRACE ELEMENTS

The Buchi digesting system is said to set new standards in the determination of trace elements. By digesting organic and biological materials in a closed quartz apparatus, more exact results in the quantitative analyses of interesting elements can be achieved than is the case with conventional methods. The main ranges of application lie in the analyses of foodstuffs and feedstuffs, clinical-medicinal chemistry and the whole spectrum of ecology.



With the digester apparatus samples are tested exactly, quickly and reliably. The system is automatic and can be operated without problem by semi-skilled personnel. Digestion under total reflux in a closed system prevents foreign elements being carried in. The acid consumption is low.

The controls are well laid out and permit manual as well as automatic operation. The glass components of the 6 digestion points are interchangeable. The apparatus has 100ml flasks as standard equipment. On request, flasks of up to 250ml can be supplied.

With the Buchi digester apparatus 6 tests can be carried out simultaneously. Weighed samples of up to 30g can be used. The digesting temperature is freely selectable between 15 — 360°C.

C042. For further details, use Reader Service Card.

LIQUID CHROMATOGRAPHS

Introduced by Varian Instruments, the 5000 series is a "family" of powerful microcomputer-CRT-based liquid chromatographs which, the makers claim, make LC responsive and simple. The CRT displays all instrument conditions continuously.

The range comprises six basic models from simple isocratic to completely automatic gradient systems and can be expanded as required to add new capability.

A full support service is available from the NZ representatives, Selby-Wilton Scientific Ltd.

C044. For further details, use Reader Service Card.

RESISTIVITY MONITORING INSTRUMENTS

A new and wider line of realistically-priced monitoring instruments for measuring resistivity of pure and ultra-pure water was recently introduced by the Balsbaugh Centre, Foxboro Analytical.

Designated as Style B, 920 Series, the new line features a highly accurate monitor with dual-thermistor compensation to cover all ranges, and a built-in manual calibration check. The easy-to-read meter shows readout of resistivity in three ranges with accuracy within 2% full scale. The solid state construction is designed with two circuit boards connected by a flexible cable permitting monitor opening during operation for easy, unobstructed maintenance. Front-panel LED indicators show resistivity measurement above or below set point. Output of 0-10 volts drives chart recorder or similar device, and optional outputs are available for driving remote devices.

The wide variety of industrial-designed resistivity sensors features cell constants of 0.01. All cells are specially constructed of titanium, and are insulated and guarded to ensure highest accuracy.

Dual thermistors are incorporated in all twist-lock and conventional cell designs and a wide selection of mounting options, for every industrial use, is available.

Literature describing the instruments is available from the NZ representatives, W. Arthur Fisher Ltd.

C041 For further details, use Reader Service Card.

ANAC Forges Link With Waters

ANAC Ltd., Auckland, has been named sole NZ distributor of Waters Associates products following an agreement signed between the two companies last month.

Thus the Auckland company — formed by a group of Auckland University physicists in 1966 — joins a small, carefully selected group of organisations providing the service and support which has made Waters a world leader in HPLC.

The addition of the Waters franchise has necessitated the recruitment of extra staff by ANAC, which has also opened an Auckland sales office to cover all NZ sales.

Brian Selman will continue to manage the sales operation, while **Ian Hills,** formerly Waters NZ service engineer, is now customer support engineer and **Conway Bishop** is applications chemist. Office manager is **Gillian Nuttall.**

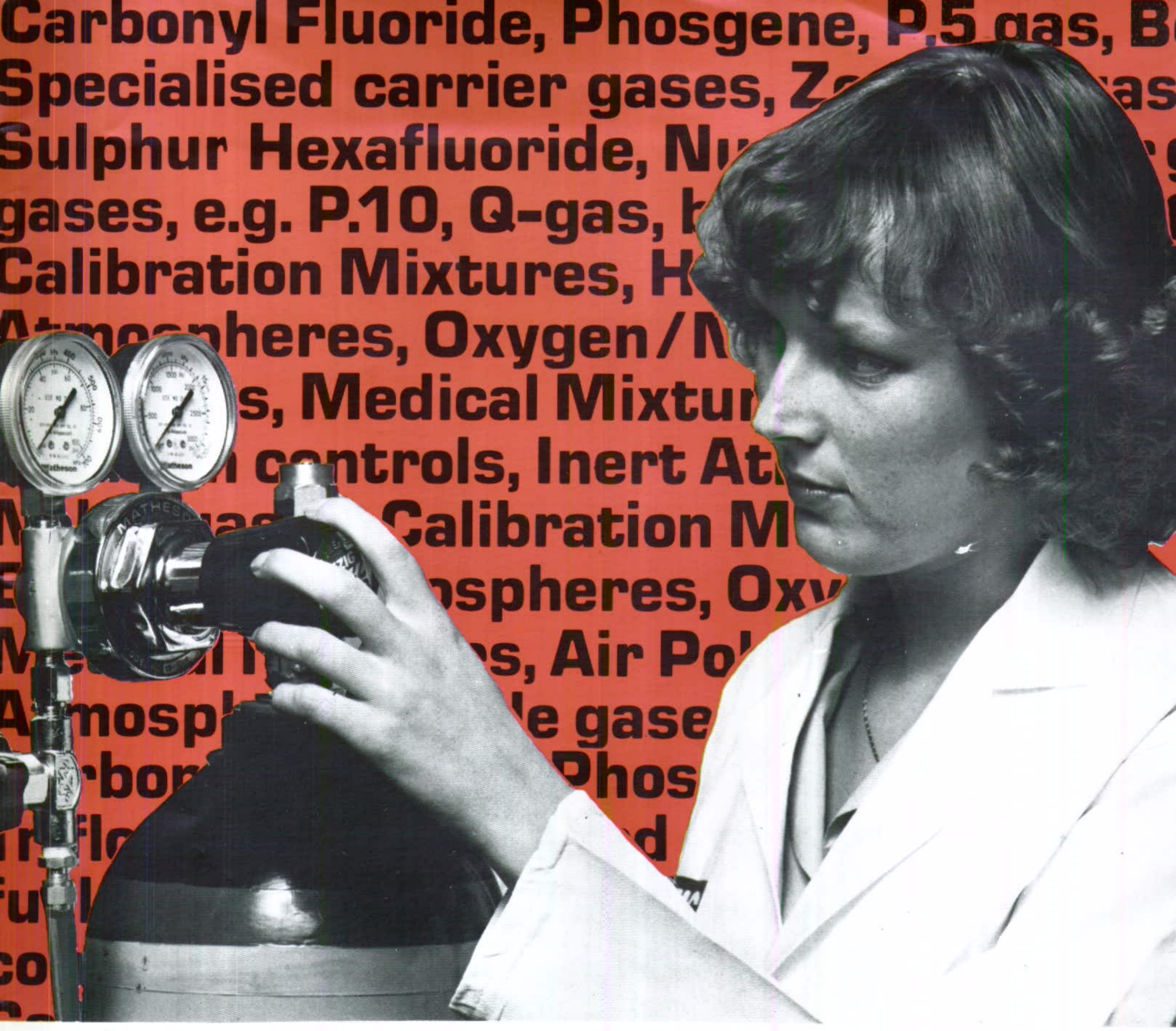
Close contact will be maintained between ANAC and Waters Associates (Australia) Pty Ltd through a co-ordination centre in Sydney.

ANAC currently employs 56 people, including 23 science graduates. Its half-year sales for the 1979/80 full year reached almost $1.5 million.

KMS Restructures

Kempthorne Medical Supplies has recently undergone further restructuring since being evolved from the merger of Kempthorne Prosser & Co. Ltd. and Medical Supplies NZ Ltd. just over 12 months ago. Kempthorne Medical Supplies Ltd will now be a separate company rather than a division of NZ Farmers' Fertilizer Co. Ltd. This has been done to better service the needs of its overseas principals and customers alike in the pharmaceutical, medical and scientific fields. The new company will be managed by **Mr. Bryan Mogridge,** previously the Scientific Dept Manager.

In the scientific area there has been rationalisation of products in the high technology area and the company is concentrating on providing service in the more general scientific lines. Product manager for these lines will be **Mr Paul Balchin,** previously Auckland sales manager.



Any Gas... Any Gas Mixture... Analysis to any Certified Accuracy

New Zealand Industrial Gases have got the lot!

By using the very latest gas technology for research and analysis, our analytical services laboratory can supply virtually any type of gas or gas mixture — and vary the purity to your exact requirements.

We'll also test your own samples to absolute certified accuracy, or to any degree you may require.

Equipment Our equipment includes mercury manometers, gas chromatographs, flame ionisation, thermal conductivity and ultrasonic detectors, Servomex oxygen analysers, Hersch oxygen meters, electrolytic water analysers, Beckman infra-red spectrophotometers. And the entire range of Matheson/International analytical and gas detection equipment as well.

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