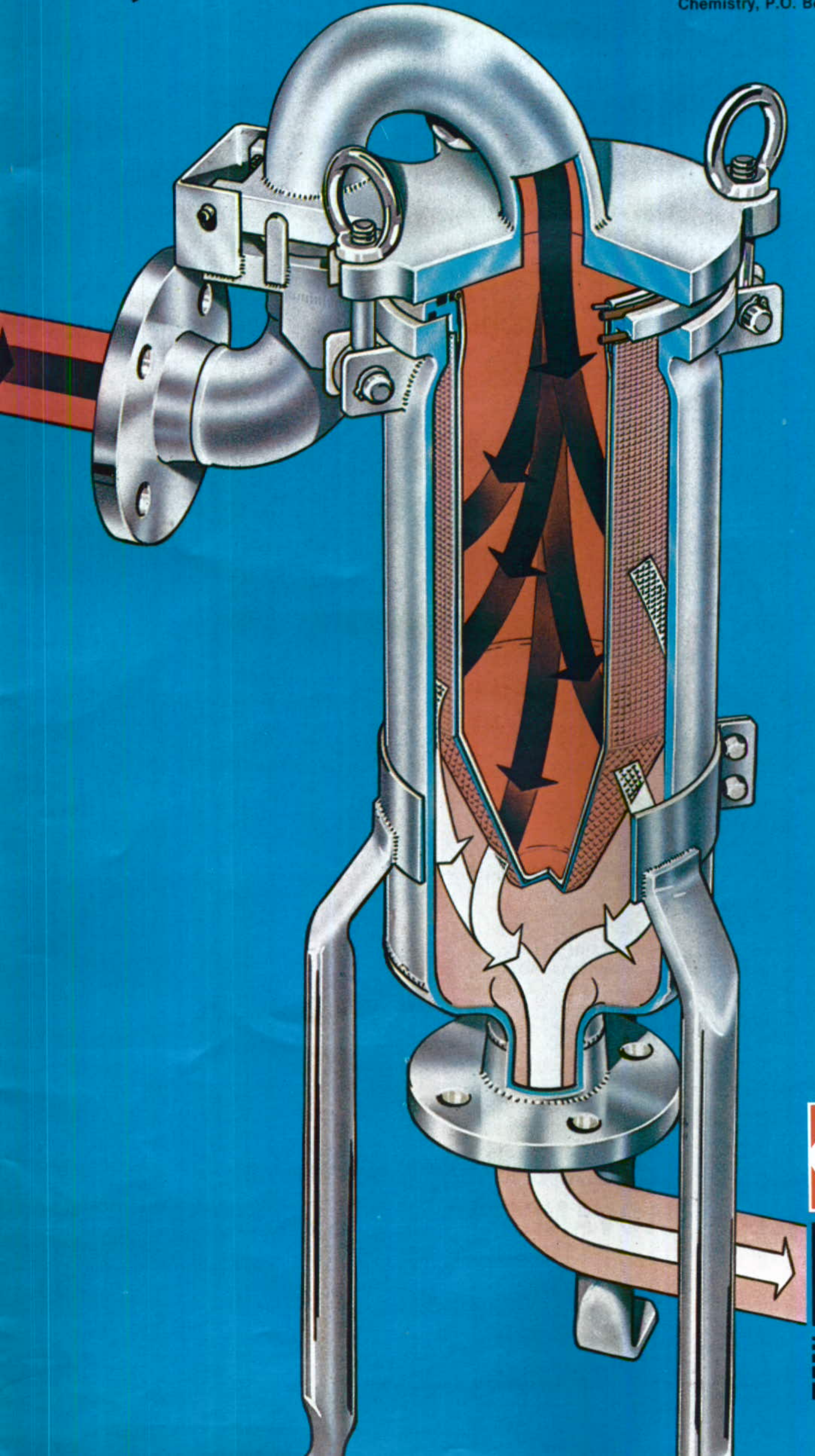
April 1981 Volume 45 No. 2

Chemistry in new zealand

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

50 yrs. of Teamwork in Chemistry

Inside: Jubilee Conference Guests; Identification, Measurement and Monitoring of Drugs; Magnetic Circular Dichroism; Mobil Process.

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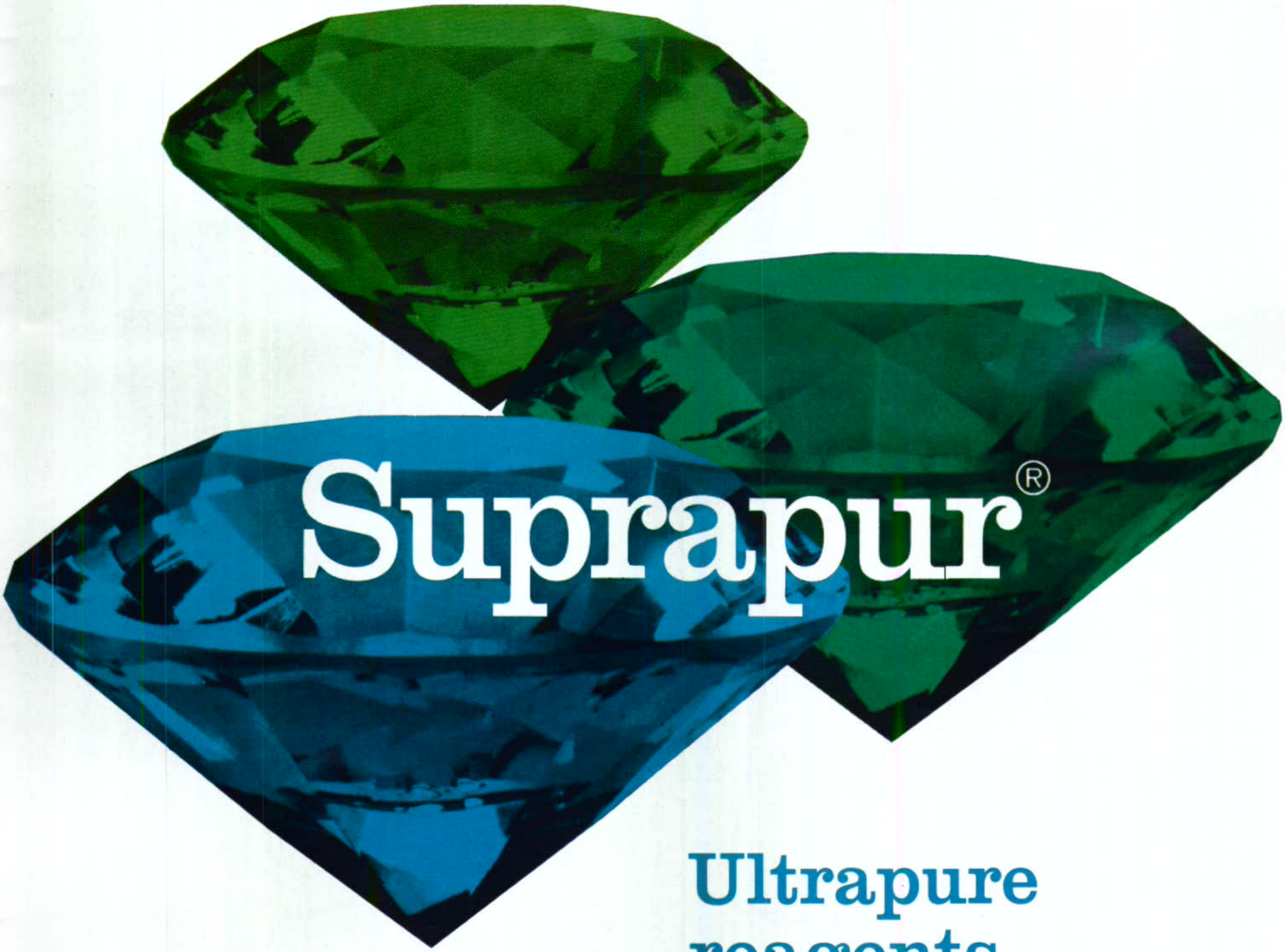
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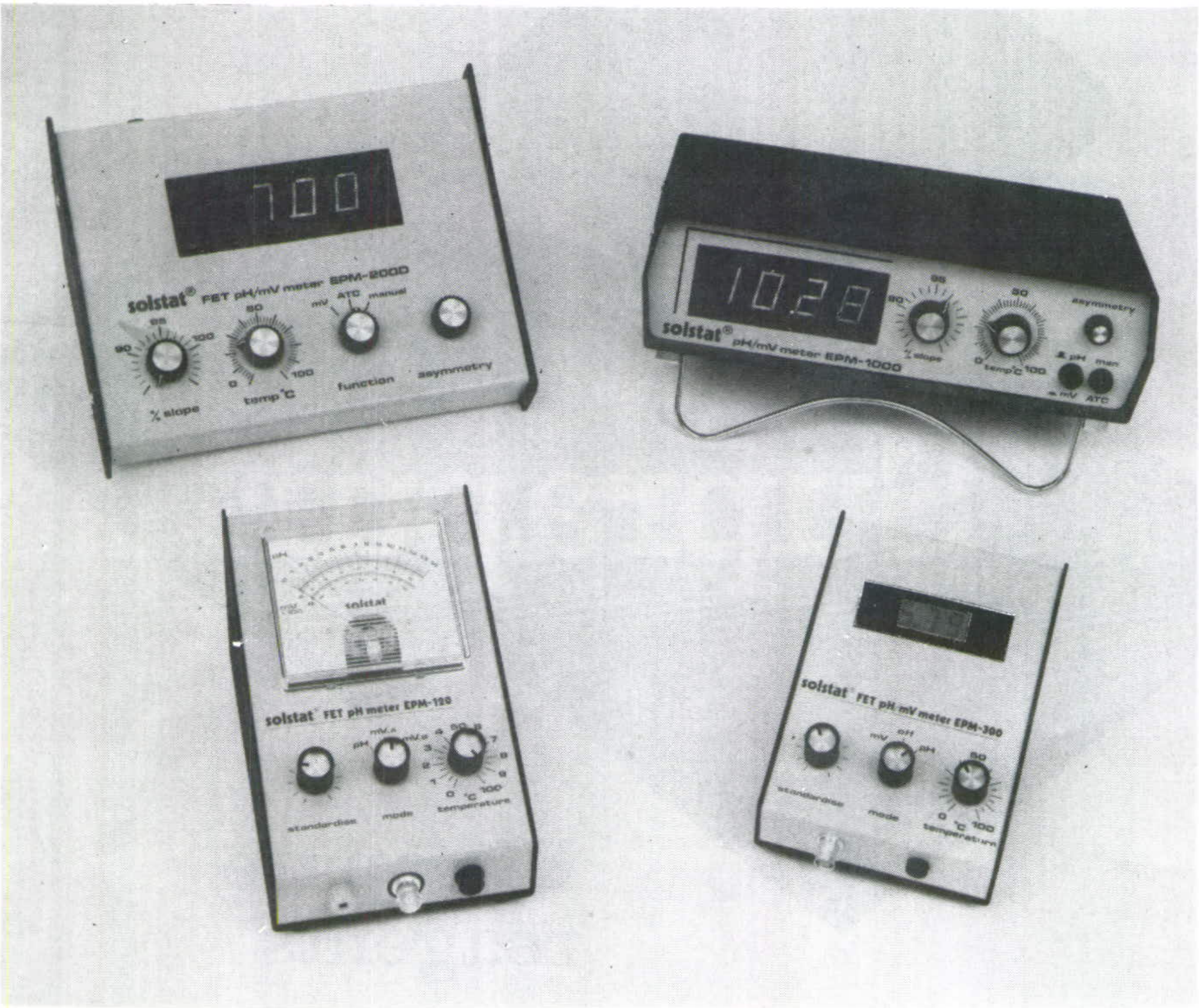
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Managing Editor: Peter Reaves
NZIC Editor: Stan Brooker, 6 Koraha St., Remuera, Auckland, 5.
Associate Editor: Dr Tony Herd, Auckland Technical Institute, Private Bag, Auckland.
Advertising Manager: Carl Roze, Phone Auckland 589-034.
Branch Editors:
Auckland: Norman Thom, Health Dept., Box 8944, Auckland.
Waikato: Dr Alistair Wilkins, Waikato University.
Manawatu: Dr Cecil Johnson, Applied Biochemistry, DSIR, Palmerston North.
Wellington: Dr Harry Percival, Soil Bureau, DSIR, Private Bag, Lower Hutt.
Canterbury: Dr Colin Freeman, University of Canterbury.
Otago: Dr Ian Weatherall, Textile Section, University of Otago, Box 56, Dunedin.

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Chemistry in new zealand
Official Journal of the New Zealand Institute of Chemistry

50 yrs of Teamwork in Chemistry

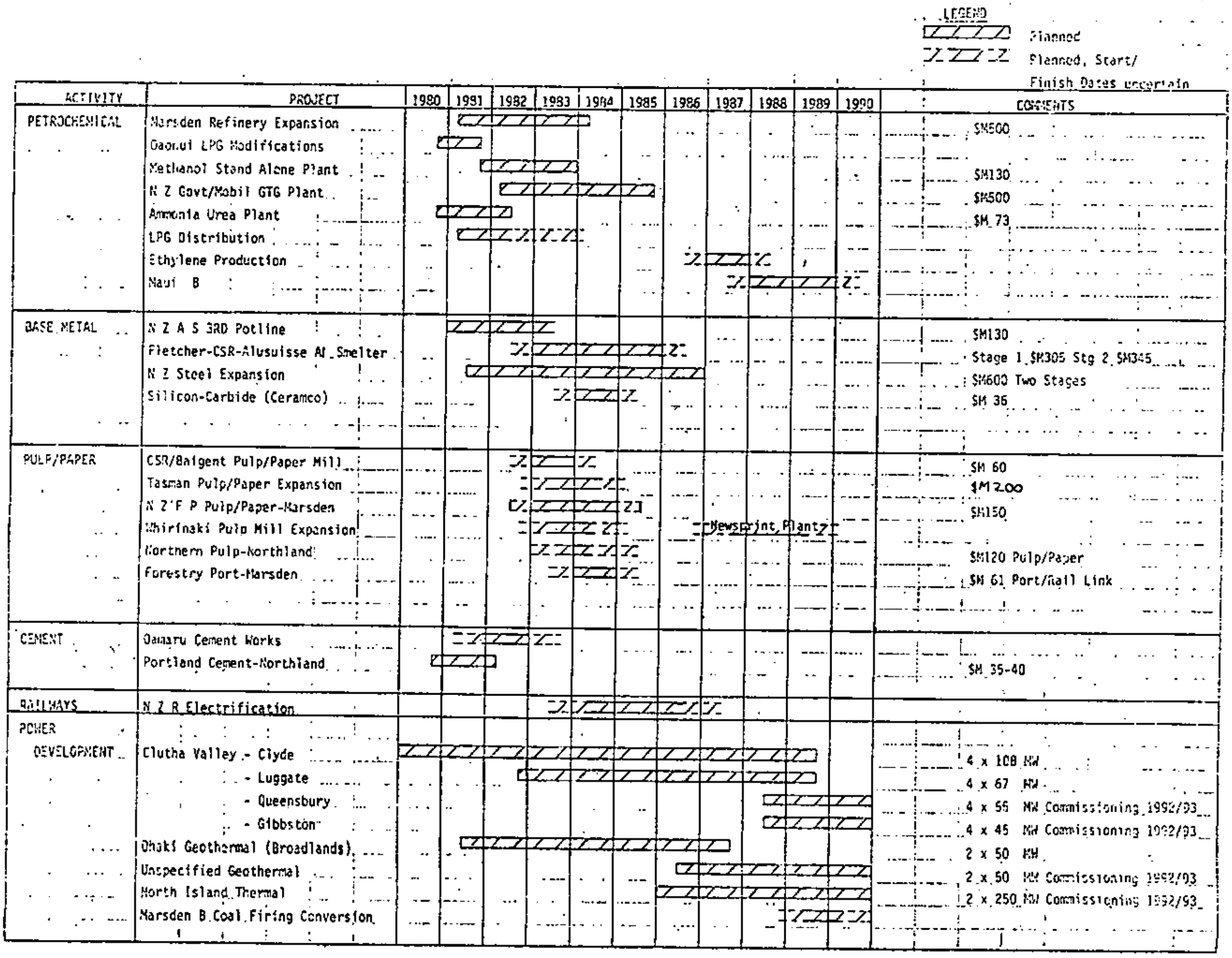
CONTENTS

Cover: Typical products for which GAF filter systems are being used include paints, pigments, vegetable oils, petroleum products, detergents, latexes, lacquers, printing inks, industrial coatings, adhesives, aerosol products, cleaning fluids, cutting fluids, plasticisers, plastisols, process water, polymer solutions, roller coatings etc.

STOP PRESS

Remember these dates!
APRIL 30: Closing date for NZIC prize applications.
MAY 15: Closing date for abstracts of papers for Jubilee Conference.
JUNE 30: Closing date for Conference registrations without incurring late fee.

Major Construction Projects In NZ — The Decade's Timetable



ACTIVITY	PROJECT	COMMENTS
PETROCHEMICAL	Marsden Refinery Expansion	$M500
	Oaonui LPG Modifications	
	Methanol Stand Alone Plant	$M130
	N Z Govt/Mobil GTG Plant	$M500
	Ammonia Urea Plant	$M 73
	LPG Distribution	
	Ethylene Production	
	Maui B	
BASE METAL	N Z A S 3RD Potline	$M130
	Fletcher-CSR-Alusuisse Al Smelter	Stage 1 $M305 Stg 2 $M345
	N Z Steel Expansion	$M600 Two Stages
	Silicon-Carbide (Ceramco)	$M 36
PULP/PAPER	CSR/Baigent Pulp/Paper Mill	$M 60
	Tasman Pulp/Paper Expansion	$M200
	N Z F P Pulp/Paper-Marsden	$M150
	Whirinaki Pulp Mill Expansion	
	Northern Pulp-Northland	$M120 Pulp/Paper
	Forestry Port-Marsden	$M 61 Port/Rail Link
CEMENT	Oamaru Cement Works	
	Portland Cement-Northland	$M 35-40
RAILWAYS	N Z R Electrification	
POWER DEVELOPMENT	Clutha Valley - Clyde	4 x 108 MW
	- Luggate	4 x 67 MW
	- Queensbury	4 x 55 MW Commissioning 1992/93
	- Gibbston	4 x 45 MW Commissioning 1992/93
	Ohaki Geothermal (Broadlands)	2 x 50 MW
	Unspecified Geothermal	2 x 50 MW Commissioning 1992/93
	North Island Thermal	2 x 250 MW Commissioning 1992/93
	Marsden B Coal Firing Conversion	

This table, supplied by the Heavy Engineering Research Association (HERA), sets out the broad timing of planned and proposed major construction projects in NZ over the next 10 years. The information shown generally has been obtained from published sources although, in some cases, it reflects HERA's own assessment of likely timing and duration. (HERA notes that there are obvious uncertainties with all projects and for this reason the information shown should be interpreted with caution).

Research Clears Schemes For Development

A growing number of researched scientific projects which may have the potential for commercial development have been uncovered by the Trade and Industry Department's Investment Unit.

In the first few weeks of a 6-month secondment to the unit from the DSIR, industrial chemist **Dr Kevin Fellows** has collated nearly a score of promising schemes which have been technically developed and could be interesting commercial prospects.

Most could be taken up by firms wishing to diversify from present activities and some could be directly incorporated into existing industrial production.

At least one of the discoveries is good news for recycling industries which are now becoming an essential and permanent part of commercial activity in NZ. A process developed to selectively dissolve and decolour plastics is expected to allow the recycling of up to 90% of all recoverable waste plastic.

Calcium silicate is a high temperature insulating material which can now be produced from geothermal water. Discharge water from the Wairakei geothermal power station could provide up to 50,000 tonnes of calcium silicate a year.

Pumice from selected areas can be screened and washed for use as an aggregate in lightweight concrete, in both pre-cast units and masonry blocks. Lightweight structural concrete can be made from expanded aggregates obtained from several low grade quarry materials normally rejected as waste. Pozzolan, which is used as a strengthening agent in structural concrete, can be similarly produced from low grade quarry materials.

The availability to NZ (in partnership with Australia) of 300 million tonnes of Christmas Island C grade phosphate makes a number of new processes attractive in the production of fertilizer and cattle feed supplements. Treating concentrated seawater with a derivative of the phosphate also produces pure industrial brine which is relatively expensive here. The brine could be used to make several products at present imported.

Large beds of kelp found off our coast contain good yields of alginates used in the preparation of foodstuffs. The processing technology is well established to refine at least 150 tonnes of alginates annually. This could carry an initial export value of $3 million with even greater potential as facilities for harvesting kelp were expanded.

A large resource of information has been compiled from analysis of tannins from NZ native plants used in tanning, dyeing, ink-making, and pharmaceutical industries. Advice is available on improving quality in the production of peppermint oil used in medicines and confectionery. Waste extracts from chemical pulp mills can be recovered for odourising natural gas, and thus replace compounds presently imported for this purpose.

There is an opportunity for a company to take over from the DSIR the work of calibrating and servicing the meters used for breath testing and the preparation of alcohol standards. With commercial development, many of these industrial projects could become overseas exchange earners for NZ, or replace imported materials, and also increase local employment prospects.

Guest Editorial

Dr Ian Shearer, recently appointed to the Science and Technology and Environment portfolios comments on ....

Opportunities For Development

I welcome this very early opportunity to indicate a little of my thinking on the contribution science and technology can make to the future of this country.

While acknowledging that major developments will provide an increasing amount of work for both scientists and the workforce generally, it is important to recognise that there are ample opportunities in what New Zealanders do best — innovative, adaptive and advanced development work at a small to medium scale. Clearly industrial development is essential particularly in relation to the energy security situation. Nonetheless, the composition of our workforce, its high educational standard and skills, indicate that the development of high technology industries at an entrepreneurial level has a considerable future.

The primary producing sectors are turning toward higher local added value in their products through the use of advanced science in industrial application. It is not difficult to foresee the potential for high technology developments on a manageable scale giving a very high added value to products through the use of skilled labour. This would, in turn, create an employment environment where skilled people would find a challenge and where training and research facilities would prosper.

Once expertise is achieved by basic research work and prototype testing, further opportunities are created in marketing, sales and product development. Thus while bigger industrial developments absorb large numbers of workers on single sites, high technology developments employ as many but over a wider area.

The demands of regional development can be easily met without adversely affecting pricing as the internal infrastructure can readily absorb the rapid movement of smaller, high value items. New Zealand's isolation from major markets would similarly be overcome if we led development rather than merely followed.

The challenge is obvious for the scientific practitioner. Science does not exist in a social vacuum. As we move towards industrial development the demands on technical and scientific expertise will increase. This will have a number of effects. The first is that the scope for innovation and research will expand.

The second is that the responsibility of scientists as members of society and not merely isolated researchers will be increased. The scientist has a responsibility to ensure that decisionmakers understand and absorb all relevant data produced. Increasingly they will be called upon to participate in the implementation of their work.

Decisionmakers in turn have a duty to ensure that they take the best possible advice. It is essential for all of us with a scientific background to take every opportunity to promote useful discussion on the contribution science can make.

KEEP IN TOUCH!

If you're changing your address or your job PLEASE LET US KNOW — in advance, if possible — to ensure your uninterrupted receipt of "Chemistry in New Zealand". Simply complete the coupon below and mail to:

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MEMBERSHIP OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Membership of the Institute enables you to attend meetings of the Branches, receive the Journal, newsletters, salary surveys, attend the Annual Conference and to keep in touch generally with the activities of Chemists in New Zealand.

Several grades of membership are available to all employed in the field of Chemistry.

For further details write to:

The Registrar, N.Z.I.C P.O. Box 1926, CHRISTCHURCH.

What's Happening

Seen in a research institute in France "If we knew what we were doing it wouldn't be research".

* * *

The Standards Association has approved the introduction of a standard system of **warning labels to be attached to hazardous substances,** based on the diamond labels and symbols in the codes of the United Nations.

* * *

New fuel discovered? The 'NZ Herald' of February 19 reported that after taking a siesta, the technicians involved in the refuelling of the latest space shuttle at Cape Canaveral were able to handle the delicate task of filling the shuttle's tanks with highly volatile liquid oxygen and **nitrogen.** It is perhaps not surprising that so far the press has not reported that the space vessel has got off the launching pad.

* * *

Back Issues of this Journal: There has been a reasonable response to our request for back issues of the Journal, but we are still short of numbers for 1979, and we particularly require those for the years 1973-1975 for binding. Any older members who have copies of the early years' issues from 1936 onwards can also help. Copies may be sent to our archives, **c/- Chemistry Dept., University of Canterbury,** or to **S.G. Brooker, Chemistry Dept., University of Auckand.**

* * *

The Commission for the Future has published its annual report which is available from the Government Printer (25¢), and it makes very interesting reading. The Commission has published a number of pamphlets and contributed to books which are in some cases available from their office in the **National Provident Fund Building, 1 The Terrace, Wellington (Box 5053),** or may be seen in public libraries. The report says that the Commission has been encouraged by the response to the NZ Futures Game which "is proving to be an excellent way of making young people aware that there are many different possibilities in NZ's future development ...". The Commission also puts out a newsletter; the latest number has an appropriate quotation from "Alice in Wonderland" to the effect that if you don't care where you are going, it doesn't much matter which way you go. Chemists can take some pride in the fact that **Prof. James Duncan** (Victoria University) is Chairman of the Commission.

* * *

The question as to whether chemists are mortal and/or morbid is being canvassed, both in the Royal Society of Chemistry in UK and by the Royal Australian Chemical Institute. The object of the surveys are related to their conditions of work. The report from the RACI says such an undertaking will be expensive, and we should imagine there could be difficulty in obtaining information on mortality from those who have experienced it.

Two new members recently appointed to the NZIC Editorial Committee are Norman Thom (left) and Lester Stonyer.

* * *

'Chemistry & Industry' reports that after a year's teething problems, **ICI's single sell protein plant** at Billingham is now producing large quantities of its product "Pruteen", an achievement which it claims puts it 5 years ahead of any competitor. The dry product contains 72% of crude protein and 8.5% fat. As a stock food it sells for rather less than the price for fishmeal.

* * *

A steering committee has been formed to initiate studies on the **composition of NZ foods** under the chairmanship of **Dr R.W. Bailey,** Applied Chemistry Division, DSIR, Palmerston North. At a preliminary meeting held in November the Committee decided to concentrate on a study of foods which are of particular interest to nutritionists. Dr Bailey will be interested to have comments from interested people and organisations.

* * *

The Mobil Synthetic fuel plan has come under fire from several sources, including the Gas Association, whose technical officer, **Mr D.J. Pearce,** claims that the $750 million cost of the plant would be better spent in converting half of NZ motor vehicles to CNG. **Mr Birch** has reacted strongly to much of this criticism, calling it "quite irresponsible".

* * *

In January a high powered delegation from the German **BASF** company visited NZ to check possibilities of taking part in the Maui gas development. The chairman of the group, **Prof. M. Seefelder** has emphasised that his company wants to contribute to our local technology and does not want to be seen as a multinational exploiting our riches and then leaving. The company has established a local subsidiary, **BASF New Zealand Ltd,** headquartered in Auckland.

Special Offer On Chemistry History Book

As part of the NZIC Golden Jubilee celebrations this year, Council is publishing — with the support of industry — a history of chemistry in NZ entitled "Chemistry in a Young Country", edited by Dr P.P. Williams, Chemistry Division, DSIR.

It contains contributions from over 30 senior chemists with specialist experience in different fields of chemistry and traces the development of chemistry in this country since 1850.

The 225-page hard cover book is expected to be available for distribution before the August Conference but, to assist with publication costs, a special pre-publication offer of $9.80 (a saving of $2.20 on the final price) is available to NZIC members.

To take advantage of this offer members should forward their order and remittance to the Registrar, NZIC, Box 1926, Christchurch. (Copies will also be available at the reduced price at the August Conference.)

Lost and Found Dept.

Our old friend **Mr W.G. (Mick) Hughson** has written to say that he is trying to **find** chapter and verse in the records as to why Mr Spackman's certificate was signed by Easterfield and Glendinning, while he complains, with justice, that his name has been **lost** from the list of Honorary Fellows in our last issue. Our apologies, Mick!

Old photographs: The Editor has a photo of the attendees at the 1945 Conference, which was an important one in the NZIC history, attracting about 100 delegates. He is now busy trying to identify people in it. Anyone who has a photo of interest that he or she is prepared to donate to the Institute, or to lend, is invited to send it to **S.G. Brooker, Chemistry Dept., University of Auckland.**

* * *

The International Union of Pure and Applied Chemistry (IUPAC) puts out two journals that our members could be interested in, one a useful newsy 'Chemistry International' ($US20 to individual subscribers) and 'Pure and Applied Chemistry'. For bulk orders which can be arranged through the **Registrar, NZIC, Box 1926, Christchurch,** these journals can be supplied at $US15 and $US70 if there is a minimum of 50 orders. The IUPAC publishes a number of other publications, including books on nomenclature of organic, inorganic and analytical chemistry. Details can be obtained from the Registrar or from **Prof. Stewart Rutledge, University of Auckland.** A recent issue of 'Pure and Applied Chemistry' contains the latest values for automic weights, and a complete review of the natural isotopic composition of the elements.

People

Mr Lester Stonyer has retired as production manager, Medical Division, ICI-Tasman Ltd., Upper Hutt, and is now living at Castor Bay, Auckland. Lester has written something of his professional life in an interesting article entitled "What is an Industrial Chemist?" (*Chemistry in NZ 42:* 108 (1978)). He was for some years the Institute's Employment Officer, and also Acting Editor for a short period. His hobbies include amateur dramatics, and restoring old houses — like the one he has bought at Castor Bay. He has joined the Editorial Committee of 'Chemistry in NZ'.

Mr M.M. McMillan has gone from Colour & Synthetics, Takapuna, to Kenogard NZ Ltd., Mairangi Bay. **Mr J.E. Jarmin** has transferred from being chemical officer at Meremere power station on the Waikato to take charge of the Operators' Training School, Bulls. **Mr T.M. Rowe** has left the Animal Science Group at Lincoln College and joined the staff of La Trobe Valley Hospital, Victoria. **Mr B.R. Clark** who has been teaching at Dunblane, Perthshire, Scotland, has returned to NZ, and is now at Taihape College. **Mr Alan Thawley** has been promoted to be Section Head at Beecham Pharmaceuticals, Essex, England. **Dr K.D. Rainsford** has gone from the University of Tasmania, Hobart, to the Lilly Research Centre, Windlesham, Surrey, England. **Mr Norman Thom,** Auckland Branch Editor, and Environmental Officer with the Dept. of Health has joined the Editoral Committee. **Dr Bill Denny** of the Editorial Committee, at present on leave at the University of California at San Diego, made a short visit to NZ in February-March, during which he spoke to the Waikato Branch on DNA synthesis, which is the subject of his research at San Diego. He also spoke on the subject at the University of Auckland. His period in USA ends in July.

Consequent on certain difficulties, chiefly financial, which have arisen at the Pottery and Ceramics Research Association, the Director, **Dr Harry Percival** (Wellington Branch Editor) and a number of other senior scientists have resigned. Harry is now with the Soil Bureau, DSIR, Wellington.

R.A. Robinson Memorial Lectureship: Prof. Robin Stokes, University of New England, NSW, and a pupil of the late **Prof. R.A. Robinson** while he was on the staff of the University of Auckland, has endowed a lectureship in honour of his mentor, to be given either by an overseas speaker in UK, or vice versa, one in every three to be delivered in Malaysia because of Prof. Robinson's association with the University there. Prof. Stokes is one of the plenary lecturers at the Jubilee Conference to be held in Auckland in August.

Richard Beyer who is completing a PhD in food chemistry in the Department of Nutrition at Otago University has been appointed Deputy Director, Australian Defence Department's Food Research Laboratories in Scottsdale, Tasmania. Richard came back to university 2 years ago to undertake postgraduate studies on rhizobial extracellular polysaccarides. He expects to take up his position in June.

Mr Eric Crooke has been appointed general manager, GAF (NZ) Ltd, Auckland, reprographics and chemical suppliers.

Mr Barrie Breach has been named Sales Engineer, Scientific Systems, for Northrop Instruments & Systems Ltd. He is based at Northrop's Wellington head office.

PROFESSIONAL SERVICES

PROFESSIONAL VACANCIES

UNIVERSITY OF QUEENSLAND

PROFESSOR OF INORGANIC CHEMISTRY

The University of Queensland invites applications for the Chair of Inorganic Chemistry which became vacant in December, 1980 with the retirement of Professor R.A. Plowman. Applicants should be able to present evidence of substantial research achievement in the field of Inorganic Chemistry. The successful applicant will be expected to demonstrate and encourage excellence in research, and will be given responsibilities by the Head of the Chemistry Department for undergraduate and postgraduate teaching in the Inorganic Section of the Department.

Salary: $A40,067 per annum.

Additional information and application forms are available from the Staff Officer, University of Queensland, St Lucia, Queensland, 4067. Applications, with the names of three referees, should be forwarded as soon as possible and must reach him by 30th April, 1981. The University reserves the right to fill any chair by invitation.

Ph.D. STUDENTSHIP AT UNIVERSITY OF CANTERBURY

Qualification: honours or equivalent in Biochemistry, Chemistry or Microbiology.

TOPIC: *A study of the protective action of water repellents on wood.*

The project is sponsored jointly by the NZ Forest Service and Ivon Watkins-Dow and the studentship will be at prevailing UGC rates (currently $4020/yr). The student will work in collaboration with staff of both the Chemistry and Forestry Departments, University of Canterbury. Provision is made for regular visits to the Forest Research Institute, Rotorua, and I.W.D., New Plymouth, to discuss and review the project.

The basic mechanisms by which water repellents (WR) protect wood from mild decay and stabilize it — avoiding movement caused by sorbed water — have not been examined in detail nor has much consideration been given to optimising formulations. Yet WR on their own or in conjunction with wood preservatives are used extensively for exterior joinery, wood based panel products etc. offering a clean durable stable product requiring minimal maintenance.

The Ph.D. programme will involve

— testing WR as a barrier to the sorption of liquid and vapour phases of water, and of water soluble chemicals (soil nutrients which may favour decay when inside the wood).

— an analysis of the distribution, penetration and fixation/stability within wood of various WR-preservative formulations after pressure impregnation or dip treatments. This will require the use of analytical techniques such as SEM, electron probe microanalysis, labelled isotopes, chromatography.

— development of treatment systems needing lower chemical loadings while giving adequate performance in service. IWD offers assistance in the preparation of promising formulations for trials.

For further details write to either:

Dr A Metcalfe,
Department of Chemistry,
University of Canterbury.

OR

Dr J. Walker,
School of Forestry,
University of Canterbury.

BRANCH NEWS

Manawatu

The February meeting took the form of an industrial visit "over the hill" to Mangatainoka. Calls were made to the Tui Co-operative Dairy Co. Ltd., to see the production of bulk cheddar cheese, (this factory also produces bulk colby cheese) to the DB Central Brewery Ltd to view the production of bottled beer. Thanks to the staff of both plants, in particular **Messrs L. Williams** (Tui) and **N. Gunn** (DB) for an informative and enjoyable visit.

The Golden Jubilee Branch dinner and the Presidential Address will be held at Wharerata, Massey University, on Tuesday May 25 at 5.30pm. A special effort will be made to encourage subsidized transport. As this will depend on the response, those wishing to attend this function should contact the Committee representative in their area.

Wellington

The Branch programme for 1981 began with an interesting and timely address in February from **Mr I.R.C. McDonald,** Director, Chemistry Division, DSIR and Dominion Analyst, on "Legal Certainty in an Uncertain World". Mr McDonald was directly involved in presenting evidence for DSIR at the recent Royal Commission on the Thomas case and he discussed the difficulties inherent in any attempt to reach legal certainty when the scientific facts are just not available to justify such conclusions and when the scientific examinations were made many years previously. In particular he examined many apparently contradictory features of the scientific evidence with particular reference to the headstamps identification of brass 0.22 cartridge cases.

Otago

Mr G.P. Speck (this year undertaking an Honours course in Chemistry) won the NZIC Otago Branch prize in 1980 for the best science student in first year chemistry at Otago University.

At the branch meeting on March 12 a talk was given by **Prof. H. Varenkamp,** University of Freiburg, who is visiting Professor in the Chemistry Department. The title of his address was "Freiburg, Germany: Chemistry, the University and the City".

Waikato Branch Chairman

Current chairman of the Waikato Branch, **Dr Roy Daniel** graduated B.Sc. (Hons) in Chemistry from Leicester University in 1965, and Ph.D. in Biochemistry in 1968. His Ph.D. research was in the field of bacterial respiration. He spent 6 months as a postdoctoral worker at the Agricultural Research Council's Unit for Nitrogen Fixation at the University of Sussex before moving to a fellowship at the Division of Plant Industry, CSIRO, Canberra where he worked on respiration and denitrification in nitrogen-fixing root nodule bacteria. In 1971 he took up a lectureship in the Department of Cell Biology at the University of Glasgow, and in 1975 moved to the School of Science at the University of Waikato, where he is Senior Lecturer in Biochemistry. Current research centres on rhizobial denitrification and on the properties and industrial uses of stable enzymes derived from extremely thermophilic bacteria. His work is supported by the Development Finance Corporation, Ministry of Agriculture and Fisheries, NZ Energy Research Development Committee, and the Lands and Survey Department. Wine biochemistry is a peripheral research interest.

Dr Daniel is married with 2 children; he and his wife run a small vineyard and have hopes of producing drinkable wines.

Branch Jubilee Celebrations Planned

To celebrate the NZIC's Golden Jubilee, Branches are planning a variety of events. Here are some which have been organised.

Manawatu:

The Manawatu Branch will be holding its Golden Jubilee dinner in conjunction with the Branch's Presidential Address on May 25. This will be a major function for members from Taranaki to Hawkes Bay to celebrate. Depending on the response of members outside the Manawatu, transport will be provided to this function.

Three public Jubilee meetings are being planned for presentation during the year as part of the Branch's sponsored lectures to senior school pupils. The first of these meetings will be held on April 7, when the speaker will be **Prof. David Cullwick** (Professor of Marketing, Department of Business Administration, Victoria University) who will speak on "Our Chemical Future". Prof. Cullwick has recently completed a market survey on potential world markets for the NZ chemical industry. His comments should be well worth hearing.

The second lecture will be held on July 21, and will be concerned with "The Chemical Profession". A number of members employed in a variety of occupations will be asked to speak on aspects of their day-to-day work. For the third lecture, **Dr E. Baker** (Department of Chemistry, Biochemistry and Biophysics, Massey University) will discuss Protein Models at an October meeting. The screening of the NZIC Jubilee film and an outline of the history of the Institute are planned for this meeting. Further details of these meetings will soon be circulated to members.

Wellington

Main focus of the Branch activity will be the week of May 11-15 during which the Presidential address will be given (Wednesday May 13). This will be a dinner meeting and the evening before there will be an advertising supplement about the NZIC in the "Evening Post", Wellington. Other press releases during that week are also possible. Static displays obtained from DSIR Chemistry Division will be sited in several libraries and banks, etc, during this special week.

Other visits and activities will take place at various times throughout 1981. These are:

- Talks to schools — visits to colleges in the Wellington area by members of the NZIC to give talks on subjects of broad general interest.
- Careers symposia — one for school pupils (March) and one for students at Victoria University (July).
- Jubilee Dinner — a special branch dinner in July with a proven after-dinner speaker.
- Static display at the Wellington Science Fair in August — particularly to advertise student membership grade.
- Films of chemical interest — these have been obtained from the British Consulate and will probably be shown during the year at the Shell and BP Theatrettes in Wellington.

Canterbury

Canterbury Branch plans to celebrate the Institute's Golden Jubilee June 22-26. While the programme has yet to be completed, the NZIC President will speak at a dinner on Monday, June 22. **Dr McEwan** will describe the Voyager 1 encounter with Saturn under the heading "Chemistry in Action" on June 24 and an open day will be held at Lincoln College and WRONZ on June 26.

The regional secondary schools' science fair has been organised to coincide with the week.

Polymer Materials Science Course

An intensive 3-day course — "An introduction to Polymer Materials Science" — is to be held by the Polymer Division, RACI, in Melbourne, July 27-29. Main speaker will be **Prof. Derek Hull,** Liverpool University, supported by a team of specialist lecturers from Australian industry and universities. Further details are available from **Dr G.B. Guise, CSIRO, Division of Textile Industry, Box 21, Belmont, Victoria, 3216 Australia.**

University News

Auckland
Chemistry Department

Prof. Brian Davis attended a symposium on Organic Synthesis, February 15-18, at the Research School of Chemistry, Australian National University, Canberra. The meeting was held to mark the retirement of the foundation Dean, **Prof. Arthur Birch**; his successor is an Auckland Graduate — **Prof. Lew Mander.**

Associate-Prof. G.A. Wright writing from Southampton where he is on study leave until May, mentions a recent success of the surface-enhanced Ramau technique in detecting the mode of water molecule absorption on metal surfaces.

Dr Bruce Pound a Research Officer in the Chemistry Department, is studying the corrosion and film formation on iron and steels in contact with geothermal fluids. Of particular interest is the ingress of hydrogen into ferrous alloys under these conditions. This work, which is supported by the NZ Energy Research and Development Committee, is being carried out in collaboration with **Associate Prof. G.A. Wright** and **Dr R.M. Sharp.**

Miss Kathlyn Ronaldson has joined the staff of the Chemistry Department as a temporary junior lecturer. Miss Ronaldson has just completed her course for the Ph.D. degree at Waikato University. She is the daughter of **John Ronaldson,** a well-known figure in the Institute and in the Agricultural Research Centre, Ruakura. Miss Ronaldson will be teaching in the Radiochemistry Laboratory and in the Geothermal Institute, and she has joined **Prof. A. Odell's** group working on Tritium NMR.

Massey

Department of Chemistry,
Biochemistry and Biophysics

Prof. Geof. N. Malcolm and **Dr Ian D. Watson** attended the 2nd Australian Thermodynamics Conference, sponsored by the Royal Australian Chemical Institute, at Melbourne University in February. Dr Watson presented the paper "Heats of Solution of Dipeptides" to the Conference. Prof. Malcolm recently returned to NZ from a year's sabbatical leave in the Department of Physical Biochemistry at the Australian National University in Canberra.

Mr Alan S. Craig, a well known electron microscopist in Applied Biochemistry Division, DSIR, and now doing a PhD with **Dr David A.D. Parry,** recently attended the 2nd Congress of the Federation of Asian and Oceanian Biochemists in Bangalore, India. Mr Craig was awarded a travel grant (one of five awarded) by the FAOB. He presented a paper entitled "Development of Collagen Fibrils in Connective Tissue" to the Congress.

Approval has been granted for the building of a fourth Science Tower. A tender for this building will be accepted soon.

Dr Roger W. Purchas, Sheep Husbandry Department, will be spending a year's sabbatical leave at Michigan State University, in the Department of Dairy Science.

Otago
Chemistry Department

Dave Fenby recently attended the 2nd RACI Thermodynamics Conference in Australia. **Jim McQuillan** has also been in Australia. He has been at the University of NSW doing research with the Laser Raman Spectroscopy facilities there.

Biochemistry Department

Clive Trotman has transferred from the Microbiology Department to take up a position in Biochemistry. **Janet Carrington** has returned from study leave spent at the Department of Biological Science of the University of ASton, Birmingham, UK. **Kevin Farnden** has returned after a year's study in Canberra.

Wellington Polytechnic

Messrs Ross Fletcher and **Peter Wilson** of Chemistry Division and ex-students of Wellington Polytechnic have received A G East Scholarships from the Polytechnic to enable them to further their studies and work experiences in the UK.

Dr Gail Irwin has been promoted to Senior Tutor.

BRANZ

The Director, **Dr Peter Foster** attended the CIB (International Council for Building Research) Conference in Oslo, Norway.

Dr Foster also attended the DESBRO (Directors of English Speaking Building Research Organisations) meeting, and the annual conference of the European Industrial Research Management Association. The theme of this conference was "Communication". Dr Foster also visited several building research-related organisations in Europe and North America.

Dr John Duncan will be working in the Department of Metallurgy and Materials Science at University of Nottingham for about six months from March. He will be using electron spectroscopy (ESCA), to study galvanised steel surfaces and the effects of different production and environmental variables. He has stood down as Chairman, Wellington Division, Australasian Corrosion Association. John has held this position since the inauguration of the Division in May 1977. However, while in Europe, he will act as NZ delegate to the International Corrosion Council meeting to be held during the 8th International Congress on Metallic Corrosion in Mainz, Germany, in September. He will give a paper on corrosion of metals embedded in timber to a session of the Congress.

Dr Hugh Baber spoke at a meeting of the Wellington section of the Oil and Colour Chemists Association (OCCA). The meeting was held at BRANZ and entitled "Fire Retardant Paints". It covered the work done at BRANZ on the performance of fire retardant paints applied to existing coated surfaces.

Dr Rob Whitney gave a paper to the NZ Statistical Association Annual Conference. The paper title was "Roof Paints on Galvanised Steel — Weathering Trials", and discussed the details of the weathering trials, concentrating on the experimental design and statistical analysis of the results.

Readers' Letters

Chemists' Employment In NZ.

The Editor,
Sir,

Discussion of the employment of chemists in NZ is difficult because such a high proportion of B.Sc. graduates go on to higher degrees and statistics for their ultimate employment are sparse. Recently this department made an effort to discover the present appointment of all those who had graduated M.Sc. or D.Phil. since its inauguration. I present these figures as they may be of general interest.

Of 54 M.Sc. graduates, 28 went on to further study. Of 29 D.Phil. graduates, 6 went on to Research Fellowships or the like. The majority of the remaining 49 found employment either in teaching (29%), with public bodies (37%), or in industry (20%); 8 of these 49 appointments were overseas (which includes overseas students returning home). Fuller details are given in the table.

Prof. K.M. Mackay,
Department of Chemistry,
University of Waikato.

	D.Phil.	**M.Sc.**
Teaching Appointment		
University	1	-
Technical Inst.	2	-
School	1	7
Overseas	1	2
Public Body		
Government	9	5
Research Assocn.	1	1
Others	1	1
Industry		
NZ	1	4
Overseas	4	1
Further Study (a)		
NZ	3	24 (b)
Overseas	3	4
Others	2	5 (c)

(a) Including Research Fellowships
(b) 12 completed doctorates (10 Waikato included in Col. 2), 10 current D.Phil., 2 current M.Phil.
(c) Including 3 not using chemistry directly (e.g. farming) and 2 unknown.

News From Govt. Departments

DSIR

Applied Chemistry Division

Mr Murray T. Fisher has been appointed to lead the Division's Analytical Services Group. Mr Fisher has had wide experience working in clinical laboratories in NZ, USA and England and has recently been teaching at Greymouth High School.

A fire recently destroyed a gas chromatography room at the Lincoln substation. The fire was thought to have been caused by an explosion of ether vapour, which had escaped from a small container in a refrigerator. The ether vapour was believed to have been ignited by the operation of an internal thermostat. This incident highlights the danger of storing inflammable volatile liquids in household refrigerators.

Chemistry Division

Mr Stephen Bloor, a graduate from Massey University recently joined the Forensic Section to work on blood grouping studies.

Dr D. Sheppard, Geothermal Chemistry Section, is visiting the Azores for 2 months to carry out geothermal studies.

New equipment purchased by Chemistry Division includes a Quadrupole mass spectrometer in Inorganic Materials, a plasma torch for the AA laboratory and thin layer gel electrofocusing equipment in the Forensic Section.

Soil Bureau

Dr Harry Percival, current Wellington Branch Editor, has joined the Chemistry and Mineralogy section of the Bureau, following his recent resignation as Director of PACRA. He will be working in the general field of weathering and soil solutions.

Upwards of 50 Soil Bureau staff attended the "Soils with Variable Charge" Conference held at Massey University, February 11-18. Soils with variable charge are those with mineral surfaces having both positively and negatively charged sites. They include the Oxisols or Ferralsols of the tropical regions, Andepts or Andosols which are particularly widespread in the volcanically-active circum-Pacific region, and the Spodosols or Podzols of the cooler forested regions. These soils are important for food production in many countries, particularly in the tropics.

This was an international soil science conference of major significance held under the auspices of the NZ Society of Soil Science and the Royal Society of NZ. There were some 300 participants (about 200 from overseas) from about 30 countries. All NZIC members at the Soil Bureau attended the Conference and most were involved in the organisation and running of the Conference and/or the presentation of papers. An excellent programme began with a review of current knowledge on soils with variable charge (based on a book produced prior to the Conference and edited by **Dr B.K.G. Theng**) and continued with two major (consecutive) sessions; one on new information on the characterisation of such soils and the other on new developments in classification, management and transfer of information for such soils. For each session, a limited number of oral papers were supplemented by poster sessions and discussion groups. Meetings of international soil science committees and of special interest groups were also held during the Conference.

Popular features were the running of pre-, mid-, and post-conference tours throughout various areas of NZ to illustrate many of the matters discussed at the Conference, and the social activities arranged on the Massey University campus for each evening of the Conference. Part of the reason for holding the Conference was to celebrate the 50th Anniversary of the Soil Bureau. The great success of the Conference did this most effectively.

NZ Dairy Research Institute

Dr Kevin R. Marshall recently visited Japan with a Dairy Board technical mission for discussions with users of NZ dairy produce.

Invermay

Prince Charles will visit the Invermay Agricultural Research Centre when he is in Otago in April. He will be looking at projects in animal nutrition and the hill farm facilities.

The Rogers Report

The Institute is indebted to **Dr W.E. Harvey** not only for 22 years' service — secretarial and presidential — but also for representing Council on the Executive Committee for Science of the TCA and more recently AAVA.

In 1970 Ted was appointed representative of this Committee on the Technicians' Certification Authority and in 1972 elected deputy chairman of what is now the Authority for Advanced Vocational Awards.

Mr E.W. Mills, AAVA's chairman, has said that Dr Harvey made an outstanding contribution to both the Science Executive and the Authority. Renowned for incisiveness and his clear view of solutions to problems, Ted was always available by telephone to assist with the decisions of the Authority.

In April **Mr Walter Freitag,** who has deputised for Dr Harvey in 1980, will become Council's representative on AAVA's Committee for Science as in 1968 Ted succeeded **Prof. Alan Odell,** currently chairman of the Auckland Branch for the third time.

* * *

Duncan McLennan, the Conference Secretary, requires abstracts by May 15 for publication in the June issue of "Chemistry in New Zealand". Delegates must remember to bring this with them to the Jubilee Conference, August 23-28.

Registration forms should reach members towards the end of March. Included will be an offer, at a pre-publication price of $9.80, of a Jubilee book (about 250 pages), compiled under the editorship of **Dr Peter Williams,** Chemistry Division, DSIR, describing the development of Chemistry in this country.

ICI NZ Ltd has contributed $2500 towards its cost.

* * *

Dr Ian Shearer, newly appointed Minister of Science and Technology and Minister for the Environment, has accepted **President Ellis's** invitation to lunch with Council of the Institute on April 2.

Dr Shearer is a graduate of Massey University, M. Agr. Sc., and of Nottingham University, Ph.D. From 1967-1975 as a scientist at Ruakura he studied the reproductive physiology of pigs.

* * *

Members will be concerned about payment of their increased subscriptions: $36 for Fellows and Members; $26 for Associates and $18 for Graduate Members — all reducible by $4 if paid by August 31.

These rates are still considerably less than those of the NZ Institution of Engineers ($92 for Fellows and Members, $40 for Graduates, 25 years and under) of the Australian Institute of Mining and Metallurgy ($A50 for Members and $A40 for Associate Members) and of the American Institute of Mining, Metallurgical and Petroleum Engineers ($US50 for Members).

Recruitment of new members is one way in which each of us can assist in maintaining subscriptions at current levels and developing the services they allow.

A draft of the rule changes required to establish a student grade of membership is to be considered by Council in April, notified to members in the June issue of "Chemistry in New Zealand" and approved by Council in August 1981.

* * *

"Setting the Standard" is the caption of an article about the labels which must be used for the transport of hazardous substances by road, rail, air and sea in the January/February 1981 issue of "Standards".

The NZIC Hazardous Chemicals Committee, chairman **Arthur Kennett,** assisted in the preparation of this Standard: NZS5417:1980 and colour wall poster of the labels.

Guest Speakers At Jubilee Conference

Six eminent chemists — from UK, USA and Australia — will deliver plenary lectures at the Golden Jubilee Conference. Biographical details follow (those pertaining to Prof. A.J. Parker appeared in our last issue).

Prof. Sir Geoffrey Allen FRS

Geoffrey Allen was born in Clay Cross, Derbyshire, in 1928 and attended Clay Cross, Tupton Hall Grammar School. After graduating in Chemistry at the University of Leeds in 1949, he obtained a Ph.D degree for thermodynamic studies of solutions. From 1952-54 he was a post-doctoral fellow working on Raman spectroscopy at the National Research Council in Ottawa, Canada, and in 1954 he returned to an appointment in the Chemistry Department of Manchester University. In 1965 he was appointed Professor of Chemical Physics at Manchester.

After Manchester, in collaboration with **Geoffrey Gee,** he established his main research interest in the field of polymer science. From 1969-73 he was director of an ICI/Manchester University Joint Laboratory working, on new polymeric materials, and from 1970-74 he was seconded half-time to the ICI Corporate Laboratory at Runcorn.

In 1975 Prof. Allen moved to Imperial College to be Professor of Chemical Technology in the Department of Chemical Engineering and Chemical Technology. He was elected a Fellow of the Royal Society in 1976.

Prof. Allen has consulted for 10 different companies and served on the Chemistry, Neutron Beam, Polymer Science, and Materials Science, and Technology Committees of the Science Research Council, becoming Chairman of its Engineering Board in 1976.

He became Chairman of the Science Research Council in October 1977 on a 4-year secondment from Imperial College. He was knighted in the Queen's Birthday Honours 1979.

Prof. Sir Geoffrey Badger

Sir Geoffrey Badger graduated M.Sc. with first class honours in Organic Chemistry from Melbourne University in 1938 and then went to the UK where he obtained the Ph.D. from the University of London (1941) and the D.Sc. from Glasgow University (1949).

He returned to Australia in 1949 to accept a position as Senior Lecturer in the University of Adelaide and became Reader (1951) and Professor of Organic Chemistry (1955). He resigned in 1964 to become a Member of the Executive of CSIRO; but at the end of 1965 he was encouraged to return to Adelaide to become Deputy Vice-Chancellor. He was appointed Vice-Chancellor in March 1967 and completed a 10-year term in March 1977. He then became Research Professor of Organic Chemistry in the University of Adelaide.

Sir Geoffrey's research has been concentrated in the field of chemical carcinogens, polycyclic aromatic hydrocarbons and heterocyclic compounds. He is the author or joint author of more than 200 papers and several books.

Allen

Badger

Cadogan

Weisz

He has been elected to a number of scientific bodies. He is a Fellow of the Royal Institute of Chemistry (1949), a Fellow of the Royal Australian Chemical Institute (1952), a Fellow of the Australian Academy of Science (1962), and a Fellow of the Australian Academy of Technological Sciences (1978). He is also a Fellow of the Australian College of Education (1969) and a Fellow of the Australian Institute of Management. He received the H.G. Smith Medal of the Royal Australian Chemical Institute in 1951, was Liversidge Lecturer for the Royal Society of New South Wales in 1956 and the ANZAAS Liversidge Lecturer in 1958. He was Abbott Lecturer in 1964, R.K. Murphy Lecturer in 1965 and received the A.E. Leighton Medal of the Royal Australian Chemical Institute in 1971 and the W.D. Chapman Memorial Lecture and Medal of the Institute of Engineers in 1974.

He was appointed an Officer of the Order of Australia (AO) in 1975 and a Knight Bachelor in 1979.

Sir Geoffrey has contributed in many ways to science in Australia. He served as a member of the South Australian Committee of the Royal Australian Chemical Institute for several years and was South Australian Chairman in 1957. He was President of the Institute in 1964. He has similarly served as a member of the Council of the Australian Academy of Science (1964-67), as Secretary (Physical Sciences) (1968-72) and as President (1974-78). He has served as President of ANZAAS (1979-80) and presided at the 50th Congress in Adelaide.

He retired from his Chair towards the end of 1979 to spend more time on his other activities.

Prof. J.I.G. Cadogan, FRS

Prof. John Cadogan, Chief Scientist, The British Petroleum Co. Ltd., was appointed to his present post in August 1969. Before this he was Forbes Professor of Organic Chemistry in the University of Edinburgh (1969-1979) and previously Purdie Professor of Chemistry in the University of St Andrews (1963-1969). He has published some 180 papers, mainly in mainstream organic chemistry, including organophosphorus chemistry, reactive intermediates, heterocyclic synthesis and reaction mechanisms.

He is a Meldola Medallist of the Royal Institute of Chemistry, a Corday Morgan Prizewinner and Tilden Lecturer of the Chemical Society, and was elected FRS in 1976.

He is visiting Professor at Imperial College, London and at University College of Swansea.

He is the nominee of the Council of the Royal Society of Chemistry for President-Elect 1981.

Prof. Brian S. Hartley

Prof. Hartley graduated as a chemist from Cambridge in 1947. After 2 years in the Royal Navy, he did research on organo-phosphorus insecticides in Leeds, graduating with a Ph.D. in 1952. This work led him to an interest in serine proteases, which he pursued over 20 years in Cambridge at the levels of mechanism, sequence and structure. In the course of this work he pioneered many new techniques of protein chemistry for which he was awarded the B.D.H. Medal for Analytical Biochemistry. He was elected a Fellow of Trinity College, Cambridge, in 1964 and a Fellow of the Royal Society in 1971.

In the 1970's his interest turned to enzyme evolution, first of the serine proteases, then of aminoacyl-tRNA synthetases and then of enzymes of microbial pentitol metabolism, which he has used in a system for experimental enzyme evolution.

In 1974 he succeeded **Sir Ernst Chain** as Head of the Biochemistry Department at Imperial College, building up strength there in protein chemistry, genetic engineering and neurochemistry. His own interests turned to genetic engineering in analysing the structure of the pentitol operons and in applying the techniques to industrial problems. He is a member of the Scientific Board of Biogen S.A. and was appointed Head of a new Centre for Biotechnology at Imperial College in 1980.

Dr Paul B. Weisz

Dr. Weisz is Manager, Central Research Division, Mobil Research and Development Corporation, Princeton, New Jersey.

He holds a BS degree from Auburn University in Physics, and an ScD degree from the Swiss Federal Institute of Technology (Zurich) in Chemical Technology.

For his research discoveries in the field of catalysis, he has been honoured by the E.V. Murphree and Leo Friend Awards of the American Chemical Society, the Chemical Pioneer Award of the American Institute of Chemists, and the R.H. Wilhelm Award of the American Institute of Chemical Engineers. In 1977 he was elected to the US National Academy of Engineering, and in 1980 received an Honorary Doctorate from the Swiss Federal Institute of Technology.

His interdisciplinary career began in radiation physics and has taken him through electronics, chemistry, catalysis, industrial processing, to energy technology. He has published some 115 papers, and holds about 70 US patents.

Len Spackman . . . A Profile

The inaugural meeting which formed the NZ Institute of Chemistry was held in Auckland in February 1931 under the chairmanship of **Prof. Easterfield.** Present in that senior gathering was a 28-year-old who was already quite a veteran in the field of analytical chemistry, having been employed in 1917 by the late **Mr A.J. Parker.** Today, 63 years after his original entry into the analytical profession, and 50 years after the formation of the Institute, of which he was a foundation member, he is still in practice in his chosen field of public analytical chemistry. The name, **Leonard Storkey Spackman**, is known throughout this country as the doyen of the Institute, probably the last surviving member of the inaugural meeting.

Prior to this time, the Auckland Chemical Society had been formed and Len Spackman had been a constant attender. The Auckland branch of the NZ Institute of Chemistry was also formed in 1931 and the members of the first committee, so far as Mr Spackman can remember, were **Prof. Worley** as Chairman and **Messrs Parker, Fielder, Parr, Griffin, Dr Andrews** with Len Spackman as the first secretary and treasurer. At the outset it was envisaged that the Institute would become a professional body similar to other professional institutions, whereby anyone wishing to practise in the profession was required to become a member and for this reason it was important that all persons engaged in the professional practice of chemistry should become members of the Institute. Mr Spackman set about persuading as many members as possible to join the Institute and it was on this basis that the Institute got away to a good start with a wide range of members throughout the profession. Len Spackman served as secretary and treasurer until 1939 and later, upon the death of **Mr Percy Parr**, he became Auckland Branch auditor, an office he held until 1978. It is only over recent years that his attendance at branch meetings has not been so frequent; for many years, too, **Mrs Spackman** was a familiar visitor at the branch meetings.

Mr Spackman worked for Mr Parker until 1933 when he left and set up in practice as a public analyst. His interests were very wide indeed, covering analytical and industrial chemistry, formulation and development of various new products, research into the kauri gum industry and a very basic study of the town milk industry. He became a very competent microbiologist, well ahead of his time in many of his techniques and thinking.

He was involved in the casein industry as a co-author of the NZ Standard, "Methods of Analysis", and was for many years employed as consultant to the Auckland Metropolitan Milk Board. His list of appointments as consultant and adviser is far too extensive to include here; suffice it to say that for many years his name was synonymous with the analytical chemical industry in Auckland.

Mr Spackman's interests, both as a hobby and on a commercial basis, extended beyond the field of chemistry. As a schoolboy in 1917 he started experimental work in the new field of "wireless telegraphy" as it was known, building firstly receivers and shortly after this branched into the development of radio transmitters. In 1921, radio transmission was licensed by the NZ Post Office and Mr Spackman was the third person to apply for an amateur transmitting licence in Auckland and the second to be granted a licence. He has been "on the air" ever since and his call sign ZL 1AC is known all over the world. During the 1920s, Len Spackman was "working" other hams in North and South America and Japan with a transmitter of about 10 watts output. All transmission in those days was by Morse key and he was known to have a clean and accurate "fist". Initially, these transmitters were powered with homemade batteries which could be charged off the mains (it was all DC in those days, of course) and subsequently he built more powerful units with rectified power supplies as the vacuum tube developed. Mr Spackman still operates a radio station, but today it is all transistorized, with single sideband transmission and reception, high gain aerials, and all the sophisticated electronic equipment which has been developed over the last half-century.

His interest in electronics went beyond that of amateur radio. As soon as the "Panatrope" (the precursor of the modern electromagnetic pickup) was developed, he went into business in public address systems. With his brother-in-law, **Mr Howarth**, he registered S-H Sound Systems Ltd and built up a modular system of public address equipment which was in use at public gatherings, raceways, Easter Shows etc. As more and more powerful valves became available, and as the push-pull amplifier was developed, so Mr Spackman kept up with the developments. Initially, the tubes were all triodes but as the pentode became available — and with it the higher amplification factors and high gain — so the equipment became more sophisticated.

His interest in the public address arena led them to the recording studio and he built up a most sophisticated recording studio in Auckland.

For many years this company, Sound Recordings Ltd., made records principally for the broadcasting industry, and many local artists and speakers visited the studios, and were first introduced to New Zealanders per medium of this recording company.

All these other activities were spare time or hobby interests and Mr Spackman operated his public analytical practice on more than a full-time basis.

It was during this time that he employed various assistants, one of them a **Mr George Page** who later achieved fame in the development of the atomic bomb during the war at Oak Ridge. In 1941, Mr Spackman employed **Jim Sprott** as a trainee analytical chemist and Mr Spackman is now part of the combined practice of T.J. Sprott & Associates.

His interest in the agricultural industry and town milk industry in particular, led him to become a farmer and he and Mrs Spackman purchased a farm in upper Wairewa, some 270 acres which they progressively brought into greater production. There they set about breeding dairy cattle, and supplying butter fat to the local Kaipara Dairy Co., and specialized in breeding high quality large white pigs.

It seems difficult to believe, taking into account all the diverse interests mentioned above, that Mr Spackman could have time for other hobbies but one has been a consuming interest — fly-fishing for trout. For some 30 years he has fished virtually every river and stream in the northern part of NZ, combining the hobby of a trout fisherman with the environmental interest of a scientist vitally interested in inland waterways. Mr Spackman knows the lakes and rivers of many parts of the country "like the back of his hand" and this knowledge is of very great value when he comes to advise on the preservation of inland waterways and the treatment of effluents.

Mr and Mrs Spackman have one son, **Irving**, who followed the tradition of science particularly in the field of electronics. Irving (ZL 1MO) is also a radio ham of long standing with interests in VHF transmissions.

In summary therefore, we have in our midst one who has devoted his whole life to science, involving a working life of more than 63 years in the practice of analytical chemistry, and we are fortunate indeed to have still working in the industry, one of the original founders of the NZ Institute of Chemistry.

T.J. Sprott

He is an Editor of "Advances in Catalysis", and a columnist for "Chemtech". He has served as Visiting Professor, and as a member of the Advisory Boards of the Chemical Engineering Department, and the School of Engineering & Applied Science at Princeton University, and as Chairman of the Center for Catalytic Science and technology at the University of Delaware.

The October 1980 issue of "Chemistry in Britain", a journal of the Royal Society of Chemistry, contains articles on Good Laboratory Practice, Buying Laboratory Equipment, Grinding Precious Materials and Hints for Lecturers which are of wide interest.

The Hints for Lecturers state the rules for preparation of slides and overhead projector transparencies.

Fixed-Bed Process For The Conversion Of Methanol To Gasoline

Wooyoung Lee, Manager, Reforming and Special Process Development
Sergei Yurchak, Associate Engineer
Nick Daviduk, Senior Associate Engineer
John Maziuk, Manager, Synthetic Fuels
Mobil Research and Development Corporation
Paulsboro, New Jersey

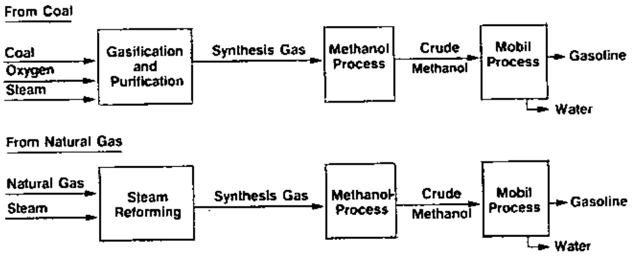
Introduction

Since Mobil announced the invention of the methanol to gasoline (MTG) process[1] in 1976, significant progress has been made in its development. This paper reviews the highlights of the development and potential commercial applications.

The MTG process converts methanol to high octane gasoline. Since methanol can be made from either coal or natural gas by commercially proven technology, the Mobil process provides the final link in a new route to high octane gasoline from non-petroleum sources (Fig. 1). This is the first new route in 40 years for the production of premium transportation fuels from coal. It is estimated to be cheaper than the only coal liquefaction process in commercial use today, the SASOL's Fischer-Tropsch Process[2].

Figure 1

MOBIL METHANOL-TO-GASOLINE ROUTE



The gasoline product is 93 research octane, unleaded, and chemically similar to gasoline made from crude.oil. It contains no detectable sulphur, nitrogen, or other impurities. Its in-vehicle performance exceeds that of unleaded gasoline sold in USA.

At the Conference on Energy Resources held last May by the Manawatu Branch, Mr R.W.L. Makeig, Mobil's Planning, Supply and Joint Interests Director, spoke on "A Fixed-Bed Process for the Conversion of Methanol to Gasoline". His address was based on this paper, given earlier in the year at the Annual Meeting of the National Petroleum Refiners Association at New Orleans. To conform with oil industry usage, temperatures throughout are °F, and most other units are non-metric. Some other terms which may require explanation are:

B/D	*Barrel/day (= units of 159 litre/day)*
BPSD	*Barrel/stream day*
Btu/lb	*British thermal unit/pound = 2.32 J/kg*
DCF	*Discounted cash flow*
DME	*Dimethyl ether*
FC	*Flow control*
FRC	*Flow recorder control*
PI	*Pressure indicator*
psig	*Pound/square inch gas*
R+O	*Research octane*
RON	*Research octane number*
RVP	*Reid vapour pressure*
WHSV	*Weight hourly space velocity*

More recently, the NZ government has selected the Mobil Process as the most desirable route for the synthetic fuels complex that will provide about one-third of the country's gasoline requirements. The 13,000 B/D MTG facility associated with two 2200 tones/day methanol plants in a single complex will convert a portion of the natural gas from the Maui off-shore gas field. Assuming that the business arrangements are successfully concluded, it will be the first commerical application of the process when it comes on stream in the mid-1980s.

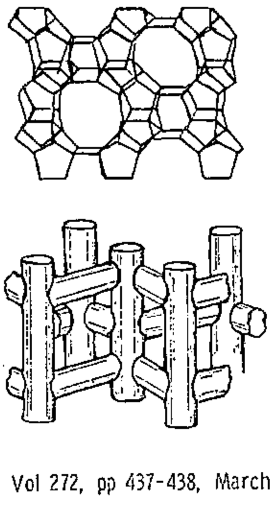
Basis of Mobil's Discovery

Mobil has been developing and commercialising zeolite (crystalline aluminosilicate) cracking catalysts since the 1950s. Currently, more than 95% of all US petroleum cracking installations use these catalysts, which are based on wide-pore faujasite zeolites. We have learned to direct the selectivity of these catalysts by varying the geometry of their cavities and channel dimensions. Thus the concept of "molecular engineering" in catalyst design was born. Cracking catalysts, which must handle molecules with a spectrum of structures and molecular weights (as high as 400 and more), are based on the use of faujasite with channels 9 to 10 Å in diameter. On the other hand, a commercial process (Selectoforming), developed to process only linear paraffins, utilises shape-selective zeolites with pore diameters of only about 5 Å.

The key element in the MTG process is a new, synthetic, ZSM-5 Class zeolite which was discovered in our continuing search for better catalysts for petroleum processing. The new zeolite was found to have a unique channel structure, distinctly different from the familiar wide-pore faujasite and the narrow-pore zeolites. It is selectively penetrated by molecules of intermediate size. In the course of exploring the potential of this catalyst, we found it could convert oxygenated compounds, like methanol, into high octane gasoline.

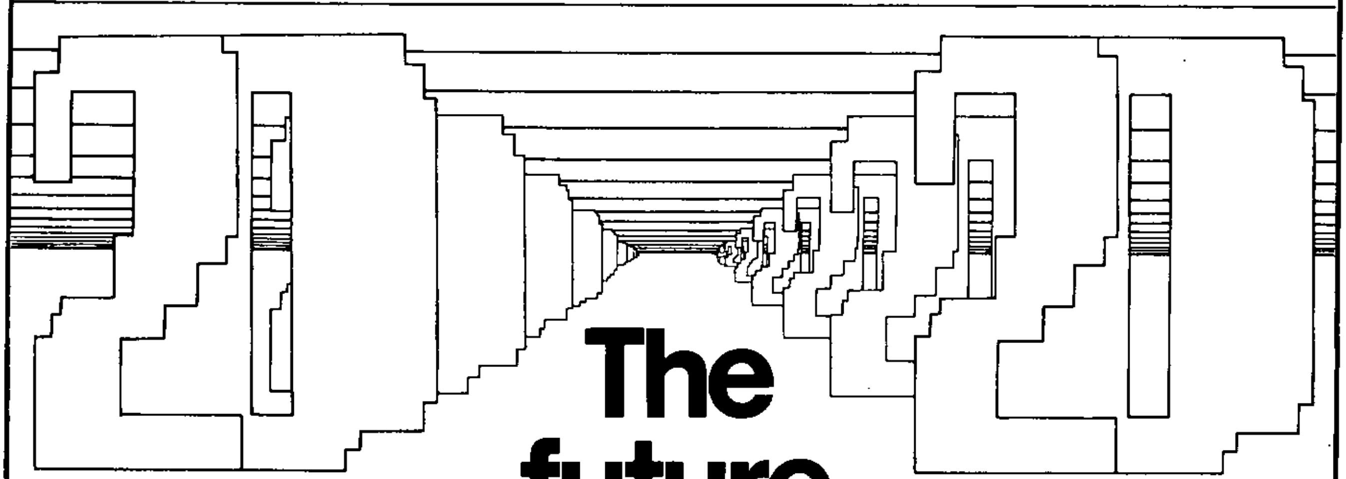
Figure 2

ZSM-5 STRUCTURE



"Nature" Vol 272, pp 437-438, March 30, 1978

The structure of the ZSM-5 class catalyst is shown[3] in Fig. 2. The lines represent oxygen atoms in a siliceous framework. It contains a novel configuration of linked tetrahedra consisting of 8 five-membered rings. These



The future starts now: a 2020 vision

In 20 years, the 20th century will have ended. New Zealanders, like people all over the world, will assess the most remarkable period of fundamental change in the whole of recorded history. The change will have been so profound as to affect the whole spectrum of human experience.

We sincerely believe that Government's agreement in principle to proceed with the Mobil Methanol-to-Gasoline (MTG) process, using Maui gas as feedstock will stand out as an historic landmark in a century of landmarks. And we're proud of our involvement with the Government in planning the project.

New Zealand has reached a turning point on the road to a brighter energy future. But what will that future be like?

Let's take the year 2020 as a focal point. Where will New Zealand get its energy 40 years from now? How will New Zealanders use it?

Crude oil will still be important in 2020. The last few years have seen great advances in oil exploration and recovery techniques, including the use of space satellites to make exploration more fruitful. Drilling and lifting technology has come a long way too. The development of deep-sea platforms, for example, has allowed the production of oil from waters so deep as to be inaccessible in earlier days.

But the need for conservation and wise management will be even greater than it is today. Because oil does remain a finite resource.

And what goes for oil can also be said for the other fossil fuels, such as gas and coal. Unrenewable resources? Of course. But enough remains to make them a most important source of energy in 2020. Which is not to say these fossil fuels won't be used in new ways.

Mobil is already involved in a proposed partnership with Government and others to synthesise petrol from Maui natural gas, and in the U.S., the Government recently decided to budget $20 billion for a comprehensive synthetic fuels development programme. The future of synthetic fuels is extremely bright, and New Zealand is in the forefront of its application.

By 2020, New Zealand will be reaping the benefits of a variety of energy resources. Together with synthesised gasoline, other fuels such as methanol, liquified petroleum gas and compressed natural gas will power motor vehicles with engines markedly more fuel-efficient than today's models. And the Mobil process for converting methanol to petrol could one day even draw its feedstock from lignite coal, or perhaps from biomass, as well as from natural gas. Diesel fuel as well as petrol may be an end result of the process.

There are other options too.

Nuclear power may have assumed a greater role, through the environmentally clean principle of fusion.

And man may finally have learned how to create electricity from the sun on a meaningful scale, through the development of photovoltaic technology.

The sun, after all, beams enough energy at us in one hour to equal the amount the whole world uses in one year.

So prospects are as bright as they are varied. There will be ample fuel for transportation, commercial and private alike, and New Zealanders will continue to enjoy their personal freedom of mobility.

One thing more about 2020: You can rest assured that changes undreamed of today will continue to unfold. And that we'll be part of trying to harness those changes to produce a better standard of living for all.

Mobil

Mobil Process (Cont)

units join through edges to form chains and sheets, leading to the three dimensional structure in the figure. It contains two intersecting channels: elliptical 10-membered-ring straight channels and sinusoidal, tortuous channels.

The sizes of these channels are just wide enough to produce hydrocarbons boiling in the gasoline range. That is, the reaction product terminates at carbon number 10. This is the reason why the gasoline selectivity is so high in the MTG process.

This new family of zeolites has also found use in a number of other processes which take advantage of either its unique shape selectivity or its strongly acidic nature. Among these announced processes are the dewaxing of petroleum distillates, the manufacture of ethylbenzene from ethylene and benzene, the isomerization of xylenes, as well as the disproportionation of toluene to benzene and xylenes. From these various processes, much experience has been accumulated on the use of this class of novel zeolite in commercial operation.

Figure 3

CHEMISTRY OF METHANOL CONVERSION TO GASOLINE

Feed $\longrightarrow$ **Product**

$$nCH_3OH \longrightarrow (CH_2)_n + nH_2O$$

Methanol $\longrightarrow$ **Gasoline Fuel Gas + Water**

Material Balance: 100 Tons $\longrightarrow$ **44 Tons + 56 Tons**

Energy Balance: 100 BTU $\longrightarrow$ **95 Btu + 0 Btu**

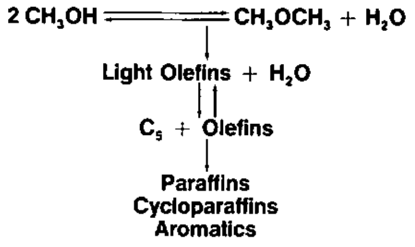
Chemistry Of Methanol Conversion

In the MTG process, methanol is essentially dehydrated, with gasoline and water as the principal products (Fig. 3).

For every 100 tons of methanol converted, 44 tons of hydrocarbons and 56 tons of water are formed. This is the stoichiometric yield. Approximately 85-90% of the hydrocarbon product is high quality gasoline. The energy balance is extremely favourable; 95% of the thermal energy of the methanol feed is preserved in the hydrocarbon product. Water, of course, has no thermal energy as a fuel and the remaining 5% goes off as heat of reaction. The overall energy efficiency of the MTG process including processing energy is also very high at 92-93%.

Figure 4

REACTION PATH



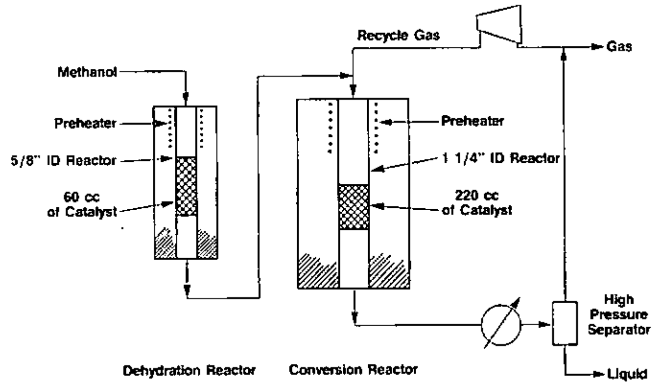
The chemistry of the MTG process is quite complex[4] and a simplified scheme is shown in Fig. 4. The initial step in the transformation is the reversible dehydration of methanol to dimethylether. These two oxygenates dehydrate further to give light olefins which in turn react to heavier olefins. Finally, the olefins rearrange to paraffins, cycloparaffins and aromatics. Almost no hydrocarbons are found higher than C_{10} due to the shape-selective nature of the zeolite. This is most convenient for gasoline manufacture since no subsequent distillation step to remove heavy ends is required.

Process Description

A major concern in the development of the MTG process was heat removal from the reactor. Conversion of methanol to gasoline is highly exothermic (about 750 Btu/lb of methanol converted) and the adiabatic temperature rise would be almost 1100° F. There are three typical reactor configurations for this type of highly exothermic reaction: an adiabatic fixed-bed, a heat-exchanger type tubular reactor, and a fluidized-bed reactor. In this paper we will discuss only the adiabatic fixed-bed process.

Figure 5

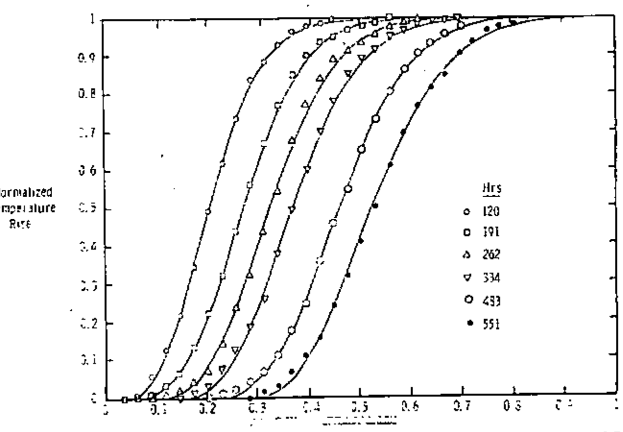
SCHEMATIC OF FIXED BED PILOT PLANT BENCH SCALE UNIT



A schematic diagram of the bench-scale unit used for process development studies is shown in Fig. 5. Methanol is dehydrated to an equilibrium mixture of methanol, dimethylether and water in the dehydration reactor. This equilibrium mixture is then diluted with recycle gas and converted to hydrocarbons and water over the zeolite catalyst in the conversion reactor. The recycle gas, which is composed mainly of light hydrocarbon products (methane, ethane, propane), provides mass to absorb the heat of reaction and thereby reduce the temperature rise in the conversion reactor to a manageable level. About 20% and 80% of the total heat of reaction are released in the dehydration and conversion reactors, respectively. The reactor effluent is cooled and partially condensed; the aqueous, liquid hydrocarbon and gaseous phases are separated; most of the gas is recycled.

Figure 6

MOVEMENT OF NORMALIZED TEMPERATURE PROFILE THRU BED

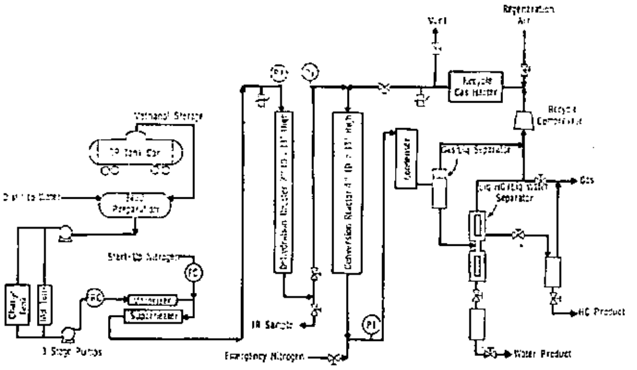


Mobil Process (Cont)

The adiabatic fixed-bed process operates at essentially 100% conversion of methanol to hydrocarbons and water until the catalyst deactivates by carbon formation to an activity level such that only partial conversion of methanol is achieved. Most of the conversion reaction occurs over a narrow band of the catalyst bed as indicated by the temperature profiles shown in Fig. 6. As the catalyst deactivates, the band moves down the reactor, and finally methanol breakthrough occurs. Unconverted methanol (e.g. 0.1%) then appears in the aqueous phase product and the cycle is terminated. The catalyst in the conversion reactor requires periodic regeneration. After burning the coke off the catalyst with dilute oxygen, the reactor is re-streamed. Cycle lengths between ZSM-5 catalyst regenerations are typically 20 days. The dehydration reactor operates for over one year without regeneration. In a long-term ageing test in a bench-scale unit, the catalyst was regenerated ten times over an eight-month period. When the test was terminated arbitrarily, the catalyst was still active.

Figure 7

SIMPLIFIED DIAGRAM OF 4 B/D FIXED BED UNIT



Demonstration Unit

The fixed-bed MTG process has recently been scaled-up to a 4 B/D pilot plant to demonstrate the performance at commercial operating conditions (Fig. 7). The catalyst bed is 4" in diameter and its length is approximately eight feet, which is ten times longer than the bench unit. This allows gas velocity in the reactor to be in the range of commercial plants. Otherwise, this 4 B/D pilot plant is similar to the bench-scale unit.

Figure 8

MTG SCALE-UP: YIELD COMPARISON AT SAME TEMPERATURE POSITION

Product, WT % of Chg	4 B/D Unit	Bench Unit
Hydrocarbons	36.48	35.42
Water	63.49	64.51
CO, CO_2	0.03	0.07
Methanol	0.00	0.00
Dimethylether	0.00	0.00
	100.00	100.00
Hydrocarbon Product, Wt %		
Methane + Ethane	1.60	1.50
Ethylene	0.04	0.02
Propane	5.60	5.60
Propylene	0.20	0.20
n-Butane	2.90	2.90
i-Butane	8.70	8.80
Butenes	0.90	1.00
C_5+ Gasoline	80.10	80.00
	100.00	100.00
Aromatics	29.60	33.40
9 RVP Gasoline		
Yield, Wt % of HC	85.20	85.30
R + O	93.70	94.30

As expected, the performance of the 4 B/D unit has been very satisfactory and no significant scale-up effects have been observed. Product selectivity, yield, and quality at a given severity are similar to those of the bench unit. Typical yields are compared in Fig. 8 at the same operating conditions. For both units, the hydrocarbon yields correspond to the stoichiometric yield, and the product selectivities are similar. The C5+ gasoline yield and octane number are also very close. However, the cycle length appears to be longer for the 4 B/D unit than for the bench scale unit.

Figure 9

TYPICAL PROPERTIES OF FINISHED GASOLINE

Components, % Wt		Composition, % Vol	
Butanes	3.0	Paraffins	53
Alkylate	3.0	Olefins	12
C_5+ Gasoline	94.0	Naphthenes	7
	100.0	Aromatics	28
			100

Physical Properties			
Research Octane		Motor Octane	
Clear	93	Clear	83
Leaded, 3 cc TEL/USG	101	Leaded, 3 cc TEL/USG	90
Reid Vapor Pressure, psig	9.0		
Specific Gravity	0.728		
Sulfur, % Wt	Nil		
Nitrogen, % Wt	Nil		
Corrosion, Copper Strip	1A		
ASTM Distillation, °F			
10%	114		
30%	145		
50%	198		
90%	330		

Typical properties of the finished gasoline are shown in Fig. 9. Gasoline produced in the MTG process is very high quality. Octanes exceed current requirements for unleaded regular gasoline, and composition is similar to conventional high-quality gasoline: highly branched paraffins (53%) and olefins (12%), naphthenes (7%), and aromatics (28%).

As expected, the gasoline contains no detectable impurities such as sulphur, nitrogen, or oxygenates. Boiling range is typical of premium gasoline. ASTM 50% point is below 200°F; 90% point is only 330°F. With Mobil's standard additive package, the gasoline has passed quality screening tests for carburettor detergency, emulsion formation, filterability, copper attack, metal corrosion, and storage stability.

In-vehicle tests of the gasoline have shown that it meets the requirements for unleaded premium gasoline. Cold engine driveability tests using seven late car models, representing popular and anticipated future power train engines, gave better performance than commercial unleaded gasoline.

One significant difference between this gasoline and conventional petroleum-derived gasoline is the presence of durene (1,2,4,5-tetramethylbenzene). The MTG gasoline may have 3-6% durene depending upon process conditions, while only 0.2-0.3% is present in conventional gasoline. Durene is the largest molecule produced in the MTG process in any significant amount. It has a high octane (estimated at higher than 100 R+O), boils in the gasoline range (386° F), but has a freezing point of 175° F. Durene might cause driveability problems if it crystallises in an engine carburettor. However, laboratory tests have shown satisfactory engine performance at levels below 5% durene. Thus, by proper choice of process parameters, durene contents are controlled at acceptable levels.

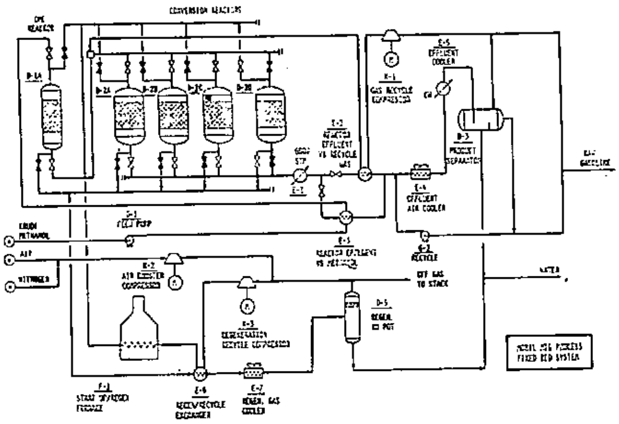
Commercial Plant Design

The commercial MTG plant is very similar in design concept to the 4 B/D demonstration plant. Adiabatic, downflow, fixed bed reactors are used to convert the methanol into gasoline. Temperature control is achieved by the use of hydrocarbon gas recycle. Coke forms on the catalyst and the catalyst is regenerated periodically. The water produced is treated and re-used in the plant.

The MTG plant has many similarities to a catalytic reformer. Both plants operate at moderate operating conditions typical of refining processes. Other similarities are feed/effluent heat exchange, fixed-bed reactor design, gas recycle for temperature control, and periodic regeneration of the catalyst. The chief differences between the catalytic reformer and the MTG plant result from the fact that catalytic reforming is an endothermic process and the MTG process is exothermic. The MTG plant does not require any process furnaces for normal operation once the equipment is at operating temperature, whereas reheat furnaces are required for catalytic reforming.

Another difference is the way in which the catalyst ages. In reforming, the entire catalyst inventory is used to carry out a series of reactions. This requires the reactors to be in series operation. In contrast, the ZSM-5 catalyst converts methanol into gasoline and other products in a narrow band of catalyst. Thus, the catalytic reaction band starts at the top of the bed and works its way down through the bed. When the activity band reaches the bottom of the bed, a small quantity of unconverted methanol appears in the product water phase. A cycle is completed and the catalyst is regenerated. In the MTG process, the band ageing of the catalyst requires that multiple reactors be placed in a parallel arrangement rather than series.

Figure 10



Regeneration of the catalyst takes place after about 20 days of operation. Permanent regeneration equipment is installed to make the regeneration operation efficient.

Conceptual commercial designs have been in development since 1975. A typical design of a commercial plant is shown in Fig. 10. The feedstock may be distilled or crude methanol. The latter contains water, higher alcohols and other impurities and comes directly from the high pressure separator of the methanol plant. The feed is preheated and vaporised by reactor effluent heat-exchange and enters into the dehydration reactor. As stated earlier, about 20% of the heat of reaction is released in this reactor. The dehydration reactor effluent which consists of dimethylether, methanol and water is mixed with preheated recycle gas and enters the conversion reactors. Although Fig. 10 shows four parallel or "swing" conversion reactors, a smaller or greater number of reactors may be used depending upon the feedrate and regeneration frequency desired. The conversion reactor effluent is cooled by steam generation and heat exchange and flows to a product separator operating with gas, liquid hydrocarbon and water phases. The gas and liquid hydrocarbon streams are sent to conventional petroleum fractionators for separation into gases, C_3's, C_4's, and C_5+ and heavier. The propenes and butenes may be alkylated and blended into the C_5+ fraction. The gasoline is pressurised with butanes to 10 RVP. This 93-95 RON clear gasoline may be used directly or blended with conventional petroleum gasoline.

When methanol breakthrough occurs in a reactor, it is taken off stream and the catalyst is regenerated by burning off the deposited coke. Air is used as a source of oxygen to burn off the coke and nitrogen is used to control the burning temperature. Referring to Fig. 10, air and nitrogen are compressed and heated in a furnace and sent to a reactor to burn off the coke. Most of the reactor effluent gases during regeneration are recycled back to the reactor after water is removed.

The regeneration of the ZSM-5 catalyst is very simple, involving only carbon burn-off. It does not require rejuvenation to disperse metal components as in the case of the regeneration of reforming catalyst. The regeneration heater is also used as a startup heater to heat up the plant by circulating nitrogen through the equipment.

Figure 11

TYPICAL ECONOMICS OF MTG PROCESS

Basis:	Feed Stock	–	Crude Methanol (17% H_2O)
	Methanol Feed	–	50,600 BPSD
	Gasoline (10# RVP Product	–	20,300 BPSD
	C_3/C_4 LPG Product	–	4,500 BPSD

• Capital Investment, U.S. Gulf Coast 1979, Instantaneous	$100-140 Million
• MTG Gasoline Costs, ¢/Gal. of Gasoline	
Methanol Cost @ 40¢/Gal. of Pure Methanol	100
Operating Costs	3
LPG By-Product Credit @ 30¢/Gal.	(6)
Capital Charges	8
MTG Gasoline Cost at Plant, ¢/Gal.	105

Economics

The economics for an MTG plant, located in the US Gulf Coast, processing 50,600 B/D pure methanol (57,000 B/D crude methanol) are shown in Fig. 11. Typical operating conditions of the plant are:

DME Reactor Inlet Temperature °F	570
Conversion Reactor:	
Inlet Temperature °F	650
Outlet Temperature °F	765
Separator Temperature °F	100
Gas Recycle Ratio — Molar	7 to 9
Catalyst WHSV (Pure Methanol Basis)	1.6
Catalyst Fill, Pounds	368,000
Reactor Pressure — psig	300
Separator Pressure — psig	250

This MTG plant is adjacent to, but not integrated with, the methanol synthesis plant. The investment does not include working capital, land, or insurance. The gasoline costs do not include catalyst and royalty charges. At a 40¢/gallon methanol cost, the gasoline will cost $1.05/gallon at the plant gate. At this cost, synthetic gasoline should now be seriously considered as an alternative to imports.

Conclusion

The MTG process is ready for commercialisation. In fact, several serious applications to commercial size plants are under active development. Most importantly,

Illicit Drug Identification In New Zealand

S.L. Nolan and P.E. Nelson.
Chemistry Division, DSIR, Auckland.

The illicit drug problem in New Zealand has grown rapidly in the last decade. Sample trends seen in laboratories identifying these drugs are described. Specific cases and methods are also described to indicate the type of work undertaken in the laboratories of Chemistry Division, DSIR, in assisting police control.

Illicit drugs seized in New Zealand by police or customs officers are all identified by scientists in the laboratories of Chemistry Division, DSIR in Auckland, Gracefield and Christchurch. Over the past 10 years the number of drug seizures has increased from 234 in 1970 to 5701 in 1980. Per capita these figures are high compared to figures published by overseas authorities. In 1977, for example, 2392 cases were examined in New Zealand laboratories compared to 19575 cases examined for police and customs officers in laboratories in England and Wales[1].

Cannabis, predominantly seen in the form of plant material, accounts for about 80% of the total number of cases examined. Growing plants, (Fig. 1), have become very common in summer months. Cannabis plant seizures are usually wrapped in foil packets ("bullets"), tied around sticks ("Buddha" or "Thai" sticks), or packaged in small plastic bags. Preparations of cannabis such as hashish (solid blocks, not unlike leather) and hash oil (a treacle-like material) are encountered less frequently. Fig. 2 depicts the monthly numbers of drug cases received in the Auckland laboratory. In 1976, the numbers were random, indicating a more or less uniform sampling rate throughout the year. From 1977 onwards, however, distinct peaks in sampling rates occurred during the summer months. These peaks correspond to the increase of cannabis cultivation in New Zealand.

No single drug, apart from cannabis has appeared at consistent levels over the past decade. Heroin (diacetylmorphine), I, reached its highest level in 1977 and 1978, accounting for 14% and 11% respectively of the total number of illicit drugs seized. In 1977, 330 seizures in New Zealand involved heroin compared to 421 seizures in England and Wales[1]. The number of heroin seizures throughout New Zealand for the first half of 1980 had fallen to 24, which was less than 1% of the total number of illicit drug seizures. LSD (lysergide), II, has varied, reaching about 15% in 1972, becoming insignificant during the heroin peak, but recently climbing again in popularity. No other single drug has reached a significant proportion of the total although all prescription poisons, the stimulants related to amphetamine, III, and the barbiturates, IV, are commonly seen.

Peter Nelson obtained his Ph.D. under Prof. A.D. Campbell at Otago University in 1970. He joined Chemistry Division of the Department of Scientific and Industrial Research in Auckland in the same year, and after working in general forensic chemistry he became involved in toxicology and illicit drug analyses in 1973. During 1977-78, he held a DSIR study award at the Home Office Central Research Establishment, Aldermaston, UK. He is the Section Leader of the Illicit Drugs and Toxicology Section in Auckland.

Susan Nolan obtained her M.Sc. Hons. in Biochemistry under Prof. J. Smith at Victoria University of Wellington in 1968. She joined the Pharmaceutical Section of the Chemistry Division of the Department of Scientific and Industrial Research at Gracefield in 1971. In 1974 she transferred to the Toxicology and Illicit Drug Section of the Auckland Branch of Chemistry Division.

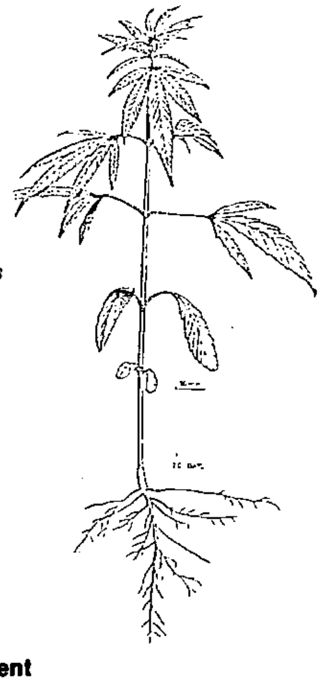


Fig. 1. The young cannabis plant.

Instrumentation Development

Accompanying the rapid increase in drug seizures, there has been major growth in instrumentation available to assist the analyst in the identification of samples and the handling of data. In 1970, the analyst may have had access to a gas chromatograph (GC), but relied mainly upon ultra violet and infra red spectroscopic methods for instrumental analysis and used spot tests and thin layer chromatography to confirm his results. In 1980 GC, equipped with a range of specific detectors, has become the mainstay of instrumental methods. Added to spectroscopic methods is mass spectroscopy (MS), while

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Mobil Process (Cont)

the proposed application of the MTG process to NZ has very significant implications. This synthetic gasoline plant will be the first commercial plant employing new technology developed since the Second World War. When it goes on stream in the mid-1980s as currently planned, every single step of both the natural gas-to-gasoline and coal-to-gasoline sequences will have been commercially proven. We believe that this route is one of the most energy efficient and most economical routes for producing high quality gasoline from non-petroleum sources. As the MTG process is being commercialised in NZ, other applications are being more seriously studied in USA and other countries. For USA, with its vast amount of coal deposits, the MTG process may have opened up a new era for synthetic gasoline production from coal.

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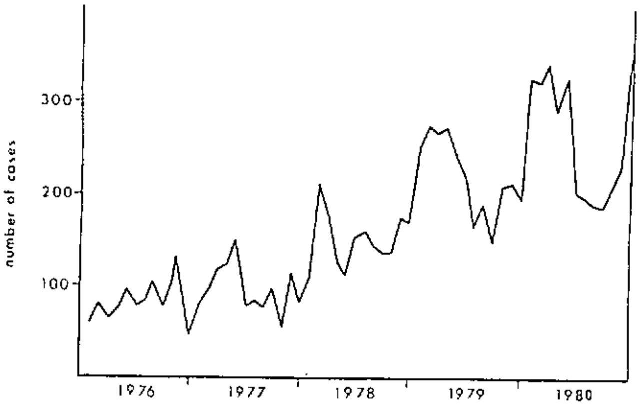
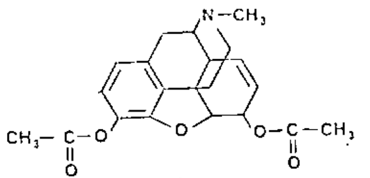


Fig. 2. Monthly sampling trends for the North Island north of Lake Taupo, 1976-1980.

high performance liquid chromatography (HPLC) developments have improved liquid chromatography to the point where it now ranks with GC. Backing up all these instruments are a wide range of data processors capable not only of deriving results but of controlling autosamplers and the instrument itself. These microprocessor units are at present being evaluated and should assist the analyst to handle a larger number of samples. Another development that is perhaps more significant is the use of computers to record and store data from each case, and to produce the final written report of the analyst's results. Automation of these clerical aspects will significantly increase the capability of the laboratories to handle the expected increase in the number of samples requiring an analysis.

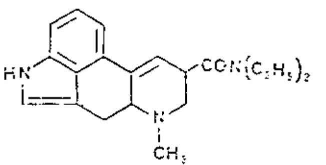
Specific Techniques

Although the majority of illicit drug identifications are relatively straightforward and involve an identification by a normal chromatographic or spectroscopic method, novel approaches have been developed or examined within the laboratories for specific tasks. These can be divided into two groups:- those designed to identify a drug not previously encountered, for which a standard for comparison or a suitable method may not be available; and those designed to assist in crime investigation, e.g., drug residues in body fluids, bloodstains and hair samples. Two examples in the first group concern the hallucinogen 4-bromo-2,5-dimethoxyamphetamine, V. This drug had not previously been encountered in New Zealand when it appeared almost simultaneously at the laboratories in Christchurch and Auckland. In both cases, a standard was not available, and there was no indication of the drug's identity except that dealers claimed it to be LSD. In the first case urgency was requested to enable the completion of an undercover investigation. Initial tests excluded LSD, but the contents of the ticket were found to gas chromatograph well. The retention time did not correspond to any commonly encountered drug. An infra red spectrum was obtained from the gas chromatographic eluate which was collected in glass capillaries. A search of an infra red spectral library indicated that the compound was 4-bromo-2,5-dimethoxyamphetamine. In the second case a GCMS spectrum was run under chemical ionisation conditions (Fig. 3)[3]. Both the ions at 257/9 and 274/6 showed the bromine doublet pattern and were separated by 17 mass units, which is generally characteristic of loss of ammonia from a primary amine. It was apparent from the UV and MS that a benzene grouping was also present and, by deduction, the compound could only contain another 7 C/N/O atoms. A substituted amphetamine seemed likely, the compound was tentatively identified as V. Both identifications were later confirmed by comparison with authentic standards.



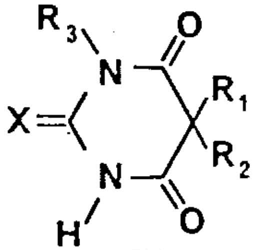
I

HEROIN



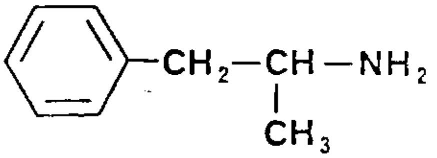
II

LSD



IV

BARBITURATE



III

AMPHETAMINE

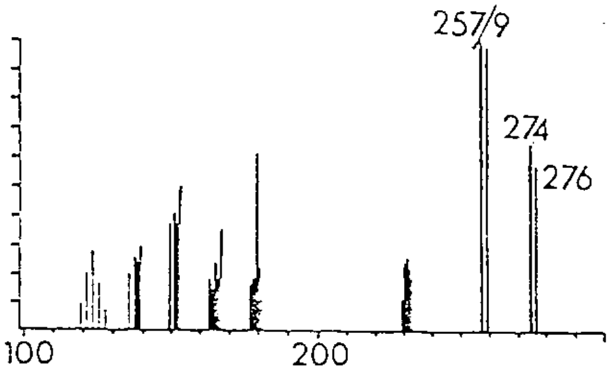
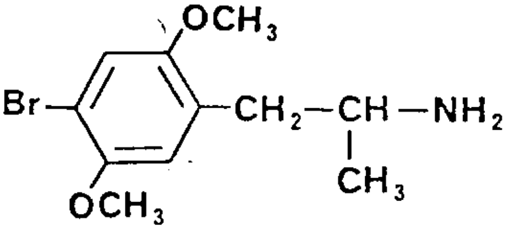


Fig. 3. Chemical ionization mass spectra of 4-bromo-2,5-dimethoxyamphetamine.

Another example of method development for drug identification involved mushrooms of the *Psilocybe* species. The hallucinogenic drugs psilocybin, VI, and psilocin, VII, occur naturally in several *Psilocybe* species. They are highly polar and not suited to measurement by direct gas chromatography. HPLC methods are ideal for analysing such compounds and a reversed phase ion pair system was developed to identify them in mushroom extracts[3]. The conditions used and the chromatogram obtained are shown in Fig. 4.



V

4-BROMO-2,5-DIMETHOXYAMPHETAMINE

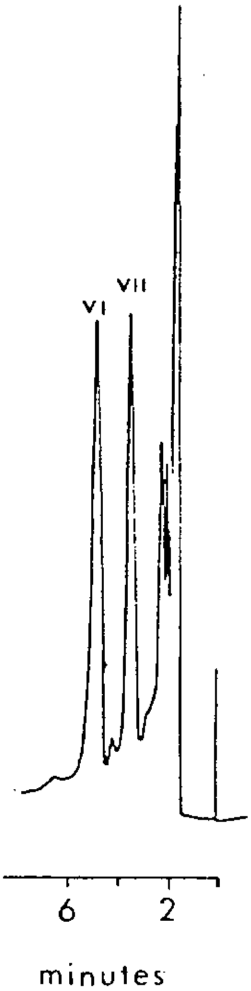


Fig. 4. HPLC chromatogram of psilocybin, V1 and psilocin, V11, on a µ Bondapak C18 column with 40:60:0.15 (v/v/w) methanol/phosphate buffer (pH 7.2)/ cetrimonium bromide eluent.

The presence or absence of drugs in biological fluids, stains and samples such as hair may be significant in crime investigation. As described elsewhere in this issue, the measurement of therapeutic drugs in blood and plasma is readily achieved. However, the detection of illicit drugs in such samples may be more complex. Cannabinoids and their metabolites, for example are present in the blood at very low levels (about 10 ng/ml) after smoking cannabis. Many methods for their detection have been published, and are based on GC, GCMS, immunoassay and HPLC. No single method is ideal — chromatographic methods require complex extraction procedures because of the relative water insolubility and the adsorption of the cannabinoids on to glassware. The low levels encountered also demand the use of high sensitivity detectors. Immunoassays appear ideally suited for this type of analysis, as extractions are avoided and the method is extremely sensitive. However, immunoassays lack the specificity necessary for forensic work and those available for cannabis can only be used on urine and plasma samples, and not on haemolysed blood.

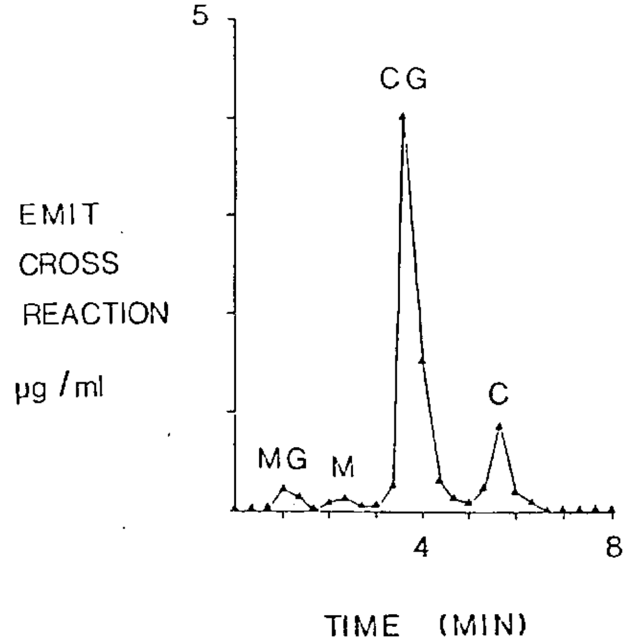
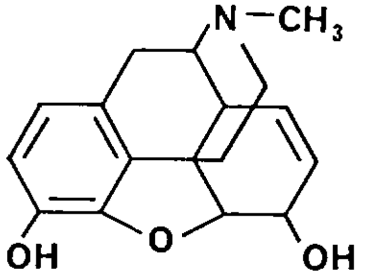
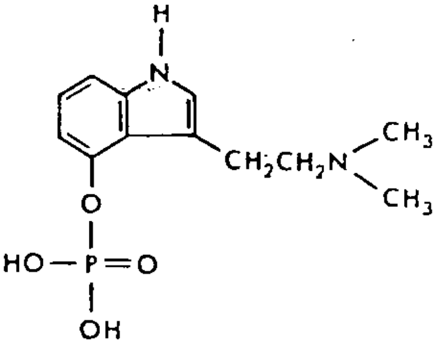


Fig. 5. HPLC-EMIT analysis of morphine-3-glucuronide (MG), morphine (M), codeine-6-glucuronide (CG), and codeine (C) in a urine sample taken 36 hours after a volunteer started ingesting 15mg codeine every four hours.



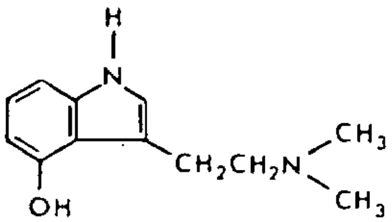
VIII

MORPHINE



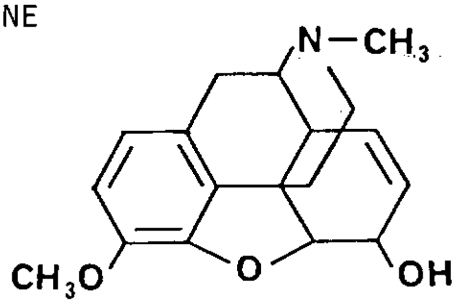
VI

PSILOCYBIN



VII

PSILOCIN



IX

CODEINE

Determination of Drugs In Drivers' Blood Samples

A.W. Missen
Chemistry Division, DSIR, Gracefield

ABSTRACT

A large number of drugs that could affect driving abilities are prescribed in New Zealand. Because many of these drugs can occur at very low levels in the blood appropriate detection methods are required. In this country these have been centred around gas-liquid chromatography with selective detectors. Surveys of drugs involved in both impaired and injured drivers are discussed.

In New Zealand, the problems associated with alcohol and driving became widely recognised in the late 1960s. The required determination of alcohol in blood samples was then developed around the appropriate technique of gas-liquid chromatography. In contrast, an assessment of the role of prescription drugs in relationship to road safety has been possible only recently, for three main reasons. Firstly, there are a large number (**ca** 50) of psychotherapeutic drugs that can affect driving abilities. Secondly, many of them can occur at very low levels in the blood, (1000-100,000 times less than the average alcohol level), and sensitive techniques for their analysis have only been developed in the last few years. Thirdly, it can be very difficult (impossible, in some cases) to interpret a particular drug level in terms of possible driving impairment.

Prescription Drugs And Driving

Apart from the illicit drugs, such as heroin, LSD, and cannabis, there are a large number of drugs prescribed in this country which, by their action upon the central nervous system, can produce drowsiness and co-ordination impairment. The most obvious prescription group is the sedative/hypnotics, which include the barbiturates and other drugs, such as nitrazepam, glutethimide, and chloral hydrate. Drowsiness is also a common side-effect with tranquillisers (including the benzodiazepine drugs diazepam, oxazepam, and lorazepam), analgesics such as codeine and dextropropoxyphene, and anticonvulsants. In certain individuals and circumstances both antidepressant and antihistamine drugs may produce sedation. For all of the drugs mentioned, any combination with alcohol may lead to serious driving impairment. Approximately 250 million doses of these psychotherapeutic drugs were prescribed in New Zealand in the year ending 31 March 1980[1]. The possibility of some driving hazard is therefore considerable.

Methods Of Analysis

To be able to identify any of the drugs of interest at therapeutic levels in the blood — 15 ug/ml for anticonvulsants down to 0.01µg/ml for antihistamines — requires methods with both extremely high sensitivity and good selectivity. Overseas, screening techniques have been developed that depend on several immunoassay analyses, each detecting a different type of drug[2]. In this country we have developed methods centred around gas-liquid chromatography (GC) employing selective detectors[3]. The principal GC detector that we use in the nitrogen-phosphorus detector (NPD). Basically this employs a glass bead or ceramic cylinder impregnated or coated with an alkali metal (usually rubidium) compound. The alkali source is heated electrically and creates a low temperature plasma under hydrogen and air flows of 3 and 50ml/min respectively. In our Hewlett-Packard NPD the exact nature of the detector response has not been elucidated. However the detector displays a very low sensitivity to hydrocarbons, a high sensitivity to nitrogenous compounds, virtually no solvent response, and an extremely low noise level. These factors are illustrated by Fig. 1, which depicts the sensitivity of the detector to certain drugs — the baseline noise level on an attenuation of 1x1 was about 1% — and also the selectivity with respect to cholesterol (a common blood constituent). Injection of solvent has resulted in a negative peak.

In screening for drugs in a blood sample we commonly employ a Celite extraction procedure[4] on a small volume

Alan Missen joined Chemistry Divison as a DSIR Bursar in 1967. He obtained his Ph.D. in Chemistry, under Prof. R.C. Cambie, from the University of Auckland in 1972. Since then he has worked in the Toxicology Section of Chemistry Divison at Gracefield, where he has been involved in toxicology analyses and several surveys on the occurrence of prescribed drugs in blood samples taken from drivers.

Drug Identification (Cont)

The method used in Chemistry Division is that developed by McCallum **et al**[4]. It involves the extraction of blood samples with pentane, followed by derivatisation to form the phosphate ester of the cannabinoids. All extraction and derivatisation procedures are carried out in silanised glassware to minimise the loss of the cannabinoids by adsorption on to the glass. The derivatised extract is then analysed by gas chromatography using either flame photometric or alkali flame detection, in their phosphorus-sensitive modes. The limit of sensitivity is 0.5 ng/ml in blood.

Similar work has been done to detect very low levels of morphine, VIII[5]. Morphine occurs in body fluids after ingestion of morphine, or as a metabolite of heroin, I, or codeine, IX. It is identified in urine and blood samples without extraction, by injecting an aliquot of the sample directly on to an HPLC column. The column eluate is collected using a fraction collector, and each fraction analysed by a morphine immunoassay. An immunochromatogram can then be constructed. Fig. 5 shows the immunochromatogram obtained from the urine of a subject who had ingested codeine.

A recent development has been the use of post column derivatisation in HPLC to improve the detection limits for morphine. The HPLC column eluent is mixed with alkaline potassium ferricyanide using a second pump and mixing tee. Morphine is converted to its fluorescent dimer, pseudomorphine, XII, which is detected by a filter fluorimeter. The detection limit is 10 ng, an order of magnitude better than ultraviolet detection. This method has been applied to blood and urine samples, and is being evaluated for the detection of morphine in bloodstains, hair, and fingernail clippings.

Acknowledgement

Fig. 1 is reproduced with permission of Mr A.E. Esler, Botany Division, DSIR, Auckland.

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Drug Determination (Cont)

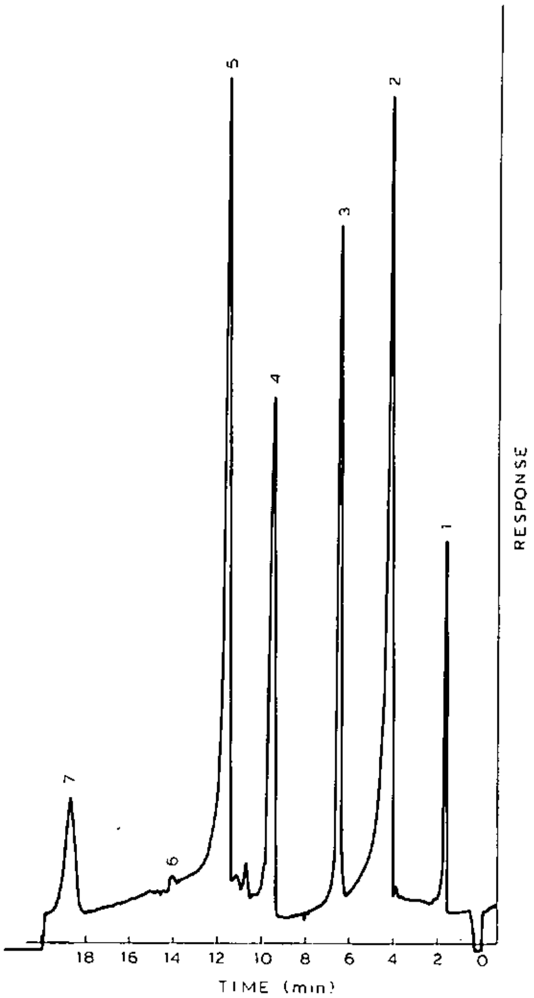


Fig. 1. Chart trace from injection of a solution of standard compounds on 3% OV-17, with temperature programming. Attenuation = 16 x 1.

1 = pethidine (2.0 ng)
2 = caffeine (3.5 ng)
3 = trimipramine (3.7 ng)
4 = codeine (10.7 ng)
5 = N-desmethyldiazepam (11.3 ng)
6 = cholesterol (5 ug)
7 = thioridazine (14 ng)

(0.4ml) of blood. 5 µl of the extract is temperature-programmed on a GC fitted with OV-17 columns and NPD. The remainder of the extract, or a second extract of 0.2ml blood is treated specifically to detect oxidation products of benzodiazepines by analysis on a GC with an electron capture detector[5], and to detect barbiturates and anticonvulsants by GC-NPD after a methylation procedure (Fig. 2). Following their detection, most drugs are quantified by GC-NPD after a solvent extraction with n-butyl chloride. The benzodiazepines, barbiturates, and the anticonvulsants are all analysed by separate procedures.

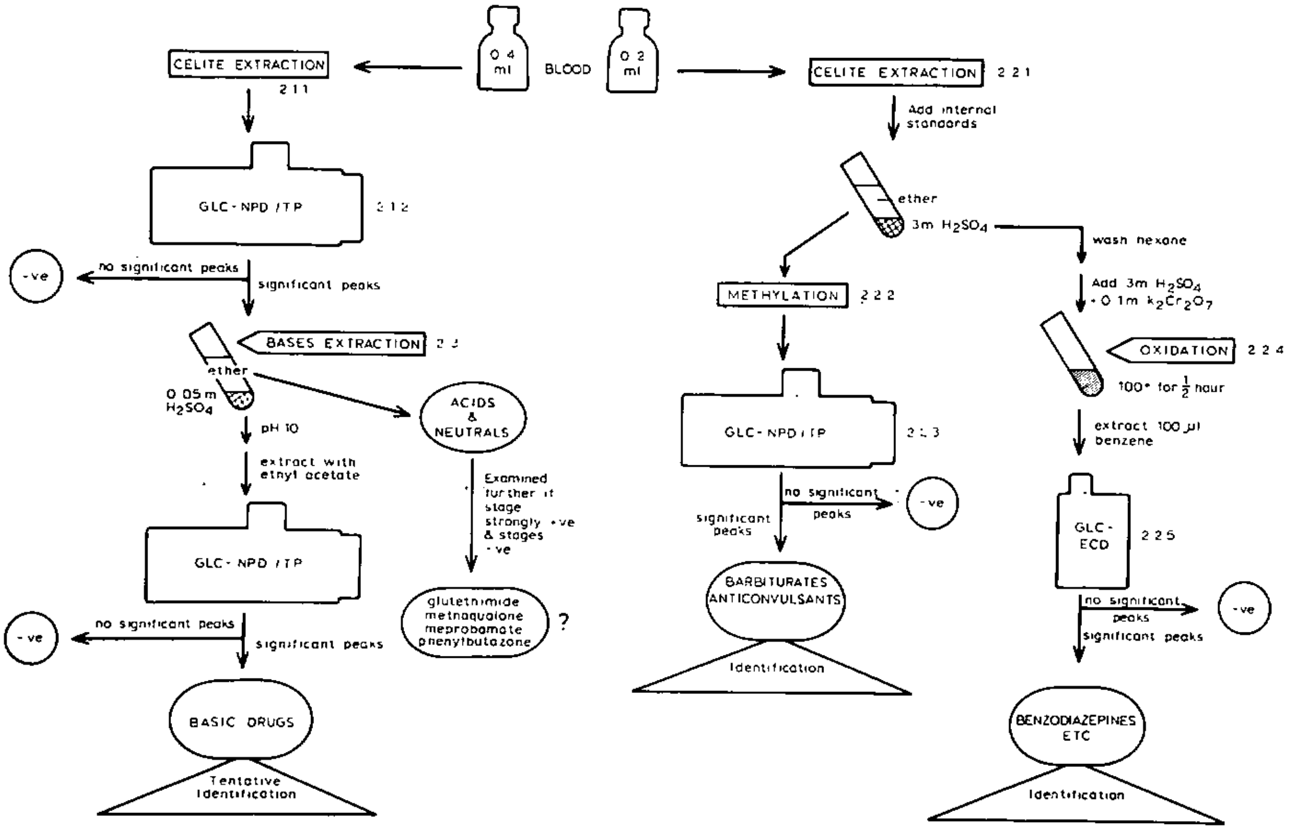
Drugs that are not detected by our screening methods include morphine, cannabinoids, LSD, and amphetamines, together with some drugs such as antihistamines, all of which may be present in the blood at very low levels.

Drugs in New Zealand Drivers

The methods that DSIR has developed have been applied both to the analysis of samples taken from drivers apprehended under the Transport Act, and also to surveys investigating the role of drugs in relation to road accidents.

In December 1978 legislation was enacted that enabled an officer to request a blood specimen from a driver who appeared to be under the influence of drugs. Before that a drug analysis could only be carried out if a blood sample was volunteered by a driver. However, regardless of legislative changes drugs have been detected in approximately 40% of such blood samples analysed over the last four years[6].

Fig. 2. Flow diagram for the screening of drugs in blood.



In 1980, enforcement officers requested an analysis to be made for drugs in 104 cases (out of a total of 8,500 bloods analysed for alchohol). After considering impairment explained by high blood alcohol levels, analyses for drugs were carried out in 65 cases. Drugs were detected in 28 samples, half of which contained diazepam (Fig. 3). Of those samples which had no blood alcohol, 70% contained drugs, often at highly significant levels. In comparison, 100 Transport Act blood samples, analysed in the same year and found to have no alcohol were analysed for drugs. In each of these cases no request had been made for a drug analysis. Only 7 contained drugs, with diazepam occurring in 5.

The high incidence of diazepam in the former situation (Fig. 3) is only partially accounted for by the large amount of this drug prescribed each year (much less in 1979/80 than in 1977/78, however). Both diazepam and tuinal appear to have been in considerable use on the illicit drug scene over the last two years. In fact, over half of the samples examined for drugs were taken from drivers who were suspected illicit drug users.

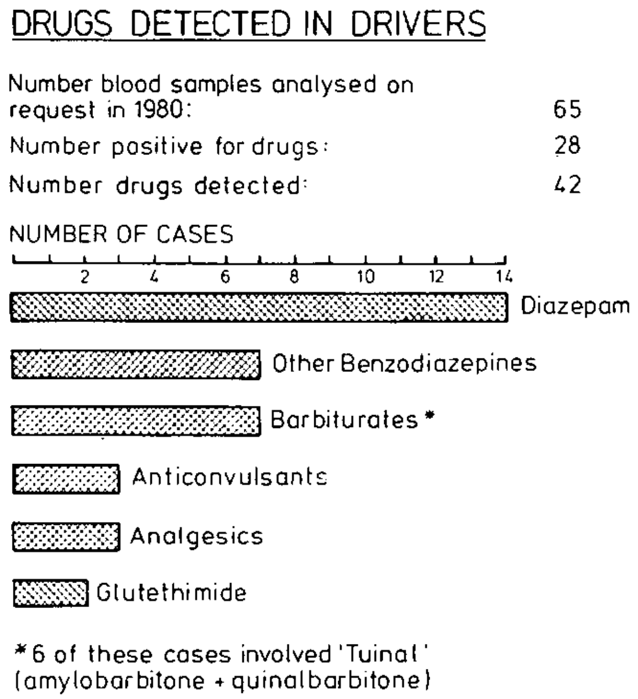


Fig. 3. Drugs detected in drivers.

We have also conducted surveys of the role of drugs in road accidents. One of these investigated road fatalities over the year ending 31 March 1978, and the results indicated that diazepam was present in only 1.6% of fatally injured drivers[7]. A more recent survey has examined approximately 1600 blood samples taken from injured road users treated at Waikato Hospital. Diazepam was detected in only 0.6% of the samples! Overseas results have shown a much higher incidence of prescription drugs in road accidents. For instance, a 1976/77 Norwegian survey[8] and a 1974/75 Texas survey[9] detected diazepam in 3.2% and 10% respectively, of fatally injured drivers.

It is thus apparent that prescription drugs play a minor role in road accidents in New Zealand.

Interpretation Of Drug Levels

The interpretation of a particular level of drug in a blood sample is still a problem. In some cases (such as diazepam) sufficient literature reports can enable an assessment of likely impairment to be made. However, any assessment must always take into account the levels of a drug's metabolites (which can indicate the frequency of drug use, and hence possible tolerance of the drug's effects), and also the presence of alcohol or other drugs.

In the case of a report of a drug analysis made under the Transport Act only a very guarded opinion of possible impairment is given and a successful prosecution depends strongly on an on-the-spot examination of the driver's condition by a medical practitioner.

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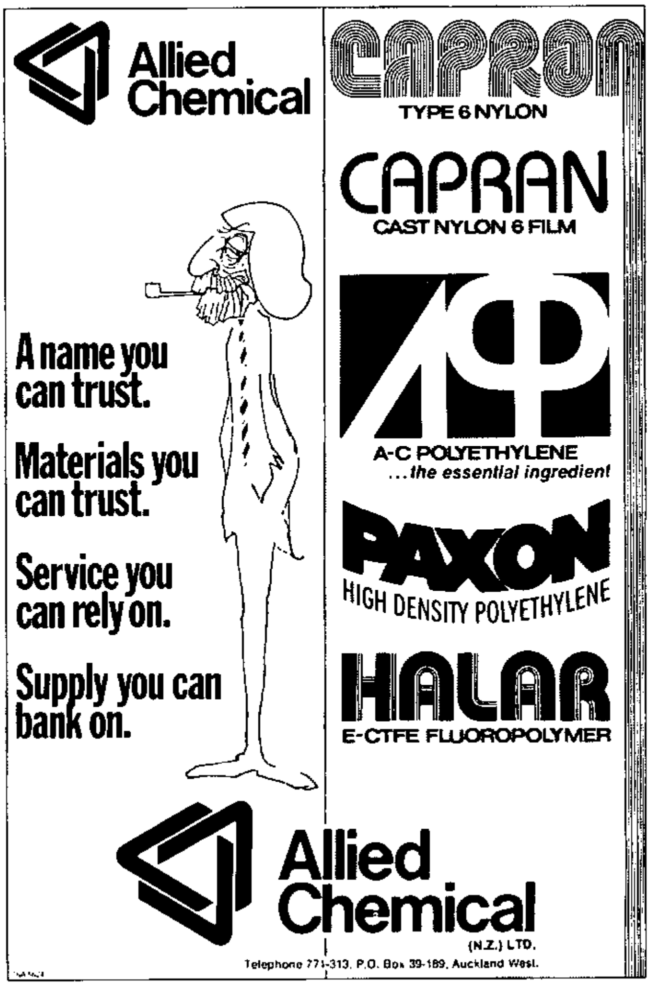


Measurement of Drugs Used In Therapy

J.R. Sharman

Toxicology Laboratory,
Christchurch Hospital, Christchurch

SUMMARY

Analyses for drugs in plasma from patients undergoing treatment are becoming routine. For therapy to be monitored, sensitive, rapid and accurate methods of analysis are essential. Gas chromotographic techniques, involving derivatisation where required and the use of specific detectors are common and necessary if the required sensitivity is to be achieved. Newer techniques such as high performance liquid chromatography and the various immunoassays are becoming available and to some extent replacing older established methods.

The effectiveness of a drug in therapy depends on its concentration at the site of action. This may be in the brain, heart, or some other organ or tissue. For practical purposes, measurement of the levels of drugs present in plasma is often the best or only indicator of this concentration available to the analytical chemist. As more evidence accumulates it is apparent that, for a number of drugs, the level achieved in blood does not reflect the amount administered, particularly when given orally. A combination of different rates of absorption from the gut, differing metabolism and varying excretion rates all play some part in this. The measurement of drug levels in the plasma of patients being treated for various illnesses is becoming routine.

Accordingly, for many drugs a therapeutic range has been established. This range represents the span of plasma concentrations for that drug, within which it induces the desired clinical response without unacceptable side effects.

Analytical methods for these drugs are often subject to rather severe constraints. Urgent analyses are often needed, which means that the analytical time should be as short as possible; the patient may be a newborn baby, and therefore 1 ml of blood may be an unacceptably large sample; and the drug may be present in the plasma at a concentration well below 1 µg/ml. As a result, methods must be capable of being carried out rapidly, be very sensitive and as accurate as possible.

During the last 20 years there has been a vast increase in the number of drugs available for medical use. This has coincided with the expansion in chromatographic techniques available to laboratories. Not surprisingly, gas chromatography (GC) is often used but, as high performance liquid chromatography (HPLC) becomes more readily available, so too do the methods for using this technique in the drug monitoring field.

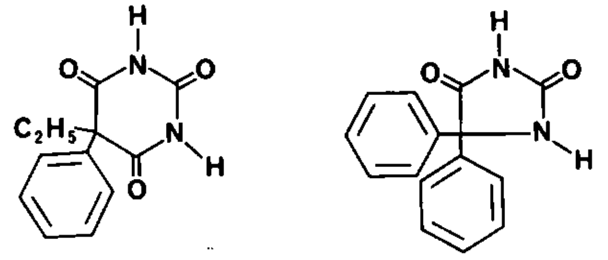
J.R. Sharman graduated B.Sc. from Victoria University (Wellington) in 1963.

Employed by Ministry of Agriculture 1963-1969 at Invermay Research Centre in charge of Diagnostic Chemistry laboratory of The Animal Health Centre.

Established first toxicology laboratory in an NZ hospital in Christchurch in 1969-1970. He is currently Toxicologist, Christchurch Hospital.

His recreational interests include building electronic devices, model making, tramping and skiing.

In the toxicology laboratory at Christchurch Hospital, more than 30 drugs are monitored on a routine basis in patients from within local hospitals and from the surrounding districts.



Phenobarbitone

Diphenylhydantoin

Fig. 1. Structure of the anticonvulsants phenobarbitone and diphenylhydantoin.

The anticonvulsants, which are used in the treatment of epilepsy, have been measured for many years. Although a wide range of drugs can be classed as anticonvulsants, the earliest that were used routinely were the barbiturate derivative, phenobarbitone, and a structurally-related compound, diphenylhydantoin (Fig 1). On GC phases, such as SE-30 and OV-17, these compounds give unacceptable tailing and therefore require derivatisation.

Recovery of these drugs from plasma made slightly acidic can be readily achieved by extraction with ethyl acetate, butyl chloride, ether or some other convenient solvent. If an easily volatilised sovent is chosen, concentration can be carried out under a stream of nitrogen or air or by the use of a rotary evaporator. Derivatisation by "on-column" methylation found favour some years ago and remains the method of choice for many workers.

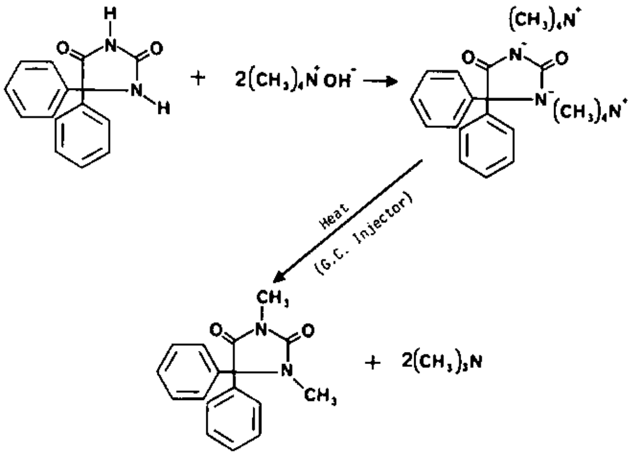
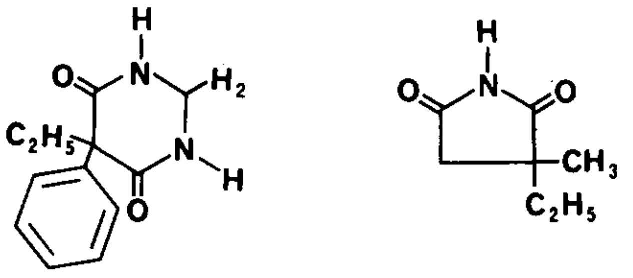


Fig. 2. "On Column" methylation of diphenylhydantoin using tetramethylammonium hydroxide.

A methanolic solution of trimethylphenylammonium hydroxide or tetramethylammonium hydroxide is added to the residue obtained by concentration of the plasma extract. This produces the salt shown in Fig. 2. On injection into the GC N,N-dimethylaniline or trimethylamine is thermally eliminated to yield the methylated drug[1]. The methyl derivatives have shorter retention times than the parent drug and give vastly superior GC characteristics in terms of peak shapes, sensitivity and resolution. Other methods of incorporating alkyl groups in these molecules are available and have advantages but the method described does not involve a delay in the analytical process. This same technique can be used to measure the barbiturates and other anticonvulsants such as primidone or ethosuximide (Fig. 3), the only changes needed being in the temperature and the internal standard.



Primidone Ethosuximide

Fig. 3. Structure of the anticonvulsants primidone and ethosuximide.

Because of the low concentration of these drugs expected in the plasma of well controlled epileptics (10-20 µg/ml of diphenylhydantoin for example), and because of the limited amount of specimen available, the use of flame ionisation detectors (FID) has tended to be superseded by the more specific nitrogen-phosphorus detector (NPD). This has several advantages from an analytical point of view. Rigorous clean-up to remove potentially interfering substances by multiple partitioning between aqueous and non-aqueous phases can be avoided, thus saving analytical time. Smaller samples can be used, a marked advantage where paediatric specimens are involved. Generally, manipulative procedures become simpler. Fig. 4 shows the recorder trace obtained when a specimen prepared for detection by NPD is put through FID under identical chromatographic conditions (detector parameters optimised). The four compounds visible on the trace from the NPD cannot be determined from the FID trace. This difference in recorder output is typical of the relative responses of these two detector types.

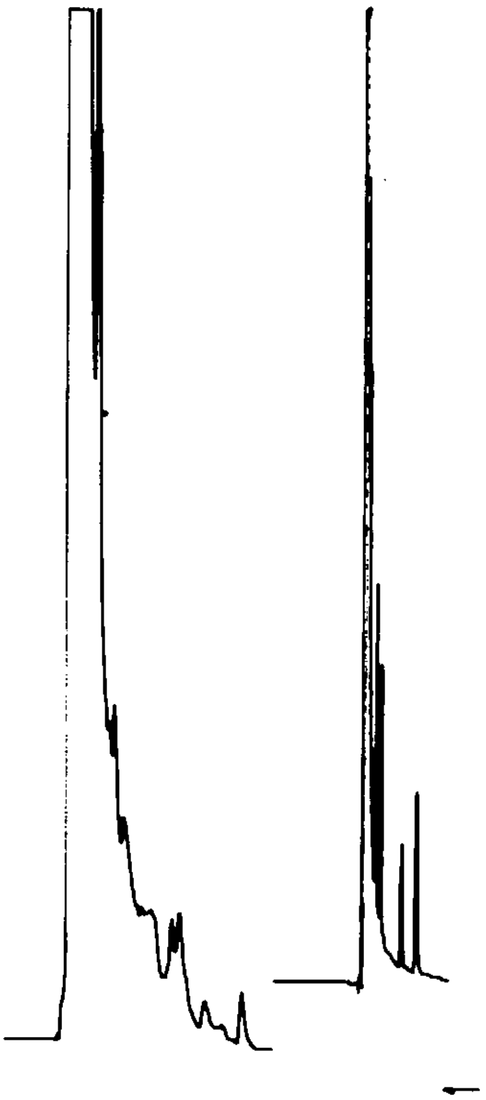
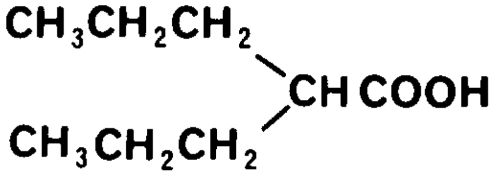


Fig. 4. Gas chromatograms of phenobarbitone, diphenylhydantoin and two internal standards on SE-30. The detector for the left hand chromatogram was a flame ionisation detector and the detector for the right hand chromatogram was a nitrogen-phosphorus detector.

For some drugs, the use of FID is essential. Among these are alcohol and valproic acid (Fig. 5). Their lack of a nitrogen atom renders them unsuitable for detection by NPD but the relatively high concentration in plasma (anything up to 4,000 µg/ml or greater for alcohol and about 100 µg/ml for valproic acid) makes them readily detectable.



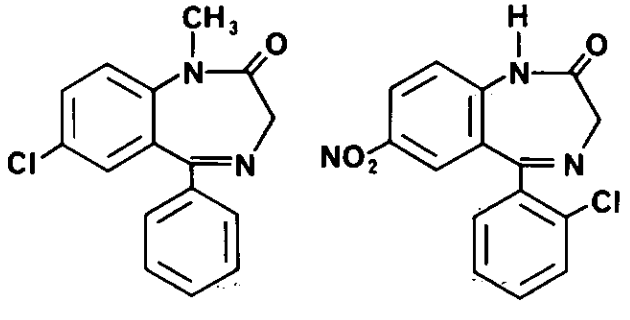
Valproic acid

Fig. 5. Structure of valproic acid (propylpentanoic acid).

Halogenated compounds such as diazepam (Valium) or clonazepam (Fig.6) can be determined by using an electron capture detector. Both belong to the benzodiazepine group which includes such drugs as Librium and Mogadon.

The use of diazepam as a traquilliser results in plasma levels of up to 3-4 µg/ml depending on the dose rate. This drug is very easily measured at therapeutic concentrations. Simple vortexing of 0.1 ml of plasma with 1 ml of toluene results in quantitative transfer of the diazepam to the solvent. Centrifugation is then all that is necessary. The toluene extract, a 1 in 10 dilution of the sample, can be injected directly into the GC and the diazepam concentration determined.

Clonazepam, also used as an anticonvulsant, is a different problem. Levels in the region of 30 ng/ml can be expected, and the drug chromatographs badly unless derivatised. This can be done rapidly and conveniently by ethyl iodide in acetone with potassium carbonate at 70°C. Because of the low plasma concentration, the clonazepam must first be extracted from a rather large sample (2 ml) and purified, a necessary but time-consuming process if the required sensitivity is to be obtained.



Diazepam Clonazepam

Fig. 6. Structure of the benzodiazepines diazepam (Valium) and clonazepam.

Drug Measurement (Cont)

Particularly since many drugs do not gas chromatograph satisfactorily unless derivatised, the more recently available HPLC techniques are useful in measuring therapeutic drug levels. These methods can frequently be used without the need for derivatisation. The ability to change solvent systems and column types is a major advantage over GC. HPLC methods can be sensitive and rapid, and they are becoming popular.

Sample preparation can be very simple. For measuring theophylline, a drug used to treat asthma, it is sufficient to dilute one volume of plasma with 2 volumes of acetonitrile containing an internal standard, centrifuge off the precipitated protein, filter any residual fine particles and inject the solution obtained. Sample preparation time is about 5-10 minutes and chromatography takes another 6 minutes. The solvent system chosen must be capable of separating similar compounds, present in the body as the result of theophylline metabolism or from dietary intake. These compounds include theobromine,caffeine and the substituted uric acid metabolites of theophylline. Caffeine, although present in adults from the diet, is a metabolite of theophylline in the newborn. Measurement of this compound can assist in determining a baby's ability to metabolise theophylline, which is frequently given to infants with respiratory distress. This particular metabolic pathway is replaced by the metabolism of theophylline to urates within a short time after birth and is unimportant in the adult.

The above method of preparation can be applied to other drugs but, because of differing sensitivities, is not universal. Many drugs require extraction and concentration before adequate sensitivity can be achieved. This process also has the advantage of removing protein and other unwanted biological material which would otherwise cause column deterioration. Detection by UV-visible absorbance is standard but supplemented by fluorescence where applicable. As a rule, refractive index detectors are not sensitive enough for this type of work. As ever more sensitive detectors become available, the use of HPLC can be expected to increase.

Some drugs which fluoresce strongly can be determined by simple fluorescence. Both salicylate (e.g. asprin) and quinidine (a drug used to control abnormal heart rhythms) fluoresce and can be analysed in this way. Salicylate fluoresces very strongly in non-aqueous alkaline solution in the presence of certain metal ions[2]. The use of sodium barbitone and magnesium acetate in ethanediol as a single reagent for this analysis gives a very simple method. Therapeutically effective levels can easily be measured by simply adding 25 μl of plasma to 2 ml of the reagent, mixing and reading the fluorescence against a standard and a blank. In fact the sensitivity of the method is such that 10 μl of plasma in 2 ml of reagent is more than sufficient if the small volume of sample can be accurately measured on a routine basis.

Under most conditions it is desirable to remove as much biological material as possible, as this may absorb exciting light, quench the desired fluorescence or, alternatively, fluoresce itself, giving falsely high results. For these reasons, it is usual to extract the drug into a solvent and then back extract into some suitable fluorescence medium. Quinidine, for example, can be extracted into amyl acetate under alkaline conditions and then recovered from the solvent by re-extraction with dilute sulphuric acid[3]. Quinidine fluoresces strongly in dilute acid and can be measured directly.

Not all methods for the determination of drugs are ultra modern. Occasionally it is possible to unearth a method which relies on extraction and the measurement of either the UV absorption or perhaps on the intensity of a colour reaction. However, because of the wide range of compounds that are present in biological materials, methods involving the separation of the analyte by gas or liquid chromatography are much less prone to interference and are replacing simple absorbance methods where possible.

Equally not all methods of drug analysis are chemical. Antibiotics, by their very nature, lend themselves to analysis by the measurement of their ability to inhibit bacterial growth. Inoculation of a simple medium containing a specific bacterium with a plasma sample from a patient on gentamicin is a standard method for measuring this drug. The gentamicin from the sample diffuses into the medium and inhibits bacterial growth around the site of inoculation. After a given time (24 hours or so) the diameter of the inhibition ring is measured and compared with standards run on the same plate. Many antibiotics can be measured in this way but problems occur when more than one is present in the sample since all might have an effect on the bacterium, giving a false result. Some antibiotics show toxic side effects on the kidneys or on the hearing, and the monitoring of plasma concentrations of these drugs is becoming more common. For this reason, and because microbiological methods are necessarily slow, immunoassays and chromotographic techniques are preferred.

While most of the chemical methods mentioned can be considered rapid, they do not approach the speed of the enzyme multiplied immunoassay technique, which is discussed in a separate article.

Most chemical analyses take at least 20 minutes and require the use of expensive equipment. Batches of 20 or 30 samples can be handled by one person in half a day but the manual input is high. Automatic injectors on chromatographs and reporting integrators allow for overnight processing, which has a number of technical advantages. These devices are only now starting to appear in New Zealand laboratories.

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Anticonvulsant Drug Monitoring Using Enzyme Immunoassay

Ralph Richardson
Department of Clinical Chemistry, Auckland Hospital.

SUMMARY

The epileptic patient has benefited from the controlled use of anticonvulsant drugs made possible by therapeutic drug monitoring. The major change in methodology for the determination of these drugs in biological fluids has been the development of enzyme immunoassay techniques. This technology has given the drug assay laboratory the ability to return results rapidly to the physician even when large numbers of specimens are being assayed. Adaptation of the assay kits to automatic kinetic analysers such as the Centrifichem has produced assays which are more rapid and precise.

Introduction

The importance of therapeutic drug monitoring for most of the anticonvulsant drugs has been amply demonstrated over the last few years. Knowledge of blood levels of these drugs has provided the physician with a guide to dosage adjustment, diagnosis of drug intoxication or indication as to whether therapeutic failure to lack of compliance of his patient[1] [2]. Because such monitoring has shown a great improvement in efficacy of treatment and reduction in polypharmacy of these drugs, the numbers of specimens received for assay in hospital service laboratories have increased dramatically.

Many methods have been employed for assay of the anticonvulsants in biological fluids. Spectrophotometric methods [3] [4] gave way to the more specific gas chromatographic methods[5] which in turn have decreased in popularity with the use of more convenient high performance liquid chromatographic techniques[6]. Although many articles are still being published on refinements to chromatographic procedures, by far the greatest impact on the field of drug monitoring has been the development of enzyme immunoassay techniques. Comparison of results obtained from the College of American Pathologists' Toxicology Quality Control Survey over six years illustrates both the increase in number of laboratories monitoring blood drug levels and the impact of the enzyme immunoassay.

In 1974 when the predominant method in use was gas chromatographic, 70 laboratories took part in the survey in assaying phenytoin and phenobarbitone. In 1980 more than 300 laboratories assayed the four major anticonvulsants (phenytoin, phenobarbitone, carbamazepine and primidone) and 60% of those laboratories used enzyme immunoassay techniques. Of these, the most popular is the enzyme multiplied immunoassay technique (EMIT®).

Description Of EMIT.

As with radioimmunoassay, the principle of this technique is based on the immunological process, and the same high degree of specificity is obtained with the radioactive label having been replaced by an enzyme label. The assay consists of two reagents, an antibody raised against the drug to be assayed, and the drug covalently bound to an enzyme.

When this labelled drug is bound to the antibody the enzyme is inactivated by steric hindrance. Because of this inactivation the assay is homogeneous — no separation of the bound and unbound fractions is necessary. The enzyme-labelled drug competes with the free drug in the specimen for the antibody binding sites, and the enzyme activity increases due to unhindered enzyme-labelled drug. Consequently the enzyme activity is proportional to the drug concentration in the sample, and it is monitored by the change in absorbance resulting from the enzyme's catalytic action on a substrate.

The advantages of such a procedure are its rapidity, specificity, sensitivity and ability to be used on inexpensive spectrophotometers. The high accuracy of EMIT procedures has been the subject of many publications comparing them with chromatographic procedures. Such comparisons have been recently reviewed by Dietzler **et al**[7].

The disadvantages of this technique are: expense (especially as all kits are supplied by one manufacturer); samples must be assayed in duplicate and although precision is quite good (coefficients of variation less than 10%) it is operator-dependent; data handling is cumbersome. Kits are supplied with graph paper arranged so as to linearise the typical S-shaped curve obtained in calibration of immunological assays. A far more satisfactory approach is to use programmable calculators capable of doing log/logit analysis of the data.

Experience With EMIT.

The decision to monitor anticonvulsant levels by this technology at Auckland Hospital was made in 1977, with use of a manual spectrophotometric system. Although the total line to complete the assay was shortened to the extent that a maximum 24-hour service was provided, it was soon obvious that such a system was unsatisfactory for large numbers of specimens as the assay procedure was tedious and repetitive. Samples needed to be assayed in duplicate and very careful checking of results was required. Consequently, as soon as a centifugal analyser was available the kits were adapted for use on this instrument.

The instrument used was a Centrifichem 300 which consists of two modules: a pipettor and an analyser. The

Fig. 1.

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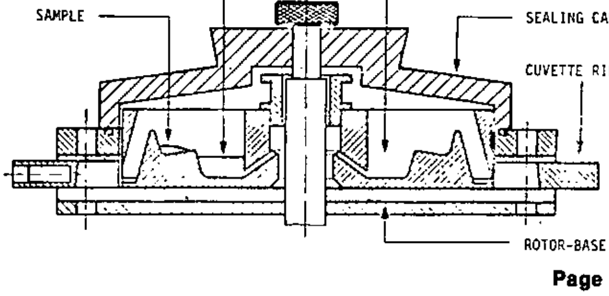



Ralph Richardson obtained his honours degree in Chemistry at the University of Auckland in 1968 and his PhD in 1972. He subsequently joined the Department of Clinical Chemistry at Auckland Hospital as toxicologist. His major interests are in the determination of drugs and their metabolites in biological fluids.

pipettor loads a teflon transfer disc with sample (3-50 μl) and reagent (250 or 350 μl). The loaded transfer disc is placed on the rotor of the analyser within a ring of 30 individual cuvettes formed by spacers between two quartz plates (Fig. 1). Once the disc has reached assay temperature it is accelerated to 1000rpm; the sample and reagents are mixed and transferred to the cuvettes by centrifugal force. The individual cuvettes continue to rotate through a fixed light beam which photometrically detects the progress of the reaction at the appropriate wavelength. Data are taken at pre-selected time intervals and printed as change in absorbance or as final concentration units. The programming controls are illustrated in Fig. 2.

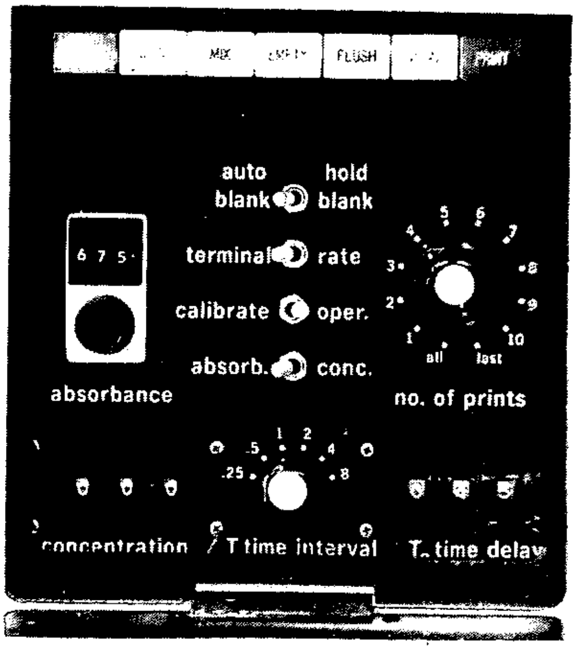


Fig. 2. Centrifichem 300 Programming Controls

Transfer discs are cleared and dried in an automatic wash cycle in preparation for re-loading.

EMIT is readily adaptable to such instrumentation. Because smaller reagent volumes are required and some dilution is possible without affecting precision, more than 600 assays can be performed with 100 test kits. However, the Centrifichem 300 cannot automatically add more than one reagent — the antibody reagent (50 μl) is added manually to the sample well of the transfer disc before samples are loaded. Consequently, all samples are assayed in duplicate.

The assay protocol and conditions are summarised below:

Sample volume	3 μl
Diluent volume	21 μl (used to flush sample probe)
Enzyme reagent volume	250 μl
Filter	340 nm
Temperature	30°C
Programme conditions	as illustrated in Fig. 2.

Phenobarbitone is the only anticonvulsant whose assay protocol is necessarily different. Because the anitbody-drug reaction is slower than for the other drugs, the transfer discs must be allowed to stand for a minimum of 5 minutes before the analysis is started.

The other anticonvulsants monitored, phenytoin, carbamazepine and primidone, can be assayed immediately the transfer disc is loaded.

Results And Discussion.

Table 1 compares the between-batch precision of the four anticonvulsants by the manual procedure with those obtained by the Centrifichem procedure.

The automated precision values are much more acceptable than those obtained with manual equipment and compare favourably with values from other automated equipment[7].

Other advantages of the Centrifichem methodology are: the speed of assay — a full transfer disc takes only 10-15 minutes and the laboratory's full anticonvulsant load can be completed in less than one hour per day; the sample volume is small enough to allow collection of microsamples from heel pricks to be used for analysis, an important consideration when assays need to be carried out on samples from babies.

There are disadvantages to the Centrifichem when used for EMIT assays. Firstly, the drying cycle of the Centrifichem uses methanol. Unless all traces of methanol are removed from the transfer discs, either protein precipitation or interference with the antibody reaction produces erratic results. Secondly, the instrument is not capable of calculating the results from the raw data produced. The curves must be drawn on the graph paper provided or calculated on a programmable calculator. However, a calculator such as the Hewlett Packard 9815 or system 85 can be interfaced to the instrument and results automatically calculated. The third general disadvantage is that the laboratory must depend on the manufacturer to provide consistently reliable reagents, particularly as at present only one source of reagent kits is available. Although chromatographic methods may remain as the reference methods the EMIT assays for the anticonvulsants are the method of choice for the routine drug assay laboratory, at least when large numbers of specimens are being received. The high degree of precision and specificity observed for automated adaptation to instrumentation such as the Centrifichem make such adaptations particularly suited to use in the clinical laboratory.

TABLE 1

PRECISION DATA

Between-Batch Replicates of Control Sera

Drug	**Control Concentration** (μmol/l)	**No. of Batches**	**$\bar{x}$ μmol/1**		**CV%**	
			Manual	**Centrifichem**	**Manual**	**Centrifichem**
Phenytoin	60	30	60.0	58.9	6.8	4.3
Phenobarbitone	129	30	126.7	131.0	8.5	5.0
Carbamazepine	25	30	26.0	25.4	6.1	3.9
Primidone	55	30	57.5	55.4	6.6	4.5

Importance of Active Metabolites In Drug Measurement

D.G. Ferry
**MRC Toxicology Research Unit,
Medical School, Dunedin**

There is considerable variation between individuals with regard to the absorption, distribution and elimination of drugs. The measurement of blood concentrations of drugs has become an established part in many areas of drug evaluation.

Metabolism is an important aspect of drug elimination. Several drugs are metabolised to produce active metabolites which may be present in plasma at concentrations comparable to the parent drug. Active metabolites which have a significant renal component of excretion may accumulate in patients with renal failure.

The possible contribution of active metabolites to pharmacological effect of a drug must not be overlooked and specific and comprehensive procedures must be employed to ensure the most informed decision regarding pharmacokinetics or clinical effect of a drug can be made.

Drugs are administered to patients to achieve a specific result, and if there was a clear and consistent relationship between dose and effect the role of the physician would be simplified. Unfortunately it is now well recognised that, in addition to differences in responsiveness to a given concentration of drug, there is considerable variation between individuals in the absorption, distribution and elimination of drugs.

In an attempt to improve this situation the measurement of drug concentrations now has a recognised place in pharmacokinetic studies into drug distribution within, and excretion from, the body. A knowledge of drug concentrations is important in clinical trials and therapeutic monitoring. It has been shown for several drugs that plasma concentration and effect are more closely related than are dose and response. There is little doubt that the routine measurement of such drugs as the anticonvulsants, digoxin and theophylline is of considerable assistance in determining the most appropriate dose for an individual patient.

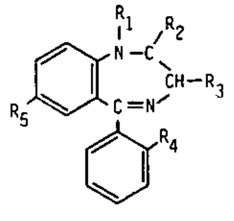
Although it is only one of the many factors responsible, the metabolism of drugs can contribute susbstantially to the variation in plasma concentrations between individuals. Some drugs are eliminated unchanged but many undergo extensive metabolism through a variety of reactions, such as hydroxylation, oxidation, reduction, acetylation and dealkylation. The rate of drug metabolism can be affected by a variety of factors such as genetics, age, sex, chemicals in the environment, diet, hepatic function and concomitant administration of other drugs.

The metabolic products are usually more polar, more water soluble and generally less active than the parent compound, but this is not always the case, and the contribution of an active metabolite to a pharmacological effect cannot be overlooked. For some drugs, such as the hypolipidaemic agent clofibrate, the parent drug is not active itself and serves as a pro-drug for the active metabolite. Usually both parent and metabolite are active, although the degree and nature of activity may differ.

In some instances the discovery of an active metabolite has led to marketing the metabolite as an agent in its own right. After an oral dose, some drugs such as lignocaine undergo extensive "first-pass" metabolism, where a considerable amount of drug is metabolised during the first circulation through the liver. Active metabolites with longer elimination half lives than the parent drug may be present at comparable or higher concentrations when administered long term. If only the parent drug concentrations are determined in a situation where high concentrations of an active metabolite may be present, a serious misinterpretation of the information may result. Active metabolites have been demonstrated for drugs in several different classes[1] and some of the most important are discussed below.

The antiepileptic drugs are probably the best examples of compounds where routine monitoring of plasma concentrations provides substantial assistance to therapeutic management. Two of these drugs, carbamazepine and primidone, provide excellent examples of compounds with active metabolites. Carbamazepine has an active epoxide metabolite which under steady state conditions has been found at concentrations between 15 and 81% that of carbamazepine[2]. The half lives of the two compounds are comparable, but what contribution the epoxide makes to clinical effect is not yet known.

Fig. 1. Structures of some benzodiazepines.



	R_1	R_2	R_3	R_4	R_5
Diazepam	CH_3	O	H	H	Cl
Desmethyldiazepam	H	O	H	H	Cl
Temazepam	CH_3	O	OH	H	Cl
Oxazepam	H	O	OH	H	Cl
Medazepam	CH_3	H_2	H	H	Cl
Prazepam	CH_2-◁	O	H	H	Cl

Don Ferry has been employed in the Toxicology Research Unit for the last 13 years, and has been involved in a variety of projects concerned with the analysis of drugs and pesticides in body fluids. His current interests include application of HPLC techniques to drug analysis and the assessment of hazard to solvent exposure.

He is married with 3 children and extra-scientific activities include spasmodic harrier running and playing enthusiastic albeit unskilled squash.

Drug Monitoring (Cont)

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Metabolites (Cont)

For primidone the importance of metabolites to clinical effect can be more readily appreciated. The principal metabolites are phenylethylmalonamide (PEMA), which has been shown to possess anticonvulsant activity, and phenobarbitone which is of course a well recognised anticonvulsant in its own right. The half life for primidone is 3-12 h, while that for PEMA is 40-60 h and for phenobarbitone is 3-5 days. There is therefore potential for cumulation, and concentrations of phenobarbitone 2-3 times and for PEMA similar to that of primidone have been reported[3]. While a significant proportion of the anticonvulsant activity of primidone can undoubtedly be attributed to phenobarbitone, the significance of PEMA is at present not clear.

The benzodiazepines (Fig. 1) are particularly notable for having active metabolites. The best known example is diazepam, which has three active metabolites, desmethyldiazepam, oxazepam and temazepam, all of which are marketed as drugs in their own right. The most important is desmethyl diazepam with an elimination half life of 51-120 h, considerably longer than that of diazepam, (24-48 h) so that it accumulates in a repeated dosage regimen to give concentrations in plasma twice that of diazepam[4]. The other two metabolites oxazepam and temazepam achieve concentrations up to 30% of diazepam[5]. Several other benzodiazepines give active metabolites; and prazepam, medazepam, flurazepam and ketazolam have little effect *per se* as they undergo very rapid and extensive metabolism to active products, including in some instances desmethyldiazepam, by which their effects are probably mediated.

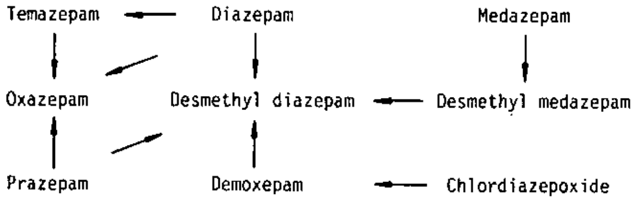
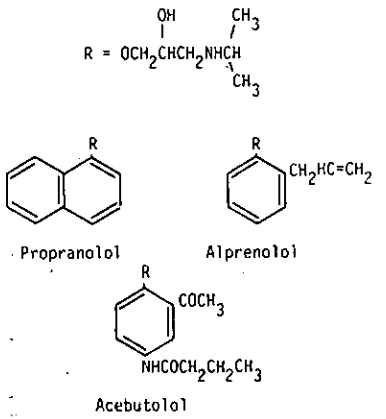


Fig. 2. Biotransformation of some benzodiazepines.

The β-adrenoreceptor antagonists are a very important group of agents for the management of hypertension. Propranolol and alprenolol (Fig. 3) undergo extensive first-pass metabolism to yield 4-hydroxy metabolites whose activity is comparable to that of the parent drug. 4-hydroxy propranolol has been shown to be present at concentrations comparable to that of the parent drug when it is administered long term[6]. The most important blocker in this regard is probably acebutolol (Fig. 3) which has an active acetyl metabolite present at concentrations threefold greater than acebutolol when the latter is given repeatedly[7]. Two other examples of drugs with active metabolites are among those used for treatment of cardiac disease. Procainamide has an equally active N-acetyl metabolite which can occur in plasma at concentrations double that of the parent drug. There is considerable variation amongst individuals, as the formation of the metabolite is genetically controlled[8]. Lignocaine undergoes such extensive first-pass metabolism that its use for the control of cardiac arrhythmias is confined to parenteral administration. The N-desethyl metabolite, which has similar activity to lignocaine but also exhibits toxic action, may be present at concentrations up to those of lignocaine itself[9]. The N-Didesethyl metabolite, although having activity only 25% of that of lignocaine, is also toxic and may be present at comparable concentrations[10].



$R = OCH_2\overset{OH}{\underset{|}{C}}HCH_2NHCH(CH_3)_2$

Fig. 3. Structures of the β blockers propranolol, alprenolol and acebutolol.

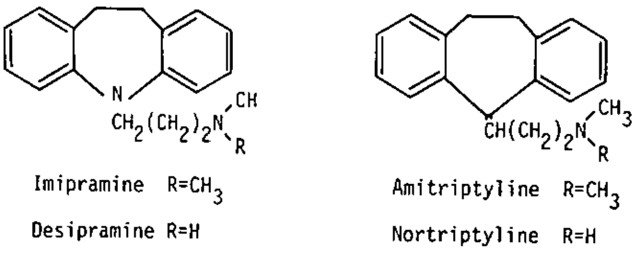


Fig. 4. Structure of the tricyclic antidepressants imipramine, desipramine, amitriptyline and nortriptyline.

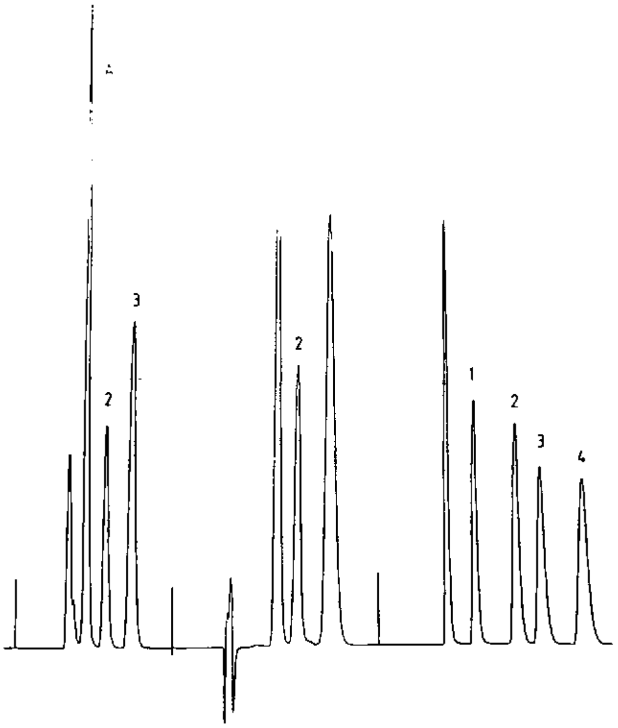
In a similar fashion to the benzodiazepines, the tricyclic antidepressants (Fig. 4) afford examples of drugs with active metabolites, and again some of these are available as drugs in their own right. Amitriptyline and imipramine both have N-desmethyl metabolites, nortriptyline and desipramine respectively. The metabolites have similar activity to the parent, and for nortriptyline plasma concentrations comparable to amitriptyline are observed[11]. For desipramine, which has an elimination

Fig. 5. High performance liquid chromatographic separation of drugs and metabolites.

A. (1) acetyl metabolite of acebutolol, (2) carbinol metabolite (3) acebutolol. Column, μBondapak CN, 10% acetonitrile/water/0.1% phosphoric acid.

B. (1) 7 hydroxy amoxapine, (2) 8 hydroxy amoxapine (3) amoxapine. Column μBondapak CN, 20% acetonitrile/water/0.1% phosphoric acid.

C. (1) desmethyl diazepam (2) oxazepam (3) diazepam (4) temazepam. Column μBondapak C18, 35% acetonitrile/water/0.1% phosphoric acid.



half life considerably greater than imipramine, plasma concentrations up to 15 fold higher have been reported[12].

Several of the newer structurally related antidepressants such as mainserin, nomifensine and the antipsychotic agents such as loxapine and amoxapine all have active metabolites, but the relative activity and plasma concentrations of these compounds have not been definitely established.

There are examples of compounds with active metabolites amongst most classes of drug and, while these compounds can be important in the normal patient, the matter can achieve a considerable significance in those with impaired renal function[1]. Accumulation of many drugs occurs in patients with renal failure[13] and the same will be true for metabolites, both active and inactive, where there is a significant renal component to elimination. Even a minor metabolite may assume importance in this situation.

It is therefore obvious that considerable caution must be exercised in the measurement of plasma concentrations of drugs with active metabolites and the subsequent interpretation of the information. Not only must the analyst be aware of the possible presence of metabolites, but he must ensure that the method employed is selective and does not suffer from problems of interference. Earlier spectrophotometric and some fluorescent procedures were totally unsatisfactory for this sort of analysis. The application of first gas chromatography and then liquid chromatography has significantly improved confidence in the results obtained. Analysis by gas chromatography of drugs and metabolites invariably requires derivative techniques and the often significant differences in polarity can make analyses difficult. The use of liquid chromatography on the other hand, particularly that employing reverse-phase columns and ion-pairing techniques, has considerably simplified the approach (Fig. 5).

While it would seem desirable to be able to measure all metabolites and in particular all active metabolites as well as the parent drug, this is not always practicable in terms of time and existing techniques. It is also apparent that the interpretation of the clinical significance of this information is difficult. However, where the presence of an active metabolite has been demonstrated and a suitable technique is available for its measurement it would seem prudent to use it.

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Local Production of Primary Gas Mixtures Underway

For the first time, primary gas mixtures — vital for detailed analysis work — are now being produced here by NZ Industrial Gases Ltd in Wellington.

Until now, primary mixtures — already blended — have had to be imported. Local production avoids the problems of lengthy delivery times often associated with imports and the NZIG product is equally as accurate as overseas mixtures.

A specially imported high load, high sensitivity balance — the only one of its type in the country — allows the gases to be weighed directly into the cylinder. This is more accurate than the previous system, in which the gases were measured by partial pressure. Local production began soon after Christmas and mixtures are available nationally in 1.2m³ cylinders. NZIG is also the importer of primary gas mixtures and will continue to do so — particularly for certain complex gas mixtures.

The company went into local production for two main reasons, said **Philip Best** NZIG's product manager for special gases. "In the past, customers have had to wait quite long periods — up to 4 months. By producing the mixtures locally, we can reduce this time to 4-6 weeks.

"Accuracy in primary mixtures is essential if they are going to be any real use in analysis — especially for calibration purposes. Mixing the gases on this new instrument means we can achieve greater accuracy in giving the customer exactly what he wants."

Essentially, the new service being offered by the company provides customers with primary gravimetric standards for precise gas mixture calibration and accuracy.

The Swiss gravimetric balance, on which the gases are weighed and mixed, allows an exact measurement to be made of all components.

"Gases are an integral part of many analytical tools. Selecting the correct purity of gas for use in equipment such as gas chromatographs, flame ionisation detectors and the like have a great bearing on the success of the project," said Mr Best.

The locally produced primary mixtures, which contain components ranging in concentrations from percentages to volumes per million, comply with the following specifications:

- The primary standard in the component range 5-50% has a preparation tolerance of plus or minus 5% of the component.
- In the range of 1-5%, it is prepared with a tolerance of plus or minus 5% of the component.
- In the range of 0-1%, its tolerance is 10% of the component. Certification accuracy is plus or minus 0.02% absolute, or 1% of the component, whichever is the smaller, on all filling ranges.

By comparison, the certified gas mixtures — the only ones available until now — had different preparation and certification accuracies:

- In the 10-50% range, the preparation tolerance is only 10% of the component and certification accuracy guaranteed to 2% of the component.
- In the range 1 ppm to 10%, the tolerance is 15% of the component and certification accuracy of 2%.
- In the range 400 vpm to 1%, tolerance is 20% of the component, with certification about 5%.
- In the 1 to 400 vpm range, the preparation tolerance is plus or minus 25%, with a certification accuracy of 5%.

Primary gas mixtures have a wide variety of applications, but the main use is as instrument calibration gases.

C076 For further details, use Reader Service Card.

The Institute's Early Years — Did We Err?

A founder member of the NZIC, **Mr Leonard Storkey Spackman,** has drawn attention to apparent errors in our article on the Institute's early years, which appeared in our February issue.
He writes:

The Editor,
Sir,

In the January 1981 Golden Jubilee issue there are several errors which, in the interests of historical accuracy, should be corrected.

On page 23 it is stated in Mr Hughson's 25th year review that in 1932 Prof. Evans continued in office as president and Mr Joiner as Secretary. In 1933 Prof. Easterfield was president and Mr Glendinning as general secretary.

This is not correct. It is my recollection that the first president was Prof. Easterfield. I believe that Mr Joiner may have acted as secretary in the formative stages but the first general secretary/treasurer was Mr Glendinning.

I have before me my membership certificate dated July 29, 1931 (illustrated) which is signed by Prof. Easterfield as president and Mr Glendinning as general secretary/treasurer. At this stage, the Institute was already registered as an Incorporated Society.

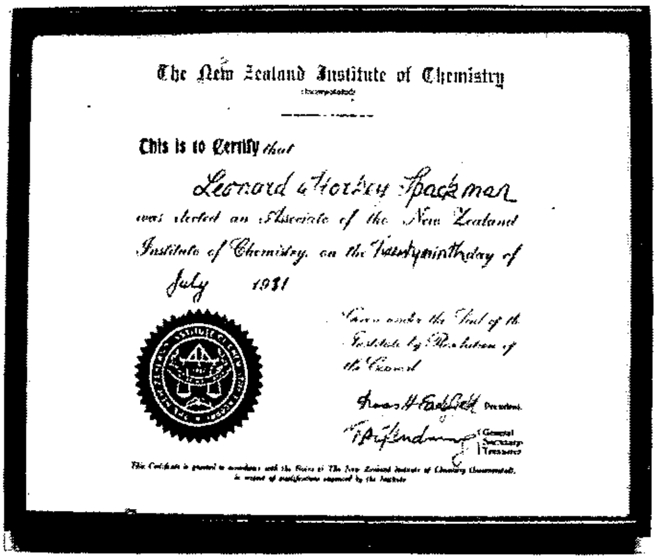
In the list of officers on page 28, not only are the dates again in error but Prof. Easterfield's name is omitted entirely from the list of presidents.

Although I may be wrong in this, it is my recollection that both the Code of Ethics and the first conference in Hamilton were later than 1934. I had the responsibility of organising the Hamilton Conference and was also convenor of the committee which produced the Code of Ethics. Apart from a short term served by Dr J.C. Andrews during the formation of the Auckland branch I acted as secretary of the branch for the first 9 or 10 years and was thus actively connected with the business of the Institute during its initial years.

The Editor comments:

We referred this letter to **Mr W.A. Joiner** who is quite sure that he was the first Secretary of the NZIC, and did not hand over the late Mr Glendinning until 1933. We are in error in omitting **Dr (later Sir Thomas) Easterfield** and there is no reason to doubt that he took office in 1933. He was still called Professor although he had been Director of the Cawthron Institute, Nelson, for the previous 12 years, **P.W. Robertson** being Professor of Chemistry at Victoria in 1933. Mr Joiner suggests that at the time of election of foundation members such as Mr Spackman, membership certificates would not be available and it could well have taken 2 years to have them designed, printed, the relevant entries made and the documents signed before they could be sent even to foundation members.

The first Conference of the Institute, held in conjunction with the NZ Section of the British Institute was held in January 1935 and is well documented in the first issue of the Journal of the NZIC in 1936.



The New Zealand Institute of Chemistry

This is to Certify that
Leonard Storkey Spackman
was elected an Associate of the New Zealand Institute of Chemistry on the Twentyninth day of
July 1931

Given under the Seal of the Institute by Resolution of the Council

President.

General Secretary Treasurer

Len Spackman's certificate — dated July 1931 and signed by Thomas H. Easterfield as President and T.A. Glendinning as General Secretary-Treasurer.

We regret other errors in the list of Presidents as published in page 28 of our last issue. Confusion arose over the fact that until the time of **Prof. L.H. Briggs,** Presidents were elected in November of each year, and in effect took office at the beginning of the following year but with the election of **Mr E.W. Hullett,** they took office at the Annual Meeting in August, so we have two entries for 1959. A consequent omission on our part was **Assoc. Prof. G.A. Wright** who took office in 1977. We apologise to Graham for this omission. The correct list is as follows:— **1931-2** Prof. W.P. Evans* - **1933** Prof (later Sir Thomas) Easterfield* - **1934-5** Prof H.G. Denham* - **1936-7** Prof F.P. Worley* - **1938-9** G.A. Lawerence* - **1940-41** Dr R. Gardner* - **1942-3** Sir T. Rigg* - **1944** Dr R.O. Page* - **1945** Dr J.C. Andrews* - **1946-7** Prof F.G. Soper - **1948** Dr J.K. Dixon* - **1949** Prof J. Packer* - **1950** Dr J. Melville - **1951** P.R. Parr* - **1952** S.N. Slater* - **1953** Dr H.E. Annett* - **1954** Dr H.O. Askew* - **1955** K.M. Griffin* - **1956** Dr (later Sir Malcolm) Burns - **1957** W.A. Joiner - **1958** Dr C.R. Barnicoat - **1959** Prof L.H. Briggs*; E.W. Hullet - **1960** Prof H.N. Parton - **1961** Dr F.B. Shorland - **1962** W.G. Hughson - **1963** S.G. Brooker - **1964** Dr S.R. Siemon - **1965** Dr A.T. Johns - **1966** M.S. Carrie - **1967** Prof D.R. Llewellyn - **1968** Prof J. Vaughan - **1969** Dr T.A. Rafter - **1970** Dr W.A. McGillivray - **1971** K.E. Seal - **1972** Prof R.E. Corbett - **1973** Dr P.K. Foster - **1974** Dr C.L. Davey - **1975** J.S. Pollard - **1976** Prof G.N. Malcolm - **1977** Dr G.A. Wright - **1978** Dr W.E. Harvey - **1979** Prof A.D. Campbell - **1980** Dr A.J. Ellis.
* Deceased.

INORGANIC ELEMENTAL ANALYSIS CONFERENCE

The Analytical Group of Philips Science & Industry Division is sponsoring a major international conference "Inorganic Elemental Analysis for Industry" in Metz, France, June 1-5.

Presentations by analytical specialists and invited speakers will cover Wavelength-Dispersive and Energy-Dispersive x-ray Spectrometry; Optical Emission Spectrometry; Atomic Absorption; Electrochemistry and Data Processing as related to Instrumental Analysis; Microanalytical Electron Microscopy.

These presentations will be related to applications in a wide range of industries, including Steel; Non-ferrous Metals; Cement; Petro-chemicals; Mining; Automotive Construction and many others. Further papers will be discussed in poster sessions which will be for open debate, when there will be ample opportunity for participants to exchange views and experiences.

The conference languages are French, German and English, and an interesting and varied social programme has also been organised for delegates' guests. For further details of this conference contact Graham Blanchett, Philips Electrical Industries of NZ Ltd., Box 2097, Wellington.

A NEW NAME IN MASS SPECTROMETRY

It is now more than 20 years since the first attempts were made to couple gas chromatography with mass spectrometry. Today, GC-MS analysis is a powerful technique and is applied in every branch of organic chemistry.

The increasing popularity of GC-MS meant that there was a corresponding increase in the requirement for a computer system to handle the vast amount of data being produced. VG Organic Ltd. and VG Data Systems Ltd. provided the technological support required by mass spectroscopists worldwide.

In the last few years, however, the market trend has been towards fully integrated GC-MS-DS systems, the data processor accessory becoming part of the mass analysis system.

This trend towards totally integrated systems has motivated the VG Instrument Group to merge its organic mass spectrometer and data system operations into one combined company to be called VG Analytical Ltd.

Consequently, VG Organic and VG Data Systems ceased to exist as separate companies at the end of 1980. The new company, VG Analytical Ltd., commenced operations in January.

The philosophy of VG Analytical will be to offer a complete and unified service to their existing and potential GC-MS-DS users. The company is represented in NZ by Advanced Electronics Ltd.

OBITUARY
Harold Edward Annett
1884-1980

A long life of service and achievement came to an end with the death of **Harold Edward Annett** on May 1, 1980. Born at Walton-on-Thames in 1884 he was educated at Tiffin School and then the South Eastern Agricultural College, Wye, a constituent College of the University of London. He was the first student to gain the B.Sc. in Agriculture from the University of London, graduating with honours. He continued at Wye for a year as research assistant to **Sir John Russell.**

In 1907 he joined the Indian Agricultural Service where he worked for some 20 years holding the post of Provincial Agricultural Chemist in many parts of India. At first he was at Pusa working under **Dr J.W. Leather**, Imperial Agricultural Chemist. While on leave, 1912-13, he studied at University College, London, under such men as **Sir William Ramsay FRS, Prof Collie FRS, Prof Plimmer, Sir William Bayliss FRS,** and **Prof Hewlett.** He passed the examinations for the Institute of Chemistry in the branch of Physiological Chemistry, Fermentation Bacteriology, and Enzyme Action, being elected direct to the Fellowship. He also had some time at Copenhagen with **Sorenson** on pH work and **Jorgenson** on yeasts.

During his time in India he held professorships in the Universities of Bombay and Nagpur. He carried out wide ranging research. Two successes he specially mentioned were the obtaining of a purified sugar from the black raw sugar derived from wild date palms by the simple expedient of acidification ("a piece of litmus paper solved the problem"), and the production of high grade opium in India. Before World War I supplies of medical opium and morphia came from Turkey — the Indian product contained too little morphia. With the war the Turkish supply was cut off and a source was urgently needed. Annett was given the task of upgrading the Indian product — an assignment he successfully accomplished in a few months. Further work on opium followed, work leading largely to the conferring of the D.Sc. degree from the University of London.

In 1925 Dr Annett visited NZ on holiday and was so impressed with the country that he retired from the Indian Civil Service and returned in 1927, at first 'taking a job' on **Mr J.M. Ranstead's** farm at Matangi to gain experience. From his reading he became particularly interested in the use of nitrogenous fertilisers along with lime, phosphates and potash, in pasture production, and the superior nutritive value of young grass. He expounded his ideas in a talk to the Hamilton Rotary Club on the occasion of their annual dinner for Waikato farmers *(Dairy Farmer,* June 20, 1928). The next step was to test out his ideas which he did on his own farm, "Grasslands". He was thus early in the use of rotational grazing in NZ, in demonstrating the need for potash in the Waikato, and in developing spray irrigation.

Dr Annett in his study sharing his desk with the head of a tigress he shot in India.'

Dr Annett served on the Council of Massey Agricultural College (14 years, 5 as deputy chairman), on the Board of the Dairy Research Institute and on the Hamilton City Council (chairman of the Parks and Reserves Committee). He cured a weed problem on Hamilton's Lake, without harm to fish or bird life, by judicious application of sodium arsenite at 10ppm spread by helicopter. He was also a member of the Hospital Board and served a term as President both of the NZ Institute of Chemistry, and the NZ branch of the Royal Institute of Chemistry. For some years he was chairman of the Hamilton branch of the United Nations Association.

Dr Annett received many honours: OBE (1950), Volunteer Decoration, Coronation Medal (1953), was a JP and a few weeks before his death was made a Paul Harris Fellow, a prestigious award in Rotary.

He held the post of honorary director of the Waikato Land Settlement Society; for 5 years was in charge of ICI agricultural advisory work; subsequently he was in charge of 2500 acres at Tokoroa where he obtained spectacular results from the use of cobalt. In the war years he was called from the army by the DSIR to supervise gasmask manufacture and later made advisory officer to the four big dehydration factories. Finally after the war he joined the Soil Fertility Research Station at Rukuhia where he worked on spray irrigation and also carried out drainage and evaporation studies.

His sports interests were wide, ranging from big game hunting to football (his last game was at the age of 56). He regarded trout fishing as the finest sport of all — his biggest catch a 13lb 10oz rainbow trout caught in 1928.

He was also a keen bowler right up to his death despite failing eyesight. A fellow bowler ruefully remarked he was so "bloody accurate" despite incorrect delivery and frequent excursions to study the head.

A fellow worker at the Soil Research Station speaks of him as forthright in expressing his opinions but always tolerant and courteous to those who did not share or even opposed his viewpoint ... he was very understanding of human nature. He was a kindly man indeed.

Dr Annett is survived by his wife and a son and daughter of his first marriage. To them we extend our deep sympathy.

E.B.D.

Editor's Note: Reference to the first issue of this journal in 1936 shows that Dr Annett attended the first Conference of the NZIC held in Hamilton the previous year. The programme included a visit to his experimental farm at Matangi, and he contributed a paper, "The Agricultural Scientist Gone Wrong", which is printed in an abbreviated form in the same first issue. His theme was that the scientists were doing excellent work, but were not getting their message across (v. Ecc. i 9).

AA SPECTROPHOTOMETER

The Model SB900 Atomic Absorption Spectrophotometer has been designed to be inexpensive and yet provide performance equal to its more costly competitors. It is a flexible instrument which can be purchased as a basic AA to which can be added additional lamp supplies, background corrector, hydride generator, graphite furnace and calculator/printer.

At prices ranging from less than $7,000 it is expected to be of interest to many laboratories which may have previously considered AA too expensive. As well, the instrument is ideal for teaching purposes and as a second instrument to back-up a more sophisticated installation.

The manufacturers claim detection limits of .2 ppb for magnesium, 3 ppb for copper and potassium, and .4 ppm for arsenic. Precision is generally 1-2% mean RSD.

The instrument has an award from the Industrial Design Council of Australia. Further information from Advanced Electronics Ltd.

C080 For further details, use Reader Service Card.

DIFFSTAKS HANDLE HIGH VAPOUR LOADS

Four new pumps have been added to the Edwards Diffstak range. Designed to handle high water vapour loads without sacrificing air pumping speed, they incorporate a high-conductance liquid nitrogen cooled disc.

For a given vapour handling capacity, Cryocooled Diffstak give roughly 4 times the air pumping speed of equivalent sized conventional trapped diffusion pumps.

At the same time they are said to retain the proven advantages of all Diffstaks: almost undetectably low backstreaming, and very clean vacuum coupled with high performance and small size.

Inlet sizes available are 63, 100, 160 and 250mm, giving water vapour pumping speeds of 500, 900, 2,000 and 6,000 ls^{-1} respectively.

Ultimate vacuum is 2 x 10^{-8} for all 4 pumps and air pumping speeds range from 120 ls^{-1} to 1700 ls^{-1}, depending on the model chosen. They are offered with a full set of options and accessories including a choice of manual or pheumatic valving. Further details from Wilton Scientific Ltd.

C075 For further details, use Reader Service Card.

NZIG: "The Future Lies In The Laboratory"

As the demand from industry, science and medicine for an ever broader range of specialist gases and gas mixtures increases, so too does the service and product base of this country's largest supplier in the field — NZ Industrial Gases Ltd.

The company, which pioneered the introduction of specialist gases to the local market 70 years ago, now has its own Analytical Services Laboratory, providing a scientific base for the production of new and sophisticated gases and gas mixtures.

The increasing demand here for high purity gases and gas mixtures has required the use of advanced analytical and quality control technology by NZIG and the laboratory now uses the most up to date analytical software, including infra-red spectrophotometry and gas chromatography, in its gases development programme.

Special gas mixtures for use as instrument calibration gases, carrier gases, zero gases, nuclear counter gases, furnace atmosphere and biological atmospheres, contain components ranging in concentrations from percentages to volumes per million. Such demanding requirements have made meticulous preparation and analysis essential elements during the gas mixing process.

By using the very latest gas technology for research and analysis NZIG is able to supply virtually any type of gas or gas mixture at various purity levels to meet precise requirements.

Industry, science and medicine are continuing to place increased demands on NZIG for new and even more refined gas mixtures. In meeting these demands the company finds itself formulating gas blends of widely varying types. For example, it supplies a mixture of ethyl alcohol and argon for the calibration of evidential breath testing equipment by the Ministry of Transport, while at the same time supplying an argon/nitrogen mix for use in light bulbs' manufacture.

The latter instance is a fine example of how carefully refined gas mixtures can greatly enhance the quality of a common household item. Laboratory testing proved that a precise blend of argon and nitrogen, introduced to the inner chamber of an ordinary light bulb, would considerably extend bulb life and provide a more natural light.

The food processing industry has also benefited from recent advances in gas mixture technology. By combining various proportions of carbon dioxide, oxygen and nitrogen and introducing the mixture to foodstuffs during packaging, a wide variety of produce can be given a much extended shelf life.

In an age of growing concern for the environment and the need to carefully monitor the quality and purity of the air breathed, the food eaten and the level of contaminants released into our surroundings, the advances made by NZIG laboratory technicians have done much to aid the accuracy of pollution monitoring through production of a variety of calibration gas mixtures for the testing of exhaust emissions and a host of other related applications.

Gas mixtures for atmospheric testing have been supplied to the NZ Meteorological Service for the measuring of air flows and pollutant concentrations throughout the country.

Numerous gas mixtures are manufactured and supplied to medical laboratories and hospitals throughout the country. Two of these mixtures — "Carbogen" and "Entonox" — are now in common use; "Carbogen" (a mixture of carbon dioxide and oxygen) for the treating of patients experiencing breathing difficulties and "Entonox" (a mixture of nitrous oxide and oxygen) for use as both an anaesthetic and a source of pain relief. Other medical gas mixtures — particularly of carbon monoxide, helium, oxygen and nitrogen — have been developed for use in the measurement of lung diffusion and respiratory efficiency.

It has long been known that carbon monoxide reacts with haemoglobin more readily than oxygen. By measuring the differences in concentration between carbon monoxide in inhaled and exhaled breath it is possible to determine respiratory efficiency. Helium has proved itself, due to its lesser density than nitrogen, as a highly successful tool in the treatment of patients experiencing breathing difficulty.

The company has pioneered the local production of instrument grade gases for use in high precision or complex analytical work. Many laboratories use oxygen, nitrogen, carbon dioxide and hydrogen in their work but until very recently these gases were only available in industrial grades. Special gases for analytical work have had to be imported but NZIG will soon begin the local manufacture of instrument gases for use in equipment such as gas chromatographs, flame ionization and atomic absorption.

"The preparation and anaysis of gas mixtures has long been considered a sort of 'black magic'," says **Phillip Best**, product manager for special gases. "Until quite recently people didn't really consider the procedure scientific — rather as an obscure 'art'. As a result, many erroneous concepts have developed which have become fables in the gas mixing industry. We're working hard to dispel these myths.

"Gas mixing is certainly a science — and a highly advanced one at that — coupled very closely to the future development and potential of some of our major industries and processes.

"We have proved that research and development of controlled gas mixtures can increase production threefold in some processes and refine the accuracy of instruments and measuring devices to limits never before thought possible."

Gas mixtures, he said, had even proved themselves as highly effective safety devices. Explosive Limit Gas Mixtures were now being used widely for the calibration of safety monitoring equipment to measure the presence of inflammable gases such as propane, methane and ethane.

"Gas mixing is a relatively new science and for that reason, perhaps, some people may be excused their 'black magic', preconceptions. But we don't spend our days waving magic wands! The future of the gas industry lies in the laboratory and the promise we've made as a company is to meet fully all the demands placed upon us by an ever more sophisticated community."

Solstat/KMS Link

A small Christchurch company specialising in the manufacture of instrumentation has just concluded an important agreement which, it hopes, will expand its NZ market share significantly.

Solstat Industries Ltd., which has been making and marketing its products for some 9 years, has now appointed Kempthorne Medical Supplies Ltd. as its sole distributors within NZ. The move is regarded as significant by KMS, too, as it extends the range of products the company offers here.

In Auckland recently was Solstat's managing director and founder, **John Campbell**. He explained that his company's policy has been one of steady growth and development through increasing experience. As a result, he commented, much of the company's business to date had resulted from personal contact and recommendations from existing clients.

This has been valuable, since the company is competing on the local market against strongly promoted imported products. It is also enjoying a measure of success in exporting to the Pacific Basin and Australia.

Mr Campbell points out that, on the local market, his company suffered somewhat from the "prophet in his own country" situation. In his position of having to devote much time at the workbench, he acknowledges this could be a drawback. Hence the recent link forged with KMS.

While benefitting from the advantages of a marketing operation with offices located in Auckland, Wellington, Christchurch and Dunedin, Solstat will not lose its personal contact with its clients, since it will provide a direct repair service, when required.

Training of KMS personnel to fully acquaint them with Solstat products has been undertaken both at the Christchurch company's plant and at KMS locations.

Cover Story

Application Of The GAF Filter System In Edible Oils And Fats Processing

S.P. Walton GAF (Great Britain) Ltd.

The process of refining edible oils and fats involves many stages of filtration and separation.

Refining removes the free fatty acids and waxes. Bleaching is then carried out with 0.5 to 2% of Fuller's-earth and/or activated earth at 90°C under vacuum to evaporate any water. This drying enables the earth to act more efficiently and will reduce the soap in oil content. At this stage the oil is filtered through a plate and frame press to remove the large solid content of Fuller's-earth.

At this stage the oil may be hardened by reacting it with hydrogen at 150°-200°C at a pressure of up to 100psi with up to 0.1% catalyst present. The hardened oil is then filtered again through a plate and frame press and may need to be re-refined and re-bleached before it is deodorised.

The oil is finally deodorised by passing it down several trays while steam is sparged through it. The oil is under vacuum and is gradually heated up to 250°C, first through steam coils and then through mineral oil coils. The oil is then cooled before leaving the deodoriser.

After this final processing stage the oil is pale in colour, bland in flavour, clear but not sparkling, and has a free fatty acid content of below 0.5%.

If all the refining, bleaching, hydrogenation and deodorisation processes had been carried out efficiently in a clean and well maintained plant, there would still be a need for a final polishing filter, because, even if perfectly clean oil entered the deodoriser, the high temperatures reached during deodorisation would still cause the polymerisation of certain unsaturated oils and even the formation of loose carbon deposits on the heating coils.

A GAF RB Series filter installed after the deodoriser will remove —

- Polymerised oil and carbon deposits
- Citric acid complexes formed in sequestering nickel salts during deodorisation.

A back-up filter would also be required in the event of the plate and frame filters in the plant not being completely efficient.

A GAF filter installed before the deodoriser will remove —

- Residual quantities of spent nickel catalyst and filter aids.
- Residual quantities of bleaching earth.
- Foreign matter in the oil such as hard fat.
- Pipe scale and rust.

Requirements Of A Filter System In An Edible Oil Plant

A RB Series filter system will remove all these contaminants and also fulfils the following requirements —

1. The system is chemically inert to edible oils and fats up to 100°C.
2. The system should not contain any copper metal which, even at ppm levels, would rapidly oxidise the oil.
3. The system should be completely sealed, thus preventing air from entering the system and oxidising the oil.
4. The system must be compact and capable of being installed in an existing plant.
5. The filter must be simple to clean and maintain and incorporate easy access so that the bag can be changed quickly.
6. The system should be capable of handling high flow rates up to 36 tonnes/hr and pressures up to 150psi.
7. The filter bag must be capable of removing particles down to 10 micron.
8. The filter bag should have a large surface area so it is not easily blinded by abnormal loadings.
9. Oil losses during bag change should be minimal.
10. The capital cost of installation and the cost of bags must be low compared with other systems.

GAF (NZ) Ltd. is a full subsiduary of GAF Corporation, USA, a world wide organisation manufacturing and marketing its products in 25 countries. The three main divisions of the company are reprographics, chemicals and building materials. The NZ company does not have a building materials division, however the range of Gafstar vinyl flooring is imported from Ireland and the USA and distributed throughout the country.

Although the reprographics division represents the major portion of the company's sales here at present, the chemical division which includes raw materials and filter systems is expected to provide significant growth in the near future.

Recommendations

Most edible oil producers have the problem of dirty oil either entering or leaving the deodorisers. Some producers have experienced particles of bleaching earth entering the deodorisers because their main plate and frame filters have proved inefficient. This has two effects on the oil during deodorisation: it increases the peroxide value of the oil, and disintegrates into fine particles that cannot be removed by the polishing filter.

A GAF RB-1A mild steel filter, installed after the bleached oil tanks but before the deodoriser, is recommended. A mild steel vessel is adequate, as edible oil is not corrosive.

A 25 micron viscose rayon filter bag (V 25 P1S) is recommended, as viscose rayon is cheap, and stable in edible oils up to 135°C. Provided the oil is at 60°-70°C, no heat exchanger or jacketed vessel is necessary. A flow rate of 18 tonnes/hr is possible, but in practice, at working pressures of around 20psi, this is substantially reduced. Where the contaminant loading of the oil is high, or where a greater flow rate is required, a double length vessel (RB-1AL) incorporating a P2S size filter bag, or a twin vessel unit (RB-2A) with a P1S bag is recommended.

Most producers have experienced polymerised oil and carbon in the oil when it leaves the deodoriser. An RB-1A mild steel filter installed after the deodoriser will provide a very efficient means of polishing the oil: with this, a V5P1S bag is recommended. Again, flow rates of 18 tonnes/hr are obtainable, but if the contaminant loading is high, or a greater flow rate is required, an RB-1AL or an RB-2A is recommended.

Conclusions

The RB Series filter system is most effective for use either before or after the deodorisers in an edible oil plant.

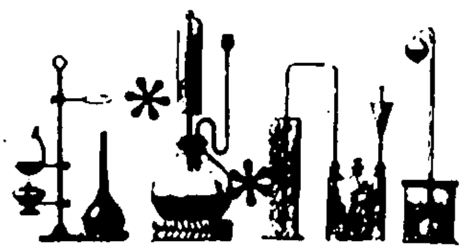
The advantage of using a closed system rather than an open bag is that the oil is not subjected to oxidation caused by air entering the system.

Bag filters have the advantage over cartridges in that a filter bag has a much greater surface area and is quicker to change than a bank of filter cartridges. One P1S size filter bag is also a cheaper proposition inasmuch as it provides the same surface area as several cartridge filters.

The two main advantages of using a bag filter, as opposed to a plate and frame filter press, are:

1. The cost of a plate and frame filter press is much more than the outlay required for a pressure filter.
2. The tremendous reduction in downtime when comparing the time it takes to change a filter bag with the time involved in rebuilding a stack of plates in a filter press.

With the RB Series installed in the production process of edible oils and fats a bright, clear and sparkling oil is obtained every time.



New Products, Services

MEASURE, TEST AND CONTROL INSTRUMENTS

In 50 years' operation, the name "Brabender" has become known throughout the world for physical measuring techniques in all sectors of research, development and industrial production.

As sole NZ agent for the W. German group, Chemby Marketing Ltd offers direct access to a wide range of instruments capable of measuring, testing, and controlling a wide spectrum of criteria for myriad applications from the processing of thermoplastics to simulated space flight.

All standard instruments are extensible in that they can be extended with respect to function and control at any time. This, of course, gives the apparatus a longer economical life. Much of this equipment is already in use here, particularly in the food industry.

C074 For further details, us Reader Service Card.

ADDITION TO FLEXIBLE CAPILLARY COLUMN LINE

Hewlett-Packard has introduced 2 new stationary phases to its fused silica capillary column product line. The new gum phases combine with a new high temperature siloxane deactivation to extend the working range of the chromatographic column to 325-350°C, it is claimed.

The columns have been engineered to provide the user with what is termed unprecedented capillary column reproducibility. Factors that contribute to reproducibility include specified column capacity ratio and specified retention index for acenaphthalene. In addition, all columns provide a theoretical efficiency (coating efficiency) guaranteed to be greater than 70%.

The gum phase columns are available in two diameters and two film thicknesses, allowing users to select a column with the resolution and sample capacity to fit their needs.

All material is tested at a stress level several times greater than the in-use stress level to guarantee high mechanical strength and flexibility.

All columns are pretested and shipped with test results indicating column inertness, capacity ratio, retention index, efficiency and film thickness.

Further information from Northrop Instruments & Systems Ltd.

C073 For further details, use Reader Service Card.

POLAROGRAPHIC DETECTOR

New application notes describing the uses of the Model 310 polarographic detector in the HPLC determination of N-nitrosamines are now available. These notes establish that chromatography and polarography can be conveniently and effectively united to explore new areas in trace analysis.

Application Note C-3 "Operating Parameters for Optimization of the Model 310", describes the various chromatographic and polarographic parameters for optimum performance of the polarographic detector. Using a model compound, dipropyl N-nitrosamine, the advantages of the Model 310 with respect to functional group response, detection limits, ease and simplicity of operation, are discussed.

Application Note C-4, "Analysis of Volatile and Nonvolatile N-nitrosamines Using the Polarographic Detector for High Performance Liquid Chromatography", deals with the trace level determination of composite mixtures of both volatile and nonvolatile N-nitroso compounds. Conditions are described for achieving the best separation of the individual components by HPLC followed by polarographic detection.

Application Note C-5, "Analysis of N-nitrosodiethanolamine in Cosmetic Products with a Polarographic Detector for Liquid Chromatography", demonstrates applicability of the polarographic detector to the analysis of "real-world" samples. Procedures for the isolation of NDELA from cosmetic products followed by detection with the polarographic detector are discussed. Further information from ANAC Ltd.

C078 For further details, use Reader Service Card.

CHROMATOGRAPHIC COLUMNS

A new series of high efficiency "Zorbax" chromatographic columns, 21.2mm ID, is now available for use in large volume preparative LC applications.

Offering excellent resolution with sample loads in the range of 20mg — 2.0g, the new columns can be supplied in four types — SIL, ODS, C-8, and NH_2. Chromatographic characteristics of each column are matched with those of the same type packing in the standard 4.6mm ID, analytical size, "Zorbax" column, thus permitting straightforward scaleup of separations.

The increased separation capacity of the larger columns makes them useful in isolations of trace impurities and in preparation of chemical standards. Efficiency of the large columns is in the range of 30,000 - 40,000 plates/meter, or 7500 - 10,000/25cm column.

The new columns supplement a series of 7 semi-preparative columns added to the broad Du Pont line last year. With an inside diameter of 9.4mm, the semi-prep columns have a typical efficiency of about 60,000 plates/meter, or about 15,000 plates/25cm column. They can handle sample loads up to several hundred mg. They are available not only in the same type packings as the 21.2mm columns but also in a cyano bonded phase for both normal and reversed phase chromatography, TMS for reversed phase separations of polar compounds and ion-pairing chromatography, and SAX for anion exchange.

Normal flow rate recommended with the 21.2mm ID columns is 40-50cm^3/min — 5 times that of the semi-prep columns.

All "Zorbax" columns are individually tested. Each column is accompanied by a Column Performance Report listing specifications which it is guaranteed to meet under a 60-day warranty against defects in materials or workmanship.

C077 For further details, use Reader Service Card.

HIGH PERFORMANCE PUMP FOR HPLC

Good performance and reliability in an economical package are offered in a new model 955 pump for HPLC (illustrated). Featuring the dual piston reciprocating design, this innovative pump delivers 0-10ml/min. with an upper pressure limit of 6000psi. Fully compatible with most HPLC systems, the 955 offers capabilities usually found only in higher priced instrumentation.

Economy and performance have been achieved through the use of a novel engineering design utilizing a single face cam to drive both pistons, a unique sheet metal oil bath to house the gearing and a single machine component containing both heads. The end result is a dependable and economical pump for HPLC. More information from Advanced Electronics Ltd.

C079 For further details, use Reader Service Card.

ACID-BASE LABORATORY

A new programmable micro pH/blood gas analyser, the ABL3 Acid-Base Laboratory, has been introduced by Radiometer, Copenhagen. It measures pH, P_{CO_2}, P_{O_2}, haemoglobin and barometric pressure and calculates 7 additional parameters. To perform a measurement, the operator needs only to introduce the 125 ul capillary sample. All other functions, such as rinsing, calibration and recording of results, are performed automatically.

A keyboard and screen (CRT) allow for communication with the built-in computer.

Further information is available from the NZ representatives, Watson Victor Ltd.

C058 For further details, use Reader Service Card.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