chemistry in new zealand

Vol 52 No 1 February 1988

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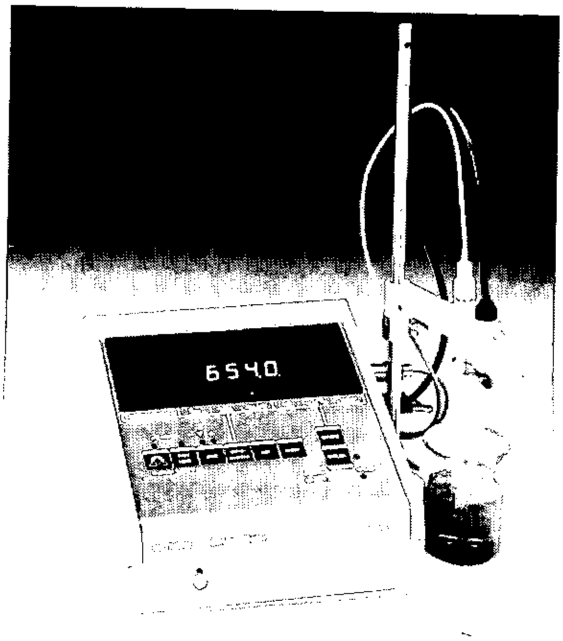

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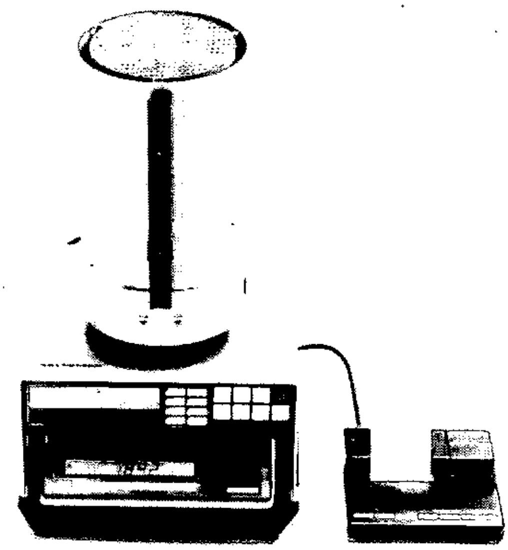

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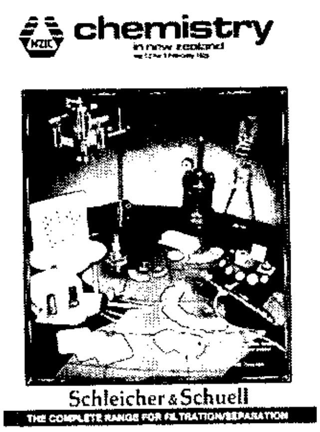
chemistry in new zealand

Vol 52 No 1 February 1988

Front Cover Story



Cover Story:
For macro- and microfiltration, specialist indicator and reagent papers, and all the necessary ancillary equipment — Schleicher & Shuell can meet all your requirements. Special products are also available for use in nucleic acid and protein research. For further information see page 24.

CONTENTS

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Advertising Features

This Issue:
In this issue we look at the instrumentation currently available for Fourier Transform Infrared Spectroscopy. Our cover story features filtration, and there are some major product items on automated wet chemistry analytical equipment.

Next Issue:
For April 1988 we plan to look at gas chromatography and safety equipment. The former will be supported by a number of application notes from some of our local practitioners. The latter will include products and services throughout the safety field, but with special emphasis on labelling and storage.

GUEST EDITORIAL

Queen's Honours and Branch Responsibilities

In the Christmas issue of the "Listener" there was an article entitled "A Gong Time Coming", which prompted me to reflect on the role of the Institute in making nominations for New Year and Birthday Honours.

Members, no doubt, reflect the same range of attitudes toward the Honours system as the public at large. Some will see an award as a tangible demonstration of appreciation by the community, through its elected representatives, for services rendered in the public interest. Recognition of acts of bravery, sporting prowess and long years of dedicated voluntary service to charitable organisations leave many of us with a feeling that these awards achieve something worthwhile.

Some may derive a certain wry amusement from the whole process. Remember Anthony Sampson's C.M.G. "Call Me God", K.C.M.G. "Kindly Call Me God", G.C.M.G. "God Calls Me God".

Others may have reservations about the merits of a system which is so vulnerable to log rolling and political cronyism. There may even be some who consider that receipt of an honour goes with the performance of a particular job in the public interest. If, however, this is implicitly part of the remuneration package, then the advantage of such a system to the taxpayer is worth bearing in mind.

However the question has to be asked, whether individuals need, or deserve to be given, special recognition for services for which they have already been well paid. Why, for example, do knighthoods go so frequently to the judiciary? Is it indeed that they are needed as an inducement to their following of even straighter and narrower paths of moral rectitude? If, on the other hand, the probability of a knighthood is part of the package for the abandonment of a more lucrative law practice, then so be it.

The Institute has its own awards to recognise service to the profession and, by implication, the community. These are, firstly, the **Fellowship**, given to those members whose work "combines professional authority, responsibility and seniority", and secondly, the **Honorary Fellowship**, awarded to those who have given "especially meritorious service to the Institute, or to science, or to the profession of chemistry".

The Rules of the Institute do not attempt to set out what is meant by "meritorious service" although they do refer to various unwritten precedents which have become established over the years. Members interested will find them set out in Section 6. One piece reflects the very real concern over this business of equity:

> *"As membership has grown it has become increasingly difficult to ensure that all members are remembered as potential candidates. To avoid injustices the custom has grown up of electing only retired members, and of considering their candidature only at the time of retirement".*

There is no strict procedure laid down for considering potential awardees but increasingly it has become the duty of branches to bring to the Council's attention people whom they regard as worthy of consideration.

In the case of Queen's Honours there are no guidelines to assist the Council. If the Institute as a whole is to make nominations then one must realise that the ground rules are different. There is no easy way for us to cope with the problem of equity. The wider criteria involved can make relative assessment beyond the professional experience of the Council.

Nominations are so often left to energetic individuals or groups, but it is difficult to suggest any formal way to improve the situation. There is no simple method of addressing this situation without becoming more formal. But as long as we have this type of honours system members are encouraged to ensure that worthy potential recipients are not overlooked through lethargy or a belief that somehow the Institute itself will sort out the possibilities.

When individuals or groups make a nomination it is important that it is supported with a thoroughly documented and well presented case. People on the spot and most closely associated with the nominee are far bettter situated to do this than the Honours Committee.

The Council will respond positively to well prepared submissions but individuals, groups and branches must take, and be seen to take the initiative in this sensitive matter.

Terry Hitchings
President

NZIC DIRECTORY, 1988

NZIC OFFICERS, 1987-88

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SPECIALIST GROUP SECRETARIES

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Chemical Education: DT Howarth, 44 Grahams Rd., Christchurch 4.
Chromatography: Dr DR Webster, National Testing Centre, P.O. Box 872, Auckland.
Electrochemistry: Dr AJ McQuillan, Chemistry Dept., Otago University, Box 56, Dunedin.
Fats & Oils: Dr SF Hobbs, 25 Woodside Rd., Mt Eden, Auckland 3.
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Organic Chemistry: Dr PJ Steel, Chemistry Dept., University of Canterbury, P.B., Christchurch.
Polymer Chemistry: RJ Norris, Chemistry Divn, DSIR, P.O. Box 2224, Auckland 1.
Thermodynamics: Dr GR Hedwig, Chemistry Dept., Massey University, Palmerston North.
X-Ray Crystallography: Dr GJ Gainsford, Chemistry Divn, DSIR, P.B., Petone.

COUNCIL NEWS

Membership Changes, 17 November 1987

Fellow:
RAINSFORD, Kim Drummond BSc, PhD(Lond), FRSC. Strangeways Research Lab, Cambridge U.K. (Research Fellow).
RUSSELL, Louise Elizabeth MSc, Tawa High School, Wellington (HOD Chemistry).

Member:
BAAS, Joan Winifred BSc, D. Phil (Waikato), Dept. of Biological Sciences, University of Waikato (Relieving Lecturer).
BOSTON, Grant Douglas, BSc(Hons)(Cant.), NZ Dairy Research Institute, Palmerston North (Research Officer).
BRAITHWAITE, Andrew Castley PhD(Auck). Chemistry Division DSIR Auckland (Scientist).
MOON, Ronald Philip MSc (Cant), Dip.Bus.Ad. 63 Atkin Ave, Mission Bay, Auckland (Development Manager — Chemistry).
ROBINSON, Philip Frederick MSc(Auck), Samson-Gold-X Coatings Ltd., Auckland (Technical Manager).
SHAW, Christopher Pinkney LRSC, Cawthron Institute, Nelson (Chemist).
THOMPSON, Peter Alan BSc, UEB Packaging Ltd., Auckland (Senior Technologist).
HAWKES, Allan David NZCS, Myceloxic Diseases Group, Ruakura Animal Research, Hamilton (Technical Officer).

Member from Graduate:
BHULA, Ms Rajumati BSc (Hons)(Well), Chemistry Dept, Victoria University (PhD Student).
GOMMANS, Louie Herman Peter MSc, D.Phil(Waikato), Dyson Perrins Laboratory, Oxford, U.K. (Post-Doctoral Fellow).
LUNDON, Yvonne BSc, P.O. Box 1656, Wellington (self-employed Tariff and Trade Consultant).
O'DONOGHUE, Erin Margaret BSc(Hons)(Massey), Horticultural Research Centre, Levin (Scientist).
ONG, Michael Kee Saik, MSc, Smith and Nephew Ltd., Auckland (Technical Manager).
VIATOS, James BSc(Hons) (Well), ARACI BHP Coated Products Divn, Port Kembla, N.S.W., (Research Officer).
TAPP, Neville John BSc (Hons) (Otago), Chemistry Divn, DSIR, Gracefield (Scientist).

Member from Associate:
NEIDERER, Alan Fraser NZCS, Otago University, Dunedin (MBA Student).

Associate Member:
TOTTON, Rosemary Ruth NZCS, ARA, Auckland (Technician).
TRATHEN, Michael, Oxyplast NZ Ltd., Auckland (Product Manager).

Associate from Technician:
DEBENHAM, Neil NZCS LRIC, 42 McDivitt St., Manurewa (Materials Development Technologist).
SPENCER, Raewyn NZCS, 27 Symond St, Onehunga.

Associate from Graduate:
HARDIE, Graeme MacLean NZCS BSc, Unilever NZ Ltd, Petone (Q.A. Supervisor).

Graduate Member:
DEACON, Nicola Anne BSc, Forest Research Institute, Rotorua (Technician).
HODGE, Suzanne Joy BSc Hons)(Otago), 61 Ohauiti Rd, Ohauiti, Tauranga.
LOCKHART, Evan Alan MSc Otago). Cadbury Schweppes Hudson Ltd., Dunedin (Chemist).
SMITH, Terrence John BSc, Chemistry Dept., University of Waikato (MSc student).

Technician Member:
McKONE, Gerard Joseph, NZCS, Chemby Chemicals Ltd., Takapuna (Technical Sales Rep).

Resignations:
The following resignations were accepted:
W.L. Dearsley, M.D. Robins, P.A. Simpson, L.V. Walsh, R.H. Walkley (Auck), R. Lloyd, K.J. Ronaldson (Waikato), R.D. Keene (Manawatu), E.A. Forbes, V.J. Holt, S.J. Lewis (Canterbury), D.M. Young (Otago).

Deaths:
The following deaths were noted with regret:
C.R. Tilly (Waikato), K.S. Birrell (Wellington).

Reinstated as Member:
N.D. Vargas (overseas).

Life Membership Granted:
B.E. Swedlund (Auck), P.R. Lever-Naylor (o'seas).

1988 NZIC/NZBS ANNUAL CONFERENCE

Palmerston North, August 23–26

The overall structure of this year's combined NZIC/NZBS Conference has now been decided, with the fine details currently being added by hard-working groups of scientists. This Conference is based on a number of mini-symposia organised by the Specialist Groups. Plenary lectures, presented by overseas researchers who are experts in their fields of endeavour, and other important meetings, are also being planned.

Special symposia honouring **Professor Arthur Campbell**, who has retired from Otago University, and **Professor Dick Batt,** who retires from Massey University later this year, are now being organised. Further information on these symposia may be obtained from either **Dr Roger Haselmore** (Plant Physiology Division, DSIR) or from **Dr Graeme Pritchard** (Department of Chemistry and Biochemistry, Massey University). Further details will be given in our next bulletin.

The Chromatography Group is organising a workshop covering a wide range of techniques. Speakers for the workshop include **Professor Paul Haddad** (University of New South Wales), **Dr Bill Hancock** (Massey University, currently on secondment to Genetech Ltd., San Francisco) and **Dr John Shaw** (Biotechnology Division, DSIR). Chromatographic-mass spectral techniques will be discussed. Further details on the workshop programme will be given in the next issue.

People to be contacted for information on Specialist Group activities are: Biochemistry **Dr Graeme Pritchard** (Massey University), Organic Chemistry **Dr Darryl Rowan** (Biotechnology Division, DSIR), Chromatography **Dr Dianne Webster** (National Testing Centre, P.O. Box 872, Auckland 1), Physical Chemistry **Dr Ian Watson** (Massey University), Inorganic Chemistry **Dr Dave Weatherburn** (Victoria University, Wellington), Analytical Chemistry **Dr Roger Haselmore** (Plant Physiology Division, DSIR) and Chemical Education **Dr Sylvia Rumball** (Massey University).

The following Plenary Speakers have accepted our invitations.

Dr Peter M. Colman

Dr Colman is a graduate of the University of Adelaide where his major was Physics. As a postdoctoral fellow in the US and West Germany he became interested in the three-dimensional structure of antibodies, and the problem of antibody recognition of antigens. That interest has continued since his move to the CSIRO Division of Protein Chemistry, Melbourne, in 1978.

There he began a collaboration with Dr Graeme Laver of the Australian National University which has led to the determination of the structure of the influenza virus antigen neuraminidase (in 1983), and more recently to the description of the structure of an antibody complexed with the same antigen. These analyses are landmarks in molecular biology and have stimulated work in Dr Colman's laboratory on the design of antiviral drugs.

Dr T. Mark Florence

Dr Florence is Senior Principal Research Scientist and leader of the Analytical Chemistry Section, CSIRO, Division of Energy Chemistry in Sydney. Dr Florence joined the Australian Atomic Energy Commission in 1957 and worked in the analytical section under Prof. Lloyd Smythe. During 1959 and 1960 he carried out research at the AAEC on methods for the determination of trace levels of lanthanides. This work was submitted to the University of New South Wales for an MSc degree which was awared in 1961. The University awarded him a DSc in 1974 for studies in analytical chemistry, the first Australian to receive a DSc in this field of research.

Since 1971 Dr Florence's prime interests and research activities have been in environmental chemistry, particularly the behaviour and determination of trace metals in natural waters. In 1976 he commenced work on environmental carcinogens, and the development of methods for the determination of carcinogenic compounds in natural waters and in body fluids. His present interests also include protein and free radical chemistry, ecotoxicology and occupational hygiene monitoring. He has published extensively (over 150 scientific papers) and has delivered many invited or plenary lectures at overseas conferences.

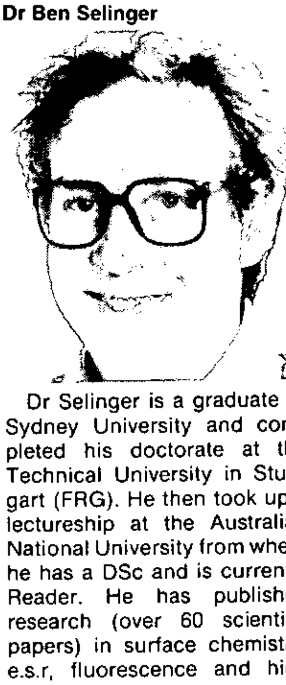
Professor Jeremy R. Knowles

Professor Knowles was educated at Magdalen College School, Oxford, and then served as a Pilot Officer in the Royal Air Force from 1953-55. He graduated in the Final Honour School of Chemistry from Balliol College Oxford in 1959, subsequently being elected a Harmsworth Scholar at Merton College and then a research lecturer at Christ Church. He was awarded the degrees of MA and DPhil in 1961, and went as a Postdoctoral Fellow to the California Institute of Technology. Returning to Oxford in 1962, he was elected Fellow and Tutor of Wadham College, and was appointed to a University Lectureship in 1966. He was a visiting Professor at Yale in both the Departments of Molecular Biophysics and of Chemistry in 1969 and 1971, and Sloan Visiting Professor at Harvard in 1973. In 1974, he joined the Harvard Faculty as Professor of Chemistry, and became the Amory Houghton Professor of Chemistry and Biochemistry in 1979. In 1983-84 he was elected Newton-Abraham Visiting Professor at Oxford University.

Professor Knowles' research is in the area of bio-organic chemistry, and involves the use of chemical methods and approaches to the solution of biochemical problems. He

works on the physical-organic basis for the extraordinary specificity and formidable rates of enzyme-catalysed reactions, on the evolution of enzyme function, the isolation and characterisation of enzyme-substrate reaction intermediates, and on the stereochemical course of enzyme reactions.

Dr Ben Selinger



Dr Selinger is a graduate of Sydney University and completed his doctorate at the Technical University in Stuttgart (FRG). He then took up a lectureship at the Australian National University from where he has a DSc and is currently Reader. He has published research (over 60 scientific papers) in surface chemistry, e.s.r, fluorescence and high resolution spectroscopy and expert systems on microcomputers. The books, "Chemistry in the Marketplace", currently in its third edition, and "Thinking with Fourier: MacFourier" and research for the Law Foundation of New South Wales on the presentation of forensic evidence in court represent his more recent activities. Dr Selinger has served on the National Occupational Health and Safety Commission and for many years on the Council of the Australian Consumers Assocation (publishers of "Choice").

1988 ANNUAL CONFERENCE Continued

Professor Karl E. Weighardt

Professor Weighardt, on graduating from the Institute for Inorganic Chemistry, University of Heidelberg, undertook further studies with Professors Hans Seibert and J. Weiss at the University and then with Professor A.G. Sykes at the University of Leeds, England. He has

held the positions of Assistant Professor of Inorganic Chemistry at the University of Heidelberg and the University of Hanover prior to being appointed Professor of Inorganic Chemistry at Ruhr-University Bochum. Professor Weighardt's research interests are in the fields of inorganic and bio-inorganic chemistry related to the synthesis, reactivity and structural determinations of transition metal complexes, the mechanism of electron transfer reactions and polynuclear iron centres in chemistry and biology.

Professor Tamotsu Kondo

Professor Kondo received the degree of Bachelor of Engineering in chemical engineering from Keio University, the oldest private university in Japan, and a PhD in chemistry from Kyushu University. After working as a research chemist at the Nezu Chemical Institute of Musashi University for 13 years, he was appointed Associate Professor, and later Professor of the Faculty of Pharmaceutical Sciences, Science University of Tokyo, where he teaches physical chemistry. Professor Kondo has worked as a Postdoctoral Fellow at the Department of Chemistry, McGill University, Montreal, Canada and taught surface chemistry at the Department of Applied Chemistry, Faculty of Engineering of Keio University. He was Visiting Professor of Surface and Colloid Science at the Graduate School of Fukuoka University in 1984 and of surface chemistry at the Department of Chemistry, Tohoku University in 1987.

Professor Kondo's research interests centre on biosurfaces and bio-colloids. He has published numerous articles on hemolysis by surfactants, permeability of microcapsule membranes, artificial red blood cells,

and liposomes and has contributed a chapter to Volume 10 of "Surface and Colloid Science" (E. Matijevic, Ed.). He is on the editorial boards of the Journal of Microencapsulation, Pharmaceutical Research, and the Journal of Biomaterials, Artificial Cells and Artificial Organs. Professor Kondo has been a member of the Chemical Society of Japan since 1949 and of the International Association of Colloid and Interface Scientists since 1981.

OTHER CONFERENCES

Heat and Mass Transfer '89 (4th Australasian Conference on Heat and Mass Transfer), Christchurch, 9-12 May 1989.

The University of Canterbury will be hosting this conference. While the conference will be broadly based, particular encouragement will be given to heat and mass-transfer processes in biological systems. The conference is expected to be an outstanding inter-disciplinary forum for the exchange of research results and practical developments in Australia and New Zealand.

Intending participants are invited to contact one of the conference's executives: Dr M.A. Connor, University of Melbourne, Parkville, Victoria 3052 Australia, or Dr J.C.F. Walker, University of Canterbury, Christchurch 1. Both oral and poster presentations are planned. Abstracts will be required by April 1988.

First Eurasian Chemical Conference, Baghdad, Iraq, 16-21 November 1988.

The organisers regret to advise that this conference has been indefinitely postponed.

THE INNOVATION PROCESS

Peter K. Foster
Building Research Association of New Zealand, Wellington

The publication of the "Beattie" report in late 1986 led to a number of public meetings, seminars, etc to debate, discuss and publicise its recommendations. The following paper was presented at one such meeting held in Wellington during 1987, under the auspices of the RSNZ. In this Dr Foster examines the real nature of the innovation process, and draws conclusions of importance to Government, to manufacturers, to scientists and to the Royal Society.

Preface

There have always been political objections to science and technology.

> *"These are times of retrenchment, when some attempt should be made to reduce the burdens of the country."*
>
> *"In the present financial condition there is no warrant for incurring this expenditure."*
>
> *"Let the country, before making new appointments, pay its debts."*
>
> (Hansard 1867: NZ Institute Bill)

This paper considers the relationship between science and technology, research and development, innovation, and the market, and draws conclusions important to Government, to manufacturers, to scientists and to the Royal Society.

Definitions

To clarify the comments to follow, the meaning of the terms, as used here, is given below:

Science and Technology (S and T) is the total technical knowledge existing at the time.

Research is technical work that increases the understanding of something. It adds to S and T.

Development is technical work that takes existing knowledge and understanding and applies them to improving some existing thing or implementing a new concept.

Innovation, the introduction of new things or methods, is achieved by market acceptance of a new product or process.

The Mythical Innovation Process

There is an all-too-popular view that research workers perceive gaps in science and technology, that *research* produces new understanding, and this new understanding allows a new product or system to be developed. This new thing is then put on the market, and accepted as an *innovation*. A direct cause-and-effect relationship is attributed to current research and innovation. This is the linear model of innovation (Figure 1).

It is crucial to recognise that this is in general, a myth, and that life is not like that. There are two reasons, the first of which is risk. Research, almost by definition, has an uncertainty of success — otherwise it would not be research. Far better to develop the innovation using known and proven S and T, where the risks are both smaller and better-known.

The second reason is the importance of time, and its dramatic effect in determining profitability. There is necessity for the rapid application of any investment. This can most easily be stated in terms of the total return which will be obtained on an investment. The total return, calculated on a "present value" basis using discount rates, decays rapidly and approximately exponentially with respect to the delay which elapses before a given cash benefit begins. For rates of return of 20 to 60 percent, the "half life" of the decay is 3 years to 18 months respectively. In other words if you have done some research which could return 40 percent on the investment, but are two years later getting it applied than you could have been, half the total profit you could have made is lost forever. Hence the extreme importance of speed in industry.

The Real Innovation Process

In the real world, the innovation process is quite different from the popular myth and starts at the opposite end — the market. In simplistic terms, a market opportunity is identified, and minimum entrepreneurial investment in *development* is carried out to get the product on the market using existing S and T. You cannot afford to wait while the research is done.

The real innovation process is complex and has important characteristics. Its degree of success depends both on access to an appropriate bank of S and T to draw on, and the availability of experts in the appropriate fields to interpret the knowledge.

S and T are far from the only inputs. *Innovation* requires successful integration of market identification, *development*, pilot production, finance and marketing. There can be a lot higher probability of failure due to matters which are the responsibility of industry management, than due to responsibilities of R and D management.

It requires different approaches — types of people different from those who do research. Strong market connections are essential.

It is independent of *current* research.

It can identify insufficient understanding and thus create the need for research, which can be done to press home the market advantage.

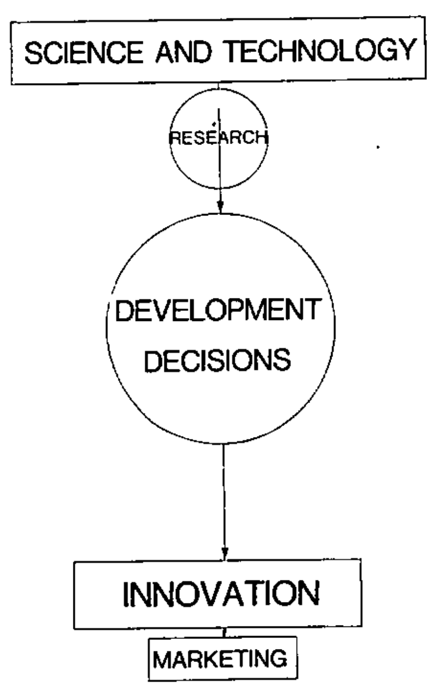


Figure 1. The linear model

Figure 2 integrates these aspects, but is still only a "snapshot" which does not consider the dimension of time. In fact a further complication is that each of the inputs to a particular innovation proceeds as a function of time in its own right. Research proceeds in parallel, to update the bank of S and T; marketers develop their techniques, and financiers develop new systems and sources of finance.

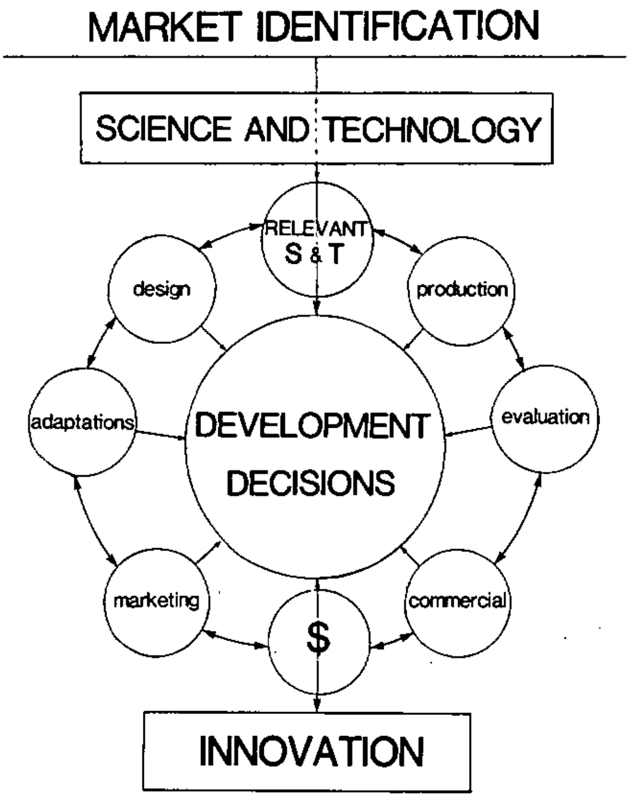


Figure 2. Simplified parallel model.

The real system of innovation is thus a parallel model. The model for product innovations developed by the European Industrial Research Managers' Association demonstrates the parallel nature and the full complexity of innovation in the real world. (Figure 3).

As stated earlier, the above is what generally happens, because the great majority of innovations depend on old science, and tend to be incremental in nature. There is a minority in which research does lead to invention. However the chief characteristics relevant to this paper are no different in this circumstance — namely, that there has to be early identification of a real market, and the same integration of technical, commercial and production factors, for the invention to become an innovation.

It is, in the important aspects, the same model, the difference being in degree, i.e. the time between the research and the identification of a market opportunity is shorter.

Messages

There are important messages which flow from the real nature of innovation.

Government and Treasury

The Treasury non-interventionist view of research appears to stem from the myth that innovation is an expected outcome of any particular research. Given this false premise, it is certainly logical to apply market principles, and to leave the judgement of which research should be done, and at what level of cost, to private sector investment decisions.

However, as argued here, the reality is very different. The innovator is not concerned with current research to achieve his market acceptance, but only with the relevant S and T from past research. He cannot be expected to contribute to general activities — the benefits of which he cannot be sure to capture to the exclusion of his competitors. Thus the market fails to ensure that sufficient research is done.

Research is *not* just another investment opportunity, to compete against other ways of spending the money.

It is essential that the research is done. As noted earlier, a market opportunity can be realised in practice only if the bank of S and T knowledge includes sufficient relevant material. We cannot expect overseas research to encompass the impact of the New Zealand environment and New Zealand materials, and the technological effects they can have. We have to be prepared to do it ourselves. The quickest way for New Zealand entrepreneurs to fail is not to have available (to them) a bank of information on the effects of local conditions, and to misapply overseas research.

Under the "myth" and the "reality" one would use different bases and approaches for determining priorities in selecting *research* areas. Under the former you would give greater weight to the areas in which scientists could see opportunities for achieving leadership in understanding. Under the latter, you would regard existence of *innovation*-minded management with financial and marketing strengths as a crucial prerequisite. Under the "myth" you can be confident that industries and markets are waiting for the results; under the "reality" you have to identify them before you start.

Given market failure for research investment, and the general antipathy in regard to centralised planning, only one option remains; that of inter-sector co-operation. This requires a mechanism for linking the public sector research effort, to the entrepreneurial aspects of market perception and finance. New Zealand is potentially in a good position to achieve this mechanism. The S and T, the market and the money come respectively under the Science and Technology Advisory Board (given the adoption of the Beattie Report), the Market Development Board, and the Economic Development Commission. This could lead to a co-operative consensus on the areas of research which are most likely to be necessary and desirable to match potentially innovative industries and sources of finance.

The partnership approach has been both well established and successful in New Zealand. The industry Research Associations in particular are good examples of both the extent to which firms in an industry contribute jointly to build up the necessary New Zealand S and T, and the extent to which industries combine with Government because the bank of information generated also benefits the community at large.

Finally, given an appreciation of the true nature of the innovation process, and given that our prosperity lies in technological advance, the concepts expressed here are fully in support of relevant recommendations in the Beattie Report. Sustaining the level of public sector research, providing incentives to the private sector to bring its innovative effort up to a matching level, an increase in co-operative research, the need for careful examination of the extent of application of the "user pays" principle, and above all the need for an Advisory Board and mechanisms for ensuring publicly-funded science is responsive to national needs — these are all logical consequences of the true nature of innovation and the associated failure of the market to lead to sufficient research to meet New Zealand needs.

One of these — the Advisory Board, and hence a structure —is the fundamental one. Everything else depends on having a structure for a partnership to operate in.

Manufacturers

The approach to where to introduce incentives to achieve more innovation in manufacturing industry could be quite different under the "myth", and under the "reality". Under the "myth", more and more R and D is clearly the place to put the money. Under the "reality", the identification of innovative companies and their help in identifying areas of base expertise to which they will need access, would be the first step, with incentives being by way of ease of access to R and D assistance.

Manufacturers have to be careful in their grounds for proposing the 150% write-off provision for R and D. Unless the grounds are *quite explicitly* and *solely* to achieve neutrality with Australian competitors, there is an implication that more R and D will produce more innovation, on a cause-and-effect basis. This would be apparent support for the myth of the linear model, and would have the weight of coming from those who should know best how innovation works. But as we have seen, the linear model leads logically to non-intervention, and therefore *no* special allowance.

Science and Science Managers

Public sector scientists who point to a particular innovation as the direct result of their research, and over-enthusiastically imply that their research was the prime cause of the innovation do little to help their cause. Not only do they perpetuate the myth, but they also feed Treasury with ammunition from the most credible source — that which will suffer most from the logical development of the myth to market control.

The managers of science have to have their resources organised so that the needs of innovatory entrepreneurs can be met. This can be done by concentrating on the market needs rather than on organisation by material or discipline. In BRANZ our groups are organised by building performance (e.g. fire resistance, atmospheric durability) rather than by material (e.g concrete, plastics) or discipline. The performance factors don't change with time as materials can do, and thus we can assist any innovator with a building product or system.

Royal Society

The second object of the RSNZ, under the Act, is "to inform the Minister in fields in which, in the opinion of the Council, the scientific effort of New Zealand should be increased; and to make suggestions as to how this may be done."

We have seen that the innovation process involves complex interactions between disparate activities performed in parallel. Accordingly the "what" and the "how" of the research activity, both of which the Council is charged with advising on, require knowledge and understanding of the total picture in relation to innovation, as no one activity can be properly planned in isolation.

As the Council has a minimum proportion of Fellows of 12 out of 14 it is the structure of the Fellowship which is important. While the Fellowship exhibits a wide range of disciplines, it has a very narrow base in terms of employer affiliation, which is virtually entirely public sector. My count of the list of 131 Fellows in 1986, resident in N.Z., is:

Museums	3
Hospitals	4
Public Service	38
University	83
Research Associations	2
Industry	1

The base is also narrow within the public sector. Of the 38 public servants, only 2 are from MAF, and 34 are from DSIR. For election to be based on a uniform standard of excellence, there would have to be 17 times as many scientists of excellent standard in DSIR as in MAF.

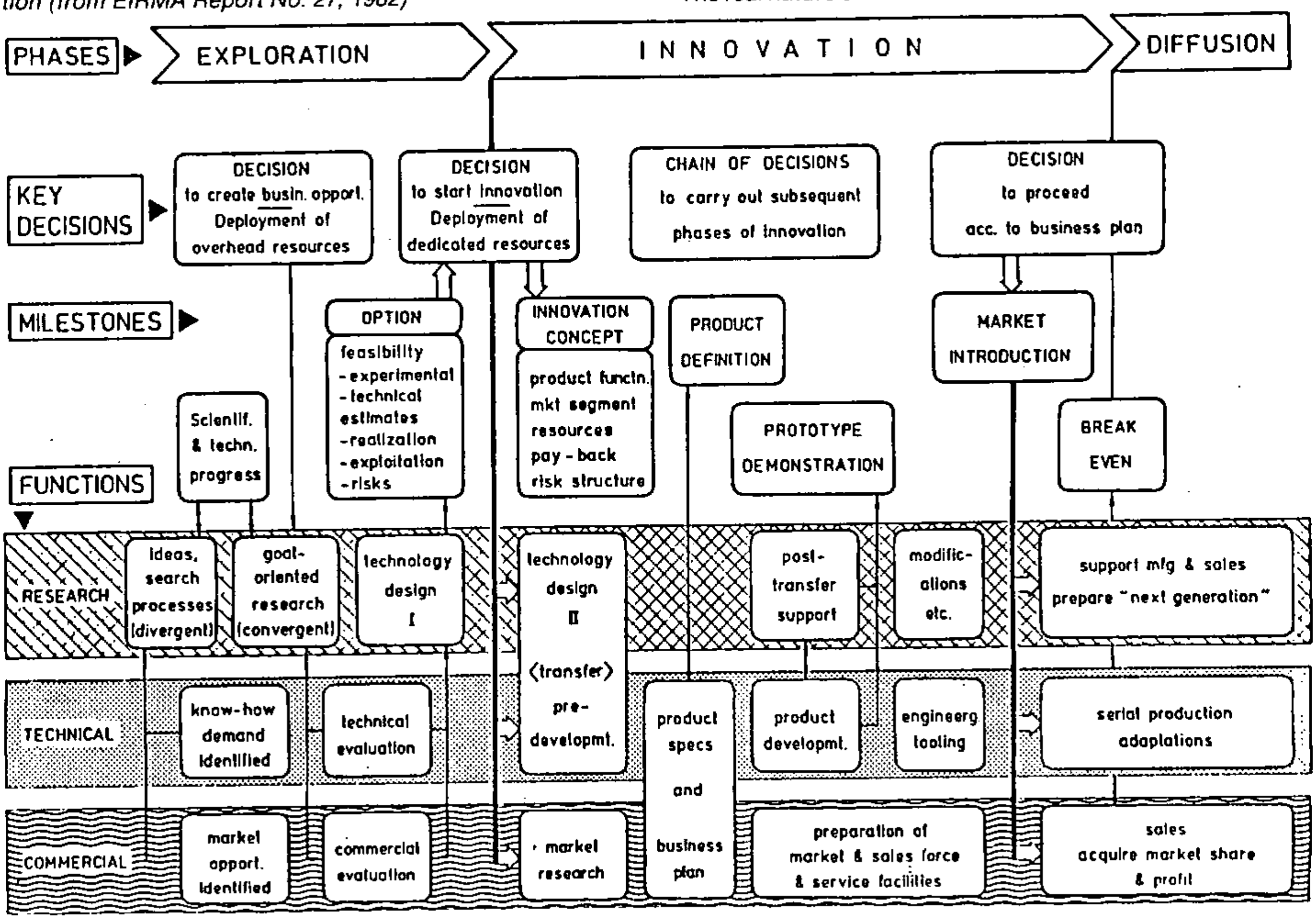
The distribution is narrow and strongly biased, in the statistical sense, in relation to the mix of interests which participate in the innovation process. The Council, as presently constituted, cannot bring an adequate range of experience to bear in seeking to attain the second Object of the Society.

Perhaps the most quoted section of the Science and Technology for Development Conference has been Charles Martin's criticism of commercial Boards of Directors with no technological literacy. We scientists have been keen to refer to this criticism. But can we defend a science body which is lacking in commercial literacy? If the Society's Council cannot speak from a base of demonstrable expertise in technology — i.e. on the economic aspects and importance of science, can it be any surprise for Government to put the Society under the microscope, or that the dissolution of the Parliamentary Meetings Committee could not be prevented.

The solution is quite simple in principle. The Fellows write the Rules and control the elections to Fellowship. The word "science" is undefined in the Act, and can be interpreted to include all science. You have every opportunity to broaden the Fellowship to encompass excellence in fields other than the academic and public sectors, and to achieve a Council that can fulfill its responsibilities under the Act.

If you have the authority you have the responsibility, and it would constitute no more than a return to the situation of 1867. The N.Z. Institute was set up in large part to ensure the continuation of studies of commercial importance by Hector and Skey.

Figure 3: Structural diagram of an industrial product innovation (from EIRMA Report No. 27, 1982)



Conclusion

The real nature of innovation leads to a need in New Zealand for, above all, a structure to link the sectors which have to communicate successfully for innovations to prosper. While messages have been identified for manufacturers, scientists, and this Society, there are two chief ones, to which all the rest are subsidiary.

Firstly Government must understand the true nature of innovation and the role of science in it; and Government *must* re-establish a structure for science that the private sector will not fund and cannot be expected to. Otherwise the communication essential to innovation can not take place. With a structure, a necessary condition for future development is satisfied.

Secondly, science and technology and research must be promoted in relation to innovation on the sound basis of the parallel model, and not on the mythical linear model which is self-defeating for public sector involvement.

Acknowledgement

Much of the material used here was published in National Business Review, March 20, 1987.

Postscript:

The seminar could be held because there was a time when science, and technology did have majority support in Parliament.

"The proposed cost will be very little compared to the advantage the Colony will derive from it."

"The object of the bill is to place the department on such a footing that it will not be liable to the risk of being struck off in some fit of pitiful economy."

(Hansard 1867: NZ Institute Bill)

FUNDING CHEMISTRY RESEARCH IN NEW ZEALAND UNIVERSITIES

David R. Williams, Department of Applied Chemistry UWIST, Cardiff, U.K.

In August, scientists attending the NZIC/NZBS Conference in Auckland, heard Professor Williams' lecture on Commercialisation and Marketing of University Chemistry. In the closing stages of his talk presented here, he ventured an outsider's view of the funding scenario in New Zealand.

Thanks to chemical breakthroughs in pharmaceuticals and family planning, we are living in a rapidly expanding post-retirement age society in which the number of teenagers presenting themselves for chemistry degrees is reducing noticeably: the escalating costs to Central Government of geriatric healthcare and the observation that elderly persons have the vote, whereas sixth formers and young students do not, helps to explain the bleak financing of university departments such as Chemistry.

Requests to Government for more funds will probably receive obdurate replies. Industrial research contracts currently being harvested by universities in UK and USA will need to be hand-picked in New Zealand because of the country's inclination to an agricultural-based, rather than industrial-based, economy and so we turn to the third source of funding — the transference of work from government research establishments into university research labs. This part of the talk examines the topic dispassionately, albeit from 19,000 km away!

I commend to all chemists working in New Zealand five sources of reading:

1. The latest Annual Report from DSIR (1986 was the most recent one available to me).
2. The November 1986 Report of the Ministerial Working Party, 'Key to Prosperity, Science and Technology.'
3. The Official New Zealand Year Book for 1986-87 published by the Department of Statistics, Wellington.
4. 'Science and Technology in New Zealand: Opportunity for the Future', E.G. Bollard, NRAC, 1986.
5. The book 'Chemistry in a Young Country' Ed. P.P. Williams, published by NZIC.

A Redistribution of Funding?

The occasion could not be more opportune for universities to take over some of the research projects traditionally mounted by the DSIR and industry. The Ministerial Working Party report shows that $M205 goes towards government research, whereas $M73 goes towards university research. Paradoxically, 40% of the staff capable of doing research are based in university (3300) (assisted by a couple of thousand enthusiastic and well-trained technicians) and the remaining 60% are based in Government (5040). Why 60% of the work force should have 74% of the funding is a question that ought to be answered openly at the ballot box.

The Ministerial Working Party report points out that the quality of the university staff in terms of the ir research attributes has improved dramatically over the past 25 years. 'Our universities now have staff of high international calibre over a range of disciplines'. A recent study by the University of Auckland has shown that approximately one-third of staff time in science is available for research. The report then goes on to read 'Figures available suggest that New Zealand invests a rather low proportion of its GDP on research carried out in teritiary institutions compared with most other OECD countries. New Zealand is near the bottom of the scale for Western developed countries.'

The Working Party was 'convinced that there is a potential for research and development which should be tapped for the future economic benefit of New Zealand'.

'We recommend that it be an early task for the Science & Technology Advisory Board to investigate the staffing and other measures needed to allow for research and development in selected areas in technical institutes and to report to Government accordingly.'

To an outsider, it seems to me that chemists in New Zealand universities ought to be pooling their knowledge in terms of deciding their priorities for special research and development and pushing these ideas at the Science & Technology Advisory Board. It seems in this sort of situation that the wheel that squeals the loudest will very definitely get the most grease and that the climate of Government opinion is in favour of handing out "grease" at the moment in order to establish a better balance of research funding between industry, government research institutes, and tertiary education.

The DSIR report makes excellent reading and touches on many areas in which we have common problems in the UK, for example, the difficulties of distributing information amongst the various groupings, the need for DSIR to be more cost-aware and to charge an average figure of $60 per hour for professional staff out on projects to industry. There is an intention expressed for outside earnings accrued by DSIR to be raised from 13.5% to 27% over a two year period. Organisations such as the Harwell Laboratory in the UK are under exactly the same instructions. Indeed, as from 1 April 1986, their method of working was adapted into a trading fund and they are now positively encouraged to make a profit. Thus, if funds do flow from DSIR to Academe, the former have it within their power to recoup their losses by charging more for their services.

Interestingly, as I consult at Harwell, I have seen two groups of scientists polarising there. There are those who are rubbing their hands and are absolutely delighted they can go out and compete for government and industrial funds on an equal basis with private research organisations. On the other hand, there are those who are terrified that they will have to justify their day-to-day existence and that this will upset the ultra-academic approach they have to keeping their minds clued up in terms of the subjects under their responsibility. The old concept of having on-the-shelf expertise "ticking over" in Harwell ready to be taken down and built into various task forces for different problems, originally in the nuclear area but now broadened out far more widely, seems to have gone a little sour in that some of the scientists sitting there on the shelves never seem to fit in exactly with the particular templates of the task forces being created! I am sure that similar situations must exist here in your DSIR. University researchers, being teachers of ever-changing syllabi, we like to think, ought to be more readily acceptable.

Other parallels that I see between New Zealand and Britain are that universities in Britain have long since become accustomed to all of their best young research staff moving on to industry and to research posts elsewhere, whereas industry and government research establishments are forever griping when one or two of their scientists are attracted away to competitive industry. Page 7 of the DSIR report also complains that although it sees as part of its role the training of specialists who may move to industry, whenever such moves occur the DSIR's own operations are 'badly affected by major losses'.

Your Official Year Book for 1986/87 (in Table 24.9) lists the imports and exports of chemicals to and from New Zealand. Without exception, imports vastly exceed exports. The ratio is approximately 2.3:1. The quality control of these imports and the safe handling of their packaging and disposal, as well as waste disposal, is a feature that must receive a great deal of attention. The DSIR report (page 54) states that opportunities for manufacture (of chemicals) in New Zealand are placed high on the list of project objectives. The measurement of levels of contaminants in food and food handling equipment are essential services which the DSIR has to provide. There are literally hundreds of small analytical projects which need to be carried out and continuously improved in New Zealand. These represent an important, and often unrecognised, part of New Zealand's constant vigilance over the quality of the local environment, of foodstuffs, and the safety of its citizens. The highly desirable aims of producing one's own chemicals and raw materials, for example, from the Ohaki geothermal field to give gold and silver, and the extraction of waxes and resins from the peat swamps in Northland through the new $M9 plant being built by the Kaurex Corporation Ltd., are all exciting ventures which must surely lead towards more self-sufficiency in terms of chemicals. Ideally, every chemist in tertiary education in New Zealand ought to be applauding and doing his or her little bit to assist such ventures. There must surely be a role for university researchers in evaluating analytical techniques and in the exploration and extraction fields!

One of the greatest pleasures that I have received over the last few years has been to be sent a copy of the book published for the 50th anniversary of the New Zealand Institute of Chemistry in 1981 and entitled 'Chemistry in a Young Country', edited by Dr P.P. Williams. The book ought to be made compulsory reading for all chemists and, indeed, for all students of chemistry in New Zealand. It starts with the impressive words, 'In the beginning, there was Skey and Aston' and each of the chapters, written in gripping style by eminent experts in their field, trace the history of New Zealand chemistry, much of it being traced back to Drs Skey and Aston. The founding of the Institute which was crystallised by Professor H.G. Denham of Canterbury University College is a remarkable story and the book is a tribute to the great steps forward made in New Zealand chemistry by very many hard working scientists over the last 50 years.

The main thrust of today's lecture is for me to encourage this current generation of chemists to write their own sentences for a similar book to be published for the 100th anniversary of chemistry in New Zealand. We might all ask ourselves, what are the most important objectives that we are aiming at and achievements to date, that our biographers of the future will be mentioning in print. Which of our tasks are worthwhile in that they enhance the calibre and the standard of living of our beloved country and which are merely superficial or paper-shuffling? We owe it to the past generation of chemists who built NZIC into what it is, to make sure that their enthusiasm and devotion to the cause of this marvellous country of yours is maintained, reinforced, and underwritten with good science.

On the one hand, I am cajoling university chemists to act as competition to DSIR for strategic research and, on the other hand, I am suggesting that DSIR scientists sensing university teachers looking over their shoulders will be subject to a catalysis reaction in terms of improving their own approaches.

All too often, we do not have a glib reply when asked by our grandchildren what we have achieved in the last 30-40 years. We give a specific example of just a small dark corner of our chemistry.

I might tell you that other countries in which there is a rather top-heavy Research Council base, suffer from a similar syndrome of frustration and a lack of dirigisme on the academic side. France is one such example.

The aforegoing remarks about industrial and government funding have been geared to provoke thought, discussion, and even argument, not to produce a feeling of comfort and complacency. Ten thousand difficulties need not make one doubt one's conviction that there is money available for the most important tasks and your chemistry can put it to rewarding uses.

Marketing University Chemistry

You, the audience, represent the top of the intellectual and academic ladder. However, how do you market your product to the general public? The greasy pole, to which Disraeli likened the pursuit of political power and influence abroad, is a very dangerous obstacle indeed! Nevertheless, Britain still contests for influence overseas and New Zealand must do the same. Although our sovereignty and freedom are not under immediate threat, we have still been beleaguered over the past 50 years by a wide range of problems which have threatened our nations in different ways.

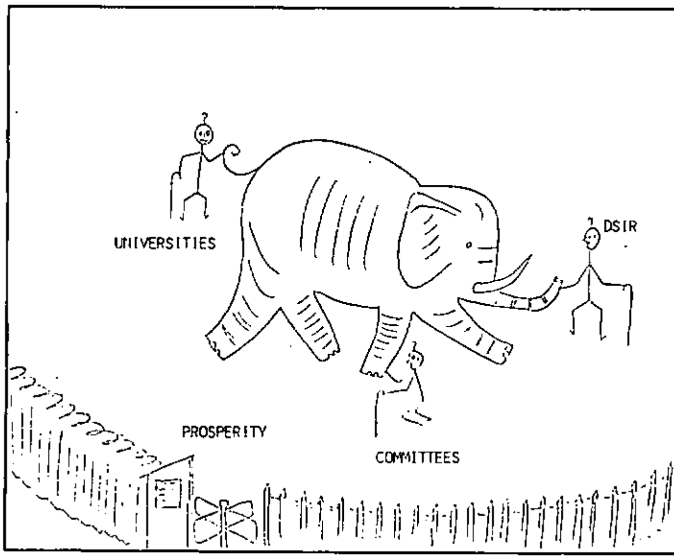
One of the most cost-effective means of underwriting our international standing is to win universal acclaim for the standard of our scientists. Let us not forget the story about the rebuilding of ruined Berlin in 1946 where residents in threadbare coats were handing bricks to each other, one by one, and in so doing were saying 'Danke Schon, Herr Doktor', and receiving the reply 'Bitte Schon, Frau Professor'. That's how future civilisations will be built, brick by brick, hour by hour, and day by day, from the bottom upwards and the end product will be closely influenced by those who are passing the bricks, i.e. the academics and intellectuals who are the thought- and building-creators of tomorrow. If anyone doubts the success of this way of building, just let them look at the number of Volkswagens and Mercedes around the world!

The Royal Society in 1985 published a substantial document entitled 'The Public Understanding of Science'. They stressed that science and technology play a major role in most aspects of our daily lives, both at home and at work. Our industry and, thus, our *national prosperity* depend on them. Almost all public policy issues have scientific or technological implications. Everybody, therefore, needs some understanding of science, its accomplishments, and its limitations. Many personal decisions, for example, about diet, vaccination, and personal hygiene, or safety at home and work, would be considerably assisted by some understanding of the underlying science. The report concluded there is a great deal of additional scope for more science in the media. Scientists must learn to communicate and, indeed, they ought to consider it their *duty* to communicate to lay persons.

The Royal Society report concluded there is a *prima facie* case for the existence of a link between the public understanding of science and a nation's prosperity. Though this link may be as difficult to quantify as that between a company's research and development effort and the same company's overall profitability, it is well worthwhile strengthening these two links. Governments and university science departments need to appreciate, for example, the interconnections between the three types of research — basic, strategic, and applied, the relative timescales and uncertainties of these three phases, and the increasing cost of instrumentation necessary to keep all three alive and thriving.

We are living in a gadget-filled, technologically-based society. Some sections of the public seem to demand that an industrial procedure, or a nuclear power plant, be completely free of risk. There is no such thing as zero risk, only a balancing of risks and their costs. A 1 in 100,000 chance of deformity from a whooping-cough vaccine causes considerable concern, yet parents who are known to be genetic risks may often be willing to accept a 1 in 10 risk of having an abnormal child.

In terms of scientific knowledge, we are dealing with woefully ignorant* governments who are handled by a woefully inadequate media. Poor old Joe Public is stuck in the middle. Our jargon-riddled industry needs to be simplified. This is a job for scientists and communicators such as academics. It is



Many recent enquiries may be likened to blind persons examining an elephant — localised knowledge without the long distance overview. What is now required is not more knowledge but movement such that profits flow through the gate receipts.

perfectly acceptable that New Zealand scientists aim for simple, scientific, pamphlets to be placed inside chemical products. Let them spell out the advantages of the chemicals that they are selling in plain, lay-persons' logic. Let us first start on the facts: do you yourself know the difference between plaque, tartar, and caries? Can you explain to a layperson what the effect on your combustion engine will be if you reduce the lead tetraethyl content of petrol? Having given the public more of the facts (and also I suspect having to bone up on them ourselves!), we must realise that sometimes the facts, themselves, are not enough. There is sometimes a great emotional charge which builds up against the mystique of scientific data. This has to be discharged through a lightning conductor from time to time — the Chernobyl press reporting was one such incident!

There is considerable evidence of public interest in science, for example, large audiences in the UK watch Tomorrow's World (9.2 million), Q.E.D. (7.7 million), Life in their Hands (5.5 million). We must regard it as part of our job to help produce such programmes. There is a need to urge newspaper editors and their senior staff to take a much more positive attitude to the role of science in their newspapers.

Enquire from an ordinary member of the public abroad what was the most memorable scientific report from New Zealand in 1987 and they will probably reply with the headlined suggestion that rocketed around the world — "DSIR to move operations to Australia to win 150% tax write-off". Is it the fault of journalist or scientist that has given this distorted reporting?

We must encourage industrialists and their science, technology, and health correspondents to produce more material and to provide press releases for these journalists describing the scientific connotations of our researches in laymen's language. It is clearly a part of each scientist's professional responsibility to promote the public understanding of science. It is recommended that every Ph.D candidate should explain the essential background and nature of his or her thesis work to a lay audience in the form of a short written article or lecture.

Unlike the task of pushing up the sales of soap powder or Australian beer by paying for press and media advertisements, to market our chemistry we do not necessarily need the financial outlay but it is of cardinal importance that we make special efforts to produce press releases, to give interviews and to print glossy brochures. Similarly, we must put the marketing and the motivation into our lecture courses so that the students learn from our convictions.

Criteria of Success

Commercialisation — the theme of this year's NZIC Conference — suggests that the bottom line profit is the main aim of the project. In my opinion, this ought not always to be the case. It would be better were we to set our success criteria upon monitoring the number of good pupils being turned out by secondary schools, the standard and numbers of good intake students into university, and the enthusiasm with which they accept industrial chemistry courses or sandwich courses and eventually go forward into industry. It can only be for the good of the country were more persons to be involved in more stages of this progression and especially so if they finished up in Government or public service as well as in industry.

It is, of course, not going to be easy to organise and to finance such schemes, but, after a few years of initiation, finances ought to begin to start flowing into the schemes from outside users.

There are other measures of success: the number of press clippings produced can be one useful indicator of business on the communications side. Audience attendance at public lectures you arrange can indicate relevance. Above all, the feeling after a few years that you are part of a vibrant Department widely sought after by outsiders is the best indicator, although impossible to quantify.

Speak to your Parliamentarians!

In terms of exports, New Zealand is very much a successful one-product society — agriculture. Although your excellent produce is supported by chemical fertilisers, pesticides and analyses, that part of the industrial revolution involving chemistry has not left indelible marks in your country. It did not need to — your exports paid for the importing of essentials and comforts.

However, as I look around Wales, where half our sheep have shaved, red-painted heads spelling out "Chernobyl Cs^{137}, unfit for slaughter", I am jolted back to reality and bear in mind the bumper sticker I saw at Livermore Labs "One good nuclear explosion could ruin my whole afternoon".

Such an incident — (over supremacy for Antarctic resources?) — a dollar swing, — an embargo, could have staggering consequences for your exports. New Zealand, I humbly suggest, needs to get into the Information Revolution ahead of its competitors. Ironically, this is one of the few areas in which distance matters not at all!

Were each participant to join Sir David Beattie in calling upon your elected parliamentarians to read his report — a telephone call once a month would be a good start — there must surely be movement of the elephant in the cartoon. What we want is not another review or committee, but progress such that the funds start flowing through the cash desk at the bottom of the figure.

Our representatives must be reminded that we are tenants of this planet, not landlords, and man has gained and maintained the edge over natural processes by collective wisdom and forward, logical (and often scientific) planning. Politicians must plan for the demise of the agricultural era.

Finally — a warning about having unquestioning belief in everything I have just told you:

"Believe nothing, no matter where you read it, or who said it, no matter if I have said it, unless it agrees with your own reason and your own commonsense."

Buddha

* As there can be no other explanation for the NZ Government's recent announcement of 20% cuts in academic research grants — 10% GST at source and 10% GST upon purchasing!

FTIR IN A TEACHING LABORATORY

Bruce Fraser and Tony Herd
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Early in 1987, the chemistry section at the Auckland Technical Institute acquired[1] a Perkin Elmer 1710 fourier-transform infrared spectrometer. As the purchase of this instrument would have fairly far-reaching consequences for our equipment budget, the decision was not reached without a certain amount of soul-searching. Twelve months later, we are confident that the arguments put forward justifying the purchase have been validated.

Applications

Like many instruments in a teaching laboratory, the FTIR is not stretched to its full capability. Most experiments using the PE 1710 are tried and trusted procedures illustrating principles and methods rather than advances in instrumentation. At Chemistry 5 level, experiments such as polymer identification and the quantitative determination of detergent in wool grease, or the EVA content of packaging film[2] have been successfully performed over a number of years on dispersive instruments. The major advantage of FT is the speed with which acceptable spectra can be produced, a big plus in laboratory classes of 12 or more students.

In low energy situations speed can be traded for better signal to noise ratios. Our major application in this area is with attenuated total reflectance (ATR) in situations where transmission spectra are impossible or misleading, e.g. paint films on opaque substrates or identification of laminated plastic films. Multiple reflectance ATR units involve considerable energy losses and dispersive i.r. instruments suffer from poor S/N ratios. Because of the multiple advantage and the absence of slits in FTIR, the higher energy incident on the sample and detector plus the ability to rapidly perform multiple scans, markedly improves the signal to noise ratio.

Teaching Computerised Instruments

Purchase of this instrument was also compatible with our policy of providing students with microprocessor-based instrumentation capable of interfacing with an external computer. The importance of this is reflected in the increasing use of sophisticated instrumentation in laboratories both in industry and scientific institutions.

The 1710 contains several on-board microprocessors required both for instrument control and for performing the fast fourier transform calculations. User interaction is via a CRT screen, a straight-forward keyboard and the intelligent use of "soft keys", whose function varies depending upon what aspect of operation the user is engaged in. Thus overall, operation of the spectrometer is very easy, allowing students to acquire routine spectra without recourse to the instruction manual, an important consideration given the high throughput of student samples during some experiments.

A number of spectral manipulation functions exist which allow us to demonstrate: smoothing (removal) of random noise from highly expanded strata, algorithms for baseline flattening (especially useful in ATR work), comparison of several spectra, and the ability to perform arithmetic operations on spectral data.

The instrument contains a limited spectral memory, allowing storage of three user spectra and a background spectrum. (The latter is required because, as with most FTIR's, the 1710 employs a single beam optical system). However, mass storage and recall of spectra is possible by interfacing the spectrometer to an external PC. We expect to implement this feature later this year.

Another consideration in the purchase of this system was the fact that it did not use an air bearing interferometer and that consequently it has an entirely sealed optical unit. Practically, this makes the spectrometer more rugged, transportable and less demanding of environmental and service requirements than most FTIR systems.

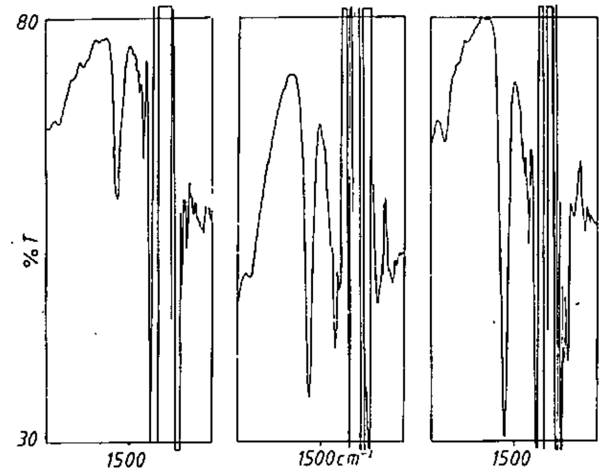
Future Possibilities

(1) As supplied, the PE 1710 incorporates an additional sample-holder mount placed directly adjacent to the detector. This facilitates the acquisition of spectra of highly scattering samples such as paper and is expected to be increasingly important in the Q.C. monitoring of packaging materials and specialty papers. The identification of paper chromatography spots may also be possible with this accessory.

(2) Microsample IR is another area of interest to us. This may be performed relatively simply and also inexpensively using a micro-sample accessory which condenses the IR beam to a 50 micron aperture and so allows the analysis of single textile fibres, small forensic samples, e.g. human hair, paint spots, etc.

(3) Quantitative multicomponent analysis of complex materials. With a suitable software package, sample properties that are not simply related to the infra-red spectrum can also be determined. For example the ash content and specific energy contents of coals can be determined by running spectra of standard coals then applying multiple linear regression analysis to establish a minimum set of factors that can be used for the analysis of unknowns[3]. The concept is the same as that used with near-i.r. analysis (NIRA), a technique that is being used in several Auckland industrial laboratories.

(4) The fast scan times of FTIR make it possible to utilise the instrument as a GC detector. However, GC-IR is not as sensitive as GC-MS and requires substantial hardware and software so that it is not an option that we will be considering in the foreseeable future.



Infrared spectra of standard wool grease containing 1, 3 and 5% NPEO detergent, all dissolved in tetrachloroethylene and in a 1mm cell. The spectra have been corrected for the wool grease and solvent by spectral subtraction. The lines to the right of the NPEO peak at 1515-1 result from slight variations in the very strong grease peaks.

FT vs Dispersive

The choice between Fourier transform and dispersive infrared is a very difficult one for a teaching laboratory. From a performance viewpoint we are under-using our instrument in most applications and a cheaper dispersive model would meet our needs in this regard. However, there are several other facets to the argument:

(1) NZCS students in Chemistry 4 and 5 are part-time students employed in real-life chemical laboratories and it is imperative that we are up with, or slightly ahead of, the play in terms of instrumentation. As noted in "Chemistry in New Zealand" for June 1985, dispersive instruments are on the way out. Several

major chemical industries in the Auckland region are likely to invest in FTIR in the next few years.
(2) In the past, infra-red spectrophotometers have given us perhaps the most trouble in terms of maintenance. This is not surprising when being used by up to 100 semi-trained operators in a single week. Assurances from Perkin-Elmer (Australia) that the PE 1700 with its tilting mirror systems and DTGS detector would be robust enough for our environment have so far proved correct.
(3) The multiplex advantage as mentioned earlier is very important, particularly when students on the sample preparation learning curve may require several attempts at obtaining a usable spectrum.

Perhaps the most telling evidence that we have made the right decision is the number of students and ex-students who wish to use the instrument for work problems[4].

Footnotes and References

(1) We use the word "acquired" advisedly as the non-buck passing of the Education Department's finance gnomes put a severe strain on our credibility rating. Happily, this financial side has at last been resolved.
(2) K.N. Allpress, B.N. Cowell and A.C. Herd, J. Chem. Ed., **58**, 741, (1981).
(3) P.M. Fredericks, P.R. Osborn and D.A.J. Swinkels, Anal. Chem., **57**, 1947, (1985).
(4) Like all instrumentation in ATI's chemistry section the FTIR is available for short-term use by approved operators.

Bruce Fraser graduated from Massey University with a BSc in 1979 and worked in the Chemistry Department before joining Sci-Med (NZ) Ltd in Palmerston North in 1980. he moved to Auckland in 1983 and took responsibility for the marketing and support of Sci-Med's chromatography operation. Bruce has been a lecturer in Chemistry at ATI since the start of 1987.

Tony Herd is an Otago University graduate and has been at ATI since 1977 where he is a senior lecturer teaching mainly analytical chemistry. Tony will also be known to readers as a past editor of "Chemistry in New Zealand".

"NEW ZEALAND AFTER NUCLEAR WAR"

Submission to the Secretary for the Environment, by the Environmental Committee, New Zealand Institute of Chemistry, November 1987

(1) This submission is based on the following premises:-
(a) That nuclear war should be avoided or prevented, and the maxmium effort should be put into prevention, not post-event repair.
(b) That, should a nuclear disaster occur, it is at a distance.
(c) That basic communications even at a reduced level, have been maintained or restored. There is no sense in trying to preserve a technology in the absence of civilisation or a reasonable degree of political, social or economic stability.

(2) Preservation of existing systems. As all chemical processes involve energy transfer, it is vital that power supplies, especially electricity, be protected from irreparable damage through EMP discharge. Without an electric power supply all other systems or structures, whether communications, control of vital human health or chemical processes e.g. water and sewage, political order, health care systems, would become extremely difficult to maintain.

Energy is the vital resource, with electrical power generation and natural gas supply being paramount. With adequate power, communications and health care, including water treatment, sewage disposal and organized medical services would be possible. Transport would be the third priority.

(3) Stockpiling. It is not considered that stockpiling of chemicals as raw materials or finished products is economic. However it is important that information on low-technology processes should be identified and preserved from possible loss. Hence archives such as old journal runs covering the early years of this century should not be discarded, or kept only in a non-secure form, e.g. computer files, and old textbooks, held in secure but accessible storage. An updated version of "Chemical Processes in New Zealand" (ed. J.E. Packer NZIC, 1978) could provide a useful resource manual.

A register of sources or stockpiles of chemicals currently within NZ should be created and maintained, e.g. through NZIC or National Hazardous Chemicals Information Service, using recording systems other than the computerized systems currently being introduced.

(4) Existing technology: It is considered that there are many examples of chemical processes that could be continued or re-established after a nuclear war, given some measure of modifications to control systems, or re-creation of older plants.

Emphasis should be place on retaining expertise and information resources about the industrial applications of electrochemistry, using our major likely power source, electricity, for the development of a post-war chemical industry base.

(5) Preservation of existing resources. As part of the process of public information concerning the consequences of distant nuclear war, public awareness of sources, as well as uses, of existing raw materials needs to be strengthened. Our dependence on overseas supplies of ferrous and non-ferrous metals, especially copper and aluminium, and most chemical feed-stocks, e.g. plastics, phosphates means that we are vulnerable. Conservation of these resources should be encouraged now e.g., by recycling, by education to use locally sourced materials (e.g. paper rather than plastic) or by changes in life-style or work habits (e.g. by reducing dependence on phosphate). Many of these changes in traditional ways of doing things would follow automatically in a nuclear war situation from a reduced emphasis on a compact urban, consumer society and greater emphasis on a dispersed rural agricultural subsistence economy.

(6) Health needs. Careful consideration must be given to the needs of the country so that in a post-nuclear age it can survive the onslaught of disease. The major emphasis here will be on disease prevention, by adequate water supplies, sanitation, control of vermin, dispersal of concentrations of population, etc.

The stockpiling of drugs, or the creation of a pharmaceutical industry, would be quite uneconomic, in a world of free commerce. It is necessary therefore to devise ways of coping with a post-nuclear scene, should it arise. This requires considerations of the basics of medicine, e.g. disinfection, sterility, simplified surgery, re-use of needles, blades, etc. which are currently disposable, production of sterile solutions, etc., rather than attempts to maintain high-technology medicine.

Much has been talked about reversion to a Maori way of life and medicine as a possible solution. While their way of life, as a semi-nomadic people living in low-densities of population largely as hunters and gatherers, would be appropriate, there is little to suggest that Maori medicine, as currently preserved or known, could offer concrete solutions to specific medical problems. More research could be funded into local herbal remedies. The likelihood of potent, useful or safe drugs of medical value being discovered is relatively remote, however. The remedies listed in "New Zealand Medicinal Plants" (eds. SG Brooker and RC Cooper), Auckland Museum, 1962) are mainly for trivial conditions, e.g. dyspepsia, constipation, and reflect better the knowledge of medicine appropriate to the mid-1800's than that of the late 1900's. A programme of extraction, purification and testing of

Continued next page

Table: Chemical processes that could be continued or re-established after a nuclear war.

Raw Material	Product	Use
Coal	Coke	Metallurgy
	Carbide (acetylene)	"
	Coal tar	Phenol, disinfectants
		Aspirin analgesics
Salt (from sea & sun)	Chlorine	Disinfectant
	Hypochlorite	"
	Chlorinated Hydrocarbons	Anaesthetics
		Solvents
	Sodium Hydroxide	Soaps
	Iodine	Disinfectants
Sulphur (volcanic)	Sulphuric acid	Acid feed stocks
		Ether
Ethanol (fermentation of whey)		Fuel
		Chemical feed stock
Natural gas	Methanol	Fuel
	Gasoline	"
Wood	Glues	Building materials
	Wood ash	Potash

1986/87 MANUFACTURERS FEDERATION R & D SURVEY

A Research and Development Survey carried out jointly by the NZ Manufacturers' Federation and the Industrial Statistics Section, Applied Mathematics Division, DSIR, carries few surprises for those in touch with the current R & D scene in this country. Released shortly before Christmas, the report is a follow up on a similar survey of R & D spending by manufacturers, carried out in 1983/84. Key points from the survey show a decline in R & D investment to only 0.45% of sales — the comparable figure in the US is 3.5%; only a third of companies have a technically qualified person on their boards; only a third have an R & D policy; reduced purchases of technology since 83/84; and a low utilisation of R & D agencies, particularly universities.

The Manufacturers Federation had hoped its 1986/87 survey would show an improved appreciation of R & D by industry and Government. This is not the case.

Change over the last three years has had considerable impact on manufacturers, and most of it has been readily accepted. But the disagreement with government over the pace of change, and the extent of it, is becoming a substantial problem. In the face of such dramatic change, the risk is that very important issues for the longer term are being overlooked; this is apparently happening now to investment in R & D.

Survey Results

A summary of results from the survey is as follows:

* Investment in R & D has fallen by about 20% in dollar terms and about 40% in real terms since 1983/84. In 1986/87 the manufacturing sector invested approximately $105m in R & D, with about $59m coming from 90 "large" companies.
* Overall R & D investment was only 0.45% of sales, with 40% of companies investing less than 0.2% and 65% of companies investing less than 0.5%. Based on limited information, the highest value of investment, 5.5%, was in electronics.
* About 60% of companies said they had someone responsible for R & D. About 30% of companies have no technically qualified person on their staff and 30% also have no technically qualified person in senior management. Overall, only about 30% of companies have a technically qualified person on the Board; 30% have a defined R & D policy and/or refer to R & D in a strategy document; 40% have an R & D budget; 50% have systems of accounts that identify R & D expenditure.
* In the manufacturing sector there are approximately 25 technicially qualified people per 1000 employees. Of these 25, four graduates and five technicians work either full, or part time on R & D.
* Companies appear to be applying R & D more or less equally to the development of *new* products, processes, services or systems and *significantly improving* existing products, etc.
* "Large" companies took out more patents in 1986/87 than in 1983/84. "Small-medium" companies took out fewer. There was a decrease in royalties paid out on technology purchased through license agreements.
* The overall usage of outside R & D agencies was low. The average percentage of R & D funds contracted out was approximately as follows:

Private consultants	5%
govt. labs & res. assn.	4%
universities	1%
technical inst.	1%

Implications

The survey results show New Zealand generally does not accord R & D the value placed on it by countries with which we compete. New Zealand is advancing into technological decline and manufacturers are prepared to go offshore to where incentives for R & D are available, or take up importing.

Government expects manufacturers to change too rapidly without due acknowledgement of the value of incentives the competition overseas is receiving. Incentives for R & D while carrying a financial benefit are perhaps more importantly a measure of national commitment.

Manufacturers' Response

Industry in New Zealand takes seriously the hard message of the R & D survey, and intends to continue to present forcefully to Government its ideas for solutions to the problem, as it has done in the past, specifically to:

- encourage industry to promote more technically competent people into its ranks by offering them a stimulating environment.
- promote R & D as an investment in New Zealand industry.
- help promote science and technology in the education system.
- back the efforts of the Science and Technology Committee, and co-operate fully with it.
- ask Government to help create a climate within which industry can operate effectively by demonstrating Government commitment to R & D.
- ask Government to note that technologically advanced countries, with which we compete and which are well versed in market philosophies, provide a range of incentives to encourage R & D.
- ask Government to reallocate existing public resources for R & D so that industry and agriculture each receive a share of R & D resources more closely related to each sector's contribution to the economy.
- ask individual companies to analyse further the results of the survey in relation to their own investments in R & D, in relation to sales performance within their own sector and in comparison with US companies.
- ask Government to acknowledge that both the private and public sectors have complementary roles in rapidly advancing the publicly perceived importance of R & D, and of technical education generally, and through the partnership correct our technological decline.

"NUCLEAR WAR" Cont. from previous page

natural products for safety and efficacy to reach modern standards would be very expensive, with few positive leads that might help it to be economic or self-supporting.

The emphasis therefore should in the meantime be on good health promotion measures, with positive suggestions for vermin control, population dispersal and related measures to relieve the strain on public health services and reduce the spread of infections.

(7) Recommendations: Specific suggestions for action that could be funded and undertaken immediately are:

(a) Identification of basic sources of information about industrial chemical methods and techniques applicable to a post-nuclear New Zealand.

(b) Compilation of a list of chemical resources currently held in New Zealand, suitable for synthesis of key chemicals.

(c) Selection of a list of essential medicines or pesticides and a compilation of their synthetic requirements to see which could be manufactured for use in New Zealand. (A list of medicines has been produced by Physicians Against Nuclear War, but their synthetic problems have not been addressed).

(Note: Items (a) to (c) could be undertaken in the first instance at very little cost by chemistry or pharmacy students on summer vacation research projects working under University or N.Z. Institute of Chemistry direction.)

COMPANY NEWS

ROCKLABS organises first New Zealand stand at overseas mining exhibition.

With the growth of interest in mineral prospecting in New Zealand, especially for gold, **Dr Ian Devereux** of Rocklabs decided it was time to show the New Zealand flag at a mining exhibition. He organised a stand for five companies at the Asia Pacific Mining Conference and Exhibition in Bangkok, 24-27 February, 1988.

New Zealand now has more geologists and geochemists working in mineral exploration than ever before, several assay labs and several engineering companies manufacturing mining equipment. Stand participants were mainly chemists and engineers, including Dr Devereux and **Dr Bruce McCabe** of McCabe and Associates in Hamilton, who specialise in waste water treatment.

After the Bangkok exhibition, which is almost certain to be successful, Dr Devereux will visit China for the first time to establish an agency. Rocklabs' efforts in exporting to China have been assisted by the New Zealand Import Export Corporation who have an office in Xiamen, Fujian Province.

Rocklabs exports were another record in 1987. Over 500 laboratories world-wide now use Rocklabs equipment. A major new customer in 1987 was General Motors (USA).

PEOPLE, NEWS AND EVENTS

The great New Zealand Christmas shut-down appears to have affected us even more than usual this year, so that the flow of news has faded away to a mere trickle. Rather than produce a page layout with more headings than content we therefore offer this catch-all page of the few items that have come to hand. For those of you who prefer your reading in well-ordered sections, rest assured that we will return to our normal format in the next issue, when hopefully, branches and branch correspondents will have a few more newsworthy activities to report.

And speaking of branch correspondents, I should acknowledge the 'retirement' from office of **Max Sutton** who has served the Waikato Branch in that capacity since 1983. Max has been replaced by **Nick Robinson**, a DPhil student at Waikato University.

— **Ed.**

1987 Chemical Education Award — M.A. Perkins

The recipient of last year's Chemical Education award was **Mark Perkins** of Cambridge High School.

Mark had his first taste of teaching as a school leaver on Volunteer Service Abroad in Fiji, where he taught junior science and fifth form maths. He then attended Otago University, completing a BSc in chemistry in 1973, followed by a year at Christchurch Teachers College. He then spent the next 9½ years at Nayland College, Nelson, initially as an associate teacher of maths, science and chemistry, then later as HOD, Chemistry. In 1984 he transferred to Cambridge as HOD, Science.

Mark's major contribution to chemical education was the introduction of the NZIC:CHEM 13 NEWS EXAM. He had initially entered senior students in the equivalent Canadian competition for a few years, when the suggestion was made to run the exam in New Zealand at a time more appropriate to local students. After obtaining the backing of the Institute this was done in 1982, with approximately 400 entrants. In 1987 there were approximately 1600 entrants.

Mark has also worked on the 7th form chemistry syllabus review committee, and co-authored a section of the Teacher's Guidelines for the new syllabus. He was on the executive of the Waikato Science Teachers' Association in 1984/85, and was President in 1986.

Retirement of Dr Peter Robinson

On 5 February, **Dr Peter Robinson** retired as Director of the New Zealand Dairy Research Institute, Palmerston North. The Institute is the largest non-government research establishment in New Zealand.

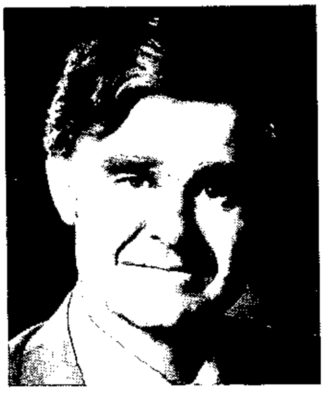
After graduating MSc in Chemistry from Canterbury University in 1953, he joined the NZDRI as Assistant Bacteriologist. Over the next decade his main research interests centred on biochemistry, bacteriology and bacteriophage studies related to cheese and its manufacture. This work included demonstration of the role of some micro-organisms in enhancing cheese flavour. After a comprehensive investigation of carbon dioxide production in cheese, Dr Robertson was sent to England to head a small, temporary sub-station of the Institute to make a comparative study of Cheddar cheese from four countries. The sub-station was at the National Institute for Research in Dairying at Reading. Peter's work on the microbiology, composition and oxidation of Cheddar cheese resulted in his being awarded a PhD from the University of Reading in 1961.

During the 1960s Dr Robertson pioneered many now widely adopted concepts such as the use of deep-frozen concentrates, frozen storage of culture stocks, weekly rather than daily transfer of factory mother cultures and the application of the principles of microbial genetics to the lactic streptococci. In this period Egmont, a new variety of cheese, was developed.

From 1961 onwards, Dr Robertson became progressively more actively associated with and responsible for, the research and development programme on mechanisation of cheesemaking, which led to the now widely-used Cheddarmaster, Large Hoop, etc equipment for mechanised cheesemaking.

In 1965 he was appointed Assistant Director, becoming Director in 1979. During this period he played a major role in coping with the expansion of the NZDRI (total staff of 50 in 1965; presently 280), including restructuring of the Institute from a discipline-oriented structure to a more effective multi-discipline product/process structure.

Dr Robertson was elected a Fellow of the NZIC in 1972 and of the NZ Institute of Food Science and Technology in 1976. In 1969 he received the New Zealand Association of Scientists special research medal. A Foundation Member of the New Zealand Society of Dairy Science and Technology, he has been closely associated in an editorial role with their journal since 1966 and is currently Chief Editor. He was awarded the 1984 J.C. Andrews award for eminence in food science and technology.



Many national and international committees have benefitted from Dr Robertson's membership. For example, the Dairy Industry Working Committee of the National Research Advisory Council, the Executive of the International Dairy Federation 1981-85, Massey University Council 1978-85 and the Palmerston North Technical Institute Council 1974-84.

People

Dr John Shaw, of DSIR Biotechnology Division has returned to Palmerston North, after 14 months as a visiting scientist in the U.S. Food and Drug Administration's mass spectrometry laboratory in Washington D.C. While in the States, Dr Shaw studied the application of modern analytical methods to the solving of problems in food chemistry and food safety. This work included (i) the separation and identification of glucosinolates from *Brassica* using high performance capillary GC-positive and negative ion CIMS, GC-MS/MS, GC-FTIR and SFC-MS and (ii) the quantitation of growth promoters in animal tissues.

Les Bolton, of DSIR's Auckland Industrial Development Division, attended an international conference, "Pacific Corrosion 87" held in Melbourne, 23-27 November. This was also the 27th annual conference of the Australasian Corrosion Association, and was attended by over 300 delegates from around the world. Les presented a paper co-authored by **Bruce Sorrenson**, also of AIDD, on "Corrosion of Stainless Steels in Hypochlorite Clean-in-Place Solutions".

We note with pleasure that Les is also one of the 10 recipients of the RSNZ Prince & Princess of Wales Awards announced at the end of last year. Another NZIC member, **Dr S.P. Foster**, received a Young Scientists' Fund Award.

Geoff Brokenshire has recently joined the staff at NECAL, Department of Health, Auckland, where he will be the senior technician in the Environmental Chemistry section. Geoff was previously with AHI Roofing, and prior to that with Merck Sharpe & Dohme Ltd.

Joe Bognar is to retire from his position as Manager, Environmental Technology, NZFP Technology Ltd., in April of this year. Joe came to New Zealand from Hungary in 1957 and took up a position with Kempthorne Prosser in Dunedin. A year later he joined NZ Forest Products in Penrose, and will have completed just over 30 years service with the company on his retirement. His first position with the company was as an industrial chemist. In 1968 he became manager of the Technical Department, Penrose Industries, in which he led a group of up to 15 staff providing a wide range of technical services to the Auckland NZFP and affiliated companies. In 1982 he took up his present position with responsibility for providing environmental consultancy and advice throughout the NZFP group.

Joe has been involved in a number of professional activities related to his employment. He is currently in his second term as a member of the Clean Air Council. He has had various involvements with groups such as APPITA, OCCA, the NZ Acoustical Society and the Clean Air Society of A & NZ.

Waikato Branch News

Commercial sponsorship by National Mutual of the Waikato Branch AGM in October of last year helped address the perennial problem of inadequate branch funds, and lifted general enjoyment of the evening. The 30 that attended shared the wisdom of the Chairman's report, and the ensuing discussion covered a wide range of topical issues, particularly as they affected the Waikato region.

STOP PRESS:

Congratulations to **Professor R.E.F. (Dick) Mathews,** Honorary Fellow of the Institute, on his recent award of the Order of New Zealand. The ONZ was instituted by Queen Elizabeth in 1987 to recognise outstanding service to the Crown and people of New Zealand, and is limited to 20 living persons.

DSIR INTECH PROGRAMME

How Intech Fosters Development of Sound Technological Ideas

The DSIR's Innovative Technologies Contracts Programme (Intech) provides seed finance and other resources for new ventures. Most of the contracts are for the preparation of business plans to evaluate the merit of taking an idea further. Contracts are also given to do the research and development identified in the business plan.

Hooking into Intech also opens the door to DSIR's technological expertise, to a worldwide database search system, and to assistance with project evaluation, market analysis, and business planning.

DSIR's programme is aimed at creating more innovation in New Zealand. While it has achieved this aim, it has also found fatal flaws in the technology, marketing and economics of some projects which would otherwise have had considerable personal finance sunk into them.

For some projects these flaws, thrown up by doing the business plan, have been rectified. For others, they have been shelved.

The DSIR experience has shown that almost every project has undergone a dramatic change because of the planning discipline.

Intech was launched by the Minister of Science and Technology 18 months ago. The Minister recognised the difficulties of successful innovation, and the lack of a seed venture capital fund in the marketplace. He also noted that planning was just as vital to innovation as finance.

The programme is funded by Government for three years. It is not a grant, but a contract which needs to be repaid with interest once the project begins to generate revenue.

DSIR

INNOVATIVE TECHNOLOGIES/CONTRACTS

MORE COMPANY NEWS

Philips Operations Merged

Philips New Zealand Limited have recently announced the merger of the I&E (Industrial & Electro-Acoustic Systems) operations of the Australia and New Zealand Philips organisations.

From 1st January 1988, all I&E activities will be handled both in Australia and New Zealand by Philips Scientific & Industrial (Pty) Ltd., with head office in Australia, New Zealand regional office in Auckland, and a branch office in Wellington.

Philips are confident that combining resources and technical expertise in the two countries will prove to be of great benefit to customers in the form of improved sales and service back-up, and will enable the company to meet the challenge of the many developments in their area.

Philips Scientific and Nicolet Instrument Corporation Sign Technology Transfer and Development Agreement

Nicolet Instrument Corporation (Madison, WI) and Philips Scientific (previously Pye Unicam), Cambridge, UK, a subsidiary of N.V. Philips, have signed an agreement for technology transfer and product development relating to Fourier Transform Infrared Spectrometers.

Under one part of this agreement Nicolet licenses Philips Scientific to manufacture an FTIR optical bench and interface for use with IBM PC AT-compatible computers. Philips Scientific also acquires the right to market the PC-based spectrometer worldwide with the exception of the United States and Japan. The optical bench to be licensed is based on technology used in the latest generation of Nicolet equipment.

Nicolet is the world's largest manufacturer of FTIR spectrometers for use in both quality control and research applications. Earlier last year, Nicolet acquired assets of IBM Instruments, Inc., including exclusive rights to very competent FTIR PC AT software and the related PC interface.

From this agreement, Philips Scientific, which has a strong competitive position throughout Europe and the rest of the world, gains access to the FTIR market, thus complementing a diversified product line which currently includes dispersive IR, UV-VIS and atomic absorption spectrometers as well as liquid gas chromatography instruments.

NEW FERMENTATION FACILITY FOR DSIR

The Biochemical Processing Centre's new pilot scale facility, capable of fermenting 1000 litres of liquid at a time, was officially opened by the Director General of the DSIR, Dr Jim Ellis, on 27 November, 1987. The Centre also has two smaller fermentors that can process 1 to 40 litres.

The pilot scale fermentation facility consists of a fermentation room of approx. 50 sq. m. and an airlock/control room. The fermentation room is designed to be run under negative pressure, with all air filtered to remove micro-organisms and give a semi-sterile environment. A through-the-wall autoclave allows sterile transfer between the fermentation room and the control room.

The 1000 l fermentor is a stirred-tank reaction vessel designed by the Industrial Processing Division, DSIR, to Biochemical Processing Centre specifications and built by Fitzroy Engineering in New Plymouth. In the design of the vessel, special attention has been paid to get a polished, crevice-free interior to minimise the possibility of contamination. All openings from the fermentor to the outside world are independently steam sterilisable. The vessel is mounted on a three point cradle, with one of the points incorporating a load cell so that the weight of contents of the vessel can be electronically monitored.

A support system, comprising of a network of pipes and valves, supplies steam, water and air to the fermentor. In addition, there is provision for sterile addition of inoculum, nutrients, antifoam or pH control medium (usually alkali). The fermentor is controlled by a three tier electrical system, developed by the Biochemical Processing Centre. The primary controls are power relays which activate solenoid valves, heater elements, pumps, etc. The second tier of control is via 24V control circuits that activate the primary relays. At this level the fermentor can be manually operated from control boards either in the fermentation room or in the control room. The third tier of control is via an Xt-type computer into which are fed sensor inputs. The computer can then control the fermentation process. Software for the system has been developed by the Biochemical Processing Centre and it is still undergoing refinement. A range of ancillary equipment is now being obtained to support the fermentor.

The fermentation facility is the result of a project of the Biomechanical Processing Centre carried out over the past three years to develop pilot scale fermentation on the Palmerston North campus. Support has come from DSIR Biotechnology Division, DSIR head Office and Massey University.

BOOK REVIEW

SCIENTISTS IN CONFERENCE — The Congress Organiser's Handbook and Congress Visitor's Companion — Volker Neuhoff VCH Publishers New York N.Y. (1987). ISBN 0-89573-591-1. $A50.
(English translation in collaboration with the late Robert Schoenfield, University of Melbourne).

This is a very thorough book. The author states in his introduction, and repeats at intervals, that every scientific gathering — of no matter what size — should be a "high level forum for high-level discussion of high-level results". From a position of what is obviously considerable experience he takes the different aspects of conference planning in order as they should occur and analyses them in fine, but not exhaustive, detail. Anyone who has been involved in planning an NZIC, or other conference will easily recognise the signposts and the pitfalls. The author has a light, urbane touch which in the English edition no doubt owes a great deal to the translator Robert Schoenfield. Robert will be known to NZIC members as the author of the RACI series, and later book, "The Chemists English" and the easy reading of the translation should therefore not come as a surprise.

I could not identify any facet of conference organisation that was not covered. It is a pleasure to record that on the evidence NZIC Conference Organisers are already working to the principles outlined by Volker Neuhoff.

The book is simply crammed with wise advice for conference organisers. I consider it an essential companion for them and will recommend to Council that it purchase two copies to be lodged with the current and next in line conference organisers.

Denis Hogan

Correction
In the December issue (p. 169) it was incorrectly stated that the cost of "Requiem for a Gasworks" was $7.50. This should read $75.00.

CONFERENCES

Oil and Colour Chemists Assn. of NZ, 26th Annual Convention, Rotorua, 21-23 July, 1988.

The programme includes a range of seminar topics, with at least five invited speakers from overseas. Subjects covered will include the following:

electron-beam curing
packaging coating trends
colour innovation
paints and adhesive developments
innovation in R & D
durene by-products
ceramic coatings
technological marketing trends

For further information, contact the secretary, OCCANZ Convention '88, Box 5019, Wellington.

Seminar on Lead in the New Zealand Environment, Auckland, 1-2 August 1988

This seminar aims to consolidate the results of numerous scientific studies that have taken place since the review of lead in the NZ environment conducted by the RSNZ in 1985/86. The major theme will be sources, pathways, cycling, transformation and sinks of lead in the NZ environment. Topics covered will include lead in natural systems, lead in air, in the diet, in fuel and in wastes, lead in the workplace, and lead in blood and in animals.

Contributions are invited, for either paper or poster presentation.

For further information contact Dr John Hay, Environmental Science, University of Auckland, Private Bag, Auckland.

Sixth Asian Symposium on Medicinal Plants and Spices. Bandung, Indonesia, 24-28 January 1989.

For further information contact Professor Sjamsul Arifin Achmad, Dept. of Chemistry, Inst. of Technology Bandung, Jalan Ganeca 10, Bandung 40132, Indonesia.

PRODUCT FEATURE : FTIR

Thinking of buying an infrared spectrophotometer? As Bruce Fraser and Tony Herd point out in their article on page 11, FTIR has many advantages, even for such routine applications as those in a teaching laboratory.

In this feature we provide a brief summary of some of the FTIR instruments currently available in New Zealand. This is a rapidly expanding field — most of the major instrument manufacturers seem to be joining in the action; the power of the instruments and their related software keeps expanding; the range of accessories and special features keeps increasing; and most importantly the instruments are becoming more cost-competitive each year. Does this herald the end for traditional i.r.?

Digilab

Digilab FTIR spectrophotometers are industry standards and innovation leaders. The current range reflects Digilab's commitment to instruments that are sensitive, robust, and versatile. From the new FTS-7, with its 2 cm^{-1} mechanical bearing, through the FTS-40 and FTS-60, whose configurations extend resolution down to 0.1 cm^{-1}, all Digilab FTIR spectrophotometers feature the latest in computing technologies and applications based on the Motorola 68020 cpu. All are equipped with colour monitors and large disk capacities. Standard optical range is 400-4000 cm^{-1} and can be expanded up to 15000 cm^{-1} in the near IR or down to 10 cm^{-1} in the Far IR. An ever-expanding array of accessories is available to fit all Digilab spectrophotometers including:

- GC/IR
- State-of-the-art microscope (operating in both transmittance and reflectance)
- Diffuse reflectance
- ATR (solid and liquid-cylindrical and prism)
- Photoacoustic
- LC/IR flow cells
- Skin analyser
- Thermogravimetric/evolved gas analysis

Digilab spectrophotometers are found where ever there is a commitment to quality in infrared spectroscopy. Wilton Instruments market Digilab in New Zealand and already have instruments installed in several universities and research institutes.

For further information please circle no. 7 on reader reply card.

Nicolet

Nicolet's new 5ZDX offers all the advantages of FTIR to all first time users who want instrument simplicity, economy, and versatility without compromising performance.

The 5ZDX is the easiest-to-operate FTIR system Nicolet has ever designed. The 5ZDX's refined menu-driven operation, incorporating several man-years of software development, eliminates the need for operator programming. Instead, the 5ZDX which utilises the new high-speed desktop 600 series workstation is operated by simple pushbutton commands. With the 5ZDX, dispersive users can quickly make the transition to FTIR without prerequisite skills in laboratory computers or Fourier transform techniques.

NICOLET 5ZDX FTIR

Not only is the 5ZDX extremely easy to use — it is inherently faster and more versatile than dispersive instruments. The 5ZDX offers all the advantages of FTIR including:

- Higher sensitivity in a fraction of the time it takes to scan with a dispersive spectrometer.
- Far greater energy throughout, since the 5ZDX does not use energy-limiting slits.
- Constant resolution across the entire spectrum of 4800-400 cm^{-1}.
- Can be used with all the latest FTIR accessories.
- Inherently superior wavenumber accuracy.
- Enhanced system reliability through design simplicity.
- Better linearity and quantitative accuracy even for strongly absorbing bands.
- Comprehensive and easy-to-use spectral processing and manipulation capabilities.

Once the spectral data is collected, the 5ZDX can then easily perform a variety of spectral manipulations. For example, a reference can be subtracted from a sample unknown to help determine the identity of a mixture of components. Such spectral subtraction routines are particularly useful in quality control and quality assurance applications.

Additionally, the 5ZDX allows quantitative analysis of the components in mixtures. The menu-driven quant package incorporated in the 5ZDX software can be tailored to the user's specific analytical methods. By combining both the calibration and analytical procedures into pushbutton menu commands, the user is not only free from the tedium of manual calculations, but is also assured of reliable, method-consistent quantitative analysis.

Principle 5ZDX features

- Rugged, precision-cast optical bench baseplate for excellent stability and performance.
- Better than 2 cm^{-1} spectral resolution (1 cm^{-1} data point separation).
- Large, easily accessible sample compartment accommodates the latest FTIR sampling accessories.
- High speed, high-resolution colour display provides instant roll, zoom, expand, overlay, subtract of spectral data. (Displayed data is updated 30 times a second!)
- Single-key command operation.
- Extensive upgrade capabilities to meet growing application requirements.

For further information please circle no. 8 on reader reply card.

Shimadzu

Shimadzu have a range of three FTIR spectrophotometers based around a Michelson Interferometer with an air-bearing scanning mirror for long term reliability and high stability.

The mirror movement is monitored and controlled by a helium/neon laser, for fully automatic alignment of the interferometer, and its KBr beam splitter is protected against high humidity by an automatic shield and humidity monitor.

All three models share a common data system including colour VDU, dual 5½ inch double floppy disc drives and a high speed parallel head printer. A full range of manipulative software is available for post-run data processing.

At the bottom of the range is the Model 4200 which is single beam only and with a best resolution of 2 cm^{-1}. This is followed by the Model 4100 which is a double beam version with the same optical specifications. Finally there is the Model 4300 which is also double beam but has a wider wavenumber range and better resolution than the other two.

All three models have a specially developed pyroelectric detector as standard and in addition Models 4100 and 4300 can be fitted with an optional mercury, cadmium, tellurium detector (MCT).

Both double beam models may be used in the single beam mode using either sample compartment, so accessories such as an infrared microscope can be permanently set up.

A wide range of accessories is currently available. Shimadzu is represented in New Zealand by AWA.

For further information please circle no. 9 on reader reply card.

Perkin-Elmer

The 1600 Series FTIR is Perkin-Elmer's newest family of affordable, high-quality Fourier transform infrared spectrophotometers. The 1600 features a stand-alone, benchtop instrument that integrates a sealed and dessicated optical system, advanced electronics and powerful software with interactive graphics and multi-tasking capabilities.

The 1600 system is extremely easy to use with single-key operation and purge-free start-up. Excellent signal-to-noise and rapid data acquisition are achieved over the standard instrument range of 7800 to 350-cm^{-1} with 4-cm^{-1} resolution, upgradable to 2-cm^{-1}.

The interactive graphics software of the 1600 allows the analyst to display up to three spectra simultaneously, pan or zoom in on spectra, expand the ordinate and the abscissa and rescale or rearrange displays. The 1600's multitasking efficiency permits the analyst to scan, manipulate and plot or print data simultaneously, saving the laboratory precious time.

The spectrophotometer easily interfaces with an IBM PC or any fully compatible external computer, expanding the processing capability of the system.

Perkin-Elmer is fully supported throughout New Zealand by Sci-Med division of Ebos Group.

For further information please circle no. 16 on reader reply card.

Hewlett Packard HP 5965A Infrared Detector

The new HP 5965A infrared detector (IRD) from Northrop is a sensitive, compact, low priced FTIR detector for capillary gas chromatography (GC).

According to Northrop, this product is the first and only FTIR detector designed and built specifically for capillary gas chromatography.

The company also says that the HP IRD is the first system to take advantage of the synergy between the complementary techniques of GC/FTIR and GC/MS. The system, which includes an HP IRD ChemStation analytical workstation, allows the scientists to combine data from both techniques for better compound identification.

Scientists can display and compare GC/FTIR and GC/MS data on the same screen or in the same report. Data from a library search on an HP MS ChemStation can be loaded on an HP IRD ChemStation it will integrate library-search results and produce a ranking of probable IDs based on hit quality and common matches.

Furthermore it is now possible to interface an IRD with the HP 5890/59770B bench top GC/MSD system to form an integrated analysis system (GC/MS/FTIR).

Three dimensions of data are simultaneously obtained from a single injection. IR spectra, MS spectra and retention times. This provides for more positive compound identification and confirmation.

Northrop expects the IRD to be used, in all areas of analysis where GC already is employed, especially environmental; chemical; foods, flavours and fragrances; pharmaceutical; and forensic.

HP 5965A consists of two compact units: the detection module and the HP IRD ChemStation for instrument control and data handling. The detector occupies fewer than eight linear inches of bench space and does not require a separate room or optical bench.

Detector Specifications

Unlike other GC/FTIR alternatives, the IRD was designed specifically for the detection and identification of capillary GC eluents. For example, this allows it to detect 5 ng of isobutyl methacrylate at a signal-to-noise ratio of 20 to 1.

A short, straight capillary-direct interface connects the IRD to the GC, eliminating the problems often associated with extra-column connections.

In addition, stable micro-optics provides exceptional immunity to vibrations, an important consideration in many GC labs where a number of instruments coexist on the same bench. Finally, a new long-life, high-flux IR source contributes to instrument sensitivity and minimises maintenance.

HP IRD Chemstation for Control and Data Handling

The HP IRD ChemStation presents retention-time and structural information on self-explanatory screens and offers single-stroke softkeys to simplify and expediate method development, instrument control and data handling.

Integration and quantitation of GC/FTIR chromatograms using standard methods can be automated. Multiple internal standards, peak ratios or multipoint calibration curves can also be used.

During an analysis the chromatogram can be displayed in real time. After an analysis, the software allows chromatograms and IR spectral data to be retrieved, displayed and manipulated in a variety of ways for interpretation and reports.

GC/FTIR setup is simplified by an automated tuning program that optimizes the signal-to-noise ratio and assists in optical alignment. A fast library-search program to compare acquired spectra with library spectra speeds compund identifications.

Optional sequencing software permits the HP IRD ChemStation to control the GC/FTIR system automatically with an autosampler in unattended analysis of up to 100 samples from injection through printed report.

Based on the recently introduced HP 9000 Series 300 computer, the HP ChemStation is available with a colour or monochrome monitor.

With other software available from Northrop, the HP ChemStation can be used to control and handle data from an HP liquid chromatograph, or UV/VIS spectrophotometer, or mass-selective detector (MSD).

All IRD components, detection module, HP ChemStation and GC are manufactured by Hewlett Packard, and are sold and fully supported in New Zealand by Northrop Instruments and Systems Limited.

For further information please circle no. 13 on reader reply card.

The Circle™ from Spectra Tech

Water — a great solvent for infrared analysis! Water is the most abundant solvent available to the analyst, yet it is avoided for most infrared measurements. This is mainly for historical reasons, i.e. the inability to produce water-resistant cells with usable pathlength. The Circle™ cell overcomes all of these traditional sampling problems. Now many new measurements for industrial, physical, biological and medical applications are practical.

The high intensity of the infrared spectrum of water invariably requires a short pathlength (typically 7 to 20 microns) if a spectrum with workable intensities is to be obtained.

The Circle™ cells gives the ideal pathlength for strongly absorbing liquids and the open boat design makes it easy to use as a beaker for filling and cleaning. In essence, it is an infrared equivalent of a UV cuvette.

The cylindrical internal reflectance element with its cone-shaped ends is well matched to the circular beam of your FTIR instrument. High efficiency Cassegrain mirror lenses ensure optimum transfer of the infrared energy to and from the cell.

The Circle™ cell is available through Watson Victor Ltd.

For further information please circle no. 15 on reader reply card.

PRODUCT NEWS

Extraction and Dialysis Modules for Flow Injection Analysis

Tecator is introducing two new products for the FIAstar product line — the 5105 Extraction and 5106 Dialysis Modules.

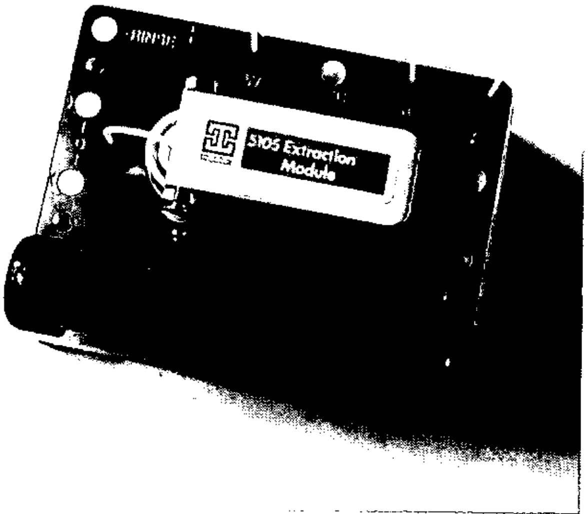


Fig. 1: The FIAstar 5105 Extraction Module including the specially designed displacement bottle.

These new accessories will broaden the application of Flow Injection Analysis (FIA) particularly in the fields of water, soil, plant, feed, food and beverage analysis.

Safe and fast determination of detergents and phenol in water with FIA and solvent extraction

The Extraction Module (Fig. 1) allows for automated in line solvent extraction. The entire analysis — including extraction, separation and detection — is performed in a totally closed system. Solvent is stored in a sealed, specially designed displacement bottle. Costly and hazardous manual methods can then be replaced.

The consumption of solvents such as chloroform and isooctane in FIA-extraction is approximately one ml per sample.

With this micro-chemical technique, analysis is performed with high speed and accuracy. The analysis time is between 30-60 seconds with reproducibility usually better than 1% r.s.d.

Typical applications are determination of detergents and phenol in water, and bitterness in beer.

Determination of nitrate and nitrite in waste water and milk with FIA and dialysis

The analysis of various waters, soils and plant extracts, dairy products and food often requires a sample preparation step including filtration and dilution. This step can be automated by in-line FIA dialysis.

The unique Dialysis Module (Fig. 2) is easy to assemble and operate. The framed dialysis membrane is conveniently placed between two rubber plates and tightened with just one large knob. Change of dialysis membrane takes only a few minutes.

The dialysis unit and manifold (for mixing of dialyzed samples and reagents) are mounted on a tray.

Typical applications are determination of nitrate and nitrite in waste water and milk.

Tecator are represented in New Zealand by Wilton Instruments Division, Salmond Smith Biolab.

For further information please circle no. 6 on reader reply card.

Fig. 2: Illustration of the FIAstar 5106 Dialysis Module.

TRAACS 800 — The Ultimate in Automation of Continuous Flow Analysis

Continuous Flow Analysis comprises the automation of wet-chemical analysis, in which samples and reagents are taken as continuous streams segmented with air bubbles (to reduce carry over between samples). These streams come together in a chemistry manifold where processes such as mixing, heating, digestion and dialysis may take place before the final segmented stream enters a flow cell for colourimetric detection. This type of analysis was invented by L. Skeggs in the early 1950's and since then it has become one of the most popular and widespread automatic laboratory techniques.

A new level of continuous Flow Analysis has appeared in the release of the TRAACS 800 Analyser from Bran & Luebbe/ Technicon Industrial Systems. This instrument incorporates several advances in design over previous systems. These advances can be divided into three main categories:

1. Hydraulics

In the past the limiting factor on sampling rate in continuous flow systems was carry over (dispersion) between samples and intersample washes. Carry over occurs in all parts of the system, but mainly in the flow cell where the bubbles are removed before detection. In the TRAACS 800 system flow cell carry over is reduced to almost zero by passing the segmented flow through the flow cell and removing the bubble interference to the signal electronically. Other reductions in carry over are achieved using a "pecking" sample probe to introduce multiple bubbles between sample and wash, and by changes in the flow rates, tubing diameters and segmentation rates.

These improvements have resulted in typical analysis rates of 120 samples/hour for simpler methods.

2. System Components

The main components of a continuous flow analyser — sample, pump, manifold and colourimeter — have been updated for better performance on the TRAACS 800 system:

a) The sampler has 120 cup capacity, "pecking" probe, and most importantly, random access sampling. This means that any cup can be sampled at any time and any number of times during a run. This enables easy duplication of standards and samples and the automatic resampling of any cup at the end of a run.

This option might be selected if the computer detects an error when monitoring the peaks during a run. Examples might be if a sample peak has been swamped by a previous out-of-range sample, or if an off-scale sample peak requires resampling and automatically diluting before re-analysis.

b) The pump runs at a slower speed, resulting in longer pump tube life and less reagent and sample volumes being pumped.

The pump speed can be computer controlled to allow for automatic shutdown into a standby mode and automatic start up for the next day.

Air injection is controlled electronically from a constant pressure source to ensure a more precise bubble pattern.

c) The chemistry manifolds have been streamlined to reduce carry over, by eliminating excess tubing and utilising high quality mixing coils and injection fittings.

d) The colourimeter uses fibre-optic technology to ensure efficient light transmission over a wavelength range of 340-800 nm. The flow cells are available in different path lengths (10mm-75mm) to suit the sensitivity requirements of various methods.

e) The chart recorder has been replaced by the computer printer which is capable of charting four chemistries simultaneously. During a run the peaks appear alongside the real-time calculated results, and the digital chart data stored on disc for later recall if required.

f) The TRAACS 800 system is completely controlled by the computer including selection of operating conditions, calculation of results, fault detection and automatic start up and shut down. Results can be automatically reformatted to files compatible with commercial data base programs to allow the user to format his own reports as a basis of a complete laboratory data management system.

PRODUCT NEWS

3. System Automation

For the first time common operating procedures are under automatic control. The first of these is the automatic baseline and gain setting.

This is where the TRAACS 800 system can automatically adjust its settings to control the base line and gain for a given reagent quality and parameter range.

The second of these is the Automatic Diluter. During a run the computer monitors peaks for offscale readings. At the end of the run the automatic dilution circuit is engaged and the "high" samples are re-run together with appropriate calibrators. The final results are correlated in the final end-of-run report.

The recent advances in continuous flow analysis have resulted in the TRAACS 800 system being able to obtain sample rates comparable with other wet chemistry analysers while maintaining the advantage of steady state operation for complex reactions. Along with the previously mentioned features, the TRAACS 800 system will contribute to improved laboratory efficiency through automation.

For further information please circle no. 11 on reader reply card.

Corrosion Resistant Alloy Tube Fittings Handle Difficult Fluids

Swagelok tube fittings made of alloys C-276, 600, C-20, 400/R-405 or titanium are available in standard configurations from Swagelok Co., Solon, Ohio.

These fittings connect tubing of like materials, assuring metallurgical and thermal compatibility throughout the system and extending system service life.

Gageability is an exclusive feature which permits verification of proper pull-up before a system is put into service, resulting in safe, reliable, leak-free performance. Hazardous risk is reduced.

The corrosion resistant alloy fittings are available off the shelf in over 100 types. Standard sizes are ¼" to ½".

Typical applications include corrosive fluids, instrument, control and sampling systems, chemical injection and feed systems, acids, bases and powerful oxidisers.

Swagelok fittings are available in New Zealand through Auckland Valve & Fitting Co. Ltd.

For further information please circle no. 12 on reader reply card.

COVER STORY

SCHLEICHER & SCHUELL
"THE COMPLETE RANGE FOR FILTRATION/SEPARATION"

For more than 100 years, Schleicher & Schuell have manufactured products for the technique of filtration, i.e. for the separation of particles from liquid and gas by means of a porous medium. The combination of a large pore size range (100 um to smaller than 0.005 um) and appropriate filtering devices ensures that the Schleicher & Schuell range can accommodate any filtration requirements.

In the field of macrofiltration; paper filters, filter thimbles and filter elements made of cellulose or glass fibre and special purpose papers, cover the requirements of the analytical and technical filtration needs encountered in the industry and research environments. Specialist indicator and reagent papers complement this range.

In the sector of microfiltration where the objective is the removal of particles in the micron or sub-micron field, Schleicher & Schuell gives the optimum choice of filter for special separation problems, offering 100 types of membrane filter divided into 22 separation grades from 12 um to less than 0.005 um.

Included in this range are:

* Mixed Ester (ME) — for use in analytical and microbiological work.
* Cellulose Nitrate (AE, PH) —the choice in DNA/RNA protein hybridisation studies.
* Cellulose Acetate (ST, DE) — specifically designed for the filtration of oils, alcohols and pharmaceuticals, this membrane has a stronger wet strength and minimal swelling.
* Regenerated Cellulose (RC) — made of pure cellulose and in almost all respects is the optimal filter. Exceptionally chemically stable to organic solvents and will not crack, buckle or retain a crease.
* Nylon (NL) — Resistant to most solvents and ideal for the filtration of aqueous or organic liquids.
* Polytetrafluorethylene (PTFE) — laminated to inert non-woven polyester. This filter is more chemically stable and can withstand higher temperatures than can other types of membrane filter. Completely hydrophobic, its specific use is in the filtration of strong acids, bases or organic solvents.

To complement the extensive range of filter media is a variety of devices ranging from the smallest disposable filter holder (made of glass or stainless steel); to pressure holders with a diameter of 293mm.

The field of nucleic acid and protein research has a special importance in the Schleicher & Schuell range. Based on exact protocols and technical literature cellulose nitrate membrane filters (BA, PH) show the best suitable support medium for the capillary transfer of nucleic acids and proteins. Other products include, the diazotized medium Transa-bind which covalently binds macromolecules as well as cationic and anionic, and ion exchange membranes (NA) used for the elution of nucleic acids from agarose gels and for different electroblot applications. Blotting papers, available in four adsorption gradations, optimise the results for capillary and electrophoretic transfer.

Of course, also available, are the necessary devices for the various procedures of this research, which include Minifold I and Minifold II for use in dot blot and slot blot hybridisations, the MV 082/0 for colony hybridisations and the Biotrap for the electro-elution, dialysis and concentration of charged macromolecules.

Available through N.Z. distributors (Behring Diagnostics Section of Hoechst New Zealand Limited) Schleicher & Schuell has a most comprehensive range for filtration, separation and molecular biology.

For further information please circle no. 5 on reader reply card.

Hach Introduces New Surface Scatter 6 Turbidimeter

Hach Company has announced the introduction of the Surface Scatter 6 on-line turbidimeter. This new model features a microprocessor-based control unit and Hach's patented design which eliminates contact between the sample and optical components, resulting in no stray light scattering errors from dirty glass. Down time and maintenance labour for cleaning sample cells is eliminated. The Surface Scatter 6 turbidimeter offers the following improvements over previous units:

* Auto-ranging digital display, no range selection required.
* Expanded range up to 10,000 NTU permits measurement of practically any sample.
* Sample/sensor compartment is constructed of corrosion resistant components to stand up to the most severe environments and samples.
* Recorder output can be spanned to cover any segment of the overall range.
* A calibration cylinder and formazin standard solution is included with the SS6 to provide simple, direct calibration in minutes.
* Design meets all United States Environmental Protection Agency (EPA) criteria for nephelometers used to report turbidity in drinking water.

For further information please circle no. 3 on reader reply card.

New Rheodyne Metal-Free Valve

Using parts and specifications supplied by Wescan (a division of Alltech/Applied Science), a new metal-free rheodyne 7125 Sample Injection Valve is now available.

The valve uses the time-proven design of the Rheodyne 7125 six-port stainless steel valve, but with the wetted stainless steel components replaced with inert polymeric analogs. This new valve may be used continuously at pressures up to 4000 psi with all common HPLC and IC eluents and samples. Because metals are not used in the wetted parts, problems of corrosion and leaching of metal ions into the eluant are eliminated.

A range of metal-free valve accessories is also available, including sample loops and connectors.

The Metal-Free Rheodyne 7125080 Sample Injection valve is available through Alltech New Zealand.

For further information please circle no. 4 on reader reply card.

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