chemistry
in new zealand
Vol 53 No 4 August 1989

Inject new life into your old LC.

Introducing the HP 1050 Series of HPLC modules.

The next time you add LC capabilities or replace an aging HPLC component, consider Hewlett-Packard. Our new HP 1050 Series of stand-alone HPLC modules lets you upgrade to the HP quality you always wanted but thought was out of reach.

Grown out of the same innovative technology that produced the renowned, top-of-line HP 1090 family of HPLC systems, the HP 1050 Series brings you all the performance and reliability you've been missing — at a pace you can afford.

Add broad spectrum capabilities a piece at a time

Select from a range of compact, stackable, easy-to-use modules for solvent delivery, autosampling and UV-Visible detection. Available now are both isocractic and quaternary pump modules, variable and multiple wavelength detectors, and 21- and 121-vial autosampler modules. And more are on the way.

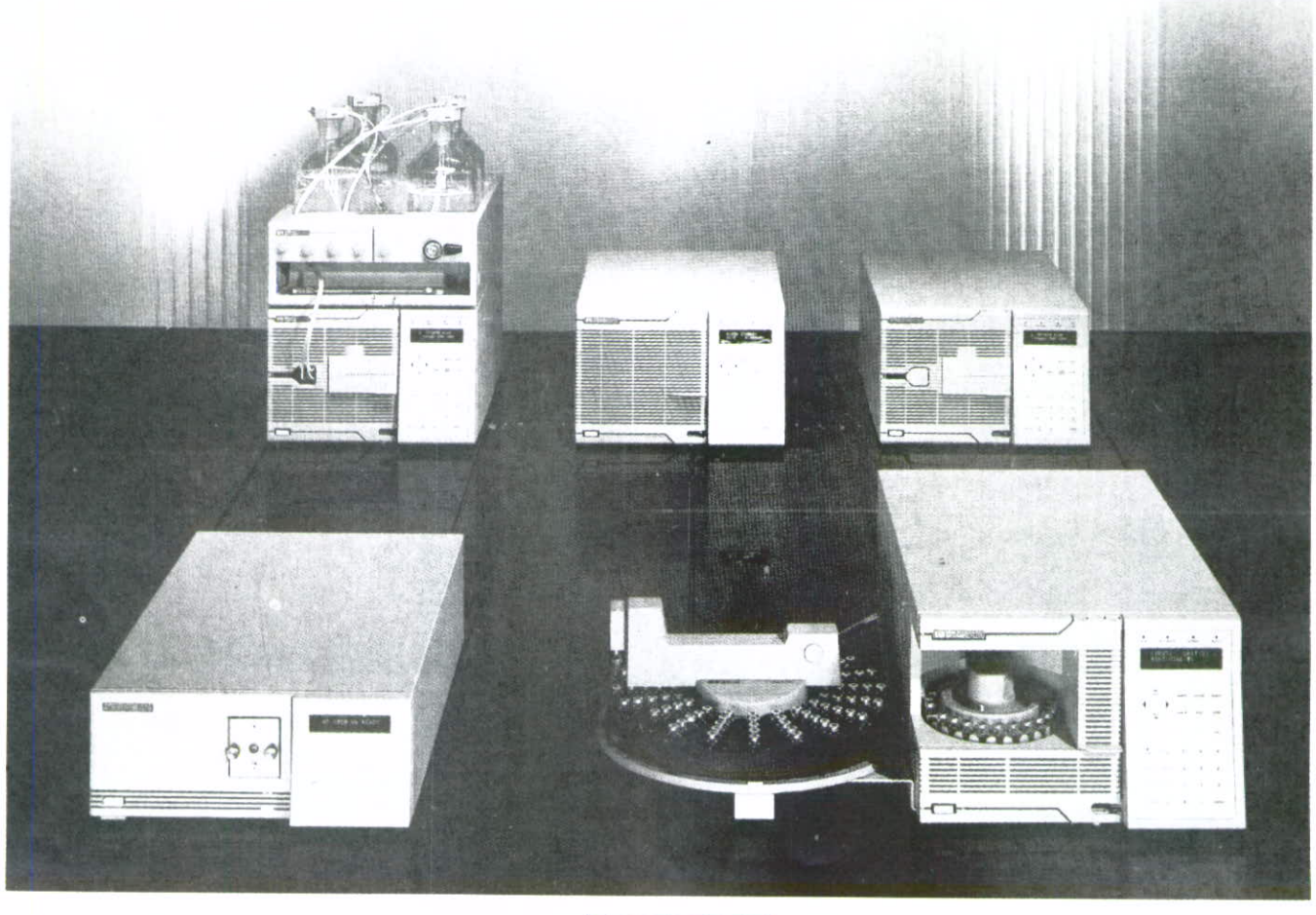
Boost productivity with superior performance and uptime

The advanced HP 1050 Series gives you the sensitivity, accuracy and precision you need. What's more, it gives you superb results without the usual hassles. That's because each module was designed to eliminate most set-up, running and maintenance problems. And built-in self diagnostics virtually eliminate wasted or lost samples.

Furthermore, the HP 1050 Series makes trouble shooting, repair and parts exchange extremely easy. Add to that inherent HP quality and reliability — not to mention HP's excellent support — and downtime becomes almost nonexistent. If fact, reliability is so high, we're even offering a 99 percent uptime guarantee.

Let HP inject new life into your lab

To learn more about the outstanding HP 1050 Series, or other HP advances in analytical chemistry, contact your nearest Medtec office.



HEWLETT PACKARD

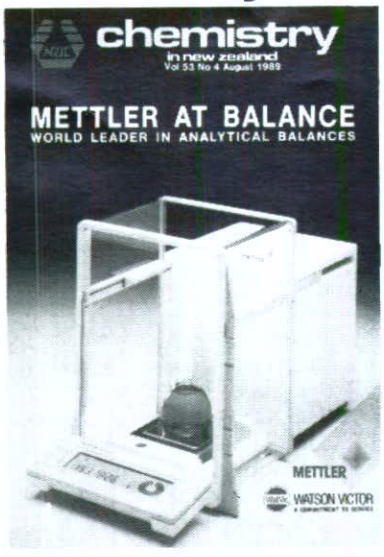
MEDTEC

AKLD TEL 480-6763
WGTN TEL 670-011
CHCH TEL 556-860

chemistry in new zealand

Vol 53 No 4 August 1989

Front Cover Story



The Mettler AT Analytical Balance has set new world standards in precision, automation and user orientation.

ERRATUM

DUE TO A PRINTING ERROR APRIL APPEARS AT THE FOOT OF ALL TEXT PAGES NEAR TO THE PAGE NUMBER. THIS IS THE AUGUST ISSUE

CONTENTS

Editor: R.B.Hall, 67 Uxbridge Rd, Howick, Auckland; ph 537 1802 or 534 9109.

Branch Editors:

Auckland: Dr Roger Whiting, Auckland Technical Institute, Private Bag, Auckland.
Waikato: Nick Robinson, c/- Chemistry Dept, University of Waikato, Private Bag Hamilton.
Manawatu: Dr Cecil Johnson, Applied Biochemistry Division, Private Bag, Palmerston North.
Wellington: Adrian Bennett, BRANZ, Private Bag, Porirua.
Canterbury: Dr Selwyn Maister, Christchurch Polytechnic, P.O.Box 22-095, Christchurch.
Otago: Dr George Emerson, Biochemistry Department, University of Otago, P.O. Box 56 Dunedin.

Published on behalf of the New Zealand Institute of Chemistry (Inc).
PO Box 12-347, Wellington.
President: D.R.Llewellyn, Hon.Gen.Secretary: Alan A Turner, Registrar: D.P.Karl.

Published by CATHEDRAL PRESS LTD, PO Box 9072, Newmarket. Phone 775-533
Advertising Manager Carl Roze. Phone Auckland 547-244.

Advertising Features

THIS ISSUE:

We feature laboratory balances, with special notes on the new mettler AT, and a range of models from Oertling and Sartorius.

OCTOBER:

Look for the information on the latest in X-Ray techniques and developments in equipment for surface analysis.

EDITORIAL

After only three issues, barely sufficient to come to grips with the intricacies of the job, your editor will be departing overseas for an indefinite period. This may be for longer than an issue or two however Bernie Swedlund has agreed to be acting editor in the interim. Please continue to support him as you have the present editor with sufficient material posted in time for deadlines. We are still short of news items from local sections.

Where are we heading, we chemists, in an age of frequent and often dramatic change. The consuming public has come to expect, as a matter of course, science based miracles to satisfy a myriad of needs in our buildings, kitchens, offices, hospitals, farms, factories, transport systems, communication systems and for our pleasure or entertainment. The same consuming public however expects, again as a matter of course, that all such needs are satisfied without in any way affecting the environment or even remotely risking the health of anybody. Laudable goals all of them but with what difficulties and at what cost. The consumers are not concerned nor is any serious attempt being made by our fraternity to explain current difficulties, progress towards solving them or what it is costing. Any thought of what is being enjoyed may be the result of a series of compromises is shunned. Perhaps all professional chemists are unwittingly or unwillingly entering a new age. An age in which we will no longer be able to be or allowed to be the discoverers of new knowledge or the reporters of chemical facts with respect to the enterprise we work for or the teachers of those seeking knowledge. Instead we must from the earliest stage of our careers learn and be taught that chemically based knowledge must be profitably and professionally managed by chemists. It must be profitable for the professional involved, the enterprise or institution where employed and for the consumers of the products or services provided. Professional management will ensure that significant risks to people and the environment are assessed, reported on, controlled and understood by all concerned. Our present dilemma is that far too often we are not managing but being managed by our employers, by our politicians, by pressure groups, by the news media and by the population at large. Finally we are left without an effective voice or public image. Professional management skills of the type required cannot be left to chance, they must be taught. All aspiring chemists whatever their field should be suitably equipped so that they can become true professionals.

R. B. Hall

HONOURS AWARDED TO CHEMISTS

In the 1989 Queens Birthday Awards **Professor Charmian O'Connor** was awarded the CBE for services to chemistry' education and the community and **Professor Arthur Campbell** the OBE. The NZ Institute of Chemistry through Chemistry in New Zealand extends it's congratulations for these awards. In this edition Charmian O'Connor's contribution to chemistry is reviewed.

Charmion Jocelyn O'Connor CBE, MSc (NZ), PhD (Auckland), FRSNZ, FNZIC, C Chem, FRSC, JP.

Charmian O'Connor graduated BSc from Auckland University in 1959 as the youngest woman ever to do so and MSc (First Class Honours in Chemistry) in 1958. She graduated PhD in Chemistry in 1963 and DSc in Chemistry in 1974.

She took up full time employment with the University of Auckland in 1958 as Junior Lecturer in chemistry and has remained on the University staff since then but has used study and research leave opportunities to benefit from overseas experience at a number of universities.

In 1963 she studied with Professor Clifford A. Bunton at University College London and later with him when he was foundation Professor of chemistry and Head of Department at University of California, Santa Barbara. In 1967 she studied at Imperial College London with Professor Sir Geoffrey Wilkinson FRS who was a Nobel Laureate in 1973 and in 1972 at Texas A & M University, College Station Texas

with Professor Janos H Fendler.

In 1982, 1986 and 1987 she spent time as Guest Professor at Nagasaki University, Japan in the Department of Applied Chemistry, School of Engineering with Professor Junzo Sunamoto who had been a visiting professor at the University of Auckland in 1981.

In August 1984 she was an Invited Guest at the USSR Academy of Sciences Institute of Biochemistry and Lomonosou State University, Moscow, Chair of Chemical Enzymology.

Recognising her international reputation in her fields of Chemistry Charmion O'Connor has participated in numerous New Zealand conferences and has received may invitations to deliver plenary lectures and invited papers at International Chemistry Conferences only some of which she has been able to accept. Some of these have been:-

1977:
First Gordon Conference on Micellar and Macro-molecular Catalysis; Wolfboro, New Hampshire - Invited discussion Group Leader.

1979:
Second Gordon Conference on Micellar and Macro-molecular Catalysis; Wolfboro, New Hampshire - Invited Paper.

1982:
VIth International Symposium on Solute-Solute-Solvent Interactions; Osaka, Japan - Invited Session Chairman and Invited Paper.
VIth International Symposium on Solute-Solute-Solvent Interactions Post Congress Symposium on "Solution Chemistry viewed from Bioorganic and Bioinorganic Aspects"; Nagasaki, Japan - Invited Lecture.

1983:
Kendal Award Symposium on "Membrane Mimetic Chemistry", held under the auspices of the American Chemical Society in honour of the Kendall Award to Professor Janos Fendler; Seattle, Washington - Invited Lecture and Session Chairman.

1984:
5th International Symposium on Surfactants in Solution; Bordeaux, France, Invited Paper. 7th International Union of Pure and Applied Chemistry Conference on Physical Organic Chemistry; Auckland, New Zealand. Invited Session Chairman and delivery of paper.

1985:
Fifth Gordon Conference on Micellar and Macromolecular Catalysis, held in Wolfboro, New Hampshire - Invited Plenary Lecture.

5th International Symposium on Colloid and Interface Science, held at Clarkson University, New York, USA - Invited Paper.

1986:
6th International Symposium on Surfactants in Solution, New Delhi, India - Member of International Advisory Committee.
8th International Union of Pure and Applied Chemistry Conference on Physical Organic Chemistry.
Pre Symposium on "New Aspects in the Chemistry of Reactive Intermediates"; Tsukuba, Japan - Invited Plenary Lecture.

1987:
The 1987 International Congress on Membranes and Membrane Processes, Tokyo, Japan - Invited Paper.

1988:
The 1st Eurasia Conference on Chemistry of Solution, Bangkok, Thailand - Invited Session Lecture.
Sixth Gordon Conference on Drug Carriers in Biology and Medicine, held in Plymouth, New Hampshire - Invited Participant.

1989:
2nd International Conference on Oils, Fats and Waxes, Auckland, New Zealand - Invited Plenary Lecture.

Refereeing:

For many years she has been a regular manuscript referree for **Australian Journal of Chemistry**, and less frequently a referee for **Journal of the American Chemical Society, Journal of Physical Chemistry, Journal of Colloid and Interface Science**, and **Canadian Journal of Chemistry.** She has refereed proposals for the National Science Foundation and the National Institute of Health (USA) and has served as a tenure referee for

Texas A & M University, College Station, Texas, USA.

Charmian O'Connor has had many senior university appointments in addition to her role as Professor of Chemistry.

Assistant to the Vice Chancellor, Equal Employment Opportunities and Staff Development, 1988-1989.

Chairperson, Advisory Committe on Equal Employment Opportunities, 1988-89.
Chairperson, Academic Staff Development Advisory Committee, 1989-1990.
Chairperson, Park Avenue Childcare Management Committee, 1989-1990.
Subprofessorial Representative on Senate, 1982-1985.
Member of Senate, 1986-
Member of Academic Committee, 1987.
Member of the Appointments Committee of Senate 1982-1990.
Member of the Promotions Advisory Sub-Committee of Council, 1982-1986, 1989-1990.
Member of Discipline Committee, 1986-1989.
Member of General Staff Committee, 1989-1990.
Member of Library Staff Sub-Committee of Council.
Member of the Review Committees of
i) the Faculty of Commerce, 1985.
ii) the School of Architecture, 1986.
iii) the Department of Mathematics and Statistics, 1987.
iv) Biological Sciences, 1988.
Member of the Sub-committee of Appointments Committee for Appointment of Tutors and Assistant Lecturers, 1983 and Chairperson 1984-1990.
Professional and other Bodies on which Professor O'Connor has served include:
New Zealand Institute of Chemistry:.
Secretary, Auckland Branch, 1961-62.
Member, Organising Committee for NZIC Conference, 1974.
International Union of Pure and Applied Chemistry:.
Member, Organising Committee for 7th IUPAC Conference on Physical Organic Chemistry, held in Auckland, August, 1984.
Royal Society of New Zealand:.
Convener, Hamilton Award Committee, 1981-1983.
Member, Hamilton Award Committee, 1980.
Selection Panel for Award of Fellowships in Chemical Sciences, 1987-1990.
National Commission for UNESCO:.
member of National Commission, 1978-1982.
Chairperson, Sub-Commission for Natural Sciences, 1974-1977.
Delegate, VIIIth Regional conference of UNESCO.
National Commissions of Asia and Oceania, Wellington, July 1980.
International Federation of University Women:.
Member, International Panel of Experts consulted by the IFUW Fellowships' Committee for the award of international fellowships and grants, 1970.
Member, Organising Committee for Regional Conference of IFUW, held in Auckland, 1972.
Delegate, Nineteenth IFUW Triennial Conference, Stirling, 1977.
Leader of New Zealand Delegation to Twentieth IFUW Triennial Conference, Vancouver, 1980.
New Zealand Federation of University Women:.
National President, 1979-1982.
Auckland Branch
President, 1974-1975
Vice President, 1972-1973, 1976-1977.
Assistant Secretary, 1970-1971.
Executive Member, 1966-1969; 1978.

Charmian O'Connor has more than 150 publications in refereed journals.

It is very appropriate that such an outstanding contribution to Chemistry in New Zealand and in other parts of the world, East and West, has been recognised by being made a Commander of the Most Excellent Order (Civil Division) of the British Empire.

NEWS

Several branch meetings enjoyed hearing **Dr Gordon Miskelly's** interesting talk on the controversy surrounding the announcement of cold fusion by Pons & Fleischman. This matter now seems to have been put to rest.

A number of groups including that in which Dr Miskelly had worked at, Cal Tech, have rigorously examined the original claims and shown that there is no experimental evidence for fusion of deuterium nuclei under the experimental conditions employed.

Dr Miskelly had interesting observations on the extent to which scientists must go to obtain funding for research work, the spped with which governments will respond with funding if they suspect that there may be something to their advantage and finally the extent to which the news media were used to keep scientists working in the field in touch with latest developments.

The news media coverage was so thorough that by the time a Journal such as Chemistry in New Zealand could use the topic as a news item the matter was history.

Canterbury Branch

There has been an excellent response to the Branch's secondary school student analysis competition. A total of 51 entries have been received from Canterbury and West Coast schools. These entries will be judged by the Chemistry Division of the DSIR.

There has been less interest in the poster, photographic and essay competitions, perhaps due to the clash with the local science fair, for which many students are working hard.

Wool Research Organisation of New Zealand (Inc)

From 7-14 February 1990 WRONZ will be acting as host for the 8th International Wool Textile Research Conference at Christchurch. This is the first time the conference has been held in New Zealand. They are held every five years and are a gathering together of fibre scientists with an interest in animal fibres. It is expected there will be around 250 attendees from around the world.

Dr Doug Rankin is currently at the German Wool Research Institute in Aachen, West Germany on a one-year secondment. He is continuing his work on pesticide levels in woolgrease and environmental concerns on absorbable organic halogens (AOX), as well as basic wool chemistry research.

Dr John McKinnon attended the Fibre Society's Technical Conference at Pine Mountain, GA, USA in March. He presented a paper entitled "The Chemical Technology and Objective Appraisal of Wool Carpet Appearance Retention Properties".

In May John visited wool laboratories in UK and Europe. He also inspected the site at Mouscron, Belgium, for the installation of the seventh WRONZ developed CHEMSET yarn scouring and setting machine.

The Textile Chemistry Group at WRONZ has appointed **Dr Andrew Watson** as a scientist. Andrew is a PhD graduate in chemistry from the University of Canterbury and had previously held a post-doctoral position at the University of Tasmania.

Canterbury Chemistry Department

Jin Songchun, from the Changchun Institute of Applied Chemistry of the Academia Sinica, Chanchun, China, is spending six months in the Department working with **Dr Ward Robinson. Dr A H White**, University of Western Austrlaia, will be an Erskine visitor in the Department from mid-August till mid-October.

Drs Vickie McKee and Alison Downard will attend the 27th International Conference on Coordination Chemistry in Australia in July, and **Dr McKee** will also be at the International Symposium on Macrocyclic Chemistry in Townsville. **Dr John Blunt** is visiting laboratories in Spain, USA and Switzerland during June, and **Dr Rod Claridge** will attend the Matrix Isolation Sepctroscopy Symposium in Noordwijkerhout in July.

Dr Murray Munro is spending May-August at the National Cancer Institute Laboratory in Rockville, Md. **Professor Leon Phillips** plans to attend the 19th International Conference on Free Radicals in Dailin, China, in September.

NOTICE

As noted in the editorial above
Bernie Swedlund
will be Acting Director
for the next few issues of
Chemistry in New Zealand.

His address is as follows:

Dr B. E. Swedlund,
34 Saltburn Rd,
Milford, Auckland

ANNUAL REPORT FOR 1988/89

Matters Temporal

The 1988/89 year has been a year of historic change for the Institute.

The Registrar for 28 years, **Denis Hogan**, has retired from both Institute duties and from his position at DSIR.

With the appointment of an executive secretary in Wellington, based at the headquarters of The Institute of Professional Engineers of NZ, the position of administrative secretary became superfluous and **Betty Wignall** retired at the end of the financial year after 14 years of service.

Dr John Rogers, our Hon General Secretary, for 8 years also took a well earned retirement from his role while keeping an active interest in the affairs of the Institute as Second Vice President.

Th position of Hon Gen Secretary was filled by **Mr Alan Turner** following a ballot of corporate members.

The shifting and consolidation of our records to our office in Wellington is now almost complete and Mr Turner, is coming to grips with the task of transferring, correcting and updating of our records.

This is going to be no mean task. We ask you to bear with us if there appears to be a problem with your records or accounts. We were unfortunately bedeviled by computer problems during the year while Cantebury University changed their system. This caused a few hiccups in our system and delays in processing the records in relation to subscription receipts. If you were one of those affected we extend our apologies. If you feel that the records are still not straight please let us know.

Also during this year, the rules of the Institutes were streamlined with the consolidation of a number of non-corporate grades into the grade of Associate. These changes should eliminate the confusion which sometimes occured amongst potential applicants.

Together with the changes occuring in the titles of the officers of the Institute the revision of the Rules of the Institute has now been completed. It is the intention of the council to publish them together with an up to date members list as soon as practical.

The year also saw the retirement of **Bruce Graham** as journal editor. Bruce ably guided the journal for a number of years but found that with his increasing commitments of work that there was precious little time for other activities.

Mr Ron Hall was selected as your new editor. I am sure he will keep up the high standard set by Bruce.

While the Institute covers the overall interests of our members the Specialist Groups are the "heart and soul". Some have more heart and sould than others but all provide the essential service of allowing contact between members of like interest.

The Chromatography group is particularly active in the running of special courses. They are to be commended in providing this facility for chromatographers old and new to keep up with developments.

Likewise, the Polymer Group run occasional courses aimed at new recruits to the polymer industry. These courses are run in conjunction with our technical education institutions, usually as joint ventures, with the institutions providing the facilities and backup and our members providing the specialist lecturers from industry. The "house full" signs are usually out quickly when these are run.

The Fats and Oils group have run a number of interesting semi-educational/semi=entertaining evening functions advertised as open to the public with a view to re-educate some of the public over the misconceptions of the evils of fats and oils in the diet.

They also organised a very successful international conference on fats and oils with the theme "Fats for the Future".

Other groups have organised various seminars etc. usually held in conjunction with the annual conference.

An "ad hoc" body within the Institute worthy of special mention is that associated with the publication of "Chemical Processes in New Zealand". The second volume of this work has been published and, like the first, is an excellent publication. John Packer and his able team have put in many hours and are to be congratulated for their efforts.

At branch level the age old problem of poor attendance at meetings remains. Of late two branches to my knowledge have organised what would be known as "public meetings". While all our meetings are ostensibly "public" how often are they advertised as such? If they were would the subject matter interest them?

The branch meetings referred to above were of a subject matter of general interest to the "public" and were advertised widely. The "public" attended in large numbers. In one notable instance the chemists did not.

These meetings were deemed a great success. While not advocating the abandonment of the holding of highly specialised talks likely to be of interest to a select band of colleagues, the better attended populist type of meeting, organised and held perhaps once or twice through the year, can be a great morale booster to the branch committee and a good means of communicating with the general public.

Another very successful and satisfying exercise is the organisation of one or two day seminars aimed at a particular segment of industry and organised through the Continuing Education offices of the Universities. Again these are joint venture occasions and usually provide a useful financial surplus which is shared by the university and the branch.

Too often the objects of the Institute, as laid down in Rule 3.1, 3.2 and 3.3, are interpreted in the narrow sense.

The promotion of science, the raising of the status of chemistry and chemists and the provision of lectures etc. in the advancement of chemistry are often thought of as internal objectives. They are more than that and we as chemists should be more forthcoming in promoting the image of chemistry as a positive force of nature.

Matters Financial

A number of members have expressed an interest in the status of the GST refund from the 1987 conference. You will all be pleased to know that the matter was resolved satisfactorily and that a full refund was obtained. Efforts are being made to simplify the reporting of GST returns and other financial matters within the Institute.

The 1988 Manawatu conference figures have not yet been finalised because of some slow payments of debts due. It has however made a substantial surplus of the order of $10,000. The conference committee have made recommendations to Council as to the use that they would like this surplus put. Your Council has considered these favourably and when the final figure is known will act accordingly.

The committee of the Fats for the Future conference also had a surplus available. They have decided to distribute this surplus to a number of the groups that gave support both financial and moral to the committee prior to the conference and who themselves can utilise the money for educational and similar purposes. The Institute itself is a beneficiary. It is a proposal that this and the surplus from the 1988 conference be placed in a special fund that is available on a loan basis to assist future organisers of conferences, seminars and the like.

1987/8 was a bad year financially for a large number of businesses and organisations with the stock market crash and its' aftermath. Unfortunately the Institute did not come out unscathed.

The Council, under the powers invested in it by the rules of the Institute, used some of the money set aside to finance the secretariat when required, to invest in Equiticorp Holdings Ltd. This was by way of a Secured First Debenture Certificate. The collapse of the company and placement in statutary receivership has been well publicised.

We have had little by way of communication from the receivers as to the likely recovery of this money. The media have published most of the details. It would appear that the most probable recovery is of the order of 20 cents in the dollar with the faint possibility of 35 cents.

The Chemical Education Trust was also a victim of the Equiticorp receivership. The total sums involved were $41,000.

The inevitable questions as to the propriety of investing such sums with private financial institutions will be raised.

While the ultimate responsibilty for the decision rests with the Council, advice was sought from reputable stockbrokers as to the best use the money could be put for a reasonable return with a minimum of risk. The risk was minimised by investing the reserves across three financial institutions.

Examination of the minutes of the various council meetings, concerned with the decisions made, show that the correct procedures were followed.

Continued next page

NEWS

BID TO INCREASE WOMEN SCIENTISTS AND ENGINEERS

Auckland University now has a liason officer to encourage more women to study the physical sciences and engineering.

She is **Mrs Elizabeth Godfrey**, formerly head of computer studies and fifth form dean at Papakura High School.

She will encourage secondary school girls, particularly at junior level, to aim for degrees in science and engineering. This will involve her in visiting schools, running career days, generating publicity and preparing displays. Mrs Godfrey will also set up a support network for women already taking science and engineering subjects at university.

At present only 8% of engineering students and 35% of science students at Auckland are women, compared with 47% in the university as a whole. The science subjects with the lowest percentage of women taking papers are physics (15%), geology (17%), computer science (23%), mathematics (31%) and chemistry (32%).

Mrs Godfrey says that women's low participation in these fields shows that equal opportunity has not led to equal participation.

"In this increasingly technological society young women need to have a wide range of career opportunities and the knowledge to provide a woman's perspective in the areas of scientific debate or decision-making. To this end they must be encouraged by positive action, initially to study science and then to continue on in associated fields of study."

She sees her appointment as a positive affirmation by the university of the importance and urgency of these concerns. While she will actively support those women already enrolled at university, her primary target will be the girls still at school.

"Not only will it be necessary to inform and encourage those senior pupils already on the path of a science-orientated course, but to act positively at the fourth form level when pupils are preparing to make their major option choices. It is at this level that girls tend to opt out of science and close the doors to may career avenues."

Mrs Godfrey, who is 43, attended Auckland Girls Grammar School. She gained a master of science in chemistry at Auckland University and lectured there for seven years.

From 1977 she taught mathematics, chemistry and computer studies at Papakura High School. She was responsible for converting the school records and administration to computer.

She was also teacher in charge of badminton, formed the school's canoe club and organised inter-school equestrian events. She is president of the Auckland Canoe Club.

Mrs Godfrey can be contacted on phone 737-999 ext 8390 (work) or 298-0836 (home).

Annual Report Cont . . .

On a more positive note, the accounts for the year show that the activities of the Institute have not been otherwise affected in the short term and that with careful management of our finances the long term consequences can be minimised.

A fact not recognised by many is that the Institute has a monetary turnover equivalent to a small business. The oft heard comment (fortunately becoming less so) is "Why have a paid secretariat?" usually followed by "What does the Institute do (for me) and what do I get for my money?" or vice versa.

I am sure that the immediate past General Secretary and Registrar, and certainly the current holders of the positions, can assure you that the administration of the Institute's affairs has become more than that can be fulfilled by a few hours a week after work at home.

That answers the first question and immediately the reasons for the second question become apparent. For, without the backing of an able administrator in a position to be able to make normal day to day decisions without the distraction of his or her normal business activities, the Institute will stagnate and inevitably die. We have had a slight oxygen deficiency of late but the waters have been stirred and we are showing renewed signs of vigour.

It will take time and some courage but we feel that with your support and vision the Institute can look forward to a healthy and stimulating future.

D.R. Llewellyn
A Turner
D Karl

CONFERENCE

10th INTERNATIONAL CONFERENCE OF THE CLEAN AIR SOCIETY OF AUSTRALIA AND NEW ZEALAND

University of Auckland 25-30 March 1990

CONFERENCE OUTLINE

The 10th International Conference of the Clean Air Society of Australia and New Zealand is to be held in Auckland, New Zealand, 25-30 March 1990. As with previous conferences organised by the Society, the programme will address most aspects of air quality management. In addition, however, special emphasis will be given to a number of topics of current interest, by way of Keynote Addresses and a number of specialist workshops. The proposed topics for these and the general conference sessions are indicated below .

KEYNOTE SPEAKERS

The following international experts in their specific fields have already agreed to participate in the conference. Other overseas speakers are currently being sought.

Milton Feldstein 1987/88 President of the Air Pollution Control Association, USA

Dr Peter Finkelstein Chief, Terrain Effects Branch, Meterology Division, Atmospheric Sciences Research Laboratory, EPA, North Carolina, USA.

Dr Kathryn Kelly Senior Vice President, Environmental Toxicology International Inc., Seattle, USA.

Dr Bob Watson Chief, Upper Atmospheric Research/ Tropospheric Chemistry, National Aeronautics & Space Administration, Washington, DC, USA.

WORKSHOPS

A range of workshops will be held at the end of the Conference week in a variety of venues. Proposed topics are as follows:

1. Geothermal Energy/Air Quality Management — New Zealand is a world leader in the utilisation of geothermal energy. Air quality considerations are an important factor in the development of this resource.

2. Solid Fuel Domestic Heaters — these are used extensively in New Zealand, with the consequent need for thorough testing and control to ensure residential air quality.

3. Ozone Layer— reductions in the ozone layer have been detected above New Zealand, possibly as a result of the 'hole' over the Antarctic. This is currently an area of intense international research and by 1990 a clearer picture should have begun to emerge.

4. Planning — an important aspect of air quality management. Specific case studies will be presented from both New Zealand and abroad.

For further information contact:
Norman Thom, Conference Director, 31 West Tamaki Rd, Auckland. Tel (09) 583 949

AUSTRALASIAN CORROSION ASSOCATION INC. NEW ZEALAND BRANCH

"CASS 90"
CORROSION - AIR SEA SOIL

Sheraton Hotel. Auckland. New Zealand.
19 - 23 November 1990.

Three symposia will be held as an integral part of the conference.
Atmospheric Corrosion.
Marine Corrosion.
Underground Corrosion.

Intending authors are invited to submit papers on a wide range of corrosion topics.

For further information contact:-

Ray Osborne, Conference Secretary. ACA NZ Branch, PO Box 5961, Auckland NZ. Tel (09) 555-871. Telex NZ 21 623 (DSIR), Fax (09) 370-618 (DSIR).

POLYMER 91 IUPAC INTERNATIONAL SYMPOSIUM MELBOURNE AUSTRALIA

10-15 February 1991

The Polymer division of the Royal Australian Chemical Institute are organising body for "Polymer 91"

Symposium Themes

1. Towards a better understanding and control of Polymers materials.
2. Extending the limits of polymer materials.
3. Polymer materials as a resource for the future.
4. Advancing Technology with polymer materials.

For further information contact:-
Polymer 91
RACI Polymer Division
PO Box 224 Belmont
Victoria 3216, Australia.

CHEMICAL CARCINOGENS IN NEW ZEALAND

What has changed in a decade?

William A Denny & Lynnette R Ferguson
Cancer Research Laboratory
University of Auckland School of Medicine
Private Bag
Auckland

In an article in Chemistry in New Zealand a little over 10 years ago[1], we commented briefly on the cancer statistics in New Zealand and the known risks due to exposure to carcinogenic chemicals. A list of all known and suspected human carcinogens was provided, as well as a summary of the methods by which suspected chemicals could be evaluated for carcinogenicity. Finally, we outlined the legislation available in New Zealand for the control of carcinogens. Has anything changed in ten years? The brief answer is yes, there have been major changes in all but one of the areas covered by the previous article. Many of these changes have been so profound that we felt it pertinent to offer this update.

Cancer statistics in New Zealand

This is the one area where there has been little change in the past 10 years, either in New Zealand or in other developed countries. Despite concerns about the increased use of synthetic chemicals, overall age-adjusted cancer rates in many countries have actually fallen, if lung cancer deaths (attributable almost entirely to smoking) are not considered[2].

The biology of carcinogenesis

In the last decade the most profound changes have been made in our understanding of the process of chemical carcinogenesis. The extent of this change can be judged by a comparison of the quote from our previous article[1] that "initial carcinogenic events take place at an unseeable molecular level", and the following brief summary of current knowledge. The body is composed of a very large number of individual cells which have their own life cycle : stem cells divide under tight feedback control to produce new cells, and as these become specialized (differentiate) they lose the ability to divide further. Cancer occurs when one of the stem cells (somatic cells) somewhere in the body escape this control mechanism and proliferate unchecked. The control of cell division is activated from outside the cell by special messenger molecules. These bind to receptors on the cell membrane, and the resulting signal is transmitted through a complex 'growth signal transduction pathway' to control elements in the cell nucleus. The process of multistage carcinogenesis (at least as it relates to exposure to exogenous chemicals) is best understood as a progressive series of disorders in the function of this signal transduction pathway[3].

Most carcinogens are chemicals which (either directly or after metabolism) react with cellular DNA to form covalent adducts. A large number of such adducts have been isolated and characterised, and these show a very diverse chemistry. Most adducts are repaired by the multiplicity of DNA repair systems available in the cell, with the rate and fidelity of repair relating to the exact chemistry of the initial adduct. A small proportion of these adducts result in permanent (heritable) changes in the DNA sequence (e.g. replacement of one base by another, or insertion or deletion of a number of bases), and these changes are called mutations. The vast majority of such mutuations are irrelevant to the organism, since they result either in cell death (production of lethally-defective proteins on transcription) or have no effect (production of proteins of slightly altered structure but unchanged function).

However, mutations at critical positions in a very small number of genes are carcinogenic. Many of these genes (proto-oncogenes) code for proteins which are components of the signal transduction pathway, and can be 'activated' to oncogenes. They then produce subtly-altered proteins (or in some cases simply elevated amounts of normal protein), which interfere with the normal functioning of the growth signal transduction pathway[3]. For example, the ***ras*** gene family codes for proteins of 188 or 189 amino acid residues, located on the inside of the cell membrane where they act as signal transducers by hydrolysing GTP to GDP. Activation of the proto-oncogene to the oncogene usually occurs by point mutations at positions 12 or 61 in the gene, which codes for alterations in the amino acid structure of the protein in the loops which bind GTP[4]

Recent genetic studies of the effects of a large number of chemicals have shown that each agent causes a unique and characteristic pattern of mutations in mammalian cells, each in essence leaving its own 'fingerprint' on the DNA[5]. Similarly, specific chemicals activate specific oncogenes in characteristic ways [6,7]. There is evidence that mutations, once caused, are very stable, persisting for decades[5]. Although the exact role between such 'oncogene activation' and the development of cancer has not been decided, the concensus is that a cell is converted to malignancy as a result of a number of such changes occurring in it, each being an event of low (and variable) probability[8].

Another method of specific oncogene activation involves gross changes where parts of chromosomes or even whole chromosomes are involved. For example, chronic myelocytic leukaemia appears[9] to be a consequence of a chromosomal translocation [t (9,22) (q34;q11)] in which the ***c-abl*** proto-oncogene is activated by translocation to chromosome 22. A recent summary[10] shows that a number of viral, hormonal or chemical carcinogens appear to result in cells with an imbalance of chromosome number (aneuploid cells), and a large amount of evidence now points to aneuploidy as being one step in the multistep process of tumour progression.

This molecular-level picture is consistent with the observed features of chemical carcinogenesis : the long (but very variable) induction time between a documented exposure and the onset of the disease, and the cumulative and additive nature of the risks. The implications for safety are clear, since this mechanism (the cumulation of multiple and unrelated random events) does not require the existence of a 'threshold dose', and indicates that the risks of prolonged and/or multiple exposures are likely to be cumulative.

Occupational carcinogenesis : the risks

The most dangerous characteristic of chemical carcinogenesis is its subtle nature. Virtually all chemicals are acutely toxic at sufficiently-high concentrations, but the results are immediate and apparent and the victim quickly learns to

Table 1

Chemicals which are carcinogenic in humans (chemicals for which there is sufficient evidence of carcinogenicity in man)

Compound	Classification
aflatoxins	environmental contaminants
tobacco smoke	
smokeless tobacco products	
azathioprine	anticancer drugs
chlornaphazine	
chlorambucil	
cyclophosphamide	
melphalan	
mehtyl-CCNU	
myleran	
analgesics containing phenacetin	miscellaneous drugs
diethylstilbestrol	
methoxsalen + UV radiation	
various steroidal and non-steroidal estrogens	
aluminium (production of)	manufacturing processes
arsenic and compounds	
asbestos (and products contaminated with it)	
auramine (manufacture of)	
boot and shoe manufacture	
chromium compounds (hexavalent)	
coal gasification	
coal-tar & coke production, soots	
furniture and cabinetmaking	
haematite mining (radon exposure)	
iron and steel founding	
isopropanol (manufacture by strong-acid process)	
magenta (manufacture of)	
minerals oils & shale oils	
nickel & nickel compounds	
rubber (manufacture of)	
vinyl chloride	
4-aminobiphenyl	miscellaneous chemicals
benzene	
benzidine	
bis (chloromethyl) ether	
sulfur mustard	
2-napthylamine	
treosulphan	
erionite	

Table 2

Chemicals which are probably carcinogenic to humans (chemicals for which there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in

Compound	Classification
benz[a]anthracene	environmental contaminants
benz[a,h]anthracene	
adriamycin (doxorubicin)	anticancer drugs
BCNU	
CONU	
cisplatin	
procarbazine	
thiotepa	
anabolic steroids	miscellaneous drugs
phenacetin	
benzidine-based dyes	manufacturing processes
beryllium and beryllium compounds	
cadmium and cadmium compounds	
creosotes	
polychlorinated biphenyls	
diethyl sulphate	miscellaneous alkylating agents
dimethylcarbamoyl chloride	
dimethyl sulphate	
epichlorohydrin	
ethylene dibromide	
ethylene oxide	
N-ethyl-N-nitrosourea	
formaldehyde	
N-methyl-N'-nitro-N-nitrosoguanidine (MNNG)	
N-methyl-N-nitrosourea	
nitrogen mustard	
N-nitrosodiethylamine	
N-nitrosodimethylamine	
propylene oxide	
styrene oxide	
tris(2,3-dibromopropyl) phosphate	
vinyl bromide	
acrylonitrile	miscellaneous chemicals
5-methoxypsoralen	
4,4'-methylene bis(2-chloroaniline) (MOCA)	
silica (crystalline)	

avoid such exposure. However, carcinogenesis can occur at exposure levels which are unnoticed by the victim, and the results may only become apparent many years afterwards. This provides no motivation to follow procedures that minimize exposure, and also makes it difficult to attribute the disease to any specific factor. The consensus of epidemiological studies is that very few (1-4 %) of all cancers can be attributed specifically to industrial (work place) exposure to known carcinogens[11], and in fact that "specific preventative measures cannot be recommended with any certainty for about 50 % of cancers in males and 70 % of cancers in females"[8] at the present time.

However, epidemiological studies have severe limitations, and can only unequivocally identify quite large risks, where a well-defined population have had heavy exposure to a particular carcinogen. Current knowledge of the mechanism of chemical carcinogenesis (a cumulation of cellular damage to some critical level) suggests that even low-level exposures may contribute to carcinogenesis, while remaining undetectable epidemiologically. It therefore seems wise for chemists to remain aware of the responsible literature on carcinogenic hazards, and to take all reasonable measures to minimize exposure to known (and suspected) chemical carcinogens.

Evaluation of chemical carcinogens

1 *Epidemiology*

Intuitively at least, epidemiology remains the most attractive method of assessing the risk of human carcinogenesis from chemicals. There are no interspecies extrapolations required, and in some situations, a direct measure of hazard can be obtained. However, the only human carcinogens which have been unequivocally identified by this technique have very high relative risks (mostly greater than a 30-fold increase in relation to the risk in the general population)[12]. In addition, there are defects in many of the studies which have been performed to this date. These include selection factors that occur in the identification of the study population, survivor effects, mis-estimates of exposure, incomplete follow-up, improper comparison rates and confounding exposures[12]. Because of these factors affecting the precision of epidemiology, and because it is not appropriate in many situations, most evaluations of carcinogenesis, including those of the International Agency for Research on Cancer, rely heavily on animal and *in vitro* tests[13].

2 *Animal Tests*

Over the last decade there has been a tightening of the animal test data which are acceptable to major agencies such as the US National Cancer Institute[14]. The current official carcinogenesis bioassay programme in the USA is the single biggest contributor to world literature on carcinogens. This programme was designed to test chemicals for carcinogenicity in both sexes of two rodent species. In general, 600 animals are used and it takes two years to complete the experimental portion of the study. However, it has been estimated[15] that when planning preliminary subchronic studies, histological analysis and preparation of final technical reports are considered, the actual time for a carcinogenesis bioassay is typically closer to four years, at an average cost of US$800,000 per compound. The obvious constraints of time, funding levels and facilities have restricted the number of compounds which can be tested in these assays to only about 300 over the last 15 years[15].

In assessing the probability that a chemical is a human carcinogen, the primary assessment is based on a critical evaluation of both human and animal data. The major reviewer of such data, the International Agency for Research on Cancer (IARC) takes the position that only chemicals for which there is evidence of such effects in human populations can be classed in this way. Chemicals which have been adequately tested in animal models are classed as possible or probable human carcinogens, depending upon the strength of the animal evidence combined with any suggestion of human evidence, as well as supporting evidence from in vitro tests. Good evidence of genetic effects will generally lead to an upgrading of animal data (see preamble to Tables 1-3).

3 *In Vitro tests*

Most of the major developments of the last decade have been in in vitro screening methods, concerning both the tests themselves and the manner in which they are interpreted. In the 1970's there was some dispute as to whether mutations were indeed relevant to carcinogenesis. The correlation between mutagenicity tests and carcinogenesis provided one of the major arguments in favour of the idea, and the new molecular biological information on oncogenes and their activation (see above) have provided compelling evidence that mutagenic events are essential precursors of carcinogenesis. Such fundamental research has emphasized the relevance of use of mutagenicity tests as predictors of carcinogenesis.

With this increased recognition of their value has come a proliferation of the number of in vitro tests, using a variety of different endpoints in a variety of different organisms. There have been two major International Collaborative Trials [16,17] aimed at identifying the most effective tests (or combination of tests) for predicting the carcinogenicity of chemicals. Despite some recent controversy[15], the ***Salmonella*** mutagenicity test originally developed by Ames[18] remains the single most useful assay, although in specific situations other tests may be more useful. For example, in assessment of potential carcinogenesis of aniline mustards, we have shown[19] that estimation of recombinogenic potential in yeast may relate more closely to animal carcinogenicity of the drugs than does a standard ***Salmonella*** mutagenicity test. However, such alternative assays are usually used to provide supplementary information.

In some situations, there is reason to believe that such ***in vitro*** assays for mutagenicity may actually provide more valuable information than classical animal carcinogenicity studies. In cases where there have been disagreements between the ***in vivo*** and ***in vitro*** tests, re-evaluation[15] of the data has nearly always shown defects in the animal methodology, not in the ***in vitro*** tests.

Legislation

Recognition of the dangers of mutagenic and carcinogenic chemicals is prominent in the regulatory requirements for various clg ses of materials in many countries. In addition to carcinogenicity information, many authorities require a minimum base set of mutagenicity tests. Such information is required in order to register a new chemical in Australia, Canada, Denmark, Japan, Sweden and the United States[20]. EEC countries are covered by an EEC directive and some EEC countries such as Britain require their own specific information. Additional tests are required if firmly positive results The presence of a compound in the lists (particularly Tables 1 & 2) reflects both its carcinogenic properties and its widespread use. As noted above, evaluation of the risk of exposure to a particular chemical by epidemiological methods is extremely difficult, and can be done with confidence only when a sizeable group of people have been chronically exposed. This is why a significant proportion of the known carcinogens are drugs, where a clearly-defined population has a heavy exposure. About half of all the substances in Table 1 refer to the risk incurred in the manufacture of compounds, where it is not possible to decide if it is the product itself, precursors, byproducts or process materials (or the combination) which are the danger. The data upon which cases are decided are also (of necessity)

Acknowledgements

The authors would like to thank **Dr L R B Mann**, who provided the stimulus by recently commenting to one of the authors "I just re-read your 1978 article in *Chemistry in New Zealand* and found it much better than I remembered! Why don't you do an update?"

References

1 W A Denny, B F Cain & L R Ferguson, Chemistry in New Zealand, 1978, 42, 96
2 E Silverberg & J A Lubera, CA — Cancer Journal for Clinicians, 1988, **38,** 5
3 I B Weinstein, Mutation Research, 1988, **202,** 413
4 A M deVos, L Tong, M V Milburn, P M Matias, J Jancarik, S Noguchi, S Nishinmura, K Miura, E Ohtsuka & S-H Kim, Science, 1989, **243,** 888
5 J L Marx, Science, 1989, **243,** 737
6 R W Wiseman, S J Stowers, E C Miller, M W Anderson & J C Miller, Proc. Natl Acad Sci (USA), 1986, **83,** 5825
7 M Barbacid, Carcinogenesis, 1986, **7,** 1037
8 J Higginson, Cancer Research, 1988, **48,** 1381
9 E Fainstein, C Marcelle, A Rosner, E Canaani, R P Gale, O Dreazen, S D Smith & C M Croce, Nature 1987, **330,** 386
10 J M Parry, Mutagenesis, 1988, **3,** 105
11 R Doll & R Peto, J Natl Cancer Inst, 1981, **66,** 1193
12 W J Nicholson, Annals N Y Acad Sci, 1988, **534,** 44
13 IARC monograph on the evaluation of carcinogenic risks to humans. Supplement 57, World Health Organisation, 1987 p 17
14 S Nesnow, M Argus, H Bergman, K Chu, C Frith, T Helmes, R McCaughy, V Ray, T J Slaga, R Tennant & E Weisberger, Mutation Res, 1987, **185,** 1

decades old, due to the long induction period for carcinogenesis. Thus for example, while there is a clear risk in the manufacture of auramine by the methods prevailing decades ago, there is less evidence (see Table 3) of any risk due to auramine itself.

- Some named compounds represent a risk only to a very narrowly-defined group. For example, diethylstilbestrol is classified as a known human carcinogen because of the incidence of cervical cancer in young women whose mothers were prescribed it during pregnancy.
- Risk-benefit considerations must always be kept in mind. Thus chlorambucil, cyclophosphamide and melphalan continue to be used in cancer chemotherapy, where their immediate benefit outweighs the risks. Nevertheless, vigorous attempts are being made to replace these compounds, particularly in childhood cancer treatment where cured patients have a long life expectancy.
- Many compounds of wide potential exposure have been detected only because they cause very unusual cancers, and their propensity to contribute to more common cancers is unknown (and undetectable). An example is vinyl chloride, which in highly-exposed populations causes the very rare angiosarcoma of the liver. Many compounds **not** in the Tables must also be human carcinogens, but will never be detected unless a large population is exposed. However, the known multi-factorial nature of the carcinogenic process (see above) means that exposure to many different carcinogens may cause not only additive but possibly synergistic risks. Therefore, the Tables should be used intelligently by all chemists as a guide. For example, given the large number of N-nitroso compounds listed (BCNU, CFNU and methyl-CCNU are N-nitrosoureas), it would be prudent to treat all N-nitroso compounds as potential human carcinogens.

15 M J Prival & V C Dunkel, Envir. Molec. Mutagenesis, 1989, **13**, 1
16 J Ashby, F J deSerres, M H Draper, M Ishidate, B E Matter & M D Shelby, Mutat Res, 1983, **109**, 123
17 J Ashby, F J deSerres, M H Draper, M Ishidate, B H Margolin, B E Matter & M D Shelby, Prog Mutation, Res Vol 5, Elsevier, Amsterdam, 1985
18 D M Maron & N B N Ames Mutation Res, 1983, **113**, 173
19 L R Ferguson, B D Palmer & W A Denny, Mutation Res, 1989, in press
20 D J.Berry & M H Litchfield, Prog Mutation Res, Vol 5, Elsevier, Amsterdam, 1985.

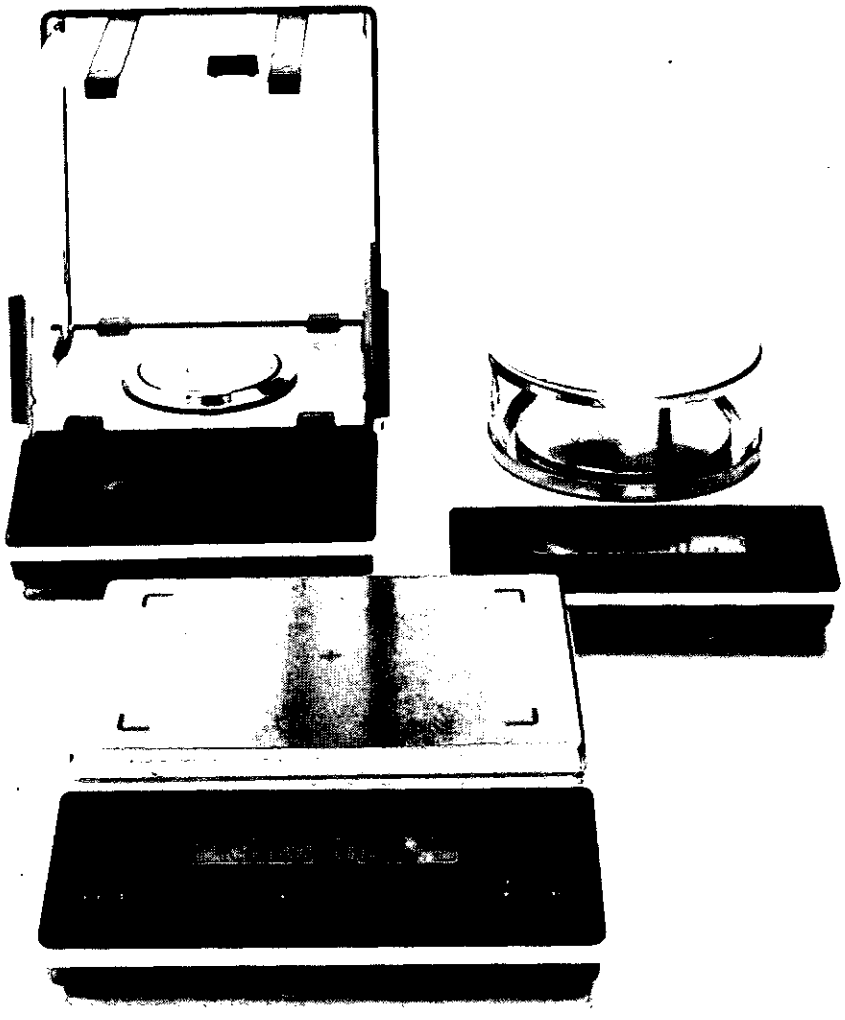
Table 3

Chemicals which are possibly carcinogenic to humans (chemicals for which there is limited evidence of carcinogenicity in humans in the absence of sufficient evidence of carciongenicity in experimental animals). (A number of rare chemicals have been omitted for reasons of space).

Compounds	Classification
various (7) pyridoindoles	environmental contaminants (including pesticides)
various (12) polycyclic hydrocarbons	
various (13) N-nitroso compounds	
Amitrole (3-aminotriazole)	
butylated hydroxyanisole (BHA)	
bracken fern	
chlordecone (Kepone)	
chlorophenoxy herbicides	
cycasin	
DDT	
mirex	
saccharin	
safrole & dihydrosafrole	
hexachlorobenzene	
TCDD ('dioxin')	
azaserine	anticancer drugs
bleomycins	
dacarbazine	
daunomycin	
merphalan	
mitomycin C	
streptozotocin	
uracil mustard	
chloramphenicol	miscellaneous drugs
griseofulvin	
medroxyprogesterone	
metronidazole (Flagyl)	
niridazole	
7 other nitrofuryl antibacterials	
phenazopyridine HCl	
phenobarbital	
phenoxybenzamine HCl	
phenytoin	

Compounds	Classification
auramine (technical)	dyes
benzyl violet 4B	
Citrus Red No. 2	
Oil Orange SS	
Ponceau MX & 3R	
trypan blue	
carbon tetrachloride	solvents
chloroform	
1,2-dichloroethane	
dichloromethane	
1,4-dioxane	
hexamethylphosphoramide	
tetrachloroethylene	
acetaldehyde	miscellaneous chemicals
acetamide	
acrylamide	
o-& p-aminoazobenzene	
o-anisidine & 7 other aromatic amines	
benzidines (4 examples)	
butyrolactone	
N,N'diacetylbenzidine	
1,2-dibromo-3 chloropropane	
1,4-dichlorobenzene	
diepoxybutane	
di(2-ethylhexyl)phthalate	
ethyl acrylate	
ethylene thiourea	
ethy & methyl methanesulfonate	
hydrazine & 3 alkylhydrazines	
lead and inorganic lead compounds	
2-nitropropane	
polybrominated biphenyls	
potassium bromate	
propiolactone	
styrene	
thiourea	
urethane	

Get down to Basics!
With the Sartorius Basic Balance Series.



Functional convenience, sleek design and quality workmanship all combined in each balance – why not go up in value when you get down to basics?
The Sartorius Basic Balance Series comes with all the basics you need for strictly weighing. Except for one thing that isn't basic: the precision it provides – from 0.1 mg to 6 kg.
With an optional interface, Sartorius Basic Balances communicate intelligently.

Hook up a data printer or let your balance "talk" to an online computer. For high-tech performance capabilities at a low price. More basic features and accessories make this series a complete bargain. Take the special glass draft shield. Or the standard hanger for below-balance weighing. And an accessory carrying case. Plus an antitheft locking device – so your Basic Balance doesn't get carried away.

sartorius

Marketed by:

WILTON INSTRUMENTS

People you can count on

Auckland, Private Bag Northcote 9. Tel 418.3039
Lower Hutt, Box 31-044. Tel 697.099
Christchurch, Box 1813. Tel 663.663

LIPSOMES AND THEIR POTENTIAL AS DRUG CARRIERS

Charmian J O'Connor, Diane P Emery
and William A Denny
Chemistry Department
and
(WAD) Cancer Research Laboratory, School of Medicine
University of Auckland

Liposomes as models of the cell membrane

Liposomes were first observed by Bangham and Horne in 1961 when they attempted to visualise dispersions of phospholipids with the aid of an electron microscope[1]. By 1964 they had "established beyond reasonable doubt the integrity of these spontaneously formed, closed membrane systems, tantalisingly similar to the membranes which appeared to surround cells".

Liposomes can be prepared from naturally occurring or synthetic phospholipids. The chemical structure of phospholipids is based on glycerol. The 1- and 2- positions of glycerol in natural phospholipids are esterified with fatty acids and a phosphate headgroup is attached at the 3- position of the molecule[2,3] (fig 1). Phosphatidylcholines or 1,2-diacyl-sn-glycero-3-phosphocholines (lecithins) are the phospholipids most commonly used in the preparation of liposomes.

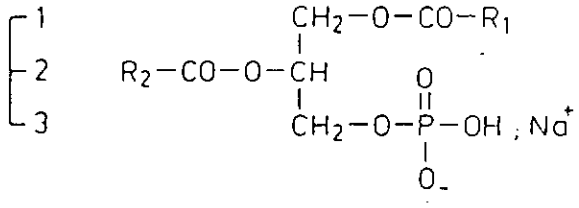


fig 1 Structure of 1,2-diacyl-sn-glycero-3-phosphate (phosphatidic acid) (11). The phospholipid is negatively charged at pH 7.

Phospholipids are generally abbreviated to four letters, the last two of which denote the class of lipid (phosphatidylcholine = PC). The first letters of the abbreviation refer to the hydrocarbon chains (1,2-dihexa-decanoyl PC or dipalmitoyl PC = DPPC)[2]. DPPC is a typical lecithin lipid, which, like many naturally occurring lipids has a zwitterionic headgroup. The hydrophobic region consists of two saturated fatty acid chains which give rise to a more rigid membrane than that formed with the corresponding unsaturated chains[4] **(fig 2).**

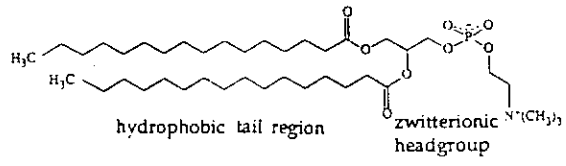


fig 2 Structure of DPPC, a typical lecithin lipid.

The number of water molecules associated with the phospholipid headgroups and the strengths of the water-lipid interactions strongly influence the formation and physical properties of vesicles. Typically, one phosphatidylcholine molecule is surrounded by 23 water molecules, with 11 molecules entrapped in the interior of the lipid and 12 molecules hydrating the headgroup[5].

At a concentration of phospholipid which is greater than the critical micellar concentration (CMC), the tail groups spontaneously gather together to exclude water, whereas the hydrophilic headgroups bind the surrounding water. The liposomes so formed encompass two distinct compartments; an interior aqueous pool and an enveloping hydrophobic bilayer. Liposomes spontaneously organise into vesicles in this way because of the amphotropic nature (Greek: ampho = both, in two ways; trepein = align) of the constituent phospholipids: each molecule has a hydrophobic (water-insoluble) tail and a hydrophilic (water-soluble) or polar head group[2]. Opposing hydrophobic attractions between the hydrocarbon chains and electrostatic repulsions between the headgroups are responsible for the self-association of lipid vesicles[6].

The properties of liposomes depend on the structure and conformation of their phospholipid constituents. The exact conformation of the phospholipid headgroups in vesicles is somewhat ambiguous. However, it is believed that the large headgroups cannot pack properly in a parallel orientation and are forced into a more perpendicular conformation. With the introduction of headgroup interactions, whether they be electrostatic or hydrogen bonding, the headgroup is pulled into an orientation more parallel to the surface of the bilayer. Electrostatic attractions, occurring between the amine and neighbouring phosphate, enhance stabilisation in PC; however hydrogen bonding is negligible[7,8]. The conformation of the PC headgroup in a membrane has been accepted to be approximately similar to that shown for the crystal structure of dimyristoylphosphatidylcholine (DMPC)[9] **(fig 3).**

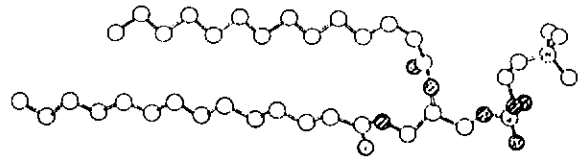


fig 3 Crystal structure of DMPC Oxygen atoms are shaded[9].

The great interest in liposomes is due to their similarity to biological membranes. Like cell membranes, they are spherically closed lipid bilayers which surround an aqueous compartment, and exemplify well the concept of function through organisation[4]. The development of life would not have been possible without the organisation of amphiphiles to form plasma membranes. The cell membrane is crucial to all biological phenomena, including biological transport, energy metabolism, cell division and macromolecular synthesis. The surface of the cell is also actively involved in cell-cell interactions and immunological recognition processes, as well as in cell differentiation and malignancy.

In 1972 Singer and Nicolson proposed the "fluid mosaic model" of biomembranes, which describes three distinct but connected layers : the glycocalix, protein-lipid bilayer, and cytoskeleton[10]. The central protein-containing lipid bilayer is the component which physically partitions the cell into compartments. The lipid structure is held together predominantly by noncovalent bonds such as van der Waal and coulombic interactions, allowing a great deal of variation in their chemical

composition and dynamic properties. Peripheral proteins are bound to the membrane mainly by electrostatic interactions, whereas integral proteins, some of which span the whole membrane, are incorporated into the lipid bilayer[11]. Exterior to the phospholipid membrane is a carbohydrate-rich layer, the glycocalix. Surface recognition of cells is determined by the glycocalix, which consists mainly of the oligosaccharide headgroups of the glycoproteins. Finally, the polysaccharide cytoskeleton is joined directly to the inside of the lipid bilayer and acts to stabilise the membrane[10] (fig 4).

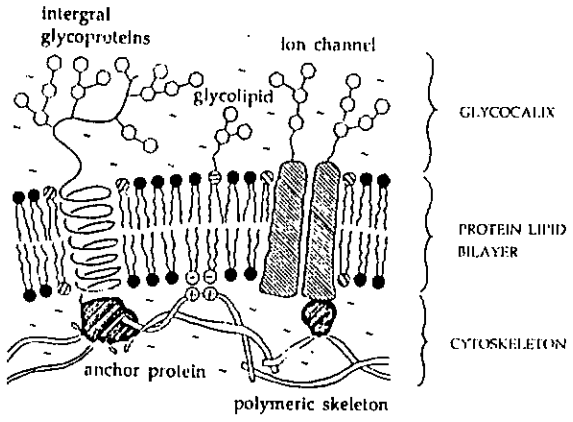


fig 4 Schematic cross section through a biomembrane. Three distinct layers are represented; the glycocalix, the protein-lipid bilayer, and the internal cytoskeleton (Adapted from ref. 4).

Preparation of Liposomes

Liposomes can be prepared by numerous methods which lead to the formation of completely different vesicle systems, differing in both diameter and in the number of bilayers - multilamellar vesicles (MLV), small unilamellar vesicles (SUV) and large unilamellar vesicles (LUV)[2,4,12].

Of all types of liposomes, MLV are the simplest to prepare and generally range between 400 and 3500 nm in diameter, with an encapsulation efficiency of between 5-15 percent of the initial aqueous phase[13]. They have onion-like structures, with smaller lipid bilayers enveloped inside larger ones, and an alternation of hydrophobic and aqueous compartments. The time allowed for hydration, method of resuspension of the lipids and thickness of the lipid film result in different preparations of MLV, even if they are of identical concentration, composition and volume of suspending aqueous phase[2].

SUV can be prepared by sonication of a MLV suspension under an inert atmosphere[14]. Probe sonication results in the formation of SUV with diameters ranging between 20-50 nm and with a low encapsulation efficiency, for the initial aqueous phase, of 0.5-1.0 per cent[13]. These values depend on specific physical conditions, since liposomes are only stable over a narrow range of pH, phospholipid composition, temperature, concentration, time of sonication and other species present in the suspension. Because of the high radius of curvature in these vesicles, there are approximately twice as many lipids in the outside monolayer of the bilayer shell[15]. This ratio is drastically different from the 1:1 ratio found in multilayer preparations, suggesting that the degree of molecular order within the bilayers of the unilamellar and multilamellar systems is different[2]. The most important attribute of SUV is that small homogeneous populations of vesicles can be distinguished from MLV by simple techniques such as separation through a gel column[16].

LUV are often prepared from water-in-oil emulsions of phospholipid and buffer in excess organic phase and can be referred to as reverse-phase evaporation vesicles (REV) (fig 5). They have a much higher ratio of aqueous space to lipid than the corresponding SUV and are generally between 200 and 1000 nm in diameter[13]. Due to their size, they are useful for entrapping macromolecules, particularly enzymes[14,17]. They can encapsulate between 35 and 65 per cent of the initial hydrophilic phase[13] and the ratio of aqueous area to lipid is high[17].

Liposomes as passive drug delivery systems

In recent years, interest in liposomes has focussed on their potential as drug delivery systems. An ideal drug delivery system is required to be non-toxic and easily degradable or excretable, and serves to protect drugs from general dilution or metabolism, as well as directing them specifically to target tissues and releasing them there. Liposomes have gained acceptance as potential drug carriers since they have many of these advantages. Due to their similarity to cell membranes

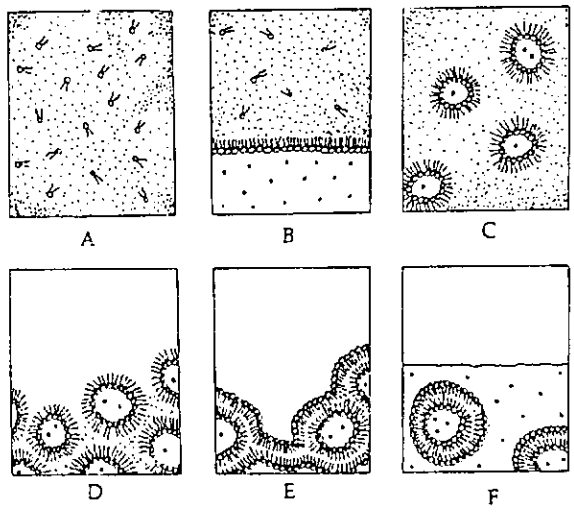


fig 5 Schematic representation of the formation of REV. The lipids are dissolved in the appropriate solvents, (a), and an aqueous phase containing the compound which is to be encapsulated is added, (b). The molecules begin to aggregate, (c) and (d). The organic phase is then removed, (e), and REV form on addition of aqueous buffer, (f). (Adapted from ref. 17).

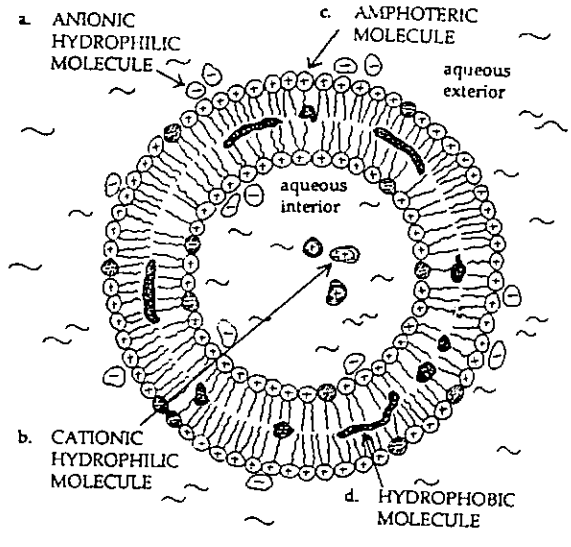


fig 6 Schematic cross section through a positively charged vesicle. Hydrophilic molecules can be anionic, (a), and therefore electrostatically attracted to the inner and/or outer surfaces of the lipid membrane or cationic, (b), whereby they may be repelled from the bilayer. Amphipathic molecules, (c), are shown to be locked into the membrane via lipophilic tail groups. Hydrophobic molecules, (d), are portrayed intercalated into the lipid bilayer. (Adapted from ref. 5).

they generally have low toxicity, and provide some protection against dilution and degradation in the body. A wide variety of drugs can be encapsulated, since there are distinct environments within the liposome for substrate localisation. Hydrophobic molecules can lie buried in the hydrocarbon chains of the lipid bilayer. Amphipathic molecules may be anchored by a long hydrocarbon tail terminating in a polar headgroup. Polar molecules are entrapped within the aqueous pool and may move about freely (especially if they are electrostatically repulsed from the inner surface of the vesicle) or they may be attracted and bound to the inner surface of the vesicles (**fig 6**).

SUV have also been found to interact with cells in ways that could prove useful in drug delivery systems, especially for the enhancement of transport to diseased tissue[18]. Liposomes can adsorb to most cell types, and once adsorbed can release their contents, some of which may enter the cell. If endocytosed, (swallowed up by phagocytic cells) the liposome may be processed by subcellular organelles known as lysosomes, after which the phospholipids of the liposomal membrane are presumed to be incorporated into the cell's own membrane, whereas encapsulated hydrophilic molecules may escape lysomal degradation and become dispersed within the cytoplasm. Adsorbed liposomes may also exchange individual lipid molecules with the plasma membrane, thus achieving transport of encapsulated lipophilic molecules. Fusion may occur where the liposomal membrane is integrated into the cell membrane and the contents of the aqueous pool are released into the cytoplasm of the cell (fig 7). Thus, the liposome has various mechanisms to adsorb to cells and release previously-inacessible drugs[18].

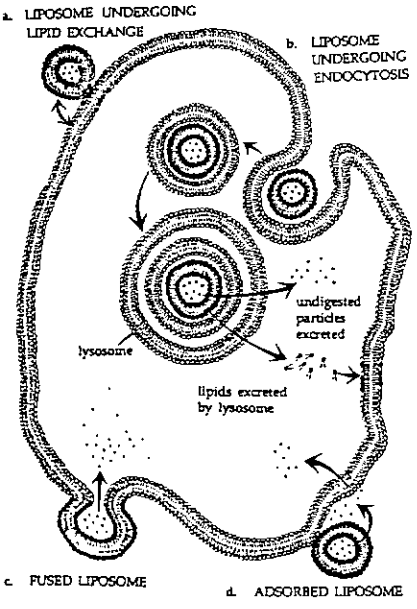


***fig 7** A liposome and cell membrane can interact in several different ways. Lipid exchange may occur, (a), or fusion of the cell and liposomal membrane may take place, (c). Liposomes may be adsorbed, (d), after which they may be phagocytosed, (b). (Adapted from ref. 18).*

Simple liposomes cannot be given orally (the most convenient route of administration) since they are degraded by surface-active bile salts in the gastrointestinal tract[19]. When administered intravenously, liposomes are generally unable to leave the circulation. Unencapsulated drugs usually diffuse through capillary walls into tissues, but liposomes are too large to pass through the walls of the capillaries in most organs[12,13]. However, SUV in the size range of tens of nanometres are able to move into interstitial spaces if the endothelial lining is discontinuous, as occurs in the liver, and to a lesser extent, in the spleen and bone marrow, or if it is damaged, as is the case in some diseased tissue[20].

Although there are obstacles limiting the distribution of liposomal drug systems in the body, they nevertheless show potential for treating many diseases. A number of animal studies have shown that encapsulation of drugs can greatly reduce the dose needed to be effective. This reduction is very important, especially in diseases such as leishmaniasis and cancer (see later), where the available drugs are themselves very toxic.

Despite their similarity to living cells, liposomes are recognised and taken up by macrophages in the liver and spleen. These cells act to defend the body against attack by foreign particles. The localisation of liposomes in the phagocytic macrophages presents a potential route for passively targeting therapeutic agents to these cells[21,22]. Systematic administration of MLV containing immunomodulators that activate macrophages, making them cytotoxic for tumour cells, has been proved to be effective in enhancing resistance to lung cancer metastasis[22].

Systemic fungal infections which occur in patients with a lowered resistance, caused by a suppression of the body's immune system by disease (eg AIDS) or immune-suppressing medication are difficult to treat, because the prescribed drugs are extremely toxic. In mice, liposomes carrying amphotericin B cured systemic fungal infections more successfully than did free drugs. This success is attributed to the larger quantities of drug able to be administered without increasing toxicity. Remarkably, of 20 human immunosuppressed patients, for whom all standard therapies had failed, liposomal amphotericin B effected a cure in 10 of the patients and resulted in notable improvement in several others[18].

However, several fundamental problems must be solved before liposomal drug delivery systems can be generally employed in clinical practice. Greater stability of vesicles is needed to attain longer storage ability and for successful *in vivo* administration. Attempts to increase stabilisation *in vivo* have focussed on modification of the liposomal membrane. Methods used include polymerisation of the lipids, impregnation of molecules such as cholesterol into the bilayer and the formation of artificial cell walls to completely enclose the vesicle. Water-soluble polymers can be attached to the membrane via lipophilic anchor groups. Insertion of the anchor groups is favoured because of the free energy gained when the system changes from one with partially solvent-exposed alkyl chains to a system in which the hydrophobic chains lie in the lipid interior of the membrane **(fig 8).**

Polysaccharide-coated liposomes have been shown[4] to have lower permeability and increased stability towards enzymic degradation by phospholipase D.

However, the most important requirement for liposomes as drug delivery systems is to improve specificity for particular cell types.

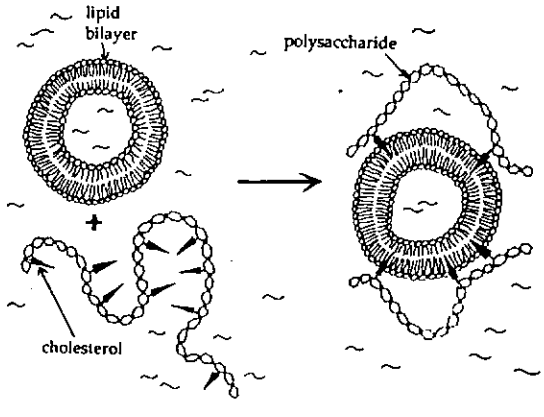


***fig 8** Schematic representation of the interaction of a liposomal membrane and a polymer such as a polysaccharide, with hydrophobic anchor groups.*

Liposomes as targeted drug delivery systems

An additional effect of coating liposomes with naturally-occurring polysaccharides such as mannan and amylopectin is to target them to specific tissues such as lung, and to specific cell types such as alveolar macrophages[23]. The reasons for this are not clear, but must be due to the altered liposomal surface and its interaction with cell surface recognition molecules. Such polysaccharide-coated liposomes have been used to advantage in the experimental treatment of Legionnaires' disease, where the bacterium, *Legionella pneumophila*, grows in macrophages. It was found that the antibiotic sisomycin could not kill *L pneumophila* in the cells when administered normally, but the treatment was successful when 36 % of the antibiotics administered were encapsulated in polysaccharide coated LUV, leaving 65% of antibiotics free from liposome encapsulation to kill bacteria present in the exterior of cells. Such results indicate that liposomes effectively transfer water soluble antibiotics directly into the cells[24].

Therapeutic opportunities are also possible for using liposomes as a targeted slow release system for drugs when these are injected into joints or when they are implanted into either muscle or subcutaneously[25].

However, the most deliberate approach to the specific targeting of liposomes has been to attach them to monoclonal antibody fragments capable of recognising tumour-associated antigens. Early work used monoclonal antibodies of high molecular weight (between 50,000 - 200,000 daltons) conjugated directly to relatively small lipid molecules (molecular weight 500-800 daltons) which were mixed with naturally occurring lipids to form liposomes. These 'immunoliposomes' proved unsuccessful due to their instability *in vivo*. In later work the antibody (IgMs) was attached to the polysaccharide pullulan which, in turn, was attached to the hydrophobic anchor groups, resulting in a more stable liposome, even *in vivo*. *In vitro*, these immunoliposomes showed increased binding to specific cell types when compared with the binding of conventional liposomes[26] **(fig 9).**

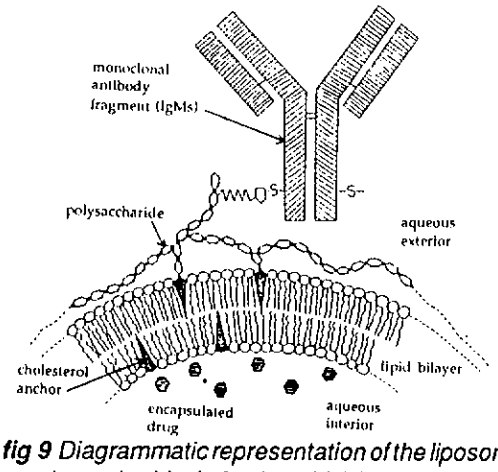


fig 9 *Diagrammatic representation of the liposome coated with a polysaccharide derivative which bears both a cholesterol moiety as the hydrophobic anchor and an IgMs fragment. (Adapted from ref. 26).*

Diagrammatic representation of the liposome coated with a polysaccharide derivative which bears both a cholesterol moiety as the hydrophobic anchor and an IgMs fragment. (Adapted from ref. 26).

An *in vivo* tissue distribution study demonstrated that immunoliposomes were more highly accumulated into implanted tumours than into heart or intestinal tissues. As expected, the immunoliposomes were mostly trapped in the liver and spleen, but less effectively than the more conventional liposomes.

Liposomes as a drug delivery system in cancer chemotherapy

Liposomes have been of particular interest in cancer chemotherapy, where treatment is required to be systemic to deal with metastatic disease, and is nearly always limited by the toxic side-effects of the drugs used.

As noted above, drug encapsulation within liposomes may permit smaller quantities to be administered, reducing general side effects. Thus a number of studies have shown liposomal doxorubicin to be at least as effective as the free drug, but much less cardiotoxic, in tumour bearing rodents and dogs[27]. For drugs such as cytarabine which are required to be given frequently, liposome encapsulation has been shown to provide an effective slow-release form of the drug. Doxorubicin encapsulated into 'fluid' liposomes showed similar effects to free drug in cytoma-bearing mice, but when encapsulated into 'solid' liposomes had a delayed antitumour effect. This was not caused by slower distribution, but by slower degradation of the liposomes by cells28.

The ability of liposomes to be sequestered by the liver has led to studies of liposome-encapsulated drugs against liver metastases, which are often treatment-limiting. Several experimental studies have shown that liposomal doxorubicin is significantly more effective than free drug against liver metastases of a variety of tumour types2[9].

Despite the above possible benefits of passive targeting, most interest in the use of liposomes in cancer chemotherapy now focuses on specific targeting by attachment of monoclonal antibody fragments capable of recognising tumour-associated antigens. Recent work has shown that such 'immunoliposomes' bind selectively to target tumour cells *in vitro*[26], and that doxorubicin encapsulated into such liposomes is more effective against human lung tumour xenografts in mice than either free drug or drug encapsulated in conventional liposomes[30].

REFERENCES

1. A.D. Bangham, in: Liposome Letters (A.D. Bangham F.R.S.,ed.), Academic Press Inc., London, (1983).
2. H. Eibl, in: Liposomes: from physical structure to therapeutic applications (C.J. Knight, ed.), Elsevier/ North-Holland, Biomedical Press, Amsterdam, (1981).
3. IUPAC-IUB Commission on Biological Nomenclature (BN)., The nomenclature of lipids. Eur. J. Biochem. **79,** 11-21 (1977).
4. H. Ringsdorf, B. Schlarb and J. Venzer, Angew. Chem. Int. Ed. Engl. **27,** 113 (1988).
5. J.H. Fendler, in: Membrane Mimetic Chemistry, Wiley-Interscience, John Wiley & Sons, Inc., Canada, (1982).
6. C. Tanford, The Hydrophobic Effect. Formation of Micelles & Biological Membranes, 2nd Ed., Wiley-Interscience, NY. (1980).
7. H. Hauser, W. Guyer, I. Pascher, P. Skrabal & S. Sundell, Biochemistry, **19**, 366 (1980)
8. H Hauser, I. Pascher & S. Sundell, J. Mol. Biol., **137,** 249 (1980).
9. R. H. Pearson & I. Pascher, Nature, **281,** 499 (1979).
10. S. J. Singer & G. L. Nicolson, Science, **175,** 720 (1972).
11. P. Linger, Angew. Chem. Int. Ed. Engl. **24,** 905 (1985).
12. G. Gregoriadis, Liposome Technology Vol. I - III, CRC Press, Inc., Florida (1984).
13. M. J. Poznansky & R. L. Juliano, Pharmacological Reviews, **36,** 277 (1984).
14. C. H. Huang, Biochemistry, **8**, 344 (1969).
15. S. M. Johnston, A. D. Bangham, M. W. Hill & E. D. Korn, Biochim. Biophys. Acta, **233,** 820 (1971).
16. Y. Barenholz, D. Gibbes, B. J. Litman, J. Goll, T. E. Thompson & F. D. Carlson, Biochemistry, **16,** 2806 (1977).
17. F. Szoka & D. Papahadjopoulos, Proc. Natl. Acad. Sci. USA, **75**, 4194 (1978).
18. M. S. Ostro, Scientific American, **256,** 90 (1987).
19. C. J. O'Connor, R. G. Wallace, K. Iwamoto, T. Taguchi & J. Sunamoto, Biochim, Biophys. Acta, **817**, 95 (1985).

20. E. Mayhew, S. Conroy, J King, R. Lazo, G. Nikopoulus, A. Siciliano & W. J. Vail, Methods in Enzymol., **149,** 64 (1987).
21. G. Poste, C. Bucana, A. Raz, P. Bugelski, R. Kirsh & I. J. Fidler, Cancer Res., **42,** 1412 (1982).
22. I. J. Fidler, A. Raz, W. E. Fogler, R. Kirsh, P. Bugelski & G. Poste, Cancer Res., **40,** 4460 (1980).
23. J. Sunamoto, K. Iwamoto, M. Takadu, T. Yuzuriha & K. Katayama, in: Polymers in Medicine; Biomedical & pharmacological applications (P. Gratsi & E. Chienelli, eds.), Plenum Press, NY (1987), pp. 157-168.
24. J. Sunamoto, M. Goto, T. Iida, K. Harra, A. Saito & A. Tomonaga, in: Receptor-mediated targeting of drugs (G. Gregoriadis, G. Poste, J. Senior & A. Trovet, eds.), Plenum Publishing Co., NY. (1985), pp.359-371.
25. A.W. Segal, G. Gregoriadis & C.D.V. Black, Clin. Sci. Mol. Med., **49,** 99 (1975).
26. J. Sunamoto, T. Sato, M. Hirota, K.K. Fukushima, K. Hiratani & K. Hara, Biochim. Biophys. Acta, **898,** 323 (1987).
27. S. Kim & S. B. Howell, Cancer Treatment Reports, **71,** 447 (1987).
28. G. Storm, F.H. Roerdink, P.A. Steerenberg, W.H. de Jong & D.J.A. Crommelin, Cancer Res., **47,** 3367 (1987).
29. E.G. Mayhew, M.H. Goldrosen, J. Vaage & Y.M. Rustum, J. Natl. Cancer Inst., **78,** 707 (1987).
30. M. Hirota, K. Fukushima, K. Hiratani, K. Kawano, M. Oka, A. Tomonaga, K. Hara, T. Sato & J. Sunamoto. Proceedings of the International Symposium on Polymer Drugs & Polymeric Drug Carriers, October 1987, Nagasaki, Japan, pp. 43-47.

WHERE DO CHEMIST GRADUATES FIND EMPLOYMENT?

AN OTAGO PERSPECTIVE

Professor B H Robinson Dept of Chemistry
University of Otago P O Box 56 Dunedin

Authoritative statements about the employment prospects for science graduates often appear in the media, employment literature, professional literature or political information. On what statistical base are these statements based?

The Vice-Chancellor's 1987 report on Graduate Employment in New Zealand states[1] that:

"the only category of science graduates to show sustained growth over the last three years are sales workers and Statisticians/Mathematicians" and that:

" there is evidence of a broadening in the job market for science graduates." From first-hand experience, and reports from students, we know that secondary students are being told by Careers Advisors and others to do accounting rather than chemistry because "that's where the jobs are." Yet the survey by Southward and Watson[2] suggested that vacancies for chemistry graduates were greater than the number of graduates being produced in New Zealand.

What is the true picture? One can accept that the Vice-Chancellor's survey is first-destination employment and that many of our graduates do not settle down to permanent employment until a few years after graduation. But there are few data upon which one can argue with the conclusions drawn from such reports or a Career's Advisor perception of the profession. Moreover, at a time when universities are being asked to be accountable for course content, the training given to students and it is important to accumulate a database on the long-term employment of chemistry graduates.

These considerations provided the impetus for a study of employment patterns for Otago chemistry graduates in the period 1978-1987. Of the 293 graduates I was able to contact 257 and most of the remaining 36 were students from South-East Asia. An interesting comment from a number of graduates contacted was that they did feel somewhat neglected once they left the department and hoped that the contact would be maintained.

The trends in employment and demographic distributions may not necessarily be the same for all New Zealand departments - indeed I imagine comparative date could reveal significant differences which reflect local flavour.

GENERAL GRADUATE STATISTICS

Number per annum:

Despite the increase in science enrolment at Otago over the last few years we have not seen an increase in the number of chemistry graduates, the total number of B.Sc./B.Sc (Hons) graduates hovering around 20 (**Fig 1**).

Numbers at graduate level have remained reasonably constant due to an increase in M.Sc. research students counteracting a decrease at Ph.D. level. The noticeable change over 10 years is that fewer graduates are taking the B.Sc. route even though this degree has greater flexibility. It seems that a 'professional school' approach is attractive to students; the number entering the honours school has risen as has their overall academic attainment.

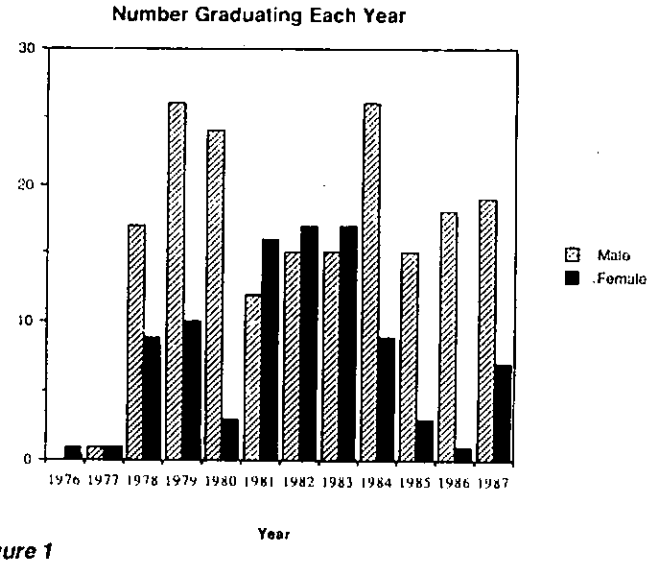


figure 1

Gender:

The female graduation percentage of 32.4% is lower than the average participation rate in the faculty (~39.8).

In the last three years there has been a noticeable decline in the number of females graduating (Fig 2) but this decline is almost entirely at the B.Sc level. However, the number of females going overseas for post-graduate study has been proportionately higher than males.

Category:

The categories of employment given in Table 1 can be broken down into smaller modules but for the purposes of this

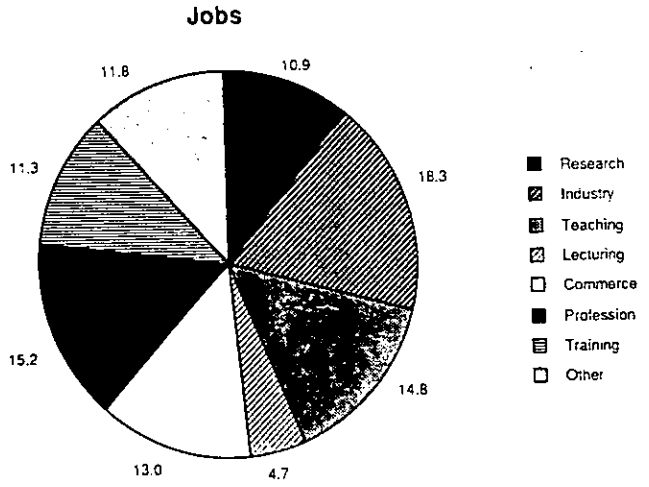


figure 2

article they provide a reasonable basis for discerning the major demographic trends. Final degrees are used as the base qualification. Training includes research degree study (M.Sc., Ph.D., Post-doc.) as well as students who are doing another degree (eg B. Com.). Most graduates in the 'professional' category are in the medical profession (7.4%) (reflecting an Otago bias) with law and engineering also being favoured; this category does not include accountancy. 'Miscellaneous' includes an undertaker, nanny and brewer!

TABLE 1

GRADUATE DISTRIBUTION IN THE WORKPLACE

Total no. of graduates: 293 (95 female)
Number of graduates contacted: 257

Classification	No. Employed	% of Total Employed	Female (%)
Research (full time)	28	10.9	3.5
Industrial Chemist	39	15.2	3.9
Secondary Teaching	38	14.8	8.6
Tertiary Lecturer	12	4.7	2.4
Technician	8	3.1	1.9
Profession	39	15.2	2.7
Commerce:			
Systems Analyst	11	4.5	0.4
Sales / Marketing	10	3.9	0.8
Accountant / Bank	7	2.7	0.8
Manager	6	1.9	0.4
Other:			
Housewife	10	3.9	3.9
Overseas	4	1.6	0.8
Self-employed	4	1.6	1.6
Unemployed	1	0.4	-
Miscellaneous	11	4.3	2.1
Further training	29	11.3	1.9

- the four major employment sectors were industry, teaching, commerce and research (Fig 2) that is, all the major employment sectors in New Zealand.
- approximately equal numbers (15%) are employed as industrial chemists or in secondary teaching. The number in industrial chemistry (this does not include management or sales persons) is perhaps surprising given our geographical location. I suspect that the percentages in secondary teaching may be lower than other centres; if not, it helps explain the paucity of chemistry graduates in teaching.
- a smaller percentage enter commerce (13%) and research (11%). Graduates are scattered throughout the commerce sector including two in high positions in the foreign exchange area of banking. The weighting towards systems analysts or computer-related commerce jobs is understandable given the usage of computers in modern chemistry undergraduate and graduate courses.
- only one graduate was unemployed (by personal choice) which meant that essentially all graduates had found employment or were in further training.

Study overseas:

- 32% of the students who carried on to Ph.D. study elected to do their degree overseas.
- of those who studied overseas for Ph.D. only 1% returned to New Zealand.
- approximately 30% of the B.Sc. or B.Sc. (Hons) graduates went overseas within six months of graduation.

Gender:

A higher proportion of male graduates have carried on to research degrees and into commerce whereas a higher portion of females have chosen a teaching career. Nine of the 10 'housewives' had been teachers. There seemed to be no gender preference in the research or industrial categories.

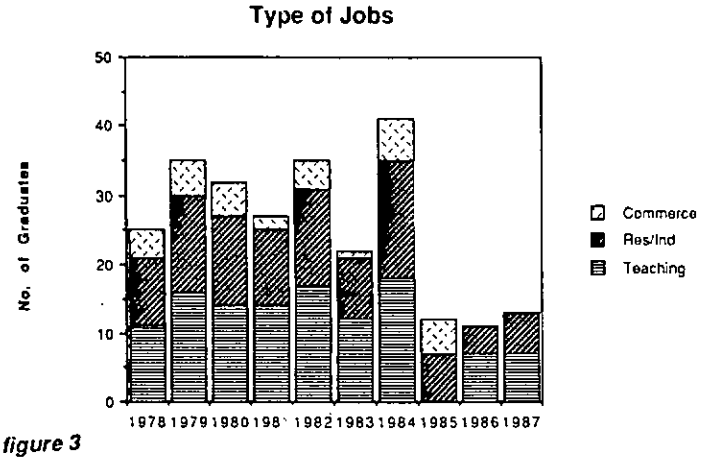


figure 3

Variation with year of graduation:

For convenience the analysis is given for three categories; teaching, research/industry and commerce (Fig 3).

- it might appear that no graduates entered commerce in 1986 or 1987. Several graduates did in fact enter commerce in this period which illustrates an important point. Most graduates employed in the commerce sector did not obtain their first position until at least two years after graduation, often because of an extended holiday overseas. This is in contrast to those entering research or industry who have their first job within six months of graduation.

Qualification and type of employment:

- graduates with a research degree generally end up in positions commensurate with their training but it was pleasing to see that some have entered teaching. (Table 2).

TABLE 2
% in occupation according to qualification

Classification	B.Sc.	B.Sc.(hons)	M.Sc/ Ph.D.
Research (full time)	17.9	28.6	53.5
Industrial Chemist	51.3	35.9	12.8
Secondary Teaching	52.6	28.9	18.5
Tertiary Lecturer	16.7	—	83.3
Technician	75.0	25.0	—
Profession	89.7	8.0	2.3
Commerce:			
Systems Analyst	70.0	10.0	—
Sales / Marketing	50.0	50.0	—
Accountant / Bank Manager	62.5	25.0	12.5
	80.0	—	20.0
Other:			
Housewife	70.0	10.0	30.0
Overseas	66.7	—	33.3
Self-employed	75.0	25.0	—
Unemployed	—	100.0	—
Miscellaneous	63.6	27.3	9.1
Further training	—	—	—

- unexpectedly (to me) B.Sc. and B.Sc. (Hons) graduates (apart from those who have gone on to a research degree) have a similar employment distribution. It does raise the question of whether a B.Sc. (Hons) degree has a role in 1990's (a B.Sc./M.Sc. combination may be better).

- the majority (over 90%) of those employed in the commercial sector had **no** qualification other than their chemistry degree and only a small percentage had done more than one commerce paper in their science degree. Bob Jones's remark about the relative worth of commerce and science graduates is possibly supported by this observation. We need to be careful about diluting a science degree simply to satisfy student perception that a commerce degree is a more marketable degree.

Overseas employment:

A total of 70 graduates are now employed overseas or are in training overseas.

CONCLUDING REMARKS

The breadth of employment revealed by this study has encouraged us to increase the flexibility of our B.Sc. courses. This is being done by introducing more choice in the papers offered and by utilising the DipGrad which enables students to take papers from other faculties at any level without necessarily having the prerequisites or papers at a lower level.

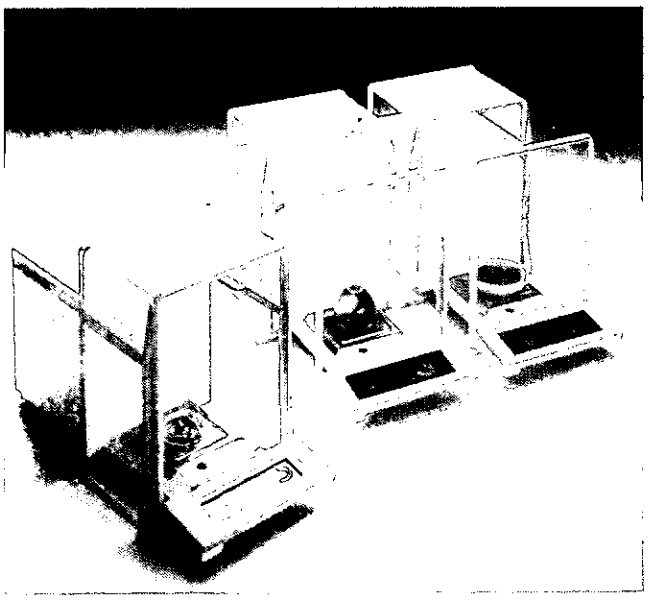
Although the statistics provide an Otago perspective I believe that most departments would reach the same conclusion. A chemistry degree is a marketable degree.

References

1. Graduate Employment in New Zealand 1987. New Zealand Vice-Chancellors' Committee Report No. 14.
2. Southward C.R., Watson I.D. Chemistry in New Zealand, June 1988, 61.

Cover Story

THE METTLER AT BALANCE



Whenever Mettler engineers are developing new balances, they never forget the practical applications. They visit laboratories, keeping in close touch with the users, ask questions and then compile the results, taking into account special requirements. With this background, the innovative Mettler AT Balance has evolved, i.e. in close contact with experts who use analytical balances on a daily basis.

As a result, we now have an instrument which is designed for optimum functionality. Ergonomic considerations and precision requirements were the major guidelines for this concept. The balance is not only an outstanding achievement in technology, it is also an attractive piece of equipment. This is to be credited to the styling specialists, who have been involved right from the beginning.

Zurich - New York with a Precision of 1.2 Meters

The Mettler AT Balance is an analytical instrument; a highly precise measuring device, which is capable of determining the weight of a 200 gram object within a precision of one tenth of a milligram (0.0001 gram). Measurements of up to 50 grams with accuracy ten times higher than this are possible. In this case the resolution amounts to one hundredth of a milligram (0.00001 gram).

A ratio of 50 to 0.00001 - what this means can best be demonstrated by a comparison:

- 5 million divisions would be required to achieve a similar resolution with an old fashioned dial scale. For a one meter ruler this would limit the distance between graduations to only 2 ten-thousandths of a millimeter (0.0002 millimeter). This is less than the distance between conductors on a modern electronic chip.

- If the 6000km distance between Zurich and New York was divided into 5 million segments, this would result in a resolution of 1.2 meters. This is accurate enough for an airline pilot leaving Zurich to programme the arrival gate at the New York Airport in the navigation system, (provided the system is accurate enough).

Entirely New Draft Protection Concept

To obtain reliable measuring results it is necessary to equip balances of this level of sensitivity with a draft shield, to pretect the object to be weighed, eliminating interferences. For conventional analytical balances however, the draft shield and glass pane holding brackets tend to interfere with the operation and work being carried out on the balance.

The AT Balance is no longer equipped with this type of bracket; as a consequence the weighing chamber is freely accessible from both sides and the top.

Whenever ambient conditions are unfavourable for dispensing operations, the aperture to the weighing chamber can be adjusted to current requirements. With the AT Balance this is achieved by a sophisticated arrangement of the wind-shield panes, thus eliminating draft interference even with the weighing chamber remaining open.

The typical weighing-in procedure with an analytical balance takes place in a nine step sequence. This includes certain inseparable sequences, e.g. "closing - taring - opening". Mettler engineers came up with the idea of combining such sequential operations into a single step.

It is now possible with the electrical sliding doors of the AT. The weighing container is put in place by the operator, and pressing the tare key is all that remains to be carried out. The windshield will close, indicate taring and then open automatically for a subsequent operation. The procedure is very similar for dispensing. After the target weight has been reached the print key is pressed, and after the weight measurement is completed, the doors are reopened automatically for retrieving the sample.

Result: In place of the previously required nine manual operations for weighing-in, no more than five are now necessary with the AT Balance. With such a high degree of practical comfort, the designation "ergonomic" is well justified.

An Ergonomic Balance

The control terminal is also laid out with ergonomic concepts in mind: legible function keys and a wide tare key, equally accessible for left-handed as for right-handed individuals.

While the digital display shows the value of the weight accurately, the world renowned Mettler DeltaTrac gives the user an overview to keep in better touch with the weighing process. DeltaTrac was used for the first time with Mettler PM precision balances and is particularly suitable for dispensing operations, whenever the digital display changes rapidly.

Fully Automatic Calibration

Precision weighing is not only a technical problem, it is in principle very difficult. Numerous factors which the user has to live with, influence the determination of the exact weight; this includes the geographic location, elevation, temperature variation and changes in air pressure. Even the gravitational forces of the sun and moon, which cause the tidal effects can theoretically be determined with an analytical balance; for a mass of 100 grams, there exist maximum fluctuations in the order of 0.03 milligram, over a complete cycle, which lies within the readibility of a Semicro Balance.

If these more or less accidental factors could influence weighing results to any extent, the display of precision results would become meaningless. A mass weighed in Zurich, which may have a value of 100.0000 grams weighed in London on the same balance, would measure 100.0546 grams, in New York 99.9586 and in Tokyo 99,9105 grams!

Since the mass however, remains the same for each locaiton, the balance must show exactly 100 grams, independent of the location where the weighing takes place. To achieve this goal, it is necessary to recalibrate the balance with a reference weight for each new location.

Even for a balance in a permanent location, measurements don't always produce the same results. This is caused mainly by temperature changes. The AT Balance, therefore, continuously senses the temperature to a fraction of one thousandths of a degree and determines the need for possible corrections.

Fo temperature changes causing a deviation of measuring results higher than 0.00015 percent, the microprocessor system initiates a recalibration. If no weighing sequence is in progress, the windshield is closed and the weight manipulator sequentially loads the two built-in calibration weights to provide the necessary calibration adjustments. At the same time, the linearity of the balance characteristic curve is being checked, and corrected as necessary.

Absolute System Compliance

During development of the new balance a major concern to the engineers was the requirement for system and automation compliance. for this purpose, each Mettler AT Balance is equipped with three data interfaces of different standards. Thus, intergration within a system is as easily accomplished as the connection of a printer or a personal computer. The interfaces also handle the remote-control functions for the draft shield mechanism and other balance functions.

It is unimportant whether a robot or a man is loading the AT Balance - the accessibility of the weighing chamber makes work easier for man or machine.

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

BALANCES

Full Range of Quality Balances from Oertling

Oertling is Britain's leading manufacturer of precision balances and weighing systems for laboratory and/or industrial applications.

The Oertling range of electronic top pan balances offers models for every purpose. Single and dual weight range models are available with capacities from 150g to 16kg and readability to 0.001g. All models feature tough wipe-clean facias with dual membrane touch-sensitive keys and can be interfaced to printers and computers to simplify and control a variety of laboratory and industrial weighing tasks.

A comprehensive series of digital analytical balances offers models for high precision and/or versatility. All Oertling electronic analytical balances have automatic touch-key calibration and contain their own internal reference masses to ensure precise and correct calibration without the need for the operator to apply weights manually. Interfacing with computers and printers allow the Oertling analytical balances to become part of laboratory workstations, laboratory information management systems or automates analyses quickly and easily.

The Oertling range of balances and scales are available through SCI-MED, Division of Zenith Technology Corporaton Ltd, the exclusive Oertling agent in new Zealand.

For further information please circle no. 10 on reader reply card.

New Waterproof Top Pan Balance Launched

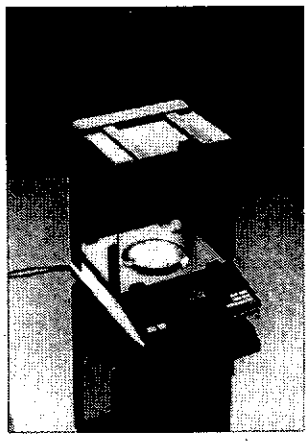
A new waterproof top pan balance for weighing in wet environments has been launched by Oertling. The 0C61/W top pan balance is waterproof to IP65 approval and features a number of built-in user selectable options, making it suitable for a range of applications in the food, chemical and pharmaceutical industries.

For hard copy of results and management information, the balance can be linked to a range of printers and micro-computers

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

For Todays Laboratory... Balances With Tomorrows Technology

With its range of laboratory balances, Sartorius can provide a balance for every weighing requirement. Six series create a new dimension of unprecedented, performance capabilities, reliability and user convenience, says Wilton Instruments, New Zealand agent for Sartorius.



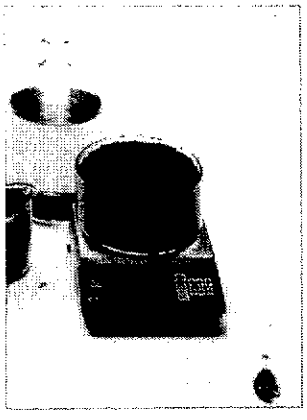
With eight models, the Sartorius Laboratory series offers you the widest selection of balances for weighing between 1mg and 2,200g. The speed and operating ease of these balances are second to none. Their expansion capabilities and system-compatibility make it easy to find the right balance tailored to your needs.

The Sartorius Handy series is designed as a "personal" benchtop balance. Aside from its smaller capacity, it has all the technical features of the "big analyticals". The H51 with its transparent draft shield, has a 51g capacity consisting of a display range of 31g plus a tare allowance of 20.0g and is readable to 0.1mg. For milligram readouts to 121g the H120 compact precision balance is hard to beat. It features a draft chamber made of high grade glass and stainless steel for interference free weighing.

The Universal series, covers advanced balances with all-round capabilities for use in the laboratory, where there are heavier workloads. Made to weigh loads up to 6,100g the Sartorius Universal models are the higher-capacity alternative to the laboratory series. You can select from four different models with 10mg resolution. All four are made for all-round applications covering general weighing and filling, formulation work, check-weighing and animal weighing. Large samples and containers are easy to weigh on a Sartorius universal balance. Its rectangular pan is as large as the toploader itself, so you can utilise the balances wide weighing range.

Sartorius Research balances are designed to solve problems beyond the conventional limits of analytical weighing. A prime example is the R120P, the first fully electronic semi-micro boasting a unique resolution of 10ug over its entire 162g weighing range. Another exemplary model is the R180D: if your sample exceeds the 33g fine range the balance automatically lets you continue weighing up to the 182g macro range. And take the R300S: it enables you to weigh up to 303g with 0.1mg accuracy - without any compromise. Now you can weigh minute quantities directly into the container you use to process your samples.

Last in this amazing collection of laboratory balances is the Analytical series. It consists of three highly accurate top-loaders in a new low-profile design with an all-glass draft shield. Whether your job in the laboratory involves final weighing, filling or formulation Sartorius' new analyticals will ease your workload with more speed, convenience and reliability.



As well as the models presented here, Sartorius have developed the "PLUS" package for selected models in the Laboratory and Universal series. This consists of expanded capabilities designed to make your routine work in the lab a lot easier. Data Input Keyboards, program packages for laboratory routines, and a computer interface are all integrated into these balances.

Overall this superb range of laboratory balances let you weigh, faster, easier and more reliably than ever before.

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

Getting Back To Basics

Sartorius GmbH, West German manufacturers of weighing instrumentation have recently released the Basic Series, a range of nine precision balances designed to handle all your weighing needs.

NZ agents, Wilton Instruments, say the new balances are exceptionally easy to use. Each balance is controlled by just two keys, one for turning the balance on and off, and the other for automatic full range taring.

Made of die cast metal the housing is built to handle heavy workloads and ignore electromagnetic interference. Fully adjustable filter levels ensure that wherever you use your Basic balance, in the laboratory or on the factory floor your results will not be affected by ambient conditions such as strong vibrations or drafts.

One feature of the new range, that definitely isn't basic is the accuracy and the level of readability of these new balances. Capacities range from 121g to 6100g with readability down to 0.1mg. B310p, and B3100p, models feature Sartorius 'Polyrange' technology which automatically gives you the finest readability possible at any capacity level.

Equipped with an optional RS 232/423 interface the Sartorius Basic can transfer all weight related data to a serial data printer or a PC. They can also be integrated into an existing automated weighing system.

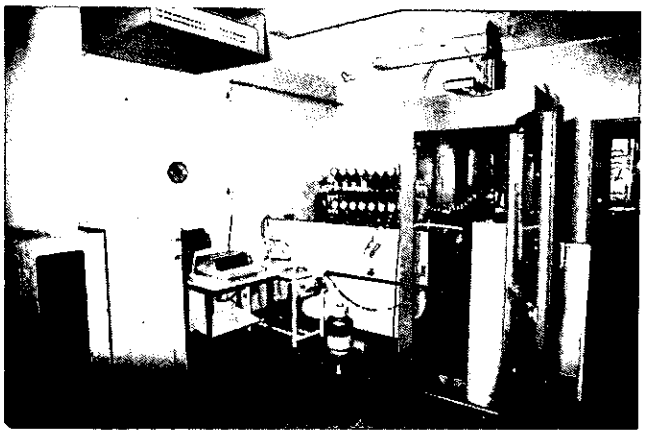
For further information please circle no. 13 on reader reply card.

New SPC Interfacing for Capsule and Tablet Weighing Systems

The popular line of MOCON automatic balances are now available with Statistical Process Control (SPC) interfacing. These systems allow for the testing of a large number of samples in a short period of time. Each system provides a statistical printout that permits immediate determination of compliance with weight variation controls. This "total system" solution offers on-line manufacturing process control documentation, making the job of weighing and sorting capsules or tablets – fast, easy and accurate.

For further information please circle no. 14 on reader reply card.

BALANCES



New Balance Room for NZIG Special Gases Laboratory

NZIG's Analytical Services Laboratory in Lower Hutt has recently commissioned its new climate controlled balance room. This facility is used to prepare Alpha reference calibration standards. Alpha standards are high accuracy gas mixtures prepared by gravimetric methods. At the heart of the new balance room are two Mettler top loading mass comparator balances which enable gas cylinders, which weigh up to 60 kg, to be weighted with an accuracy of 10 mg. Thus small quantities of gas can be weighed into the cylinder with very high accuracy.

The data from the balances are collected by a computer, allowing easy corrections for impurities in the gases used, buoyancy changes through atmospheric pressure changes, and various calculations such as required filling weights and the final composition of the standard.

The pre-analysed gases are "on tap" continuously eliminating risk of contamination and a two stage high vacuum pump is used to evacuate the gas transfer lines. The cylinders used for Alpha standards are heat evacuated prior to filling. Heat evacuation removes all residual impurities.

Alpha standards with component concentrations as low as 1 ppb and with as many as 20 different component gases have been prepared with this method.

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

Mettler AJ Series

When all you need is the weight, the new Mettler AJ Series Analytical Balances deliver results as only Mettler can. As basic balances they increase productivity in your laboratory and help you through a heavy workload.

With every AJ Series Analytical Balance, you get the confidence that comes only from owning a Mettler. Like all Mettlers, the AJ Series is built to last. Durable mechanical parts, integrated electronic components and our unparalleled quality control assure you of years of accurate, trouble-free performance.

The AJ Series Basic Analytical Balances are built with Mettler quality, backed by Mettler service, bringing confidence to your work. But, they're brought to you at a new low price, because we took out applications features you may never use. It's Mettler' Basic Analytical Balance.

Mettler technology insures accurate results. Touch the control bar to make sure that your balance is calibrated. With the AJ Series, electronic calibration only takes a few seconds to insure accurate results.

Touch the control bar again to call up the balance's menu. It offers adjustable integration time for stable results anywhere, and an automatic stability detector to insure reproducible results everytime.

Basic means ease of use, maximum accuracy with a minimum of instruction time. No longer is valuable working or teaching time wasted on learning how to use an analytical balance. From the very first moment that a student or laboratory technician begins using the AJ Analytical he is working at maximum efficiency and accuracy. This makes the AJ Analytical as much at home in the classroom as it is in the most demanding research laboratory.

For further information please circle no. 17 on reader reply card.

PRODUCT NEWS

Hewlett Packard Introduces: 58890 Series II Gas Chromatograph

Hewlett-Packard Company recently introduced the HP 5890 Series II Gas Chromatograph. The new GC features a broader operating temperature range, more control features and an option to add a pressure-programmable, on-column capillary inlet.

Building on the HP 5890A platform, HP provides current users with the capability to improve gas-chromatographic performance without compromise to existing methods and processes.

Extending the oven temperature range from 400°C to 450°C and adding the on-column inlet allows for analysis of high-boiling compounds, such as C120 in waxes, as well as steroids and triglycerides, in bioscience samples.

These features will increase total sample throughput and extend the molecular-weight range of samples that currently can be analysed with capillary GC.

Capillary on-column technology eliminates flash vaporisation by introducing a sample as a liquid directly onto a capillary GC column. This technique reduces sample discrimination and degradation, which are the two most common sources of quantitative analysis error in GC.

The new on-column, capillary-inlet design is compatible with the HP 7673A automatic injector and sampler. This combination provides chromatographers with the ability to develop automated on-column capillary methodologies for use in routine labs.

The electronic pressure-controlled, on-column inlet option allows keyboard entry of column-head pressure for higher retention-time reproducibility. Pressure programming of the column head allows compounds to be analysed at lower temperatures, resulting in less thermal-sample degradation and more accurate results.

In combination with inlet-temperature control, pressure programming of the on-column inlet increases the speed of analysis, and the ability to separate complex matrices. Cryogenic cooling minimises the time between sample runs. These capabilities increase chromatographic performance, as well as laboratory productivity.

Extension of the maximum oven temperatures to 450 degrees C will be helpful in petroleum applications where higher temperatures are required for accurate characterisation of heavy fractions.

The addition of two valve-driver channels doubles the HP 5890A's capacity and reduces the cost of valve configurations. Additional heated zones provide more configuration flexibility, and the GC setpoint storage makes the unit easier to use during stand-alone operation. An events timetable within the GC provides time programming for thermal-conductivity detector sensitivity, detector-signal switching and multiple valve events to increase automation.

For further information please circle no. 18 on reader reply card.

New Electrode Design For More Accurate pH Results

Orion Research Incorporated offer Ross Sure-Flow™ pH Electrodes with a unique reference junction design that solves the common problem of clogged reference junctions.

Sure-Flow electrodes have a free-flowing ground glass liquid-to-liquid junction which provides optimal flow and contact between electrode and sample. The stable flow rate gives more reproducible results.

Especially important in "dirty" sample types, such as colloids, slurries, and viscous samples, the junction area can be easily opened and flushed clean by pressing down on the electrode's spring action cap.

The Aure-Flow construction not only improves performance, but also extends electrode life by reducing junction failure. Routine care and maintenance is easier, too.

Response is fast, with the benefits of a Ross internal reference system. That means readings stable to 0.01 pH in 30 seconds, even when temperatures vary from one another by 50°C.

Sure-Flow electrodes are recommended for measuring pH in any type of sample; offering easy cleaning for "dirty" samples and an optimal flow rate for "clean" samples.

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

Advances in Titration

The new Mettler DL25 automatic titrator with it sapplicational versatility allows the user to switch back and.forth rapidly and simply between methods. The standard equipment of the DL25 Titrator includes a titration database for 15 methods. The user can also define 35 additional methods to match his needs.

The improved Mettler DL21 is an efficient, dedicated automatic titrator for specific applications in routine operation.

The application possibilities of the two titrators are: titrations at end points (one or two) or equivalance points (one to several), TAN/TBN determinations in the oil industry, p and m value calculation in water control labs, and calculation of the half neutrlisation value as well as pH stating operations (pharmaceutical field).

Both titrators are simple to use and designed for high sample throughputs.

For further information please circle no. 19 on reader reply card.

Chromacol Gold™

For many years now chromatographers have known of and worked to reduce the effects of active sites in packed columns, injector liners, and especially in capillary columns since such sites have been shown to reduce and in certain cases remove completely some sample components.

Recently certain types of non european autosampler vials have been shown to exhibit a similar activity and analysts have found that with low concentrations some components have disappeared completely.

Chromacol, one of the world's leading suppliers of high quality glass vials has launched Chromacol GOLD™ to answer this problem.

Chromacol GOLD™ is a range of vials produced under stringent conditions to significantly reduce if not eliminate this activity by removing the alkaline contamination associated with borosilicate and soda lime glasses.

For further information please circle no. 20 on reader reply card.

PRODUCT NEWS

Jasco Model 7850 UV/VIS Spectrophotometer

The Jasco Model 7850 is a research grade UV/VIS spectrophotometer incorporating a double-beam-grating optical system for maximum optical performance. The state-of-the-art electronics and computer technology ensure simplicity of operation while maintaining full flexibility and outstanding reliability. Based upon a modular concept and design, the 7850 allows the user to integrate a specific system best suited for their application and budget with a wide range of accessories.

Outstanding Optical Performances

A proven and reliable double-beam system is used for optimum stability, accuracy and repeatability. Resolution is user-selectable in seven steps from 0.1 to 5pm. A double-grating monochromator is incorporated to reduce stray light. Stray light is specified to less than 0.0005% at 220nm enabling photometric accuracy to be maintained over the entire -0.3 to 5.0 ABS range.

Extensive Software Range

As one of the most fundamental research tools, a modern UV/VIS spectrophotometer should be capable of both acquisition of accurate date and manipulation of data to select a wide range of software to cover specific application. Besides the comprehensive software package built into the spectrophotometer as standard, six different optional software packages are currently offered.

Fast, Easy Operation

A simplified keypad, a two line-by-16-character LCD and menu-driven software design make the 7850 easy to operate, while maintaining full versatility. The macro command capability permits users to chain the instrument commands together to automate measurement and to save such a macro command in non-volatile memory.

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

SGE's Polyimide Clad Fused Silica Capillary Columns

The introduction by SGE of aluminium clad fused silica capillary columns has revitalised interest and created new business in SGE capillary columns. From sales viewpoint they are considered a success. However, there has been two areas where the ALSIL capillary columns have met with some market resistance.

1) The aluminium coating on ALSIL capillary columns is of course an electrical conductor which means care is required when it is installed in a system where high voltages are present. This has restricted sales in some laboratories, especially where magnetic sector mass spectrometers are used.

2) The deterioration of ALSIL capillary tubing under certain thermal cycling conditions.

For these reasons and to complement ALSIL columns SGE have decided to reintroduce polyimide clad fused silica capillary columns. However, they will now be available with the new range of superior performance stationary phases incorporating technology developed by SGE. These new stationary phases have far lower bleed than any other plimide clad fused silica capilary columns previously available and are also produced and tested to the same high standard as the ALSIL capillary columns. This ensures any column that passes SGE's tough test procedure is extremely inert and of the highest available standard

The rapid cool down phase in most modern gas chromatographs can cause some weakening of the fused silica after many cycles. The temperature at which weakening begins after a rapid cooldown is around 240°C but this depends, to an extent, on the cooldown rate of the GC. Under such conditions the column may become unusable after as few as 200 cycles. For general applications where such temperature cycling conditions are being used, SGE recommends polyimide clad capillary columns. For special high temperature columns such as SGE's HT5 range, where the high temperature capability of polymide cladding is not adequate, the use of ALSIL is still recommended. Where the ALSIL columns are not being extensively thermally cycled, or are used isothermally for long periods of time, the ALSIL columns will remain significantly stronger than polyimide clad columns.

All SGE columns are available in New Zealand from Alltech New Zealand.

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

MEETINGS

A New And Exciting Analytical Symposium

An outstanding line-up of local and overseas presenters is set to take part in the 1989 Hewlett Packard/RACI Analytical Symposium.

"Advances in Separation Science" is the theme of this year's Symposium and addresses will be given by Dr. Jack Henion, New York State college of Veterinary Medicine; Professor Tony Fell, University of Bradford, UK; Prof. Alan Bond, Deakin University, VIC; Dr. Rainer Schuster, HP Waldbronn Division, USA; Dr. Roger Frior and Ms. Sandy Lewis, HP Avondale Division, USA.

The two day Symposium is being organised with the support of the RACI Analytical Chemistry Group and will be held in Sydney on 16 & 17 October and in Melbourne 19 & 20 October, 1989.

One of the highlights of the Symposium will be the presentation by Dr Jack Henion - "Breakthroughs in Particle Beam LC/MS Technologies". Dr Henion states:- "Using a special form of electrospray ionisation called "ion spray", we can obtain routine on-line LC/MS analysis of enzymatic digests of proteins at the low picomole levels. Through the aid of multiply-charged ions we can determine the molecular weight of proteins approaching 1000,000 d to within one dalton with a quadrupole mass spectrometer whose mass range only goes to 1,4000 d!"

Another feature of the Symposium is a UV/VIS workshop to be conducted by Prof. Tony Fell. Limited to just 40 people, it will give them a chance to explore computer-aided derivative techniques with a world leader in the field.

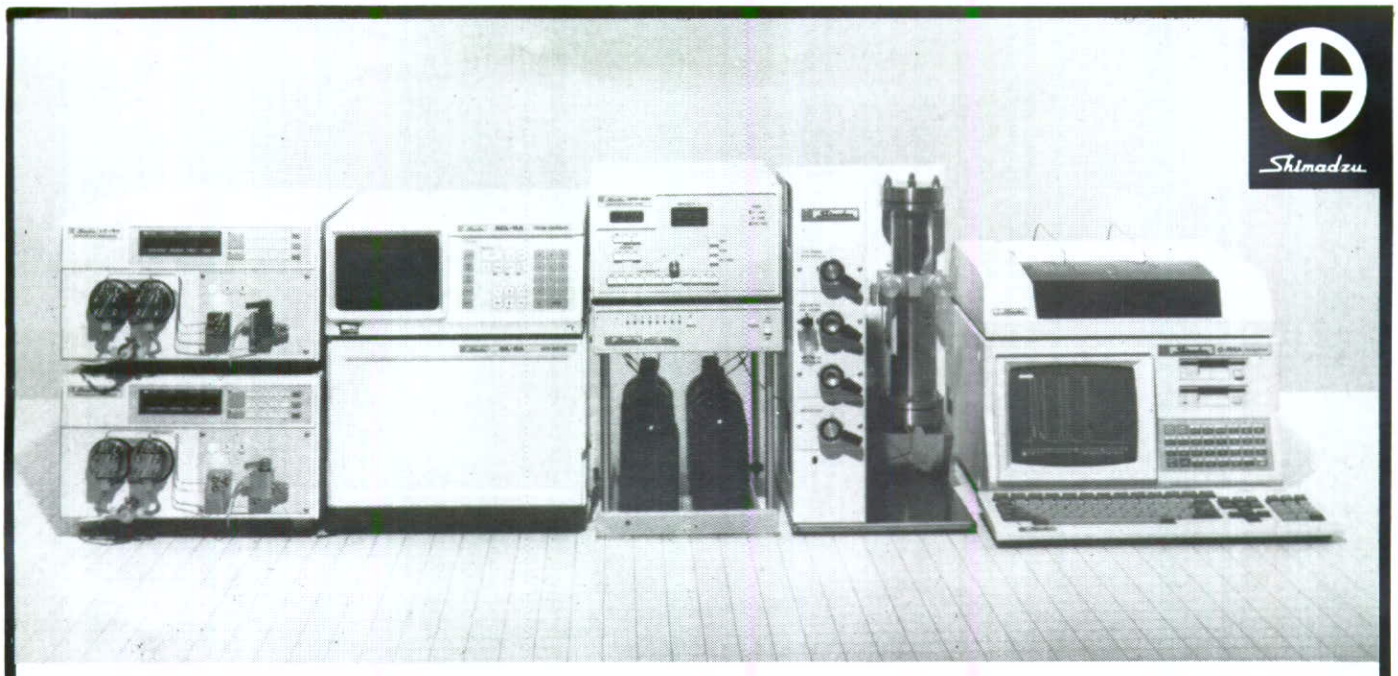
An exhibition of the latest HP equipment will be part of the Symposium and delegates will be able to see the latest products, including the 5890 Series II Gas Chromatograph, 5971A Mass Spectrometer, 3365S MS-DOS Chromatographic Chemstation, 1050 HPLC series, HP8452A Spectrophotometer with new Dissolution Software and the HP1090L Liquid Chromatograph.

A Symposium program brochure and registration form is available from Medtec Products Ltd. Call Peter Hermans on (09) 480-6763 or Wayne Sprosen on (04) 670-001.

FIRST PACIFIC POLYMER CONFERENCE
MAUI - HAWAII
December 12-15 1989
Conference Objective:

The first **Pacific Polymer Conference** is being organised by the newly established Pacific Polymer Federation. It is designed to bring together polymer scientists from the Pacific region and from other parts of the world to discuss recent advances in polymer scince, in polymer technology and in the application of polymers. The program will consist of keynote speakers, invited, contributed lectures and posters devoted to chemistry, physics and technology of polymers.

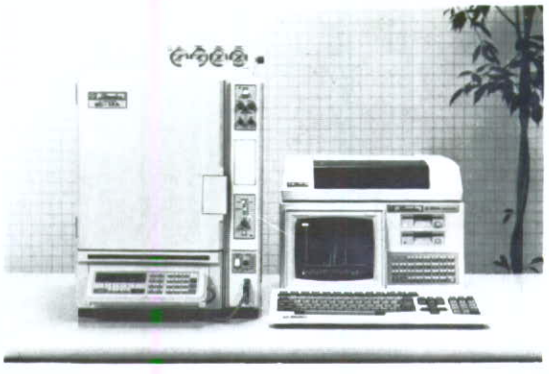
For further information concerning attendance contact:-
Jane C. Vogl
Polytechnic University
333 Jay Street
Brooklyn, NY 11201, USA.



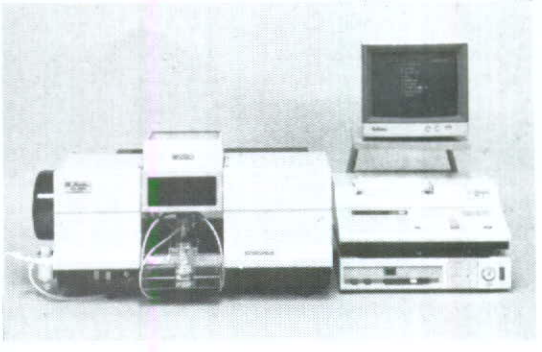
SHIMADZU — THE BRAND OF RELIABILITY

For a variety of needs . . .
Shimadzu analytical and measuring instruments

Automated analytical and measuring instruments of higher performance are the result of research and development in advanced technologies, quality control and laboratory automation.
Shimadzu has been a top manufacturer of analytical and measuring instruments since 1875. Advanced technologies in electronics, biotechnology and other fields are incorporated into the development of new products and applications technologies from a world-wide viewpoint.



AWA with twelve years experience marketing Shimadzu x-ray equipment are now proud to bring you the Shimadzu range of Scientific Instruments.



MAIN PRODUCT LINES —
ANALYTICAL & MEASURING INSTRUMENTS

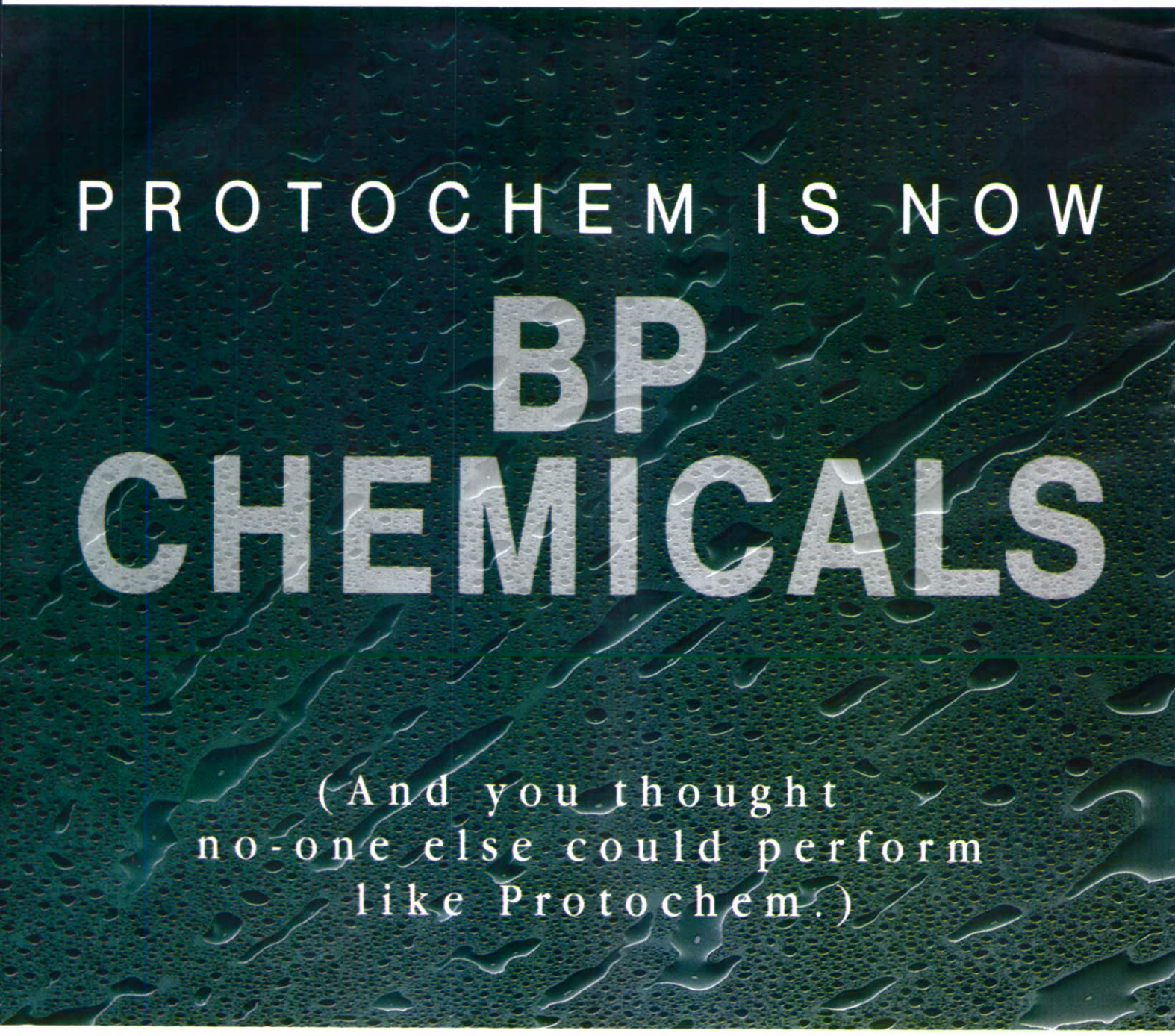
- Spectroscopic Apparatus
- Electromagnetic Analytical Apparatus
- Chromatographs
- Thermal Analysis Instruments
- Environmental Pollution Analyzers
- Balances and Balance Appliances
- Powder and Particle Property Analyzers
- Magnetometers
- Biotechnology Instruments
- Other Analytical and Measuring Instruments

AWA Scientific + Medical

A division of • AWA New Zealand Limited

• Auckland	• Porirua	• Christchurch
P.O. Box 1636	Private Bag	P.O. Box 8421
Fax: (09) 763-214	**Fax:** (04) 370-159	**Fax:** (03) 384-632
Tel: (09) 760-129	**Tel:** (04) 374-201	**Tel:** (03) 388-160

Shimadzu



No, we haven't abdicated our position of leadership. Nor have we lessened our commitment to fast reliable delivery. We're the same people with the same high level of service as before. In fact, as BP Chemicals we are totally committed to meeting world-wide customer requirements all the time.

As one of the world's major chemical groups, backed up by technological and feedstock strength, BP Chemicals is well placed to meet the changing requirements of, and grow as a competitive supplier to, Australian and New Zealand customers.

Our long term commitment to this end is reflected in our name change.

Moffatt Sharp 11915/NZ

Protochem is now BP Chemicals. But the best by any name is still the best.

■ For fast reaction on fast delivery, call (09) 39 6215.
Or write for information to BP Chemicals ANZ Pty. Ltd.,
P.O. Box 37-081, Parnell, Auckland.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

_____

PHONE _____ FAX _____

BP CHEMICALS

NEW ZEALAND INSTITUTE OF CHEMISTRY (INC)

BALANCE SHEET AS AT 30TH APRIL 1989

1987/88		1988/89		1988/89
	CURRENT LIABILITIES			
7892	Sundry Creditors	10925		6580
2369	Goods and Services Tax	4860		541
1602	Subscriptions in Advance	984		359
17930	Proposed Transfers to Development Fund	-		5013
				1000
29793			16769	12104
	SPECIAL ACCOUNT			40
567	Easterfield		567	3430
	GENERAL FUNDS			29067
23350	Balance 1.5.88	(432)		
(21370)	Grants to Chemical Education Trust	-		
				45318
(2412)	Add Excess of Income over Expenditure for Year	37294		500
				-
				-
(432)	Balance 30.4.89		36862	
	DEVELOPMENT FUND			
36791	Opening Balance	45317		
-	Transferred from Accumulated Funds	17930		
8526	Add Interest Earned for Year	3451		
	Less Equiticorp Holdings Ltd			
-	Debenture Write-down	(19999)		
45317			46699	45818
				2330
				2330
				-
				822
				822
				360
				360
$75245			$100897	$75245

1988/89		1988/89
CURRENT ASSETS		
Bank of New Zealand	12546	
Petty Cash on Hand	941	
Prepaid Travel Account	3795	
Subscriptions in Arrears	2123	
Prepayments: Re Future Conferences	1000	
Sundry Debtors	19862	
Stock of Wallcharts on Hand	24	
Stock on Hand - Ties and Scarves	3339	
		43630
INVESTMENTS		
Equiticorp $21,000 Debenture	1	
Lyttelton H.B. Stk. 6.25 1998	500	
N.Z.I. Bank	28769	
B.N.Z. Autocall Account	27171	
		56441
FIXED ASSETS: at Cost		
Office Equipment	582	
Less Accumulated Depreciation	116	
	466	
Films	-	
Less Accumulated Depreciation	-	
Presidential Chain	360	
		826
		$100897

These accounts must be read subject to the attached notes.

NEW ZEALAND INSTITUTE OF CHEMISTRY (INC) INCOME AND EXPENDITURE FOR THE YEAR ENDED 30TH APRIL 1989

1987/88			1988/89
	EXPENDITURE		
	ADMINISTRATIVE & SUNDRY EXPENSES		
2077	Accountancy/Audit Fee	2300	
553	Ballot Costs	398	
	Branch Expense Grants		
9905	- Re Capitation Fees	14514	
3000	- Re Student Travel	2805	
2135	Computing, Address Labels etc	1301	
990	Conference Registrations - Council	1280	
	Donations		
2000	- Prince & Princess of Wales Science Awards Scheme	-	
-	Secretarial Set-Up Costs	1700	
8903	Honoraria & Allowances	8267	
-	I.P.E.N.Z. Rent, Secretarial, etc	2095	
1832	National Chemistry Week Expenses	-	
2069	Overseas Visitors Expenses	1400	
8653	Printing, Stationery, Stamps & General	5674	
496	Prizes	100	
	Subscriptions		
631	- Royal Society of N.Z.	596	
190	- S.A.N.Z.	182	
50	- I.P.E.N.Z.	63	
300	- F.A.C.S.	(49)	
60	- N.Z. Futures Trust	55	
9800	Travelling Expenses	12940	
355	Depreciation	116	
53999			55737
	PUBLICATIONS		
20855	Journal - Publisher	18014	
2249	- Editor	1123	
817	Chemistry of N.Z.	1052	
2278	Sundry Publication	-	
2804	Sundry Publications for Resale	797	
29003		20986	
3087	Less: Publication Sales	1042	
25916			19944
79915	**TOTAL EXPENSES**		75681
10020	Proposed Transfer to Development Fund ($6/Member)		-
(2412)	Excess of Income over Expenditure for Year		37294
$87523			$112975

1987/88			1988/89
	INCOME		
81433	Subscriptions		96750
	Interest Received:-		
721	- Bank of New Zealand	3155	
2011	- B.N.Z. Finance Ltd	-	
31	- Local Body Stock	31	
2763			3186
(10)	Sale Ties and Scarves - Net Surplus		39
-	Periodic Table Wallcharts		24
50	Use of Address System		-
413	- A.N.Z.A.A.S. Conference Refund		-
2874	Conference Surplus - N.Z.I.C. 1988		12976
$87523			$112975

NEW ZEALAND INSTITUTE OF CHEMISTRY (INC)

NOTES TO FINANCIAL STATEMENTS

STATEMENT OF ACCOUNTING POLICIES

General Accounting Policies

The measurement base adopted is that of historical cost. Reliance is placed on the fact that the entity is a going concern.

Accrual accounting is used to match expenses and revenues.

Particular Accounting Policies

Goods and Services Tax — These accounts have been prepared on a G.S.T. exclusive basis.

Subscriptions — Arrears and Sundry Debtors are stated at expected realisable value.

Depreciation — Has been charged using the straight-line method based on an estimated 5 year economic life of the assets concerned.

Investments — Are stated at cost or, where applicable, with the addition of interest compounded to date.

AUDITOR'S REPORT

We have audited the financial statements of the New Zealand Institute of Chemistry (Inc.) in accordance with accepted auditing standards, and have carried out such procedures as we considered necessary. At the date of this report, the audit of the 1988 Conference Financial Statements relating to the surplus included in the Institute's accounts, had not been completed. Not withstanding the above, in our opinion the financial statements give a true and fair view of the financial position of the Institute as at 30 April 1989.

AINGER TOMLIN
Chartered Accountants

CHRISTCHURCH

These accounts must be read subject to the attached notes.