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in new zealand

October Issue, Vol. 53, No. 5
Incorporating the 1989 Year Book

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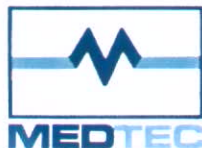
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CHEMISTRY IN NEW ZEALAND

October Issue, Vol. 53, No. 5

Incorporating the 1989 Year Book

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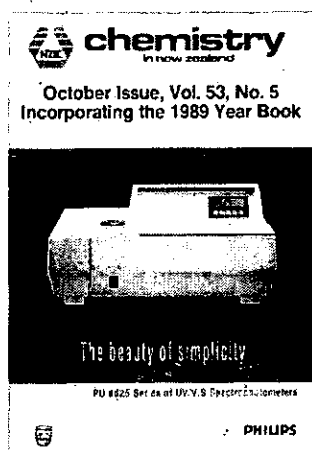
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FRONT COVER



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pricing.

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YEARBOOK

Company Listing

The main listing has addresses and phone numbers plus a brief description of each company. Companies are listed in alphabetical order. Each company is given a reference number by which it is referred to in subsequent listings. The letter code indicates the sections in which products or services offered by the company can be found

Section A, Laboratory Instruments

Balances, pH meters, gas chromatographs etc. listed under brand names

Section B, Laboratory Equipment

Bench surfaces spatulas, hot plates etc. listed by brand name

NZ Association of Consulting Laboratories

Areas of expertise and equipment available

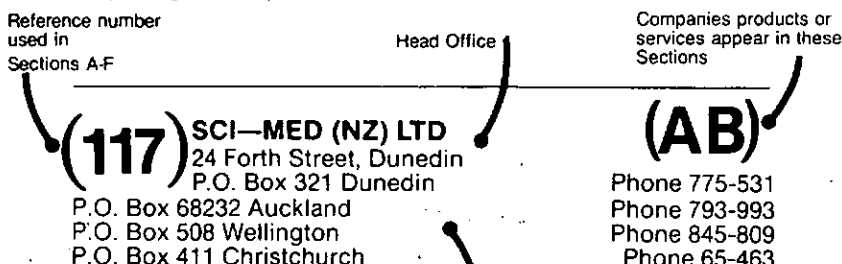
Section C, Consultants

Areas of expertise and equipment available

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HOW TO USE THE DIRECTORY:

If you know the product you are interested in e.g. a pH meter turn to the appropriate section (in this case Section A, Laboratory Equipment). Brand names of pH meters are listed and referenced back to the Company Listing see example below.



A wholly owned subsidiary company of the EBOS Group, supplying New Zealand and the South Pacific with scientific instrumentation, fully supported by our technical, marketing and service team.

Branches

The editor felt so strongly about the events that occurred at the A.G.M. that he asked Council to use his spot to place the following:

Notice From Council to Members.

Annual General Meeting

It was with considerable consternation, concern and dismay that Council was unable to conduct necessary formal business on your behalf at the Annual General Meeting on Thursday 24 August.

The reason was the lack of a quorum.

According to our rules a quorum of 30 members are required. Present at the meeting were 27 people, one of whom was the visiting RACI/NZIC lecturer, Graham Johnson (also President of RACI, NSW Branch), one or two non-corporate members and two non-members!

Despite sending out messages and messengers to rally support the formal AGM lapsed for want of the minimum number required.

As a result of this the Institute was unable to adopt or approve

the Annual account or report.

It will now be necessary to call for a further AGM at considerable expense and inconvenience. These extra expenses will have to be met from your subscriptions.

It reflects badly on members who attended, participated in and presumably enjoyed the 1989 Conference who then displayed how little interest they really had in the current and future affairs of the organisation to which they belong, by failing to devote a very little of their time to matters of business that effects them.

Those members who attended the Easterfield Address immediately before - and there were many - should feel particularly shamed.

Council exists to service your interests. Electing members to it without then supporting these elected representatives with the physical presence of a minimum few members at a general meeting leaves them powerless.

Formal notice of a further attempt to hold an AGM follows in this issue.

Dear Member,

You will be aware that the Institute has now established a permanent secretariat in Wellington and that Mr. Alan Turner has been appointed as the First Executive Officer. As a result we are looking forward to slowly raising the professional profile of the Institute. Initially Mr. Turner has concentrated on getting our records transferred to the computing system which we now share with the Institute of Professional Engineers and coping with the many details which the new operation entails.

Inspection of the NZIC membership records shows that the younger age brackets are under-represented and if a healthy future is to be assured then it is important that we all pay attention to recruitment. Council members have discussed this but it should be of concern to all members and I would welcome your suggestions.

It is my hope that communication between Council and NZIC members can be im-

proved. One often hears the question asked "what is the Institute doing for me". By trying to improve our communications perhaps this question will be heard less often. With this in mind I have initiated this letter so that I can keep you informed of what Council officers are doing on your behalf. In August we learnt that the Government was to set up a Ministry of Research, Science and Technology and that the Rt. Hon R.J. Tizard had been appointed as the new minister. I can now report that there is to be some action on the Foundation of Research, Science and Technology and that Mr Tizard has asked the Institute to provide them with a list of suitable people to serve on the Foundation. Branch Committees and Council members have been asked for their suggestions and by the time you receive this issue of Chemistry in NZ a list of names will have been sent to the minister.

Your sincerely,
Joyce M. Waters

NEW FELLOW - ROYAL SOCIETY OF NZ

Professor David Parry of the Department of Physics and Biophysics, Massey University, was recently elected a Fellow of the Royal Society of New Zealand in recognition of his research work in the area of molecular biophysics.

After winning the Alan Flower Memorial Prize, and gaining a First Class Honours degree in Physics and Mathematics at King's College, London (1963), David Parry obtained a position in the British Civil Service, designing ship hulls. However, before starting that career the opportunity to do a PhD in the Biophysics Department at King's College arose.

His postgraduate studies under Dr Arthur Elliot and Professor Maurice Wilkins were largely devoted to the structure determination of a synthetic polymer (nylon 6 y form) a range of synthetic polypeptides in solution and finally to paramyosin, the "catch" muscle in molluscan muscles.

On obtaining his PhD he joined Dr Bruce Fraser and his team at the CSIRO Division of Protein Chemistry, one of the three Wool Research Divisions in Australia. The group was a world leader in fibrous protein structure and stimulated Professor Parry's interest and involvement in mo-



lecular biophysics during the three years he spent in Melbourne.

In 1969 a two-year joint appointment was obtained at the Children's Cancer Research Foundation and the Harvard Biophysics Department where he worked with Drs Carolyn Cohen and Don Caspar. While in Boston his activities were directed towards the structure and function of tropomyosin, a thin filament regulatory protein from vertebral skeletal muscle. This post-doctoral fellowship was followed by two years at the Laboratory of Molecular Biophysics at Oxford University working with Dr Andrew Miller on the molecular structure of collagen.

In 1973 Professor Parry took up a lectureship in the Department of Chemistry, Biochemistry and Biophysics at Massey Uni-

versity. Since his arrival in New Zealand he has extended his research into the growth and development of collagen fibrils in connective tissues, and the relationship between the constituents of connective tissue and the mechanical properties of the tissue (in collaboration with Dr Alan Craig), on thin filament regulation in muscle, and on the structure of intermediate filaments (in collaboration with Drs Steinert and Steven at the National Institute of Health in Washington, DC and Dr Fraser in Melbourne). In recent times Professor Parry has worked on an increasingly diverse range of medically-oriented problems - interferons and interleukins, a viral receptor recognition protein, streptococcal M6 protein, the nuclear lamina and most recently a protein component of the desmosome.

Professor Parry won the ICI prize in 1981 and gained a DSc from the University of London in 1982. He was also elected a Fellow of the New Zealand Institute of Chemistry in 1983. In addition to his research and teaching Professor Parry is a member of the International Advisory Board of the International Journal of Biological Macromolecules, editor (with Dr L. L. Creamer) of two volumes on Fibrous Proteins, invited or plenary speaker at 13 conferences in USA, UK, Switzerland, Israel, Australia and New Zealand,

writer of 10 recent reviews, presenter of more than 50 overseas lectures in the past 10 years.

He is also Chairman of the Organising Committee for the 1990 IUPAB Satellite Congress in Palmerston North.

CONFERENCES

PACIFICHEM '89

The 1989 International Chemical Congress of Pacific Basin Societies will be held in Honolulu, Hawaii on 17-22 December. Sixty independent symposia are planned covering all major aspects of pure and applied chemistry including biotechnology in a meeting that is expected to involve about 3000 registrants. The Congress is co-sponsored by the American, Japanese and Canadian Chemical Societies; the New Zealand Institute of Chemistry is one of the Official participating societies and will be formally represented at the meeting. It is hoped that during the Congress an informal gathering of NZ participants can be arranged, and, to this end, I should be grateful if anyone planning to attend would notify either Dr. B. Halton (Chemistry Department, Victoria University, Wellington) or myself, preferably by the beginning of November.

Joyce M. Waters

COUNCIL NEWS

Notes from the Council meeting held at Waikato University on 20/21 August 1989.

In attendance were Dr. D. R. Llewellyn (in the Chair), A. A. Turner (Secretary and Executive Officer), S de Mora, B. Williamson, A. MacGibbon, D. Karl, J. Rogers, C. Trotman, R. Whitney, N. Pritchard with R. Hall and B. Swedlund as observers.

Formal minutes have been prepared by the Secretary. These notes have been prepared by the editors and are to highlight particular topics but do not form a full record of the meeting.

Financial

The financial report prepared by the Treasurer and published with the August edition of the Journal was discussed. The majority of the NZIC Income is derived from members subscriptions and major items of expense are shown in the accounts. In the short term the establishment of an office in Wellington will mean the use of some reserve funds in the coming year. The budget for 1989/90 reflects a no change situation as no major initiatives, either for income or expenditure, are envisaged.

As a consequence, no change in subscription rate is planned for the short term.

There was discussion on the best procedure for the NZIC to adopt to invest funds safely. The recommendation of Council was that any such funds be invested to safeguard the capital in Government backed stock while earning a modest income.

It was agreed that a general article on funding and accounts would be prepared by the Treasurer for the information of the membership. Because the Institute is a nonprofit organisation earning interest income it was necessary to apply for a certificate of exemption from withholding tax.

As an executive officer has been appointed members, branch committees and specialist groups requiring reimbursement for making payments should send all such matters directly to Alan Turner in Wellington for action rather than to the Treasurer.

Salary Survey

The planned survey has not been completed due to doubts over the availability and cost of the needed computer facilities to process the information collected.

Membership

The total NZIC membership is currently 1471 compared with 1679 last year. It was noted that there are 313 life members and 1157 fully active members. Mem-

bership drives and initiatives by the branches have had only a moderate response. It was resolved delays in processing applications were unacceptable and every effort would be made to speed up the process through the membership committee. All new membership applications should be sent to Alan Turner in Wellington.

An increase in membership from those potentially eligible in many industries and occupations must be pursued vigorously.

Awards and prizes

The Queens Birthday awards to Charliam O'Connor and Arthur Campbell were applauded. It was announced that Lester Davey has been awarded a Scholarship to Bristol University by the Royal Society of London.

It was emphasised that Branch Committees should bring forward proposals for awards of all kinds for processing to ensure that deserving people can be considered.

It was announced that the Shell Prize will not be awarded this year. It was noted that there was only one applicant for this prize and only two for the ICI Prize. It is difficult in present times for people to put the effort into writing the essays needed. The possibility of University project essays becoming eligible for consideration will be considered. It was also emphasised that Shell and ICI prize essays can remain strictly confidential to allow commercially sensitive topics to be used as material to earn an award.

If awards by companies are to be worthwhile to the recipient and to the donor companies promotional budget they must be competitive.

Public awareness of Chemical Matters

The problems the NZIC has in being unable as an organisation to make quick responses to the news media during times of heightened public awareness of a particular issue was debated.

It was agreed that the executive officer become the preferred initial contact. He would then redirect enquiries to experts who would answer on behalf of the Institute. This of course presupposes appropriate names on a list to be held in the Wellington office.

The role of the Wellington Office in Information Collation

Alan Turner will prepare a detailed timetable of information required for Council meetings and for other purposes and will send this to Branch Committees.

Meeting of deadlines is very

important to allow council members to consider matters properly before their meetings.

National Chemistry Day

This event was moderately successful in most parts of the country. The analytical competition did not attract as much support as hoped but a number of students carried out their tasks successfully.

The junior kitsets, launched in Dunedin for young people using simple everyday materials to develop an interest in chemistry, were particularly successful. It was agreed that these would be useful elsewhere in New Zealand.

Specialist Groups

It was noted that there are a number of specialist groups under the general umbrella and using some NZIC materials, which, never the less, act somewhat independently of NZIC and have many members who are not NZIC members.

Other organisations have similar dilemmas and have introduced multi-level subscriptions to cover such situations. This problem will be explored in more detail.

"Chemistry in NZ"

As noted in the Journal the present editor will be spending some time overseas starting in September. In the meantime Bernie Swedlund has taken over the position.

There was considerable discussion on the role of the Journal and plans for its future. A number of options must be carefully considered before any changes are made.

It was agreed that greater use can and must be made of the Wellington office in the gathering of general news and in the editorial process. The editor and the executive officer must work closely together and ultimately the editor must become responsible for the editorial function through the executive officer, rather than to an individual council member or the president.

The principle difficulties being experienced with the Journal at present are (apart from too rapid changes in Editors) an acute shortage of advertising material to support the cost of publishing.

A worry is the poor response from Branch Editors for the interesting items that must be occurring in their areas and a complete lack of articles commenting on current conditions in the world of chemistry.

There are no serious production problems and the costs of production are as low as can be tolerated by the publisher.

Closer Relations with Australia

As mentioned at the informal meeting in place of the aborted AGM at Conference, there are a number of good reasons why NZIC should carefully examine the benefits that might arise from a closer association with the Royal Australian Chemical Institute - The RACI.

It was agreed that Clive Trotman will, together with others, thoroughly explore all aspects of a number of proposals for close relations with RACI and prepare detailed information for the membership.

NOTICE OF AGM.

The Annual General Meeting of the NZ Institute of Chemistry will be held in Wellington on Wednesday 6 December 1989, commencing at 6 pm.

The venue is the Wellington Regional Aquatic Centre, Kilbirnie Crescent, Kilbirnie, Wellington. The Annual Report and Financial Statements were published in the August issue of "Chemistry in New Zealand".

Refreshments will be available and the AGM will be followed by a Wellington Branch Meeting and Dinner.

The meeting will be addressed by Mr Walters, MNZIC, of the Health Department with a talk on the subject of water quality.

Note: This AGM takes the place of the AGM scheduled

for 24 August 1989 which had to lapse because there were not enough corporate members to form a quorum.

LETTER FROM AUSTRALIA

There are a few journalists in Australia who take every opportunity to put the boots into university lecturers. They had a field day a few years ago when our government had an enquiry into sabbatical leave and our life-style was the subject of unprecedented scouring. Only occasionally is there a rejoinder from university circles, but I remember one good one. The Journalist led with "If you walk into a bar in Patagonia you'll probably find an Australian professor there!" Next week there was a letter to the editor from an agronomist who recalled that, when he was in Patagonia a few years ago, he went in for a drink and found two Australian journalists propping up the bar!

All this was in my mind this year when I decided to spend a few weeks in Argentina. I had been working by mail for some years with a theoretician in Buenos Aires, and a period of leave gave me the chance to visit him and continue our collaboration. As far as I know, I was the only Australian academic in the country at that time, and in view of the above perhaps I was fortunate to have just missed the TV news team who visited Argentina to interview the new president, Carlos Menem. They had to work in two shifts to record a day-in-the-life-of-

Menem, because he only sleeps for a few hours each night and is likely to propose a couple of sets of tennis at 10.00 pm before sitting down to dinner.

There were many young New Zealanders in Argentina since South America is a popular destination for walkers. It's become more accessible from our part of the world, too, since Aerolineas Argentinas started their trans-polar flights between Auckland and Buenos Aires. In fact the Auckland - B.A. link makes it as easy to travel that way to Britain or the U.S. east coast as it is to go by more conventional routes. New Zealand chemists who travel through Buenos Aires should give some thought to stopping off for a few days: they don't get many visitors there, and they would be delighted to see you. The favourable exchange rate - even for \$NZ! - means that you can stop over without losing the respect of your banker.

Universities in Argentina have been starved of funds for many years now, but by careful choice of problems they have managed a credible level of research activity. Natural product chemistry is prominent, so many of your organic chemists would feel at home there. Most of the chemists speak good English, too, which is handy in a city where

not too many other people do. There is even an English-language newspaper, the Buenos Aires Herald. While I was there I supplemented this daily dose of English by listening each evening to the short wave broadcasts of the BBC, in which inconsequential things like cabinet re-shuffles and transport strikes were interspersed with the good news of the Australian cricket successes.

One night there was even a report of a IUPAC meeting being held in Singapore (I think) and concerning itself with natural products which have medicinal properties. I only half listened to the reporter's introduction and to an earnest statement from Jon Clardy. The next speaker, however, had a ripe New Zealand accent and since I'd been dozing a bit I had to follow him to the end to discover that he was - have you guessed? - our old friend M.H.G. Munro, from Christchurch.

Natural product chemistry used to be very cheap, but first preparative chromatographic techniques and then spectroscopic analysis raised the price tag, and many organic chemists turned to other things. The extracting of plants, marine organisms and other living species, for taxonomic reasons or in search of new drugs, is still

stronger in the southern hemisphere. One finds its practitioners in Australia, New Zealand, South Africa, South America and in developing countries such as Fiji and Indonesia.

The corrective map of the world which you can buy at Sydney airport - you know, the one with our countries at the top - shows how little of the world's land mass is in the southern hemisphere. Among the more arcane consequences of this difference is the fact that CO₂ in the northern hemisphere contains slightly less ¹⁸O (by about two parts in a thousand) than atmospheric CO₂ in the southern hemisphere. The reason, according to CSIRO scientists, is that the greater plant mass in the northern hemisphere allows the CO₂ to be more nearly in equilibrium with the ground water, which is low in ¹⁸O. All this is probably a bit too complicated for journalists, who so far have not nominated CSIRO's atmospheric scientists for the local equivalent of the Golden Fleece award.

It's enough for us to know that the southern hemisphere is on top, even if Murray Munro's message reached me via London - by the underground route, so to speak.

Ian D. Rae

CHEMICAL EDUCATION TRUST REPORT FOR YEAR ENDING APRIL 30, 1989

The first report of the Chemical Education Trust published twelve months ago referred to the wide range of activities in the field of chemical education which have been pursued through the branches of NZIC. These activities are more fully outlined in the Annual Report of Council and present an impressive picture of the results that can be achieved through the enthusiasm of Institute members.

Nevertheless, the fact remains that these activities are uncoordinated and, more important, that there is no specific budgetary provision to ensure their continuity. The CET resulted from the wise decision of Council to contribute \$20,000 from its reserves as a "seedling" provision for development of a fund established with very clearly defined objectives to stimulate and increase "the interest and participation of both students and teachers in the physical sciences in general and chemistry in particular".

As foreshadowed last year the CET made a token payment to each of the branches primarily to draw attention to the existence of CET and give an indication of future possibilities without commitment to any specific line of action. This payment of \$400 to each branch was made in May last year and the very diverse range of activities which have been supported augur well for future assistance to schools. The following is a brief summary of the projects undertaken:

Support was given for a public address in the inaugural "Focus on Science" week in the Wai-kato.

Copies of the book "Chemical Processes in New Zealand" have been offered at half price to colleges in the Wellington area and twenty-two have accepted the offer.

Semi-permanent display materials (placards, etc) which can be sent from school to school have been prepared for use in the Manawatu, Taranaki and

Hawke's Bay regions.

A mobile display on chemistry which can be easily taken to schools and other venues has been prepared for use in the Auckland area. Equipment (a pH meter and chemical apparatus sets) has been purchased for loan to schools from the Science Advisory Centre in Dunedin.

In Canterbury support was given to a seminar for secondary students on super-conductivity, for an energy spectacular involving a demonstration of energy stores in chemicals and for the Science Roadshow.

In addition it has been decided to purchase a copy of a 30 minute video prepared for the Canadian Chemical Society entitled "Do-It-Yourself-Chemistry" to determine its suitability for use in teaching chemistry to younger students.

It was intended to make a further and larger monetary distribution to branches during the current year but this plan has been upset by the failure of Equiticorp involving the freezing of a substantial portion of the funds of CET. The income of the trust has been effectively halved

and the Trustees therefore decided it was prudent to cancel the proposed payment until the situation becomes clearer. However, the Trustees have indicated their belief that it will be possible to support a team to take part in the 1992 Chemistry Olympiad if Council decides to make such a selection.

During the year there has been a steady growth in the fund which now stands at approximately \$53,000. A further appeal for support has been made to industry and the outcome of this is not yet clear.

G. N. Malcolm
G. B. Petersen

A. W. Mackney
TRUSTEES

The trustees included their audited Income and Expenditure Account as well as the Balance Sheet for the year. Because of limitation of space this is not reproduced but copies are available on application to the Acting Editor.

CHEMISTS IN THE HOSPITAL ENVIROMENT

by Gerald A Woollard

Traditionally the training of chemists has been in the study of the basic science itself. There is an important role to be played by the academic chemist but seemingly little regard is given to the occupational aspects of this science especially at university level. Students whilst gaining an excellent grasp of the fundamentals of their subject are often unaware of the importance of chemical concepts in a great diversity of jobs. Basic chemical knowledge is a vital component in a number of occupations outside the most recognisable areas of research, industry and teaching. One of these which is perhaps little known to most is the area of clinical chemistry.

The Pathologies

Pathology is an area of medicine dealing with the study and diagnosis of disease. The pathologies differ from all the other forms of medicine in that they are predominantly laboratory based. Other than that the boundaries can sometimes be difficult to define. The major types of pathologies are Chemical Pathology (clinical chemistry), Haematology, Bacteriology, Mycology, Virology, Histology, Immunology, Cytology, Forensic pathology.

Each of these pathologies are distinct in some respects in that they employ their own staff and have independent laboratory facilities. Functionally they are not distinct as there is overlap between their areas of interest and the same disease often requires the services of more than one pathology. Chemical pathology is a medical term which can be used interchangeably with clinical chemistry which is a scientific term. This is undoubtedly a reflection of the convergence of medicine and chemistry in this area. Chemical pathology is one of the most broadly based pathologies as it deals with any part of medicine which can be considered as chemistry based. The major identifiable branches are Clinical biochemistry, Clinical toxicology, Paediatric biochemistry, Inborn errors of metabolism.

There are other related specialist areas which rely on clinical biochemists. Examples are Endocrinology, Nuclear medicine, Hormone units.

There is no absolute distinction between these disciplines and although the clinical chemist necessarily specialises in one area, (s)he generally becomes reasonably conversant in all of them. Depending on the organisation of the hospital the above facilities may be located in one or several units.

Organisation

The organisation of hospital laboratories to an outsider can seem (and often is) very confusing. As all pathologies are a form of laboratory medicine, some hospitals prefer to group all their pathology laboratories into a single department which is given an appropriate name such as the department of pathology, laboratory medicine, laboratory services or something similar. Other hospitals see pathology as far too big and diverse to be manageable as a single department and prefer to keep their laboratories intact under the management of medical consultants in the respective fields.

Usually the largest chemically orientated laboratory is the central clinical chemistry (or biochemistry) laboratory. The medical specialist affiliated to this department has the title of chemical pathologist and hence often the name used is the



The Hitachi 737 is the largest bulk chemistry analyser in the Department of Clinical Chemistry. It operates on the random access principle and routinely performs any combination of 17 tests on up to 250 samples per day. It uses very small sample volumes and apart from placing the samples into a carousel it is completely automated right through to the reporting of the patient's results.

department of chemical pathology. Clinical chemistry laboratories unlike some of the others do not service a single ward but instead are available to all wards in the hospital and also to other hospitals and general practitioners. With a few exceptions (eg, diabetic or asthma clinics) they are not usually attached to any particular unit although there is always a very close attachment to the acute departments such as critical care, coronary care, resuscitation and emergency etc.

The organisation of clinical chemistry services is sometimes fractionated either on analytical grounds or for clinical convenience. For instance, certain distinctly biochemical tests which require the handling of radionuclides may be done by a nuclear medicine laboratory. The prime purpose of this type of laboratory is to service a nuclear scanning facility and hence it is situated within that department which may be remote from the central clinical chemistry laboratory. The same may be said of some endocrinology departments which may have their own laboratory set up. These often extensively employ clinical biochemists to do biochemical testing which is a specialism of its own activities. However, at the same time certain endocrine tests such as for steroids may be done in the central biochemistry laboratory. The latter laboratories are often in the domain of physicians rather than pathologists.

Clinical toxicology laboratories are unique in that there is normally no medical specialist in the field. Because they are a chemically based laboratory which uses equipment similar to that used by the clinical biochemistry department they usually function as a specialist unit within that department and are under the management of the chemical pathologist. Overseas there is a growing tendency for the toxicology units to be run by medically trained clinical pharmacologists (who are physicians rather than pathologists) using either clinical chemists or clinical pharmacists for their operations. Clinical pharmacists are a new breed of specially trained pharmacists with considerable clinical, pharmacological and analytical skills. Toxicology units in this country mainly employ chemists. A clinical toxicologist is invariably scientifically rather than medically trained.

The Work of Clinical Chemistry Departments

Essentially a clinical biochemistry laboratory, as the name

implies, is one that performs chemically based laboratory medicine. This means that the disease being investigated requires the use of analytical techniques that are overtly biochemical. The nature of the disease does not need to be biochemical in origin. Obviously, a number of biochemical abnormalities are diagnosed but quite often the tests are better described as physiological because they test for altered renal, hepatic, cardiac or pulmonary function using biochemical means.

The sort of chemistry used in clinical biochemistry laboratories will be familiar to most chemical graduates. The normal range of tests will be based on the detection of enzymes or the use of enzymes to detect other compounds, steroid chemistry, protein chemistry, titrations, wet chemistries, physical chemistry such as ion selective electrodes, osmolality etc. Most of the types of instrumentation will also be familiar such as electrophoresis, atomic absorption, and various forms of chromatography. The most unfamiliar instruments are likely to be the specialised types of computerised autoanalysers which are manufactured almost exclusively for clinical laboratories.

All hospital laboratories are expressly geared to rapid and accurate analyses aimed directly at patient care. The level of service supplied depends on the size of the hospital and varies from the miniscule to the megalithic. Whatever the size, there is a proportion of extra work to be done which is predominantly extensive quality control and assurance programs and problem solving (ie analytical or instrumental failure). A level of investigational work is also carried out in the larger facilities. This is normally developmental in nature although some more fundamental research may be done provided that patient care is the immediate endpoint.

Service laboratories are always different to the research laboratories which most chemists are trained in because of a) the urgency of results b) the high throughput. This is always apparent to graduates entering the system for the first time.

Staffing in Hospital Laboratories

There are functionally three groups of staff in hospital laboratories.

Pathologists (and their registrars), Medical laboratory technologists (incl trainees and laboratory assistants), Hospital scientists.

The pathologists are medically trained and have completed the fellowship examinations of the Royal College of Pathologists of Australasia (FRCPA) specialising in a particular pathology. The college offers advanced training in a number of pathologies (see above) as well as a general course in a combination of all subjects. In addition the pathologists often have science degrees which are taken either before their medical qualifications or during their specialist training. It is the responsibility of the pathologists to manage their respective departments and also to provide the medical input between his/her department and other departments and wards.

The medical laboratory technologists are numerically by far the largest occupational group. Their training consists of a three year NZ Certificate in Science (NZCS) specialising in paramedics. Following this period they sit a two year course in their chosen field which may be biochemistry, microbiology, haematology, blood transfusion etc. These courses are designed and run within the hospital environment by the Medical Laboratory Technology Board (MLTB). Their professional organisation called the NZ Institute of Medical Laboratory Technologists (NZIMLT). Depending on their progress in these examinations and subsequent promotions, the technologists hold positions known as trainees, staff technologists or graded technologists. Those who do not sit the MLTB examinations are not registered as technologists and remain as assistants. They usually take a lesser qualification called the qualified technical assistant (QTA). Collectively, the technology group

are the major work force in the hospital laboratories. They are responsible for the full spectrum of activities associated with routine analyses, quality control and much of the internal management. Much of the data leaving the various laboratories is generated by the technologists and so their major function is that of a service commitment. Not all countries have an equivalent laboratory technology group.



The Roche Cobas Fara is a centrifugal analyser currently used for about ten special chemistries.

The hospital scientists are the most heterogeneous occupational group in the laboratory medicine system. They are chosen on an ad hoc basis and may come from a variety of scientific backgrounds depending on the requirements of their position. They are comparatively rare as there are only about 140 nationwide. Not all hospital scientists are biochemists. The range of graduates employed include physicists, computer scientists, mathematicians, cytologists, microbiologists, etc. Not all hospital scientists work in laboratories but may be assigned to departments such as oncology, neurophysiology or gastroenterology. Those working in the physical, mathematics or computer sciences may be grouped in a single medical physics or electronics department or have attachments to appropriate clinics, wards or laboratories. Numerically the clinical biochemists make up the bulk of the hospital scientists. They usually work in association or collaboration with the mainstream of their laboratory and the profiles of their jobs may seem technological at first glance. However, the context of their jobs differ from technologists in several fundamental respects.

They are not normally involved with the routine operation of the department but may have a significant service commitment in a specialist area.

Their work has a strong developmental component in which new diagnostic procedures are developed or existing ones are modified.

They may engage in more clinically orientated research usually with close association of a medical supervisor.

They supply the scientific interface with their department just as the chemical pathologist supplies the clinical interface.

They often assume a problem solving role either with more advanced instrumentation or in specialised area of medical science where they offer a consultancy.

Clinical Biochemists

Clinical chemistry is a major discipline in its own right and can be regarded as a composite of a very wide range of basic chemical sciences. Foremost amongst these are biochemistry, organic chemistry, and analytical chemistry. However, in order to function effectively an equally sound knowledge is required in a number of medical sciences. These should include physiology and anatomy but depending on the job requirements may also include medicinal chemistry, pharma-

cology, radiochemistry, neurology, microbiology etc. It can be seen that a clinical biochemist is far from a chemist in the traditional sense but is a medical scientist providing a valuable service at the interface between the medical practice and the science required to perform it.

Most of the clinical chemists employed in hospitals, irrespective of their specialities in clinical biochemistry, clinical toxicology, nuclear medicine etc are graduates in either chemistry or biochemistry with little or no medical science training. It is sometimes difficult to see how they manage but usually it is a result of a great deal of self training in the additional subjects. The fact that they cope at all is in a way a statement about the quality of chemistry and biochemistry as universally applicable subjects. There is a level of inefficiency about this approach to the training of clinical chemists and it would seem more desirable to have a graduate university program aimed at the production of well versed medical scientists with postgraduate specialisation in areas such as clinical biochemistry. It is pleasing to see that there is progress in this area as a number of the medical sciences, such as pharmacology and physiology are being made accessible to BSc degrees but there is still a gross deficiency in postgraduate training except for the MSc degree in toxicology at Otago University which hopefully is a sign of more medical science degrees to come.

Perhaps the most promising advance to date in the training of clinical chemists has been the design of a MSc degree in medical science at Auckland University. The degree can be taken in any major clinical discipline including biochemistry and it represents the first serious recognition by the medical school of the value of medical scientists and of medical science as a worthwhile career opportunity.

Interestingly, there has been a lot of difficulty world wide in encouraging medical graduates into laboratory medicine to help fill a rather large void that exists between the laboratory output and the patient input (another way of defining the laboratory clinical interface). Accordingly, there are a number of overseas universities who are trying to rectify this eg. Ninewells in Dundee, by offering a Bachelor in Medical Science (BMedSc) in clinical chemistry. The success of these have yet to be proven but tragically, and predictably, they are not open to chemical graduates.

At present there is really no such thing as a clinical biochemist leaving university in New Zealand. This is not the situation overseas as a number of countries take a more professional approach to clinical biochemistry and offer masters courses in the subject at university level. A notable training program in the UK is the Masterate in Clinical Biochemistry (MCB) which is not a university qualification but rather a joint examination given by the Association of Clinical Biochemists, the Royal College of Pathologists and the Royal Institute of Chemistry. Perhaps this, or similar types of ventures could appeal to the NZIC as a direction for the future.

In terms of professional bodies for the clinical biochemist, the principle one in this country is the NZ Association of Clinical Biochemists (NZACB). It is not a strong association because of the small numbers involved and many clinical biochemists also belong to the NZIC. However, they tend not to have as good a participation as would be desirable. The NZACB is our recognised national body and is affiliated to the International Federation of Clinical Chemists (IFCC). In this part of the world by far the strongest professional organisation for clinical biochemists is the Australian Association of Clinical Biochemists (AACB). Membership to this association is by stringent written and oral examination and is increasingly being used by New Zealanders as the only accessible form of recognition for them as a profession. Scientists are not permitted to any form of membership to the RCPA which is reserved for medically trained pathologists only. This is not the case in the UK where scientists can gain membership to the Royal College of Pathologists (MRCP). The American Association of Clinical Chemists (AACC)

is not as appealing to biochemists here and neither are their pathology organisations such as the American Society of Clinical Pathologists (ASCP) which does accept scientists. The College of American Pathologists does not. The clinical chemists specialising in toxicology, in addition to membership to biochemical or pathology associations, often belong to pharmacology or toxicology associations. Perhaps the most active one here is the Australasian Society of Clinical and Experimental Pharmacologists (ASCEP) which like the NZACB carries no professional recognition or status.

The Present and The Future

The reasons why clinical chemistry tends to be overlooked as a scientific discipline in NZ universities is probably complex and related to factors such as the limited number of employment opportunities, the strong presence of the medical laboratory technologists or to the poor representation that clinical biochemistry has in the medical schools. Whatever the reasons, the absence of formal graduate training is probably detrimental to the progression of this important aspect of chemistry. There may be a distinct benefit in the current situation in that there is a great diversity of skills in the chemists who become clinical chemists which may be absent if they all came from a common university background. At the same time there are some rather disappointing consequences principally in that there is a lack of professional recognition within the hospital system which is built on occupational structure and registration. The clinical chemist may also show suboptimal skills in the clinical and interpretative aspects of laboratory tests despite an obvious ability in the scientific and analytical basis of the tests.

These deficiencies need attention in order that clinical chemistry can progress properly.

It can rightly be argued that the clinical biochemist should be involved primarily in research. There have long been constraints on the type of research being done within hospitals as the more fundamental research is seen as inappropriate to a service organisation. The type of research which is sought is usually more in the nature of developmental work. This includes introduction of modified or new testing procedures, investigation of current and prospective instrumentation, special investigations, specific problem solving, detailed examination of unusual or non routine patients etc.

The major internal pressures on clinical chemistry laboratories is that of advancing technology. Analytical procedures are getting increasingly automated so that tests which were once done with a high manual component are now done with push button ease. This has been the legacy of the micro processor age and has rapidly changed almost every aspect of laboratory function. The benefits are immediately evident in the higher rate of throughput and the lower cost per test. As with other areas of medicine, the advances have outstripped the ability of hospitals to pay for them and some rationalisation is being imposed with the current monetary restrictions. A major consequence to the changing face of clinical laboratories is one of changing workload. At the benchface, much of the original testing which required considerable analytical skills can now be done with relatively little training. Therefore lesser qualified laboratory technologists can potentially undertake these analyses. The registered technologists who have extensive training are correspondingly being under utilised in their traditional roles and are redefining their job expectations. The progression away from strictly routine work is naturally towards developmental work, more sophisticated analyses, management and the so called laboratory/clinical interface. The latter is that area which is involved in data interpretation rather than data generation which is normally the prerogative of the chemical pathologist as is the management responsibility. The clinical chemist on the other hand may have an element of his/her research eroded and be moving more towards developmental

work and also the interpretive aspects of laboratory testing. It is evident then that there is a convergence of the three occupational classes which is causing a level of conflict and redefinition of roles. The final result of all this reshuffling as far as the clinical chemist is concerned is difficult to foresee. In the current world of deregulation the most suitably trained person will win which can be a gloomy proposition for the clinical chemist unless his training in the clinical area is improved. Pure reliance on advanced analytical skills may not be enough and the group as a whole adapt in a health system that is rapidly changing.

Despite the conceptual difference that exists between technology and science there is a point of convergence towards which the medical technologists are moving. This is evident in

that the technologists themselves have been seeking scientific status in their drawn out quest to initiate a graduate training scheme at Otago University leading to a Bachelor of Medical Laboratory Science (BMLSc). Unfortunately this has not been instigated to date. This type of career orientated degree probably has more to offer than their current technical training. It may be that the distinction between medical technologists and the clinical scientists will diminish so that with the relentless technological pressures and the emerging economic pressures the two groups may eventually become indistinguishable. Whatever the outcome of the struggle between the triad of pathologist, scientist and technologist, clinical chemistry will remain an important and exciting medical discipline of far reaching benefit to all those who visit the hospitals as patients.

CORRECTION

CHEMICAL CARCINOGENS IN NEW ZEALAND

W. A. Denny & L. A. Ferguson. *Chemistry in New Zealand*, August 1989, pg 71-75

Regretably, a major portion of text was omitted from the above article when it was published in the August issue. The final part of the article is reproduced below, with the missing text inserted.

We apologise to the authors and to any readers who may have been inconvenienced by this omission.

Legislation

Recognition of the dangers of mutagenic and carcinogenic chemicals is prominent in the regulatory requirements for various classes 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 States²⁰. 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 have been obtained from the base set. New Zealand requires mutagenicity information only for pharmaceuticals and then only if the material is "similar to a known mutagen or carcinogen"²⁰.

In the New Zealand Toxic Substances Regulations of 1983, and the three amendments to date, there are various materials whose use is restricted. These are divided into "deadly poisons", "dangerous poisons", "standard poisons", and "harmful substances". Some of the listed materials are known human carcinogens, while many others have been classed as probable and possible carcinogens, while many others have been classed as probable and possible carcinogens by the IARC¹³. However, these carcinogens are not specially identified within the regulations. There are only two carcinogens (again not identified as such) which are regulated as a special case by these requirements: chewing tobacco is not permitted, and nor are levels of nitrosamine higher than 30ppm in babies' teats.

An updated list of known and suspected human carcinogens

Since 1969, the International Agency for Research on Cancer (IARC) has carefully evaluated all the available evidence for the carcinogenic risk of chemicals to humans, and has produced a series of monographs on individual compounds. In a recent review of Volumes 1-42 of these publications¹³, the IARC has produced an updated list of all chemicals for which there is some evidence of carcinogenic risk. We have reproduced part of this list in Tables 1-3, and roughly classified the compounds according to their use. Several points should be kept in mind when reading the Tables:

- They fully cover those compounds which are reported to be known or probable human carcinogens (Table 1 & 2), together with all but a few of the less common compounds suspected as possible human carcinogens

(Table 3). The complete IARC list also includes a larger group of compounds (not included here) which are rated as not classifiable as to their carcinogenicity to humans, due to insufficient or conflicting evidence.

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 sizable 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, by-products of process materials (or the combination) which are the danger. The data upon which cases are decided are also (of necessity) decades old, due to the long 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.

MEKP: THE UNPREDICTABLE HARDENER OF UNSATURATED POLYESTER RESINS

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Introduction

Unsaturated polyester resin, reinforced with fibres (mostly glass) or a variety of fillers is one of the major range of plastics' materials used in the manufacturing of boats, refrigerated trucks, sanitaryware, pools, body car patch, synthetic marble etc. UP Resin is sold in a liquid form to the transformer, who adds the necessary reinforcement, then (or simultaneously) adds hardener before moulding the mix into the desired shape.

In the case of unsaturated polyester resin the hardeners are a variety of organic peroxides. There are more than two dozen of these used commercially depending on the required hardening conditions and the end result desired. But there is one peroxide used more than any others, and in New Zealand, the only one for cold curing (except in the case of body car patch), it is methyl ethyl ketone peroxide.

MEKP is an unpredictable product whose activity varies a lot depending on its age, or its brand and the resin in which it is used. A fast MEKP with one resin can become a slow one with another whereas a competitive MEKP will do precisely the opposite. Also an MEKP which has lost its oxygen content sometimes becomes a faster initiator, whereas MEKP with a high oxygen content can sometimes be slower than a competitive one with low oxygen content.

Similar problems arise with the concentration of MEKP in the commercial solution. The following notes are an attempt to explain why.

MEKP Manufacturing & Quality

MEKP is formed by the reaction of hydrogen peroxide and methyl ethyl ketone in acidic medium, and generally in the presence of phlegmatizers or plasticizers. The product is not a single peroxy species but rather a mixture of products of variable stability which exist in a state of unstable equilibrium, as in Figure 1.

Commercial MEKP is characterised by the following properties

- 1 Active Oxygen: the ratio of free oxygen per 100g of the commercial MEKP mixture
- 2 Concentration: the % of MEKP isomers in the commercial

liquid. The rest being phlegmatizers or plasticizers. Most commercial MEKP is either 50, 40, or 30 % strength.

- 3 Half Life: the time for half the original quantity of peroxide to decompose.

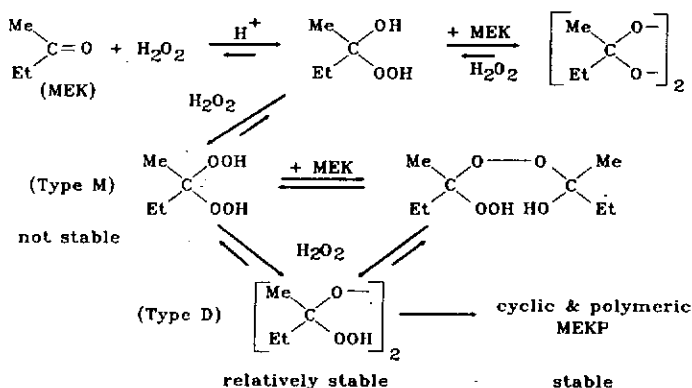
The following table shows us the various type of Isomers which are generally contained in a commercial MEKP

Type of MEKP Species	% Average in Commercial MEKP	Active Oxygen
Type D: Dimer MEKP	8.0 — 19	23 %
Type M: Monomer MEKP	22.0 — 34	26 %
Hydrogen Peroxide	0.7 — 2.8	47 %
Type C Cyclic Polymers	(no action at room temperature)	

Type M is the principal initial component formed in MEKP, however it slowly changes to its dimer Type D plus hydrogen peroxide under acid conditions at ambient temperature.

- a) The behaviour of commercial MEKP in the gelation and cure of cobalt accelerated unsaturated polyester is dependent upon the presence and amount of hydrogen peroxide, Type M & Type D MEKP
- b) Active oxygen as a measure of activity is erroneous. Active oxygen content is no criteria of MEKP quality, it is merely a measure of the total amount of peroxide present and is not a measure of any given system. It is the total active oxygen of all species including those which have no action on polymerisation.
- c) Also the percentage concentration of MEKP often depicted as 50-40-30% can be misleading. Commercial MEKP does not contain necessarily 50-40 or 30 % Active material.

Analysis of commercial MEKP shows that they contain slightly over 40 % of usable peroxide compounds. It is not the active oxygen content nor the percentage concentration of the solution which determines the activity of commercial MEKP formulation in the resin, but the relative amount of Type M & Type D: MEKP and hydrogen peroxide. This can vary from batch to batch and also during storage, depending on the type of stabilizer, phlegmatizers or plasticizers used.



Gel time & cure time in relation to the chemical formulation of polyester

(A) There are many types of polyester resins formulated for end purpose. They are made by varying the glycols and diacids in the alkyd base. It has been found that the activity of the different MEKP species is a function of the formulation of the alkyd base of the polyester resins.

The following is a list of the main type of commercial polyesters and the type of MEKP Isomer which is more suited to them.

- 1 Fire Retardant Polyester (produced with tetrabromophthalic anhydride) e.g. Polyflite 61601—61607. Activity of this resin is controlled by hydrogen peroxide (gel time) and Type M: MEKP

ACTING EDITORS ADDENDUM ON ACADEMIC ASPECTS

The chemistry associated with MEKP is perhaps reducible to somewhat basic principles as follows:

Analytical methods for oxidising agents in solution generally depend on the reaction with acidified potassium iodide to liberate iodine, which is then titrated with thiosulphate solution using starch as indicator, or less sensitively, the colour of iodine dissolved in a layer of chloroform. Differentiation of the possible oxidising agents present is more difficult, but could probably be made by devising a method which depends upon the varying reagents. For some oxidising agents ingenious experiments have determined which oxygen atoms are involved in the oxidation process. As an example if a good question of this type one can ask which molecule supplies the oxygen atoms for the oxygen evolved when hydrogen peroxide is decomposed by potassium permanganate?

Rates of polymerisation will vary with the concentration of initiator, but not linearly, and also with the type of polymerisation which may be ionic or radical. Cationic polymerisation is likely to be initiated by hydrogen peroxide acting as an acid e.g.

$\text{PhCH}=\text{CH}_2 + \text{H}^+ \longrightarrow \text{PhCH}^+\text{CH}_2 \longrightarrow$ cationic chain
whereas radical polymerisation is probably initiated by thermal homolysis of a bond between two oxygen atoms e.g.



Chain length and hence gel time will be determined by scavenging of active particles and e.g. cations may be destroyed by reaction with anions, and radicals by forming unreactive peroxides such as RO-OR

- Bisphenol A Polyesters** In which part of the glycol is hydrogenated bisphenol A. e.g. PolyLite 61353 for chemical resistance. Type M: MEKP plays the dominant role assisted by hydrogen peroxide to speed time.
 - Isophthalic Polyesters** In which the isophthalic acid represents at least 25% in moles of the diacids, e.g. PolyLite 61306 for chemical resistance are cured by Type M: MEKP as bisphenolic resin.
 - Vinyl Esters** Generally produced by acrylation of epoxy or bisphenolic compounds e.g. Corrolite 61746 used for chemical resistance. Type D: MEKP gel and cure vinyl ester resins while Type M does not. Gel time, cure time and peak exotherm are proportional to Type D content in the initiator formulation.
 - General Purpose Polyester** This is the most common polyester resin produced by reaction of propylene glycol, phthalic anhydride and maleic anhydride e.g. PolyLite 61360. The cure of GP polyester resin was dependent on both Type M: MEKP and hydrogen peroxide.
- (B) **Residual Styrene** The co-polymerisation of the unsaturated polyester alkyd and its styrene monomer is rarely complete; the rate of which can be measured by the remaining free styrene.

In most finished items the free styrene will vary from a 4–6% (in weight) for a badly cured laminate (a GRP boat for instance) to less than 0.1% in a properly cold cured with postcure at high temperature laminate (used for foodstuff containers for instance).

As for the gel time and the cure time, it has been found that the MEKP type of isomer is very important in getting the proper co polymerisation rate of alkyd and styrene.

Local Examples

The sort of variation that can happen with various brands of MEKP available in New Zealand is illustrated by two specific cases that happened at our customer's premises, where different brands of MEKP were used.

- Short gel time injection type polyLite** (General purpose type) Here we need to have the longest gel time (working time) and the lowest peak exotherm (to reduce mould deterioration) with the shorter cure time to get the more efficient total cycle time.

Resin	Catalyst	Gel Time at 25°C	Peak Exo.	Cure Time (Gel to PE)
PolyLite 61-P	(A)	1 min 45 sec	174°C	7 min 15 sec
	(B)	1 min 45 sec	156°C	6 min
	(C)	1 min 45 sec	166°C	7 min

It is easy to see that although catalyst (B) gives the lowest peak exotherm, it also gives the fastest cure time.

2 General purpose orthophthalic laminating polyesters

	PolyLite 61.Q	Resin X	PolyLite 61.Q	Resin X	PolyLite 61.Q	Resin X
MEKP A	1%	1%				
D			1%	1%	2%	2%
Gel time	22 min	16 min	59 min	30 min	16 min	16 min
P Exo.	146°C	151°C	152°C	151°C	179°C	166°C
Cure time (Gel-P Exo.)	13 min	17 min	23 min	24 min	10 min	13 min
Cycle time	35 min	33 min	82 min	54 min	26 min	29 min

This table shows the drastic difference of activity of two different polyester resins with two different types of MEKP. Although both polyesters have similar characteristics with catalyst A, the gel time of 61.Q is two times longer than Resin X gel time with catalyst D. Curing time remaining the same. This can be either an advantage or disadvantage depending on working conditions.

Most people want to demould quickly, but the working time is a function of the mould shape or labour available. By choosing the right catalyst one can try to accommodate both. It is therefore possible to obtain longer working times for complicated parts or gel times too long for simple vertical parts, thus producing drainage.

Conclusion

As with cars, there is no universal and ideal polyester. Polyester manufacturers cannot make resins that behave the same with all kinds of peroxide. (The corollary is also true).

Consequently the fabricator should always select his peroxide for the polyesters he uses, and according to the process involved. Also, there is a general law of chemistry saying that the speed of reaction roughly doubles for each 10°C increment. Hence an MEKP which loses half of its activity in six months will have lost half of it in two months at 26°C and will be nearly unusable after less than a month at 35°C.

* MEKP should always be kept in a dark and very cool place.

PolyLite is A C Hatrick (NZ) Ltd Polyester brand name.

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The Optimum Selection Of Calibration Standards to Establish a (linear) Calibration Graph

F.G. KOMEN Process Analysis Chemist, N.Z.Steel Ltd, Auckland

The conventional way of choosing calibration standards has been to select the standards evenly spread over the required calibration range.

For instance ISO 1118-1978(E), Colourimetric Determination of Titanium in Aluminium, specifies in Table 1 and 2 the preparation of standard solutions for establishing calibration curves as:

ml Ti-solution	Table 1 Corresponding mass Ti	Table 2 Corresponding mass Ti
0	0	0
1.0	0.0025	0.015
2.0	0.0050	0.030
4.0	0.010	0.060
6.0	not used	0.090
8.0	0.020	0.120
12.0	0.030	0.180

As another example ISO 4693-1986(E), Flame Atomic Absorption method for Copper in Iron Ores, specifies in 7.5.3 the preparation of calibration solutions as:

Transfer 1.0,3.0,5.0,7.0 and 10.0ml of the appropriate standard solution (either 0.10mg Cu/ml or 0.010 mg Cu/ml) to 100 ml flask etc.

The general procedure, following the instrumental readings, is to prepare a calibration graph by plotting the (net) absorbance values of the calibration solutions against their concentrations and read from this graph the concentration corresponding to the absorbance value of the unknown.

However with the advent of sophisticated hand-held calculators and of computers, analysts are more likely to express the relation between absorbance and concentration in a mathematical form, which will ideally be linear over the range used.

The procedure employed to calculate this relation is still mostly the classical, standard linear regression in the form of: absorbance = m . concentration + b,

where m and b are constants, concentration the independent and absorbance the dependent value.

The classical linear regression calculation to express the relation uses the method of "least squares", minimising the overall discrepancy. (See any standard reference book on Statistics)

It is important to remember that the line equation $y=m*x+b$, obtained by the principle of "least squares" is an estimate, based on sample data, of the unknown true regression line. The estimates of m and b have an estimated standard error of:

$$\text{for m: } S_m = \sqrt{\frac{1}{n} + \frac{\bar{x}^2}{S_x^2}}$$

$$\text{for b: } \frac{S_y}{S_x}$$

where : n = number of data points

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad S_x^2 = \sum_{i=1}^n (x_i - \bar{x})^2$$

$$s = \sqrt{\frac{\text{residual sum of squares}}{n - 2}} \quad \text{residual sum of squares} = \sum_{i=1}^n (y - m - b*x)$$

Because the standard error formulas have S_x^2 or S_x^2 in the denominator, making S_x^2 as large as possible would make the standard error as small as possible and thus would provide the most precise estimate of m and b.

When the number of datapoints is even, the maximum value of S_x^2 is realised by placing half of the independent points at each of the two endpoints of the range to be covered. Thus statistically and mathematically a better estimate of the calibration equation is obtained by having the chosen standards grouped at either end of the required range.

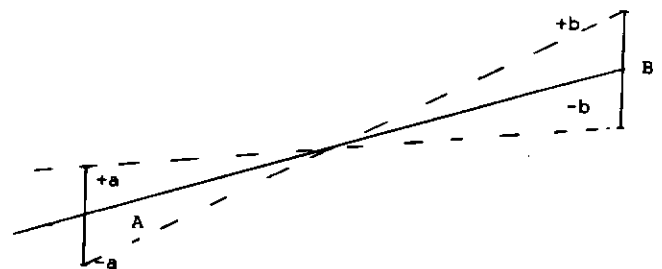
For example: ISO 1118 - Table 1-Points over whole range $S_x^2 = 0.000672$.

If however values of .0025, .0025, .0025, 0.30, .030 and .030 were chosen: $S_x^2 = 0.001134$.

Thus the standard error of m and b are reduced by the choice of standards.

Heuristically it can be seen as follows:

Imagine a calibration line made up of two points: A and B. There will be a standard error in the absorbance value at both ends, denoted in the graph by a and b as follows:



A worst case situation will be when the A reading is minus standard error and the B reading plus standard error or vice versa, giving calibration lines as indicated by the dotted lines. It will be clear from this picture that fixing A and B more precisely (by repeating A and B) the calibration line will be better fixed.

Conclusion:

The forgoing shows, that in selection of calibration standards it is better to select more standards at the top and the bottom of the required range, rather than evenly through the range. To take into account normal operational differences, it would be advisable to have the repeat standards at the top and bottom of the range produced from different base solutions, with the same nominal concentration. If there is doubt about the linearity of the calibration, it will be necessary to intersperse the top and bottom standards with intermediates; however repeating intermediates will not greatly increase the fixing of the calibration line and is therefore not needed.

Thus a standard method might specify:

Prepare three base solutions each containing 1000mg Cu/ml, marked solution A, B and C.

- Pipette into 100 ml flasks: 1.0ml of A
- 1.0ml of B
- 1.0ml of C
- 10.0ml of A
- 15.0ml of C
- 25.0ml of A
- 25.0ml of B
- 25.0ml of C

Make up to 100ml with distilled wateretc.

UNIVERSITY NEWS

PROFESSOR TED RICHARDS RETIRES

Professor E. L. (Ted) Richards retired in May after 19 years occupying the Logan Campbell Chair as Professor of Food Technology.

He has been head of the Department of Food Technology for 17 of those years, eventually stepping down from Headship of the Department in December, 1987. His retirement will bring an end to a career which has spanned a total of 45 years distinguished activity in research and education in organic chemistry and food technology.

Ted Richards was born in Wellington and educated at Rongotai College. At the age of 17 he joined the DSIR as a cadet and attended Victoria University part-time, graduating with a BSc in Chemistry, and an MSc (First Class Honours) in Organic Chemistry.

Ted then joined the NZ Defence Scientific Corps and was sent to undertake PhD studies at Bristol University. His PhD project on the interaction of amino compounds and sugars was related to the non-enzymic browning of foods. He completed his doctorate in record time, and was then sent to undertake one year's post-doctoral study at Cambridge, followed by secondment to the NZ Dairy Research Institute in Palmerston North, where he was later offered a permanent position.

In 1959 Ted Richards was appointed a Senior Lecturer in Biochemistry at Massey Agricultural College where he continued with his research work on the interaction of amino compounds and sugars, producing about 20 publications in international scientific journals. He also spent a sabbatical year as a Fulbright Scholar in the USA.

In 1970 Ted Richards was appointed to the headship of the Food Technology department.

During his 17 years as HOD the Department grew dramatically from an original staff of 5 people to its present 15.5 academic staff, accompanied by a steady growth in student numbers at all levels. Professor Richards continued to emphasise the importance of a strong scientific base for an applied activity such as food technology, and to stress the importance of a strong research base. Amidst the busy duties of a Head of Department he found time to undertake his own research and continued to publish some papers in international journals.

Professor Richards has also worked actively on several senior committees. Perhaps his most distinguished activity in this area has been his membership of the Massey University Council for the past 6 years and also his membership of the board of NZDRI from 1983 through to 1989. Professor Richards also served for a number of years on the NZ Dairy Industry Training Council, on the



National Committee of the International Dairy Federation, and on the Board of Management of the NZ Dairy Industry Graduate Training Programme. He has also served on a number of internal Massey University Committees such as the Student Welfare Advisory Committee. He has served as Chairman of the Manawatu Branch of the NZ Institute of Chemistry and has also found time to play an active part in the affairs of the local branch of NZIFST.

As a true gentleman Ted Richards is liked and respected by all staff who have worked for him over the years, and particularly those who have worked closely with him in the area of food chemistry. It is indeed appropriate that in the month of his retirement Professor Richards was honoured as the recipient of the 1989 J. C. Andrews Award for eminence in food science and technology.

Professor P. A. Munro

Waikato

A welcome addition to the Department of Chemistry during June was Dr Richard Ede, who returns to Waikato to take up a lectureship in Chemistry. Richard's D.Phil work was carried out in collaboration with the Forest Research Institute of Rotorua (under supervision of Dr John Ralph), and involved investigation of the synthesis and reactions of quinone methides. After a short post-doc at FRI, where he helped develop new HPLC and NMR methods for

wood resin analysis, he took up a 20 month post-doc at the University of Helsinki, with Associate Professor Gösta Brunow. The main area of research was the reactions of peroxyformic acid with lignin; the research being stimulated by the need to develop chlorine-free wood pulping and bleaching methods. As well as the pulping research, he investigated the use of 2D NMR for obtaining new structural information from polymeric lignin samples. Dr Ede will contribute to both graduate and undergraduate courses in organic chemistry, and will continue research into wood pulping chemistry, lignin structure (particularly the interaction between lignin and polysaccharides), and also natural product synthesis. He also hopes to build a sauna in his lab.

Drs Derek Smith and Brian Nicholson, and doctoral students Les Arnold and Nick Robinson attended the ICCC (Coordination Chemistry) Conference at Surfers' Paradise, Queensland, in the first week of July. It was encouraging to see a good representation of New Zealand scientists at the conference, mixing it with international chemists of high standing. Key speakers at the ICCC were Wolfgang Hermann, Alan Cowley, Mike Bruce, Tom Meyer, Jackie Barton and Jean-Pierre Sauvage. The varied social programme was well attended, especially the wine tasting held at Bond University.

Other Chemistry Dept staff members have been kept very busy with NZIC conference organisation, in particular Lyndsay Main, Ken Mackay and Derek Smith, who were the executive organising committee. A return to the quiet activities of Term III will probably come as a welcome rest! Dr Alan Langdon has departed for 12 months leave, two months of which will be spent at the University of Victoria, British Columbia, the remainder at the University of Waterloo, Ontario. Brian Nicholson commenced three months leave in July at the University of Adelaide. Associate Professor Malcolm Carr is taking a temporary break from Chemistry Dept teaching (for health reasons); his duties are currently being performed by new lecturing appointee Richard Ede, and part-time tutor Nick Robinson.

Otago

Visitors: Gordon Miskelly, a former PhD student of David Buckingham who has been at

California Institute of Technology with Prof. Nathan Lewis visited Otago in June. He spoke in the Chemistry Department and to the Branch where his talk was entitled "Cold fusion - hot science". This was a day to day account of events since 23 March with emphasis on his group's attempts to verify the claims of Pons and Fleischmann.

Gordon has now taken up an appointment as Assistant Professor of Chemistry at the University of South California in Los Angeles.

In July Prof. J. E. Drake from the University of Windsor, Ontario spoke to the Chemistry Department on "Coordination chemistry of main group elements".

Staff-movements

July: Brian Robinson and Jim Simpson each presented a paper at the IUPAC - sponsored Conference on Coordination Chemistry at Broad Beach, Queensland. Brian then went on to Melbourne to the Symposium on the use of platinum metals in cancer chemotherapy where he gave another paper.

Rob Smith was an invited speaker at a Gordon Conference in New Hampton, New Hampshire on Organic reactions and processes. His paper was "Mechanistic aspects of organocuprates".

David Hawke who recently completed his Ph.D with Keith Hunter has been awarded a post-doctoral scholarship at the University of Miami to work with Prof. Frank Millero on the thermodynamics of seawater.

Jim McQuillan has just completed eight months at the University of York, UK, working with Prof. R. Hester on applications of vibrational spectroscopy in electrochemistry. He is about to spend the remainder of his leave with Prof. S. Pons at the University of Utah carrying out FTIR studies with Hg electrodes.

August:

Barry Peake left for the Chemistry Department, Woods Hole Oceanographic Institute to study aspects of marine photochemistry and then for three months at the Scripps Institute of Oceanography, University of California to assess the use of EPR methods for determining transition metals in marine sediments.

Biochemistry Department

Pat Sullivan and Max Shepherd (Experimental Oral Biology, Dental School) travelled to Turkey in April to present papers at an international meeting on Candida.

Cont next page

BRANCH NEWS

Waikato

The Waikato Branch's contribution to National Chemistry Day, held back in late June, took the form of a radio talkback programme. Branch representatives **Peter Molan** (Univ. of Waikato), **Doug Wright** (MIRINZ) and **Mike Lowe** (Hamilton Analytical Laboratories) participated in the Mike Minogue Talkback Show on Radio Pacific (Waikato). Peter answered many listeners questions on such diverse topics as flavanoids, Royal Jelly and the medicinal properties of honey. One listener even suggested that chemists were on this earth for the good of humanity and had been placed here by the Almighty! Doug Wright and Mike Lowe, on together later in the morning, presented a more philosophical case for chemists, including the distinction that exists between scientists and technologists. Also, there was a dig at the ethical differences between chemists and those who commercialise their efforts (accountants) and at the way this often leads to the chemist receiving the bad publicity. Finally, the case made for some chemicals and their necessity to our current way of life was generally well received.

Dr Anthony Kirby, of Cambridge University, spoke to the Branch during August on the kinetics and mechanism of addition and elimination reactions that mimic enzyme reactions. Audience turnout and participation was high, with many from the biochemistry departments taking an interest.

The Branch's annual schools lecture was presented by **Dr R C Gardner** of the Dept of Cellular and Molecular biology, Auckland University. Dr Gardner described the DNA fingerprinting technique

in terms that the essentially lay audience could understand, and reviewed the sophisticated manipulations that are now possible with strands of DNA. Turnout from local colleges, particularly Hillcrest High, St John's and St Paul's Collegiate, was encouraging.

Manawatu

Arrangements for the Manawatu Chemical Trust have now been formalised with control of its funds being passed from the Branch committee to the Trust. Over the past two years the Trust has made numerous contributions for the purchase of equipment to schools in the Branch's area.

Attendance at Branch meetings appear to be on the increase. Subjects chosen have been popular with Institute members, as well as members of other organisations and students from the polytechnic and university. From some of these meetings, students have applied for membership of the Institute.

The year's activities started with visits by leading lipid research chemists from the Fats for the Future Conference, held at the University of Auckland during 12-17 February. On 20 February, **Professor Mike Gurr**, a nutrition consultant with the UK Milk Marketing Board, started the series of lectures with a combined Institute of Chemistry - Massey University Department of Chemistry and Biochemistry meeting. He spoke on the nutritional objectives of his group, the fats - cholesterol - coronary heart disease hypothesis and his current co-operative research topics. **Professor Frank Gunstone**, University of St. Andrews, Scotland, continued the Branch's

activities on 22 February with an excellent overview of the place of fats and oils in the World's economy. New seed oils as potential sources of specific fatty acids (eg. erucic and other long-chain monoenoic acids, lauric acid, v-linolenic acid and epoxy acids) and new methods for the structural analysis of these acids were described by Professor Gunstone.

Manawatu members also attended meetings organised by the research organisations in Palmerston North. On 21 February **Dr David Topping** (Division of Human Nutrition, CSIRO, Adelaide) spoke to a meeting organised by Biotechnology Division, DSIR, on the subject "How could dietary fibre affect plasma cholesterol?" At a meeting in Massey University's Department of Chemistry and Biochemistry, **Dr Marvin Bagby** of the US Department of Agriculture's Northern Regional Research Center in Peoria, Illinois, discussed research in his laboratory concerned with the development of new seed oils and new uses for these and "traditional" oils. The following day, **Professor Colin Ratledge** (University of Hull) visited local research organisations and presented a special seminar at Massey University on the biotechnology of lipids.

Dr Bagby visited New Plymouth on 20 February, where he addressed a meeting at the Ivon Watkins - Dow lecture theatre on aspects of work in his laboratory. While in New Plymouth, he paid a short visit to the Motonui gas-to-gasoline plant.

On the 16 March, the Branch organised a very popular barbecue meeting at which **Mr Malcolm Reeves** (Food Technology Department, Massey University) discussed "Chemistry's contribution to the production of the Bacchanalian liquid." Mr Reeves showed the way in which chemistry has influenced wine making, both in good and undesirable ways. The Branch had a change of venue for its meeting and this was the first at DSIR's Plant Physiology Division.

"The Mannosidosis Story: From Storage Disease to Designer Pharmaceuticals" was the title of a lecture presented at a Branch meeting on 27 April by **Professor Bob Jolly** of the Veterinary Faculty, Massey University. Professor Jolly showed how some basic research, originally of little or no commercial relevance, later became of major commercial importance.

Dr Don Llewellyn gave his

Presidential Address. "Where Did We Come From and Where Should We Go," to a Branch meeting on 24 May. **Dr Llewellyn** outlined the Institute's beginnings and development, with emphasis on the development of chemistry in the United Kingdom and the Royal Chemical Society. He then opened the meeting for suggestions as to what the Institute should do for its members in the future. A lively discussion followed. At this meeting **Dr Llewellyn** presented the Branch's prizes to the best third year students in the Department of Chemistry and Biochemistry, Massey University. **Michael Naim** received the chemistry prize and the biochemistry prizes were awarded to **Simon Greenwood** and **Andrew Flaus**.

Dr Llewellyn visited New Plymouth and Napier on 26 May and 2 June respectively for discussions with members in Taranaki and Hawkes Bay. In these centres he received industrial chemists' perspectives on the contribution of the Institute in their areas. This was an interesting change from meetings dominated by academic researchers.

Certain undesirable aspects of chemistry were presented to a meeting on 20 June by **Dr Graeme Sutherland**, Head of DSIR's Chemistry Division Illicit Drugs and Alcohol Section. In his lecture, entitled "Drug Abuse Control from a Drug Analyst's Perspective." **Dr Sutherland** covered a wide range of topics from cannabis to the latest designer drugs. He drew on his wide experience of drug investigation, including court appearances as an expert witness, to give a most interesting lecture that was appreciated by the audience.

The Branch presented 4 prizes to exhibitors at the Manawatu Science Fair. **A. Marsh** (Generic Drugs) and **N. Webb** and **E. Paul** (How do coal flowers grow?) won prizes in the Intermediate Section. The Senior Section prizes went to **G. Hollway** (Radiocarbon Dating) and **H. Codd** (Steroids). The judge, **Dr Margaret Brimble** (Department of Chemistry and Biochemistry, Massey University) said that this year there were many excellent exhibits with strong chemistry themes. Prizes were awarded on the scientific merit of the experimental nature of the projects and for excellent eye-catching presentations.

Cont next page

UNIVERSITY NEWS Cont . . .

Murray Grigor was in Brisbane in May for a meeting on Iron-binding proteins. An innovation at that meeting was the use of TV cameras to view posters while the audience was in the auditorium to hear the authors speak to their posters.

Iain Lamont attended a meeting on *Pseudomonas* in Chicago in July and then continued to UK until the end of August.

Warren Tate was a contributor to a meeting on the Ribosome in Montana in August and visited several laboratories in California.

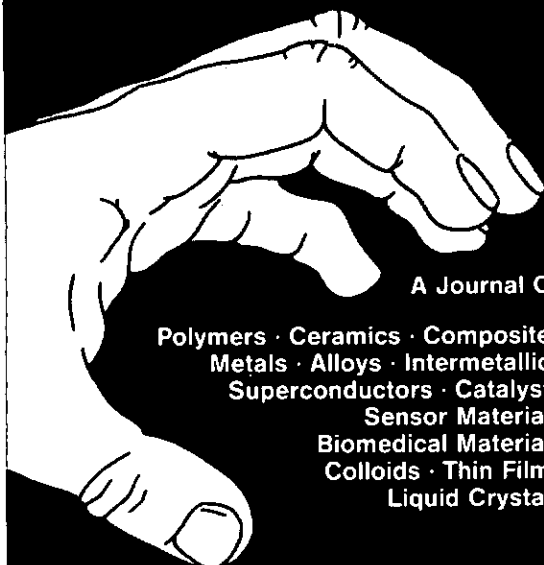
Ian Forrester left in May on three years leave of absence to

work in Biotechnology at Wisconsin.

Grants
Professor George Petersen's Programme Grant from the MRC has been renewed for four years from 1/7/89. Under the general title "Nucleic acid structure and function", the programme includes a study of the structure and function of two large introns from the Duchenne muscular dystrophy locus on the X chromosome and a continuation of studies on computer-aided interpretation of protein and nucleic acid structures. The programme employs three full-time and three part-time staff.

ADVANCED MATERIALS

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NEW BUILDING OPENED FOR BIOTECHNOLOGY DIVISION, DSIR

Biotechnology Division's new building for cellular and molecular biology research, the John Lyttleton Laboratory was opened on Thursday 22 June by the Rt Hon R J Tizard, Minister for Science and Technology, in Palmerston North.

The John Lyttleton Laboratory is named after Dr John Lyttleton who was a staff member of biotechnology Division from 1947 to 1975. Dr Lyttleton was trained in physics and chemistry, and conducted outstanding research in the areas of cellular and molecular biology.

The 12 laboratories in the new building are occupied by researchers into plant, animal and microbial molecular biology, microbial physiology, immunology, plant and insect interactions and the electron microscope unit. Research on plant and food biochemistry, nutrition and animal physiology is continuing in existing buildings.

Long term objectives of plant molecular biology research involve the identification and manipulation of genes involved in nitrogen assimilation and in the production of compounds conferring insect resistance on plants.

A new hybridoma cell culture facility is housed in the new laboratory building. Monoclonal antibodies have played an important part in the identification of promoters of plant genes, and are now being used in the development of test kits for the detection of insecticide and pesticide residues in export crops. Monoclonal antibody production is also

an important component of a research contract recently signed with the New Zealand Wool Board.

Biotechnology Division has been involved in animal research from its beginnings in 1938, and this involvement is continued in the John Lyttleton Laboratory. The Animal Gene Technology programme has as a key objective the development of DNA probes for use in an international gene mapping programme for sheep.

The programme on microbial physiology and molecular genetics continues the focus on cellular and molecular biology within the John Lyttleton Laboratory. Part of this research programme is the development of malo-lactic cultures which can be used to consistently produce high quality wines. Much of the research in this programme is carried out in association with Massey University.

Strong inter-relationships with Universities and other organisations is a key aspect of work being carried out in the John Lyttleton Laboratory. This is clearly demonstrated in the Electron Microscope Unit which was established at biotechnology Division in 1965 to service the electron microscopy needs of the research community in Palmerston North. The Palmerston North science campus has had one of the most successful Electron Microscope units in the nation and this is now located in the John Lyttleton Laboratory.

Avis Hughes.



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BRANCH NEWS Cont . . .

Dr Roger Slack, Deputy Director of DSIR's Plant Physiology Division was recently elected Fellow of the Royal Society. The Fellowship recognises Dr Slack's research, along with that of Dr H. Hatch of Nottingham University School of Agriculture, in discovering the C4 pathway of photosynthesis in plants. This pathway is an environmental adaptation of some plants, such as tropical grasses, to withstand severe drought conditions. Dr Slack's current research is aimed at improving malting barley, the raw material of beer.

Dr Tony Kirby (University Chemical Laboratory, Cambridge, England) addressed a Branch meeting on 1 August, dis-

cussing "Structure and Reactivity in Intramolecular and Enzymic Catalysis." He showed how the detailed mechanisms of efficient intramolecular reactions of simple compounds may be elucidated and the compounds modified to increase the efficiency (i.e. rate) of the reactions. This approach may result in the designing of more efficient catalysts, which possibly can be extended to the better understanding of enzymic reactions. Dr Kirby illustrated his lecture with many interesting reactions, including the addition of nucleophiles to unactivated alkenes and ionised carboxy groups and the rapid hydrolysis (in water near pH 7 and 37°) of amides, esters, acetals and phosphate esters.

BOOK REVIEWS

ORGANOMETALLICS, A CONCISE INTRODUCTION, By **Christoph Elschenbroich and Albert Salzer**, VCH Publishers, Weinheim and New York, 1989. (479 pages, £47.75 hbk, £20pbk).

It all began in Paris when in 1760 Cadet de Gassicourt prepared cacodyl oxide from arsenic trioxide and potassium acetate. Today, the chemistry of metal-carbon bonds is one of the most successful areas combining organic and inorganic chemistry. This textbook on organometallic chemistry developed out of a one semester lecture course to students. It is outstanding compared to other books on this subject and an ideal introduction for master of science students in this exciting field. It starts with a short historical outline and current trends in organometallic chemistry. The authors then divide the major part into main group organometallics and organotransition metal compounds by choosing carefully the most relevant and illustrative reactions, compounds and structures. Somewhat more specialised material is presented in sections called "Excursions", like ESR, NMR and Mössbauer spectroscopy, the Gillespie-Nyholm model, photochemical concepts like the metal to ligand charge transfer and many more. Important theoretical tools like the isolobal concept devised by R. Hoffmann, the 18 valence electron rule developed by N.V. Sidgwick and the concept of frontier orbitals developed by K. Fukui are clearly presented using many examples to help students to understand this rather complex part of modern chemistry. Special sections include metal-metal bonds, clusters and catalysis. Important recent developments like the preparation of organotransition metal compounds in high oxidation states (W. A. Herrmann) or stabilisation of highly reactive species by metal coordination (W.R. Roper) are included. The last chapter, organometallic catalysis, is nicely presented explaining in detail important processes in industry like the Fischer-Tropsch reaction or the Wacker process. In the running text the author's name and year is linked to the facts described, so the original paper can be easily obtained via consultation of Chemical Abstracts. At the end important key papers and review articles are listed. On the whole, this book is highly readable and designed for students in third year chemistry.

Elschenbroich and Salzer have created a classic of its kind. (P. Schwerdtfeger).

STRUCTURE AND REACTIVITY, J. F. Liebman and A. Greenberg (EDS), VCH Publishers Inc., New York, 385 pp., £66(UK), 1988.

Structure and Reactivity is the tenth book in a series entitled "Molecular Structure and Energetics", edited by Liebman and Greenberg. The breadth of the titles, both of the series and of the present multi-authored volume does not augur well for the focus of the series or individual volumes within it, and it is not surprising that Structure and reactivity lacks coherence amongst its chapters.

Nevertheless, those chapters on which I am competent to comment are well-written, authoritative, and are worthwhile additions to the review literature. Three chapters deal with strained organic molecules but from different viewpoints, and two with electrostatic potentials. Polar effects on the lability of carbon-carbon bonds, including material on heterolytic C-C bond rupture, receives a timely review. Another chapter deals with the application of experimental molecular structure determinations to assessment of resonance structure contributions (a static concept) whilst dynamics are highlighted in a chapter on UV photoelectron spectroscopy and matrix isolation. Finally, there is a chapter on molecular aspects of explosive materials which deals largely with the physical chemistry of detonation.

I cannot imagine that the whole of this book would appeal to any reader. It thus belongs on library shelves rather than in individual collections, a point reinforced by the quoted price. The blend of topics, and approaches, theory and experiment does not in my view combine into the coherent volume that the editors aimed for in their foreword statement for the series.

D.J. McLennan
Department of Chemistry
University of Auckland

ORGANOMETALLIC CHEMISTRY—AN OVERVIEW
by **John S Thayer**

(VCH Weinheim, Basel, Cambridge, and New York. (1988) 170 pages 68 DM)

In 1982, "Comprehensive Organometallic Chemistry" was published in nine massive volumes. At that time, there were nearly 1000 entries in the "index

of reviews". Thus Professor Thayer shows great courage in attempting to give an overview of Organometallic Chemistry in 160 pages. There are 14 rather short chapters. After an introduction, there are chapters on synthesis, ionic metal-carbon bonds, and electron-deficient species. Sigma bonded species are divided among three chapters (reactive metals, heavy metals and metalloids) as are synergic bonds (divalent carbon, unsaturated hydrocarbons, and polynuclear compounds). Then come three chapters on organometallic compounds in biology (covering medicinal, biochemical, toxicological, biocidal and environmental aspects). An Afterword covers recent work close to the publication date, and there are author, subject and compound indices.

Clearly every reader will have a different view on which topics to emphasise and which to neglect, so the book must be judged in the context of the author's expressed aim. He writes "there is no currently extant book on Organometallic Chemistry for the person with a reasonably good background in Chemistry who may be interested in learning something about the subject." He goes on to say that "the author has emphasised topics not readily

available elsewhere". My unease about this book arises from the conflict between these aims. Is there actually a reader with a reasonably good background in chemistry, who will read up "readily available" topics, but who also needs some of the very basic information which is included in the book. Is such a reader, for example, unacquainted with five-coordinate pyramids or the *cis* and *trans* isomers of disubstituted octahedra? Yet diagrams of these make up one quarter of the two pages devoted to the massive topic of organotin compounds! Similar uncertainties about the level of treatment arise in most chapters.

In accord with the second aim, the sections on very broad and important topics like "The Grignard Reagent" are short and rather general. Indeed the limitations of the Grignard Reagent are best gleaned from the discussion of reactions of competing organometallic agents. The accounts of other major areas of organometallic chemistry such as organosilicon chemistry, organophosphorus chemistry, transition metal carbonyls, are similarly brief or peripheral. By this disproportionately brief treatment

Cont next page

OBITUARY

Nancy Elliot Sirett and Thomas Henry Kennedy

The death of two long-standing members of the Otago Branch of the Institute occurred during the month of June. Both were graduates of the Department of Chemistry of the University of Otago who spent their careers working within the Medical School in Dunedin where they were able to contribute much to medical research both in New Zealand and internationally. Nancy graduated in 1954 and joined the MRC Endocrinology Research Unit in 1954 working with Dr H. D. Purves. On his retirement in 1973, Nancy transferred to the Department of Physiology with Professor J. Hubbard until her own retirement in 1987. Nancy was elected a member of the Institute in 1960 and a Fellow in 1981. In 1987 she was awarded a DSc by the University of Otago for her research.

Tom graduated in 1938 and joined the MRC Thyroid Research Unit. Here he made many contributions to thyroid endocri-

nology before he eventually retired from the MRC Immunopathology Group in 1979 where he had been working for several years with Dr D. Adams. He was elected a member of the Institute in 1939 and a Fellow in 1980.

Both Tom and Nancy played an important part in the development of medical research within New Zealand. Their background in basic science ensured a rigourousness in their work that was passed on to colleagues around them. Tom was Otago Branch Secretary for the Institute for many years. Tom contracted polio as a child and thereafter his health was never strong. He had a very caring attitude to those, particularly students, with whom he came in contact. Nancy had an enthusiasm for her work and life in general that was infectious. Her retirement was tragically cut short when she contracted cancer. Both Tom and Nancy will be missed by their many friends and colleagues in Dunedin and throughout the country.

COVER STORY

PHILLIPS ANALYTICAL'S NEW PU8625 SERIES: UV/VISIBLE SPECTROPHOTOMETERS MADE SIMPLE

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BOOK REVIEWS Cont from previous page

of the main core areas of organometallic chemistry, the author has drawn an unbalanced and often oversimple picture.

One strategy expected from an author writing an overview would be to key very clearly into the literature with ample references. In some areas this has been achieved quite nicely. Thus the chapters on "Organometallic Compounds in Biology" are accompanied by a reasonable number of references to mainly modern works. In contrast, the chapter on synthesis is of very little value to a reader who wishes to follow through to more detail. Approximately 18 methods are indicated, with 42 equations, but there are only 12 references and three of those are to one method, the direct synthesis. There is no indication of the relative importance of different methods. Thus the huge topic of organometallation is covered in only two equations and a few lines, little more than devoted to a restricted

method like reductive carbonylation.

Not only does the author's approach lead to very uneven treatment, but the attempt to discuss quite complex topics in a short space produces oversimplification and some confusion. This is particularly evident in the section on electron deficient compounds. The author explains why these are better described by three-centre two-electron bonds, but the only specific example illustrated is tetra (methyl lithium) which is, at very least, an eight-centre eight-electron system. Similar problems arise in the chapters on pi-bonded transition metal carbon compounds (termed metal-carbon synergistic species). The bonding description is at a very basic level for terminal CO and olefins, incomplete for bridging carbonyls, and non-existent for ligands like cyclopentadiene.

Apart from a few of the diagrams, the presentation is very

clear and of high quality. The "Afterword" is a laudable attempt to cover material appearing close to publication day, although this is not always integrated with the earlier text.

Despite the above criticisms, there are many good features of the book. The enormous width of Organometallic Chemistry is well indicated, there are many interesting pieces of chemistry recorded and an adequate introductory view of the less common areas is given. For a New Zealand student the book would be of some value in the library, and as a guide to writing an essay on an organometallic topic. While, in the view of this reviewer, the author has not really succeeded in his heroic endeavour, he is to be congratulated for making the attempt. This is the sort of book where the 2nd edition is likely to be very much better than the first. A revision which led to a more even treatment and to much stronger links with the literature would be a publication of considerable value.

K M Mackay

Infra-red Spectroscopy:

A three day practical workshop course supplemented by a self-paced learning text.

Date of Course: November, Tues 21st - Thurs 23rd

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If you would like further information on this course, or to register as a participant, please contact: Bruce Fraser, Faculty of Science and Engineering, ATI, Private Bag, Auckland.

Chemistry in New Zealand 1989 Year Book

YEARBOOK

Company Listing

The main listing has addresses and phone numbers plus a brief description of each company. Companies are listed in alphabetical order. Each company is given a reference number by which it is referred to in subsequent listings. The letter code indicates the sections in which products or services offered by the company can be found 106

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HOW TO USE THE DIRECTORY:

If you know the product you are interested in e.g. a pH meter turn to the appropriate section (in this case Section A, Laboratory Equipment). Brand names of pH meters are listed and referenced back to the Company Listing see example below.

Reference number used in Sections A-F	Head Office	Companies products or services appear in these Sections
(117)	SCI-MED (NZ) LTD 24 Forth Street, Dunedin P.O. Box 321 Dunedin P.O. Box 68232 Auckland P.O. Box 508 Wellington P.O. Box 411 Christchurch	(AB) Phone 775-531 Phone 793-993 Phone 845-809 Phone 65-463
	<i>A wholly owned subsidiary company of the EBOS Group, supplying New Zealand and the South Pacific with scientific instrumentation, fully supported by our technical, marketing and service team.</i>	
	Branches	

IMPORTANT ADDENDUM

Since final compilation of this directory many agencies handled by Roche Products NZ Ltd (No.110) including "Kontron", "Schiller", "Delmar Avionics", "Gould" and "Lunar" are now handled by:

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1 ABELS LIMITED **C**
 101 Carlton Gore Road, Newmarket
 Private Bag 18, Newmarket, Auckland.
 Phone 548-145
 Fax 523-3131

Wellington Phone 689-216, Fax 682-174
 Christchurch Phone 494-976, Fax 499-307

Refiners and producers of edible oils and fats for NZ and export markets. Advanced analytical laboratory used for research, quality control and consulting work.

2 ADVANCED ANALYTICAL **A**
 1/6 Aegus Place, Takapuna
 P.O. Box 36-280, Northcote. Phone 419-1448,
 Fax (09) 418-0022
Suppliers and servicers of scientific instrumentation for chemical analysis.

3 AHI BENCHLINE INDUSTRIES **B**
 AHI Benchline Industries has ceased to operate.
 Their products are now manufactured by EUROFORM
 BENCHTOP see entry 184

4 ALLIED CORPORATION (N.Z.) LTD
 P.O. Box 39-189, Auckland West
 Phone 771-313

5 ALLTECH ASSOCIATES INC **AB**
 P.O. Box 10-0352 Nth Shore Mail Centre
 Takapuna, Auckland 9. Phone 444-3230
 Fax 444-2399 Free Phone 0800-652-766
Subsidiary of major US chromatography supplier, and distributors of chromatography products for other internationally recognised manufacturers.

6 ALPHA BIOLOGICALS **C**
 6 Fencible Drive, Howick, Box 38-213 Howick.
 Phone 534-4424 Fax (09) 534-4424
Microbiological quality control laboratory. Telrac registered for testing foods, cosmetics, waters, sewage and effluents.

7 ALPHATECH SYSTEMS LTD & CO. **A**
 35 Scarborough Tce, Parnell, Auckland
 P.O. Box 37-583, Parnell. Phone 770-392
 Fax 398-514
 63 Mills Road, Brooklyn, Wellington Phone 893-905

Importers and distributors of scientific and medical equipment.

8 AJAX CHEMICALS
 17 Olive Road, Penrose, Auckland. P.O. Box 12-645 Penrose.
 Phone 592-593 and 596-956 Fax (09) 594-856

9 ANALABS **C**
 M/657 Great South Road, Penrose Phone 597-265
 P.O. Box 17-198 Greenlane. Fax (09) 599-630
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10 APPLIED INSTRUMENTS LTD
 P.O. Box 62-010, Sylvia Park, Auckland
 Phone 592-633
Importers and distributors of industrial instrumentation.

11 ASL CAMBRIDGE **C**
 (Analytical Services Ltd)
 85 Queen St, Cambridge
 Private Bag, Cambridge
 Phone (071) 274-409
 Fax (071) 274-495

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12 ALLAN ASPELL & ASSOCIATES LTD **C**
 34 Constellation Drive, Mairangi Bay.
 Phone 478-2962

Public analysts and scientific consultants. Routine analysis and specialist investigations. Telarc registered laboratory. Microbiologists.

APPLIED GEOLOGY ASSOCIATES LIMITED
 see no. 135

AQUA TREATMENT LTD
 see no. 183

13 AUCKLAND INDUSTRIAL DEVELOPMENT DIVISION (DSIR) **C**
 9 Albert St, Auckland
 P.O. Box 2225, Auckland. Phone 34-116 Fax 370-618

A division of the industrial group of DSIR, in the field of material science, corrosion, welding, metallurgy, and surface analysis.

14 DELETED

15 AUCKLAND VALVE & FITTING CO. LTD **AB**
 26 Ryan Place, Manukau City, Auckland
 P.O. Box 97-687, Sth Auckland Mail Centre.
 Phone 278-6164 Fax (09) 277-9069

Christchurch Valve & Fitting Co. Phone 381-830
 New Plymouth Phone 79-535
Specialists in valves and fittings and the installation of laboratory gas systems.

16 AUSTIN CHALK CO. LTD
 1 Stone St, Kaiapoi
 Phone 6119
 Works, View Hill, Oxford Phone 24-349
Manufacturers of texture surface coatings, contract manufacturers, manufacturers of industrial minerals and fillers, agricultural and industrial lime products, building products, clays, bone flour, and anti-graffiti coatings.

17 AVERY NEW ZEALAND LTD **A**
 21-23 Pretoria Street, Lower Hutt Fax (04) 698-822
 P.O. Box 44-155 VIC, Lower Hutt. Phone 698-588

7C First Avenue, Whangarei Phone 84-872
 17-19 Teed St, Newmarket, Auckland Phone 502-072
 64 Commerce St, Hamilton Phone 75-459
 2 Newton Trade Centre,
 Newton Rd, Mt Maunganui South Phone 52-318
 322 Aberdeen Rd, Gisborne Phone 74-479
 27 Carlyle St, Napier Phone 54-602
 194 Courtenay St, New Plymouth Phone 83-907
 57 Ingestre St, Wanganui Phone 56-064
 3/1005 Tremaine Ave, Palmerston North Phone 88-680
 80 Kingsley St, Christchurch Phone 65-119
 62 Sturdee St, Dunedin Phone 53-227
 42 Gloucester St, Nelson Phone 87-798
 1 Bank St, Timaru Phone 89-488
 39 Gala St, Invercargill Phone 84-737

Shops 11 & 12, Raiwaga Shopping Centre,
 Suva, Fiji Phone 383-423
Manufacturers, importers and suppliers of electronic and mechanical weighing and counting machines, including analytical and top-pan balances.

18 AWA NEW ZEALAND LIMITED
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Phone 370-159 Fax (04) 379-412

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P.O. Box 8421 Christchurch
P.O. Box 5070 Dunedin

Phone 760-129
Phone 388-160
Phone 777-485

Suppliers of scientific, medical and electronic engineering instruments components and systems.

19 BASF N.Z. LTD
P.O. Box 407, Auckland
Phone 644-371

P.O. Box 13248, Christchurch
P.O. Box 44032, Lower Hutt

Phone 50-849
Phone 693-069

Importers and manufacturers representatives.

20 BAYER N.Z. LTD
Marine Parade, Petone, P.O. Box 38-405 Petone
Phone 688-176 Fax (04) 688-181

27-33 Lansford Cres, Auckland
105 Rutherford St, Christchurch
203 S Nelson St, Hastings

Phone 889-159
Phone 843-136
Phone 60-259

Subsidiary of Bayer AG Leverkusen.

**BEHRING DIAGNOSTICS : HOECHST
NZ LTD.**
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21 BDH CHEMICALS NZ LTD
P.O. Box 1246, Palmerston North
Phone 82-038 Fax (063) 67-311

Importer of laboratory chemicals.

22 R.A. BELL INSTRUMENTS LTD
P.O. Box 12-279, Wellington.
Phone 764-516

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23 BETA CHEMICALS (N.Z.) LTD
9 Lorien Place, East Tamaki, Auckland
P.O. Box 58-034, East Tamaki
Phone 274-4574 Fax (09) 274-5365

Wellington
Christchurch

Phone 683-936
Phone 666-882

Manufacturers of adhesives, sealants, plastisols, screen printing inks, specialised paints, solvents.

24 BETZ NEW ZEALAND
P.O. Box 4200, New Plymouth East
Phone 79-738 Fax (067) 89-850

11 Paniar Cres Hamilton, Box 13-029 Hamilton

Phone 68-904

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25 BLAXALL SCIENCE COMPANY
P.O. Box 25-095, Christchurch
Phone 662-828 Fax (03) 652-072

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26 BROWN & DUREAU (N.Z.) LTD
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Phone 608-438

12 Fifeshire Ave, Wellington. Phone 850-398
453 Asaph St, Christchurch. Phone 64-336

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A 27 ROBERT BRYCE & CO. LTD
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P.O. Box 30-145, Lower Hutt. Phone 683-559

72 Hayr Rd, Mt Roskill, Auckland 4

P.O. Box 27056, Mt Roskill
Cnr Phillips & Leeds Sts, Christchurch
P.O. Box 1691, Christchurch

Phone 656-169

Phone 60-752

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28 G. BUCHAN WATER TREATMENT
92 Ellice Rd, Glenfield, Auckland
P.O. Box 65-040, Mairangi Bay. Phone 444-8209

Involved in all aspects of chemical metering and control for water treatment and other industrial applications. Also involved in sewage processing with extended aeration.

29 CARBORUNDUM N.Z. LTD
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P.O. Box 30-069, Takapuna North. Phone 444-3860

Manufacturers of all coated abrasives, some bonded abrasives and some nylon abrasives.

CARINA CHEMICAL LABORATORIES LTD
See No. 139

30 CASTROL N.Z. LTD
P.O. Box 11-047, Wellington
Phone 843-978 Fax (04) 842-044

Port Rd, Seaview, Lower Hutt

Phone 683-049

Cnr Hamer & Jellicoe Sts,
Freemans Bay, Auckland

Phone 796-460

504 Cranford St, Papanui, Christchurch

Phone 526-099

Manufacturers and marketers of lubricants and allied products.

31 CATOLEUM NEW ZEALAND LTD
44 Cryers Rd, East Tamaki, Auckland
Phone 274-5032

Suppliers of chemicals and technical services in the areas of water treatment for boilers, cooling systems, clarifiers and effluent systems. Also process chemicals for paper mills, refineries, petrochemical plants and the mining industry.

32 CAWTHON INSTITUTE
98 Halifax St, Nelson, P.O. Box 175
Phone 82-319 Fax (054) 69-464

P.O. Box 38-213, Howick, Auckland

Phone 535-9024

Independent scientific research institute offering consulting and testing services in chemistry, microbiology, biotechnology and environmental consulting, TELARC registered in chemistry and microbiology.

CERAMIC ENGINEERING LTD
See No. 140

AB 33 CHEMBY CHEMICALS LTD
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Takapuna. Phone 444-4650 Fax (09) 444-4285

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34 CHEMICAL CLEANING LTD
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201-203 Fraser St, Timaru

Phone 45-026

Suppliers of commodity chemicals, proprietary detergents, fungicides, bottle washing compounds, aluminium echants, bleaches and sequestrants.

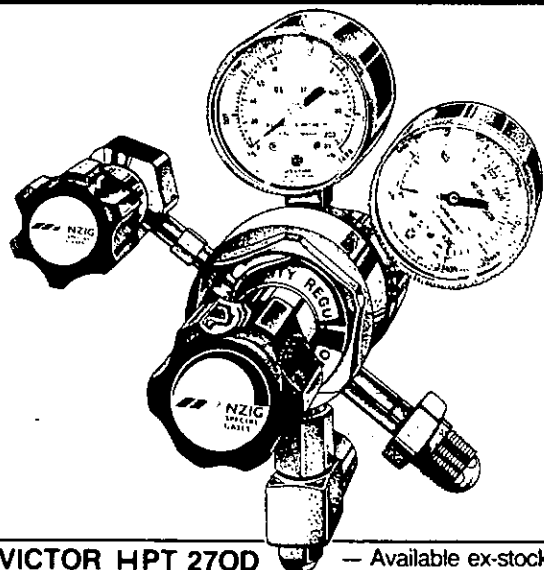


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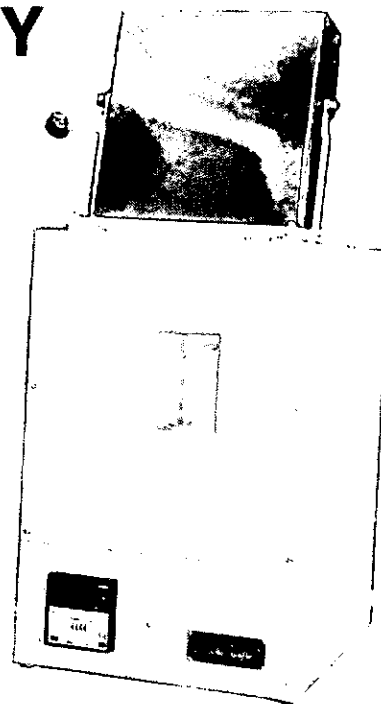
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39 CHEMTEST LABORATORIES
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40 CIBA-GEIGY (N.Z.) LTD
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Manufacturers of silicone fluids, resins, release agents, antifoams, and other silicone products.

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48 DU PONT (N.Z.) LTD
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49 EBBETT AUTOMATION LTD
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50 ELECTRIC MEASUREMENT & CONTROL LTD
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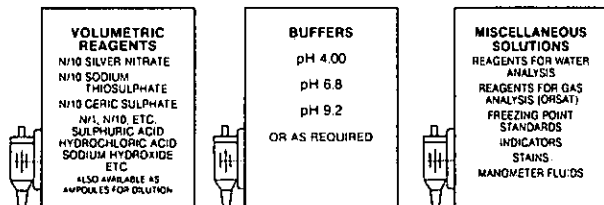
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ADMINISTRATOR HOUSE, 44 ANZAC AVENUE,
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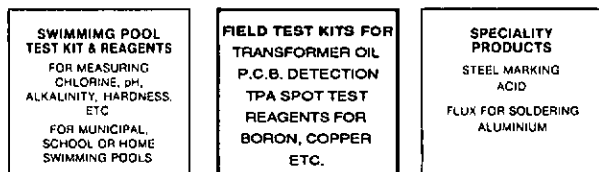
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65 A.C. HATRICK (N.Z.) LTD

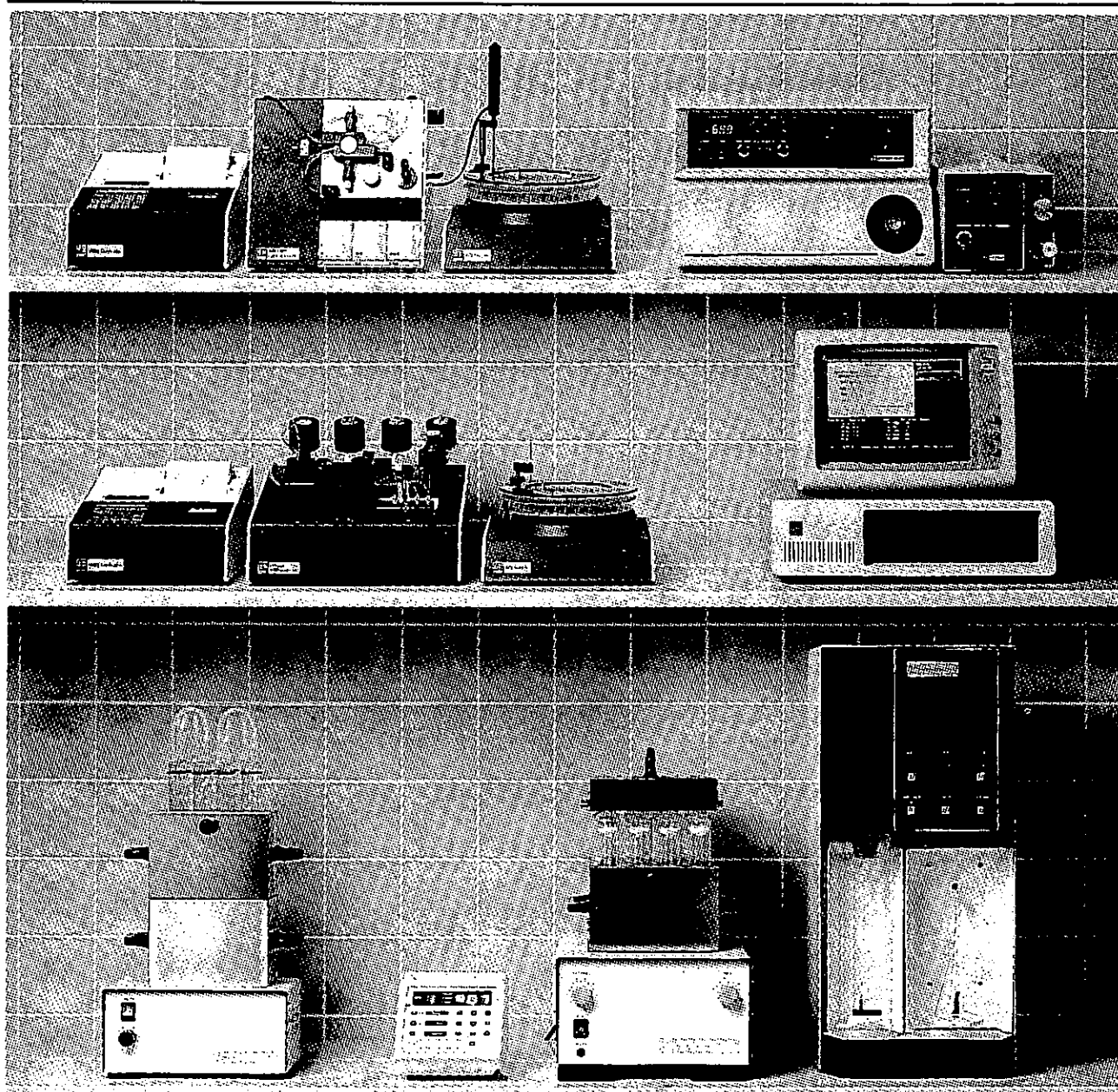
P.O. Box 2359, Auckland Facsimilie (09) 797-979 Phone 32-695
 Avondale Plant, Patiki Rd, Avondale Phone 887-007
 Facsimilie (09) 881-066
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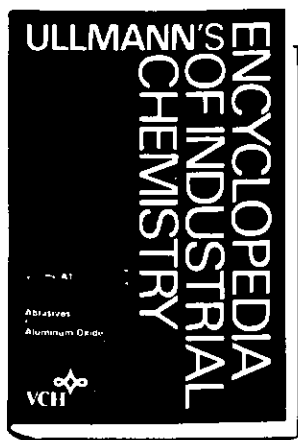
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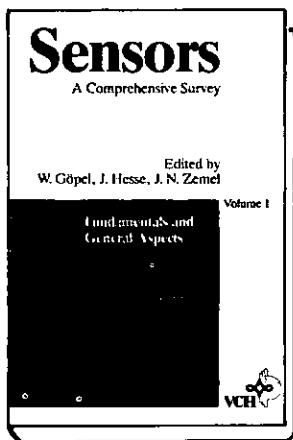
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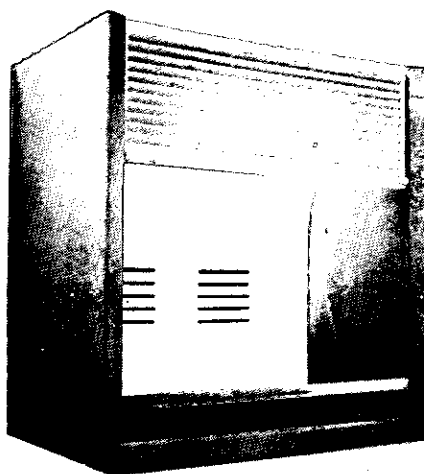


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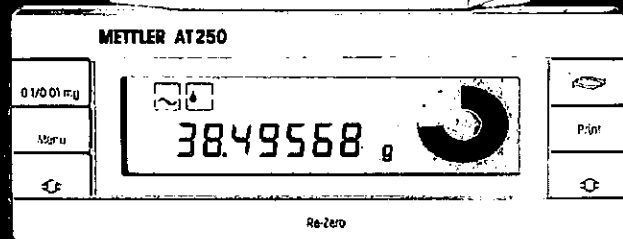
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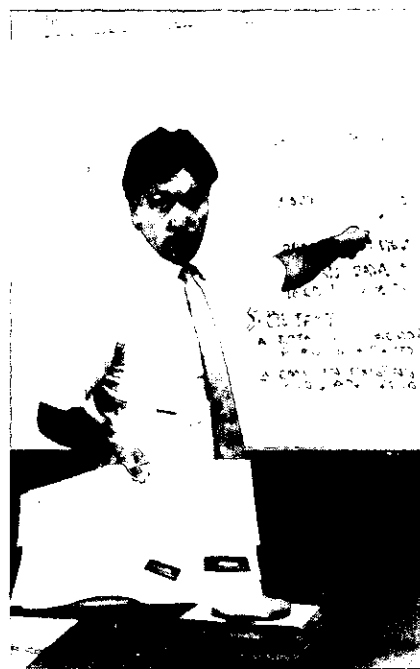
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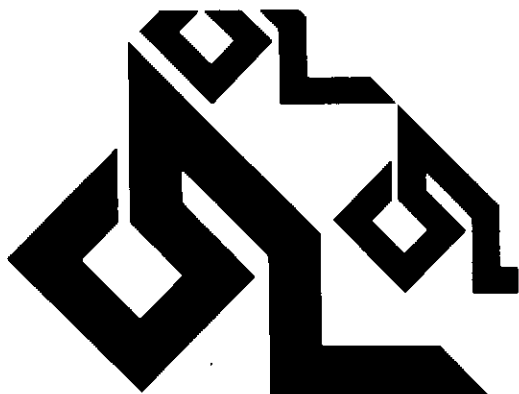
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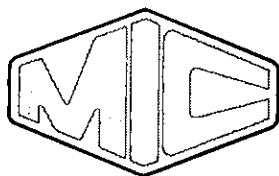
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SECTION C — CONSULTANTS

1 Abels Ltd

Oil and fat analysis. Instrumentation: GLC, AA, wide-band nmr, uv-vis.

6 Alpha Biologicals Ltd

Telarc registered for the microbiological testing of foods, cosmetics, waters, sewage, effluent and trade wastes. Microbiological quality (including sterility) of veterinary preparations. Plant hygiene evaluation. Instrumentation: Laminar flow cabinet, microscopes, incubators, analytical balances, centrifuge, water baths, pH meter, Seward Stomacher, freeze drier, membrane filtration equipment etc.

9 Analabs

Geochemical analysers including fire assay. Water analysis, coal and peat analysis. Pharmaceutical, veterinary and agricultural product analysis. Industrial trouble shooting. Arson investigations and blood alcohol analysis. Instrumentation: AAS x 2, accessories including Hg vapour and continuous hydride apparatus, uv-vis, GC with FID and ECD and computing integrator, radial compression HPLC with variable wavelength UV detector and computing integrator. Automatic calorimeter, adiabatic calorimeter, proximate analyser, high temperature ultimate analyser, US Bureau of Mines Fischer assay apparatus for fuel reserve evaluation.

11 ASL Cambridge (Analytical Services Ltd)

elements of nutritional interest, fertilizers, foodstuffs, nutrient solutions, potting mixes and water for horticultural and domestic use. Telarc registered for soil, plant, potting mix and nutrient solutions. Instrumentation: AAS, uv-vis.

12 Allan Aspell & Associates Ltd

Chemical and microbiological analysis (environmental and industrial). Chemical consultants. Product development. Laboratory chemicals. Water and effluent treatment. Instrumentation: AAS, uv-vis (scanning), fluorimeter (scanning), furnace, pH and ion selective electrodes, conductivity meter, GC (FID, EC, NP), integrator, incubators.

13 Auckland Industrial Development Division

Consulting services in the fields of quality control and quality assurance. Metallography, mechanical testing of metals alloys and plastics, corrosion testing. Failure analysis, metallurgical examinations and investigations, contract research and development work for industry, manufacturers and government.

24 Betz New Zealand

Engineering service programmes for water and process systems.

28 G. Buchan Water Treatment

Water treatment plant design and equipment sizing, potable, effluent, sewage.

32 Cawthron Institute

Food and beverage analyses.

microbiological and biological testing, water quality and trade wastes, trace elements, wood and forestry industries, fishing industry, pesticide residues and formulations, soils, solid fuel burners, consumer products environmental consulting. Instrumentation: AAS (3x), GC (5x) with FID, ECD, FP, TCD, i.r., uv-vis, total organic carbon, HPLC (2x), flame photometer, Kjeldahl, freeze drier, incubators, microscopes, centrifuges (3x), scintillation counter, ATP photometer, laminar flow cabinet.

35 Chemical Service Laboratories (1985) Ltd

General analytical services including most instrumental techniques. Plant, animal product, water, metal drug analyses including evidential blood alcohol analysis. Formulation and product development, process development and quality assurance. Industrial and domestic bacteriology, including plate counts, culturing and identification of organisms. Instrumentation: uv-vis, IR, GC, HPLC, AAS.

39 Chemtest Laboratories

Analytical services for water, soils and plant tissues. Instrumentation: AAS, visible spectroscopy.

43 David E. Cooper

Analysis and treatment of water and waste water, air pollution and control. General laboratory apparatus, refractometer universal measuring bridge, automatic sampler, timing switchgear, 6 gang stirrer, specific ion meter, conductivity meter, ORP flowthrough sensor, transmitter recorder, turbidimeter, B.O.D. manometric, pilot and bench scale plant.

44 P.J. Dawson Laboratories Ltd

Analysis of pesticides and mycotoxins, amino acids and vitamins. General industrial consulting. Instrumentation: GLC (with FID, EC and N-P detectors), HPLC (variable uv), uv-vis.

51 Email Industries

Contamination control laboratory. On site certification by Telarc certified personnel for all types of laminar flow work stations.

55 Farmers Fertiliser Ltd

The services of the laboratory (Telarc registered) is available for the analysis of fertiliser, acids and sulphates. (Laboratories at Whangarei, Otahuhu, Morrinsville and New Plymouth.)

57 Flinders Cook (Technical Services) Ltd

General analyses of solvents, oils, fuels, pharmaceuticals, foodstuffs, blood alcohols, solvent residues, food oils, plastics and monomers etc. Instrumentation: GLC (with integrator), AAS, infra-red, uv-vis, HPLC, Karl Fischer, pH, selective ion, refractometers, Brookfield viscometers.

58 Fort Richard Laboratories Ltd

Microbiological consultancy.

60 Geochemistry (VUW)

Geochemistry. Mineral characteristics and identification, analysis, mineral reactions, utilisation and processing. Petroleum geochemistry, organic and sedi-

ments. Instrumentation: x-ray diffraction, x-ray fluorescence, Mossbauer spectroscopy, electron microscopy, AAS.

63 W. Grayson & Associates Ltd

Routinely undertake analyses of adhesives, agricultural chemicals, compressed gases, detergents, disinfectants, food chemicals, metals and alloys, pharmaceuticals, polymers, solvents, surfactants, water treatment chemicals, water, soil, wood (CCA treated), geochemical analyses, food, dairy products, microbiological tests, hygiene of industrial plant and equipment, ceramicware testing, forensic investigations, plastics consultants. Instrumentation: 3 x GLC, 4 x HPLC, uv-vis, ir, furnaces, balances, incubators, autoclave, microscopes, stomacher, Laminar flow cabinet, auto Kjeldahl system, Karl Fischer apparatus, polarimeter, refractometer, flash-point apparatus, air drying ovens, vacuum ovens, viscometers, muffle furnace, centrifuges, Perkin Elmer mercury analyser, 3 x AAS with vapour accessories and a wide selection of AAS lamps.

67 Hazards Analysis Ltd

Assessment of dust explosion, vapour explosion and toxicity hazards in the workplace, use of HAZAN and HAZOP safety analysis. Instrumentation: particle size and moisture content determination, flammable and toxic vapour measurements.

68 Healing Industries Ltd.

Consultancy and advice in electroplating, anodising and phosphating.

74 Independent Service Laboratories

Chemicals analysis with industrial applications. Geochemical analysis with respect to mining/exploration work including sampling, onsite work and particle sizing. Consultants to ready mix concrete producers in supplying expertise and staff to enable plants to comply with NZS 3104/3112/3121 statistical analyses of strength tests results by computer. Expertise in contract research projects. All results reporting is computerised.

77 Ipsco

Telarc certified to carry out HEPA and clean room testing. Particle counting, cold d.o.p. photometers.

78 Ivon Watkins Dow

Low level organics analysis. Identification and quantification using GC/MS. Contract manufacture and pilot scale development. Instrumentation: GC/MS, GC, HPLC. Also, all types of process equipment.

92 Mooyman and Hornby Laboratories Ltd.

Water, soil and plant analyses. Instrumentation: AA, uv-vis, flame photometer.

97 NZ Industrial Gases Ltd

Sampling and analysis of gases.

Leak detection, system purity checks. Preparation and analysis of gas mixtures. Sourcing special gases for supply to laboratories and industry. Instrumentation: GC with FID, TC and ultrasonic detectors. IR with gas cell. Trace oxygen meters. High capacity, high accuracy balances. Sampling cylinders.

186 Pearson Biologicals

A TELARC registered laboratory offering comprehensive microbiological testing and consultancy for the food and cosmetic industries, for the supplier of water for drinking or industrial use and for those concerned with the quality of air and water in the working or leisure environment.

103 Plasfab Installations 1977 Ltd

Design and/or consultancy for laboratory fume cupboards, exhausts and associated equipment.

105 Portals New Zealand Ltd

Chemical analysis of waters and effluents. Instrumentation: AAS, uv-vis, pH, conductivity, nephelometry, filtration.

106 Processed Chemicals Industries Ltd

Analyses of water, soils and plant materials. Advice on water purification.

113 Scientific Analytical Ltd

Analyses of soil, herbage, water, trace elements, food and processed foodstuffs, household and industrial products, manufactured goods. Instrumentation: AAS x 2; flame, hydride, GFA, uv-vis, balances, pH meter, ion selective electrodes, muffle furnace, Kjeldahl, Karl-Fischer, amperometric and potentiometric titrations, conductivity.

114 Scientific & General Consultants Ltd

Chemical analysis of food, animal byproducts, oils (food and mineral), cosmetics and toiletries, fertilizers and pharmaceuticals. Industrial processes, insurance loss adjustment. Bacteriological services. Instrumentation: uv-vis, GLC, AAS, Karl Fischer, potentiometric amperometric titrations etc. Viscometry — Brookfield and u-tube, salt spray cabinet for accelerated corrosion testing.

115 Scientific Service Laboratories Ltd

Design of small-scale chemical plant such as pilot or semi-scale plants in glass. Neutralisation of acidic waste.

121 Stevens Chem Industries Ltd
Microbiological and chemical analysis. Instrumentation: HPLC, GLC, ir, uv.

187 Tasmex Laboratories

Microbiological and chemical analysts. Instrumentation UV-VIS spectroscopy, specification dissolved oxygen, public health equipment, microbiological accommodation to NATA spec.

125 TELARC

Consultancy, education, and accreditation services in all aspects of quality assurance, laboratory testing and industrial design.

131 John Yolland & Associates Ltd

Chemical engineering process and plant design, commissioning, feasibility studies, environmental and biotechnology projects. Independent product evaluation and testing.

133 XL Consultants

Consultancy advice in the fields of bulk chemical handling, manufacturing and compounding, personnel selection, lecturing on scientific topics.

134 Analytical Research Laboratories

Soil, water, foliage analyses. Food chemistry, pesticide residue analyses, plus product development in agricultural areas. Instrumentation: HPLC, GLC, AA, uv-vis.

135 Applied Geology Associates

Mineral exploration, mine and quarry design, mineral processing design, economic analysis and environmental management consulting services. Project management services.

137 Auckland Dairy Laboratory

The laboratory provides a comprehensive analytical service covering all foods, food additives and pharmaceuticals. The range of analyses covers compositional, nutritional, microbiological, trace

139 Carina Laboratories

Properties and failures of industrial materials, including adhesives, dyes, detergents, polymers, surface coatings, etc. Design of processes, development of new processes and products, advice on project development, marketing, finance, all other aspects of new chemical business. Instrumentation: general laboratory, GC, IR.

140 Chemistry Division, DSIR

Analytical services in paint, plastics, oils, ceramics, minerals, food, pharmaceuticals, water, effluents, geothermal fluids — almost anything chemical. Consultancy in laboratory staff training. Instrumentation includes AA, XRD, GC/MS, HPLC, ICP, NMR, ESR, and general lab. techniques.

144 Coatings Technology Ltd

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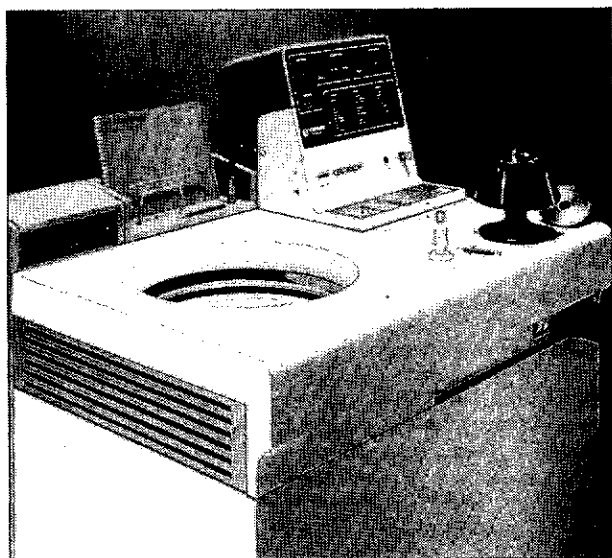
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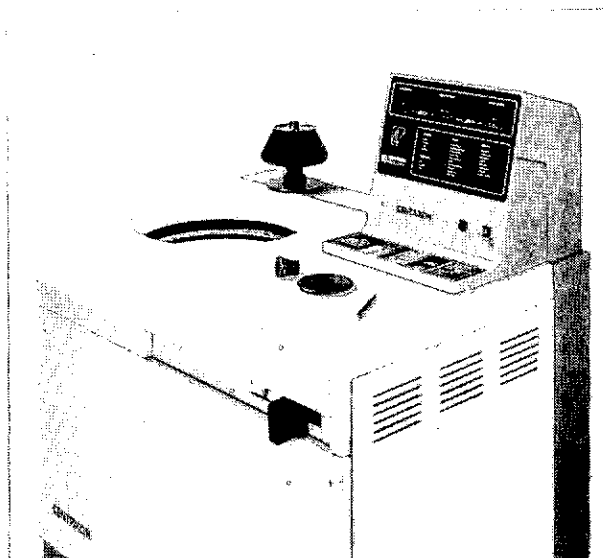
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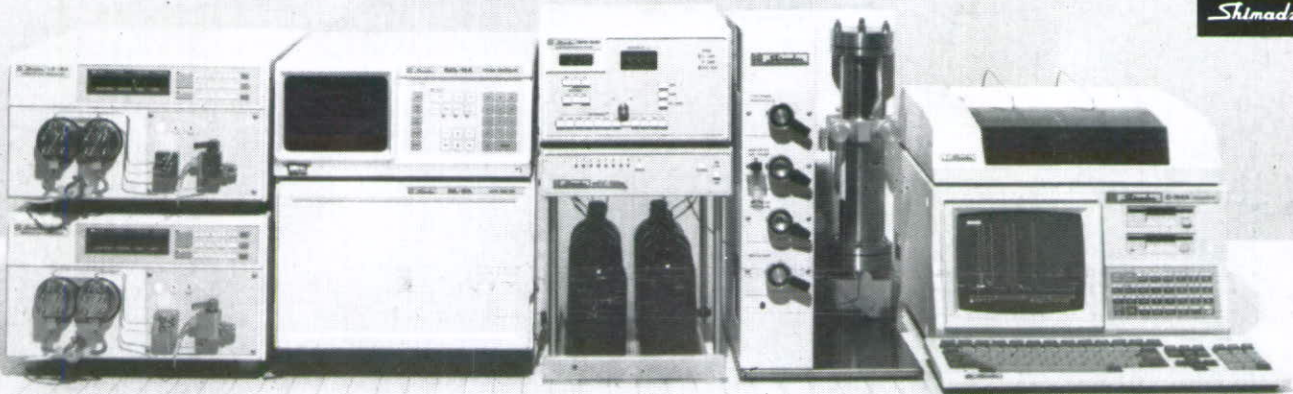
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