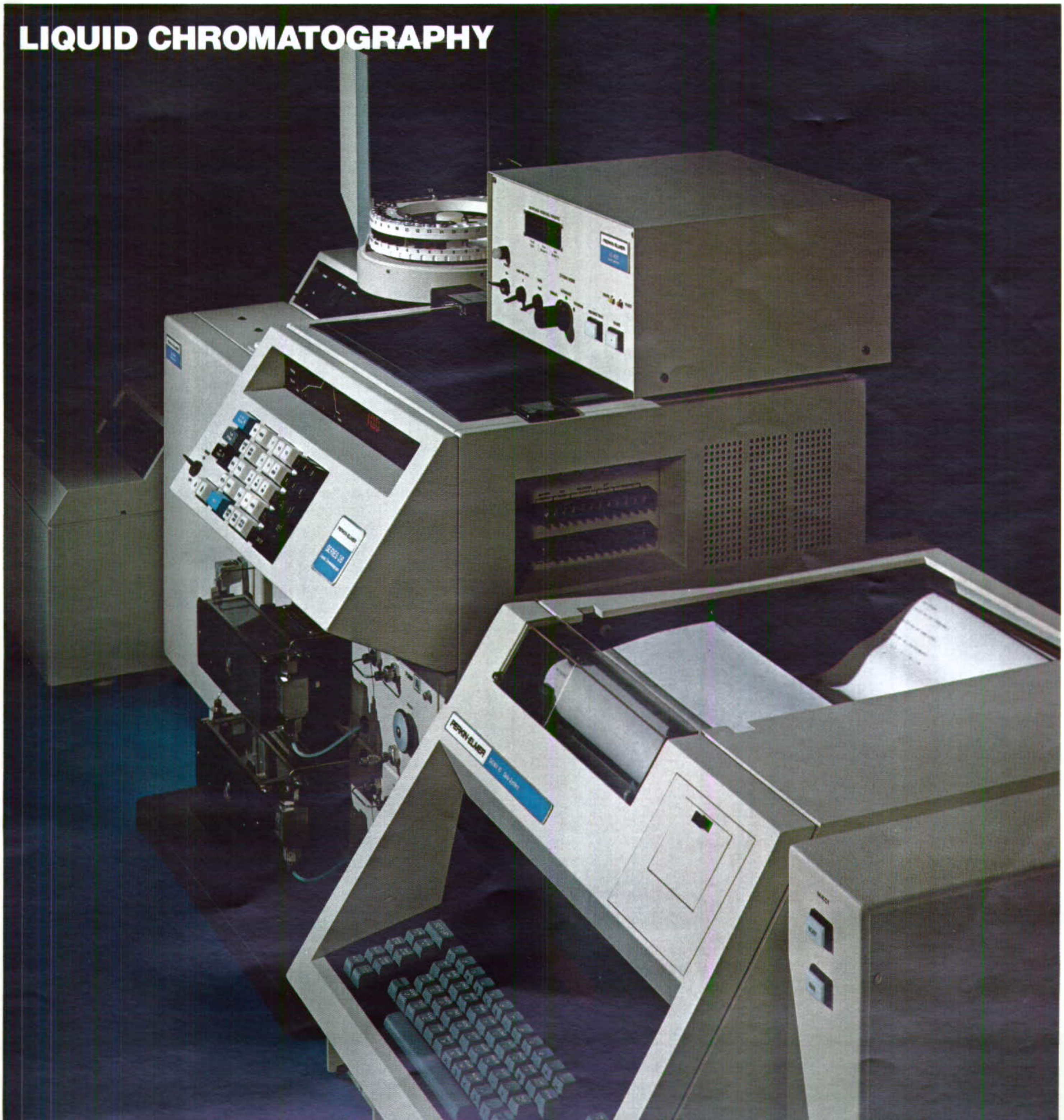
June 1980 Vol. 44 No. 3

Chemistry in new zealand

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

INSIDE: Electrical Stimulation Of Meat; Automating Atomic Spectrometry; Chemistry In The Energy Field; Analysis Of Wool Glass; Computers And Laboratory Instruments.



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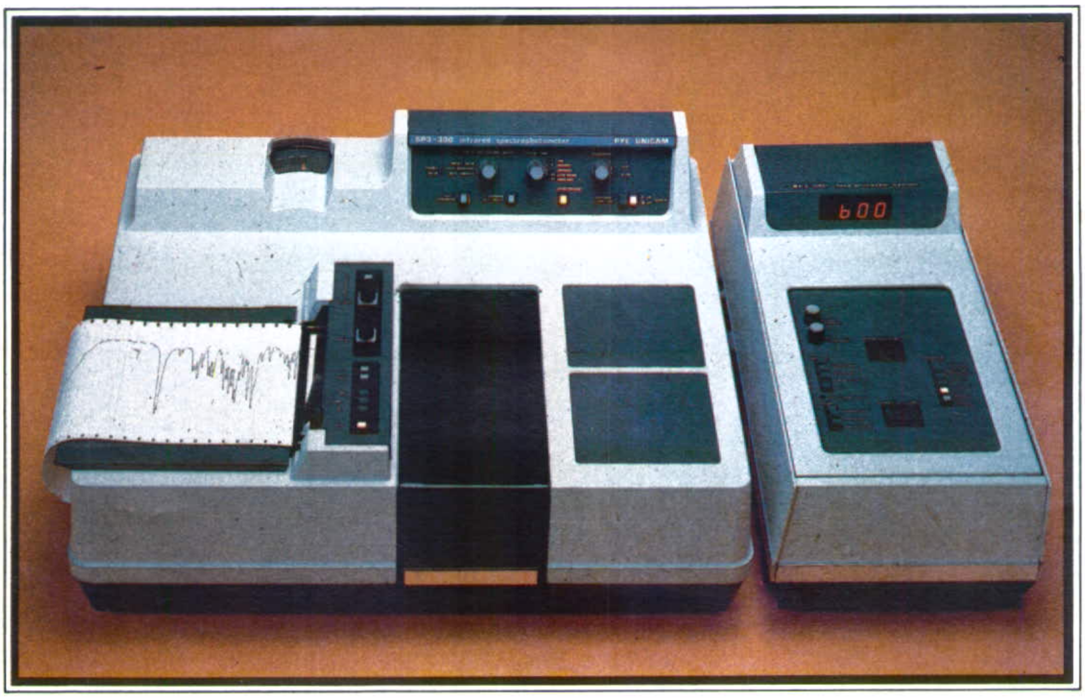

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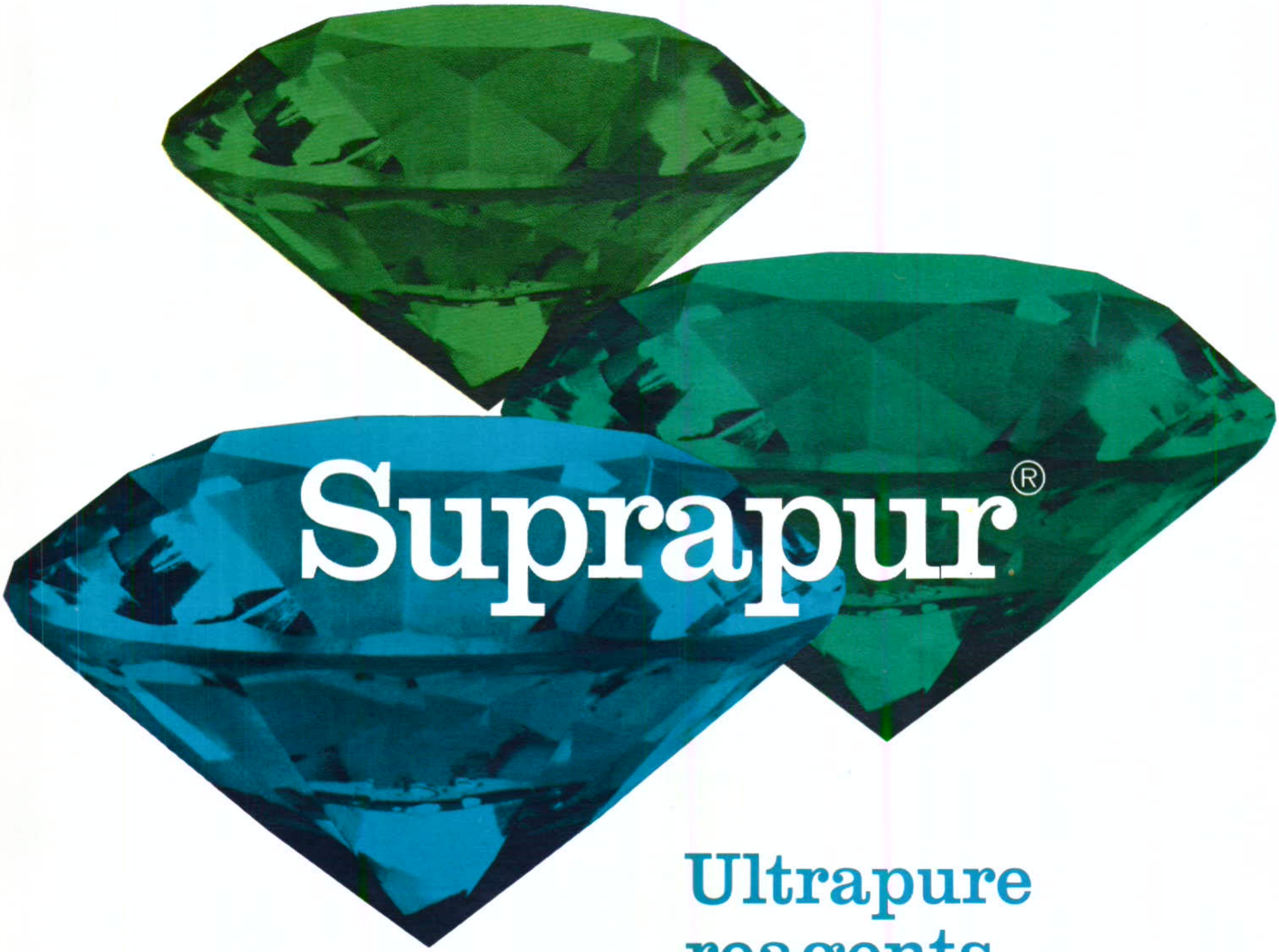
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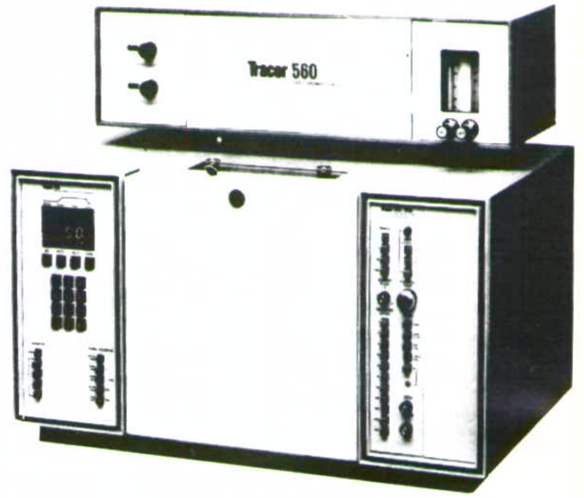

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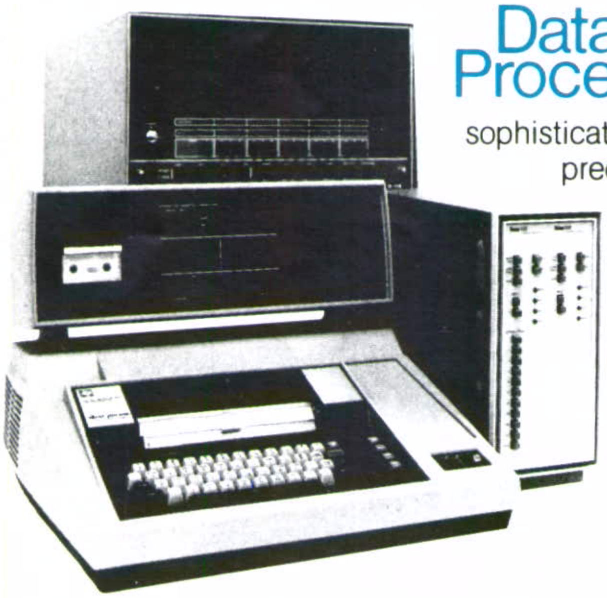

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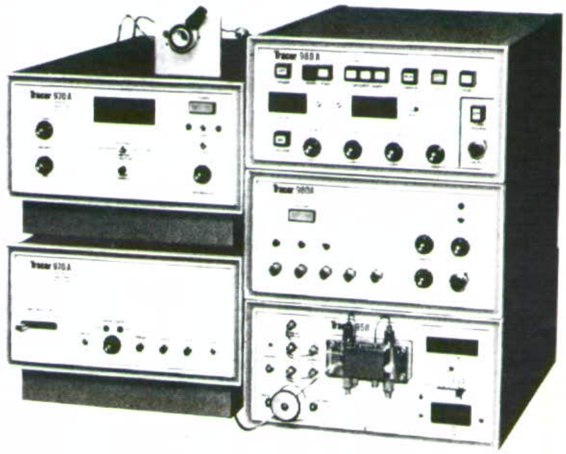

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CONTENTS

Cover: The Perkin-Elmer methods processor can be programmed to cope with routine, repetitive work. It combines five units to provide complete keyboard control of the analysis.

STOP PRESS

As we go to press we learn with regret that Dr H.E. Annett, President of the Institute in 1953, has died at the age of 95 in Hamilton. He was a pioneer in agricultural science both in NZ and in India. An obituary will follow in a later issue.

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Guest Editorial

The Greatest Of These Is Clarity

I have had a sneak preview of a revised Notice to Authors which appears elsewhere in this number. There are the usual specifications for tables and references, but priority has been given to a short paragraph urging us to write in a concise, clear natural style.

And quite rightly. Chemistry in New Zealand reaches chemists of many different kinds — as you can see from the section of the Yearbook ominously entitled "Occupational Breakdown" — and to hold their attention our material must be topical and readable. That isn't easily achieved, except by the happy few who have been writing prose all their lives without knowing it.

Authors are in constant danger of being seduced by the ponderous and pompous styles we read on every side. So many public figures speak and write as if their mothers had been frightened by a four-letter word: they go to almost any lengths to avoid words of one syllable. This leads to obscurity. In my own suburb, the tip is now a Refuse Facility; and when my bank proudly announced the opening of a new Customer Outlet, I was disappointed to find it was not a side door leading to the car park, but a branch office at the other end of town. Shades of Sir Ernest Gowers!

An American author has devised a semi-quantitative measure of literary obscurity that he calls a Fog Index. Applying it to one's own work can have a salutory effect, as I could demonstrate by exhibiting the first draft of this article.

At different times the chemist finds himself writing for readers of different kinds. A research paper, a review article, an application for a research grant, a report to managing director or minister, each must be cast in different language calculated best to get the message across. More important still, chemists are engaged with architects, biologists, economists, engineers and politicians in discussions that will influence the success or failure of the great industrial projects scheduled for NZ in the '80s. The clearest thinking and writing will be needed if this kind of communication is to penetrate the interdisciplinary barriers.

And last, what of the person in the street? This column recently carried a reference to the "uninformed public", but in the context of chemistry "misinformed" is often nearer the mark. While newspapers publish regular articles, written by specialists, on medicine and even astronomy, those with any content of chemistry seem to be written by economists or other "special correspondents". It is common for a news item to be reduced to nonsense by confusion over metric units; and last month a leading daily referred to the cost of extracting hydrogen from the atmosphere. The average newspaper reader has some elementary knowledge of science and deserves better than this. But he will continue to be misinformed until professional chemists take the trouble to write topical scientific articles for the general public. To paraphrase Matthew Arnold: We have something to say; let us say it as clearly as we can.

R.W. Green

Dr Green is a New Zealander who studied at the old Auckland University College under Dr R.A. Robinson, and holds the degree of D.Sc. (NZ). For a number of years before he retired in 1975, he was Associate Professor in Inorganic Chemistry in the University of Sydney and Chairman of the Advisory Committee, Australian Journal of Chemistry. Since he retired, he and his wife Julie have been living in Takapuna, and he helps out as a member of the Editorial Committee of "Chemistry in NZ".

Comment

Polemics From The Pulpit

The message that we should like to bring to the faithful in this pastoral letter is "Never despair — look on the bright side". It is better to ask fellow diners to pass the cream than to enquire moodily if there is any milk in the jug. It was part of the joys of a recent visit to the Archdiocese of Canterbury to meet again our old friend and predecessor, no less a person than Hugh Parton, now presented with a cardinal's biretta by the hierarchy in Christchurch, for has he not written a book on the Acts of the Apostles (of the University of NZ)?

We hope to publish a history of the Journal in our Jubilee issue next February, but it is relevant to our theme here to recount that His Eminence told me that after missionary efforts in an uncharted land by Tony Keys (now Archdeacon of Epsom) over the years 1936-38, the Journal lapsed in 1939, and the delegate from the Canterbury Diocese was sent to Council with firm instructions to vote against its resuscitation in the war years; he returned to the Cathedral City to inform the future Cardinal that the Journal was to be restarted forthwith and that one Parton had been appointed Editor with a generous provision of funds — £10 to cover the whole cost of each issue. (For younger readers who do not have their computers handy that equals $20). Those who want to read a fine editorial and a fitting tribute to His Eminence should consult the literature of the time.[1] It is good to know that this dignitary is still pontificating from his cell in the monastery at Ilam.

We have since our youth adopted the principle that even if a job is not worth doing, it should be done well.[2] Some doubts have been raised on the latter score, but we go optimistically forward blazing a trail, laying a true foundation in the faith, and setting the NZIC alight ecclesiastically. To those who feel that we may be mired in a miasma of mixed metaphors we would point out that perhaps we do better than other publications; including one from an academic source that perpetrates such solecisms as 'Ladies bike' and offers to sell 'Principals of Biochemistry' which smacks of slavery, a practice which is ecclesiastically frowned upon.

S.G. Brooker.

1. *J.N.Z. Inst. Chem. 12* 1 (1948)
2. *J. Unpub. Pap. 22* 77 (1066)

What's Happening

Institute President, **Prof A.D. Campbell,** made recommendations to the Minister of Justice with regard to the membership of the committee of inquiry into the Arthur Alan Thomas case. These were not accepted and the President is now wondering whether the NZIC should take any further interest in the inquiry, and he would welcome any feedback from members.

•

The NZ Farmers' Fertiliser Co. has presented a set of the Journal of the Society of Chemical Industry dating right back to the first issue in 1882 to the Auckland Institute and Museum library, which holds the NZIC publications (now confined to journals from sister organisations) and has a number of volumes of historic value in chemistry. On looking over this gift, we found that **J.A. Pond,** the first Government Analyst in Auckland, was a member of the SCI from the start, the only one from NZ.

•

We were privileged to be present at the official opening of the new Kaputone wool scouring plant at Belfast on April 15. This plant incorporates the Wool Research Institute's "Mini-bowl" principle, which gives a very large saving in energy. In his opening speech, NZ Wool Board chairman **Alan Clark** referred to a publication of 1881 which recorded the scouring of the wool on a NZ farm while still on the sheep, which involved "dry chuckers-in" for first bath and "wet chuckers-in" for the second. The sheep were left to dry off in the paddocks. It was stated that largely owing to research conducted at WRONZ, wool scouring charges in NZ were the lowest in the world.

•

As all our readers will know the Government signed up documents on April 1 (an auspicious day) for the building of a plant to manufacture 1200 tonnes/day of methanol by the Mobil process. We expect to deal with this in depth in a later issue.

•

Editor **Stan Brooker** had the honour of representing NZ chemists at the IUPAC General Assembly in 1969, and found it very interesting and inspiring. The National Committee for Chemistry is looking for someone who might represent NZ at the 31st Assembly to be held at Leuven, Belgium, August 25 — September 2 1981. Anyone likely to be in Europe at that time should write to **Assoc. Prof. Stewart Rutledge,** University of Auckland.

•

Those who tried to work out the item on p38 of the February issue about the largest prime number will be comforted by the fact that it can be proved that there is no such thing!

The US Council of Teachers of English has given its 1979 Doublespeak Award for the most appalling use of the English language to the nuclear power group at Three Mile Island. Officials there were cited for inventing a whole lexicon of jargon and euphemisms that played down the danger. "Explosion" became an "energetic disassembly", a fire "rapid oxidation" and a reactor accident a "normal aberration".

•

Ted Fletcher, one of our good keen members who is a school teacher in Hawkes Bay has written to us about the item in our February issue on **Jean-Baptiste Litre.** The chairman of the Metric Advisory Board, **Ian Stevenson** has written to Ted saying inter alia "As there was nobody called Litre, someone has invented one and written the spoof you referred to." The matter concerns the MAB because under the convention, metric units named after people are abbreviated to a capital letter, and "L" would cause less confusion than "l" which looks like 1 or capital I on some scripts. Ted has written to the Royal Society of London, who have no record of a special medal struck for Litre, and it does seem a little curious that Sir Humphrey Davy should use Litre's measuring cylinders to make NCl_3. We could not find Litre in Diderot's extensive French biographical dictionary (1862). Has any reader any ideas?

On June 1, with the grant of its Royal Charter, the Royal Society of Chemistry (RSC) comes into being as a result of the unification of the Chemical Society (CS) with the Royal Institute of Chemistry (RIC). Both the CS and RIC at present hold Royal Charters — that of the CS dating from 1848 and that of the RIC from 1885. These will be surrendered and the CS and the RIC will cease to function as separate organisations. The Queen has granted her patronage to the new Society.

The RSC will have as its main objectives the advancement of the science of chemistry and its applications, and the maintenance of high standards of competence and integrity among practising chemists (as distinct from pharmacists). It will speak to Government and all sections of the community on behalf of some 40,000 scientists concerned with chemistry — as the Chemical Society and the Royal Institute of Chemistry have done in the past — but it will do so with a single authoratative voice.

The first President is Sir Ewart Jones, FRS, a Past-President both of RIC and CS. The Secretary-General is Mr John Ruck Keene, formerly General Secretary of the CS; Dr Eric Parker, formerly the Secretary and Registrar of the RIC, will be the Registrar and Secretary for Public Affairs.

"HPLC will kill us all," said a speaker at the symposium held by the International Federation of Pharmaceutical Manufacturers Associations held in Geneva. He went on to say, "How could industry justify the use of such a technique on products developed many years ago? You will uncover things you did not know about your product."

•

Many of those studying and teaching organic chemistry in recent years will have used either Morrison and Boyd's textbook, published by Allyn and Bacon, or Solomons' book of the same name, put out by John Wiley and Co. According to "Chemical and Engineering News" for December 24 last, the publishers and authors of the former book are suing the authors and publishers of the latter for infringement of copyright, claiming $1.1 million for loss of profits. Solomons and Wiley have filed a counterclaim for alleged disparagement of their book.

•

We recently received an advertising blurb about a "Transliterated Dictionary of the Russian Language". The publishers modestly claimed they were "introducing a new tool that makes it possible to work with the Russian language without studying it". The blurb went on to say "this unique dictionary presents solutions to both the problems of letter recognition and letter order. Conversion tables in the dictionary make it possible to determine the Roman equivalent of any Cyrillic letter. Thus, any Russian word encountered can be converted, on a letter-by-letter basis, from its Cyrillic form to Roman, as shown here:

administrativnyi (adj.) administrative
agent (n.m.) agent
akademiya (n.f.) academy

Once converted many Russian words are easily recognised.

"For example, suppose you are confronted with the Russian word ЭЛЕКТРОН . You use the conversion table to transliterate it to 'Leningrad'."

(The only trouble is that the word transliterated is not Leningrad, but electron!)

•

Readers will have noted with interest the alleged deaths from cancer of students using the radiochemistry facilities at the University of Waikato. The matter arose from a publication in the student magazine "Nexus" of allegations by a lecturer in German at the University. Following this and discussion by the University Council, the Director-General of Health set up an independent committee of enquiry, which completely exonerated the University and its staff. Display advertisements advertising the findings of the Commission were inserted in the newspapers by the Registrar of the University. Finally on May 2, **Mr R.J. Rigg,** the lecturer in German who had instigated the fuss, made a public apology, admitting that the article's publication was "ill-advised and unjustified."

(Note: The University Council dismissed Mr Rigg following its May meeting).

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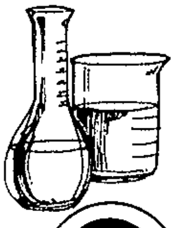

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NZIC CONFERENCE 1980:
Lectures and Biographies

GUEST LECTURES

Biochemistry Plenary Lecture
"Chemical Defences of Plants" — Prof. E.E. Conn.

Organic Chemistry Plenary Lecture
"Pyrrolizidine Alkaloids and their Role in the Association of Insect/Plant Relationships" — Dr J. Edgar.

Analytical Chemistry Plenary Lecture
"Emission Spectrometry with the Inductively Coupled Plasma" — Prof. L. de Galan.

BIOGRAPHIES

Prof. Eric E. Conn was born in Berthoud, Colorado on January 6, 1923. He received his B.A. in Chemistry *cum laude* from the University of Colorado in 1944 and his Ph.D. in Biochemistry from the University of Chicago in 1950. Upon graduation he taught in University College at Chicago University for two years, and then joined the faculty of the University of California at Berkeley in 1952 as an Instructor in the Department of Soils and Plant Nutrition. In 1954 he was appointed Assistant Professor in the Department of Plant Biochemistry at Berkeley. In 1958, he moved with his colleague, **P.K. Stumpf** to the Davis Campus of the University of California where they formed the new Department of Biochemistry and Biophysics.

Prof Conn is a member of the American Society of Biological Chemists, the Biochemical Society, the Phytochemical Society of North America, the Phytochemical Society of Europe, and the American Society of Plant Physiologists. He is an elected member to the Editorial Board of **Plant Physiology** and has recently been appointed an Executive Editor of the **Archives of Biochemistry and Biophysics.** He has served as President of the Phytochemical Society of North America and has held several offices, including the Chairmanship, of the Pacific Slope Biochemical Conferences. Prof Conn was a Fulbright Research Scholar in NZ in 1965-66.

Prof Conn's research interests lie in the biochemistry, especially the intermediary metabolism, of secondary (natural) plant products. His laboratory discovered and provided the first characterization for two key enzymes involved in phenylpropanoid metabolism in plants, namely phenylalanine ammonia lyase (PAL) and cinnamic acid-4-hydroxylase. In recent years his research group has examined the origin and metabolism of hydrogen cynanide and its important precursors, cyanogenic glycosides, in the plant kingdom. He was nominated Faculty Research Lecturer of the Academic Senate of the Davis campus in 1977. In addition to his research activities, Prof Conn has a strong interest in the teaching of undergraduate and graduate students in biochemistry. Together with Prof Stumpf, he has authorised the **Outlines of Biochemistry** which is now in its 4th edition and is used throughout the world. Because of his interest and success in teaching, he holds the Distinguished Teaching Award of the Davis Academic Senate and therefore is one of only two faculty members ever to receive the two Senate awards in teaching and research.

Dr John Edgar completed his Ph.D. in chemistry in 1964 at the University of Adelaide after which he spent 18 months as a Postdoctorial fellow with **Dr Edward Leete** at the University of Minnesota working on idole alkaloid biosynthesis. Then followed 12 months of mass spectrometry with **Prof Klaus Biemann** at MIT. In 1967 he joined CSIRO, Division of Applied Organic Chemistry, to work with **Dr Claude Culvenor** on the chemistry and biological activity of pyrrolizidine alkaloids. This group subsequently transferred to the Division of Animal Health in 1971.


de Galan


Edgar

Dr Edgar's work in the chemical basis of insect/plant associations grew out of the chemical studies of the toxicity and mamalian metabolism of the pyrrolizidine alkaloids, when it was discovered that some Australian butterflies, mainly *Danainae*, contain dehydropyrrolizidines in their "hair pencil" secretions. This led to the realisation that these butterflies were accumulating and using the alkaloids from the plants with which they associated. Since 1971 Dr Edgar has participated in a Royal Society expedition to the New Hebrides to work on the *Danainae* of those islands, has, with **Dr Pliske,** worked on Venezulan *Ithomiinae,* with **Drs Boppre** and **Schneider,** on the African *lepidoptera,* has completed a chemical study of the Solomon Islands *Danainae* and is currently working on certain Caribbean and Mexican *Ithomiines* and their food plants with **Dr Harvey** at the University of Texas.

As well as work with butterfiles and their host plants, Dr Edgar has also worked on the Australian Arctid moths and on British moths with **Dr Miriam Rothschild** and has collaborated with **Dr Eisner** on a study of North American Arctid and the defensive role of the stored alkaloids. As an author of over 40 papers on the chemistry and ecological role of pyrrolizidine alkaloids Dr Edgar has considerably advanced our understanding on the chemistry of insect/plant associations.

Prof. Leo de Galan was born in 1937 and obtained his Ph.D. at the University of Amsterdam in 1965. He spent 1966 as a Postdoctoral Fellow with **Prof J.D. Winefordner** at the University of Florida. Upon his return to the Netherlands he became associated with the Technical University in Delft,.where he is presently Professor of Analytical Chemistry.

Dr de Galan heads a group of 15 co-workers and graduate students. His research interests are atomic absorption and emission spectrometry, and liquid chromatography. He is the author of more than 50 research papers, and has presented invited lectures at major international conferences, such as the Colloquium Spectroscopicum Internationale and the meetings of the Federation of Analytical Chemistry and Spectroscopy Societies. He has been Chairman of the' Analytical Division of the Royal Dutch Chemistry Society, and is presently organising the 23rd Colloquium Spectroscopicum Internationale, to be held in Amsterdam in 1983. Following his visit to the NZIC Conference, Dr de Galan travels to Sydney, where he will be an invited speaker at the 12th Australian Spectroscopy Conference.

TRICOM MOVES

In line with its planned expansion, Tricom Publications Ltd., publishers of this journal, have recently moved into new permanent headquarters. The move was necessitated not only by the increasing number of publications produced under the TRICOM banner, but also because additional space was required to house newly-acquired typesetting facilities to cope with its publication requirements.

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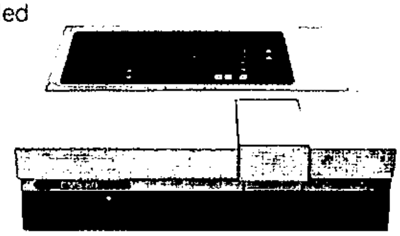

DMS 80

MAY COUNCIL BRIEFS

A recommendation is to be made to the August AGM that a Student grade of membership be established for tertiary students. Also referred to the AGM was a suggested change in the rules pertaining to the ICI Prize for excellence in research.

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An Environmental Committee is to be established, based in Dunedin with corresponding members in all other Branches. Its terms of reference are:

1. To collate comments from knowledgeable NZIC members on "topical subjects" and to co-operate with the Publicity Committee in making NZIC views known.
2. Comment on behalf of the Institute on Environmental Impact Reports.
3. Comment on other matters referred to it by officers or members.
4. To seek out informed comment on issues of its choice.

•

The Institute's emblem came under scrutiny and Branches are asked to consider the merits of adopting a different logo and/or possibly retaining the present emblem as the Institute's official seal.

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The NZ Post Office has approved in principle the use of an NZIC cancellation stamp during the Golden Jubilee year, 1981. Council is looking for suggestions.

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The salary survey is underway and will be reported in the August issue of "Chemistry in NZ".

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Dr A.J. Ellis informed Council that many changes were occurring in the Hazardous Chemicals area including the use of the HAZCHEM (USA) system of labelling, Dangerous Goods Act, Toxic Substances Act (and Toxic Substances Board), new SANZ standards on labelling. Several potential authors for journal articles were mentioned.

•

Dr Ellis is also organising the Golden Jubilee celebrations. These include publication of "History of Chemistry in NZ" by the RSNZ/NZIC — a major undertaking and one involving many members. A 10min. film is also being made. He would welcome suggestions on what other activities might be organised.

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Council resolved to join the Federation of Asian Chemical Societies. Although no fees are involved, it has been decided to donate $50 to assist with Federation costs. Membership of the body links the Chemical Societies of Australia, Hong Kong, Malaysia, Thailand, Korea, Sri Lanka, Iraq, India, Indonesia and NZ.

•

Council decided not to make submissions to the Commission of Inquiry into the A.A. Thomas case.

Conference dates were noted as follows:

NZIC/NZBS 1980 — August 18-22 — Massey University

NZIC/NZBS 1981 — August 23-28 — Auckland University. "Chemistry in the Service of Man"

NZIC/NZBS 1982 — August 23-27 — Otago University. "Chemistry and the Life Sciences". Chairman — Dr M Sheppard. Secretary — Dr Joan McKenzie

NZIC/NZBS 1983 — August — Hamilton

NZIC/RACI — COMO 10, 1981 — May 10-15 — Queenstown

IUPAC Conference on Physical/ Organic Chemistry — August 1984 (Chairman — Prof P. de la Mare).

IUPAC CHEMRAWN II — International Food Conference — Philippines — February 1982

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The availability of overseas travel funds for NZ scientists was discussed, following a Wellington Branch report. Council decided to bring this subject to the notice of other member bodies of the RSNZ and the NRAC. Wellington also proposed that greater funding be given to the overseas visitors fund. Currently surplus conference funds are credited to this fund. This proposal was widened into a general consensus that 1981 be looked upon a a fund-raising year. Branches were asked to discuss this aspect of Golden Jubilee celebrations.

•

The following elections were confirmed:

Fellowship (FNZIC):

CHILDS, Cyril Walter (B.Sc. (Hons) Ph.D. (Otago) Soil Bureau DSIR, Lower Hutt (Scientist).

EMERSON, George West M.Sc. (NZ) Ph.D. (Otago). Dept. of Biochemistry, Otago University (Senior Lecturer).

GRIMMETT, Murray Ross M.Sc. (Otago) Ph.D. (Massey) Dept. of Chemistry, Otago University (Assoc. Prof. of Chemistry).

KENNEDY, Thomas Henry M.Sc. (Hons) (NZ) Endocrinology Res. Dept. MRC Otago Medical School (Retired).

McKEOWN, Robert Henry M.Sc. (NZ) Ph.D. (Otago) MRIC MPS Dept. of Pharmacy, Otago Medical School (Senior Lecturer).

PASTELIDIS, Demetre Graduate (Athens) Shell Oil (NZ) Ltd., Petone (Head Analyst).

TATE, Kevin Russell M.Sc. Ph.D. (Well) Soil Bureau DSIR, Lower Hutt (Scientist).

THOMSON, Cullen William MNZIC MI Chem E ANZIM McLeod Bros Ltd, Dunedin (Chemist).

WILSON, Arthur David M.Sc. (NZ) Southland Dairy Co-op Ltd., Edendale, Southland (Manager, Whey Products Divn.)

Membership (MNZIC):

HINTZ, Mrs Frances Bloomfield B.Sc. Te Puke High School, Te Puke (Teacher).

MAHONEY, Michael Francis B.Sc. St. Patrick's College, Wellington (HOD Science).

MILSOM, Paul John M.Sc. (Hons) Unilever (NZ) Ltd., Petone (Chief Chemist).

REWCASTLE, Gordon William M.Sc. (Hons) Ph.D. (Auck) Cancer Research, Pathology Dept., Auckland University (Research Chemist).

WILSON, Eric Lawrence B.Sc. (Hons) Ph.D. (Leeds) Div. Horticulture and Processing DSIR, Auckland (Scientist).

BRASELL, Maurice Robin M.Sc. (Cantuar) C/o NZ Electricity Dept., Auckland (Scientist).

BROWN, Warren Noel B.Sc. Kiwi Fertiliser Co Ltd., Morrinsville (Works Chemist).

GERLACH, Robert Frederic M.Sc. D.Phil (Waikato). Dept. of Inorganic Chemistry, Universityof Michigan.

LESLIE, Philip Robert M.Sc. (Auck). Eli Lilly & Co, Basingstoke, England (Plant Chemist).

LIMMER, Alan Wayne M.Sc. Chemistry Dept., Waikato University (Ph.D. Student).

KOONER, Zorawar Singh M.Sc. (Ludhiana) Chemistry Dept., Otago University (Ph.D. Student).

McRONALD, Gordon Eric B.Sc. (Hons) (Otago). Fletcher Agriculture, Dunedin (Chief Chemist).

STEEL, Peter James B.Sc. (Hons) Ph.D. (Cantuar). Overseas.

Associate Membership (Assoc. NZIC):

BRENNAN, Alan Lawrence NZCS. Chemistry Dept., Waikato University (Head Chemistry Technician).

LEWIS, Anthony Leslie NZCS. Ravensdown Fertiliser Co Ltd., Timaru (Works Chemist).

RUBIE, Henry Stephen NZCS. Catoleum Pty Ltd., Auckland (Technical Representative).

WOTHERSPOON, James Stewart NZCS. Roche Products (NZ) Ltd. (Technical Services Representative).

Graduate Membership:

CLOSE, Murray Edwin B.Sc. (Hons) (Cantuar). Christchurch Science Centre, MWD, Christchurch (Scientist).

ELLIS, Phillip Anthony B.Sc. NZCS. Middows Taylor Ltd., Auckland (Asst. Chemist).

HARRINGTON, David Athol B.Sc. (Hons) (Cantuar). Chemistry Dept., Auckland University (Ph.D. Student).

KETTLE, Anthony James B.Sc. (Hons) (Otago). Abels Ltd., Newmarket (Lab. Technician).

MAYER, Gregory Douglas B.Sc. British Paints NZ Ltd., Auckland.

MONKS, Simon Digby B.Sc. Wellcome NZ Ltd, Auckland (Laboratory Supervisor).

OLIVECRONA, Lloyd Malcolm B.Sc. (Hons) (Well). Technical Waxes NZ Ltd., Petone (Chemist).

OSVATH, Peter B.Sc. (Hons) (Well). Chemistry Dept., Victoria University (Teaching Asst.).

STANLEY-HUNT, Anne B.Sc. Chemistry Dept., Victoria University (Hons Student).

PROVAN, William George B.Sc. Dip.Sci (Otago). Dept of Nutrition, Otago University (Scientific Officer).

THOMPSON, John Gerard B.Sc. Chemistry Dept, Victoria University (Hons Student).

Technician Membership:

CARDILE, Clay Mitchell NZCS. 57 Friend St, Karioi, Dunedin (B.Sc Student).

MILLER, David John NZCS. ICI NZ LTd., Auckland (Technical Services Rep.).

MOORE, Anthony John NZCS. Dental Research Unit, MRC, Wellington (Senior Technician).

THOMPSON, John Christopher NZCS. AIDD, DSIR Auckland (Technician).

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Electrical Stimulation Of Meat: Long-Term Research Vindicated

Carrick E. Devine
Meat Industry Research Institute of NZ

New Zealand's present prosperity has its origins in the first shipment of frozen mutton exported to Britain in 1882. We have diversified our meat exports considerably. From its small beginnings in the first shipment lamb, mutton and beef, together with by-products, now constitute more than 50% of our total exports. Lamb still goes overseas to many markets in carcase form, and surprisingly, the product appears to have changed little over the last 100 years. However, marked changes in technology have ensured that the micro-biological quality of the product is high. Other attributes of the meat, such as appearance and tenderness, have not always improved to the same extent. The introduction of electrical stimulation to processing of lamb and beef, however, heralds a new era when NZ will be exporting a uniformly high quality tender product. New Zealanders consume about one-third of all NZ's meat production, and so are affected as consumers by many of the same problems that pertain to exported meat, and like consumers overseas, we will also benefit by improved processing.

What causes toughness, and how does electrical stimulation result in tender meat? The answers to both of these questions have become clearer after many years of fundamental research undertaken by the scientists at the Meat Industry Research Institute of NZ (MIRINZ). The early history and contribution of MIRINZ in the field of muscle biochemistry has been described by Locker[1]. Specifications for holding carcasses at a narrowly defined temperature range in order to achieve tender meat, and for electrical stimulation, are some of the results of that research. Few areas of research undertaken by MIRINZ over 21 years have had the far-reaching importance of electrical stimulation. Contrary to some ill-founded beliefs, we supply much of our lamb to discerning markets and we cannot afford to lose these markets because of a poor quality product. If we can gain new markets, retain old ones, and cut costs even when introducing new processing and packaging technology, then research is certainly vindicated.

Carrick Devine is a section head in Meat Science at the Meat Industry Research Institute of NZ, Hamilton. After graduating B.Sc. in Chemistry & Zoology in 1961 and a Master's degree in Zoology in 1963, he joined the Wellcome Medical Research Institute, Department of Medicine, University of Otago Medical School, where, as a research assistant to Sir Horace Smirk, the Director, he undertook pharmacological studies in the field of hypertension. He consolidated the studies by investigating the pharmacology and structure of nerves innervating blood vessels by electron microscopy under Dr Olaf Simpson. After obtaining a Ph.D. in 1968, he went overseas to undertake physiological and ultrastructural studies with Dr Andrew and Avril Somlyo. Further research was undertaken on the sites of activator calcium for smooth muscle contraction before returning to the Wellcome Institute in 1971.

After taking up an appointment with MIRINZ in 1973, Carrick has been occupied with basic muscle studies associated with electrical stimulation. His present research is centred upon various aspects of muscle biochemistry and physiology, electrical stimulation, animal stress and exhaustion, and preslaughter factors affecting meat quality.

His other activities include running (a by-product of animal exhaustion studies and his previous interest in cardiovascular research), house modifications and "avoiding bureaucratic constrictures". He became a member of NZIC in 1965 and has been secretary, Waikato Branch, NZIC, for the past 4 years. He is married and has two children.

In order to understand the importance of electrical stimulation, several terms must be defined and the events which occur from the time a live animal becomes meat explained.

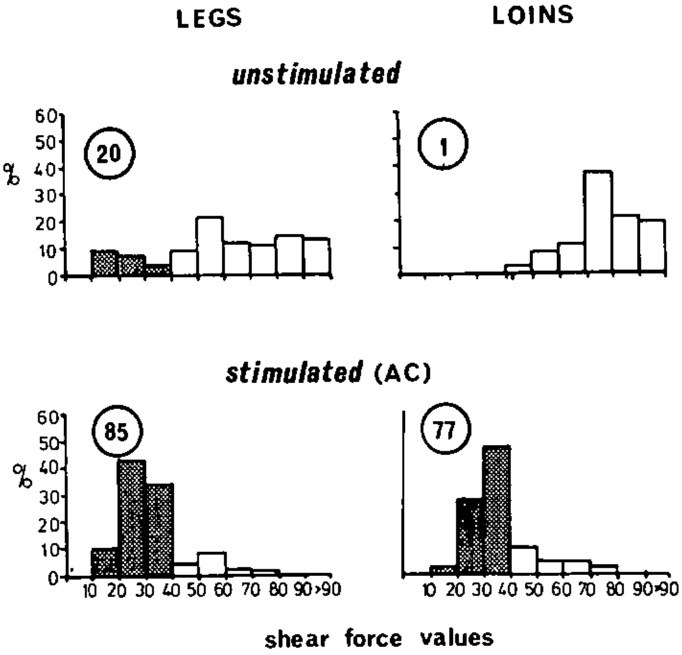

Fig. 1: Histograms of shear force values for leg and loin muscles from unstimulated and stimulated carcasses cooked from the frozen state — potentially the worst possible situation where both cold shortening and thaw shortening would contribute to meat toughness. The shaded portions indicate shear force values less than 40, indicating acceptably tender meat. The actual per cent below 40 is shown in circles. Loins are more susceptible to the cold, being relatively thin muscles, and lose heat more readily than legs, and the improvement is most significant here.

Adapted from C.J. Hagyard[16], unpublished data and B.B. Chrystall[15], Farm and Food Res. 9: 141-143 (1979).

Muscle To Meat

Although meat is the end product of a slaughter process, much of the research into meat is in fact research into the response of live muscle. As is well known, muscle utilizing adenosine phosphate (ATP) can do work without oxygen being present and the "oxygen debt" can be made up later by "puffing". Even without muscle contraction, the various muscle ATPases still slowly utilize ATP. It is the anaerobic utilization of the muscle ATP formed from glycogen, a hydrophilic sugar polymer, that allows muscle to stay "alive" for several hours after the death of the animal. Muscle contraction, which involves a sliding of actin and myosin filaments in relation to each other, utilizes ATP to produce energy plus adenosine diphosphate (ADP). The amount of free muscle ATP at rest is limited and does not allow for many contractions,

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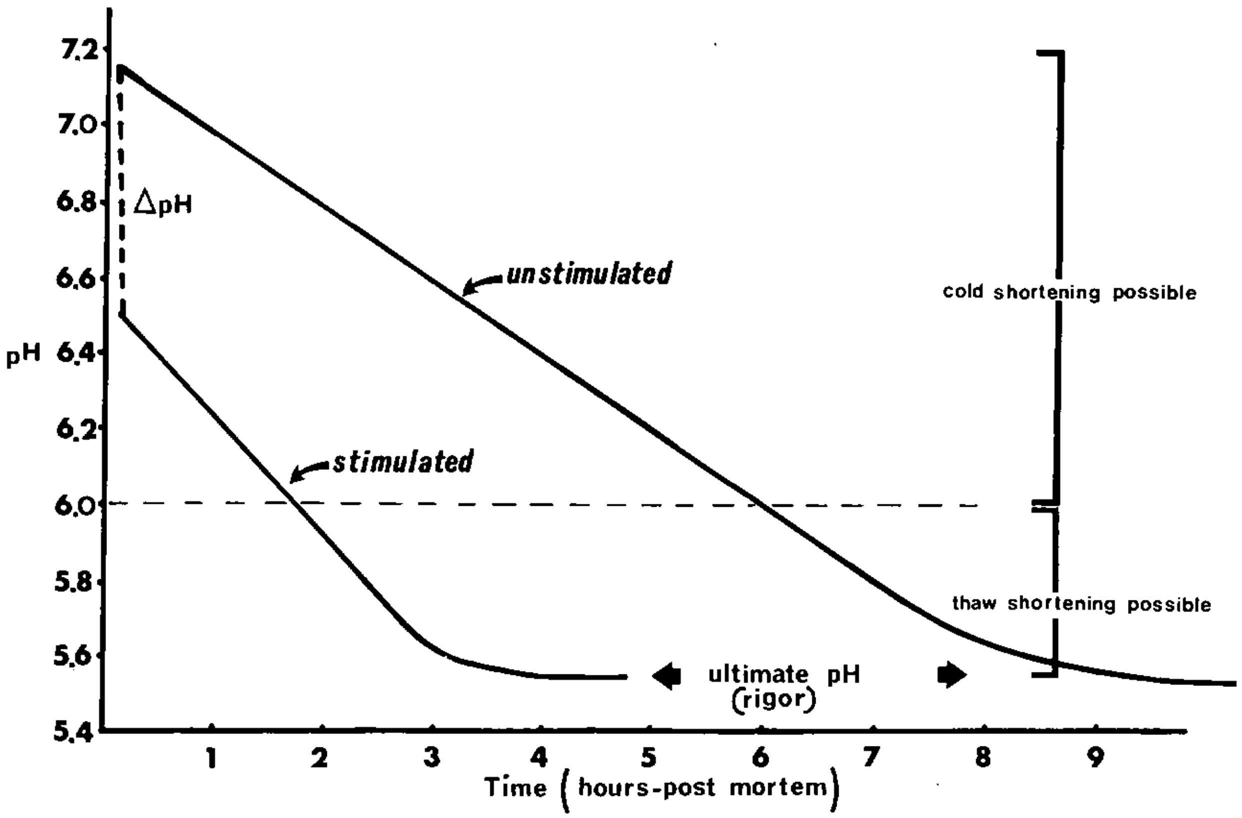

Fig. 2: Fall in pH of beef sternomandibularis (neck) muscle held at 35° C. Unstimulated muscle falls to its ultimate pH of approximately 5.6 in 8 hours. If frozen at pH values above 6.0 muscle will cold shorten and be tough when cooked. Below pH 6.0, the ability to cold shorten is lost; but if muscle is frozen before it goes into rigor, it will shorten if thawed rapidly (thaw shortening) and again the result will be tough meat. Electrical stimulation for 120sec results in a concurrent fall in pH (ΔpH) down to values of around pH 6.5. Following stimulation there is an increased rate of pH fall (dpH/dt), which further decreases the time for the muscle to enter rigor. Upon entering rigor, electrically stimulated muscle will commence ageing earlier because it is warmer and becomes even more tender.

Modified from B.B. Chrystall & C.E. Devine[10], Meat Science 2, 49-58 (1978).

Meat Stimulation (Cont)

so ADP is rephosphorylated by creatine phosphate, also stored in the muscle. The end product, creatine, is rephosphorylated by ATP. Ultimately, all ATP has to be formed from glycogen. If there is oxygen present, glycolysis to produce ATP occurs via the Embden-Myerhof scheme to produce pyruvic acid, which then enters the tricarboxylic acid cycle to produce water and carbon dioxide and further ATP. During anoxia or intense periods of muscular activity, or if an animal is slaughtered, the muscles produce ATP via glycolysis and produce lactic acid. In a live animal the lactic acid is transported away from the muscle and may actually provide a substrate in some organs which have plenty of oxygen (such as the heart, with normally large, healthy coronary arteries carrying oxygen-rich blood from the lungs) to form ATP. In excised muscle, the lactic acid accumulates and the pH slowly falls from an initial value of around pH 7.0 (Fig. 2). Eventually, the low pH, together with the conversion of adenosine monophosphate (a breakdown product of ADP) into inosine monophosphate results in the muscle going into rigor at a pH of around 5.6 (Fig. 2). If the animal is exhausted, the amount of glycogen in the muscle is low and the ultimate pH of the muscle will be higher. The process that takes place if there is no muscle shortening is called **conditioning** (C). The muscle eventually becomes firm and goes into **rigor.** The process takes about 24 hours and is akin to rigor mortis in humans. (Interestingly, the time course of these events is well known and the time of death in humans can be retrospectively determined by knowing the rates of temperature and pH falls after death). The muscle is now meat.

After rigor has been achieved, there is another post mortem change whereby the muscle becomes more flaccid. This is termed resolution of rigor, or meat **ageing** (A). This change is not due to bacterial decay, which would occur much later (of the order of days). During ageing the muscle becomes more fragile and providing the muscles have not shortened (see below), the cooked meat is more tender. In aged meat there is a proteolytic breakdown by endogenous enzymes of the muscle structure so that there is eventual decay of the Z bands[2] (the intact Z bands are shown in Fig. 3). The whole process is termed conditioning and ageing (C & A). Conditioned and aged meat would be an extremely acceptable product (with the proviso that some cuts would never be tender) and there would be few criticisms. Even so, it must be remembered that there are other contributors to meat toughness, such as the connective tissue components, collagen and elastin (eg tendons and ligaments). Frying steaks have less connective tissue than stewing steaks, casserole meats or roasts. It is still not possible to make stewing steak into filet mignon.

Tenderness, Toughness and Shortening

Tenderness has always been a desirable characteristic of meat, but one not always found. Usually it is the cook or butcher who gets the blame for tough meat, but poor processing resulting in shortened muscle is usually the real cause.

The tenderness of meat is a characteristic noted at the time of eating. In the laboratory it is measured experimentally by shearing meat in a "tenderometer", a device simulating the tooth action. In histograms of shear force units (Fig. 1) from the MIRINZ tenderometer, values less than 40 indicate acceptable tenderness. What is the reason for meat becoming tough?

It was noticed by Dr. Locker[3] in early experiments at MIRINZ that fresh pre-rigor muscle exposed to low temperatures contracted, and when cooked became tough. If the meat went into rigor before being exposed to

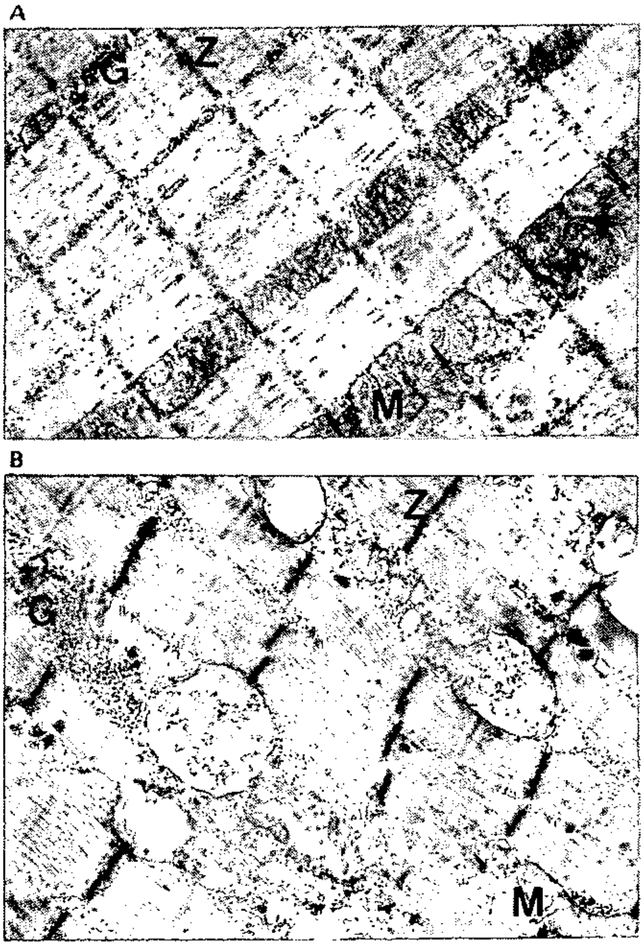

Fig.3: Electron micrographs of (A) unstimulated and (B) stimulated neck muscle from a lamb, at the same magnification. In the unstimulated muscle intact mitochondria (M) lie between bundles of myofilaments. Densely stained Z lines (Z) lie at right angles to the mitochondria and myofilaments. After stimulation swollen mitochondria are present in the muscle. The fine densely stained particles (G) are glycogen granules. Magnification x 28,000.

the cold, toughness did not occur (Fig. 2). The clear fact emerged that **when shortened muscle is cooked, it is tough.** It is necessary therefore to stop muscle from shortening, and a great deal of research at MIRINZ has had this end in view. For microbiological reasons it is desirable to cool carcasses as quickly as possible, and therefore the risk of cold shortening is high. It is unfortunate that in conventional freezing works with high throughput, early freezing to conform to hygiene requirements actually results in meat becoming tough, whereas farm-killed meat hung overnight from a branch of a tree, with natural cooling, is seldom tough.

The extremely successful marketing of lamb in the United States embodies a conditioning and ageing (C & A) process where carcasses are held in controlled conditions for 40-48 hours. This specification was one of the major achievements of early research at MIRINZ[4]. It is, however, expensive and therefore done only for special markets. It would obviously be desirable for a convenient, cheap process to be developed. This aspect of toughness was uppermost in the minds of MIRINZ scientists for some time and the solutions had even been hinted at in the literature. By handling carcasses by the pelvis (rather than by the hocks) in such a way as to result in the muscles being restrained by carcase and bone (squat posture), shortening is reduced and the meat is more tender[5]. Electrical stimulation of muscles was eventually shown to be the most effective way to speed up the rigor process, and the total process was termed accelerated conditioning (AC)[6] [7].

As long ago as 1749, Benjamin Franklin[8] noted that electric shocks tenderized turkeys. More recently, electrical stimulation to tenderize meat was the subject of a 1951 United States patent by Harsham and Deatherage[9], but that fact that cold shortened meat was tough was not known then, so the full importance of the technique was not realized and therefore not utilized. An understanding of meat science to the degree attained at present proved to be essential to implement new technology.

Stimulation Parameters

Knowledge of a phenomenon of stimulating a muscle to make it go into rigor early is a long way from introducing a technology into a meat industry which kills over 25 million lambs and 2.5 million cattle each year. What voltages should be used? How long should stimulation be? Should it be just after slaughter, or could it be applied later, and if so, how much later? How early could carcasses be frozen and what about safety standards? All of these problems occupied the attention of MIRINZ staff and involved complex and often dangerous techniques such as measuring current through each leg of a woolly carcase moving along a rubbing electrode at 3000V! Trailing wires were an obvious hazard, so radio telemetry techniques were necessary. In early experiments the blood-spattered environment of the bleeding rail was the site of many carcase manipulations and many telemetry measurements.

In early investigations there were difficulties also in using whole carcases, so many of the basic principles were elucidated on isolated beef neck muscles. It was found that, provided the muscle pH did not fall too far, post-mortem delay before stimulation was relatively unimportant. However, the temperature of the muscle was important. As the carcase cooled, stimulation became less effective. The implications were clear; carcases had

Fig 4: A post-dressing accelerated conditioning tunnel. Flashing lights, foot switches, door and warning devices prevent accidental entry (not shown). One electrode is the earthed rail at the top, and the other is the U-shaped rail extending down the tunnel and rubbing against the backs of the lambs. The applied voltage is 800V RMS (1130V peak) at 14.3 pulses per second, with approximately 2 amps peak passing through each carcase.

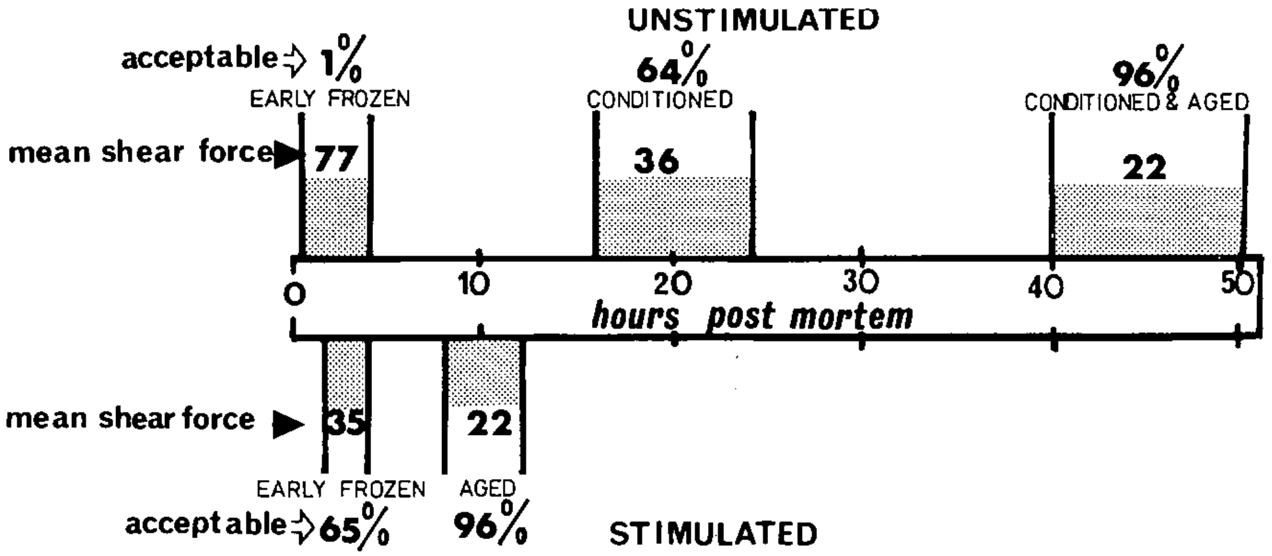

Fig. 5: The time scale of various processing and freezing delays to produce meat of different degrees of tenderness in unstimulated and stimulated lamb carcasses. The figures indicate the mean tenderometer scores and the percentage below shear force values of 40 (regarded as acceptable). In early frozen lamb, there is no saving in time, but stimulated lambs are much more tender. Most dramatic, however, is the reduction in time needed to produce C & A lamb.

From B.B. Chrystall[15], Farm and Food Res. 9, 141-143 (1979).

Meat Stimulation (Cont)

to be stimulated before they cooled too much, and experiments showed that the practical limit was 30 minutes after slaughter. This meant that the carcase could be subject to stimulation much later than first thought, but still within well defined limits. It is well known that frequencies around 50 Hz — the frequency of the mains supply — affect nerves and muscles, are lethal and might be convenient and ideal for stimulation. With a carcase resistance of near 500 ohms and an applied voltage of 1000V, approximately 2 amps was flowing through the carcase (ie 2 kW). There was often severe heating and melting of the Achilles tendon during stimulation utilizing these frequencies. Experiments showed that the optimum stimulation frequency was from 9 to 16 Hz, with a consequent reduction of the total energy to approximately one-seventh of the values at 50 Hz and a concomitant reduction of heating at electrode contacts[10] Electronic switching of the 50 Hz mains supply, using equipment designed by Richard Hand of the MIRINZ instrumentation section, proved to be the most convenient way to produce this frequency. The stimulation period is important — the longer the period the greater the effect, up to about 120sec. Muscle from a freshly slaughtered animal is more responsive than muscle held for some time after death, hence the full effects of AC can be achieved with shorter stimulation periods. The C & A process results in uniformly tender meat in approximately 48hrs. When conditioning is achieved by electrical stimulation, carcasses are relatively warm when they go into rigor and ageing proceeds much more rapidly. The AC and A process can therefore result in lamb as tender as the C & A product, but this is achieved in only 8hrs (Fig. 4). This technology means that NZ can process more C & A quality carcasses, for which at present there is an unsatisfied demand.

Mechanism Of Stimulation

Understanding the mechanisms behind electrical stimulation has been important in developing the optimum parameters, but these mechanisms are also interesting biochemically. Analysis of the changes occurring during electrical stimulation showed a large fall in pH (ΔpH) during the stimulation, related to the work done and utilization of ATP. It was Δ pH which varied with frequency and duration of stimulation. Once stimulation ceased, however, it was noted that the rate of fall of pH (dpH/dt) was faster than that of unstimulated muscle. This increase in rate was unaffected by the other stimulation parameters. Both the Δ pH and the increased dpH/dt contributed significantly to the decrease in the time taken for the muscle to go into rigor (Fig. 2)[10].

The initial contraction upon stimulation with electrodes applied to the head and hocks is similar to the contraction in living muscle, and utilizes approximately one-third of the muscle glycogen reserves to produce ATP. This probably represents the greatest amount of work the muscles have ever done at one time. Because there is no circulation, anaerobic glycolysis produces lactic acid, which accumulates, lowers the pH and eventually inhibits glycolysis.

The Δ pH and the subsequent post-stimulation increased dpH/dt can be brought about by stimulation of the nerves with relatively low voltages (up to 50V). This mode of stimulation, which has the potential of being safer, has been proposed in some Australian beef processing plants by the use of an anal electrode[11], or in some Swedish beef processing plants by careful placement of electrodes[12]. Both methods suffer from the disadvantage that nerves die relatively early post-mortem, and therefore stimulation has to be carried out much earlier, limiting the flexibility of the operation. In experiments where nerves are blocked by curare (a drug used by South American Indians to paralyse their prey), direct stimulation of the muscle was still effective, indicating that an intact nervous system is not necessary[13].

Experiments are continuing to find out exactly how stimulation is exerting all its effects, especially the mechanism of the increased dpH/dt following stimulation. Examination of stimulated muscle under the electron microscope shows the presence of swollen mitochondria (Fig. 3), but whether these organelles or other structures (such as sarcoplasmic reticulum or myofilaments) have been functionally modified by stimulation has not yet been elucidated[14].

Incorporation Of Stimulation Into Processing

Incorporation of the results from experimental beef neck muscles stimulated at 200V to a processing system involving whole lamb or beef carcasses stimulated at higher voltages required considerable development and the co-operation of several freezing companies (Auckland Farmers Freezing Co-op Ltd., R & W Hellaby Ltd, and Hawkes Bay Farmers Freezing Co. Ltd., at Whakatu). The AC tunnel has safety doors and switches at each end. While carcasses pass through the tunnel attached to the normal overhead rail by gambrels and sliders, they rub across a U-shaped electrode at their shoulder level (Fig. 4); the earthed overhead rail functions as the other electrode. The carcasses slide along the electrode, taking 90sec. The peak current flowing through each carcase is 1.8-2A at 1130V peak at 14.3 pulses s^{-1} derived from the 50 Hz mains. Such voltages, with several carcasses stimulated in parallel, require special equipment handling up to 60A. All this happens within 30min of slaughter and with the pelt removed from the carcase. A shorter stimulating time (45sec) is used in some freezing works where the carcase is stimulated within 5min of death with the pelt intact. Resistance at the wool electrode interface is overcome by high pressure water jets and voltages up to 3000V. Each system has its own particular advantages, depending on the requirements, usually space, of the individual freezing company.

AC Process and Freezing

Freezing: Freezing is an integral part of NZ meat processing for our overseas markets. While early freezing has, in the past, led to the problem of cold shortening, electrical stimulation means early freezing can become a practical possibility, with the opportunity for novel processing changes. Small carcasses like lamb lose heat rapidly, so high freezing rates can be achieved (provided, of course, carcase temperatures do not fall below, say, 10°C while the muscle pH is above 6.0).

Experiments have shown that with adequate stimulation lamb carcasses can enter the freezer 2 hours after slaughter[15]. At present, stimulation has concentrated on lamb processing, as cooling is more of a problem than for beef.

With beef carcasses, cooling is less rapid and the risk of toughening is consequently lower. Stimulation still gives a major advantage; it allows carcasses to be cut up while in rigor and still warm, and then packaged and frozen — a process called hot-boning.

The saving of time by electrical stimulation can best be seen by the comparison of tenderness values and freezing times achieved with non-stimulated, AC, and AC & A lamb (Fig. 5). Electrical stimulation plant is being steadily introduced into NZ freezing works for lamb and to a lesser extent for beef, and in relatively short time both New Zealanders and overseas consumers will reap the full benefits. In conjunction with new packaging, the ability to guarantee tenderness should raise lamb from a cheap commodity to a high quality product. Appreciation of the advantages of electrical stimulation is worldwide, with Australia, England and the United States planning to incorporate it into processing. We should therefore be poised for new opportunities in the market-place, as there is now world-wide agreement on the advantages of electrical stimulation in producing high quality meat.

Acknowledgements

Being the result of many years of research, electrical stimulation is not the work of one person. Thanks are therefore due to the many scientists, engineers, technicians and freezing companies, many of whom have already been referred to, who have contributed in a major way to development of this technology. In particular, I would like to thank the previous Director, Mr Norman H. Law, FNZIC, MBE, under whose guidance electrical stimulation commenced, and the present Director, Dr. C. Lester Davey, FNZIC, under whom it reached its full development.

REFERENCES:

1 R.H. Locker, *Chemistry in New Zealand 41*, 48-52 (1977).
2 C.L. Davey and K.V. Gilbert, *J. Food Technol. 2*, 57-59 (1967).
3 R.H. Locker and C.J. Hagyard, *J. Sci. Food Agric. 14*, 787-793 (1963).
4 R.H. Locker, C.L. Davey, P.M. Nottingham, D.P. Haughey, N.H. Law, *Advances in Food Research 21*, 157-222 (1975).
5 C.L. Davey, K.V. Gilbert, *J. Sci. Food Agric. 25*, 923-930 (1974).
6 B.B. Chrystall, C.J. Hagyard, *NZ J. Agric. Res. 19*, 7-11 (1976).
7 C.L. Davey, K.V. Gilbert, W.A. Carse, *NZ J. Agric Res. 19*, 13-18 (1976).
8 C.A. Lopez, E.W. Herbert, *"The Private Franklin; The Man and His Family"*, 1st ed. p.44. W.W. Norton & Co. N.Y. (1975).
9 A. Harsham, F.E. Deatherage, *Tenderization of Meat*, US Patent Office, 2,544,681 (1951).
10 B.B. Chrystall, C.E. Devine, *Meat Science 2*, 49-58 (1978).
11 F.D. Shaw, D.J. Walker, *J. Fd. Sci 42*, 1140-1141 (1977).
12 H. Nilsson, H. Ruderus, S. Fabiansson, *European Meat Workers Conf.* (1979).
13 C.E. Devine, B.B. Chrystall, C.L. Davey, *J. Sci. Fd. Agric. 30*, 1007-1011 (1979).
14 C.E. Devine, *Proc. 18th Meat Ind. Res. Conf.* 10-14 (1976).
15 B.B. Chrystall, *Farm and Food Res. 9*, 141-143 (1979).
16 C.J. Hagyard, *Unpublished data (1979).*

Running — A Study In Energy Utilisation

C.E. Devine

Physiological and biochemical studies on muscle and exhaustion of lambs are not only of relevance to meat, but also to human physical endeavour. The upsurge of running is one area of interest and possible abuse to the ear of a non-runner. Maximal physical effort, e.g. weight lifting, sprinting or pushing a reluctant car to start it, are "anaerobic" and entail much subsequent puffing i.e. the work is done and the oxygen debt repaid later.

The fuel for this type of exercise is ATP produced from glycogen (see the particles of glycogen in the electron micrographs), of which muscles have an important but limited supply which would last only for a very short time (e.g. 120sec or so) at high work output. This is not long, but sufficient for flight or fright reactions and heavy lifting.

Liver glycogen is available for more prolonged efforts but has to be transported as glucose. Obviously a weightlifter has only a few lifts at maximum effort. Fat is the fuel for prolonged muscular effort but it has to be oxidised aerobically. White muscle (so termed because the amount of red pigment myoglobin is low) uses ATP produced mainly from glycogen with a minimum contribution from fat.

"Aerobic" metabolism occurs mainly in slower acting, smaller, red muscle fibres with a small diameter for rapid diffusion and containing myoglobin for more efficient oxygen transfer. Red muscle fibres use glycogen as well as fatty acids and are responsible for endurance activities. Fat has a higher energy content and less bulk than glycogen and is therefore more useful as an energy store. Migrating birds use fat stores and would be unable to lift themselves off the ground if fat were substituted by glycogen.

When the energy requirement for muscle work exceeds the aerobic capacity of the muscle, glycogen is degraded anaerobically and the glycogen reserve is rapidly depleted, with a total energy production of only 10% that of aerobic metabolism.

At about 60-70% of maximal oxygen uptake, which occurs in activities such as running, there is initially glycogen utilization and much puffing, but eventually fat utilization takes over an increasingly greater role after 20-30min or so and supplies about 75% of the energy of the second hour of running.

At these moderate work intensities one would expect that one could go on for ever with events such as running. Such is not the case, since glycogen is still the premium fuel. As speed increases, however, porportionally greater amounts of glycogen are used. With insufficient training and low glycogen stores a hopeful marathon runner will "hit the wall" as glycogen runs out and slow to a shuffle or walk. If he runs too fast, with too much inefficient anaerobic glycogen utilization, the result is the same. The good "jogger" runs perhaps at an 8min/mile rate (5min/km) aerobically.

Consider the ability of a top-class marathon runner who runs aerobically (at 85% of maximal oxygen uptake) at less than 5min/mile rate (3.125min/km) for some 26 miles (42km). Until absolute exhaustion, there is sufficient glycogen left for a final anaerobic sprint. A world record run therefore is a delicate balance between an aerobic beginning (with a slight anaerobic content, depending on the distance run) and a final anaerobic sprint of up to 300m or so. In many of our experiments we have found that even unfit humans are considerably fitter than lambs, which can be fairly exhausted after a vigorous 3 mile (4.8km) run. It is unlikely that lambs in the NZ situation would be exhausted even after a prolonged journey in a truck, as the actual work intensity is low. They are usually packed so close that they support each other.

Automating Atomic Spectrometry, Today and Tomorrow

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SUMMARY

The present status and some future challenges of automation in atomic absorption spectrometry and inductively coupled plasma atomic emission spectrometry are discussed. Some basic functions of the techniques have been successfully automated, but further development is desirable and possible in three distinct areas. Data handling can turn from basic calibration to more powerful correction procedures if more insight is gained into the fundamental physical principles of the atomizer sources. Instrument control can incorporate feed-back mechanisms, when more refined sensors and mechanics are developed. Finally, computerized optimization and decisions offer a true challenge for future automation of atomic spectrometry.

Introduction:

It might be argued that atomic emission spectrometry ranks as the oldest automated technique in analytical chemistry. Already in the early 50's, direct readers were used for simultaneous multi-element spark analysis and they were soon equipped with computers for data acquisition and data handling. Over the years, the computer programs were refined to allow dynamic background measurement and interelement corrections. Essentially the same facilities are available in current readout systems for inductively coupled plasma atomic emission spectrometry.

Nevertheless, it might also be argued that atomic emission and absorption spectrometry rank among the most retarded techniques with respect to automation. Whereas in the past 30 years computer technology has developed tremendously, it is only recently that some of its potential has been applied to atomic spectroscopy. To substantiate this statement it is illustrative to consider the impact of computerization in 2 methods related to analytical spectrometry.

In instrumental neutron activation analysis the introduction of the solid state Ge (Li) detector revolutionized the analytical capability of the method in the 60's. Very soon computer programs were developed for the automatic conversion of the multichannel spectra to printed lists of element concentrations. Assisted by the basic expressions for the count rate and the method's proven freedom from interference, such programs often relied on only a single calibration with one internal standard.[1] The search for the relevant spectral line, the correction for background and the deconvolution for interfering lines are all incorporated in the computer software.

By contrast, X-ray fluorescence spectrometry is very prone to interelement effects arising from matrix absorption and secondary fluorescence. Whereas early computer programs relied on the use of a vast number of calibration standards, these requirements have been greatly relaxed in recent years. Again, the basic understanding of the fluorescence equation led the way to empirical and fundamental correction procedures using sophisticated software[2]. In energy dispersive X-ray fluorescence the knowledge gained in automating the above two methods is elegantly combined.

The question arises why the more classical atomic absorption and atomic emission methods of analysis have not profited to a similar extent. This is the more surprising since the basic task seems to be the same: the collection and handling of data at a selected number of wavelengths. In the following sections some of the problems encountered and the progress made in automating atomic spectrometry will be reviewed.

Data Handling

The ultimate goal of an automated instrument is the unguarded extraction of analytically useful information from a number of samples. For an atomic spectrometer this general aim may be specified further. Since atomic spectrometry permits the selective determination of one or more elements in a complex matrix, sample pretreatment can frequently be simplified to the mere dissolution and automated presentation of samples with a sample changer[3]. Still, this ignores the necessity in AA and ICP analysis of converting solid samples into solutions. Indeed this step in the analytical procedure has hardly been automated yet and often consumes time and labour. For AA-analyses the problem is complicated by the limited dynamic range of the method, so that different dilutions are frequently required for various elements. This area has also been neglected, since AA has long been considered a single-element technique. Even then, samples of widely varying composition might benefit from an automatic dilution device.

The next step is data acquisition. Let us first consider the single-element AA-instrument and the multi-element direct reader for AE. In either case the wavelength(s) are preset and fixed. Data acquisition then seems to be simple with only the period of data collection to be specified. However, the subsequent need for background correction requires at least a rapid switching from one wavelength to another. In the AA instrument this may be done by incorporating a deuterium lamp or — in the future — employing the Zeeman effect[4]. In the direct reader we find spectrum shifters such as a movable entrance slit or an oscillating quartz plate. As we shall see, the extent of the spectral shift is by no means unequivocal.

The major problem, however, is the conversion of the primary intensity or absorbance to an analytical concentration. In AA calibration curves are seldom linear and must be adapted to an empirical polynomial since the reasons for non-linearity are manifold and only approximately described by appropriate expressions [5,6].

Running (Cont)

If one considers an hour's run, up to 1000 kcal, mainly of fat, are used up. This could be a significant proportion of the day's energy requirements of, say, 3000 kcal, and it would be easy to see how a combined programme of running and dieting could induce a weight loss. Unfortunately those who need to diet most find running hardest.

The beneficial cardiovascular effects of running have not yet been proved or disproved, as no large group of people have been doing it for a sufficiently long time, although heart attacks are rare in marathon runners and common in sedentary occupations. Reports have come in regarding post mortems, which showed that coronary arteries of runners who died of non-cardiac causes are "as clean as a whistle" due to the protective action of the high density lipoproteins mobilized in running.

Another group of people who have similar vessels but are not so fortunate are skid row alcoholics, where protection is a result of increased synthesis of high density lipoprotein by alcohol!

Moreover, a warning device must be included to guard against too high a signal. Good linearity and an extended range is one of the claimed assets of ICP-AES but here, too, exceptions occur and the dispute between linear or double logarithmic calibration curves has not yet been solved[7].

The next question concerns the stability of the instrument, because this determines the frequency of recalibration. Certainly, the instrument requires recalibration each time it is restarted. How long the calibration can be trusted is a matter of dispute. The type of element, the nature of the samples and the quality of the instrument contribute to the result. Direct readers may be equipped with automatic correction for variations in ambient temperature. The smaller and more robust AA-monochromators do not seem to suffer from wavelength drift. On the other hand, drift may also arise from variable sample aspiration and from changing source conditions, such as flame composition in AA and RF-power in the ICP. Possibly, such phenomena could be corrected by ratioing to a reference line of the argon carrier gas, but such attempts have not been very promising. Consequently, recalibration is either left to the discretion of the operator, requiring at least periodic supervision, or performed at rigid time intervals. It is then relatively simple to instruct the computer to correct for drift by executing a linear interpolation between two successive calibrations. Although this negates the influence of drift, it would be much more proficient if the change in calibration signal were used to restore the instrument to its original operating conditions. Such a feed-back system obviously requires control of the instrument parameters, such as wavelength setting, gas flow rates, RF-power, hc-lamp current etc. The topic of instrument control will be treated in the next section.

The final aspect of data handling is the execution of interelement corrections. In as far as the presence of concomittants gives rise to physical or chemical interferences, the subject can be readily dismissed. Although such interferences undoubtedly exist in both AA and ICP-AES, there is no equivalent in either technique of the elaborate, successful correction programmes developed for X-ray fluorescence spectrometry. The reason is not the absence of computer facilities, but a lack of physical understanding of the nature and the extent of the interelement effects. The internal standard principle, so successful for arc and spark spectrometry, offers no improvement in AAS[8] or in ICP-AES[9]. Therefore, up to now, interelement corrections have been restricted to spectral interferences encountered in the ICP. Both on-line and off-line corrections have been applied. On-line corrections at fixed wavelength use the empirical expression[10]

$$I^{i}_{corr} = I^{i}_{meas} \, (1 + \Sigma \alpha_{ij} c_{j})$$

where c_j is the concentration of the interfering element. Obviously, the procedure is iterative and requires measurement of all potential interferants. Moreover, the correction coefficients α_{ij} must be predetermined. Understandably, it is only utilized in direct readers, where it avoids the need for wavelength shifting[11]. One further advantage of on-line measurements is the possibility of correcting for line-overlap.

This opportunity is not available in off-line corrections, where the gross intensity of the analyte wavelength is corrected for the background intensity at one or other side of the line. Because the potential interferants need neither be measured nor known, the technique offers an obvious advantage for unknown samples and programmable monochromators directed at a few spectral lines. However, the position of the background reading remains critical, especially if the background is structured. This observation is the more important in direct readers, where the spectrum shifter applies a single, preset wavelength variation to all spectral positions.

In conclusion, it can be said that data collection and handling in atomic absorption and emission spectrometry is currently restricted to the basic operations of spectral correction and calibration. True interelement corrections and drift detection are not even considered, due to a lack of understanding the fundamental processes in the atomization sources.

Instrument Control

Even when operated at fixed wavelengths an elementary form of instrument surveillance must be included if the instrument is to run unguarded. For example, it must be periodically verified that the gases are flowing, the hc-lamp is burning, the photomultiplier is at high tension, etc.

Much more sophisticated instrument control is required, when we exchange the rigidity of data collection at one (AA) or more (AE) fixed wavelengths for the flexibility of measurement at variable wavelength. It is in this area that AA and AE spectrometers are currently showing most progress. Sequential multi-element, i.e. multiwavelength AA instrumentation was heralded by the Jarrell Ash model 850 and improved by the Perkin Elmer model 5000. The latter instrument incorporates not only automatic wavelength selection, but also adjustment of flame gases, lamp current and gain, allowing separate optimal conditions for up to 6 individual elements[12]. Undoubtedly, this form of automation was forced upon AA-spectrometers by the growing competition of the ICP with its inherent multi-element capability.

In retrospect, wavelength selection is fairly simple in AAS. The unique, intense hc-line is readily isolated from its few neighbours with a medium sized monochromator equipped with a stepping motor to turn to the desired wavelength[13,14]. Naturally, the programmable monochromator was also considered for possible use in ICP emission spectrometry. With its wide dynamic range and relative freedom from chemical interferences[15], the ICP is a natural choice for the analysis of unknown samples. It has become obvious, however, that the complexity of the ICP-spectrum does not warrant the prescription of a unique spectral line for each element. The risk of spectral overlap is too great, so that the wavelength of choice for a particular element depends also on its matrix. This observation rules out the use of a direct reader and explains the need for the flexibility provided by the programmable monochromator. Unfortunately, a dilemma arises.

The medium sized monochromator, found so useful in AAS, may not provide sufficient resolving power to isolate the desired analyte line in a complex spectrum. On the other hand, a monochromator of higher resolving power is delicate to tune mechanically. Moreover, in either case emission spectrometry suffers from a disadvantage not encountered in atomic absorption: the analyte may not be present in a particular sample, in which case the monochromator looks in vain for the requested spectral line.

At present, the dispute remains undecided. If speed (and hence minimal sample consumption) is essential, the medium sized monochromator should be preferred. Its robustness and fair spectral band pass allow it to be instructed to proceed directly to a prescribed wavelength and start data collection there. The risk of insufficient resolution may be reduced somewhat by including measurements at alternative wavelengths, but at the obvious cost of time. The high-resolution monochromator is usually instructed to proceed close to the desired spectral line and then scan slowly and in small steps over the line. This takes more time, but guarantees data collection at the peak intensity.

Possibly, the mechanically scanning monochromator represents only a passing phase in computerized wavelength control. Alternative systems, such as IDES[16,17], photodiode arrays[18] and vidicon tubes[19] have been described for atomic spectrometry, but must be further developed before they meet the requirements of analytical practice.

Wavelength selection is, of course, only one aspect of instrument control. The possibility of re-optimizing other instrument parameters during the time needed to proceed from one spectral line to the other has been included in the automated AA-instrument. It is hoped that the example will be followed in sequential ICP-instruments, because compromise conditions developed for direct reader-ICP combinations necessarily yield poorer results than individually optimized conditions[20]. As remarked earlier, feed-back control to improve stability might well be beneficial in both AA and ICP spectrometers.

One area of instrument control merits closer attention. So far I have not explicitly considered furnace atomic absorption spectrometry. It is well known that precise control of the temperature program of graphite furnaces is an essential requirement for accurate analyses. Indeed, the exact temperature program depends not only on the analyte to be determined, but also on the composition of the sample matrix[21]. Level and duration of the drying and ashing step influence the precision of the result and relax the demands for background correction.

Consequently, many AA instruments provide microprocessor control of the furnace heating programme. It should be realized that mere control of the voltage or power supplied to the furnace is not sufficient, because this does not account for changes in the electrothermal properties of the graphite tube upon its recurrent use. True temperature control through thermocouples or photodiodes is offered in some instruments, but only during the ashing and atomization step. There remains a need for measurement and control of the furnace temperature over the entire heating cycle.

Although some steps have been taken, development of instrument control in atomic spectrometry is not yet complete. Whereas data handling is hampered by a lack of fundamental understanding, instrument control is mainly limited by hardware problems. Mechanically precise wavelength drive, stable power supplies and accurate furnace temperature sensors are needed to further develop the control functions of an automated spectrometer.

Optimization And Decisions

It should be realized that the instrument automated to the above stages still does no more than faithfully carry out the instructions provided by the operator. The simple command "determine these elements in this sample" is not sufficient for a computer. It must be translated by the operator into specified experimental conditions (wavelength, gas flow, power etc.) that the instrument may then control. In the same way, the operator selects linear ground and inter-element correction etc.

The entire area of decisions, from the selection of appropriate conditions to the acceptance of an analytical result, is very exciting but also largely unexplored. The major problem is the formulation of algorithms that describe the mental processes of the operator. Previous analytical procedures and basic acceptance criteria may be entered into the computer memory. However, the often intuitive approach and the experience of the analyst are very difficult to formulate. One advantage of any attempt towards automation in this area is the necessity to objectively describe such processes.

A few initial steps have been taken. Most automated instruments provide facilities to store and recall several analytical procedures. Simplex and other optimization programmes have been used successfully in atomic absorption[22,23] and ICP emission spectrometry[24]. Warning signals against too high absorbance readings for either analyte or background are incorporated in many AA spectrometers. There remain, however, at least two areas where computerized decisions would be extremely helpful.

One is the selection of a suitable wavelength in ICP emission spectrometry. As has been remarked above, the most sensitive line of an element may not be suitable for a particular analysis, because it is overlapped by a spectral line of another sample component. In principle, it would be easy for a computer to detect the presence of a possible interferant, consult a library of interfering lines and compare their wavelength separation with the spectral bandpass of the spectrometer. Unfortunately, the available listings of ICP spectra are far from complete[25,26].

The other challenge is the choice of an appropriate temperature program in furnace atomic absorption spectrometry. It is well known that especially the drying and ashing step of a heating program must frequently be adapted to a particular sample[21]. Although the optimization procedure is straightforward[27], the goal of the optimization is less easily defined. Reduction of background, prevention of analyte losses and acceptable precision should all be observed.

Conclusion

The discussion of automation in atomic spectrometry has intentionally been kept general rather than exhaustive. The present state of the art has been sketched in broad lines with reference to atomic absorption and ICP atomic emission spectrometry. The future challenge of automation resides not so much in the development of refined computer programs, but in the formulation of basic algorithms. In turn, these depend on a better specification of our analytical goals and an improved knowledge of the fundamental processes in our atomizers. And finally, the task of the computer programmer would be much relieved by improved instrumentation.

REFERENCES:

1 M. de Bruin, P.J.M. Korthoven, *Anal. Chem. 44,* 2382 (1972).
2 R. Jenkins, *in keynote lectures XX CSI, Cambridge,* p.37 Heyden, London 1979.
3 W.G. Boyle, W. Sunderland, *Anal. Chem. 42,* 1403 (1970).
4 L. de Galan, M.T.C. de Loos-Vollebregt, *in keynote lectures XXI CSI, Cambridge,* p.64. Heyden, London 1979.
5 L. de Galan, G.F. Samaey, *Spectrochim. Acta 24B,* 679 (1969).
6 H.C. Wagenaar, L. de Galan, *Spectrochim. Acta 29B,* 301 (1974); *30B,* 361 (1975).
7 F.J.M.J. Maessen, *Proc. Winter Conf. on atomic plasma spectrochemical analyses,* San Juan, 1980 (in press).
8 F.J. Feldman, *Anal. Chem. 42,* 719 (1970).
9 W.B. Barnett, V.A. Fassel, R.N. Knisely, *Spectrochim. Acta 25B,* 139 (1970).
10 P.W.J.M. Boumans, *Spectrochim. Acta 31B,* 147 (1976).
11 N.R. McQuaker, P.D.K. Gluckner, G.N. Chan, *Anal. Chem. 51,* 888 (1979).
12 T.W. Barnard, *Anal. Chem. 51,* 1172A (1979).
13 E. Cordos, H.V. Malmstadt, *Anal. Chem. 45,* 425 (1972).
14 R.W. Spillman, H.V. Malmstadt, *Anal. Chem. 48,* 303 (1976).
15 V.A. Fassel, *Anal. Chem. 51,* 1291A (1979).
16 A. Gustavsson, F. Ingman, *Spectrochim. Acta 34B,* 31 (1979).
17 A. Danielsson, E. Soderman, P. Lindblom, G. Sunakoist, T. Berggren, *in keynote lectures XXI CSI, Cambridge,* p.1 Heyden, London 1979.
18 G. Horlick, E.G. Codding, *Applied Spectry 29,* 167 (1975).
19 K.W. Busch, N.G. Howell, G.H. Morrison, *Anal. Chem. 46,* 575, 1231 (1974).
20 S.S. Berman, J.W. McLaren, *Applied Spectry 32,* 372 (1978).
21 C. Hendrikx-Jongerius, L. de Galan, *Anal. Chem. Acta 87,* 259 (1976).
22 L.R. Parker Jr., S.L. Morgan, S.N. Deming, *Applied Spectry 29,* 429 (1975).
23 W. Wegscheider, G. Knapp, H. Spitzer, *Z. Anal. Chemie. 283,* 9, 97, 183 (1977).
24 L. Ebdon, M.R. Cave, D.J. Mowthorpe, *Anal. Chim. Acta* (in press).
25 R.K. Winge, V.J. Person, V.A. Fassel, *Applied Spectry 33,* 206 (1979).
26 P.W.J.M. Boumas, M. Bosveld, *Spectrochim. Acta 34B,* 50 (1979).
27 B. Welz, *Atom-Absorptions Spektroskopie* 2nd ed. 1975, Weinheim, Verlag Chemie.

Chemistry In The Energy Field

Condensation of an address given to the Wellington Branch, NZIC, by Energy Minister, Hon. W.F. Birch, in April

The early 1970s saw the world embroiled in debate about the possibility of natural resource depletion causing physical limits to growth. We understand better now the limits of the world's natural resources, that NZ is one of the more fortunate countries particularly where energy resources are concerned, but that the cost of resource extraction is likely to escalate. In addition, oil, which has established itself as the traditional and low-cost source of energy, particularly for the transport sector, can be seen today to be especially vulnerable to interruption in supply through accident or political action.

In common with other oil consuming nations, NZ is faced by the spectre of an energy source that is unreliable in terms of both price and continuity of supply. This unreliability puts continuing pressure on the country's external balance of payments and acts as a component of inflation. Even more important in the long term is that oil no longer has the capacity to maintain the growth patterns and energy needs of the industrialised world. One of our primary goals, therefore, in energy policy is to reduce our dependence on imported oil by a two-pronged effort —on the one hand, promoting conservation measures and demand restraint and, on the other, substituting indigenous sources of energy.

In the substitution area, important steps have been taken, including the programme to have 150,000 vehicles running on CNG by the end of 1985 and, recently, the formalising of a joint effort by NZ and the Mobil Oil Corporation to develop a synthetic petrol plant, using Maui gas as a basis for manufacturing a third of our motor gasoline requirements. The methanol to gasoline or MTG process is a fine example of how chemistry can dramatically affect the choice of synthetic fuels options. The key to the Mobil process is the specific zeolite catalyst type which is capable of selective and efficient conversion of chemical compounds. The Mobil catalyst has also provided a big stimulus for looking at the possibility of developing and modifying catalysts for the purpose of producing specific fuel products.

The Government's recent decision to proceed with a stand-alone methanol plant, initially producing for export, leads to way to a whole new field of prospects. Studies by the Liquid Fuels Trust Board (LFTB) have shown the possibility of a viable industry producing acetic acid and vinyl acetate for export to Pacific markets. The principal role of vinyl acetate is in the production of emulsions for the coatings industry, but it can also be used for the manufacture of emulsions in the adhesives, paper and textile industries.

Shortfalls in the regional market supply of methanol are estimated to grow to over 100,000 tonnes/year in the 1990s and NZ should therefore give consideration to setting up an industry to supply both the local market and this developing export demand.

Another likely basis for an industrial chemical development is ethane, extracted from the Maui gas stream. The ethane would be steam cracked to produce ethlyene of very high purity for polymerization to polyethylene. Production of methanol also opens up the possibility of manufacturing MTBE (methyl tertiary butyl ether) as a substitute for the lead currently used in upgrading the octane rating of our petrol. The prospects of new industries based on methanol derivatives may well see the realisation in NZ of the "exploded pharmacy" concept of chemical developments. It should be kept in mind that the domestic market will be the most profitable market for the chemical methanol produced, and the manufacture of 400,000 tonnes/annum from this plant will provide unprecedented possibilities for a range of new developments, all of which will require a substantial input from scientists with a chemistry background.

New Zealand's very large reserves of recoverable coal raise the obvious prospect of their use as a long term source of liquid fuels — either as an alternative to, or in parallel with, biomass. We know in general terms that coal can be processed into liquids by pyrolysis, by hydroliquefaction, and by gasification followed by synthesis. A big research and development effort, involving the Coal Research Association, the LFTB, Ministry of Energy (new technology), DSIR and the universities, is being mounted to ensure that we are not forced to rely solely on overseas technology and advice for new directions in energy. We will need to evaluate which of the processing routes is most suitable taking into account the nature of our coals, economics and the availability of our technology.

Many people think that alcohols are the fuels of the future — and there are good reasons for thinking this. It seems probable that it will be cheaper to synthesise methanol by way of coal gasification than to produce pyrolysis hydro-liquefication, or Fischer Tropsch products. Furthermore alcohols are excellent fuels in engines specially designed to use them and the alcohol route from coal is compatible with the production of alcohol from biomass. The production of methanol from coal would also allow the continuation of any industries which develop based on the use of methanol produced from Maui gas. At this stage it is too early to make a definite commitment to alcohol fuels alone and work will be done on hydro-liquefication and on the Fischer Tropsch synthesis. I understand Otago University is particularly interested in Fischer Tropsch work. We shall naturally follow keenly progress elsewhere with the commercialisation of synthetic fuels technologies from coal, and we can be grateful for the breathing space afforded us by our opportunity to make the much easier and cheaper conversion from natural gas.

The involvement of chemistry in the energy field is by no means limited to the areas I have mentioned. It has a role, too, indetermining the nature of gas fields, in the investigation of the use of blended fuels, in the monitoring and investigation of the effects of additives in fuels and so on. Much interest continues to be shown also in the prospects of battery-electric vehicles and chemistry will doubtless play an important part in improving battery technology and helping to overcome the present limitations in this form of transport.

On the energy front, particularly, whichever way one turns, there is a need for new technology, new answers, a new effort and inevitably the solutions will involve the discipline of chemistry.

In the longer term the Government's moves to encourage private sector interests into fuel ethenol production may come to be seen as no less important. The biomass route to production of such fuels covers a wide range of chemical activities. A pertinent example is fuel ethanol production based on sugar beet, in which three distinct phases may be defined —the growing of beet, its processing into ethanol, and utilisation of ethanol as fuel.

In the first phase, it is necessary to know what the "fermentables" yield will be and, because sustainability is important with energy farming, there is an ongoing need to monitor the nutrient depletion of the soil and the uptake of trace elements. Similarly, in the second phase — sugar extraction, fermentation and distillation — various chemical analyses are required if the processing to fuel is to be efficient and quality control maintained. Some of the wastes from ethanol production may well yield useful compounds on detailed examination, compounds which might be of significant value and capable of substantially improving the economics of the total operation.

In use as a fuel, ethanol will need to meet specifications which, of course, will constrain to some extent the operation of the processing plant. An example is the expected limitation of acidity which, if not controlled, can be a cause of serious corrosion in carburettors and fuel pumps. The production of alcohols from wood or other feedstocks raise similar questions. It can be seen, therefore, that a fair amount of analytical chemistry related to process control is called for and, perhaps even more importantly, that there is also a need for investigations into the biochemistry of the process.

The new opportunities will place responsibilities on your Institute to anticipate expanding requirements for training, to adapt existing courses to suit the needs of new industries for scientists and technicians. The 1980s will be a decade of change and challenge in which all New Zealanders will be involved. I trust that your profession will reach out and meet these challenges.

Fisher & Paykel Industries Ltd has registered a new subsidiary, Micro-computer Electronic Co Ltd., to provide a marketing and service function in the micro-computer and electronics fields. **Peter Watts**, formerly marketing director, W & K McLean Ltd., has been named managing director.

Analysis Of Wool Glass By Atomic Absorption Spectroscopy

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The analysis of any glass may be performed by various wet chemical methods, by X-ray fluorescence spectroscopy or by AA spectroscopy. The wet chemical methods are time-consuming, tedious and sample loss may be significant. X-ray fluorescence requires carefully analysed primary standards for the calculation of appropriate matrix correction factors and, in any case, most laboratories will not be able to afford the instrumentation.

AA spectroscopy offers a rapid and reliable means of analysing nearly all elemental glass components except for a few light elements such as O, H, F, S and Cl.

Wool glass of the type produced in NZ contains 11 elements (expressed as oxides), 10 of which can be analysed by AA. Typical wt% values are:

SiO_2 — 61.0
Fe_2O_3 — 0.30
TiO_2 — 0.15
Al_2O_3 — 3.6
CaO — 7.9
MgO — 3.7
Na_2O — 15.3
K_2O — 0.30
B_2O_3 — 4.8
SO_3 — 0.5
BaO — 2.3

The viscosity of wool glass is critical for the processing of fibres at a desired operating temperature because it affects the ability to draw or spin fibres. The fibres are drawn or spun through a titanium 'colander', a flat disc with holes of the order of 7 μm and vertical sides — with fibre size determined by changes of the disc. Too high viscosity prevents drawing of fibres through the holes, while too low viscosity causes thin fibre varying in diameter and lacking in desired properties. High silicon and aluminium levels increase the viscosity, while high barium, potassium, sodium and calcium decrease it. The most significant parameters are Si and B levels and, hence, analyses of these are most important.

The dry raw materials are mixed in about 1 tonne batches and fed into the furnace where they are fused during their passage through the molten furnace contents. Recycled window glass constitutes a major portion of the batch and represents a good, cheap source of 'cullet' (recycled glass). The composition of this cullet is not exactly that required for glass wool and batch mixes must be adjusted to compensate. Use of cullet enables both cost and energy savings and is necessary to assist fusion of the feldspar and other minerals comprising the remainder of the batch mix. Feldspar, soda ash, borax, barytes, limestone and either magnesite or dolomite are the usual constituents. Feldspar and borax levels are the most frequently altered constituents of any batch mix to control Si and B levels.

Although Mg and Ba levels have no effect on glass viscosity, the combined CaO/MgO must be less than 10.5% wt/wt and a sufficient level of BaO must be present to prevent devitrification.

Lin Drake is the analyst of AHI Technical Centre, Auckland. She was born and educated in Rangiora and graduated B.Sc. (Hons) from the University of Canterbury in May, 1971. While working in the Chemistry Department at Sydney University, she completed a M.Sc. in nuclear magnetic resonance spectroscopy. In December, 1978, she returned to NZ and was appointed to her present position in April, 1979.

For chemical analysis, a glass sample is decomposed by suitable means eg aqueous HF or fusion with NaOH, Na_2CO_3 or $LiBO_2$, dissolved and diluted with an aqueous solvent known as the 'matrix'. The matrix generally contains chemicals whose purpose is to suppress inter- and intra-elemental interferences within the flame.

Most of the dissolution methods known contain disadvantages for the wool glass analysis. Fusion mixtures introduce an element for which an analysis is required (Na or B). High temperature, open-container HF/HCl dissolution causes loss of volatile silicon and boron halides and sealed container HF dissolution methods contaminate the sample with boron, added as H_3BO_3 to complex elements forming highly insoluble fluorides. A separate sample is, therefore, required for boron analysis from which the insoluble fluorides are removed by filtration.

Two types of matrices are possible for HF dissolution procedures: a fluoroboric acid-boric acid matrix and a highly acidic matrix (2.8M HF, 0.8M HNO_3) containing only sufficient boric acid to complex the insoluble fluorides. The disadvantages of this matrix are obvious — the solution is highly corrosive, requiring the use of polyethlylene pipettes and volumetric flasks. Even with the use of a corrosion resistant nebuliser, corrosion of parts of the burner chamber may occur and there exists a constant hazard to the analyst. The fluoroboric acid-boric acid matrix allows volume measurements in calibrated glassware without significant contamination and, in the concentrations of HF used, is less hazardous to the analyst.

After experimenting with dissolution procedures, it was found unnecessary to use a raised temperature to achieve solution of the glass thereby avoiding loss of SiF_4 and the following procedure was established:

A sample of the wool glass (received in solid form) is pulverised in a tungsten-carbide vibratory grinding mill. 0.25g of glass is placed in a polyethlylene bottle, slurried with 2-3ml distilled water and, over 5 minutes, 11ml 49% HF is added. The bottle is capped between additions and swirled. After a few minutes for digestion 5ml conc. HNO_3 and 1ml conc. HCl are added, the bottle is re-capped and swirled occasionally until the glass dissolves (generally 5-10 minutes). 25ml distilled water is then carefully added followed by 4.4g H_3BO_3 added over several minutes. The bottle is swirled until the solution is clear, diluted to 250ml in a volumetric flask and returned to the plastic bottle.

Two dilutions are then made: 25ml into 100ml (1:4) for Si analysis and 1:100 (with the addition of 300 μg/ml Li or K and 3000 μg/ml Sr or La) for Mg, Ca and Na.

The glass digest for boron analysis is performed at elevated temperatures (90° C) allowing SiF_4 to escape and using silica flour to complex excess HF after digestion of the glass sample. Insoluble fluorides and excess silica flour are removed by filtration. As boron is not subject to substantial chemical interference, no additions to the matrix are necessary. A sample size of 6.25g digested with 10ml H_2O, 2ml HNO_3, 7ml HCl and 13ml HF, provides adequate boron levels after dilution to 250ml.

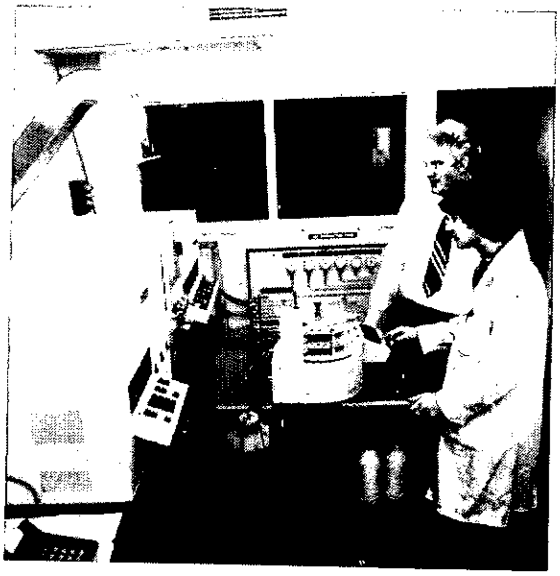
The sample of the unknown wool glass is then analysed against a wool glass of known composition which has been dissolved in the same manner and is subject to the same matrix interferences. Use of this standard glass renders the preparation of complex standard solutions unnecessary.

A Perkin-Elmer AA 5000 Spectrophotometer with corrosion resistant nebuliser and hollow cathode lamps is used for the analyses of the glass solutions. This instrument is completely microprocessor-controlled, offering many advantages to the chemist. The instrument contains a motorised, 6-lamp turret and full instrumental conditions for the analysis of 6 elements including pre-set flame conditions on the automatic gas control box are retained in the instrument memory. The memory is extended with a magnetic card reader accessory which loads or stores the entire block of programmes. Operation is, therefore, possible by persons with minimal training providing that the instrument is pre-programmed by a skilled operator for any particular analysis.

A Hewlett-Packard 9815A mini-computer is connected to the instrument via an RS 232C interface, which provides data print-out capabilities and infinitely extends the programme storage capabilities. The wool glass analysis thus requires either the loading of 2 magnetic cards or 2 programme blocks from a data tape to complete the analysis.

A combination of single and multi-element lamps allows full use of the turret to be made without changing lamps and the instrument's sensitivity allows all elements to be determined using the nitrous oxide (5cm) burner head, thus shortening analysis time. The instrument's microprocessor allows accurate single-standard calibration in 'Concentration' mode provided the element concentration is in the linear range; two- or three-standard calibration allows extension of analyses beyond the linear range for any element.

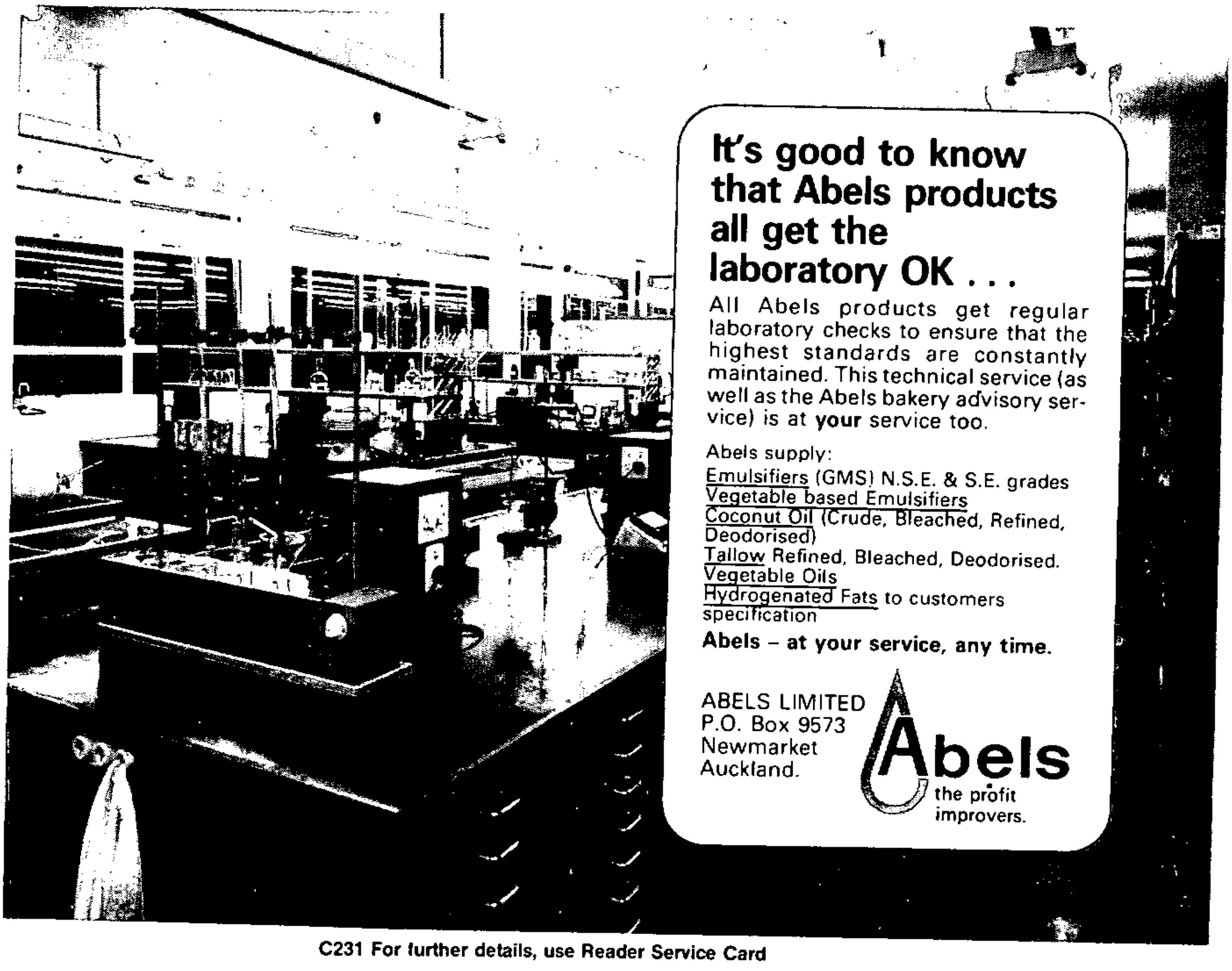
To complete an analysis by this AA, the untrained operator need only load a card and push three buttons on the instrument during the analysis: Flame On/Off, followed by (n = 1 to 6) RCL — this instruction causes the AA to set up for each of six programmes in memory. Wavelength selection is of the strongest signal within plus or minus 0.2nm of the programmed wavelength. Subsequent lamp and flame changes occur automatically as each programme is recalled and standard and sample concentrations are printed on the HP 9815A printer. Extension of analyses has been made possible by the purchase of a microprocessor controlled auto-sampler, which allows the analysis of up to 50 samples for 6 elements, without attention from an operator other than loading programmes and samples and initiating the analysis cycle. Although there is a restandardise facility, it cannot cope with matrix changes during each programme unless standards are of identical concentrations. However, it is invaluable for repetitive multisample analyses which can be performed on the same solutions.



The author and Dr D. Bryant with the Perkin-Elmer AA-5000 spectrophotometer

Other invaluable microprocessor controlled functions are the instrument's safety features (automatic pressure and flame sensing, burner head differentiation and burner drain sensing) for which non-compliance causes automatic flame shut-down, rapid and simple optimisation procedures (such as nebuliser adjustment and lamp alignment) using photomultiplier gain digital readout and average, coefficient of variation and standard deviation facilities.

In conclusion, purchase of a fully microprocessor controlled AA enables an important and necessary analysis (wool glass) to be performed by a relatively unskilled operator with no decrease in accuracy and in minimum time.



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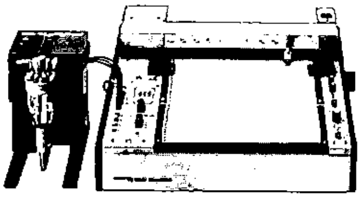

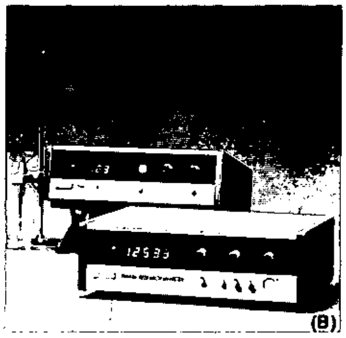

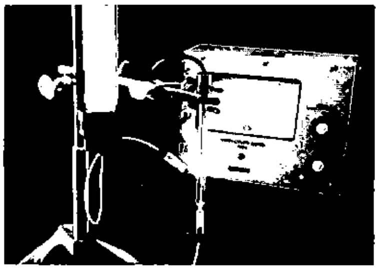

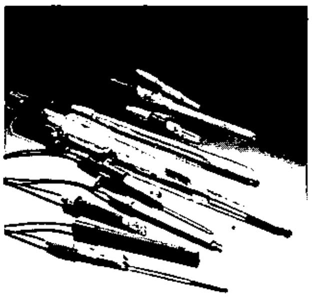

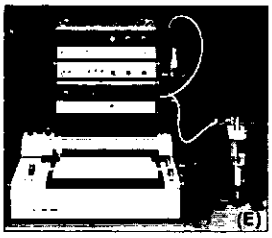

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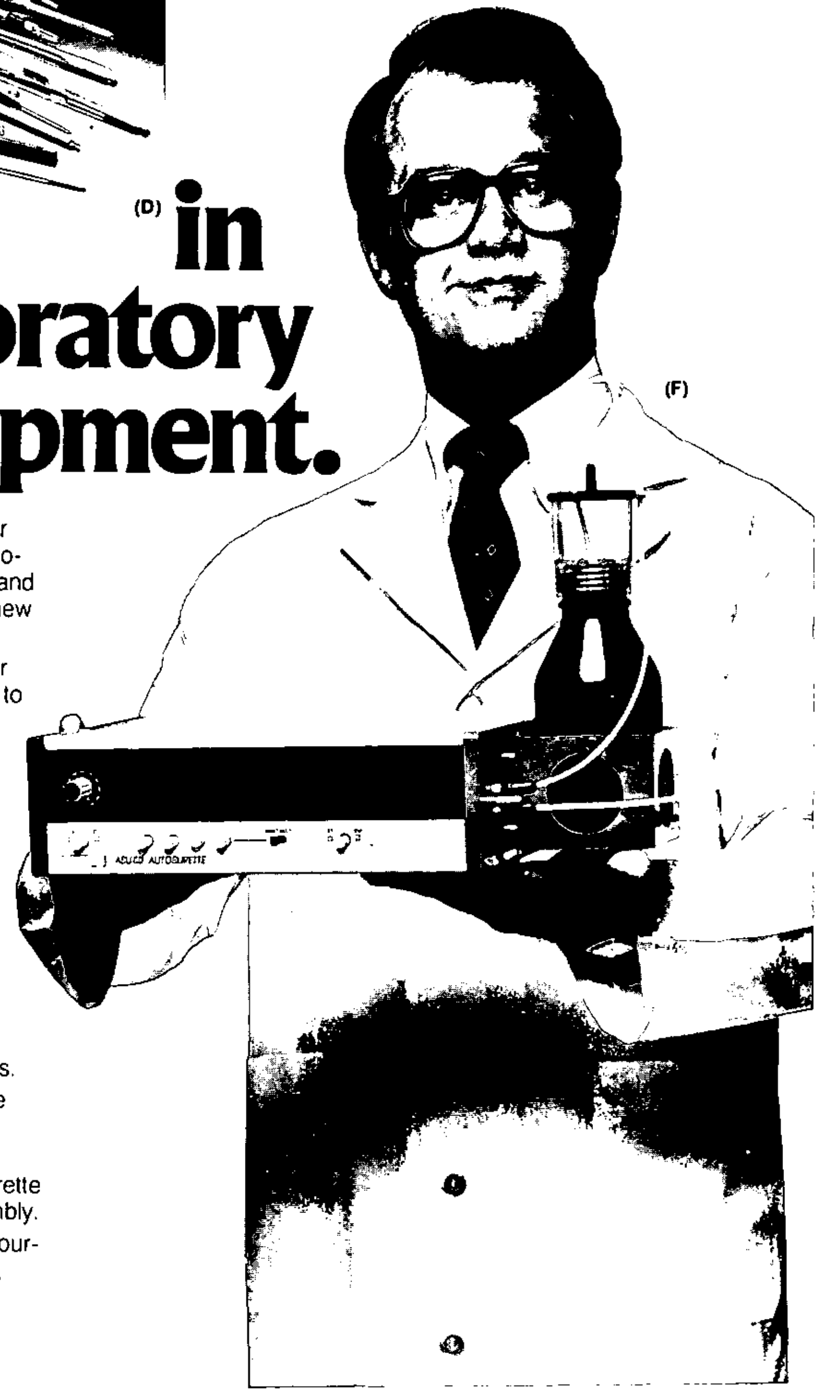

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Computers And Laboratory Instruments In Chemistry Division

P.P. Williams

ABSTRACT

A brief account is given of the use currently being made of laboratory instruments interfaced to a variety of computing devices in Chemistry Division, DSIR.

Although the word "microprocessor" is still quite new to most people outside the computing field, it is already becoming difficult to define the meaning of the word with any exactness. Devices which can be called microprocessors come with a variety of capacities, capabilities and powers, so that the differentiation from mini-computers, at one end of the range, and pocket calculators, at the other end, becomes difficult even to perceive, and almost impossible to define. When devices of different ages are compared, and it is realised that the best programmable pocket calculators of today are nearly as powerful as (and far more "friendly" than) the large computers of the early days, the distinctions between micro-, midi- and maxi-processors become even more blurred.

Through the 1970's, Chemistry Division bought or assembled several items of equipment in which computing devices of varying complexity were closely associated with laboratory instruments. The name that is given to the processor is unimportant; the enhanced power and convenience of use that it confers on the laboratory instrument can be very significant, and often relatively inexpensive. The computing device in any application may either be "passive", in that it simply accepts and processes data coming from the instrument, or "active", because in addition to accepting data, it also influences the operation of the instrument.

Historically, the first instrument of this type installed in Chemistry Division was a Hilger 4-circle X-ray diffractometer for single crystal structure work. The small PDP-8 in this instrument performed an active role, and despite its high price at the time, presented the most economical means of controlling the large number of operations required of the instrument in the course of a single experiment. This instrument was one of three installed in NZ at about the same time. It soon became evident that, in addition to advantages of economy, the marriage of computers to instruments provided substantial advantages in flexibility and versatility and, by the end of the first year, all three laboratories had modified the standard software in different ways to suit their own experimental procedures. In Chemistry Division, the experience gained through operating, and modifying, this equipment had a significant effect on the introduction of more equipment of this type.

Peter Wiliams was educated at Te Aute College and Auckland University where he graduated M.Sc. with first class honours in 1954. He went to Dominion Laboratory (now Chemistry Division) in Wellington to work with I.K. Walker in physical chemistry. Subsequently, he worked on X-ray crystallography at Cambridge University, gaining a Ph.D. in 1961, and on the structure and chemistry of cementitious minerals at the University of Aberdeen in 1967 while holding a Nuffield Travelling Fellowship. He is now a Group Leader of Chemistry Division, DSIR.

A minor, but formerly irritating, chore performed in the Pharmaceuticals Section of the Division is the measuring of medicinal tablets to ensure that mean tablet weight, and deviations from the mean, meet a standard laid down in the British Pharmacopoeia. The standard requires 20 tablets to be weighed individually, and statistics to be derived from the results. Not only was the job boring and deadly dull, but the statistics derived from only 20 measurements were of very doubtful value. To improve the situation, a balance with a digital output was interfaced to an elderly Hewlett-Packard programmable desk calculator. The calculator functions in a passive mode, and requires the analyst to drop tablets one at a time into a previously tared beaker on the balance pan. Mean weight, standard deviation, skewness and kurtosis of the distribution, and information about outlying measurements can all be obtained as soon as the last tablet hits the pan. Statistics from 100 tablets can now be obtained in under 5 minutes — and the staff enjoy their work.

The "friendliness" of desk calculators makes them very useful for this type of application, while retaining all their normal powers and uses. In the atomic absorption spectroscopy laboratory, a Hewlett-Packard model 9815A calculator has been interfaced with an AA instrument to expedite semi-routine analytical work. Again, the calculator performs a passive role, and is used by the AA operator as an extension of the normal operating console. In addition to performing the normal calculations for standardisation and interpolation on linear calibrations, the calculator will accept data from the instrument and set up corrections for stray light, curvature and drift, will accept data from samples to be averaged, and assist in performing analyses by flame emission spectrometry. This equipment is in almost constant use by many different operators who find that use of the calculator increases throughput, reduces the chances of incorrectly recorded results, and reduces the amount of operator labour for each anaylsis.

The most ambitious project in the Division using processors linked to instruments is operating in the blood alcohol laboratory. In this application, a mini computer in a passive role accepts data from five gas chromatographs simultaneously. Although the processor for this job is much larger than the others described, and uses a sophisticated operating system, most of its capacity is devoted to file handling, and the clerical organisation required for sample identification and report generation, so that the analytical function per se is only a small part of the total operation. Apart from integrating peaks and performing the arithmetic needed to calculate alcohol concentrations in blood samples, the processor assists the analyst by maintaining records for all the samples currently being analysed (which may be as many as 130), checking the agreement between duplicate samples, ensuring that results from alcohol standards are consistent and reliable, and warning the analyst if the results indicate that a gas chromatograph is misfunctioning.

Some highly automated items of equipment with built-in processors have been purchased recently, including an HPLC, used mainly for analysis of illicit drug samples, and a Fourier Transform NMR. In both of these instruments, the processor actively controls the operation of the instrument, thus contributing to analytical stability and ease of use. Small processors are also built in to some of the remarkably powerful integrators being used in conjunction with chromatographic techniques. These clever little devices are enhancing the analytical and

Application of Microprocessors In Chromatography

T. Vine, Perkin-Elmer Australia

Tim Vine graduated B.Sc. (Applied Chemistry) from the University of NSW in 1964. He then worked for 15 years with BHP at the Port Kembla, Newcastle and Whyalla steel plants, and the final 6 years at the BHP Melbourne research laboratories as the Materials Analysis Section Leader.

He joined Perkin-Elmer Australia at the beginning of 1976 and is currently chromatography specialist for this company.

Entirely new possibilities for analytical instruments have been provided by the availability of reliable and relatively inexpensive microprocessors. The obvious improvements include improved and expanded parameter entry and status readout via tapes, keyboards, printer/plotters, etc. It should be realised however, that replacement of conventional switches by a keyboard does in itself not improve instrument performance. Microprocessors require substantial human engineering to apply and utilise them in a logical manner if an improvement in instrument operation and performance is to be achieved.

The most substantial advantage that microprocessor control provides, derives from the intelligence and decision making capability available through microprocessors.

Digital control makes it possible to dedicate logic and arithmetic to an increasing number of functions. Arithmetic capability, as well as providing data processing, can utilise available memory to store reference values far more accurately than a stored voltage, and then intelligently check the entered parameters. Illogical entries are recognised, rejected and indicated to the user. It can detect and remember deviations from set points as might occur if the carrier gas supply were depleted and report these deviations at an appropriate time. The analyst cannot afford to stand by the instrument, continuously monitoring meters and gauges, but the microprocessor can; accordingly, it labels faulty analytical results as such.

One can effectively interact with the system via the microprocessor's calculative ability in order to determine the elapsed time of any segment, and any deliberate "real time" changes can be remembered and reported to the user at an appropriate time. Since the internal clock in the microprocessor as a time shared digital display are readily available, one can provide features such as continuous readout of time and/or solvent temperature functions either as an aid in method development (retention times, solvent strengths or elution temperatures) or as diagnostic tools. Finally, since the microprocessor is not busy all the time, one can use it at essentially no extra cost for such features as digital stopwatch, eg for use in flow measurements.

As Gas and Liquid Chromatographs become more versatile and offered the user a larger number of variables, they became more complicated to operate as a result of the increased complexity of the instrument controls. Now, the availability and proper use of microprocessors permits the reversal of this trend and significantly reduces the complexity of instrument set up. The so-called teaching machine concept is used in both Gas and Liquid Chromatographic instrumentation and here the instrument itself asks questions in a logical sequence and demands appropriate logical answers as inputs.

The teaching machine concept can be applied in two different ways, both of which are commercially available. The first method utilises an intelligent keyboard, and this system is used on both the Perkin-Elmer Sigma 2B Gas Chromatograph and Series 3B Liquid Chromatograph. The keypanel consists of a numerical keyboard, and a function keyboard. The function keys have a dual function of setting actual parameters, or monitoring actual values. Values for both are displayed on the instrument's inbuilt digital display. Values for every parameter may be modified independently, or alternatively by using a "set-up" mode, an entire programme can be set or checked in logical sequence.

Every value in the programme must be either accepted by pressing an entry key, or altered by entering a new value, while in this mode. Validity of every value is checked in this way. Both instruments also include a synoptic display which indicates the status of the programme during running and, as previously stated, actual and set values can be checked during the run. The second method utilises a data processing stand-alone console, consisting of a high level computing system, printer/plotter and full ASCII keyboard. This keyboard applies the teaching machine concept to both instrument control and data processing and prompting is by means of the printer/plotter and built-in digital display.

This process is used by the Sigma 10 Chromatographic data system, which is suitable for simultaneous control and data processing of both Gas and Liquid Chromatographs. As well as control, the Sigma 10 can plot chromatograms and simultaneously process data from 4 of a total of 10 possible inputs by means of a time sharing system. The lower cost of the present day processors allows the use of more sophisticated software without dramatic increases in the cost of the equipment.

Older systems involving simultaneous data handling of more than one signal used a multiplexing A/D technique. In this case, the A/D convertor would be switched from one signal to another, never allowing it to look at any one signal for more than a brief period of time. The digitized results for the signal consisted of a series of points, which has to be reconstructed by the computer into a continuous signal by sophisticated algorithms for further data processing. The signal fidelity is never as good as the original. In the technique used in the Sigma 10, an integrating A/D converter continuously monitors the signal, converting the signal amplitude to a frequency. At the end of a fixed period of time, 1/30th of a second, all of the counts accumulated during that time interval are dumped from the temporary A/D buffer and form the value associated with a single area slice. The enormous advantage of this slice technique over the point-by-point sampling technique, is that during this small time interval, all higher frequency noise transients are automatically averaged out by the integrating nature of the A/D technique.

The final benefit that microprocessor controlled instruments provide, is that like their big brothers, they are compatible with:

(a) Host computers
(b) Magnetic tapes and punched cards, and
(c) RS232C compatible devices.

Additionally, they can be programmed in high level computer languages such as "Basic".

Computers (Cont)

research capabilities of several laboratories in the Division.

A link is currently being established between a minicomputer and a double-beam MS-30 gas chromatograph-mass spectrometer system. Initially the role of the processor will be completely passive, but later extensions are planned to enable the processor to control the mass spectrometer scans according to a predetermined programme. The very large quantities of data that stream from a GC-MS demand the use of a relatively powerful processor, with large amounts of storage for data files.

Our experience in Chemistry Division has been that when marriage of a processor to an analytical instrument has resulted in greater throughput and larger numbers of analytical results, the next problem is how to organise and collate the data, derive further results, furnish reports, and generally make the best use of the extra valuable data that has become available. It is often possible to use the processor to assist in this work as well, and in at least one case, we have found that the benefits from this use of the processor are even greater than those obtained by using it simply as an analytical aid. As the use of processors in conjunction with instruments increases, thus extending the ability of analysts to process samples and obtain good results, it seems inevitable that the next major function for processors to perform in laboratories will be to relieve scientifically trained staff of the increasing burden of clerical work which many of them now face.

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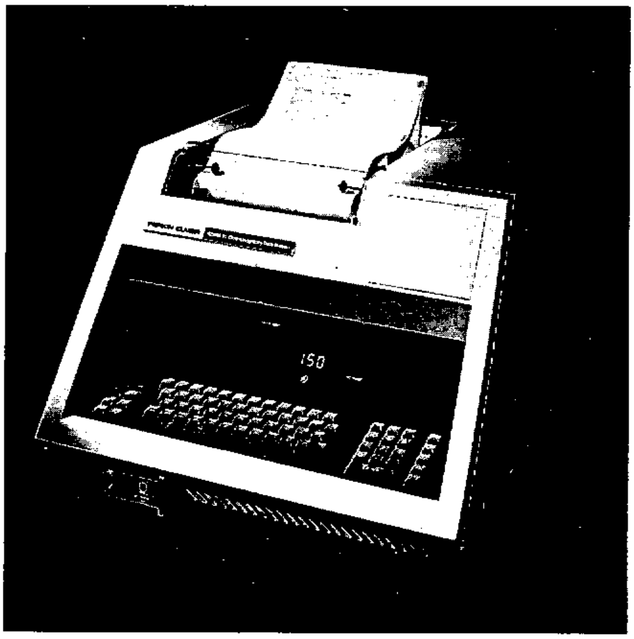

Ordinary data handling systems for chromatography can give users the ability to get large amounts of data from a chromatograph, but not the flexibility to reduce that data to meaningful information. SIGMA BASIC, an exclusive feature of the Model SIGMA 10 Chromatography Data Station, provides that flexibility. Imagine taking standard chromatography data and converting it into almost any form you need. It's possible with the SIGMA 10.

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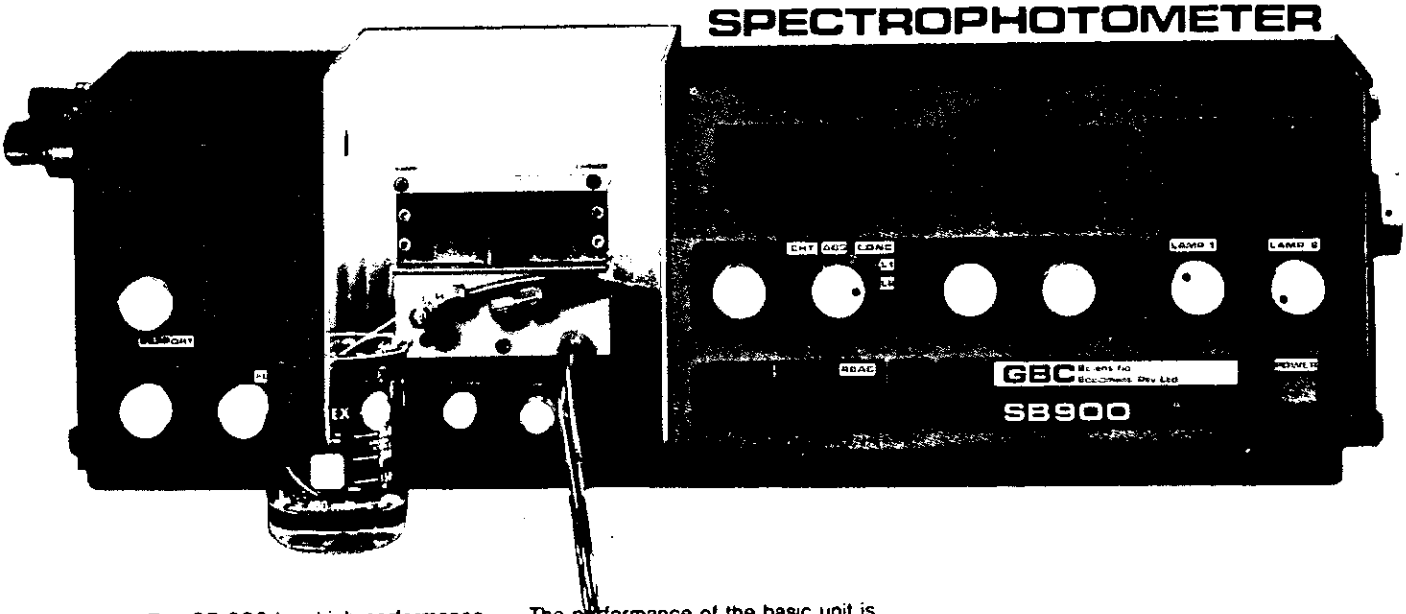
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Electron Microscopy — A Research Tool For Pigment Design, Application Studies

G. Roy Siddle,
Technical Manager,
La Porte Group Australia

Pigments and pigmented thin films are an integral part of almost every aspect of modern life. They are decorative, protective, sealing, wrapping and often informative.

The design of modern pigments and study of their functions in the pigmented films have progressed beyond the resolving power of optical microscopes in many cases.

The main problems with the optical microscopes in this area are a lower resolving power of the order 1 micron and a very limited depth of focus. For pigment particle work in the submicron region and for the depth of focus required for surface studies, we turn to the electron microscope. Here the resolving power can be improved to about 0.0003 microns with attendant good depth of focus. Among the electron beam's disadvantages are that the low penetration means that it must operate in a high vacuum.

Both types of electron microscope — transmission and scanning — are used in these studies. The high resolution transmission electron microscope is probably the most versatile. Both, however, use an electron beam produced by a hot cathode, accelerated by a potential of around 100kv and focused by electromagnetic lenses, as a source of illumination.

With each type of electron microscope there are advantages and disadvantages — the transmission type has high resolution but will not penetrate opaque objects, whereas the scanning EM can examine opaque objects, but at lower resolution.

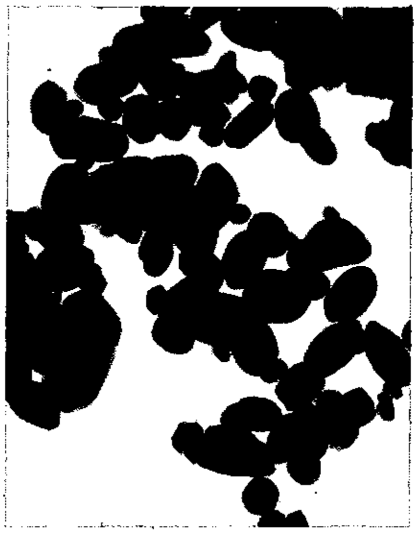
Pigment Examination

The illustration shows a titanium dioxide pigment (120,000 x magnification on the photomicrograph provided) without surface treatment. The sharp clear edges of the particles and the size range and shape are clearly shown.

Upon subsequent surface treatment the nature of that treatment will be shown, whether it is continuous, adherent, tightly bound, fluffy and irregular, amorphous or crystalline. All this information is vital to correct pigment design.

Dispersion Within Paint Films

The degree of aggregation, effects of milling, effects of dispersants, pigment resin interactions producing flocculation can all be studied by using the transmission EM on very thin films comprising one pigment particle thick which are cast by specialist techniques or by direct examination with the scanning EM.



For such surface work using the transmission EM, surface replicas are made using heavy metal shadowings at 45° to the surface on a film supported on water soluble PVA, which is carbon coated also under vacuum before the PVA is dissolved away.

We, thus, examined a carbon replica shadowed with an opaque heavy metal.

From such studies on exposure or weathered film, detailed knowledge is obtained of the processes of photochemical erosion under the influence of UV, moisture and oxygen in the atmosphere. The photocatalytic suppression by the surface treatments on pigments can be studied from this picture of the breakdown of films and, thus, more durable systems researched.

Film forming mechanisms of latex polymers can be studied and the effects of transient plasticizers, time and temperature on the surface coatings produced, together with an insight into the dispersion characteristics of the pigments in such films are all obtained.

From this brief outline of the properties and applications of electron microscopy, it will be appreciated that the techniques are varied, the field is large and the information gained is vital to R&D in many areas.

For the pigment and coatings industry, the electron microscope has proved to be of very significant benefit in that so much of the work is in that particle size range where the instrument comes into its own.

The Successful Use Of Gases

Philip G. Best,
Product Manager, Special Gases,
NZ Industrial Gases Ltd.

Today, laboratories have an array of instrumentation vital in analysing many thousands of products in the industrial and research fields. Gases form an integral part of many analytical tools. Getting gas from its cylinder and into analytical instruments is a science in itself. The selection of the correct flowmeters, gauges, regulators and purifiers are critical to the smooth running of the instrumentation.

The first step on the road to successful use of gases in laboratory instrumentation is the correct selection of the pure gas or gas mixture required. Does one require a gas to be 99.0% pure or 99.9999% pure? Are the impurities critical? If so do you need to know the exact proportion of each? To what tolerance does your gas mixture need to be manufactured to? Does it need to be a primary, secondary or gravimetric mixture? This information and advice can be provided by your Special Gases supplier. Answering these questions truthfully is important to gain the optimum cost efficiency.

The second step is the selection of the equipment to transfer your gas from cylinder to instrument. It is important that the gas in your cylinder is the same composition as gas entering your instrument. To do this regulators, flowmeters, purifiers and general pipework should be commensurate with the standard of the gas you are using. For instance, there is no logic in passing your $200 gas mixture through a $40 leaky regulator — the proportion of gases in the mixture will change. Sometimes it is advisable to pass gas through a purifier to remove particles, oil, water, acetone or other gases. All this information is available from your supplier.

The third step is housekeeping. The correct gases have been chosen and are being fed through the correct equipment. One must now ensure that the equipment continues to do the task it was installed for. Before couplings are closed it is important to ensure that no particulate matter is picked up which may damage down stream equipment. Lines should be periodically tested. Gas leaks can be found with soapy water, smaller leaks can be discovered using gas leak detectors like the Matheson 8016. Further information on maintenance can be obtained from your Special Gases supplier.

Instrumentation In Research

INDICATOR PAPER BOOKS

Whatman, well-known manufacturer of laboratory products, has announced the introduction of indicator papers in book form to complement its existing range of indicator and test papers.

Initially, three products are available in the new presentation —Litmus Blue, Litmus Red, Universal (pH 1-11).

The books, each containing 20 leaves of paper, are available in packs of 10, packed in clear plastic boxes

Although convenient for use in all laboratories, these economic packs are particularly suitable for use in the education market. Local supplier is Selby-Wilton Scientific Ltd.

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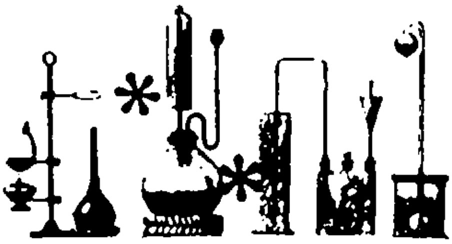


New Products, Services

AGENTS NAMED

One of the largest US companies involved in the research and manufacture of gas analysing equipment and process control systems, Meloy Laboratories, Virginia, has named Northrop Instruments & Systems Ltd its NZ agents.

Meloy manufactures a range of gas analysing and environmental control equipment, including gas detectors and hydrocarbon anaylsers, sulphur and phosphorous analysers and calibration sources, air pollution measurement equipment, process control equipment for the petrochemical industry and gas line equipment for natural gas lines.

Northrop, which already represents Hewlett Packard in NZ, has given notice of its readiness to become involved with the national development programme based on Maui gas and associated petrochemical industries with its latest acquisition.

C053 For further details, use Reader Service Card.

DATA ENTRY KEYBOARD SYSTEM

UPA Technology has recently introduced the "Memoderm" data entry keyboard system, featuring the Model DE-11 data entry unit. Local agent is Selby-Wilton Scientific Ltd.

The Memoderm, Model MP-11DE, is an interactive plating and coating thickness measurement system incorporating multi-probe unit, built-in alphanumeric printer, statistics, histogram, calibration memory and complete user control of operating functions. Through the alphanumeric printer, the user is prompted to enter data such as density, histogram interval size, date, time, operator and batch identification. The user may select from a printer generated "menu" of measurement units to label the printouts. He may also enter calibration data and other information manually from the keyboard. Thickness measurement time intervals from 1-999sec can be selected, or the user can enter his desired accuracy and the system will automatically select the correct time interval.

The Memoderm data entry keyboard system is designed particularly for those users requiring the utmost in plating thickness measurement versatility and operator control. With the data entry unit off, the Memoderm is ready for ultra simple one-button operation when manual data input is not required.

Memoderm is also available with single probe input, Model MP-10DE.

C050 For further details, use Reader Service Card.

SPECIALIST DEMONSTRATES SPECTROPHOTOMETERS

Ray Osland, a technical expert on IR Applications from the Applications Laboratory, Pye Unicam, Cambridge, will be in NZ from June 3 — 10. Mr Osland has 15 years' experience with IR Applications and is visiting Philips NZ to introduce and demonstrate the new range of SP3 spectrophotometers. He will be holding demonstrations in both Auckland and Wellington.

The SP3 series of Infrared spectrophotometers offer the performance benefits of a ratio recording system, hitherto available only from high cost research type instrumentation.

This breakthrough is made possible by basing the design on a rapid response pyroelectric detector (developed by Philips research laboratory at Southampton), a quality grating monochromator, new high energy ceramic source and advanced electronics.

In combination these elements ensure excellent performance over the whole range with outstanding photometric accuracy, wavenumber and transmittance repeatability, even at low energy levels.

Instrumentation In Research

All three models in the SP3 range are suitable for both qualitative and quantitative studies. The most simple version, the SP3-100, has a frequency range of 4000cm^{-1} to 600cm^{-1} and is designed for applications where rapid sample throughput and quantitative accuracy are essential.

Additional performance and flexibility are offered by the SP3-200 and SP3-300 models, the latter covering the range from 4000cm^{-1} to 200cm^{-1} with two diffraction gratings.

Both models offer the Pye Unicam "Spectraset system" of preprogrammed, optimised combinations of instrument parameters giving easy and error free operation. For more exacting applications the system may be overriden to allow individual adjustment of all parameters.

Also featured are calibrated scale expansion, reduction and back-off, permitting detailed study of specific spectral regions and presentation of spectra either offset or above one another for ease of comparison, provision for dry air or inert gas purge of optics and optional chart sizes. A full range of sample handling accessories such as the SP3040 Automatic Sample Changer can be accommodated in the large accessible sample compartment.

The SP3 series is complemented by a range of fully integrated data processing systems, offering facilities ranging from conversion of transmittance to absorbance or concentration units, through to programmable keyboard control of instrument parameters and formatted data output.

The system forms an intelligent interface between the SP3 series and central computers for on-line operations.

C051 For further details, use Reader Service Card.

NEW TMS COLUMNS

New "Zorbax" TMS (trimethylsilane) columns for use in reversed phase and ion-pairing high performance liquid chromatographic analysis have been developed by Du Pont.

Utilising the same technology as "Zorbax" CN, C-8 and ODS columns, the TMS columns expand the selectivity range for reversed phase chromatography This short chain reversed phase packing produces rapid separations with excellent peak symmetry in highly aqueous mobile phase systems. It is designed for separation of moderately polar to polar compounds such as pharmaceutics and pesticides.

Column to column reproducibility is a key characteristic of all "Zorbax" packings. Produced from a monofunctional silane, the dense monolayer coating of the TMS bonded phase provides maximum surface coverage. The unique spherical support of the packing and the uniform particle size provide optimum column efficiency and yield high resolution in 15cm as well as 25cm columns.

This technology is also available to chromatographers who choose to pack their own columns. Bulk packings are produced in the same fashion as packings supplied with Du Pont LC columns.

C047 For further details, use Reader Service Card.

STOPPED-FLOW SPECTROMETER

The well-known "Nortech" SF-3A stopped-flow spectrometer has now been superseded by the recently introduced SF-3L version. The many new features incorporated in this instrument include a novel temperature control and thermostatting system which extends the operating temperature range down to minus 100°C and up to plus 100°C. The low temperature facility, in particular, opens up new fields of research in stopped-flow spectrometry. With the new, finely regulated pneumatic driving system, experimental replication is now even more precisely controlled.

The simplicity of design ensures easy and trouble free operation and maintenance is minimal.

A wide range of flow modules, control equipment, optical accessories and data display instruments are available. Thus, a very versatile and comprehensive research system, built around the SF-3L flow unit, can be tailored to the specific needs of the scientist, says the local distributor, Selby-Wilton Scientific Ltd.

C048 For further details use Reader Service Card.

BEAM SWITCH SIMPLIFIES AUTOMATION

Low cost automation in the productivity-conscious factory is now easier to achieve following the introduction of a beam switch capable of operating reliably in sunlight.

Said to be less expensive than the nearest readily-available alternative, this new beam switch contains its own transformer and output relay and comes ready to plug into 230 Vac mains.

A useful feature of the switch is its immunity to extraneous light as strong as 100,000 lux. Reliability is further increased by protection against water, shock, vibration and voltage fluctuations.

The switch comes in three versions: through-beam pair, retro-reflective and proximity. The first two check the passage or presence of bottles, boxes, plastic bags, cans, cars, people, etc., while the third also checks sheets of film, paper, wood, etc., from one side only.

The beam on the pair type is narrow and strong enough to cover a path up to 30 metres. At closer range an object only 20mm wide can be detected. Smaller objects can be detected by the retro-reflective and proximity types. Response time on all types is 0.03sec.

C045 For further details, use Reader Service Card.

LC COLUMN FOR MEASURING ANION-FORMING ACIDS

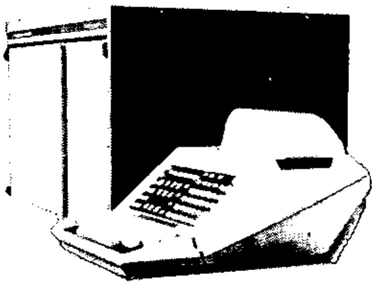
A liquid chromatographic column suitable for use with several types of organic acids commonly found in such products as pesticides, herbicides, food additives and pharmaceutical products is now available from Du Pont.

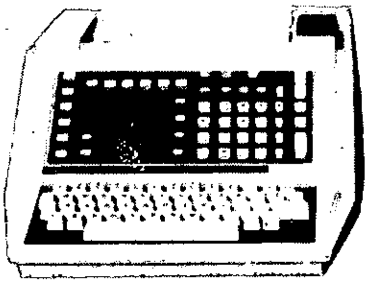
The "Zorbax" SAX chromatographic columns are particularly useful in separating compounds that form anions in aqueous solutions, such as those containing aromatic and aliphatic carboxylic acids or sulfonic acids. They can be used for analyzing complex biological species such as nucleotides.

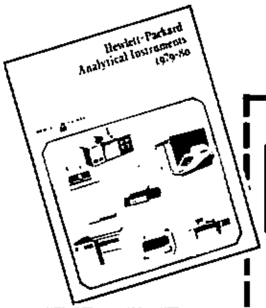
Uniform spherical shape and size of the SAX particles in the new columns provide optimum column efficiency, says Du Pont. The material used in the packing contains a quarternized functionality that is chemically bound to "Zorbax" SIL particles with minimal reagant polymerization.

Maximum operating pressure for the new SAX columns is 345 bars (5000 psi) at temperatures up to 50°C. The recommended pH range of the column material is 2.0 to 6.5 and the packing is compatible with water and all common organic solvents. The new columns currently are available in 4.5mm (I.D.) columns of 25cm and 15cm lengths.

C046 For further details, use Reader Service Card.







Trade Display: Aussies Chasing $32M Market

Seeking a larger share of a market valued at some $32 million, Australian manufacturers of measuring, testing and control equipment are staging a 3-day trade display of their products at Alexandra Park, Auckland, June 10—12. A broad cross-section of companies will be represented and some will be seeking NZ agents for their products. Entry to the event is free.

The display will feature a wide range of specialised electrical measuring and control equipment for industry. Products will range from oscillators, spectrum computers, spectrophotometers, precision metering pumps and valves to salinometers, pressure and temperature gauges and recording charts.

Commenting on the broad trading circumstances in which Australian manufacturers have decided to mount the specialised display, a spokesman for the Australian Trade Commission said "Arising from NZ's developing export interests and the intensification of its energy programme, Australia — through its own industrial development programme — is favourably placed to introduce and supply new products in this specialist field for the NZ market, now worth about $32 million for this type of equipment.

"Australian suppliers are attempting to increase their share of this market, particularly in view of the NZ Government's recent relaxation of general import controls on such equipment."

An Australian computer marketing organisation, Anderson Digital Equipment, is to feature a small, completely Australian designed and made computer. This equipment, a Computex Spectrum II with standard display unit and hand-copy terminal, has already been sold within Australia and in Papua-New Guinea. At the display, the firm's local representatives, Anderson Digital Electronics, Wainuiomata, will demonstrate examples of control-type applications for the Spectrum II.

The Spectrum II family of computers comprises a series of powerful floppy disc computers requiring only the addition of any standard terminal to provide a comprehensive computing facility.

A wide range of computer users, including scientific, business, professional, industrial and educational organisations, have already adopted the Computex Spectrum II system in Australia.

Exhibiting its latest range of industrial and marine instruments will be specialist instrument makers, KDG Instruments Pty Ltd., Sunbury, Victoria.

Typical of KDG's products are dial pressure gauges covering pressures from as low as 0-1in water gauge (250Pa) and differential pressure gauges which can withstand statics of 1500psi (10,000kPa) while measuring ranges of 40in water gauge (10kPa) and greater.

One most successful KDG product to be demonstrated "live" will be an electronic transmitter which senses the head of liquid in a column and transmits the information to a remote-indicating controller.

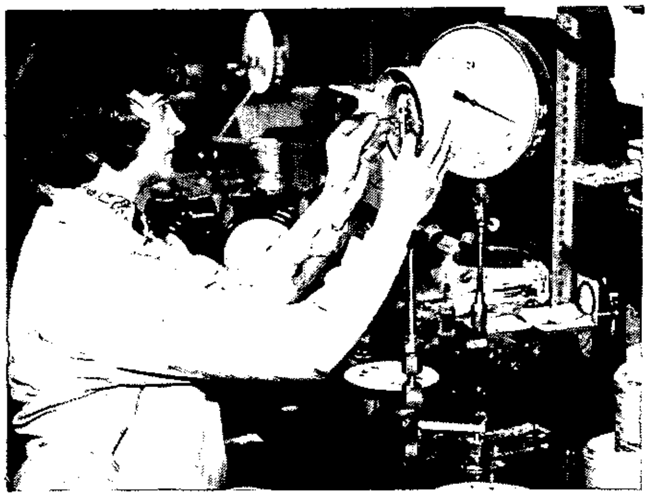
An Australian firm specialising in recording instrument charts and marking systems will exhibit its product range at the trade display. Miller Graphic Controls Pty Ltd., Melbourne, stock more than 20,000 different charts for use with over 500 different brands of recording instruments. The company says it has access to information on a total of 80,000 charts, through its library and through its American affiliate company, Graphic Controls Corporation.

The company's stand will be manned by its local agents, E.C. Gough Ltd., Christchurch. Product samples and a wide range of trade literature will be available on the stand.

Another Melbourne firm, Budenberg Gauges (Australia), will be exhibiting a specialised range of pressure gauges and thermometers at the display. It will also be showing a range of mercury-in-steel thermometers.

In NZ, the firm is concentrating on marketing products aimed at clients who need custom-built instruments outside the ranges offered by local gauge and thermometer manufacturers.

The company's special lines include a series of stainless steel pressure gauges used in the oil and chemical industries, dual-scale pressure/temperature gauges for use with ammonia, sealed-system gauges for the dairy and food-processing industries and a "safety blow-out" design suitable for use with very high pressure hoses.



A Bourdon tube gauge being calibrated against a standard gauge at the Budenberg factory in Melbourne.

Diversified Group Unites Under Chemby Banner

The emergence of Chemby Industries Ltd. as a major supplier of raw materials and machinery essential to NZ's important manufacturing and export industries has been given public testimony by three Auckland-based member companies adopting the parent company name.

Buckley & Young Ltd., founding company of the group and the important marketing arm of imported and locally-made chemicals, other raw materials and machinery, becomes Chemby Marketing Ltd.

Colour & Synthetics Ltd., the group's first local manufacturing venture and producer of base chemicals for a diverse range of industries, is now Chemby Chemicals Ltd.

Smith Manufacturing Ltd., the country's largest manufacturer of shrink and stretch-wrap packaging machinery, is now Chemby Engineering Ltd.

Chemby Group managing director, **Graham Smout,** said the start of the challenging 1980's was a propitious occasion for the three companies to adopt the parent name and demonstrate their confidence in the future.

"It makes good sense for them to come under the one umbrella and together promote Chemby here and overseas as a soundly-based enterprise providing the chemical, raw material and machinery needs of a host of major primary, processing, manufacturing and export industries."

Chemby Industries Ltd. is a 100% NZ-owned enterprise with manufacturing plants or offices of subsidiary or associated companies in Auckland, Wellington, Christchurch, Timaru, Sydney and Melbourne.

Among the major industries they supply with chemicals or machinery are plastics, paints, textile and tanning, pulp and paper, wool processing, toiletries and other household products, and foodstuffs and beverages. Timaru associate, Annett & Darling Ltd., is the world's largest producer of scours and other equipment taking wool through to the semi-processed state.


88.765

Methods Processor Puts Chemists Back Into Chemistry

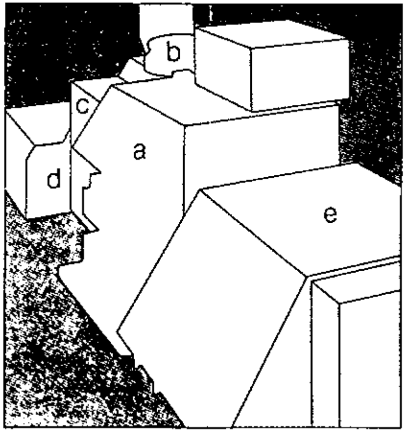
A common complaint among chemists today is that they are so involved with routine, repetitive work that they are unable to devote sufficient attention to more challenging tasks. A solution has been provided by the Perkin-Elmer methods processor for liquid chromatography, now available through the NZ agents, Warburton Franki Ltd.

A combination of data processing and control technology, this unit can be preprogrammed to perform reliably and automatically all day, all night, even at weekends. By eliminating the necessity for manual control of dull, monotonous routine work, effectively it puts chemists back into chemistry. The system can even undertake studies previously considered too difficult or tedious.

The methods processor combines five separate P-E modular units, as indicated on the diagram. They are

(a) The Series 3B pump module, which performs difficult qualitative and quantitative analyses with the convenience of micro-processor control.
(b) The Model 420 automatic sampler/injector, which allows unattended injection of up to 42 different samples.
(c) The Model LC-100 column airbath oven, offering precise temperature control from 10°C above ambient to 99°C.
(d) The Model LC-75 detector and autocontrol, which adds spectroscopy to separation.
(e) The SIGMA 10 chromatography data station which processes data and delivers a printout.

This combination provides complete keyboard control of the analysis. The operator can enter the pump method, key in the data processor method, designate a vial number in the autosampler, indicate sample name and date, time and run number, even change solvents and wavelengths.



Described by Perkin-Elmer as bringing the LC technique to its fullest potential, it is claimed that no other LC system is as variable, versatile or technologically advanced. In the one system, the various components provide infinite options to allow the operator to determine exactly the kind of analysis required.

The methods processor can send error messages, reprompt for non-valid entries and the method in use can be modified without need for a complete re-set up. The system will not "lock up".

Economically, too, the unit has advantages in its cost-cutting capabilities. Solvent usage is reduced and operating time shortened. Repeatability and timing of conditions, as well as overall initial results, are said to be better than with manual operations.

The system can handle multiple mixed samples, each in a different solvent program and data reduction method, if required. Complex analytical sequences can be programmed and started through straightforward keyboard operation. Instructions are given in plain language. All functions are performed without need for system modification.

C054 For further details, use Reader Service Card.

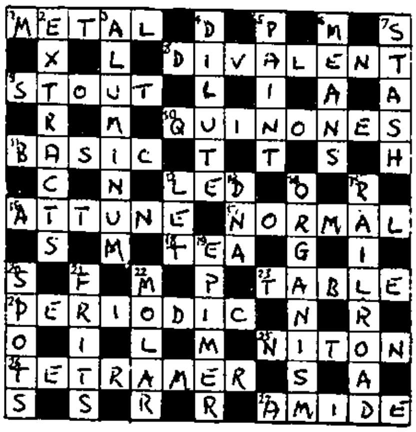
People

Dr. J.P. Fawcett has left the Wallaceville Animal Research Centre to join the staff of the Central Institute of Technology, Petone. **G.R. Selfe** has retired and is now living at 19A Cooney's Drive, Tauranga. **R.D. Kean** has gone from NZIG, Lower Hutt to Mobil Oil, Wellington. **A.J. Sutherland** has retired from the Correspondence School, Lower Hutt, and is now looking after the inner man at Govinda's Restaurant, 13A Frome St, Adelaide. **Dr R.V. Winchester,** formerly of Chemistry Division, Lower Hutt, is now with the Dept. of Health Environmental Division, Auckland. **R.Y. Tapper** has finished his period as a Teaching Fellow at Lincoln College and returned to Fairlie High School as Head of Science. **Dr T.C. Reid** has left the Invermay Animal Health Lab. to join the MAF at Whangarei. **P.R. Leslie** has been appointed a development chemist with Eli Lilly & Co, Basingstoke, England. **Br J.S. de Courcey** is now with St Patrick's College, Strathfield, NSW. **Dr G.W. Rewcastle** has joined Cancer Research in Auckland. **T.J. Nisbet** has gained his Ph.D. and left the Dairy Lab, Ruakura, for the Division of Clinical Services in the Dept of Health, Wellington. **A.S. Webley** has been appointed Research Chemist at Lime & Marble Ltd., Nelson. **Q.T. Tapsell** has gone from Wellington High School to Tuakau College. **Addresses wanted: L.B. Nicholls,** last heard of at Whakatane. **Bernie Peters** recently joined ICI Tasman Vaccine Ltd., Upper Hutt, as Pharmaceutical Production Supervisor. Friends of **John McNaughton,** ICI Tasman Vaccine Ltd., will be sorry to learn that at the end of a recent Saturday run he collapsed and died. **Ron Braithwaite** has resigned as works manager, NZ Farmers Fertiliser Co Ltd., Te Papapa, to take up a position with Comalco. **Steven Chaney** has moved from production supervisor, NZFF Co. Ltd., Te Papapa, to become works engineer, Challenge Phosphate Co, Otahuhu. **Glen Woodward** has resigned as works engineer, Challenge Phosphate Co, Otahuhu, to take up a position with Fletchers Duroid Division. At the ATI's ceremony of awards in April, **Mike Martin** was awarded both the Science Technician of the Year Award as top NZCS student at ATI, and the NZIC (Auckland Branch) prize as top NZCS Chemistry Option student. Mike gained four A passes in Chemistry V. He had been employed for 3 years as a research technician in the textiles section, UEB Industries Ltd., but has recently taken a position as senior laboratory technician with the Hikurangi Dairy Co. **John Milligan** MNZIC has been appointed to the permanent tutorial staff at the ATI in the chemistry section. An M.Sc. graduate from Auckland University, John had previously taught for 8 years in Auckland secondary schools.

Norman Lodge, a scientist at DSIR, Mt Albert, Auckland, has been awarded the first Clark Fletcher Citrus and Sub-tropical Fruit Memorial Bursary. He is at present in USA furthering his knowledge in this area.

Walter Partridge has been appointed marketing manager, explosive products, plastic products and resins, for the newly established NZ Du Pont operation.

CHEMICAL CROSSWORD
Solution to April Puzzle



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■	R	■	M	■	10 Q	U	I	N	O	N	E	S
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■	C	■	N	■	12 L	E	13 D	■	14 O	■	15 R	■
16 A	T	T	U	N	E	■	17 N	O	R	M	A	L
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20 S	■	21 F	■	22 M	■	P	■	23 T	A	B	L	E
24 P	E	R	I	O	D	I	C	■	N	■	R	■
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26 T	E	T	R	A	M	E	R	■	S	■	A	■
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Manawatu

Prof. Alan R. Battersby (Professor of Organic Chemistry at Cambridge University) presented a lecture entitled "Adventures of an Organic Chemist with Living Systems" to the March meeting of this Branch. Topics that he discussed included the stereochemistry of the amine oxidase transformation of primary amines to aldehydes and the synthesis of systems that will do some of the chemical reactions accomplished by chlorophyll, haemoglobin, the cytochromes, etc.

Branch prizes for the 300 level at Massey University were presented by **Prof. A.D. Campbell** to **A.G.C. Bingham** (Chemistry) and **D.E. Baldwin** (Biochemistry) at the Branch's April meeting. Prof. Campbell gave the Presidential Address on the subject of "Analytical Chemistry". He described various aspects of the teaching of analytical chemistry at university level and the registration of testing laboratories. He also discussed the recently developed analytical techniques of optoacoustic spectroscopy, inductively coupled plasma spectroscopy, molecular emission cavity analysis and flow injection analysis.

BRANCH NEWS

Wellington

The March meeting was addressed by the ICI prizewinner for 1979, **Dr B.K.G. Theng**, who spoke on the "Principles and Practice of Clay-Polymer Interactions" (to be published in a future issue). **J.R. Willimott**, executive director, ICI (NZ), presented the ICI prize and medal to Dr Theng.

The Minister of Science and Technology, **Hon. W.F. Birch**, addressed the April meeting on the subject "Chemistry in the Energy Field" (a condensed version of his address is published elsewhere in this issue). The Minister's talk was followed by a lengthy and interesting question and answer session. Also at this meeting Mr Birch presented the Branch prizes for Chemistry and Biochemistry (Biochemistry: Third Year — **Miss Ann Thomas**, Second Year — **Miss S. Vintiner**; Chemistry: Third Year — **Miss Anne Stanley-Hunt** and **John Thompson**, Second Year — **Barry Dent**, First Year — **David Jacobson**).

The Branch held "Careers in Chemistry" seminars for college students in both Wellington and Lower Hutt during April. The seminars attracted a good response from sixth and seventh formers. Participants in the seminars comprised Branch representatives from various occupations in Government, Industrial and Educational organisations.

Otago

In March **Dr Bruce Cain**, Auckland Medical School, gave a talk on "New Drug Development — Logic or Serendipity?"

In April **Prof. Earl Friedon**, Florida State University, gave a talk on "Multiple Actions of Serim Metalloproteins" and later in the same month **Prof. D.P. Craig**, Australian National University, gave a talk on "Chiral Discrimination".

University News

Auckland

Biochemistry Department

Prof K.H. Loke, Department of Biochemistry, University of Kuala Lumpur, Malaysia, is visiting the Department until June. He is on a short sabbatical working with **Prof Renwick** and **Dr T. Brittain** on the steroid aromatase of human placenta.

Chemistry Department

Prof Earl Frieden, Florida State University, Tallahassee, visited the Chemistry and Biochemistry Deparments and delivered a lecture entitled "Multiple Actions of Serum Metalloproteins."

Prof R.J. Gillespie, FRS, Department of Chemistry, McMaster University, Hamilton, Ontario, Canada has been visiting the Department.

Prof Heinz Koch, Ithaca College, Ithaca, NY, recently spent 6 months working with **Dr D.J. McLennan** on chlorine kinetic isotope effects and mechanisms of elimination reactions.

Prof Alan Stein, Memorial University of Newfoundland, arrived last month to spend a year working on mechanisms of nucleophilic substitution.

Dr Angela Lavis has arrived in the Chemistry Deaprtment to work with **Prof R.C. Cambie** and **Associate Prof P.R. Bergquist** (Zoology) on the chemistry of sterols from sponges, and their relationship to taxonomy. The subject of Angela's Ph.D. research was the Analysis of Sterols from Marine Organisms by Combined GCMS.

Dr Christopher A. Reed, Associate Professor at the University of Southern California, Los Angeles, is spending several months in the Department as part of a sabbatical leave. Dr Reed, a former student of the Department, is interested in the model compound approach towards understanding biologically-important molecules such as cytochrome c-oxidase.

Another former student of the Department who visited recently is **Dr Terry Collins** who gave a colloquium to the inorganic chemists on his research into porphyrin chemistry. Dr Collins is completing a post-doctoral period at Stanford University before taking up an assistant professorship at the California Institute of Technology.

Dr J.E. Packer spent November 26, 1979 — January 7, 1980 as guest scientist in the radiation chemistry section of the HahnMeitner-Institute, West Berlin, and January 8 — February 29,1980 as honorary research Fellow in the Biochemistry Department, Brunel University, Uxbridge, Middlesex. At both places he studied fast radical reactions using the technique of pulse radiolysis.

Dr B.G. Pound is employed as a fulltime research Fellow working on the fundamental mechanism of geothermal corrosion using electrochemical techniques. His project is supported by the NZ Energy Research and Development Committee.

Dr A.J. Easteal spent the period December 11, 1979 — February 8, 1980 as Visiting Fellow in the Research School of Physical Sciences, Australian National University. He was attached to the Diffusion Research Unit, and did tracer diffusion coefficient measurements by the diaphragm cell technique.

Massey

Department of Chemistry, Biochemistry and Biophysics

On a recent 6-week overseas trip, **Dr David A.D. Parry** visited a number of laboratories involved in fibrous protein research in USA and UK. The last week of the trip was spent attending the Seventh Katzir-Katchalski Conference, held on a kibbutz at the side of the Sea of Galilee. The meeting was entitled "Structural Aspects of Recognition and Assembly in Biological Macromolecules" and brought together about 120 biophysicists who discussed the structure and function of fibrous and globular proteins, viruses and nucleic acids.

Drs Parry and L. Creamer's (Dairy Research Institute) 2-volume publication of papers given at last year's International Conference on Fibrous Proteins held at Massey is now available. it is titled "Fibrous Proteins: Scientific, Industrial and Medical Aspects" and is published by Academic Press, London.

Dr John S. Ayres recently developed a cellulose ion exchange resin capable of recovering water-soluble proteins in a very pure form. An initial use for this resin has been the recovery of proteins from whey, a byproduct from cheese and casein production.

Dr Gavin R. Hedwig leaves in September to spend a year's sabbatical in the Medical School's Department of Phramacology and Biochemistry, University of Virginia, at Charlottesville. He will be studying aspects of biological microcalorimetry with **Prof. Rodney Biltomen**.

The use of neutron activation techniques for the analysis of uranium and other trace elements in stream waters will be studied by **Dr Robert R. Brooks** during his sabbatical leave, from mid-August. Dr Brooks will be carrying out this research with **Prof. D.E. Ryan** in the Trace Anaylsis Research Center at Dalhousie University, Halifax, Nova Scotia.

Dr W.S. (Bill) Hancock recently returned from 10 months' sabbatical leave with **Dr A.M. Gotto's** group at the National Research and Demonstration Center for Cardiovascular Diseases in Houston, Texas. While in Texas, Dr Hancock

University News (Cont)

studied various aspects of the analysis of apolipoproteins. Results of this work will be of particular use for the quantitation of these compounds in serum samples from heart disease patients Dr Hancock also visited numerous university departments and commercial firms to evaluate recent developments in the use of high performance liquid chromatography in biological fields.

Department Of Biotechnology

Prof. R.L. Earle has received a 3-year grant from the DSIR to investigate rates of ethanol production during anaerobic fermentation of whey in tower fermenters.

Soil Science Department

An important new project is underway in which an abundant and renewable resource — common salt — is being analysed as a possible fertiliser for NZ soils. This project, funded by Dominion Salt Ltd., is under the direction of **Dr Max A. Turner,** in collaboration with **Dr Dave R. Scotter** of this Department and **Dr Peter F. Reay** of Applied Biochemistry Division, DSIR. Although the adding of salt as a fertiliser to soil is not new and has long been practised in European countries (going back to Biblical times) it is not commonly used in this way in NZ. The research is designed to find out what effect salt application has on the amount of sodium taken up by pasture, in particular the duration of the residual effect of autumn and spring applications. Experiments will be carried out on a number of different soil types.

Victoria

In recent weeks the Chemistry Department has been happy to welcome a number of overseas visitors. **Prof. E. Vogel** (University of Cologne), the first Institute sponsored visitor of the decade, spent 3 days there and delivered lectures on "Huckel Aromatic Compounds" and "Arene Oxides: Chemistry and Biochemistry". **Prof. A.R. Battersby** (University of Cambridge) made a brief call before delivering his lecture "Vitamin B12 Biosynthesis" at DSIR. **Prof. R. Gillespie** (McMaster University) gave the "Chemical Society Nyholm Lecture". **Prof. R. Battino** (University of Ohio at Dayton) talked on "Direct Calorimetric Determination of Heats of Solution of Gases and Liquids" and followed this with an entertaining discourse on methods of teaching Introductory Chemistry. **Prof. E. Frieden** (Florida State University) delivered a lecture entitled "Multiple Actions of Serum Metalloproteins".

Dr Richard Furneaux and **David Officer** are among the first recipients of awards from the Royal Society of NZ "Young Scientist Fund", which will allow them to attend international conferences in Australia.

Dr Robin Speedy has returned from leave spent at the University of Southampton.

Dr Stuart I. Smedley recently addressed the Annual Conference of the Chemists Guild and Pharmaceutical Association in Queenstown. The title of his address was "The Thermodynamic Reason for Optimism" — in essence a review of the country's energy and productive resources.

Otago

Chemistry Department

Visitors to the department included **Dr J. Elix,** Australian National University, who spoke on lichen chemistry and **Prof. R. Battiono,** Wright State University, Ohio, who spoke on gas solubility.

Prof. D. Craig, Australian National University, is visiting the Department and is giving a series of lectures to senior students.

Dr. D. Fenby has left for a term's study leave at Gef-sur-Yvette, France. **Dr. C. Pope** is relieving at the University of South Pacific for 6 weeks.

Pharmacology

Papers on the relationships between chemical structure and pharmacological activity were presented in May at a Dunedin meeting of the Australian Society of Chemical and Experimental Pharmacologists to mark **Prof. F.N. Fastier's** retirement from the Chair of Pharmacology. One of the contributors was **Prof. A.L.A. Boura,** Department of Pharmacology, Monash University.

Nutrition Department

The Nutrition, Chemistry and Biochemistry Departments have received a grant for $20,000 from the University Grants committee to purchase HPLC equipment.

Biochemistry Department

Dr John Cutfield left in May to work with **Dr Guy Dodson** on insulin structure at the University of York.

Dr Toney Reeve has transferred to Dunedin and is working in collaboration with **Dr R.H. Wilkins** on NZ Cancer Society funded projects.

Dr Ian Bathhurst has returned to NZ as an MRC Post Doctoral Fellow and is working with **Dr M.G. Smith** on Casein Biosynthesis.

News From Govt. Departments

Dairy Research Institute:

Dr Wayne B. Sanderson recently travelled to London for a meeting of the Permanent Committee of Commission B of the International Dairy Federation. He then attended the International Circle of Dairy Research Leaders meeting on the "Seasonal Effects of Milk Composition on Milk Processing."

Dr Peter S. Robertson will be travelling overseas to assist in the investigation of methods for utilising the components of whey.

Dr L. (Laurie) K. Creamer recently left for a period of study leave at the Food Science Department in the University of Wisconsin at Madison, Wisconsin, USA.

Dr D.S. Munro recently travelled to Japan with a Dairy Board Mission to discuss with Dairy Board customers the use of NZ milkfat in a number of specialised products.

Howard Heap will soon be going to Utah State University, Logan, to work on applications of the NZ starter handling system to American cheese making in the department of Nutrition and Food Sciences, College of Agriculture.

A.J. Baldwin is on study leave at the Danish Dairy Research Institute at Hallerod until November. He is studying the application of new test methods to instant whole milk powder.

DSIR, Applied Biochemistry Division:

Dr Julian Lee joined the Plant Chemistry Group to work on plant-animal-mineral research, with an initial responsibility for setting up and calibrating the new Plasma Emission Spectrometer before it becomes an operational analytical tool. After gaining his Ph.D. from Massey's Chemistry Department, Dr Lee spent two years in Canada on an NRAC Fellowship in the Geochemistry Section of Geological Survey in Ottawa investigating the chemistry of trace elements in surfacial environments (e.g. water in peat and bogs).


Greenwood

R.M. (Mike) Greenwood, Biochemistry and Microbiology Group, retired at the beginning of March. He has been with the DSIR since 1943 when he joined the Plant Chemistry Laboratory, working on the dehydration of fruit and vegetables, a task pioneered by the Laboratory to feed NZ (and other) troops overseas during the war. Towards the end of the 1940's Mr Greenwood started research into pasture legumes, a work which continued until his retirement with the establishment of a rhizobia collection, and latterly on the systematics of rhizobia classification. Mr Greenwood now plans to examine reserves in the Manawatu and adjacent areas, reporting on aspects on management to the Lands and Survey Department.

A colloquium, chaired by **Dr Ray W. Bailey** (Director, ABD) and held at "Wharerata", Massey University on March 20, reflected the diverse scientific interests of Mr Greenwood. Speakers at the colloquium included: **Dr John G. Robertson,** ABD (reviewed Mr Greenwood's work in DSIR), **Dr Ray W. Brougham,** Director, Grasslands Division, DSIR (discussed agronomic aspects of nitrogen fixation), **Dr Ian A.E. Atkinson,** Botany Division, DSIR (discussed the botanical interests of Mr Greenwood), **Dr N. Lambrechtsen,** Plant Materials Section

Letter From

America

by Bill Denny

A short time ago a Royal Commission decided that it was not yet necessary to commit NZ to the acquisition of a nuclear power-generating facility. Some of the reasons cited were the safety problem of such plants in areas of unstable geology like NZ, and the prohibitive capital costs of the very high technology associated with them. The decision was widely agreed with by a public increasingly against the concept of nuclear power. This attitude has probably strengthened following the accident at Three Mile Island in Pennsylvania on March 28, 1979.

On the other side of the Pacific Ocean another of the states in the region, very different in many ways from NZ, is nevertheless moving towards a similar outlook. Although institutions in California have been in the forefront of the development of nuclear energy for electricity generation from the beginning, the state's $5 billion investment in nuclear power-generating facilities is being widely questioned. The same reasons raised in NZ — safety in a geologically unstable region and the sheer cost — will probably halt or at least severely limit further development. The current situation in California is given in the table.

The first plant licensed was the Humboldt Bay facility which came on line in 1963, but which was shut down in 1977 when an earthquake fault line was discovered to run directly beneath it! Studies have been going on since then to decide if it can be successfully modified as required to stand the effects of a Force 7 earthquake. Of the two plants currently operating, Rancho Seco is on line again only recently after being shut down since the beginning of 1980 to undergo a $50 million modification programme ordered by the Nuclear Regulatory Commission (the plant is almost identical to the Three Mile Island facility). The new 2190 Mw Diablo Canyon plant on the coast near San Luis Obispo is operationally ready but lacks a federal licence to start up as controversy rages around it. The plant lies only 4 km from a major offshore fault line, and although the Nuclear Regulatory Commission has ruled it currently could withstand the maximum pressure of a nearby earthquake, a licence is not yet forthcoming. Down the coast from Los Angeles, San Onofre is, by comparison, free of controversy, and the two extra units now under construction there are expected to come on line in 1981 and 1983 — but at a cost of nearly $3 billion! Capital costs such as these are rapidly becoming prohibitive even for California (which if it ever seceded from the Union would be the sixth richest nation in the world). It is the utility companies who have to finance the building of these plants. Since construction now takes a decade, with no return until power begins to flow, the companies' cash flow problems become acute (a circumstance that will not be assisted by interest rates which in early April reached 19.75%).

Presently, about 3% of California's electricity is generated by nuclear plants; by 1985, if Diablo Canyon and San Onofre II and III receive licences, this is estimated to rise to 12%. However, that may well be all for California. State law now prohibits the construction of new plants until the State Energy Commission rules there is a safe way to dispose of the wastes. Increasing governmental and public distrust of nuclear energy in general, rising concern about the safety of reactors in an earthquake-prone region, and the enormous capital costs make it very likely that no more nuclear power plants will be built in California.

NUCLEAR POWER-GENERATING FACILITIES IN CALIFORNIA

Site	Operator	Year of Operation	Size (Mw)	Cost ($m)
Humboldt Bay, Eureka	Pacific Gas & Electric	1963-1977	65	22
San Onofre I	Southern Cal. Edison	1968—	556	88
San Onofre II		1981	1100	2900
San Onofre III		1983	1100	2900
Rancho Seco	Sacramento Municip. Utility District	1975—	913	350
Diablo Canyon	Pacific Gas & Electric	1980	2190	1700

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Govt. Dept. News (Cont)

MWD (described some soil conservation plants) and **John Lloyd**, Fruitgrowers Chemical Co., Port Mopua, Nelson (described aspects of the seed innoculant industry in NZ).

The Division has set up and is operating a satellite link to the Telenet Global Network. This is currently being used to access mass spectral and C^{13}-NMR data from the Chemical Information System (CIS) available on an Interactive Science Corporation Computer just north of New York. In addition, the following components are also available: X-Ray Crystallographic Search System, Registry of Toxic Effects of Chemical Substances, Conformation Analysis of Molecules in Solution by Empirical and Qantum-Mechanical Techniques System, Powder Diffraction Search-Match, Structure and Nomenclature Search System and EPA's Oil and Hazardous Materials-Technical Assistance Data System. The link is also being used for literature searches. Further information on these may be obtained from **Dr John Shaw** of the Division. Further links are being contemplated by Chemistry Division (Wellington), Plant Diseases Division (Auckland) and Canterbury University (in association with Chemistry Division, Christchurch).

DSIR — Chemistry Division

Dr N.B. Milestone recently visited USA under the auspices of the Liquid Fuels Trust Board to assess the performance of the methanol to gasoline demonstration plant constructed by Mobil.

P.R. Grounds, a recent graduate from Canterbury University, has joined the food section as a scientist in the pesticides laboratory.

DSIR — Soil Bureau

Dr K.R. Tate has received a DSIR Study award to work at Rothamstead Experimental Station, England, with **Dr David Jenkinson** on the dynamics of soil organic matter.

NOTES TO AUTHORS

The Editor is always pleased to receive offers of papers for publication. The Journal aims to publish material of particular relevance to NZ chemistry but also welcomes any original chemical work including more general scientific essays or reviews. Topical comment may take the form of a Letter to the Editor.

Presentation

Authors should present their material in a concise, clear, natural style. They are urged to observe the high standards expected of a professional publication.

Manuscripts

The original and two copies of the manuscript should be typed **double-spaced** on A4 paper with wide margins. The left-hand margin should be not less than 40mm. All pages of the manuscript must be numbered consecutively including those containing references, tables and captions to illustrations, which are to be placed after the text.

Abstract & Biographical Details

Authors are asked to supply a brief summary (100-150 words) of the content of the article. This will precede the published paper. Authors are also asked to provide photographs of themselves (passport size is appropriate) and some brief biographical details so that these can be published with their paper.

Footnotes within the text should be used only when essential. Normally a system of references (see below) should be used. In the few instances where footnotes may be required they should be placed within horizontal rules immediately under the lines to which they refer.

References to the literature must be by unparenthesized superscript numerals in the order in which they are first mentioned and must be assembled in numerical order on a separate sheet at the end of the paper. The order given should be:

AUTHOR (initials first): JOURNAL: VOLUME: PAGE NUMBER and YEAR. Journal abbreviations should follow those set out in Chemical Abstracts, e.g. R.S. Hull, *J.Chem.Phys. 63:* 1141 (1975). References to books should give the author (with initials), title, publishers, year published and page number, e.g. F.A. Cotton and G. Wilkinson, *Basic Inorganic Chemistry*, John Wiley & Sons Inc., New York, 1976, p379.

Mathematical expressions and simple chemical formulae

Where possible mathematical expressions and chemical formulae should be in normal typescript. Judicious use should be made of the solidus (slash) to avoid 2-line mathematical expressions. Other material should be in a form suitable for photo-reduction.

Symbols: A marginal note should be made to indicate the presence in the text of either italics, Greek letters or other symbols that may be unfamiliar to the typesetter.

Diagrams & Structural Formulae: These should be submitted in such a form as to permit direct photo-reproduction. To that end stencils should be used wherever appropriate and lettering must be of such a size as to remain easily legible after the material has been reduced to either an 85mm column or a 175mm page. Black ink must be used on board, drawing or tracing paper, or plastic sheet. For convenience in reduction diagrams should not normally exceed 420 x $600mm^2$ (i.e. A2 size). The originals and two copies of all diagrams and structural formulae should be indicated in the margin. All diagrams should be numbered in series and a typed list of captions provided.

Photographs should be high contrast prints on glossy paper and again must fit into an 85mm column or a 175mm page. A typed caption should accompany each photograph.

Tables should be numbered with arabic numerals. They should be arranged having regard to the dimensions of the printed page, and the number of columns should be kept to a minimum. Long headings to columns should be avoided by the use of explanatory footnotes. Structural formulae should not be used in the headings or in the body of a table. Each table must be referred to in the text and its appropriate position should be indicated in the margin of the manuscript. Only in exceptional circumstances will presentation of essentially the same data in both tabular and graphical form be permitted; when adequate the latter form should be used.

Proofs: Galley proofs will be forwarded to authors for correction, and should be returned within 7 days to avoid printing delay. Such proofs will be checked by the publishers for normal printers' errors but authors will be responsible for scientific accuracy. Failure to return proofs will be taken as an indication that they are correct.

Parliamentary Point Of View

By Ian Shearer, MP

The Information Battle

One of the problems an MP faces early in his/her career is the lack of sufficient time for any in-depth study on any one topic. I have had a copy of "Science Indicators 1978" (National Science Foundation publication) on my desk for several weeks now and haven't had the covers open. Since its arrival I have variously been involved in a study of Aluminium Smelters, Industrial Relations, Special Education Policy, Urban Public Passenger Transport, Endangered Species, National Parks and Freedom of Information, to name a few.

In marked contrast with my earlier role as a scientist, where I could fully devote my energies to one limited field of endeavour, I now find myself very much a jack of all trades and, perhaps, master of very few. Not that that's necessarily bad — a broad base of information is useful in every field of endeavour — but sometimes, just sometimes, I wish I could spend more time really getting to grips with new scientific and technological long-term advances and a little less on short-term trivia.

DSIR Open Day

In mid-March members of the Government National Development and Science Committee accepted the invitation of DSIR Chemistry Division to visit them on their open day. I have been visiting various sections of DSIR for many years now and always find it of particular interest. There is no doubt in my mind that much of the scientific endeavour currently being carried out in NZ is of an internationally high standard. This of course has its problems. Inevitably our scientists will be enticed, encouraged (even bribed?) by overseas countries and companies to leave these shores.

Inevitably the statistics will show the politically sensitive "brain drain" and the Government of the day gets thrashed. But hold a minute. Surely it's in the interests of a scientist to seek the highest attainment possible in a chosen field? Surely a scientist in the forefront of a particular field of knowledge has a duty, not only to NZ but to this global spaceship we call Earth, to share and use that knowledge? Surely scientists of like minds and fields of endeavour should be able to get together to pool their abilities and so move the frontier even further? (The fact that the laboratories of Nobel Prizewinners tend to be fertile ground for future Nobel Prizewinners is proof of this). It seems to me then that we should not — indeed, must not — condemn those New Zealanders who do leave, but rather congratulate them on achieving such a level of endeavour as to warrant their being in demand overseas. As one who came back, I am sure that ultimately many will return, with even greater achievements to their credit and eventually I can see more and more

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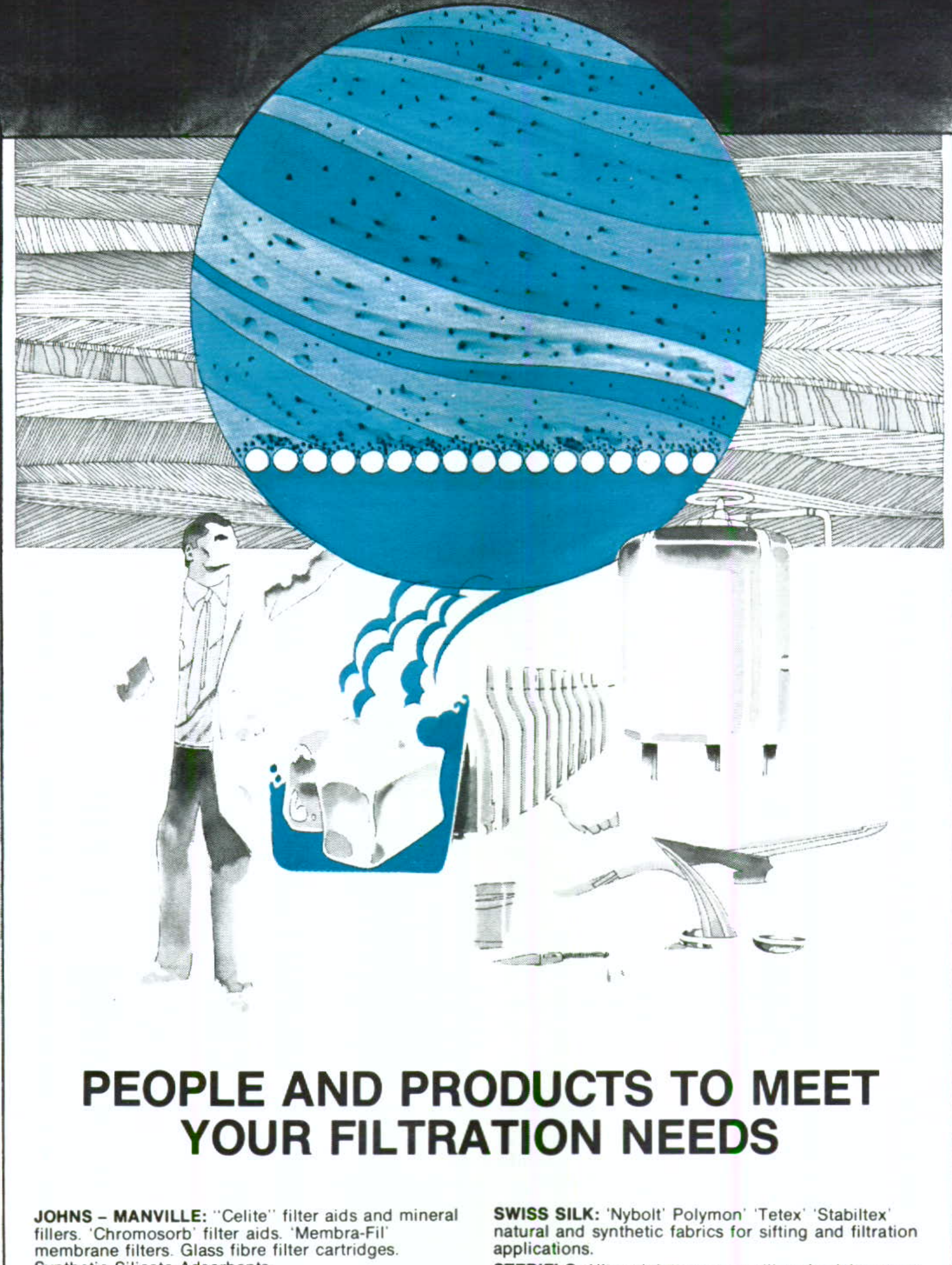

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The Fletcher Memorandum

Next year is the Golden Jubilee for the Institute. Fifty years ago a small group of enthusiasts started getting a professional body for chemists going in NZ. The report elsewhere on the May NZIC Council meeting will show you where we are now. What interests me is where will we be in another 50 years? Members who have ideas on what we **should** be doing, or **could** be doing, are invited to communicate with me anytime.

•

I attended the annual conference of the NZ Society for Cosmetic Chemists in April last at Rotorua. Splendid gathering it was, too. It's good to know that the quality of our lady's (and men's) surface coatings are in good professional hands. While there we took a trip to Reparoa to see the new ethanolfrom-whey plant being built —energy pundits please note!

•

The Pacific Science Association (Honolulu) has written to the RSNZ asking scientists in NZ to study subjects of particular interest to those in the Pacific. Subjects include coral reefs, nutrition, public health, and solid earth sciences. Write to me for the whole list.

•

The joint NZ/US Agreement for Scientific and Technological cooperation offers the opportunity for funds for NZ scientists to undertake collaborative research in USA (or have their partners come here) —any takers? I have the details.

•

Has anyone done a sum of all the people required to build and run these marvellous new projects the country is mounting this decade?

•

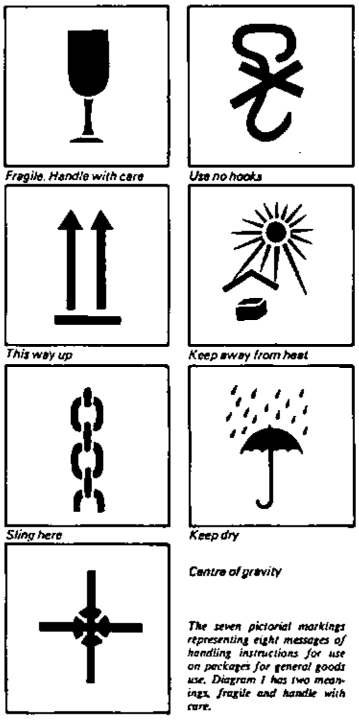
The Institute has several prizes. The Easterfield medal awarded biennially for excellent research, by younger chemists, the ICI prize open to all chemical researchers, the Industrial Chemistry prize open to all industrial chemists and the student essay prize open to students who give a paper at conference. None of these prizes is outstandingly popular and we would like to encourage more applicants. Any suggestions?

•

Talking about applicants — our analysis of the statistics of the membership of the Institute has shown that overall membership has scarcely grown over the past 5 years. We have been between 1300 and 1500 for some time now. We hoped that the new Journal and a more active executive would attract more new members. We guess there are approximately another 1500 chemists in NZ who are eligible to join. The new Technician grade has not attracted many entrants. Any comments?

•

Over the past two years the Institute has had **A.C. Kennet** and **R. Hopgood** attending Standards Association Subcommittees which are bringing forward new standards in the labelling and transporting of Hazardous Materials. The labelling standards is now available as NZS 5427, **"Pictorial markings for handling of goods"** (ISO/R780) (illustrated). The whole area of dangerous and hazardous goods — as far as legislation is concerned — is rather fuzzy. The NZIC has been inclined to make submissions to the Government on this area — what do you think?



The seven pictorial markings representing eight messages of handling instructions for use on packages for general goods use. Diagram 1 has two meanings, fragile and handle with care.

•

On a personal note — the chimney on my pot belly stove seems to "soot up" too rapidly, and after watching a fire service documentary on TV on this subject I wondered if some bright chemist has the answer (other than to buy the new DSIR "hot box").

J. G. Fletcher

Parliamentary Viewpoint (Cont)

overseas developed nations wanting to send their scientists to train here.

It's amazing what one learns on a DSIR Open Day. During the short time our Committee was at Chemistry Division we learned that the "secret" catalyst for the methanol plant was pretty well known by DSIR scientists, that an entirely new set of sulphur compounds associated with the scent glands of stoats, ferrets, and opossums, had been discovered right here in NZ (the scientist is now overseas on study), that samples of illegal drugs can be "fingerprinted" for police detection and prosecution purposes, and, that decorative tiles can be made cheaply and effectively out of waste glass, just to name a few. The great pity is that most New Zealanders are completely unaware of all these endeavours.

Sneak Preview

Although it is too early to obtain full details of legislation proposed within the Minister of Science and Technology's portfolio, I have learned that the following is proposed:

1. Transport Research Association Bill — to set up a new RA. The most recent one to be set up was the Heavy Engineering Research Association 2 years ago.
2. Carter Observatory Act Amendment — this is to enable the Minister to make appointments to the Carter Observatory rather than the GovernorGeneral as at present.
3. Wheat Research Levy Act Amendment — the current Act has a maximum rate for the levy and the plan is to increase this maximum rate.

Further information on this and other legislation will be available once the House commences on May 15.

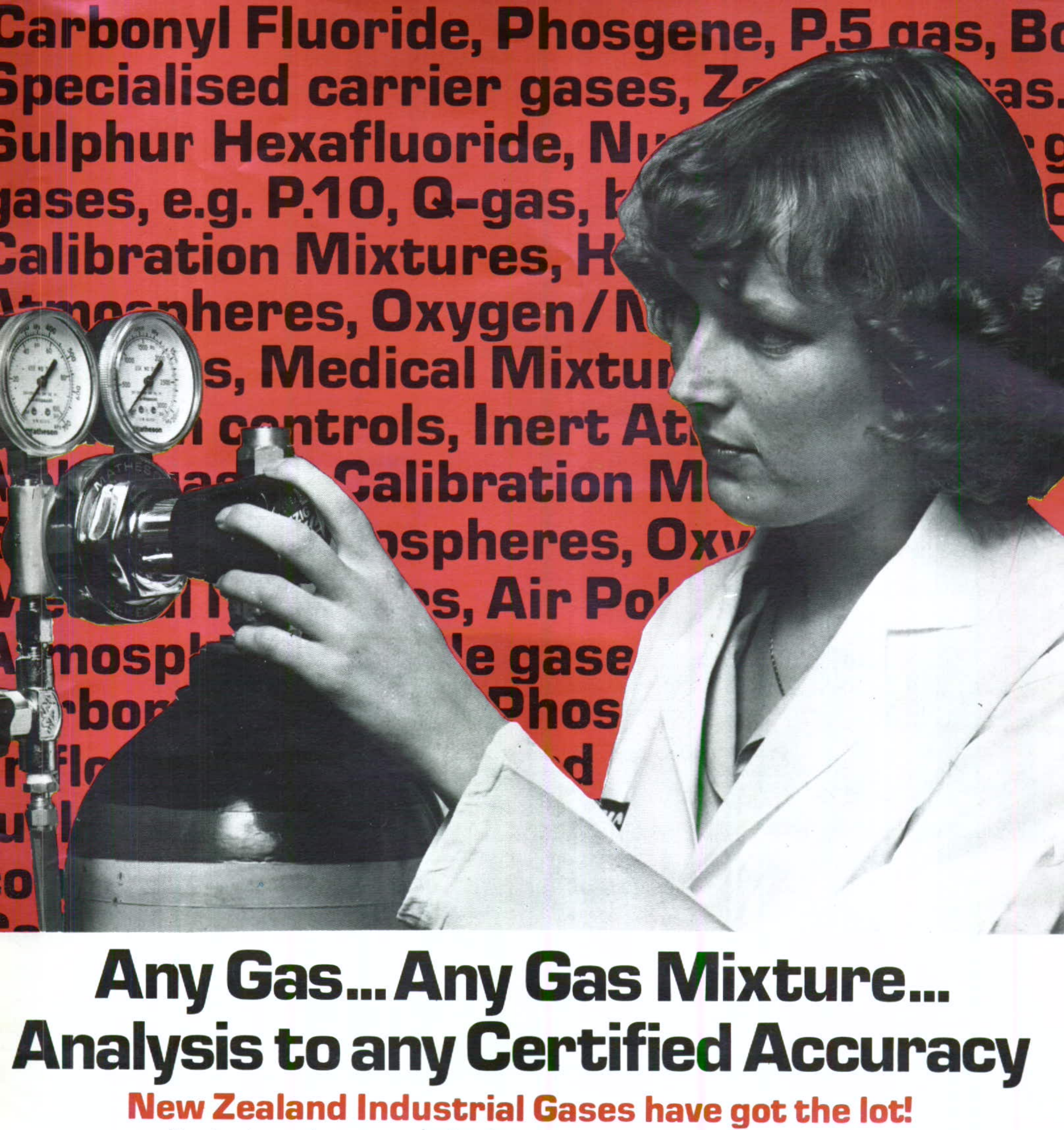
LETTER TO THE EDITOR

Sir,

I was interested to read in the April issue that a Dr. S. Hades has shown that there are no thermometers in Hell. The great Linus Pauling pre-empted him with the following fine example of a null hypothesis.

"To prove that the temperature of Hell is constant, consider the contrary. If the temperature of Hell is not constant, a temperature gradient must exist. If a temperature gradient exists, the damned could construct a refrigerating machine. But the object of Hell is to torture the damned with extreme heat. Hence, a refrigerating machine is not possible. Ergo, the temperature of Hell must be constant."

John R. Walker,
University of Canterbury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