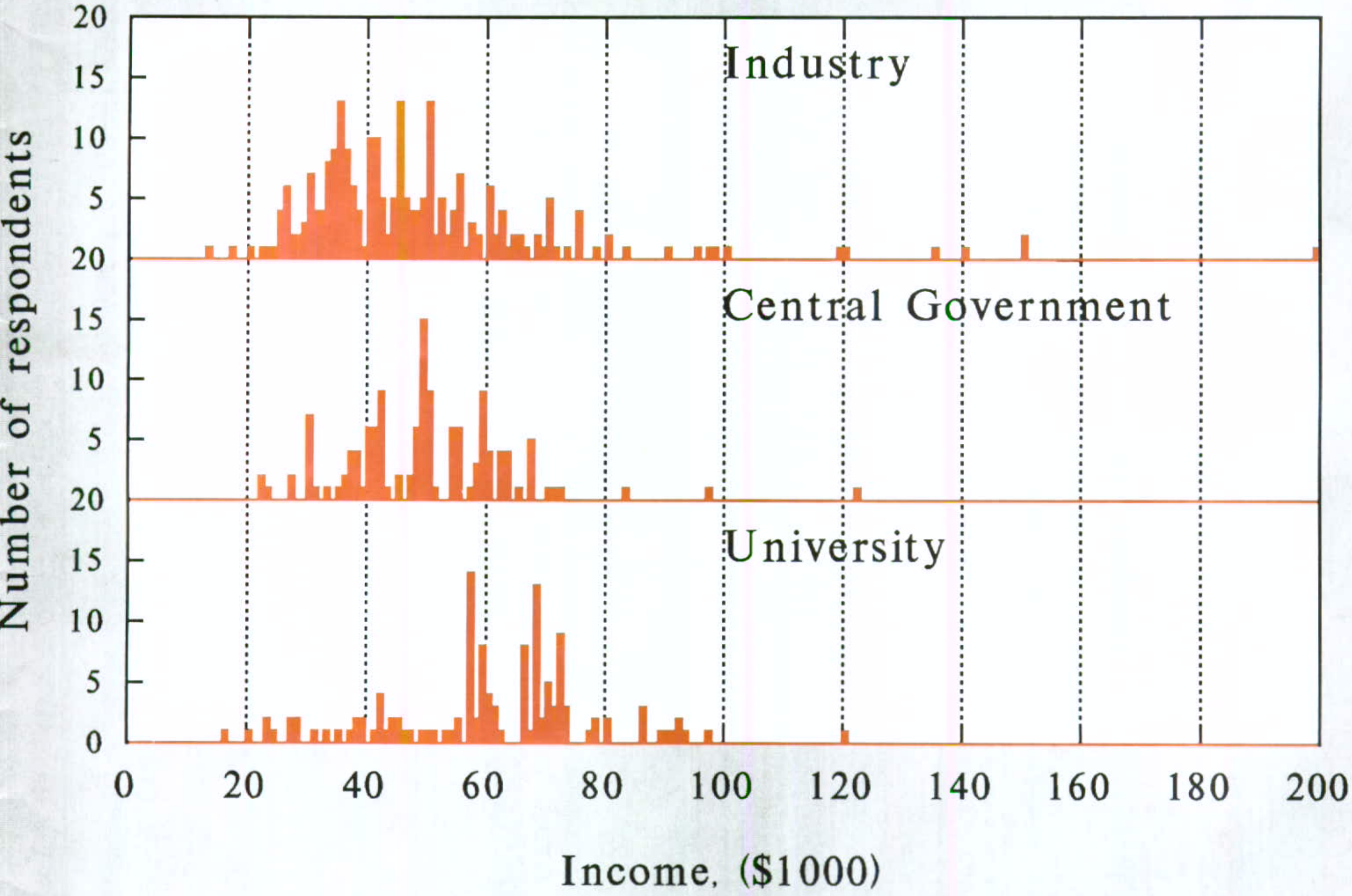
chemistry
in new zealand

Vol 53 No 6 December 1989



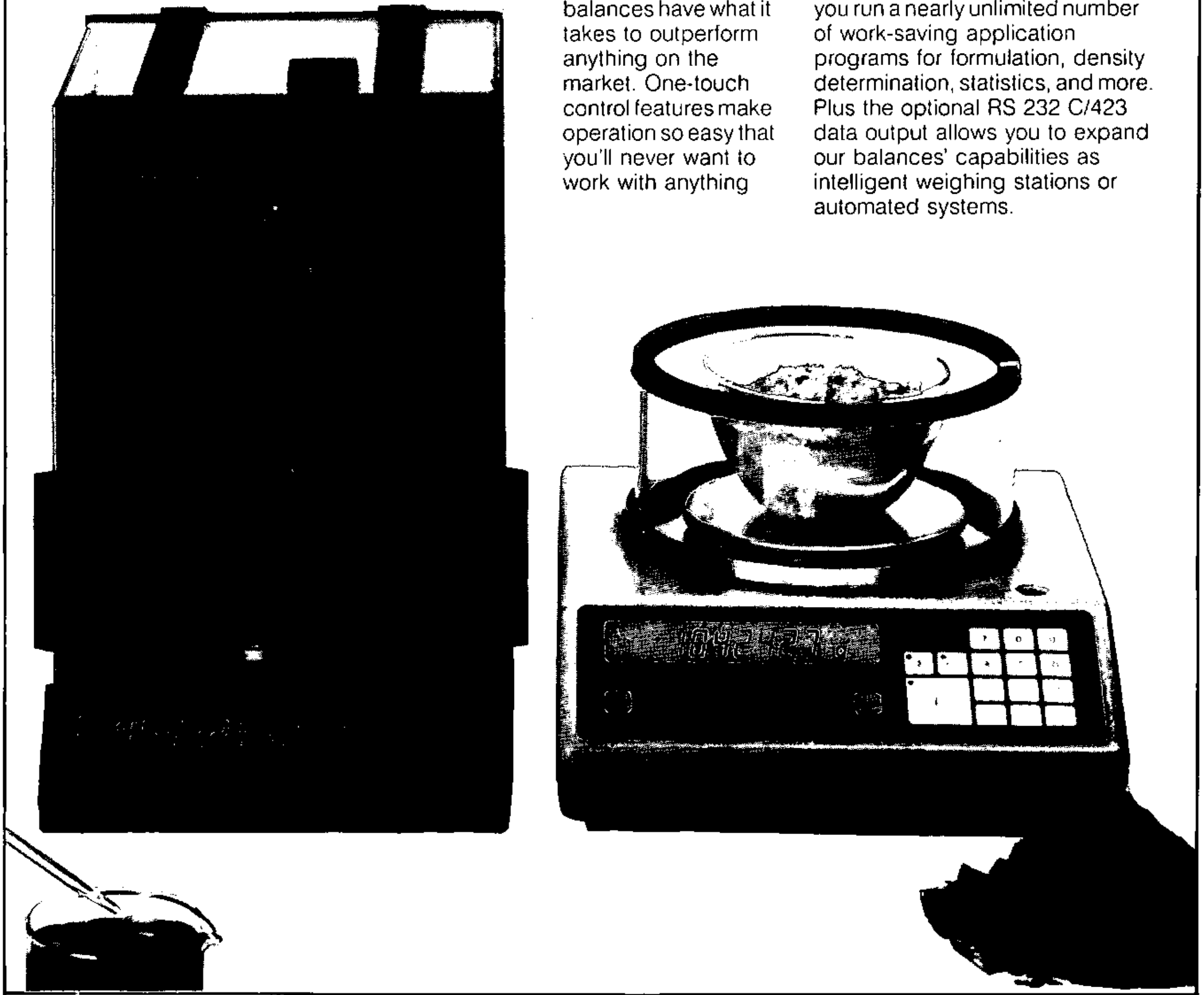
SPECIAL FEATURE:
Company Profiles Pg 135
1989 Income Survey Pg 151

In search of excellence?

You'll find it in two of the world's best balances

Sartorius Research and Excellence series represent a unique generation of analytical and precision balances created to deliver top performance down the line.

They enable you to accomplish tasks you thought were impossible. Combine the powerful capabilities of these balances – and you'll be perfectly set to handle any job in your lab. One glance at the performance specifications will tell you why. You name it, these Sartorius balances have what it takes to outperform anything on the market. One-touch control features make operation so easy that you'll never want to work with anything else. Our advanced, easy-to-read LCD is so convenient that you won't want to look at anything else. And it's so fast that you'll always be on target while filling. Flexibility, reliability, profitability, think of all the abilities sophisticated Sartorius balances give you. Along with their unequalled track record in accuracy. Dedicated keyboards let you run a nearly unlimited number of work-saving application programs for formulation, density determination, statistics, and more. Plus the optional RS 232 C/423 data output allows you to expand our balances' capabilities as intelligent weighing stations or automated systems.



Performance Specifications

Sartorius Research series	**Capacity**	**Readability**
R 160 P	162 g	10 µg . . . 50 µg
R 200 D	42/205 g	10 µg/0.1 mg
R 300 S	303 g	0.1 mg
Sartorius Excellence series		
E 1200 S	1,220 g	0.001 g
E 2000 D	500/2,020 g	0.001/0.01 g
E 5500 S	5,550 g	0.01 g

Marketed by:

WILTON INSTRUMENTS

People you can count on

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

chemistry
in new zealand
Vol 53 No 6 December 1989

Dear Reader

COMPANY PROFILES

On the next few pages we feature profiles on some of our regular advertisers. Please support these companies in your purchasing decisions. We need their support, and they need yours.

Featured Companies:

Advanced Analytical Ltd.
Alphatech Systems Ltd & Co.
Analabs
Associated Process Control
Farmac Enterprises Ltd.
W. Grayson & Associates
John Morris Scientific
Medtec Products Ltd.
Scientific & General Consultants

S&G
CONSULTANTS

Scientific and General Consultants is a multidisciplined Laboratory providing independent, confidential, analytical and consultative services to industry and commerce. The utilisation of a nationwide team of trained inspectors and samplers allows us to respond to a client's needs rapidly, efficiently and cost effectively.

Scientific and General Consultants are able to offer analytical and consulting services in the following fields:-

- Food and natural products
- Edible oils and fats
- Cosmetics and personal care products
- General lubricating oils
- Pharmaceutical products
- Consumer products
- Fertilisers
- Soil and foliage
- Organic Analysis
- Inorganic Analysis
- Product development
- Quality Control
- Consultancy and Investigation
- Pesticide residue analysis
- Environmental analysis

The use of "State of Art" analytical instrumentation and techniques produces not only results, but service of the highest quality.

Scientific and General Consultants provide a cost effective service to clients who cannot justify the expense of their own inhouse laboratories. Furthermore, companies who have inhouse laboratories avail themselves of these services for "one off" jobs as well as routine quality control of manufactured or supplied products.

As the need for independent, confidential analytical requirements grows, the laboratory offers an increasing number of services.

Scientific and General Consultants is staffed by highly trained, skilled and professional chemists and technicians ensuring clients of the utmost care and attention to their needs.

As Scientific and General Consultants is an integral part of the SGS group we are able to offer a worldwide based backup service.

**SCIENTIFIC AND GENERAL
CON SULTANTS
ANALYTICAL SERVICES
228 NEILSON ST, ONEHUNGA
P.O. BOX 13-219, AUCKLAND
TELEPHONE: (09) 642-593
FAX (09) 646-728**

John Morris
Scientific

John Morris Scientific Ltd.
CONTACT:
P.O. BOX 6348 AUCKLAND 1.
FREE PHONE: (0800) 651-700
FACIMILE: (09) 444-0974

Import and distribute a wide range of quality Laboratory Instrumentation on both sides of the Tasman.

We have sales and service centres in all major cities throughout Australasia.

Part of our product range is:

ALCATEL
Superior Vacuum Systems

CAHN
Precision Balances

EIMA
Ultrasonic Cleaning Baths

FORTUNA
Dispensing

GERHARDT
Kjeldahl, Soxtherm Digestion

GILSON
Pipetman. Liquid Handling. HPLC/LC.

HERMLE
Centrifuges

JANKE & KUNKEL (I.K.A.)
Shaking, Stirring, Dispersing

METROHM
Karl Fischer, Autotitration, ph, Voltammetry

NEW BRUNSWICK SCIENTIFIC
Fermentation/Media Systems

TECHNE
Thermoregulators/Baths, Dri Blocks

YELLOW SPRINGS INSTRUMENTS
Enviromental and Sports/Medical Equipment

ALPHATECH

SYSTEMS LTD & CO.

Distributors of a wide range of equipment from the world's market leaders for Analytical Chemistry, Biochemistry, Molecular Biology, Research Physics, Clinical Biochemistry, Medical Physics, Nuclear Medicine...

Applied Biosystems - Sequencers, Synthesisers
Atto - Electrophoresis
Beckman - Centrifuges, LS Counters, Capillary Electrophoresis
Bicron - Radiation Monitors
Bomen - FT-IR
Brownlee - HPLC Columns
Chrompack - GC Columns/Accessories
Carla Erba - GC, Nitrogen Analysers
Chemetrics - Chemical Test Kits
Europa Scientific - Isotope Ratio Mass Spec
Hamilton - Syringes
Hanna Instruments - pH, Conductivity, Temperature, Pumps
Hitachi - UV/Vis, Fluoro, AA, Integrators, Electron Microscopes
Horiba - Particle Size Analysers
Molecular Dynamics - Densitometers, Phosphor Imagers
Princeton Applied Research - Electrochemistry Analysers
Quadrex - GC Columns
Restek - GC Columns
The Nucleus - Nuclear Spectroscopy
Valco - HPLC/GC VALVES
Waters - HPLC
Zymark - Laboratory Robotics

ALPHATECH SYSTEMS LTD & CO.

AUCKLAND
35 Scarborough Terrace, Parnell
P.O. Box 37-583, Parnell, Auckland
Tel: (09) 770-392 Fax: (09) 398-514
Telex: NZ 21433

WELLINGTON
63 Mills Road, Brooklyn
Tel: (04) 893905

W. GRAYSON & ASSOCIATES LTD

The origins of W. Grayson & Associates go back more than 50 years to 1935 when Len Spackman opened his doors as a public analyst. He was later joined by Jim Sprott who took over the business in 1964 and it grew until he sold out in 1983. Meanwhile, in 1976 Bill Grayson began a product development laboratory which eventually took over what had been T. J. Sprott & Associates in 1985.

At present we are operating ten laboratories, with state of the art instrumentation which assures not only the optimum choice of method, but the qualified people to solve your problems.

Our primary objective is to serve your technical, chemical and microbiological requirements to the best of our ability. Please feel free to discuss any matter where we may be of assistance.

Telarc Registered for:

Asbestos monitoring
Blood alcohol analysis
Toxic metal release from cookware
Timber analysis and related products
A broad range of microbiological analysis of: foods, food additives, nutrients, vitamins, animal feeds, for pathogens and non-pathogens
Vitamin D analysis
Examination of volumetric glassware
Calibration of thermometers
Examination of hazardous substances containers

Specialist Laboratories in:

Product development
Quality assurance, corrosion
Chromatography and plastics
Food and pharmaceuticals
Water, effluents and enviromental chemistry
Microbiology
Geochemistry and fire assay
Timber analysis

(09) 590-329 A TELARC registered laboratory
Telephone

Hugo Johnson Drive. Penrose. Auckland. New Zealand
P O. Box 12-545, Penrose FAX NZ (09) 599-044
Also at Invercargill Phone (021) 82-247

Member NZ Association of Consulting Laboratories

FARMAC

The company has existed for a number of years under a series of different names and ownerships.
i.e. Stanzol
T.J. Sprott Manufacturing
Anatech

During this time the important side of the business, that is, the control of manufacturing and supply has been under the control of one person. This ensures that there has been a consistant and reliable approach to your needs. The company is a privately owned New Zealand operation.

The preparation of Laboratory Reagents and Standard Solutions requires time and skill. For the busy quality control laboratory, or the laboratory without the expertise available, our freshly prepared concentrated Volumetric or Ready To Use Standard Solutions are the most Cost Effective means of ensuring that the laboratory continues to produce reliable results.

pH meters require constant checks and adjustments of calibration. We can produce Buffer Solutions to suit your particular needs as well as having available standard colour coded buffers.

Farmac has pioneered the use of "Bag In The Box" reagent solutions in New Zealand. The barrier properties of the bags provide for solution stability. Accidental contamination of expensive reagent with used solution by returning slops to the reagent bottle can now be a thing of the past.

We specialise in the preparation and manufacture of Test Kits for:

- The measurement of pH, chlorine and cyanuric acid in swimming and spa pools.
- The measurement of transformer oil acidity
- The measurement of breakdown products in cooking oils and fast
- T.P.A. spot tests for boron, copper etc.
- We can develop and manufacture kits for your particular requirements.

Other specialised products are available.

See our advertisement in this catalogue or call us about your special requirements.

FARMAC ENTERPRISES LTD.

288 NEILSON STREET, ONEHUNGA,
AUCKLAND 6.
PHONE (09) 668-186
FAX (09) 646-728

Analabs leads the mineral-testing arm of Inchcape Inspection and Testing Services [IITS], a multinational services group. Although Analabs has grown as a mineral-testing company, it has diversified into other sectors of industrial analysis including agriculture, manufacturing, pharmaceuticals, construction, transport and storage, water, and the environment. The New Zealand operations are a reflection of this expansion.

Well-equipped laboratories are located in Penrose and New Plymouth. They are managed by Paul Morrow [Penrose] and Hein Trompert [New Plymouth] who lead a highly professional team of chemists and laboratory personnel.

Analabs is committed to quality analysis, IITS' philosophy on servicing. Consultation and advice are available from experienced chemists offering a broad range of specialist knowledge.

NEW ZEALAND
Penrose
New Plymouth

FIJI
INDONESIA
PAPUA NEW GUINEA
PHILIPPINES
SOLOMON ISLANDS
UNITED KINGDOM

AUSTRALIA
Adelaide
Brisbane
Burnie
Cairns
Darwin
Kalgoorlie
Perth
Melbourne
Townsville

ANALABS

M657 Great South Road
Penrose
New Zealand
Tel: [09] 597 265
Fax: [09] 599 630

14 Hudson Road
Bell Block, New Plymouth
New Zealand
Tel: [067] 72 400
Fax: [067] 71 992

ADVANCED ANALYTICAL LTD.

Representing
VG INSTRUMENTS GROUP COMPANIES
including:

ORGANIC MASS SPECTROMETERS

VG ANALYTICAL:	High performance magnetic sector GC-MS systems.
VG MASSLAB:	Quadrupole based fully automated GC-MS systems.
VG TRITECH:	Medium resolution magnetic sector GC-MS systems.

INORGANIC MASS SPECTROMETERS

VG ELEMENTAL:	Inductively coupled plasma mass spectrometers — IPC-MS.
VG GAS ANALYSIS:	Gas analysis and automatic on-line process mass spectrometers.
VG ISOTECH:	Stable Isotope and Thermal Isotope ratio mass spectrometers.
VG QUADRUPOLES:	Quadrupole residual gas mass spectrometers and medical gas analysers.

SURFACE ANALYSIS SYSTEMS

VG IONEX:	Secondary ion mass spectrometers (SIMS).
VG SCIENTIFIC:	Electron spectrometers, ESCA and AUGER etc.

MICROANALYSIS

KEVEX:	X-ray Microianalysis equipment for electron microscopes and microprobes.

Advanced Analytical (Division of Advanced Electronics Limited) represents VG Instruments Group throughout Australia and New Zealand. A broad range of VG equipment has been sold, and is fully supported by our engineers.

ADVANCED ANALYTICAL LIMITED
P.O. Box 36-280,
Northcote, Auckland 9.
Phone (09) 419-1448. Facsimile: (09) 418-0022.

MEDTEC
MEDTEC PRODUCTS LTD

Medtec Products Limited was formed to provide the Analytical and Healthcare markets of New Zealand with quality products matched by premium service and support.

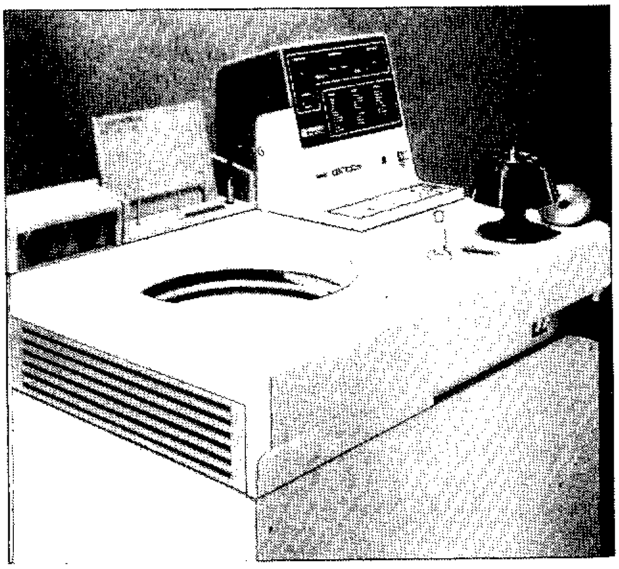
Medtec Products Limited has branches located in the three main centres of New Zealand and covers the whole of the country by personal representation.

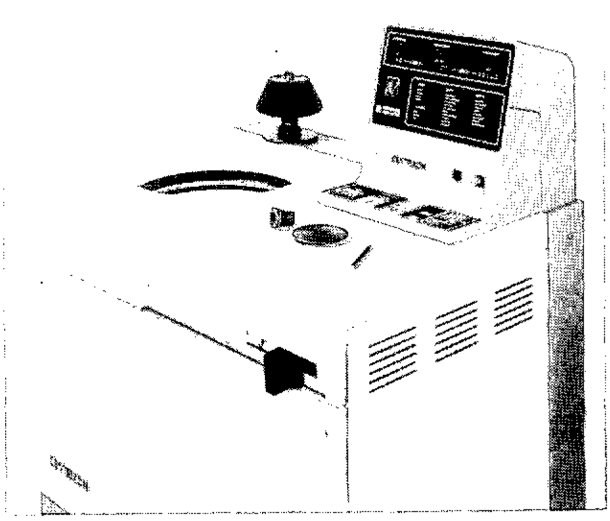
The Principals represented by Medtec Products Limited are:

Hewlett Packard	- Gas Chromatographs Liquid Chromatographs Chromatoggraphy Consumables Mass Spectrometers UV VIS Spectrophotometers Integrators Data Handling Computers & Calculators Computer Peripherals
Damon I.E.C	- Centrifuges & Accessories Cryotomes
Ohaus	- Electronic Balances
Molecular Design	- Chemistry Software
Jones Chromatography	- Chromatography Data handling Chromatography Consumables

Office Locations

129 Onewa Road Northcote Auckland	125 Naenae Road Lower Hutt Wellington	323 Cranford Street Edgeware Christchurch
PH. 4806763	670010	556860
FAX 4806386	672821	558105





chemistry in new zealand

Vol 53 No 6 December 1989

CONTENTS

Acting Editor: B. E. Swedlund, 34 Saltburn Rd, Milford, Auckland 9. Phone 495-767

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

Published on behalf of the New Zealand Institute of Chemistry (Inc).
PO Box 12-347, Wellington. Ph (04) 739-444, Fax (04) 732-324
President: Dr. J. Waters, Hon.Gen.Secretary: Alan A Turner, Registrar: D.P.Karl.

Published by CATHEDRAL PRESS LTD, PO Box 9072, Newmarket. Phone 371-572
Advertising Manager Carl Roze. Phone Auckland 547-244.

Editorial

A piece of gross ignorance, but probably widespread, is involved in the common meaning of 'What is a chemical?' We have for instance, those enthusiasts for growing plants under dirtless conditions, who mindless of the the fact that their plants will die without the inorganic nutrients supplied can proudly declaim 'no chemicals used in cultivation'.

Another catch cry, that of 'organically grown' also has pretty obvious faulty reasoning behind its use. The chemist often finds it difficult to counteract such 'slogan thinking', but surely has a duty to point out that we are surrounded by, nay even composed of chemicals, and that all life and industry depends on the existence and use of chemicals. One suspects that the honest man in the street, whose votes will determine the government we get, would not think of sugar, medicine or DNA as being chemicals, but would instantly recognise the atom bomb, ozone, and CFC as being chemicals and therefore nasty.

Chemists, as apostles of the newer knowledge of the last two hundred years, have a little blame to bear, since who has not heard of the wonders of the man-made as compared with the natural. When unnatural is thought of as the opposite of a natural product, and synthetic is equated with second quality, because it is not the real thing, we have the kind of thinking that disparages chemistry.

The word natural, if it means occurring in nature, surely applies to synthetic products, since the atoms they are built from certainly occur in nature. If a synthetic product is unnatural, then so are all man-made objects such as a road, a house, all clothing, and most things which surround us in civilised living. The word natural certainly has a place, when it is opposed to spiritual, intellectual or fictitious, or to describe law or custom, but when applied to chemicals and chemical products displays inappropriate thinking, and should be abandoned. The chemist needs to assert that we live in a world of chemicals, that understanding molecules and their interaction — the subject of chemistry — is, if not everything, then is at least a major and critical part of knowledge, and quite vital to continued well being and probably even to existence. Chemicals can be used well or badly but of one thing there is no doubt —

CHEMISTRY RULES — O.K.

Letter From The President

I reported in the last issue of the Journal that nominations for the Foundation for Research, Science and Technology were to be sent to the Minister of Science for his consideration. This was done but at the time of writing we have yet to learn if any of our nominees have been appointed.

During the last year or so there have been requests from some Branches to establish closer relations with the Royal Australian Chemical Institute. This is seen as a means of strengthening NZIC involvement in the affairs of chemistry. Suggestions as to the form such relations should take vary from closer cooperation over Conferences, through publication of a common Journal to eventually a complete amalgamation of the two organisations. Some preliminary discussions with the RACI have occurred and so far the idea has met with a favourable response, at least in principle. However I should like to emphasize that the approach to the RACI has been a very preliminary one and we are some way from making any decisions. Members will be kept informed about the discussions and they will be given an opportunity to express their views. Cooperation in the organising of Conferences has already occurred to a limited extent, particularly amongst the specialist groups and I am sure that this will continue in the future. Whether or not closer cooperation proceeds beyond this level remains to be seen.

In December the 1989 International Congress of Pacific Basin Societies is to be held in Hawaii. This Congress is sponsored jointly by the Chemical Society of Japan, the Chemical Institute of Canada and the Americal Chemical Society, but a further twenty-one chemical societies from around the Pacific Basin, including the NZ Institute of Chemistry, are official participants. This year the host organisation is the Chemical Society of Japan. Dr Brian Halton (Wellington Branch) and I will be formally representing NZIC interests at the Congress. In the past three years Dr Halton has been in constant communication with the Congress organisers and has served on one of the sub-committees. It is thus very appropriate that he should be representing us.

In conclusion may I take this opportunity of extending Christmas and New Year Greetings to you all.

Yours sincerely
Joyce M Waters

National Chemistry Day -30th June 1989

National Competitions

Once again the response to the National Essay Competition for 6th and 7th formers was disappointing with relatively few schools throughout the country taking part. The Poster Competition brought forward a better response with some excellent entries being received. However here too, the number of schools who sent in entries was not great. The results of the these competitions are as follows:

Essay Competition (Forms 6 & 7)

First Prize ($200):
Justine Daw,Rangitoto College, Auckland.
Second Prize ($100):
Craig Scrimgeour,
ManurewaHigh School,
Auckland.
Third Prize ($25):
Nadia Huffam,
Okato College, Taranaki.

Entries were judged by Mr Robert Neale, University Orator and a member of the English Department, Massey University.

Poster Competition (Forms 3 & 4)

First Prize ($200):
Jenni Sickling, Glenfield College, Auckland.
Second Prize ($50):
Rachel Brader, Tawa College, Wellington.

Two additional entries received special merit prizes of $25 each. These were awarded' to Louisa Burgess, Wellington High School and Joni Darcy, Kerikeri High School

Poster Competition (Forms 1 & 2)

First Prize ($200):
Virginia Peters,Kerikeri High School.
Second Prize ($50):
Antony Dalbeth,
Kerikeri High School.

Entries in the Poster Competitions were judged by Mrs Judith Hitchings and Mr Terry Hitchings (Canterbury Branch).

Branch Activities

Variety was the keynote in the activities run by Branches. Auckland and Wellington offered prizes to local entries in the National Poster Competitions. Auckland also offered an 'incentive' prize to the teachers of winning pupils.

National Chemistry Day gave the Otago Branch an opportunity to participate in the production of a 'chemical kitset' designed to encourage school involvement in a set of experiments designed around food and household chemicals. Such chemical reactions with everyday reagents are intended to promote an awareness of chemicals and how they can form new substances. The kitset, which was launched by the Otago Education Board Science Advisory Service at Tainui School, with assistance from Bayfield High School six and seventh form chemistry students, is believed to be a first for New Zealand primary schools. The Otago Branch and Otago Education Board Science Advisory Service were delighted with the success of the Chemistry Kits and would like to encourage other Branches to follow up this idea.

A new venture in the 1989 activities was the two-hour radio talkback show on Waikato's Radio Pacific on 30 June which featured three Waikato Branch representatives.

Auckland Branch ran a successful crystal growing competition for intermediate schools in their region.

Teachers were informed that a 'crystal growing kit' was available on request and this contained an amount of copper sulphate as well as some simple instructions on crystal growing procedures. Prizes were awarded to the best entries. Analytical competitions were once again run by Canterbury, Otago, Waikato and Wellington Branches. In some centres lectures on subjects as diverse as "Advances in DNA Technology" and the supposed discovery of "Nuclear Fusion at Room Temperature" were given.

Considerable media publicity was given to National Chemistry Day with articles and news reports covering activities appearing in the Northern Advocate, New Zealand Herald, Manawatu Evening Standard and the Otago Daily Times.

FRS Award For Plant Physiology Scientist

Research into the chemistry on which all life is based has earned a DSIR plant physiologist one of sciences highest honours.

Roger Slack of Palmerston North has been elected a Fellow of the Royal Society of London, a distinction attained by only a handful of New Zealanders.

The fellowship recognises his work in discovering what became known as the Hatch-Slack pathway of photosynthesis in plants.

The label, Dr. Slack notes, was given by those who came later and built on the breakthrough.

He is aghast at the suggestion that the researchers might have named it for themselves.

He calls it by the more common term, the C4 pathway, by which photosynthesis produces a four carbon compound.

Dr. Slack explains that the pathway is the defence which plants such as tropical grasses have evolved against drought.

They use half the amount of water to produce the same amount of growth as the other, C3 plants.

"It's an environmental adaption so that plants can grow well under conditions of high temperature, strong light and limited water," he says.

DSIR's environmental coordinator, Bernard Forde, describes the C4 discovery as "probably the most significant in plant physiology in the decade."

The breakthrough came at a time when scientists believed all plants grew by a universal process which resulted in a three-carbon compound.

Following the lead of researchers in Hawaii, Dr. Slack and colleague Hal Hatch established that sugar cane worked differently, producing a four carbon compound.

Since the discovery in the 1960's, research has shown that the C4 plants include sugar cane, maize, sorghum, tropical pasture grasses, and many of the worst weeds of summer.

The pathway can be put to practical use in developing herbicides which will kill C4 weeds while leaving C3 crop or pasture plants unscathed.

Dr. Slack is now deputy director of DSIR's Plant Physiology Division. His current research is aimed at improving malting barley, the raw material of beer.

Dr. Slack says the industrialised countries of East Asia offer a potential export market for New Zealand malt and malting barley.

Letter to The Editor

Chemists coming through the years of user-pays, restructuring, and rationalization, will not be short of stories to tell about how it affected them.

Your readers may find amusement and perhaps a timely warning in the following tragi-comedy from a technical institute teaching advanced chemistry and claiming to carry out research. It concerns the activities of a senior so-called administrator.

The story began some years ago when, with his "new broom sweeps clean" approach, he issued an instruction that all chemicals which had not been required for use during the previous two years were to be offered for sale. Anyone familiar with the difficulties in getting chemicals for education and research will know the delays of a year or more and the exorbitant costs frequently associated overcoming these delays.

Following a meeting where the views of the staff were expressed with some frankness, he dropped the idea. We had succeeded, so we thought, in convincing him that a chemical store is less like a supermarket, requiring rapid turnover of stock, than a library where stable molecules await our sudden call to service.

But the slow kinetics of stubbornness had been ticking over these few years and he recently issued forth in an even more virulent form. On his instructions all chemicals have been valued by the technical staff. Let us say the value placed on them is $40,000. Each department has been given a figure for the value of the chemicals he considers it should have, let us say $25,000. Now if we don't sell some of them, or get rid of them in some way, we are to be charged interest at current rates for the difference ($15,000). Not surprisingly one of our departments is now considering a rapid and wholesale dumping of their valuable stock built up over a number of years.

He is not a scientist and he is still very active in New Zealand tertiary education. You will appreciate why I must remain anonymous.

I must rush out now and keep my test-tubes warm in case they follow our chemicals to the tip.

Signed
Labile Chemist

This letter is published without any endorsement of the author's views or actions. The acting-editor, floating in a cloud of idealism, is himself, quite unsympathetic to bureaucratic realism, but does notice that administrators do have a problem when confronted by the burden of what to do about the limitation of space and money. This subject is now open for discussion.

The N.Z. Institute of Chemistry The N.Z. Biochemical Society The N.Z. Society of Plant Physiologists

1990 CONFERENCE
Victoria University of Wellington
20-24 August

CHEMISTRY, RESOURCES AND THE FUTURF

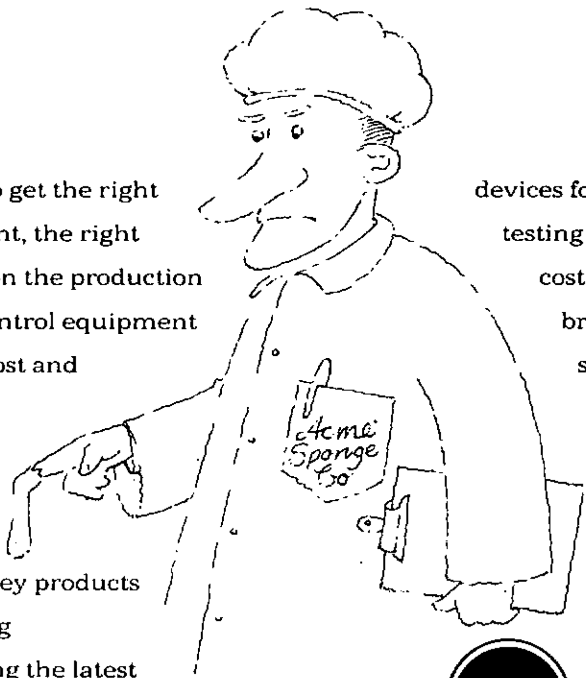
Organisation for the 1990 NZIC/NZBS/NZSPP Conference is now well underway. We welcome the New Zealand Society of Plant Physiologists who join us for the first time. The conference, registered as an official 1990 event, will have a programme which reflects the way Chemistry and the Biological Sciences can positively help take New Zealand into the 21st century.

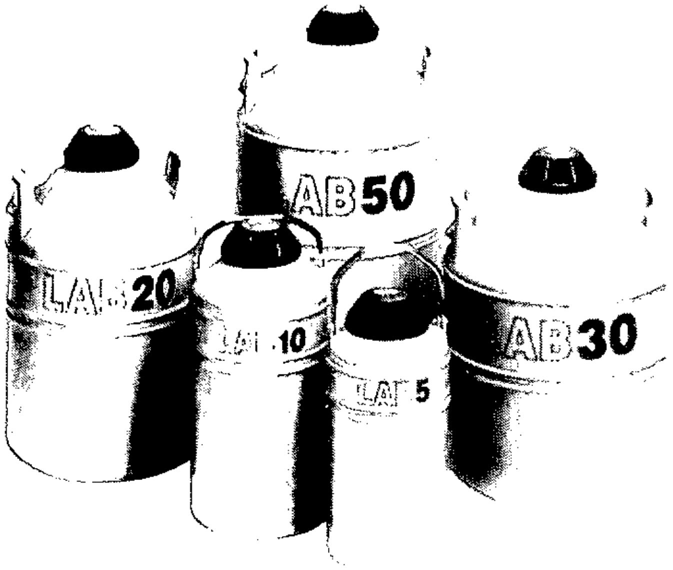
The conference committee are in the final stages of confirming the participation of a very high profile international speaker who will open the conference with a general public lecture on the evening of Monday 20 August. A number of plenary sessions are planned for the four days, and speakers who are experts in their fields have been selected and approached. It would be premature to announce these people but details will be included in the next issue of "Chemistry in New Zealand".

Subjects to be covered in the plenary sessions are: **Science Policy, Plant Molecular Biology and Genetic Engineering, Industrial and Chemical Technology, Natural Product and Agricultural Chemistry, Health and Environment, and Chemical Education.** The normal specialist sessions will also be included. Extensive Trades Displays will exhibit the latest techniques and equipment available to the working scientist, educationalist or industrialist.

A number of social events are planned, including a wine and cheese evening, harbour cruises and a play at Downstage Theatre. The conference dinner will be held on Wednesday 22 at the world renowned Southwards Car Museum. A very special night of entertainment has been organised.

The organising committee look forward to your attendance and participation at this special conference. The call for papers will be circulated in February/March with the registration forms following in April/May. Further information can be obtained from Dr Neville Tapp, Development Department, Unilever (N.Z.) Ltd, Private Bag 1, Petone. Fax (04) 683-338.


Acme Sponge Co


LAB 50
LAB 20
LAB 10
LAB 5
LAB 30

1989 EASTERFIELD ADDRESS (EDITED FOR PUBLICATION)

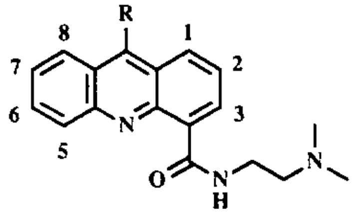
SYNTHESIS AND DEVELOPMENT OF TWO NEW CLASSES OF ANTICANCER DRUGS:

THE TRICYCLIC CARBOXAMIDES AND THE XANTHENONEACETIC ACIDS

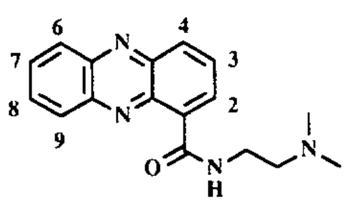
GORDON W. REWCASTLE, CANCER RESEARCH LABORATORY,
UNIVERSITY OF AUCKLAND MEDICAL SCHOOL, PRIVATE BAG, AUCKLAND.

In the search for any new anti-cancer agent, there are two basic approaches that can be followed. These are the random screening of existing compounds, whether they are of biological or synthetic origon, or the rational synthesis of new compounds designed to target a specific site or tumour type. Both of these approaches have had their successes as well as their failures, and the two types of compound to be discussed here, namely the tricyclic carboxamides **1-3** and the xanthenoneacetic acids **4**, represent examples of compounds that have been derived separately via these two alternative routes.

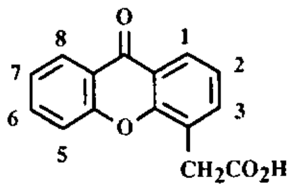
At a superficial glance these two compound classes might appear to be fairly similar, but in actual fact their physical properties and antitumour effects are completely different. For example, the carboxamide derivatives have an amine sidechain which is fully protonated at the physiological pH of 7.4, whereas the xanthenones have an acidic group which is completely deprotonated at that pH. Therefore in the body we are actually dealing with a positively charged species in one case and a negatively charged one in the other. This difference in physical properties also carries over into the antitumour effects, and we find that the tricyclic carboxamides fall into a class of compounds which bind to DNA by intercalation (which is the process whereby planar molecules, which possess the right size and electrostatic properties, are able to insert themselves in between adjacent DNA-basepairs), whereas the xanthenones appear to have very little affinity for DNA, with their main effects being on the host immune system and the tumour blood flow.



1 $R = NH_2$; 2 $R = H$



3



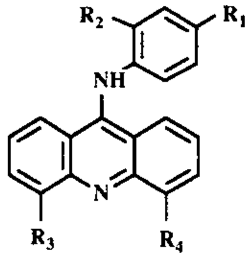
4

DNA binding agents

Work on DNA-directed antitumour agents has been an on-going project in our laboratory for many years, and its main success has been on the 9-anilinoacridines which were first identified as having antitumour properties in the late 1960's. The anilinoacridines owe their antitumour activity to the fact that they bind to the DNA of the tumour cell by intercalation of the planar acridine portion of the molecule into the DNA; but intercalation by itself does not produce antitumour activity, and it is always necessary for extra functionality to be present in the molecule in order for antitumour effects to be seen. It is knowing what that functionality should be, and whether to place it so that it resides in the major or minor grooves of the DNA, that is one of the major problems in the design of the DNA-affinic antitumour agents. The parent 9-anilinoacridine compound **5** actually shows no antitumour effects, but by the addition of a methanesulphonamide group in the para position of the anilino ring, good antitumour properties are obtained, although the resulting compound **6** is not very dose potent. This poor potency can be overcome by the further addition of a methoxy group and the resulting compound, known as amsacrine **7**, is now in worldwide use as an anti-leukaemia drug. Amsacrine was the first synthetic DNA-intercalator ever to be licensed as an anticancer agent, and is still the only New Zealand developed pharmaceutical to be marketed either here or overseas.

However amsacrine is still not the complete answer, as it has no activity against solid tumours such as lung or colon tumours, and so further development work was necessary to try and see if solid tumour activity could be achieved. The end result of this research was the identification of the carboxamide derivative **8** which is known by its clinical investigation number CI-921. This compound displays very good activity against mouse lung tumours, and on the basis of this result it was entered into clinical trial. Initial phase-1 clinical trials were performed at Auckland Hospital as well as overseas, and on the basis of the results obtained the compound has gone on to further phase-2 clinical trial in the United States.

With the 9-anilinoacridines we know that the anilino-sidechain resides in the major groove of the DNA, when the drug is bound, but, until just a few years ago, it was not known how DNA intercalating drugs actually interfered with the growth of tumour cells. However, recent work has identified the target of action and has shown that that target is not the DNA itself, but an enzyme associated with it known as topoisomerase-II. This species is actually a duplex enzyme that is responsible for cleaving both strands of the DNA double helix, so that other strands can pass



5 $R_1 = R_2 = R_3 = R_4 = H$

6 $R_1 = NHSO_2CH_3$ $R_2 = R_3 = R_4 = H$

7 $R_1 = NHSO_2CH_3$ $R_2 = OCH_3$ $R_3 = R_4 = H$

8 $R_1 = NHSO_2CH_3$ $R_2 = OCH_3$ $R_3 = CH_3$ $R_4 = CONHCH_3$

9 $R_1 = NHSO_2CH_3$ $R_2 = OCH_3$ $R_3 = H$ $R_4 = CONHCH_2CH_2N(CH_3)_2$

through it, and then it is responsible for reconnecting the two loose ends. Without the action of the enzyme the DNA is not able to replicate, with the result that cell division is prevented. It is believed that in the presence of a DNA intercalating drug such as amsacrine, that a ternary drug-DNA-topo-II complex is formed, and that this prevents the rejoining of the two ends of the DNA by the enzyme. Thus the DNA is not able to successfully replicate, and the tumour cell eventually dies.

9-Aminoacridine-4-carboxamides

The work with the anilinoacridines didn't stop with the amsacrine series, and it was subsequently found that the 4-carboxamide group offered an excellent position for the addition of extra amine containing substituents which dramatically increased the DNA-affinity of the molecule. In fact the increase in DNA binding for compound **9** was so significant that it was possible to dispense with the existing anilino sidechain and yet still retain antitumour activity. Both of the acridine-4-carboxamide derivatives **1** and **2** were found to have good antitumour activity, and both appear to have all of the necessary structural requirements for a topoisomerase-II inhibitor. Each has a planar chromophore capable of binding to DNA by intercalation, and a flexible sidechain capable of interacting with the topoisomerase enzyme. If we start by considering the 9-amino derivative **1**, we find that the structure of the sidechain is extremely crucial to the antitumour activitiy, since merely adding another methylene group completely abolished activity[1]. Kinetic studies showed that only the compound with two methylene groups has a long residence time component on the DNA, and thus it would appear that the antitumour activity is a direct result of binding to a specific site or sites on the DNA[2].

When we look at the Watson-Crick base-pairings for the DNA double helix (Fig. 1) we find that both the thymine and cytosine molecules have carbonyl groups pointing into the minor groove, and we believe that it is hydrogen bonding to these carbonyl groups that is responsible for the specific activity of the compound with the C-2 sidechain. Fig. 2 shows hydrogen bonding between the amine sidechain of the carboxamide and a cytosine carbonyl group, and we believe that it is this sort of interaction that is responsible for the strong DNA binding and good antitumour activity of the compound with the two methylene groups. Compounds with extra methylene groups cannot undergo such a specific interaction, and as a result display no antitumour activity. Thus we had established that the C-2 sidechain was the optimum one for activity, but there was no guarantee that the acridine portion of the molecule was the optimum structure, and so the next step was to discover if that was so.

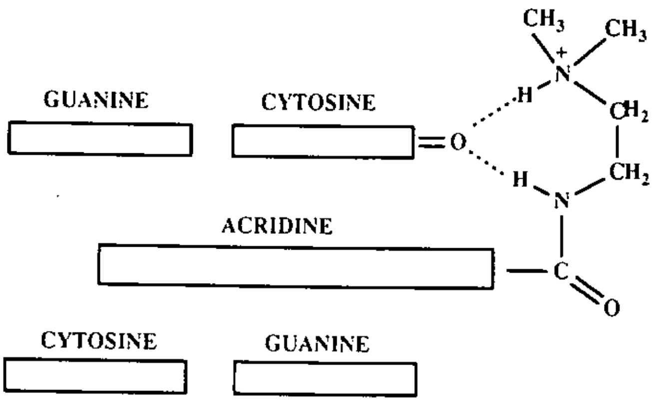


Fig. 2. DNA binding model

Structural modifications

The discovery of any new anti-cancer drug, or any pharmaceutical for that matter, falls into two distinct phases; the identification of the new lead structure, and the rational development of that lead into a useful clinical drug. In other words what we have to do is refine or "fine-tune" the structure for optimal antitumour activity. The initial approach that we followed with the 9-aminoacridinecarboxamides involved defining the basic structure-activity relationships of the molecule, or in other words finding out just what effect that different substituent patterns had on the overall activity of the molecule. Then, having established where substituent changes were acceptable, we looked at an expanded range of groups at those positions, to further refine the structural requirements. Finally, all of this information was put together in combination to try and define the most pharmacologically favoured structure.

In order to ascertain the best substituent pattern for the acridine portion of the molecule it was necessary to prepare a variety of substituted derivatives, but in order to do this some new synthetic routes had to be developed. The synthesis of the parent unsubstituted 9-aminoacridine-4-carboxamide is fairly straightforward[1], involving the cyclodehydration of diphenylamine-2,2'-dicarboxylic acid (**10** $R_1=R_2=H$) to give acridone-4-carboxylic acid (**11** $R_1=R_2=H$) which is then further converted to carboxamide derivative **1** as shown in scheme **1**. However, as soon as we start making substitutions on the rings we find that because the acid groups are no longer equivalent, there are two alternative ringclosure routes giving rise to different isomeric acridone-acids. Only one product is obtained when a single substituent group is ortho to the amino group, since one of the two ring closure routes is blocked, but in all other cases a mixture of both possible product acids is obtained.

Obtaining a mixture of products wouldn't matter so much if they could be easily separated, but acridones are very insoluble compounds, and even as their methyl esters the isomeric acids were too insoluble for separation by chromatography. In some cases it was possible to obtain one of the two isomers by repeated recrystallization, but this was expensive in terms of material, and didn't help in giving the other isomer. We did a study looking at different ringclosure conditions[3], to see if we might be able to affect the

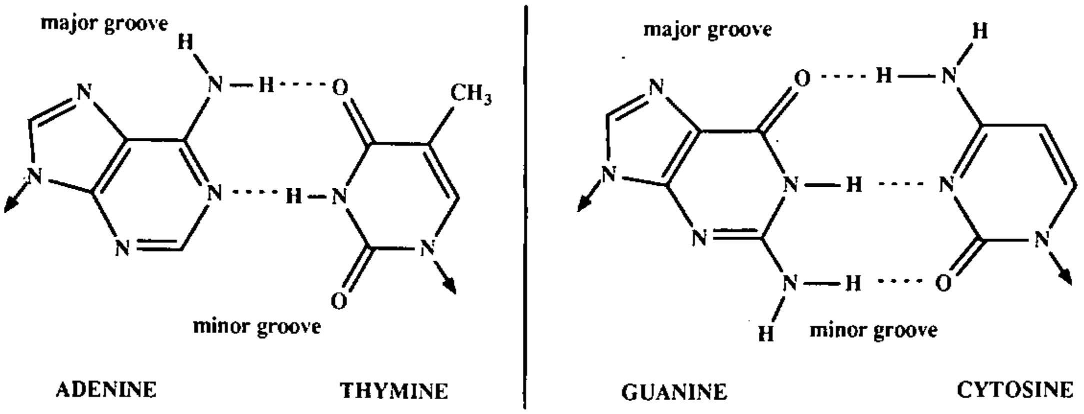
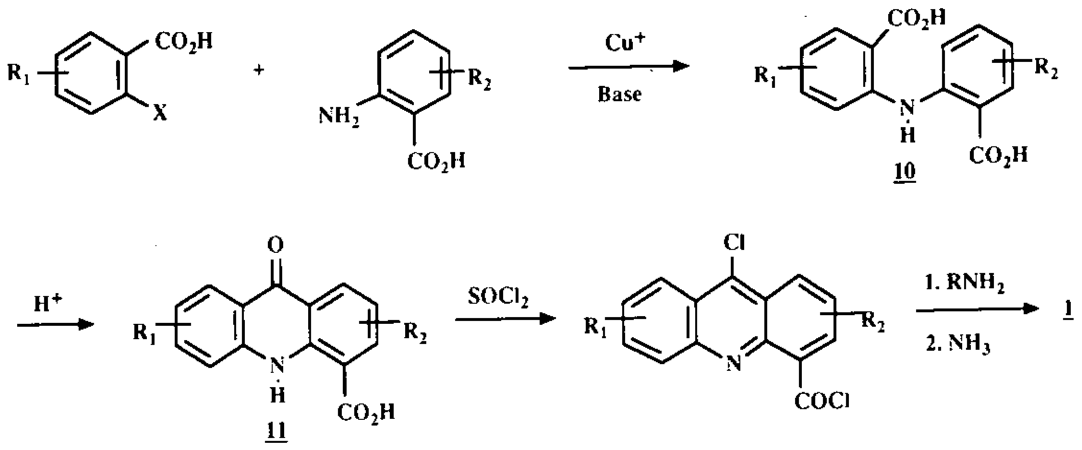


Fig. 1. Watson-Crick base-pairing of DNA



Scheme 1. Synthesis of N-(2-dimethylaminoethyl)-9-aminoacridine-4-carboxamides

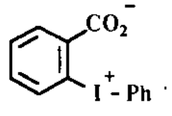
direction that the ring-closure took, but although we did find some variations between different acidic reagents, these were not synthetically significant, and we realized that in order to obtain the desired subsituted acids cleanly we would have to investigate alternative, unequivocal synthetic routes.

Alternative synthetic routes

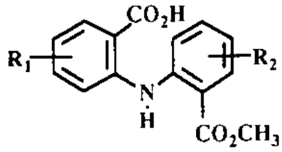
We eventually came up with three different routes, all of them involving iodine containing species, and the first of these involved the use of 2-iodoisophthalic acid as a starting material which placed both of the acid groups on the same side of the intermediate diphenylamine-diacid (scheme 2). The ring-closure of this compound worked well when the substituent was ortho or para to the amino group, but still gave isomeric products when the substituent was in the meta position. However, we were able to overcome this. problem in some cases by the use of a chlorine blocking group in one of the ortho positions. The chlorine atom was then removed by hydrogenation after the ring-closure. Another problem that had to be overcome was the fact that having the two acid groups ortho to the iodine atom made it a much more labile leaving group than was normally seen in this copper-catalyzed type of reaction. Thus it was found that base hydrolysis occured readily, and that primary alcohol solvents underwent substitution to give alkyl-ether derivatives. However, both of these problems were overcome by the development of an anhydrous reaction system that used non-nucleophilic organic triamine bases such as N-ethylmorpholine and secondary alcohol solvents such as butane-2,3-diol[4].

The second unequivocal procedure that we developed involved the use of diphenyliodonium-2-carboxylates (DPIC) **14** which are normally used as a thermal source of benzynes. However it had been reported that if the reaction temperature was kept below 100°C then benzyne formation was prevented, and it was possible to use them as reactants in copper-catalyzed reactions with aniline derivatives. However the two things that were the most interesting, as far as we were concerned, were that they were reported to condense with deactivated anilines that normally wouldn't react with halobenzoic acids, and also that there was no need for any added base, as the internal carboxylate group acted as a proton acceptor. Thus we thought that we might be able to condense DPIC's with esters of 2-aminobenzoic acid, and this is precisely what we found[5]. The condensation of the two species went well, and ring closure of the resulting diacid half-ester **15** with polyphosphate ester then gave acridone derivatives whose substitution pattern was unequivocal.

After we found that diphenylamine-2,2'-diacid half-esters **15** were useful sources of the desired acridone-acids we started looking to see if there was an alternative ways of synthesizing them, and it was soon discovered that they could also be made by the condensation of 2-aminobenzoic acids with methyl 2-iodobenzoates[6]. The method uses the same anhydrous reaction conditions that were developed for use with iodoisophthalic acid, and gives good yields with iodoesters, but not with other haloesters. Thus, 2-fluoro- and 2-chloroesters fail to give any reaction whatsoever, and while reaction can be achieved with bromoesters, neither the reaction yield nor the product purity are as good as that achieved with the iodo compounds.



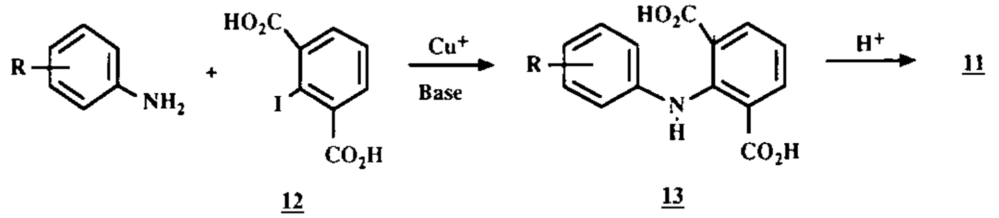
14



15

Biological effects

The result of all the development work was that we now had three different synthetic methods that in combination were able to give us a variety of substituted acridone-acids, and these in turn provided many substituted derivatives of 1. Initially we concentrated on methyl, methoxy and chloro substituents as they gave us a reasonable variation of steric and electronic properties, without making the synthetic work too difficult. Activity was measured in mice containing a strain of leukaemia known as P388, and results were interpreted in terms of the increase in lifespan of the drug treated mice over that of the untreated control animals. Most of the substitution changes resulted in a decrease in activity compared to that of the parent compound, and the 5-methyl derivative was actually the only one to show a significant increase in activity[7]. In fact the only position where all of the substituted derivatives retained good activity was the 5-position. Therefore, having identified the optimum position for substitution, we then investigated a wider range of derivatives substituted at the 5-position.



Scheme 2. Use of 2-iodoisophthalic acid

While the earlier compounds had often shown good antileukaemic activity, none of them had shown any indications of solid tumour activity, but the same was not true of the new derivatives and we were able to find two active derivatives, and significantly they both contained strong electron withdrawing groups[8]. The solid-tumour active compounds were the 5-trifluoromethyl and 5-methanesulphonyl derivatives, and we believe that the 5-nitro derivative would also be in this group if it weren't for the fact that it appears to undergo rapid metabolic reduction to the inactive 5-amino compound. The question that can be asked is what is it about electron withdrawing groups that is so significant, and we believe the answer can be found in the degree of ionization of the molecules at the physiological pH of 7.4. At that pH the parent 9-aminocompound 1 is actually doubly protonated, on both the sidechain nitrogen and the acridine-ring nitrogen, whereas the 5-trifluoromethyl and 5-methylsulphonyl compounds are apparently only protonated on the sidechain nitrogen. We believe that the difference in antitumour activity can be explained by this difference in protonation, as a result of distribution effects, since the doubly charged parent compound is much less able to migrate from the bloodstream through lipophilic cell membranes to the site of the tumour, than are the monoprotonated derivatives.

Acridine-4-carboxamides

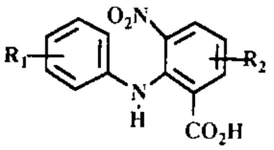
The addition of electron withdrawing substituents to the 9-amino compound is not the only way of effecting the pKa however, and a much simpler way is to remove the resonant 9-amino group altogether, to give the parent acridine 2. An alternative route is to shift the nitrogen atom into the ring, to give the analogous phenazine derivative 3. Both of these compounds have much lower pKa's than the 9-amino compound, and significantly both display good solid tumour activity. So, having identified two new classes of solid tumour active compound, the next step was to refine the structures as we had done with the 9-amino compound to try and identify the most active members of the series.

The acridine compound is actually derived by reduction of the same acridone acid that produced the 9-amino derivatives, so it was a relatively simple matter to prepare a range of substituted acridine-carboxamides from the acridone-acids already prepared for the earlier work. Once again, we started with methyl, methoxy and chloro derivatives, but this time the problem wasn't so much finding inactive compounds, as being able to rank all of the active ones[9]. In fact the only position where activity wasn't seeen was at the 3-position where all of the compounds were completely inactive. This is presumably a result of steric effects which prevent the side-chain from occupying the necessary conformation for interaction with the DNA or topoisomerase II enzyme.

Phenazine-1-carboxamides

The best of the acridine derivatives were sent overseas for further testing, and in the meantime we went on to look at the phenazine system which formally can be derived from the acridine by addition of an extra nitrogen atom, but chemically involves a quite different approach. Once again the carboxamide derivative is derived from the analogous acid, which in this case was prepared by reductive ring-closure of 6-nitrodiphenylamine-2-carboxylic acid 16 with alkaline sodium borohydride. Normally sodium borohydride doesn't reduce nitro groups, but under strongly alkaline conditions, reduction does occur, and in this case ring-closure also occurs to give the desired phenazine acid. Some of the amine derived from direct reduction is also formed, but this is easy to remove because of its much greater solubility in polar solvents such as methanol.

As with the acridine work, we again faced the problem of forming isomer mixtures during the ring-closure, but we also faced another perhaps more serious problem, and that was the actual displacement of substituents either during or after the reductive ring-closure had occurred. Halogen substituents are particularly prone to displacement from the product phenazines when alkoxides are used as the base, but fortunately this problem can be overcome by the use of aqueous hydroxide instead. A second, more troublesome displacement occurs during the actual ringclosure, as a variety of ortho-substituents can be displaced to give mixtures of the desired substituted derivative and the parent unsubstituted acid. This displacement isn't limited to easily displaced groups like halogens, and even alkoxy and carboxyl groups can be displaced.



16

Fluorinated intermediates

Eventually two different solutions were developed to overcome this latter problem. Firstly, to overcome the problem of displacement of an ortho substituent, two such substituents were included so that one of them had to stay, and this was found to work quite well. However a better solution was discovered when it was found that with an ortho fluoro group ring-closure actually occured exclusively on the fluoro-substituted carbon[10]. It didn't matter what other substtuents were present, reductive ring-closure still only gave a single ring-closed product.

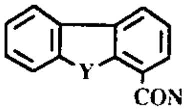
Thus both of the problems of isomer formation and substituent displacement were readily solved by the use of fluoro substituents. But, the advantages of a fluoro group didn't stop there, and the presence of a second fluorine was just as advantageous. In fact, merely by the appropriate choice of reaction conditions it was possible to isolate three different types of product. Firstly, in contrast to the other halogens, if the reaction was performed in water with hydroxide as base, then both ring-closure and fluorine displacement occured to give an hydroxy-phenazine-acid, but if the same reaction was performed for a shorter period of time with a large excess of borohydride, then the appropriate fluoro-acid could be isolated. These fluoro-acids could then be converted into a variety of different derivatives by further reaction with nucleophiles such as amines or thiols. Finally, as with the other halogens, performing the reduction in the presence of alkoxide gave rise to the analogous alkyl ethers.

Having established unequivocal routes to a variety of substituted phenazine acids, we then went through the same development procedure as used for the two series of acridine-carboxamides, once again starting with methyl, methoxy and chloro substituents[11]. The 3-methyl derivative was found to have the highest activity in mice, but it was not very dose potent, and so most of the subsequent work has concentrated on substitution at the 9-position where the most potent derivatives were found. We have looked at a number of different substituents at this position, but so far we haven't been able to find any compounds that are better than the best of the acridine carboxamides.

Synthesis of related compounds

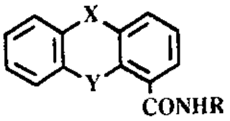
The success that we had with both the acridine and phenazine systems prompted us to investigate a number of other related tricyclic heterocyclic carboxamides **17** and **18**, to see if they also might display good solid tumour activity[12]. In general the synthetic routes were fairly straightforward, although in two cases, namely with the phenoxazine (17 X=O; Y=NH) and carbazole (18 Y=NH) derivatives, complicated multi-step syntheses were required, and this got me interested in looking at new ways of synthesizing substituted heterocycles of this type directly from the parent compounds.

In 1986 I took a year's sabbatical leave to work on this problem, and went to the University of Florida where I worked with Professor Alan Katritzky who at that time was looking at protecting groups for use in lithiation reactions involving NH containing heterocycles. The Katritzky group had developed a procedure which used carbon dioxide as both a protecting and activating group for the lithiation of indole and related heterocycles[13], and I believed that it might be useful for the derivatization of some of the tricyclic heterocycles that we were interested in. However, when I looked at the lithiation of carbazole by this procedure no lithiation occured. So, initially not having had any luck, we then looked at a system that was much more likely to work, and that was with phenothiazine.



18 $R = CH_2CH_2N(CH_3)_2$

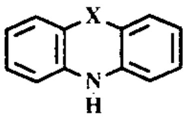
$Y = NH,O$



17 $R = CH_2CH_2N(CH_3)_2$

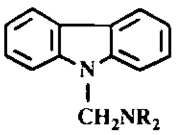
$X,Y = CH,CO,NH,O,S$

Phenothiazine **19** actually undergoes C-lithiation even without a nitrogen protecting group, so it was no surprise when lithiation did occur successfully with the carbon dioxide system[14]. However the advantage of the N-CO$_2$-system over the direct lithiation procedure was that we were no longer limited in the range of electrophiles that could be used, since reaction at nitrogen was now not possible. A virtually identical result was achieved with phenoxazine **20**, and this was of great interest since phenoxazine doesn't undergo direct lithiation like phenothiazine does, yet with the N-CO$_2$- group present it was just as reactive[15]. If carbon dioxide was used as the electrophile, as well as the protecting group, then the product was the 1-carboxylic acid, which is precisely the compound that was required for our carboxamide work[12].



19 $X = S$; 20 $X = O$

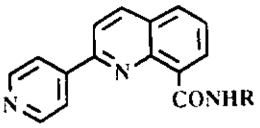
Having achieved success with phenoxazine, I then went in pursuit of a new method for the lithiation of carbazole, since that was another of the compounds we were interested, but which wouldn't lithiate using the CO$_2$ method. I actually investigated quite a number of different protecting groups, without any success, before I finally came across one that worked, and that was the N-dialkylaminomethyl, or Mannich base, derivative **21**[16]. Compounds of this form were found to lithiate quite readily under the right conditions, but those conditions were very crucial. In fact the reaction only occured in solvents such as hexane, where direct coordination of the amine group to the butyllithium was possible. If the reaction is performed in the presence of other coordinating compounds such as tetramethylethylene-diamine (TMEDA), or in more polar solvents such as THF, very poor results were seen. The reaction was not limited to carbazole, and a number of other heterocycles were also found to react under similar conditions[17].



21

Tricyclic carboxamides

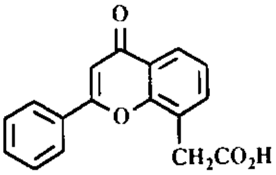
The result of the lithiation work was that new, improved procedures, were found for the derivatization of certain N-H containing heterocycles, and in fact the carbazole and phenoxazine carboxamides were now available in just two or three steps from the parent heterocycles whereas before they had required several steps from monocyclic precursors. However the lithiation work was only a sideline to the main topic that we are discussing, and that is the anti-tumour activity of the heterocyclic carboxamide derivatives **17** and **18**. But unfortunately, when we look at the anti-tumour activity of these compounds we find a lot of effort for very little reward. With the exception of the acridine and phenazine derivatives which we have already discussed, none of the new compounds had any solid tumour activity. The dibenzodioxin derivative (**17** X=Y=O) did have some anti-leukaemic activity, but apart from that, no positive results were seen. However we were able to determine one thing from all of this work, and that was in order to achieve good solid tumour activity we had to have an aromatic nitrogen atom syn to the carboxamide sidechain. Moving it to a different position in the molecule, or removing it completely resulted in the complete loss of anti-tumour activity. So, armed with the knowledge that we need this aromatic nitrogen atom, we then went and looked at a number of other structures that contained this feature, and I am pleased to say, that since then the results have been much more rewarding,[18-20] with the most active compound being the 2-(4-pyridyl)quinoline-8-carboxamide **22** which is at least as active as the best of the acridine-4-carboxamides.



22 $R = CH_2CH_2N(CH_3)_2$

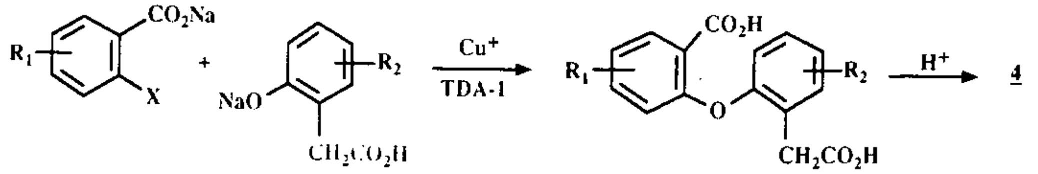
Flavone-8-acetic acid

The work with the tricyclic carboxamides has now been scaled down while we await further testing, and more recently we have been looking at a quite different type of anti-tumour activity. I mentioned at the beginning that there were two ways of looking for new anti-cancer agents, either the random screening of pre-existing compounds, or the design of new compounds designed to target a specific site. From a synthetic viewpoint the latter approach can be very rewarding, as we have seen with the tricyclic carboxamides, which were compounds designed to target the DNA of the tumour. However the random searching for new structures can be just as rewarding, and the work that I am now going to discuss stems from the discovery that flavone-8-acetic acid (FAA) **23**, is highly active against mouse colon tumours[21]. FAA was first prepared and tested in France as an anti-inflammatory agent, and it was only later that its anti-cancer activity was discovered by the National Cancer Institute in the United States during routine screening.



23

We became interested in FAA for a number of reasons, and decided to begin looking for active analogues. The original workers had found that the structure activity profile was quite tight, with substitution at both the 2 and 8 positions being necessary for activity[21,22]. However no-one had looked at modifications to the central ring, so that is what we decided to investigate. We actually looked at a variety of changes, including removing the carbonyl group, replacing the ether oxygen, and even aromatizing the ring, but all of these alterations gave rise to inactive compounds.[22]



Scheme 3. Synthesis of xanthenone-4-acetic acids

Xanthenone-4-acetic acids

There was one modification to the flavone system that was acceptable however, and that resulted from the formal fusing of the phenyl ring to the pyran system to give xanthenone-4-acetic acid (XAA) 4[23]. The xanthenone derivative was not only as active as the flavone in mice, but was also more potent, and so, having discovered that fused tricyclic acetic acids could have good antitumour activity, we then set about preparing a number of analogues to try and identify just what the structure activity requirements might be. As with the flavone work we looked at modifications that involved removing the carbonyl group, replacing the ring oxygen or carbonylgroups, or various other structural modifications that including expanding and contracting the central ring, or aromatizing it. But unfortunately, no matter what was done, no sign of any antitumour activity was seen[24]. However, despite a lot of hard work for no reward, we still had the xanthone itself, which we then set about optimizing.

The approach that was used to "fine-tune" the earlier acridine and phenazine structures applies equally well to the xanthenone system, and once again, the first step was to prepare a set of derivatives substituted by a limited range of substituents at all of the available positions. The initial route that was followed was based on literature work, and involved conversion of 4-methylxanthenones to the analogous acetic acids via bromination and cyanation. However this approach cannot be used if the desired substituent is a methyl group, and problems were also encountered with some other substituents. To overcome this we tried putting the acetic acid sidechain in directly, by condensing 2-hydroxyphenylacetic acids with 2-halobenzoic acids (Scheme 3), but at first this approach was unsuccessful. However, once we started to use the solid-liquid phase transfer catalyst tris(dioxaheptyl)-amine (TDA-1), the method was much more successful, and the intermediate diacids could also be readily ring-closed to the desired XAA derivatives[23].

Of the compounds that were initially prepared, several were found to be highly active against the colon 38 mouse tumour. The tumours were analyzed by an histology assay, and although it wasn't possible to rank the more active derivatives in terms of activity, it was possible to do so in terms of potency, and when that was done the 5-methyl derivative was found to be the best compound. Unlike the earlier carboxamide derivatives, none of the xanthenones had any significant activity against leukaemia, and this is a result of them no longer being DNA targeted molecules. The flavone and xanthone-acetic acids instead appear to be targeting the immune system of the mouse[25], and there are also effects on the blood supply to the tumour[26].

We subsequently looked at a variety of other substituents at the 5-position, but none of these were found to be any better than the methyl group[27]. However we were successful in looking at a number of di-substituted compounds, that included the 5-methyl group as one of the substituents, and highly potent derivatives, that show up to an eleven fold increase in potency over that of flavone-acetic acid have now been found[28].

Acknowledgements

The work with the xanthenone-acetic acids is still continuing, but I would like to stop at this point and acknowledge the valuable assistance of all my colleagues who have been involved in the various projects I have discussed. I would especially like to thank all those people whose names appear in the following references, as well as Lawrence Crane, Christ Honeybun, Karen Fergusson and Paul Johnson.

REFERENCES

1. Atwell, G.J., Cain B.F., Baguley, B.C., Finlay, G.J. and Denny, W.A. J. Med. Chem., 21, 1481-1485 (1984).
2. Wakelin,L.P.G., Atwell, G.J., Rewcastle, G.W. and Denny, W.A. J. Med. Chem., 30, 855-861 (1987).
3. Stewart, G.M., Rewcastle, G.W. and Denny, W.A. Aust. J. Chem., 37, 1939-50 (1984).
4. Rewcastle, G.W. and Denny, W.A. Synthesis, 217-220 (1985).
5. Rewcastle, G.W. and Denny, W.A. Synthesis, 220-222 (1985).
6. Rewcastle, G.W. and Denny, W.A. Synth. Comm., 17, 309-317 (1987).
7. Rewcastle, G.W., Atwell, G.J., Chambers, D., Baguley, B.C. and Denny, W.A. J. Med. Chem., 29, 472-477 (1986).
8. Denny, W.A., Atwell, G.J., Rewcastle, G.W. and Baguley, B.C. J. Med. Chem., 30, 658-663 (1987).
9. Atwell, G.J., Rewcastle, G.W., Baguley, B.C. and Denny, W.A. J. Med. Chem., 30, 664-669 (1987).
10. Rewcastle, G.W. and Denny, W.A. Synth. Comm., 17, 1171-1179 (1987).
11. Rewcastle, G.W., Denny, W.A. and Baguley, B.C. J. Med. Chem., 30, 843-851 (1987).
12. Palmer, B.D., Rewcastle, G.W., Atwell, G.J., Baguley, B.C. and Denny, W.A. J. Med. Chem., 31, 707-712 (1988).
13. A.R. Katritzky and K. Akutagawa, Tetrahedron Letters 26, 5935-5938 (1985).
14. Katritzky, A.R., Vazquez de Miguel, L.M. and Rewcastle, G.W. Synthesis, 215-217 (1988).
15. Katritzky, A.R., Vazquez de Miguel, L.M. and Rewcastle, G.W. Heterocycles, 26, 3135-3140 (1987).
16. Katritzky, A.R., Rewcastle, G.W. and Vazquez de Miguel, L.M. J. Org. Chem., 53, 794-799 (1988).
17. Katritzky, A.R., Rewcastle, G.W. and Fan, W-Q. J. Org. Chem., 53, 5685-5689 (1988).
18. Atwell, G.J., Baguley, B.C. and Denny, W.A. J. Med. Chem., 31, 774-779 (1988) and 32, 396-401 (1989).
19. Atwell, G.J., Bos, C.D., Baguley, B.C. and Denny, W.A. J. Med. Chem., 31, 1048-1052 (1988).
20. Denny, W.A., Rewcastle, G.W. and Baguley, B.C. J. Med. Chem., 32, in press (1989).
21. Atassi, G., Briet, P., Berthelon, J-J. and Collonges, F. Eur. J. Med. Chem., 20, 393-402 (1985).
22. Atwell, G.J., Rewcastle, G.W., Baguley, B.C. and Denny, W.A. Anticancer Drug Design, 4, 161-169 (1989).
23. Rewcastle, G.W., Atwell, G.J., Baguley, B.C. Calveley, S.B. and Denny, W.A. J. Med. Chem., 32, 793-799 (1989).
24. Rewcastle, G.W., Atwell, G.J., Palmer, B.D., Baguley, B.C. and Denny, W.A. unpublished results.
25. Ching, L-M. and Baguley, B.C. Eur. J. Cancer Clin. Oncol., 24, 1521-1525 (1988); 25, 821-828 and 1061-1065 (1989).
26. Zwi, L.J., Baguley, B.C., Gavin, J.B. and Wilson, W.R. J. Natl. Cancer Inst., 81, 1005-1013 (1989).
27. Atwell, G.J., Rewcastle, G.W., Baguley, B.C. and Denny, W.A. J. Med. Chem., in press.
28. Rewcastle, G.W., Atwell, G.J., Baguley, B.C. and Denny, W.A. unpublished results.

Chemistry Enrolments in New Zealand Secondary Schools - Trends and Implications

Robert G. A. R. Maclagan
Department of Chemistry, University of Canterbury
Christchurch, New Zealand

Introduction

The enrolment trends in Chemistry in secondary schools are an indicator of future numbers of students at tertiary level in the subject. They also indicate how the subject is perceived by secondary school students, and the level of chemical knowledge in the community. In this article I will present some basic data on enrolment in Forms 6 and 7 Chemistry. At a time when there is considerable interest in encouraging girls to further their studies in Science, the trends in the gender balance of Form 6 and 7 Chemistry classes will be examined. We will compare the enrolments in Chemistry with those in other subjects, particularly Physics. Comparison will also be made with the situation in Australia. The trends in Australia have been the subject of a number of studies, particularly by Dekkers and De Laeter[1], whose paper stimulated this study. My aim in presenting this data is to stimulate thought and discussion amongst members of the profession of Chemistry in New Zealand. Some initial thoughts in reaction to the data will be given.

Enrolment Trends

Table 1 gives the basic data on Chemistry and total enrolments for the period 1978-87 obtained from Education Department statistics.

While the 3rd Form enrolment peaked in 1976 (the parent class of the 1980 7th Form), 7th Form enrolments are still increasing. A major reason for this is an increase in the retentivity for females which has increased 63%. More males enter high school each year than females. The gap between the numbers of males and females is narrowing but there are still more males in the total 7th Form population. While relatively more females than males stay on into the 6th Form, it was only in 1987 that the female retention rate in the 7th Form caught up with that for males. The male retention rate has increased, reaching 23.5% in 1987, but not as much as that for females. The increased retentivity for females may arise because many traditionally female professions now require seventh form study. The increase in unemployment has also had an effect on the retention rates.

A similar pattern has been found in Australia, but the changes there appear to have occurred several years ahead of New Zealand. There have been more females than males in Year 12 in Australia since 1977. The retention rate for females surpassed that for males in 1976. In Australia the retention rate to the final year of high school is approximately 50%, about double that of New Zealand.

Chemistry Enrolments

In Figure 1 are plotted the enrolments by gender in Form 7 for both Chemistry and Physics for the period 1976-87.

The number of males studying Chemistry has remained essentially constant over the past ten years varying from year to year in the range 2570 to 2904. However, there has been a 81% increase in the number of females studying Chemistry at 7th Form level in the period 1976-87. The increase in the number of females studying Chemistry has led to a 31% increase in total 7th Form Chemistry enrolments. However the 7th Form population has increased 79% in that period. The percentage of the final year students studying Chemistry has been about 45%, but is now decreasing as more students stay on for a fifth year of high school. Only 8% of the parent Form 3 class studied Chemistry in the 7th Form in 1987.

A similar increase in the number of females studying Chemistry in the final year of high school has occured in Australia. In the period 1976-85, there was an 86% increase in the number of females studying Chemistry in Australia. Until 1982 the enrolments in Chemistry in Australia at Year 12 had remained essentially constant for two decades. The percentage of students studying Chemistry in their final year of high school is higher in New Zealand than it is in Australia, where it was 29% in 1985. The decreasing percentage of students studying Chemistry in the 7th Form in New Zealand suggests that New Zealand may not continue to be ahead of Australia for long. The greater retention rate in Australia gives 12% of the parent Year 8 class in Australia studying Chemistry in Year 12, which is higher than in New Zealand.

The percentage of those females who studied Chemistry in Form 6 who continue to study Chemistry in Form 7 is lower than for males. In 1987 48.0% of females and 57.5% of males continued to study Chemistry. For Physics, about 45% of both sexes continue. This means that the enrolment in Physics, which is larger than that in Chemistry in Form 6, is smaller than that in Chemistry in Form 7. In the period 1976-87, the percentage increase in the number of females studying Physics has increased 61% compared with the 81% increase in Chemistry enrolments.

In 1986 enrolments in Biology were 2306 males (36.5% of the class) and 3126 females (55.1% of the class), giving 45.3% of the 7th Form population enrolled. This predominance of females studying Biology has a long history. In contrast to the situation in Chemistry and Physics, this larger proportion of females is still not as unbalanced as French where the female enrolment is over twice that of males, or Mathematics which was taken by 71.1% of males, but only 49.7% of females.

Discussion

Dekkers and De Laeter[2] suggested that changes in the enrolment in science subjects can be attributed to the interplay of four main factors:

(i) *The career relevance of science as a school subject.* In 1987 about 3,000 students enrolled in conventional Stage 1 Chemistry papers at New Zealand Universities. At Canterbury, less than 5% of those had not done Bursary Chemistry. Thus about two-thirds of the students who study Chemistry at Form 7 level continue their study of the subject for at least one more year. This proportion is declining.

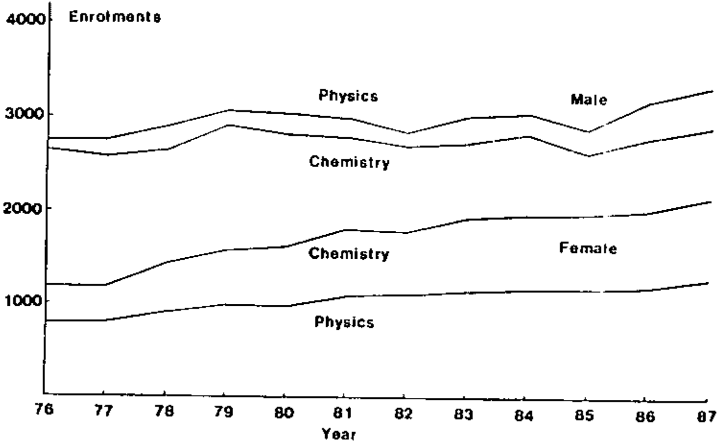


Figure 1 — Enrolments by gender in Form 7 Chemistry and Physics 1976-1986

Moves to reduce the amount of Chemistry studied in some Intermediate courses is unlikely to reduce the desirability of studying Chemistry at Form 7 level.

(ii) *Increases in the number of secondary-school subjects.* While the number of Form 7 subjects available has not increased to the same extent as Form 6 subjects, the continued increase in the retention rate is likely to lead to a similar increase in Form 7 subjects.

(iii) *The relative difficulty of Science as a 7th Form subject.* This is possibly the main reason why the proportion of students studying Chemistry has declined as the retention rate has increased. If more less able students are returning for a fifth year of high school, this would tend to decrease the percentage of students studying Chemistry. The increase in 7th Form enrolments does not necessarily mean more students studying Chemistry.

(iv) *Interest and enjoyment of Science as a school subject.* There are significant differences in the views of males and females on this subject. Those involved in syllabus revision are aware of the importance of the interest and enjoyment factor and have made appropriate changes. However the expectations of University departments, which are not unreasonable, do not give those involved in syllabus revision complete carte-blanche.

Members of the Institute would agree that a higher proportion of Form 7 students, particularly females, should be increasing their knowledge of Chemistry in their final year of high school. This is only likely to be achieved to a limited extent with the subject Bursary Chemistry. A number of other alternatives exist. A course focusing on Chemicals or Consumer Chemistry rather than Chemistry might have a wider appeal. In Australia the subject Physical Science, combining both Chemistry and Physics has been introduced, and appears to appeal to a different group of students from those who opt for Chemistry and Physics. However there is a danger that in introducing more new subjects like these, many high schools could not offer them, or if they did, other subjects like Chemistry might become unavailable. These alternatives require serious consideration as well as the continuing review of the current syllabus.

References

1. J.Dekkers and J.R. De Laeter, Chemistry in Australia, **54**, 167 (1987).
2. J.Dekkers and J.R. De Laeter, Search, **14**, 140 (1983).

Table 1. Secondary School Chemistry Statistics 1978-87.

Year	Parent Form 3 Class of Form 7		Form 6		Form 7		
	Male	Female	Male	Female	Male	Female	Total
1978			6620	3899	2641	1431	4072 Chem
			39.9%	22.8%	50.7%	35.8%	44.2% % Chem
	33087	32099	16591	17094	5209	3997	9206 Total
					15.7%	12.5%	14.1% % Form 3
1979			6208	4178	2904	1558	4462
			37.1%	23.8%	54.1%	37.1%	46.7%
	33988	32751	16731	17570	5363	4197	9560
					15.7%	12.8%	14.3%
1980			6005	4371	2810	1599	4409
			36.6%	25.1%	52.0%	36.5%	45.1%
	34229	32817	16396	17046	5399	4382	9781
					15.8%	13.4%	14.6%
1981			5969	4233	2791	1801	4592
			37.0%	25.0%	52.1%	38.1%	45.5%
	33377	31732	16148	16933	5362	4724	10086
					16.1%	14.9%	15.5%
1982			5676	4403	2688	1771	4459
			35.9%	25.6%	52.1%	38.5%	45.7%
	32304	30387	15823	17231	5154	4596	9750
					16.0%	15.1%	15.6%
1983			5722	4601	2727	1910	4637
			33.2%	25.3%	48.9%	36.8%	43.1%
	31459	30141	17257	18219	5571	5190	10761
					17.7%	17.2%	17.5%
1984			5672	4853	2816	1952	4768
			34.0%	27.3%	47.7%	36.9%	42.6%
	31288	29992	16682	17728	5903	5292	11195
					18.9%	17.6%	18.3%
1985			5547	4966	2623	1976	4599
			34.8%	28.8%	47.5%	39.9%	43.9%
	30832	29898	15934	17250	5525	4958	10483
					17.9%	16.6%	17.3%
1986			5014	4470	2776	2003	4779
			29.2%	27.4%	43.9%	35.3%	39.8%
	31381	30008	17148	16329	6326	5672	11998
					20.1%	18.9%	19.5%
1987			4856	4292	2882	2145	5027
			27.5%	23.4%	38.4%	30.1%	34.4%
	31881	30298	17680	18340	7505	7121	14626
					23.5%	23.5%	23.5%

BRANCH NEWS

BRANCH NEWS - AUCKLAND

Bruce Bettany has moved from the DSIR food Laboratory at Mt. Albert to NECAL Mt. Eden. Here he is working on pentachlorophenols in environmental samples.

Tony Betts has moved from NECAL to work in the corrosion section in AIDD in Parnell.

Les Boulton of the Engineering Materials Group at AIDD recently attended the Conference called "Step into the 90's", held at Broadbeach, Queensland from 27-31 August, which was jointly organised by ACA, AIMF and IMMA. He presented a paper entitled "Thin Layer Activation: A New Method for Monitoring Corrosion" at the conference, which was well attended despite the internal pilots' strike. At the ACA Council Meeting held prior to the conference, Les was elected to the position of Australasian President of the Association, a post he will hold until the next ACA Conference is held in Auckland in November 1990. At this latter conference (entitled "CASS'90": Corrosion in Air, Sea and Soil) it is hoped to have the current Presidents of the Institute of Corrosion Science and Technology (UK), the National Association of Corrosion Engineers (US) and the Australasian Corrosion Association (NZ and Australia), all present together, for the first time at any international conference.

CHEMISTRY SCHOLAR OF THE YEAR COMPETITION

The University of Auckland and Auckland Institute Chemistry Departments held an open day for seventh form students from Auckland Secondary schools. Over four hundred students toured both establishments and attended lectures in the large lecture theatre at the University. The annual seventh formers' visit to the Chemistry Department aims to help bridge the gap between school and university, say organisers Dr Penny Brothers and Dr Judy Brittain. Before the main programme, which took place in the afternoon, 60 of the schools' top chemistry students tested their skills in the Chemistry Scholar of the Year competition. The students carried out two assignments in the laboratory, one involving titrimetry and the other determination of the enthalpy of solution for a univalent electrolyte. All the students also sat a written test as the third session of the competition.

In the afternoon the students divided into small groups to visit stations around the department where they saw experimental demonstrations, performed some "hands-on" experiments, and inspected some of the department's modern research equipment. They also attended a short lecture outlining the first year chemistry course at the University.

For the last hour they gathered in the large chemistry lecture theatre to hear four recent graduates talk about their time at university and experiences in the work place following graduation. The day finished with the Chemistry Scholar of the Year finalists' quiz, in which the four top candidates (two girls and two boys this year) had a Mastermind Quiz session, in front of the seventh form visitors as audience. It was an exciting finish with Ellen Carter of Epsom Girls Grammar School being the winner by one point. Ellen intends at this stage to pursue a science degree course at Otago University. The finalists each received a book token from the Auckland Branch of the Institute.

BRANCH NEWS MANAWATU

"The Neurochemistry of Amino Acids, Alkaloids and Steroids" was the subject of the lecture presented by **Professor Graham Johnston** (Department of Pharmacology, University of Sydney) at a special Branch meeting on 15 August. Professor Johnston discussed the conformational structures of GABA (gamma-amino-butyric acid), its interaction with receptors and how substituted GABA analogues with restricted conformational structures could be used in studies of this compound. Complicating factors in this work include environmental influences (such as anxiety-producing stress) that can increase the apparent availability of GABA binding sites in the brain, resulting in analgesia. Professor Johnston presented his subject matter in a manner that maximised the audience's understanding of a complex topic, rarely presented at Branch meetings.

Dr Jim Johnston of the Chemistry Department and Research School of Earth Sciences, Victoria University of Wellington, presented a most interesting petrochemical lecture to a Branch meeting on 27 September. Dr Johnston described the application of biomarker geochemistry to the understanding of petroleum generation in the Taranaki basin and its importance in petroleum exploration. He described detailed analyses that his team have carried out on oils, condensates, coals and shales obtained from wells in the Taranaki region, and how results from this work was used to locate possible source rocks of the hydrocarbons.

Dr Alastair MacGibbon (NZ Dairy Research Institute) was elected Chairman at the Branch's AGM on 1 November. Others elected were Drs Mark Brimble (Treasurer) and Darryl Rowan (Branch Editor). The new Committee is; Drs Julian Lee (ex-officio), Cecil Johnson, David Newstead, Jill Norris, Joyce Waters, Alan Furness, David Husbands, John Cowles (Taranaki Representative) and Rev. Ted Fletcher (Hawkes Bay Representative). Mr Scott Ingham was elected the student representative on the Committee and Dr Alastair MacGibbon is the Council Delegate.

For his Chairman's Address, **Dr Julian Lee** (Biotechnology Division, DSIR) chose the title "When One Is Not Enough: Mutli-element Analysis" Dr Lee showed how elemental analysis has developed since the landmark experiments of the qualitative measurement of sodium emission in a flame by Kirchhoff and Bunsen in 1859 to the inductively coupled plasma spectrometer. He discussed various methods that are available for multi-element analysis (chromatographic, electrochemical, radio-chemical and spectroscopic techniques) and reasons why a particular method is chosen. Dr Lee showed examples where unexpected influences of elements had been detected, that would not have been noticed if a limited range of elements had been analysed. He also showed the importance of multi-element approach for the analysis of small samples.

UNIVERSITY NEWS

VICTORIA UNIVERSITY

Recent Ph.D. Graduates from the Department have been **Christopher Cunningham, Joanne Rollo, Victor Luca and Dugald McLachlan.**

Professor Tomlinson stepped down from the position of Chairman of the Department at mid-year and **Professor Ferrier** assumed those responsibilities.

Brian Halton returned in March from a sabbatical leave spent in the USA, Germany and in Melbourne (Monash). In August he attended and gave a Plenary Lecture at the 6th International Symposium on Novel Aromatic Chemistry in Osaka and also presided at the Symposium on current Topics in the Chemistry of π Electronic Compounds. Professor Ferrier was also away at mid-year attending conferences in America and Europe. Dr. Weatherburn and Professor Curtis attended and presented posters at the International Coordination Chemistry Conference at Broadbeach and the Macrocyclic Chemistry Conference in Townsville.

Professor Curtis has been elected to the office of Vice-President of the Royal Society of New Zealand.

Recent visitors to the Department have included Dr. Colin Rochester (University of Dundee), Professor I.O. Sutherland (University of Liverpool), and Professor Howard Reiss (UCLA).

The department has recently acquired two new pieces of equipment, a Biorad FTIR and a HP diode array spectrophotometer.

OTAGO
Chemistry Department

Professor Brian Robinson, Jim Simpson and Lyall Hanton all attended the XXVII International Conference on Coordination Chemistry in July at Surfers' Paradise, Queensland. Brian then attended a meeting on "Metal Complexes in Chemotherapy" at Marysville, Victoria.

Professor David Buckingham has been appointed External Advisor in Chemistry (3 years) to the University of the South Pacific and he spent a very busy week in this capacity at Suva in August.

Dr Chris Hunter arrived from England at the beginning

Continued next page

UNIVERSITY NEWS Cont . . .

of November to take up the appointment as lecturer in bioorganic chemistry. He recently completed a Ph.D. project at Cambridge on "Biomimetic Supramolecules based on Porphyrins" under the supervision of Dr J.K.M. Sanders.

Dr Wayne Fairbrother, a student of Dave Buckingham, visited the Chemistry Department briefly in November and lectured on "Some examples of the use of NMR in Biology". He has recently completed a D.Phil. at the University of Oxford and is going to the Scripps Institute in California.

Two Chemical Engineering students from the Energy Academy of Denmark have been working in the Chemistry Dept on the weathering of limestone. This is part of a programme to provide practical training for students at the Academy and two further students will arrive in 1990.

Dr Keith A. Hunter, Department of Chemistry, attended a meeting in October of the Scientific Committee on Oceanic Research (SCOR) Working Group No. 80 in Plymouth, England on "The Role of Phase Transfer Processes in the Cycling of Trace Metals in Estuaries".

In August, Dr Keith Hunter attended the 3rd Asian Chemical Congress in Brisbane at the invitation of the Intergovernmental Oceanographic Commssion's SP-REP (South Pacific Regional Environment Programme) to participate in a workshop concerned with quality assurance and validation of trace metal analysis in marine systems. The workshop, aimed at transferring new analytical and research methodology to Pacific Rim countries with more limited resources, was a considerable success.

Keith Hunter left in November for a six-month leave period in the Department of Oceanography, University of Washington, Seattle, where he will be working with Professor James W. Murray on ion absorption on metal oxides.

Dr Joanne Davies, a former student of Keith Hunter, has returned from Paris where she completed a Ph.D. project on "The biogeochemical cycle of manganese in the North-western Mediterranean Sea" under the supervision of Dr Patrick Buat-Menard at the Centre des Faibles Radioactivites, C.N.R.S., Gif sur Yvette. She is the recipient of a post-doctoral fellowship in Marine Science and is studying mineral inclusions in marine microalgae.

Kim Currie, an Otago Chemistry graduate and formerly of the Wairakei Geothermal Research Centre, is working on a Ph.D. project concerned with air-sea exchange of carbon dioxide. This work is being funded by the Ministry of Energy and the Meteorological Service.

David Hawke completed his Ph.D. in Marine Science in July and has received a post-doctoral fellowship at the Rosenstiel School of Marine Atmospheric Science in the University of Miami. He is working with Professor Frank Millero in the Department of Chemistry on the Thermodynamics of sea water electrolytes.

Barrie Peake is on leave in the Chemistry Department of the Woods Hole Oceanographic Institute, Mass, where he is working with Neil Blough and Oliver Zafiriou on techniques involved with new types of spin-trapping reagents for aqueous free radicals.

Emeritus Professor Arthur Campbell attended the 35th IUPAC Council Meeting at Lund, Sweden in August and toured in Scandinavia and Britain visiting institutions, former students and friends.

A recently reported fire in the Chemistry Building occured in a fume hood in the Nutrition Department. The fume hood was seriously damaged but the fire was contained restricting the damage to a small part of one staff office.

Laurie Melton, Department of Human Nutrition, attended the 13th International Seaweed Symposium in Vancouver Canada from 13-18 August and presented a paper, "*Alginate from NZ Macrocystis pyrifera*. He then continued to the 5th Cell Wall Conference in Edinburgh (August 30-September 2) to deliver a second paper "*Cell wall changes in different tissue zones of kiwi fruit during ripening*".

BIOCHEMISTRY DEPARTMENT

Dr Michael Legge, a graduate of Essex University has taken up a 3-year appointment as Lecturer in Biochemistry. Michael is not a stranger to NZ having spent 11 years with the departments of Clinical Biochemistry and Obstetrics and Gynaecology at the Christchurch Womens Hospital from 1973-83.

Michael is replacing Ian Forrester who has taken 3 years leave of absence to work at the University of Wisconsin Biotechnology Centre in Madison.

Dr Michael Hubbard arrived in November to take up a MRC Senior Fellowship. His project is a study of intracellular calcium homeostasis. Since graduating from Otago, Michael has been at the NIH National Cancer Institute and latterly with Phillip Cohen's group in Dundee investigating the regulation of protein phosphatase I_G.

John Cutfield has returned from a sabbatical year at York University with Professor Guy Dodson.

People

The Department of Chemistry and Biochemistry at Massey University will be losing a lipids biochemist when **Dr David Husbands** retires at the end of this year. After 18 years at Massey University, Dr Husbands has decided to call it a day and do those things that he has always wanted to do, grow oats, barley and maize and make products that are useful and profitable. He will also play the violin and hopefully buy and sell musical instruments of extra special quality.

Dr Husbands studied agricultural chemistry at Reading University in England from 1957-1961 and did Ph.D. studies at Queen University, Belfast in the Faculty of Agriculture. During this time he "discovered" lipids and during a stay in America from 1964-1967 joined the Lipid Mafia, a group to which he still belongs.

He worked as a scientific chicken farmer for Unilever at Colworth House, showing the operating companies (BOCM and Silcocks) how to feed high fat diets to chickens. He also published work on fatty acid metabolism in birds.

His first enquiries about coming to Massey University were in 1963, and finally he made the journey in 1971. Some of this work is well known, many other parts (according to Dr Husbands) deserve more recognition than they have received. During 1989 he was an active member of the Manawatu Branch Committee.

Dr Husband's "pet hates" are; (1) sitting on committees, (2) applying for promotion, (3) writing grant applications and (4) filling in the forms devised by the Inland Revenue. He is bitterly disappointed in the performance of the 4th Labour Government and is thinking of joining the Employers Federation.

According to Dr Husbands, "He has four charming children, lives in the country and intends never to sit in a car in a traffic jam ever again! He enjoys the Maori Heritage of New Zealand and intends to celebrate 1990 by not marking a single examination script".

Special Award For Young Woman Scientist

An outstanding young woman scientist is being sought for the first ever *National Zonta Science Award*. Established by the Zonta Club of Wellington the Award is open to women graduates in the fields of pure and applied sciences.

Announcing the Award in Wellington in October, Mrs Mandy Natusch, Chairperson of the Club's Science Committee said, "Zonta's aim is to encourage young women to enter the field of science, thus making their special talents available to society."

She went on to say, "Zonta International has had a long history of assisting women scientists. The pioneering American aviator, Amelia Earhart, was a Zontian. In her memory Zonta established the Amelia Earhart Fellowship Awards to enable young women graduates to study aerospace sciences."

The Zonta Club of Wellington has been active over the last year in raising money and other support for the first Award. British Airways has generously agreed to provide return air travel to Europe, the UK or the USA for the recipient. In addition the winner will receive $5,000 in cash and the Zonta Science Medal.

Science is not the only area of achievement, though, in which Zonta has an interest. The recently-announced More Magazine Businesswoman of the Year, Sharryn Waters, is a founder member of the Wellington Zonta Club and was nominated for the competition by her club.

Applications for the National Zonta Science Award close on 31 March 1990 and the winner will be announced in May.

Applications to the **Zonta Club of Wellington, PO Box 10-274**, Wellington. For further information or comment, contact Mandy Natusch, (04) 729-064 daytime or (04) 650-960 evenings, or Elisabeth Airey, (04) 846-133 daytime or (04) 758-109 evenings.

PRODUCT NEWS

Kryo-Thermat — The New Water Recirculator Line From Haake

HAAKE's new refrigerated water recirculator line works at temperatures between -15 to 40°C. It is designed to remove heat of high quality measuring and analysis systems — such as electron microscopes, lasers, spectrometers, etc. It can also be used for cooling of rotational evaporators, electrophoresis-systems, reaction vessels in the chemical industry as well as for temperature control of tools for plastic manufacturing.

Characteristics of the Kryo-Thermat line:

— Six types, all of them with strong circulation pumps and cooling capacities from 350 to 5500 watts. The pumps are exchangeable for an adaptation to the respective application.

— The actual and set temperature are displayed digitally at the same time. Deviations are thus recognised permanently.

— Electronic control with a precision of better than ±0.5°C.

— HAAKE ETC-system measures and controls temperatures in external objects by using an additional temperature control sensor (Pt100).

— The complete electronic module can be removed from the recirculator for remote control.

— Safe in operation by adjustable high and low temperature protection, fixed low liquid level protection and protection against overload of the pump motor and the compressor.

— An integration into complete temperature control circuits is provided by remote alarm and external input for switching off the recirculator.

— All types with a high heat removal capacity are prepared for blowing the hot air out of the room by using flexible air ducts. This avoids heating up the room.

HAAKE equipment is available from Watron Victor.

For further information please circle no. 1 on reader reply card.

Maintenance Kit for pH-Electrodes

No pH-meter's performance is better than the condition of its electrodes, and with this in mind, RADIOMETER has introduced a pH-electrode maintenance kit: GK ANNEXTM. The kit is intended for use with pH-electrodes from all manufacturers. It can be employed with combined pH-electrodes, glass pH-electrodes, and reference electrodes with saturated KC1 as salt bridge.

Neatly housed in a purpose-moulded plastic case, the kit includes not only the various cleaning solutions for removal of exterior deposits, protein, etc, and the refilling solution and crystals, but also all necessary utensils such as pipettes, rinse chambers, and a waste container.

Furthermore, a GLP•LOGBOOK is included, enabling every electrode's life history, calibration data, etc, to be recorded. The book provides much advice about electrode maintenance and pH-measurement in general.

The operating instructions are all pictorially expresses for rapid assimilation by even the most junior technician.

For further information please circle no. 2 on reader reply card.

Breakthrough in Chromatography

Spectra-Physics Autolab Division announces the introduction of ChromJet, a fast, powerful computing integrator for chromatography. ChromJet is the newest data system in the Spectra-Physics line of chromatography instrumentation, ergonomically designed to satisfy the needs of the chromatographer as well as the chromatography laboratory.

In addition to processing, storing and reintegrating up to 128 chromatograms using a patented, guaranteed integration algorithm, ChromJet has a full-sized, QWERTY computer keyboard that easily fits human hands, and a four-line, 40-character supertwist backlighted liquid crystal display. A specially designed inkjet printer provides clear, easy-to-read chromatograms and reports, and accommodates convenient Z-fold paper from either the front or the back of the instrument.

ChromJet provides low noise, high linearity, high-speed data integration, up to 60 slices per second, and ensures accuracy even with fast-capillary GC oAsubtraction, batch re-processing, built-in statistics, and time functions. A dual channel version is available, as well as optional Extended BASIC programming and extra memory (to 512 Kbytes).

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

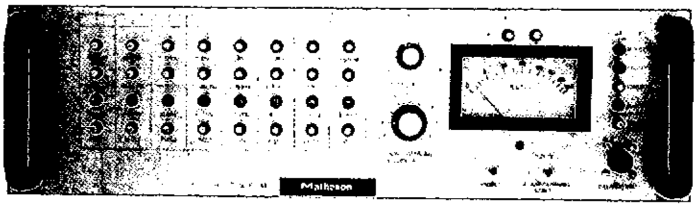
Blood Gas Analysis

Blood Gas Analysis calibration packages are available from NZIG Special Gases. The gas mixtures are supplied in high pressure, low weight aluminium cylinders containing 1.3m3 of gas. Each cylinder is provided with a TELARC endorsed individual certificate of analysis.

Pressure control is provided by the Victor model MBG two stage regulator specially designed for use with blood gas analysers requiring a high degree of pressure control.

Available from NZIG Special Gases, PO Box 30202, Wellington, phone (04) 684-249.

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



Custom Gas Detection Systems

Matheson Custom Gas Detection Systems provide the needed flexibility for a wide range of sampling/detection situations.

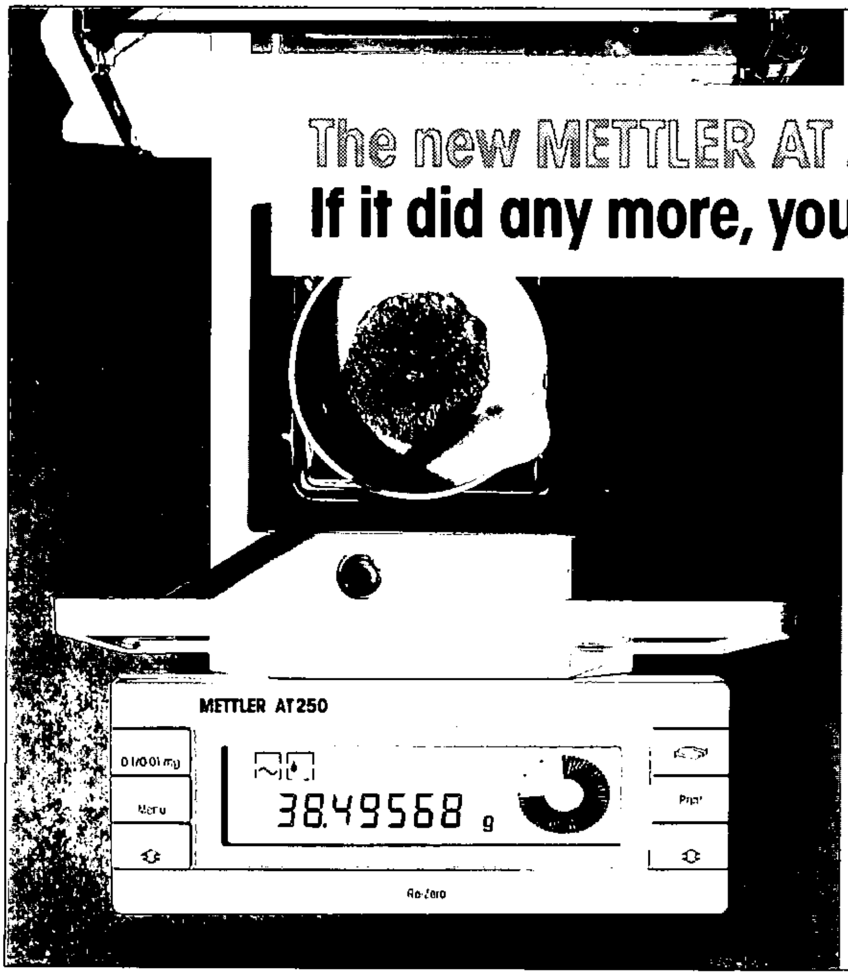
Matheson offers stationary multichannel and computerized gas detection and alarm systems to meet the individual and various needs of the industries we serve. They are designed to continuously monitor the concentration of flammable, corrosive and toxic vapors and gases in the ambient air.

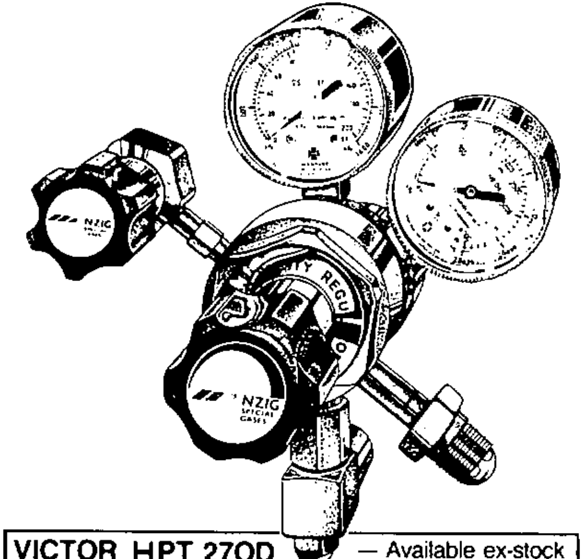
These units are easily mounted in different locations for fast detection of gases and vapors. In addition to monitoring, each unit is equipped with one or more relay contacts per sensor, giving multi-level gas alarm and remote/external alarm capabilities.

The signal from the sensor head is transmitted to the central unit over a standard instrument cable. This makes it possible to install sensor heads (in applicable models) up to 6000 feet away from the main unit. All sensors are manufactured to customers' specifications for alarm set points and detection ranges. Sensors are calibrated with the actual gas, whenever possible. In addition, sensors can be relocated at any time to meet the changing needs of the laboratory, plant or process.

The detection systems are available in 1, 2, 3, 4 point units, expandable 8 channel systems and computerized duplex systems for monitoring up to 511 sensors. Matheson speciality gas equipment is available from NZIG Special Gases.

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


METTLER AT250
0.1/0.01 mg
Menu
38.49568 g
Print
Re-Zero



PRODUCT NEWS

The New "Robot-Friendly" A 200S/DIC Analytical Balance

Specially tailored to work with laboratory robots, the A 200S/DIC analytical balance was unveiled by Sartorius at ACHEMA '88. According to Wilton Instruments, New Zealand agents for Sartorius its design engineers have endowed this "robot-friendly" analytical balance with all the capabilities that guarantee the user high sample throughputs and maximum reliability for use of the balance with an automated system.

Featuring a readability of 0.1mg, the new balance has a loading capacity ranging up to 212g and therefore meets all requirements calling for analytical accuracy. It stabilizes unusually fast, after just 2 to 4 seconds (depending on the characteristics of a sample and the robots's "gentle touch"), the weight is output to the interface port and is reproducible at any time.

Diverse functions that a robot would otherwise have to do when commonplace analytical balances are used have been integrated into the A 200S/DIC in order to save time. For subroutines, this model is a small robot in itself.

When an automated laboratory system is installed, the user normally has to program the robot's movements, organise the data flow and configure the individual system components. Not so with the A 200S/DIC. The control unit can select and adjust any of the parameters of the balance's operating program by sending a software command to its interface port. Such parameters in the menu of the balance's operating program include four levels of vibration damping, 9 stability range settings, the data output format with a total of 16 parameter combinations possible, and many other settings.

In addition, the parameters selected in the set-up mode can also be changed in the process as the user begins to discover the balance's full performance capabilities. Two especially important functions are motorized and can be activated by a software command.

1. Opening and closing the obligatory analytical draft shield:

2. Loading and removing the calibration weight, i.e., full automation of the calibration procedure.

Moreover, the control unit of the entire automated system can do the following by software command sent to the balance's interface port:

— Activate the tare function once a container is placed on the weighing pan;

— Poll the tare and sample weighs and

— Change all other parameters in the balance's menu, such as the number of decimal places displayed, to meet the requirements of dedicated applications.

As for additional features, the A 200S/DIC gives the robot optimal access to the weighing pan. The draft shield opens extra-wide up to 180 deg's and can be positioned to open at any location required.

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

New, Direct Reading Chlorine Analysis

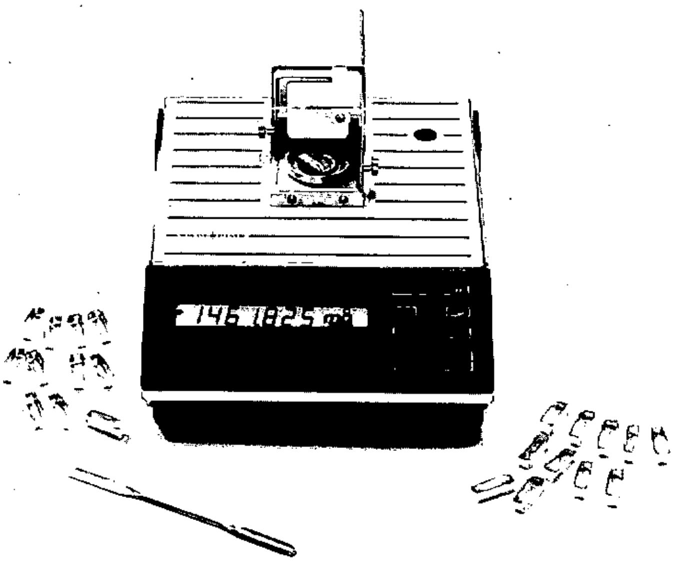
In the field of water management and control the determination of chlorine residual is the number one concern. Throughout the world literally millions of tests are carried out each day.

Of greatest concern is the residual in drinking water supplies. Water treatment plants and laboratories rely on the chlorine test as one of the major safeguards of water quality.

Testing in New Zealand supplies is not always carried out as often as perhaps it should — maybe because the usual colour based tests are not thought to be very reliable. The new Palintest Chlorometer 1000 offers a new approach — accurate measurement with a direct reading instrument that removes errors due to the operator's eye or faded colour standards.

The method for the determination is based upon the well tried DPD reagent but the resulting colour is measured instrumentally and displayed as free chlorine. The Chlorometer outfit is portable, durable and complete with carrying case, reagents and instructions.

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



A World First: Toploading Micro Balances Form Sartorius

With the M3P micro balance, Sartorius now brings the weighing convenience of toploading balances to micro weighing as well.

This new development which had its debut at ACHEMA '88 has a total loading capacity of 3g including the tare range. The electronic weighing range is 1,500mg, and the weight readout is readable up to six decimal places.

Loading a sample is no problem at all on account of the balance's standard convenience features that ensure optimal reliability.

These are:

a) Effective electronic vibration filtering (4 digital vibration filters)

b) Semiautomatic calibration feature

c) Extensive thermal shielding of the housing

For the majority of applications, the complete weighing procedure takes place within the electronic weighing range of 1.5g. Therefore, the new M3P eliminates the need to arrest and release the weighing system — which is an absolute must for other micro balances.

All in all, the M3P makes weighing so simple that even untrained personnel should have no trouble whatsoever with micro weighing. The straightforward and uncomplicated control panel on the display unit of the balance helps guide users every step of the "weigh": each function, such as taring, application of the internal compensating weights, and calibration has its own separate and clearly labelled key.

For processing weight data, the new M3P micro balance comes with a standard bidirectional RS 232 C/423 interface.

Max./ loading capacity — 3g
Electronic weighing range — 0...500*...1,000...1,500mg
Readability — 1*...2...5ug
Tare range — 1,500mg
Weighing pan — 22mm dia.
Housing (W x H x D) — 219 x 153 x 291mm

* The finest readability can be obtained at any level of the entire electronic weighing range by taring.

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

SGE Unijector For PE8000 Series GCs

SGE International has announced the release of a UNIJECTOR for the Perkin Elmer series 8000 Chromatographs.

The UNIJECTOR is a versatile universal injection system designed to give the chromatographer four possible injection modes:-

Split, Splitless/Direct, Concentration/Headspace and Splitless. Its simplicity enables rapid and simple change over between the injection modes.

The UNIJECTOR is also available for most other gas chromatograph makes and models.

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

PRODUCT NEWS

New Alltech Chromatography Catalogue

The new Chromatography Catalogue from Alltech is now available. With more than 700 pages devoted to products for GC, HPLC, TLC, Ion Chromatography, Biochromatography, and Sample Handling, Alltech's new catalogue is considered to be the most complete selection of chromatography products available from a single source. Catalogue 200 includes hundreds of chromatograms to guide the analyst in product selection and separation conditions.

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

Rotavapors from Buchi

Today's BUCHI Rotavapor, vauum rotary evaporator, combines traditional craftsmanship with up-to-date technology. In addition to the conventional evaporation of solvents, the number of possible applications of the Rotavapor has greatly increased. From the robust standard model RE-111 up to the fully automatic RE-140/EL-141, the Rotavapor takes full account of your personal needs.

The two different drive units can be provided with a total of six tried-and-tested glass assemblies, and their application can be optimised by the extensive range of accessories.

The following areas of application of the Rotavapor can also be combined, e.g. extraction/concentration with simultaneous solvent regeneration.

- Distillation
- Concentration
- Reaction
- Powder Drying
- Coating
- Crystallisation
- Solvent Purification
- Extraction
- Degassing

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

HT5 Capillary Columns From SGE

SGE International has released its HT5 stationary phase in polyimide coated capillary columns.

HT5 stationary phase exhibits unique selectively making it an ideal confirmation column for environmental analysis. HT5's thermal stability (low bleed) also makes HT5 ideal for analysis using ECD and GC-MS detectors where minimal baseline drift is critical.

Polymide coated HT5 columns are also recommended for general applications where temperature cycling conditions below 370 deg C are used.

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

Light Years Ahead — Nikon Microphot-FXA

While still retaining the basic design of the prestigious MICROPHOT-FX, the new MICROPHOT-FXA has taken a giant leap forward in ease of operation and optical performance. Thanks to its improved optical design, observation and photomicrography can now be accomplished simultaneously without removing your eyes from the specimen. All functions are fully controlled by an in-base microcomputer system with large screen which is a user-defined multi-camera management system.

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

P.O.N.A. Capillary Columns From SGE

SGE International has announced the release of their high resolution P.O.N.A. capillary gas chromatography columns, developed specifically for the analysis of petroleum refinery products.

The 50m x 0.15mm ID fused silica columns coated with bonded and crosslinked dimethyl siloxane, have been designed to give the petrochemical chromatographer the necessary resolution between specified Paraffins, Olefins, Naphthalenes and Aromatics important in the petroleum refinery environment. Speed, Resolution, Reproducibility and Guaranteed Performance of SGE's P.O.N.A. columns will ensure rapid data on critical petroleum feed stock compositions.

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

Maureen Te Rauna, Receptionist

Kevin Moloney, Product Specialist

Ross Mason, Service Technician

Barry Kerslake, Manager

Brian Breese, Technical Support Manager

Five more reasons for our success

At Wilton Instruments, we know it takes more than just good products to win sales.

And while we've got those products from world-leading manufacturers, we know our greatest resource is our people.

People whose skills and potential are closely matched to their jobs. Our travel and training programmes, tailored to individual needs, ensure our staff keep up with world developments and with the demands of a constantly changing, quality-driven market.

People who know that exciting new developments in science and technology need personal commitments to service and quality to provide the benefits to you the customer, and to New Zealand – in teaching, research, medicine, public health, environmental monitoring, industrial measurement and quality assurance.

People who stay with us over the years … measuring their success and ours by the relationships they build with you.

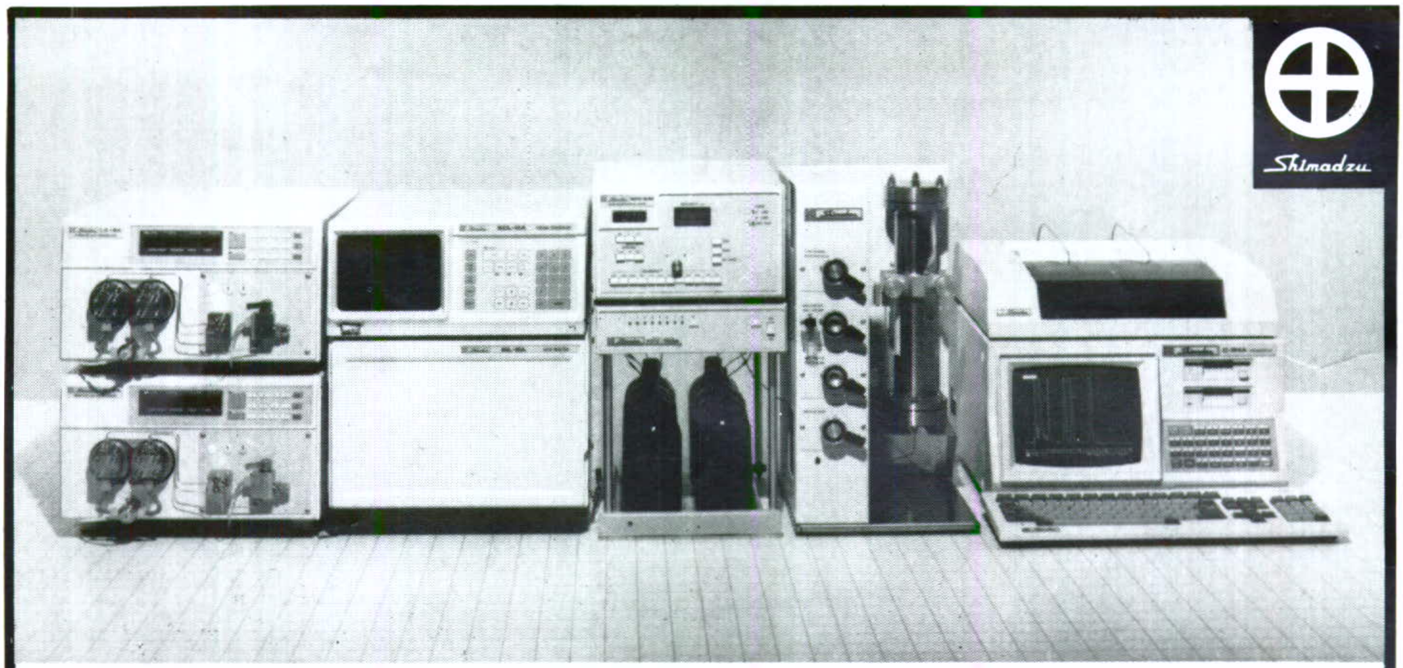
People you can count on.

Matching *solutions* to your needs.

WILTON INSTRUMENTS

People you can count on

Lower Hutt. Tel (04) 697·099
Auckland. Tel (09) 418·3039
Christchurch. Tel (03) 663·663
A member of the Salmond Smith Biolab group.


Shimadzu