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Welcome to conference

Chemists in Otago and Southland extend a welcome to all delegates at the 1982 conference. It was in 1969 that the last Institute conference was held in Dunedin as the IUPAC meeting replaced the regular conference in 1976.

The conference committee has selected for a theme "Chemistry in the Life Sciences" which, we believe, reflects the emphasis of chemical activity in this area; industrial, research institutes and university.

Readers are referred to the article in this issue of the journal which provides an overview of the various chemical activities in Otago and Southland.

Despite strong competition from both the Royal Australian Chemical Institute and the International Union of Biochemistry Conferences in Australia, we expect 170 delegates at Dunedin.

The conference this year has been shortened to three days and includes an evening set aside for posters, an afternoon session at the MAF Research Station at Invermay, a monoclonal antibody workshop and a specialist lignite symposium.

There will be 70 papers in specialist lecture and poster sessions which should ensure that there is something for everybody.

One highlight this year is the Post-Conference Symposium on "The Regulation of Carbohydrate and Lipid Metabolism". This conference has attracted 15 overseas visitors, many of whom are leaders in their fields and 60 participants for the Friday and Saturday meetings.

An active social program has been arranged to complement the scientific sessions and the conference committee is sure that all delegates will enjoy themselves. We look forward to meeting you.

Max Shepherd
Chairman — Conference Committee

Chemistry and industry in the deep south

D. J. Brasch,
Chemistry Department, University of Otago.

Otago and Southland form one of the smaller branches of the New Zealand Institute of Chemistry. However, this is a region where the first settlers combined their proud traditions of industrial enterprise and the love of learning so that today the contribution of Otago and Southland to chemistry and industry in New Zealand is quite out of proportion to size.

This article is based on the work of many Otago branch members. It makes no claim to be complete. Its aim is simply to highlight some of the activities of chemists from the Waitaki river basin to the Bluff.

UNIVERSITY OF OTAGO

Any review of chemistry in Otago and Southland must surely begin at the University of Otago, which employs more chemists than any other establishment in the two provinces. It was at this university that Professor James Black first taught chemistry in 1872 and where the separate discipline of biochemistry was first established in New Zealand in the 1930s by Professor N. L. Edson.

Chemistry Department

Today the Chemistry Department at Otago is proud to be one of the strongest in the country. It occupies a modern well equipped building, student numbers remain high and the Honours School is thriving. The seven storied research building houses advanced students and 22 academic staff.

Research has, of course, always been a major activity within the Chemistry Department and a wide range of interests has developed. The topics covered however fall into fairly clearly defined project areas, each of which is contributed to by a small group of staff. For example, analytical chemists study microchemical methods for the determination of elements in organic compounds and analytical techniques associated with environmental chemistry, including the transport of river and atmospheric derived trace elements to deep ocean waters.

Applied chemists investigate poly-saccharides of industrial interest, wood pulping reactions and chemical reactions at very high temperatures. The inorganic group works at organometallic bioorganic chemistry and classical transition metal chemistry, while the organic chemists study the structure, synthesis and utilisation of extractives from New Zealand plants, the application of organometallic reagents to organic synthesis and the chemistry of azoles.

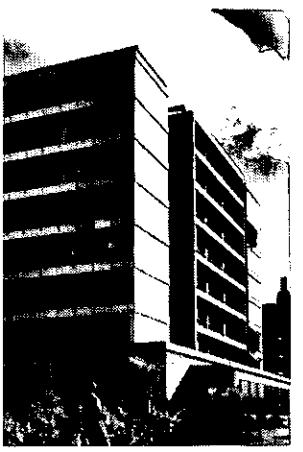
Finally the physical chemistry group continues its interest in the thermodynamics of interactions in electrolyte and non-electrolyte solutions, surface chemistry and ESR spectroscopy. Recent developments include the biophysical research led by Professor Buckingham, where work involves the synthesis, structure and reaction mechanisms of transition metal complexes as applied to biological systems and investigations aimed at the production of liquid fuels from lignite.

Space does not permit a complete listing of academic staff and their research interests to be included in this article. A list is however available in a recently published Chemistry Department brochure which is to be given to all delegates at the NZIC Conference in Dunedin and which may be obtained by writing to the departmental secretary. Also listed in the brochure are the main items of research equipment housed in the department.

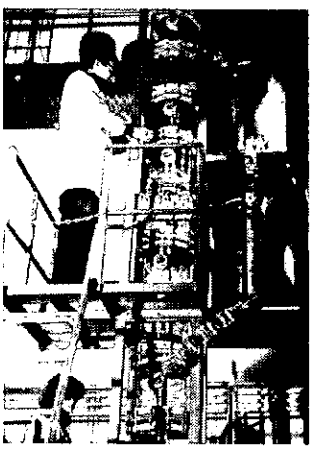
New Zealand's only microanalytical laboratory is in the Chemistry Department and provides an analytical service for research workers throughout the country. Facilities are available for the determination of carbon, hydrogen, nitrogen, oxygen, halogens, sulphur, phosphorus and certain functional groups in organic and metal-organic compounds on the milligram scale.

The University of Otago has in the past been first to introduce many new approaches to the teaching of chemistry in New Zealand and in July this year the senate gave final approval to new development in applied chemistry teaching. Starting in 1983 it will be possible for students to major in either chemistry or applied chemistry at Otago and so applied chemistry, which was first established as a course by the late Professor Soper in 1945, has at last come of age.

It is hoped that this promotion of applied chemistry to full Advanced 2 status will lead to increased interest by students from all parts of New Zealand who seek to bridge the gap between academic sciences and industry. The Chemistry Department is well equipped with modern equipment, much on a pilot plant scale, to provide practical work to support the applied chemistry courses.



The chemistry staff and research building, University of Otago, Dunedin.



A pilot plant distillation column in one of the applied chemistry laboratories.

Biochemistry Department

The subject of biochemistry was first recognised in New Zealand as a separate discipline when in 1936 Dr N. L. Edson was appointed to a lectureship in biochemistry within the Medical School's Department of Physiology. It was in 1949 that biochemistry was separated from physiology to become an independent department.

With the appointment of Professor G. B. Petersen to succeed Professor Edson, a new phase of rapid growth began in the Biochemistry Department. A new building with adequate grants for equipment and furnishings has given New Zealand a highly productive Department of Biochemistry which, although no longer the only centre for university studies in biochemistry in this country, still remains one of the largest and most impressive in the southern hemisphere.

Research in the department is varied and productive and as is the case with the Chemistry Department, the present research projects fall into clearly defined areas. Professor Petersen's research group uses the techniques of modern molecular biology to study the regulation of genetic expression in prokaryotes. As part of this program the complete sequences of the DNA molecules

of seven filamentous bacteriophages are being determined, together with partial protein sequence data from several of the proteins coded for by these small genetic systems.

The developmental biochemistry group is studying the relationship between gene expression and differentiation. Model systems under study range from the functions of ribosomal component proteins to the biochemical basis of embryo dormancy and reactivation in the small crustacean *Artemia*. The metabolism of the rat mammary gland is being studied in two laboratories. In the first of these the regulation of lipogenisis in lactating animals is of interest, while the second is mainly concerned with the molecular biology of the glands. Some emphasis is being placed on determining the properties of a previously undescribed casein, apparently equivalent to the K-casein of other species.

Other research groups are concerned with the biochemistry of mammalian spermatozoa, particularly calcium metabolism in rat spermatozoa; the metabolism structure, genetics and biosynthesis of the cell wall and membrane of the dimorphic fungus *Candida albicans* the structure, biological potency and receptor binding properties of several insulin derivatives and research on structure-function relationships for biomembrane components mediating cell-cell interactions, the generation of sensory signals and the regulation of cellular mechanical activity.

The molecular basis of cancer is being studied by a small cancer research group, particular attention being paid to the alterations in the genomic organisation which accompany the transformation of human cells to the malignant state. One current project is aimed at isolating and cloning DNA from the double-minute chromosomes found in many cancer cells. Another makes use of sequencing techniques to pin-point the exact sites at which carcinogens and anti-tumour drugs damage DNA.

Finally reference must be made to two very important areas of plant biochemistry which form part of the departmental research program. In one of these, isoprenoid biosynthesis is being investigated with emphasis on the relationship between biosynthetic regulation and regulation of growth and development. In the other, projects on symbiotic nitrogen fixation are aimed at developing an understanding of the ultrastructure and metabolism of the developing legume nodule with an emphasis on the interactions between the host and the bacterial symbiont.

Again space prevents a detailed listing in this article of academic staff and their research interests for this very research orientated Department of Biochemistry. The department has however prepared a brochure which is available from the departmental secretary and which will be provided in the satchels of all delegates attending the NZIC Conference in Dunedin this year.

Home Science

In the Home Science Faculty there has been for many years several active groups teaching and researching on chemical aspects of textiles, food science and nutrition. Important projects now underway in these three main areas are as follows. Textiles: interaction of chemicals with fibres such as iodine-iodide interaction with nylon fibres and investigations of keto-acyl peptide end groups formed in proteins subjected to long wavelength ultraviolet light. Food Science: storage conditions for apricots and other stone fruit; structure development in baked products and influence of alternative New Zealand ingredients. Nutrition: existing data updated in New Zealand Food Composition Tables and data for fibre, starch, vitamin A and magnesium added to the list of nutrients; extension of New Zealand Dietary Survey; dietary and anthropometric survey of Dunedin children in a multidisciplinary study; intake of minerals from water and water based beverages; calcium and unusual sugars in breast milk and infant formulae; potential commercial value of some carbohydrates; importance of trace elements for New Zealand residents: zinc, copper, selenium, chromium, as well as the toxic element cadmium in New Zealand oysters.

Chemistry and Chemists in the Medical School

Chemistry has always made an important contribution to medical research in Otago, initially through the Medical Research Committees and more recently through Medical Research Council and other grants.

Several members of the Institute of Chemistry have featured in the early developments. These include Tom Kennedy who not only pioneered the isolation of goitrogens but also synthesised several analogues. Muriel Bell worked on a wide range of nutritional problems including the initiation of trace element research.

Others whose contribution must be recognised are Frank Denz and Jack Dacre for work on food additives, and Marianne Bielschowsky for the study of carcinogenic compounds and development of inbred strains of mice. The analytical expertise of Geoff Dunkley was well recognised and Professor Fred Fastier established the Department of Pharmacology.

The present research activities of chemists in the Medical School are best described on a departmental basis as follows:

In the Department of Medicine the major activity is the study of lipids and lipoproteins with particular emphasis on the transport and metabolism of cholesterol. The relation between mineral metabolism and bone disease is another chemistry orientated project. Chemists in the Wellcome Research Institute are concerned with hypertension and the fundamental mechanisms involved in blood pressure rises and in the rheumatic diseases, including new drug evaluation and collagen and proteoglycan biochemistry.

The chemical interests of the Physiology Department centre on neurochemistry, while biochemical investigation on the preservation of isolated organs is studied by the Department of Surgery. Anatomy's activites involve studies on intrauterine silastic devices releasing non-steroidal anti-inflammatory drugs. Measurement of drug and prostaglandin concentrations are performed.

The Departments of Clinical Biochemistry, Pharmacy and Pharmacology all have extensive chemically orientated teaching responsibilities in addition to research programs. Major research projects in Clinical Biochemistry include studies on the mechanism of insulin action, while the pharmacists are working on the synthesis and structure-activity relationships of barbituric acids and the development of new drug formulations. Pharmacologists in the Medical School are researching the mechanisms of fertilisation, the effect of drugs on the respiratory tract and the effect of alcohol on behaviour and membrane stability.

The Toxicology Research Unit puts most of its emphasis on analytical toxicology. Projects include the tissue and subcellular distribution of therapeutic gold salts and the environmental contaminant cadmium. The measurement of the absorption of solvents, chlorophenoxy herbicides and the organochlorine insectides is a major interest. Pharmacokinetic studies of drugs and drug metabolism are part of a continuing program.

Finally reference must be made to the National Poisons and Hazardous Chemicals Information Centre. The function of these centres is to provide information on the toxicity of therapeutic substances and commercial, household, agricultural and industrial chemicals. The information is principally for the medical profession and emergency services but numerous enquiries emanate from the chemical industry.

INVERMAY

Although the Invermay Research Station was established in 1949 on the farm in North Taieri, its early work was confined largely to agricultural field research and it was not until 1961 that extensive laboratory facilities were acquired with the establishment of the Agricultural Research Centre at the old Taieri Airport.

In addition to soil fertility research, the Soil Fertility Section at Invermay now provides a soil testing service for South Island farmers and growers, processing about 35,000 samples annually. The basic "Quick Test" service analyses pH, calcium, magnesium, sodium, potassium and phosphate. Phosphate retention and sulphur analyses can now also be provided on a routine basis upon request and a soluble salts analysis is carried out on all glasshouse soil samples. Non-routine analyses of nitrogen, carbon and some trace elements can be offered for research purposes. Plant analyses are provided for research and extension purposes but not as a direct service to farmers.

The Invermay laboratory was one of the first in New Zealand to develop and adopt automated continuous flow analytical systems. These systems have been further sophisticated in recent years by provision of direct data entry to computers and micro-processor control of instrumentation.

Significant analytical developments in the laboratory have included: the oxalate extraction method for molybdenum, which has been adopted throughout the world; application of the Olsen test for soil phosphate to replace the Troug test; an automated sulphate test which routinely processes 200 samples per day.

A third chemical laboratory attached to the Animal Nutrition Section performs a very wide range of analyses on animal and plant components. These include the automated chromatographic measurement of S-methyl cysteine sulphoxide, a toxic component of brassica, oxfendazole (an anthelmintic) and brodifacoum (an anticoagulant rabbit poison) by HPLC and tannins in lotus by colorimetry. This group has also compared the palatability of venison from wild and farmed deer.

THE INDUSTRIAL SOUTH

In Otago and Southland chemistry based industry has always been important and at present about 25 per cent of local NZIC branch members are employed in industry.

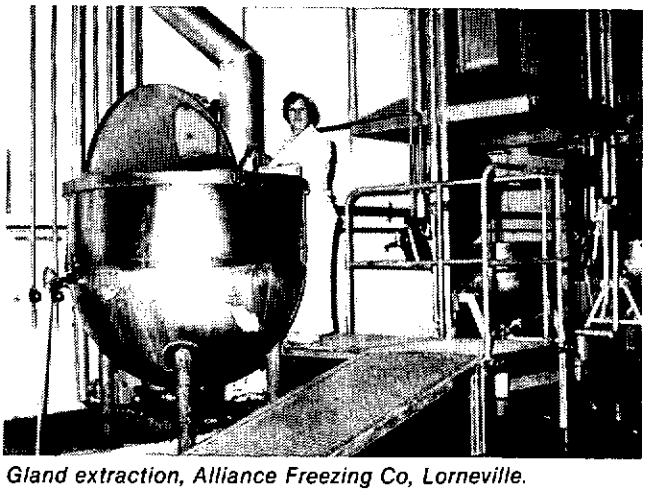
It was in this region that the frozen meat trade which transformed New Zealand farming was begun and there were pioneering ventures also in cheesemaking, in the establishment of a fertilizer industry and in the manufacture of pharmaceuticals. One hundred years later Otago and Southland are still pioneering in meat production in the development of marketable products from cheese whey, in aluminium smelting, whisky manufacture and fertilizer production to mention but a few.

Chemistry and Industry in Southland

Southland has been rightly called the home of the dairy industry in New Zealand, for it was in Edendale that the first cheese factory was established and it was also in Edendale that the first factory in New Zealand to process cheese whey into lactose was built.

Since those early days very many of the innovations in the dairy industry in New Zealand have been developed in Southland, for example reverse osmosis, ultra-filtration, the production of refined lactose, whey protein concentrates and more recently whey cheese.

All dairy manufacturing units in Southland have now merged into the Southland Dairy Cooperative at Edendale. In the 1981/82 season 147 suppliers produced 43.6 million litres of milk from which 4569 tonnes of cheddar cheese was made.



Gland extraction, Alliance Freezing Co, Lorneville.

The processing of cheese whey has occupied the attention of a succession of chemistry graduates. The whey byproduct can be processed at Edendale to make either lactose or whey cheese blocks. Both products involve, as a first step, evaporating the whey to less than 10 per cent of the original volume in quintuple effect evaporators. The subsequent steps require further concentration. In the case of lactose this is done in a manner to produce large lactose crystals which can be recovered in centrifuges and washed to produce commercial lactose. In the case of whey cheese, evaporation is done in a manner to produce extremely small lactose crystals; below the threshold size for mouth feel, for a non gritty whey cheese.

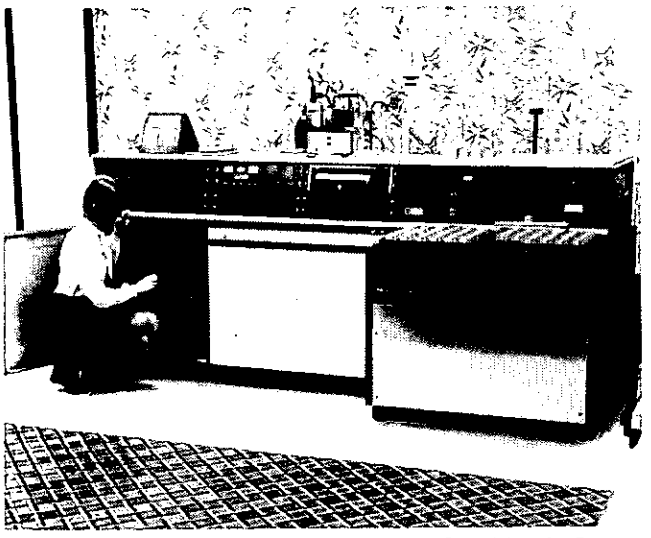
Probably the most urgent challenge in the cheese industry in the future lies in the search for more marketable products from whey. The Southland Dairy Co-op is working actively in this field and hopes in the near future to market a range of flavoured spreads based on whey cheese. The long term aim of this program is to develop a marketable table product for use in overseas countries of much higher population so that a significant tonnage of whey based materials is used.

Another industry to which many chemists have contributed is meat processing. Southland is the home of four very large works and as well as the traditional products of meat processing these companies manufacture and market a diverse range of food and pharmaceutical products for the pharmaceutical, health food and other food industries.

The Alliance Freezing Company for example has a seasonal kill of 4.25 million sheep and lambs, and 40,000 cattle. Apart from meat, the main product ranges are freeze dried foods, frozen food, pharmaceuticals and other food items such as soup stock, beef powder and edible tallow. Alliance's research and development program is orientated towards the development of these four main product groups and the company employs biochemists, food technologists, chemical engineers and other qualified personnel to develop this area.

Glands are collected from both bovine and ovine sources and are exported as a freeze dried 500 micron powder, mainly to the health food and cosmetic industry. Some of the glandular powders produced are liver, pituitary, duodenum, brain, testicle, ovary, thymus, thyroid and pineal. Blood (haemoglobin and plasma liquids) is also converted to freeze dried powders and these are sold to the pharmaceutical industry for specialised use in bacteriological media manufacture and clinical biochemistry.

There are just two fertiliser works in the Otago-Southland region. The Southland Cooperative Phosphate Company plant situated in Awarua, has been operating since 1958 and since that time has in-



X-ray Fluorescence Spectrometer, Southland Co-op. Phosphate Co, Awarua.

creased its manufacturing capacity from 110 thousand tonnes a year to its present 450 thousand tonnes a year. At present it is manufacturing fertiliser at two thirds of its maximum capacity and supplying to all of Southland and a considerable part of South, West and Central Otago. Ninety-five per cent of sales are in the form of bulk deliveries.

There are three unique aspects of the company's operation, namely a fully automated manufacturing process, a sophisticated technical services laboratory and a 260 hectare farm unit.

The automated manufacturing process means that one operator in the centralised control room can select any blend of phosphate rock required, electronically monitor the blending consistency, automatically precrush, maintain a constant sulphuric acid to rock ratio and automatically transport product to the appropriate storage area.

The works laboratory offers full quality control backup for all industrial processes occurring on site. In addition the laboratory conducts environmental monitoring of air, water, animals and pastures on a regular basis. Current research projects include: (1) The influence of fertiliser on animal health and production, with samples being taken from all over the province. (2) Field trials to assess the influence of climatic factors on the mineral uptake in pasture plants. (3) The recovery and utilisation of trade wastes. (4) The optimal use of imported raw materials.

Techniques used include X-ray fluorescence spectrometry, AAS, colorimetric, volumetric and gravimetric analyses, with some selective ion electrode work. Twenty-six elements are routinely determined and typically the laboratory processes 6,000 samples a year and performs 39,000 determinations.

So much as been said of aluminium production in New Zealand recently that comments on the New Zealand Aluminium Smelters plant at Tiwai need be quite brief. Some facts however are worth recording here. The total investment to date in Tiwai is $170 million. Aluminium exports in 1980 were worth $250 million and the value of New Zealand purchases from the smelter in 1980 was $71 million. Import saving was equivalent to $20 million. The smelter has also been instrumental in stimulating manufacturing skills and introducing new technology into New Zealand. An average of 65 per cent of the construction work at the smelter to date has been undertaken by New Zealand contractors.

The current smelter workforce of 1100 people is estimated to support the jobs of an additional 2055 people in Southland — 800 jobs in industries directly associated with the supply of goods and services to the plant and 1255 jobs in household consumer-based industries. When the third potline at present under construction is complete the overall smelter employment within Southland will rise from 3,155 jobs to 4,289.

Special care for the environment is a feature of the smelter's operation. It has an environmental monitoring department with six staff members responsible for checking plant emissions and conducting vegetation and farm surveys. A committee of government departments and other interested groups maintains a regular check on the success of the environmental protection programme.

One cannot omit from any review of Southland's industry the New Zealand Paper Mills plant at Mataura. In fact the first paper mill in New Zealand came into production in May, 1876, at Woodhaugh, Dunedin, but by the end of June in the same year, a mill on the Mataura river was also producing paper.

Today the Mataura paper mill is part of New Zealand Forest Products. It specializes in short runs of high

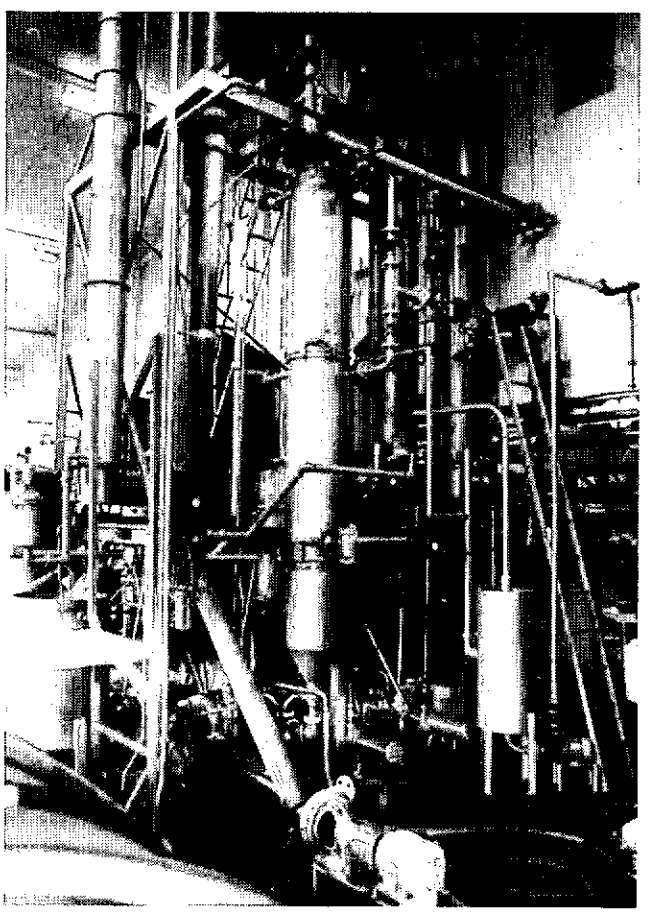
Effluent control system, New Zealand Aluminium Smelters, Tiwai.

quality papers which have to meet very demanding specifications. Many of the papers produced are very specialized products, such as MICR cheque paper for magnetic ink character reading and the 'high white' paper developed for use in most types of electrostatic copiers. There are two paper machines currently in production at Mataura with an annual rated capacity of close on 20,000 tonnes.

Chemistry's Role in Otago Industry

Although Dunedin is the true industrial base of Otago, companies in this province which employ chemists extend from Oamaru in the north to Balclutha in the south and west to Roxburgh. To discuss all chemistry orientated industry in Otago is an impossible task in the space available and so we shall limit our survey in the main to those companies which employ members of the Institute.

Many of Otago's food processing industries are now household words throughout the country. One of these is W. Gregg and Co, a food manufacturing company whose history is closely associated with the history of the province, being established in 1861 and operating out of Dunedin ever since. It manufactures a wide range of foodstuffs including coffee and instant coffee, desserts, canned fruit, liquid and powdered drinks, spices and recently malt and malt extract. The company was responsible for the technical input required to establish a whisky distilling industry in Dunedin.



The Triple Effect Evaporator used for juice concentration at W. Gregg and Co. Ltd., Roxburgh.

Recently, under contract to the New Zealand Apple and Pear Marketing Board, Greggs has installed a plant at Roxburgh for manufacturing concentrated apple juice from Central Otago apples.

The head office and factory of Cadbury, Schweppes, Hudson is in the heart of Dunedin and with a staff of over 800, it is one of the biggest employers in the city. The original company, R. Hudson and Co, started manufacturing biscuits in Dunedin in 1868.

The company employs several chemists to check the quality of raw materials and products and offers considerable encouragement to technicians studying for the Certificate of Science. The manufacture of products for other companies to very tight specifications, as well as the manufacture of their own products, keeps laboratory staff busy. Many of the analyses used involve quite sophisticated procedures, for example nuclear magnetic resonance is used to determine total fats in various ingredients.

Fur Dressers and Dryers were established in Dunedin about 100 years ago. In the early years the major work was the dressing New Zealand feral rabbits and opossum. Later the company undertook the dressing and dyeing of raw skins from overseas for the fur trade. When trading in local feral rabbit skins was prohibited, the fur trade imported raw French rabbit skins and these still remain a major processing item. Today the range includes sheep, lamb, goat, deer, rabbit and fitch of New Zealand origin.

The fur dressing trade still remains much of an art, handed down from generation to generation. Chemistry plays its part in meeting the demands of fashion, especially in the areas of bleaching and dyeing. New Zealand opossum skins processed in Dunedin are exported to many overseas countries and they find wide acceptance by overseas furriers.

Fletcher Fishing, a 100 per cent subsidiary of Fletcher Challenge, is one of New Zealand's leading fishing companies. The Dunedin laboratory of Fletcher Fishing works in close association with the processing plant. It is currently studying methods of extracting fish oil from various deepwater species including orange roughy and methods of refining and analysis. The main analytical tool used is temperature programmed gas-liquid chromatography. Fatty acids are converted to methyl esters by the boron trifluoride-methanol procedure prior to analysis.

New Zealand Cement Holdings operates two plants, one at Burnside near Dunedin and the other at Westport. Planning for the future is an integral part of the company's operations and in order to take care of future cement requirements of the country a decision has been taken to proceed with detailed planning of a new $300 million cement works in Weston, in North Otago. The company already operates a lime works in the area where a unique deposit of limestone is being worked and geological exploration over recent years has confirmed the presence of large quantities of coal.

Virtually the only soap manufacturer in New Zealand apart from Unilever and Colgate-Palmolive, is the firm of McLeod Bros in central Dunedin. McLeods is international by reputation, specialising in contract soap manufacture for Avon, Shultons, Shiseido, Middows Taylor and Cussons to name a few. In the past a major part of the McLeod operation has been the manufacture of oleic and stearic acids but this work has now been superseded. Much of the soap produced goes to the Australian market. The company is at present developing soap based lubricants mainly for the rubber trade.

McSkimming Industries manufactures ceramic products, including bricks and tiles, refractories and bathroom ware. Some of its products are processed by a combination of the ancient art of pottery combined with sophisticated technology which is important in the refining and blending of raw materials and the precise control of temperature in the curing and firing cycles, McSkimmings is the only New Zealand manufacturer of toilet pans, which are made at its factory at Benhar, in South Otago.

Otago has always been the centre of New Zealand textile industry. With the failure of Mosgiel and the purchase of Mosgiel assets by Alliance Textiles of Dunedin, this company dominates a large portion of the

industry. It now employs 1317 staff compared with 1653 for both Alliance and Mosgiel before the collapse of Mosgiel.

Alliance Textiles employs chemists at its mills for a wide variety of work, including the monitoring of raw materials and finished products, research and development projects and plant processes. The latter include dyeing operations, chemical moth proofing using polychloro-2-(chloromethyl sulphamido)-diphenyl ethers, flame proofing using potassium hexa fluoro titanate to deposit metal salts inside the wool fibre, shrink treatment based on permono-sulphuric acid or chlorination plus resin and water proofing using wax emulsions and silicones.

Alliance Textiles also has interests in a wool scour plant at Sawyers Bay. This plant uses a pentanol extraction process to remove wool grease, the pentanol being recovered by steam distillation.

Probably the most up-to-date cheese factory in New Zealand will be the Otago Cheese Company's new factory at Stirling in South Otago. Some of its features will be unique, including the five English cheese formers — Mark II models. The plant has a fully equipped laboratory which will carry out all levels of cheese analysis, test milk samples, check bacteria starter levels, monitor effluent, etc. When the plant opens it will replace virtually all cheese factories at present operating in Otago.

FUTURE TRENDS

It is appropriate to conclude this review by briefly assessing the future for chemistry and chemists in Otago and Southland. The present economic conditions in New Zealand, plus the birth rate statistics, suggest that chemistry teaching and research in tertiary institutions is not about to expand dramatically in the near future. With the present restrictions on public spending, research chemists may be obliged to seek more funding from New Zealand industry if chemical research is to thrive. So far industry in New Zealand has been reluctant to support university research in chemistry, although many exceptions to this do exist and attitudes are changing.

The future for industrial chemistry in the region is however very promising for several reasons. We are now moving into an age when energy for chemical industry will be at a premium and both Otago and Southland have abundant energy resources. The southern rivers are producing ever increasing supplies of hydroelectricity and this is the cheapest source of power available to the nation and is among the cheapest in the world. And there are the enormous lignite deposits of Southland. And there is the prospect of oil in the great south basin.

Our pastures and orchards and engineering enterprises already export a vast range of products based on chemical processing. Surveys conducted by the Department of Lands and Survey show that of all New Zealand's provinces probably none has a greater potential for increased farming production than Otago. The possibilities for economic expansion based on the region's vast land resource have been clearly demonstrated by the results so far achieved by the chemistry based industries whose activities have been described in this review.

ACKNOWLEDGEMENTS

Many members of the Otago Branch of the Institute have assisted in this review. Special thanks are due to Professor M. F. Robinson and Drs G. W. Emerson, D. G. Ferry and D. A. Forss. The assistance of those companies mentioned in the text is also gratefully acknowledged.

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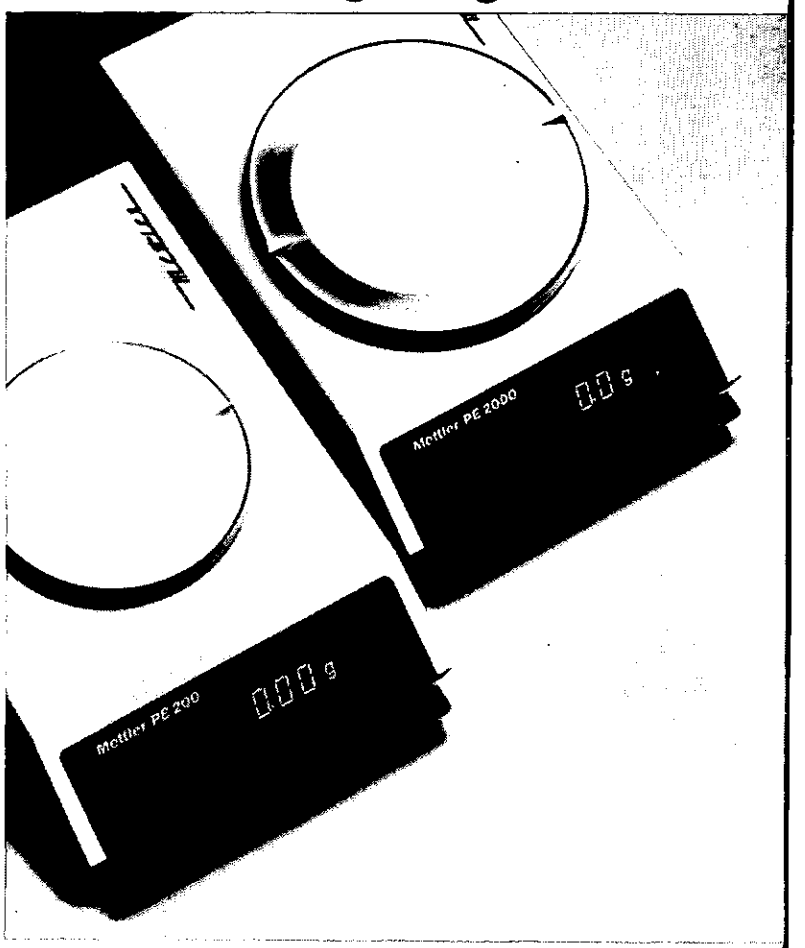
The new PE200 has 210 g capacity with 0.01 g readability; the PE2000 offers 2100 g capacity with 0.1 g readability. Like all Mettler electronic balances, they operate with a single control bar to turn the balance on or off, to tare, and to plus-minus checkweigh.

With the standard features of higher priced models.
Standard features include: Delta Display high-speed filling guide, an automatic stability detector that ensures only stable values are shown on the readout and transferred for data processing: adjustable integration time for easy adaptation to environmental conditions; overload protection; and below-balance weighing.

Optional handsets speed work
Plug-in handsets automatically program the balance for quick and easy formula weighing, percentages, piece counting and animal weighing. They also let you weigh in a variety of non-metric units: ounces, troy ounces, carats, pennyweights, grains and taels.



PE balances. Latest proof of Mettler technology leadership.
For decades, Mettler has been the innovator in precision balances. The PE balances take us — and you — another step ahead.

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WATSON VICTOR LIMITED

A member of the Nicholas International Group P.O. Box 1180, Wellington.

BRANCHES AT:—

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PHONE 593-039	PHONE 69-282	PHONE 777-291

OBITUARIES

H. G. WOOLMAN

Harold George Woolman, who died in Christchurch on February 12 in his 80th year, was one of our more distinguished industrial chemists.

Born in Northern Ireland, he was educated at Friends' School, Lisburn and at Manchester University, where he graduated BSc (Hons) and gained a blue in athletics. In 1922 he broke the inter-varsity long jump record. He also gained his MIChemE, and FRIC.

He returned to his old school as science master for two years, followed by short periods with Vickers-Armstrong and Shell-Mex in England, before joining Reckitt & Colman in 1930, where he became technical director.

When import control was introduced in New Zealand, Reckitt & Colman decided to start manufacturing its range of products in this country, and Woolman was sent out to set up the plant, of which he was appointed general manager.

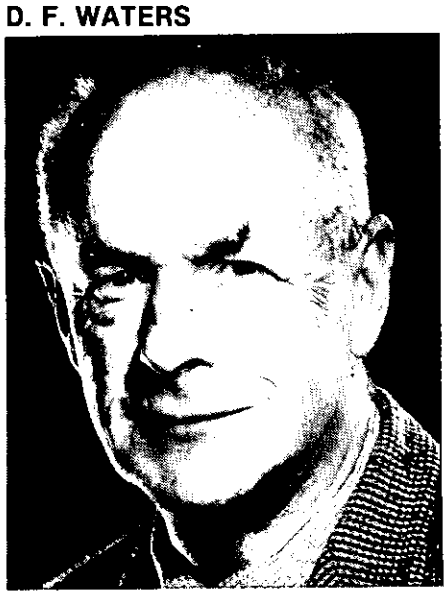
In 1962 the business became a New Zealand company and its operations were transferred to Auckland, where he again set up the plant. He retired in 1967 and spent the last years of his life on his daughter's farm at Matakana, North Auckland. He suffered a lot from chest complaints, but his rather sudden death was due to an abdominal aneurism.

Harold Woolman was active in the NZIC in Dunedin and maintained a keen interest in the RIC. He was in fact chairman of the New Zealand branch when it disbanded in 1955.

His chairman's address is one of the rarer pieces of chemical desiderata. In it he discussed commercial chemical development, knowledge which he put to good use in the production of rose hip syrup, in which project he teamed up with Dr Muriel Bell. He was also a part-time lecturer in applied chemistry at the University. He had a number of hobbies, the chief being photography in which he held the distinction of ARPS.

In 1927, he married Olive Willison, a science graduate of the University of London, who survives him, together with three married daughters, eight grandchildren and one great grandchild. We extend our sympathy to his family.

D. F. WATERS



Desmond Frederick Waters, a foundation member of the Institute of Chemistry, died unexpectedly at his home in Hamilton on May 9, 1982.

Des Waters joined the staff of the chemical laboratory of the Department of Agriculture under B.C. Aston in 1925 and continued in the department till his retirement in 1966. He was involved in an early survey of iodine deficiency in connection with goitre in lambs, in bush sickness research and in facial eczema investigations.

It is of interest that when extracts of limonites, effective and ineffective in control of bush sickness, were being compared, Waters suggested a colour in the effective extract as being due to cobalt. His suggestion was not followed up unfortunately.

From 1945 when agricultural workers were moved up to Hamilton from Wellington, he was in charge of the chemical laboratory of the newly established Rukuhia Soil Research Station. The smooth running of this laboratory is greatly to his credit.

Under his administration came the soil advisory service for manurial requirements, the fertilizer testing laboratory, the plant research laboratory and the notable work of J. E. Allan in spectrography.

Of an ingenious turn of mind Des was responsible for innovations in the soil testing laboratory making for rapid turnover. He, with Ian Sweetman, designed a novel machine for breaking down and sieving soil samples in preparation for analysis. The device has had wide acceptance overseas.

He had a friendly, outgoing manner which made for easy staff relationships. He was recently awarded an honorary fellowship of the Institute of Chemistry.

Des Waters leaves his wife, Millie, three sons, two daughters, and four grandchildren. To them we convey our sympathy.

E.B.D.

LETTER

Dear Sir,

This letter is in response to 'Sceptical Chemist' in June 1982's issue.

As a holder of an NZCS in Chemistry, I see the abolition of the external examination at stage 3 of NZCS for an internal assessment, as a disappointing and retrograde step.

The place for the Certificate holder is in all fields of chemistry but in particular in Industry.

The performance here is due to the type of tuition emphasising the applied aspect of the program, along with the strict maintenance of candidate standards prior to graduation.

The type of examination questions set nationwide, act to reinforce the applied use of Chemistry and ensure that the skill level is maintained.

Only recently have chemistry positions been advertised to attract either NZCS or BSc, showing that the endeavours by technical institute tutors and students to gain parity, have lifted the NZCS from a second rate qualification to one of credibility capable of competing with the BSc.

This recognition is as important to the past and present students, as it is to industrial managers, and so is the guarantee of a continued supply of high calibre graduates.

If the AAVA cannot give this assurance then they are letting the qualification as such down.

Laboratory Manager.

NZIC Annual General Meeting to be held at 8 pm on Tuesday August 24 1982 in the Archway Lecture Theatre Block, University of Otago, Dunedin.

AGENDA

1. Welcome by President, Dr W. S. Simpson.
2. Apologies.
3. Minutes of 1981 A.G.M.
4. Matters Arising.
5. Annual Report: see this issue.
6. Finance: see this issue.
   — 1981/82 statement of income and expenditure
   — 1981/82 Balance Sheet.
7. Elections of Officers:
   — President.
   — First Vice-President.
   — Second Vice-President.
   Honorary General Secretary.
8. Awards and Prizes:
   (a) Easterfield Medal
   (b) Easterfield Regulations
   (c) ICI Prize
   (d) Shell Industrial Chemistry Prize
   (e) Chemical Essay Prize
   (f) Rocklabs-Prochem Prize
9. General Business.
10. Presidential Address.

The meeting will be followed by a trades display mixer function in the poster display area.

J. ROGERS,
Honorary General Secretary.

NZIC Annual Report — 1981-82

On behalf of the council, we have pleasure in presenting the annual report for 1981-82.

It has been customary to present consolidated membership figures up to the time of preparation of the report, usually about June 30. It has been decided to rationalise this procedure in line with the financial year. Membership figures in this report, therefore, are as at April 30, 1982.

The feature of the early part of the year under review was naturally the Golden Jubilee Conference in Auckland in August. This was an outstanding occasion from all points of view and reflected great credit on *Alan Mackney* and *Duncan McLennan* and their team. It brought to a fitting conclusion a most active and interesting year.

PRIZES

Institute prizes were awarded as follows:

ICI Prize: Dr D. A. D. Parry, Department of Biochemistry and Biophysics, Massey University.

Shell Industrial Chemistry Prize: Dr M. S. White, Fertiliser Manufacturers' Research Association.

Student Essay Prize: Mr B. J. M. McIntosh, Chemistry Department, University of Canterbury.

Conference Student Paper Competition: Mr P. G. Farley, Chemistry Department, University of Otago.

Inventors Award: Thirteen entries from the Rocklabs-Prochem Golden Jubilee Award were received by the extended closing date of December 31. Three were from Australia. First prize was awarded jointly to *M. D. Lowe* and *Dr M. M. Sutton* of Ruakura Agricultural Research Centre and *Dr A. G. Clark, J. Gellen* and *D. Thompson* of the Biochemistry Department, Victoria University of Wellington. The adjudicators awarded three joint runner-up prizes and five highly commendeds. Formal certificates bearing the Institute's seal have been presented to all placegetters. A total of $2000 was distributed in prizes and certificates and council is much indebted to *Dr Ian Devereaux* and Rocklabs for this and for the initiative in creating the award. It drew a very strong field of entries and proved a highly successful and stimulating jubilee event.

Jubilee Film. The jubilee film, Chemistry in Agriculture, was completed in time to be shown at conference. With council, branch and University purchases there are now six copies of the film so that each branch can use one copy for careers evenings etc.

CSIRO Film "A Long Shot That Paid Off" — A copy of this film on the development of AAS which shows the late *Eric Allen* in his lab at Ruakura has been purchased from CSIRO and is available to branches through the Registrar.

PUBLICATIONS

Journal. Following the failure of Tricom Publications, a new contract was negotiated with the Magazine Factory of Auckland on very much the previous lines. The journal is coming out regularly and maintains a high standard of content and presentation. There has been a significant increase in price and the journal continues to form a major proportion of NZIC expenditure. It is to be hoped that advertising revenue can be increased so that price increases can be kept to a minimum.

Careers in Chemistry. There is a steady demand for this pamphlet. Stocks are reducing and planning for a re-issue has begun.

Chemistry in a Young Country. Sales of this publication have been steady but there are still 340 copies in stock. About 200 of these need to be sold for this project to break-even and it is rather disappointing that fewer than 200 copies have so far been sold to members. The finances of this publication were affected by the decision to return, at their request, the $1500 donation by the Royal Society of New Zealand. Large sales cannot be expected outside the chemical community and we are dependent on sales to our own membership to avoid a loss.

Chem NZ. Council has continued to support this publication of the Chemical Education Group which now has a circulation nearing 500.

Membership. Branches have recruited actively and the membership committee has considered a larger than usual number of applications. However, the nett increase in membership is only 74 and it is clear that there are many more chemists being trained than are being recruited to the Institute. Active recruiting must remain a priority.

Student membership. Amendments to the Rules creating a class of membership for students have been passed. This grade for tertiary students prior to graduation is under the control of branches. A nominal subscription of $10 has been set.

Council committees and representatives. These are listed elsewhere in the magazine and council thanks the convenors and members of its committees and its representatives on other bodies. They make a vital contribution to the life of the Institute.

Education committee. Following the 1981 Penfold Report on the Teaching of Chemistry in Forms 1 to 7, a Wellington based committee has been set up as recommended, to seek discussions with the Department of Education and with the Universities Entrance Board with a view to the NZIC becoming formally involved with curriculum development activities. A positive response has been received from the department and the board. Initial discussions have been held and further developments are projected. The objective is to develop a better understanding of chemistry and the positive contribution of chemistry and chemists to the community.

Visitors. Profs. M. G. McGlashan and *W. E. Purnell* visited several branches after the Jubilee Conference where they had been plenary lecturers. *Dr J. D. Faulkner* was keynote speaker in a symposium Chemistry and the Undersea World organised by the Auckland branch. He also visited other branches.

Fats Conference. Council has made an interest free loan of $3000 available to the organisers of the International Fats Conference in Auckland in February 1983. Organisation is well advanced and considerable interest in this conference has been reported.

Finance. The income and expenditure account shows an excess of income over expenditure of nearly twelve and a half thousand dollars.

This is a satisfactory outcome. Costs for printing, postage, travel etc. continue to rise steeply. The cost of the NZIC Journal rose from $1 to $1.50 per copy with the April 1982 issue. These factors resulted in the decision to increase the subscription to $40 which is only a 10 per cent increase at a time when inflation is much more and when some costs are increasing faster than the overall inflation rate.

The NZIC sub is still substantially lower than that for sister institutes of chemistry and other professional bodies. The subscription now includes a uniform branch fee.

Federation of Asian Chemical Societies. NZIC is a subscribing member of FACS, which is being very active in its formative years. Unfortunately we are not wealthy enough to send delegates to the many meetings FACS is organising.

We are hopeful of occasional direct representation through members being able to combine attendance on our behalf with business in the Asian region.

Pan Pacific Conference. The Chemical Societies of America, Canada and Japan are sponsoring a further Pan Pacific chemistry conference in Hawaii in December 1984 and it is likely that NZIC will be a co-sponsor and be represented on the organising committee.

Salary survey. A salary survey was undertaken in April by *Mrs W. A. Singer* of Chemistry Division DSIR and the results should be available in this issue of the journal.

Finally, it is a pleasure to record our thanks to council branch and conference committees and to all the council representatives for the considerable effort they have put in to making this a memorable year in the life of the Institute.

W. S. Simpson President
J. Rogers General Secretary

Section 1.

Elected Officers: President: Dr. W. S. Simpson, 1st Vice-President: Dr. D. E. Wright, 2nd Vice-President: Prof. R. D. Batt, General Secretary: Dr. J. Rogers.

Branch Delegates to Council: Auckland Dr. J. H. Garside; Waikato Dr. C. E. Devine; Manawatu Dr. E. N. Baker; Wellington Dr. H. J. Percival; Canterbury Dr. H. K. J. Powell; Otago Dr. J. M. McKenzie.

Officers Appointed by Council (expiry date in brackets): Registrar D. J. Hogan (31/12/84); Administrative Secretary Mrs N. E. Wignall (31/12/82); Journal Editor: Dr. A. C. Herd (31/12/82); Hon. Librarian S. G. Brooker (31/12/82).

Committees Appointed by Council (dates of expiry in brackets): Membership Assoc Prof. D. J. Brasch (31/12/82); Dr. T. A. Rafter (31/12/83); Dr. A. F. Wilson (31/12/84).

Publications: Dr. A. C. Herd (31/12/84);

THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC)
BALANCE SHEET AS AT 30TH APRIL, 1982

1981 $			
	CURRENT LIABILITIES:		
937	Sundry Creditors	1,548.38	
537	Subscriptions in Advance	197.25	
2,700	Funds Received — Re 'Chemistry In A Young Country' Publication	—	
(4,174)			1,745.63
	SPECIAL ACCOUNTS:		
2,756	Overseas Visitors Travelling	2,054.14	
567	Easterfield	566.86	
(3,323)			2,621.00
	ACCUMULATED FUNDS:		
	Balance, 1.5.81	23,330.35	
	Add: Excess of Income over Expenditure for Year	12,455.26	
(23,330)	BALANCE, 30.4.82		35,785.61
$30,827			$40,152.24

1981 $			
	CURRENT ASSETS:		
452	Cash on Hand		—
5,866	Bank of New Zealand		3,191.39
465	Air New Zealand: Deposit a/c & Prepaid Travel		71.78
2,278	Subscriptions in Arrears		3,154.73
1,114	Prepayments: Re Future Conferences, etc		3,208.00
121	Sundry Debtors		1,109.93
—	Stock of Publications on Hand		2,985.72
(10,296)			13,721.55
	INVESTMENTS:		
1,000	North Canterbury Hospital Board Stock (5.25%, 1.11.84)		1,000.00
500	Lyttelton Harbour Board Stock (6.25%, 1.7.98)		500.00
3,000	U.D.C. Group Holdings Ltd (14.5%, 19.5.82)		3,000.00
12,600	B.N.Z. Term Deposits — Various Terms		4,000.00
3,000	Marac Holdings Ltd (14.75%, 19.5.82)		3,000.00
	(14.4%, 4.11.82)		14,035.09
(20,100)			25,535.09
	FIXED ASSETS, at cost:		
	Office Equipment	619.41	
	Less: Accumulated Depreciation	536.41	
			83.00
	Films	682.40	
	Less: Depreciation	136.40	
			546.00
	Presidential Chain		266.60
(431)			895.60
$30,827			$40,152.24

We have audited the books of the New Zealand Institute of Chemistry (Inc) for the year ended 30th April 1982, and have received all the information and explanations we have required. In our opinion, according to the best of our information and the explanations given to us as shown by the books of account, the Balance Sheet and Income and Expenditure Account are properly drawn up so as to give a true and fair view of the state of the Institute's affairs as at 30th April, 1982.

CHRISTCHURCH: **SHANAHAN, WINDER, TOMLIN & CO.**

23rd June, 1982

Per: .....
A. J. Tomlin.

STATEMENT OF ACCOUNTING POLICIES

General Accounting Principles

The general accounting principles appropriate for measurement and reporting of profit under the historical cost method are used by the Institute.

Particular Accounting Principles

1. Depreciation has been charged using the straight line method based on the estimated 5 year economic life of the assets concerned.

Dr. J. H. Garside (31/12/84); Dr. H. K. J. Powell (chairman) (13/12/83); Dr. J. R. Cretney (31/12/84).

Energy and Chemical Materials Resources: Dr. I. D. Watson (31/12/82);Dr. K. L. Mackie (31/12/83); replacement required.

Public Affairs: G. R. G. Wright (31/12/84); Dr. S. I. Smedley (31/12/84); Dr. D. M. Bibby (convener) (31/12/83).

Hazardous Chemicals: Dr. W. A. Temple (31/12/84); Prof. A. D. Campbell (31/12/84); Assoc Prof. M. R. Grimmett (31/12/84); A. M. Scrymgeour (31/12/84).

Environment: Dr. R. Laverty (31/12/82); Dr. P. W. Larking (31/12/82); Dr. W. A. Temple (31/12/82); Prof. A. D. Campbell (31/12/82).

Archives: Dr. R. F. C. Claridge, Administrative Secretary, Registrar.

Chemical Syllabus Committee: J. B. Butchers (convener), W. Freitag, G. Marwick, D. J. Marrison, B. A. Milburn, Dr. D. G. Weatherburn, Dr. C. G. Hughes.

NZIC Annual Report

	1979	*1980*	*June 1981*	*April 30 1982*
Auckland:	345	368	382	397
Waikato:	114	113	116	123
Manawatu:	126	134	141	148
Wellington:	309	319	319	334
Canterbury:	183	177	180	201
Otago:	110	111	115	119
Overseas:	168	182	187	193
	1355	1406	1440	1515

Obituary: We record with regret the deaths during the year of the following members — W. G. M. Hughson Hon Fellow, L. W. Tiller, (Wgtn), G. W. Stace (Auck), Prof F. G. Soper, Hon Fellow (Otago).

THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC)
INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 30TH APRIL, 1982

1981 $			
	EXPENDITURE:		
	ADMINISTRATIVE EXPENSES:		
5,678	Honoraria		6,955.16
5,072	Travelling Expenses		5,232.36
4,369	Printing, Stationery, Postage, Tolls etc.		5,497.32
1,500	Branch Expenses — Grants		1,500.00
450	Computing, Address Labels, etc.		409.80
—	Conference Expenses Paid by Institute		2,118.47
600	Audit Fee		998.00
300	Travel Grant — Chem. Ed. Conference		—
200	Grant — Fats and Oil Conference		—
—	— Re Chemistry Teaching Project		300.00
150	Prizes		200.00
50	Donation — Asian Chemistry Society		—
	Subscriptions		
70	— Royal Society of New Zealand		70.00
—	— Common Concern		14.00
105	— S.A.N.Z.		125.00
—	— Asian Chemistry Society		194.27
—	— N.Z.I.E. — Water Research Group		100.00
118	Depreciation		218.40
(18,662)			23,932.78
	PUBLICATIONS:		
6,418	Journal — Publisher	11,259.00	
600	— Editor Honorarium	800.00	
1,425	Careers Booklet & Sundry Publicity	1,416.55	
—	Chemistry in a Young Country	8,591.00	
428	Chem., N.Z.	750.20	
—	Lists of Members	1,495.00	
1,401	Sundry Publications	1,429.30	
(10,272)		25,741.05	
1,531	Less: Publication Sales	3,256.25	
	Donations to 'Chemistry In A Young Country'	3,400.00	
	Sales 'Chemistry In A Young Country'	2,338.37	
	Stock on Hand	2,985.72	
(1,531)		11,980.34	
(8,741)			13,760.71
(4,427)	EXCESS OF INCOME OVER EXPENDITURE		12,455.26
$31,830			$50,148.75

1981 $		
	INCOME:	
(28,680)	Subscriptions	39,814.55
(121)	Use of Mailing List	—
1,999	Interest — Bank of New Zealand — 1,685.16	
114	— Local Body Stock — 83.76	
390	— U.D.C. Group Holdings Ltd — 436.99	
526	— Marac Holdings Ltd — 2,478.29	
(3,029)		4,684.20
—	Conference Surplus	5,650.00
$31,830		$50,148.75

OVERSEAS VISITORS TRAVELLING ACCOUNT

247	Payments Made	701.62
2,755	Balance, 30.4.82	2,054.14
$3,002		$2,755.76
1,959	Balance, 1.5.81	2,755.76
1,043	Conference Surplus Allocated	—
$3,002		$2,755.76

1981-82

Specialist Groups:

Group:	*Secretary:*	*NZIC*	*non-IC*	*Total*	
Analytical Chemistry	D. J. Hogan	44	3	47	
Biochemical Society	Dr. A. M. Roberton	67	83	150	
Chemical Education	D. T. Howarth	157	282	439	
Chemical Engineers	E. R. Palmer	no records			
Chromatography	Dr. J. A. Zabkiewicz	111	73	184	
Electrochemistry	Dr. A. J. Easteal	39	27	66	
Geochemistry	Dr. J. B. Finlayson	33	93	126*	bulk mailings
Organic	Dr. K. E. Richards	85	5	90	not recorded
Polymer	M. C. Cochrane	52	18	70	
Thermodynamics	Dr. D. V. Fenby	no records			
X-Ray Crystallography	Dr. W. T. Robinson	24	2	26	
Trace El. & Health	Dr. T. E. Kjellstrom	no records			
Industrial Chemistry	J. R. Yolland	incomplete			
Inorganic Organo-M.	Dr. J. Simpson	64	19	83	

Representatives to other bodies (expiry dates in brackets): UNESCO Dr. G. R. Burns (31/12/82); RSNZ Member Bodies Dr. D. E. Wright (31/12/82); SANZ J. G. Fletcher (31/3/83); Dr. H. J. Percival (31/3/84); AAVA C'tee for Science W. Freitag (31/3/83).

Membership: During the year the following changes in membership have taken place.

Members elected to Fellowship:	29
New Members	32
Members re-instated	4
Assoc. Members elected to Membership	2
Graduate Members elected to Membership	24
New Associate Members	6
New Graduate Members	36
New Technician Member	1
Technicians elected to Assoc. Membership	4
New Student Members	11
Deaths	4
Resignations	11

(Note: Usual May deletions for non-payment not yet done with change of census date.)

1982 NZIC salary survey

Wendy Singers,

Chemistry Division DSIR

There were 767 replies, 764 were salary returns and three letters. This gave a response rate of 66.8 per cent, slightly higher than the last survey.

Of the 764 returns 34 were excluded; four unemployed, two retired, two part-time, five returned by PO — address unknown, six late and 15 incomplete. Two of the letters were from members explaining why the form couldn't be filled in. The third letter stated:

'If the institute devoted itself to raising the ethical standards of the chemical profession, eliminating price-cutting and other unprofessional activities among its members, the institute, the profession and all its members would be far better off.'

As a statistician the ethics of the institute are outside my brief. However, salary surveys by the institute would seem necessary when some chemist's salaries are as low as $11,960 and $12,000 (both including paid and unpaid overtime); below the average weekly wage. As the bottom of the junior lecturer scale is $16,123 I have assumed that the salaries below $10,000 in the university group belong to students.

The analyses were calculated using GENSTAT (1). Because of the space limitations imposed I have presented only a summary of the salary trends and employment group differences. A later paper will deal in greater detail with the information obtained.

Histograms of salaries plus allowances for those employment categories with sufficient numbers to be meaningful are presented in Figure 1. For central government and research associations the labelled peaks correspond to the top of the various grades in the science occupational class i.e. the highest peak for central government corresponds to the top of grade 104.

A breakdown by agegroup for the peaks of the histograms and total numbers in the employment categories is included (Table A).

In the industry category one salary in the 30000-37999 bracket for the 28-31 agegroup included over $80000 non-taxable allowances. The respondent had left the final figure to be calculated as I saw fit. I was uncertain as to whether the car and launch were gifts from the company or merely for the use of the respondent. There was the problem of biasing the industry information with this figure so it was excluded.

I am sure that members will have lively debate on these histograms but before generating too much heat, note that there are peaks in the age distributions at the 41-45 agegroup for university staff and 32-40 agegroups for central government that can be correlated with the different periods of expansion of the universities and the central government laboratories. Industry peaks at the 28-35 agegroups and also has more staff in the 24-27 agegroup.

TABLE A: Breakdown of Salaries by Agegroups

Agegroup	< 24	24-27	28-31	32-35	36-40	41-45	46-50	51-55	56-60	61-65	Total
UNIVERSITY											
Total	1	5	9	11	29	37	22	12	7	4	137
SL Bar				1	9	4	2	1			17
SL					5	9	1	1			16
R,AP					4	13	6	2	2		27
Above 38000					1	5	9	5	5	3	28
CENTRAL GOVT											
Total	1	7	14	38	42	25	15	24	14	5	185
104			5	14	8	2	1	1	2		33
105				6	8	7	3	2	1	3	30
106				1	6	3	1	1	1		13
107					1	4	2	6	3	1	17
108					4		2	3	1		10
Above 38000						3	3	5	5		16
INDUSTRY											
Total	4	25	36	44	28	21	13	24	16	5	216
17000-18999		12	9	7	1			3		1	33
25000-25999		1	2	5	3	2	1				14
27000-29999			3	9	7	3	2	2	2	2	30
30000-37999			2*	9	6	10	3	9	5		44
Above 38000				4	5	4	4	4	1	1	23
SCHOOL TCHG											
Total		4	5	4	11	2	11	6	3	1	47
RESEARCH ASSNS											
Total	2	3	9	12	15	7	3	4	5	1	61

* Includes a member with non-taxable allowances in excess of $80000 which was not included.

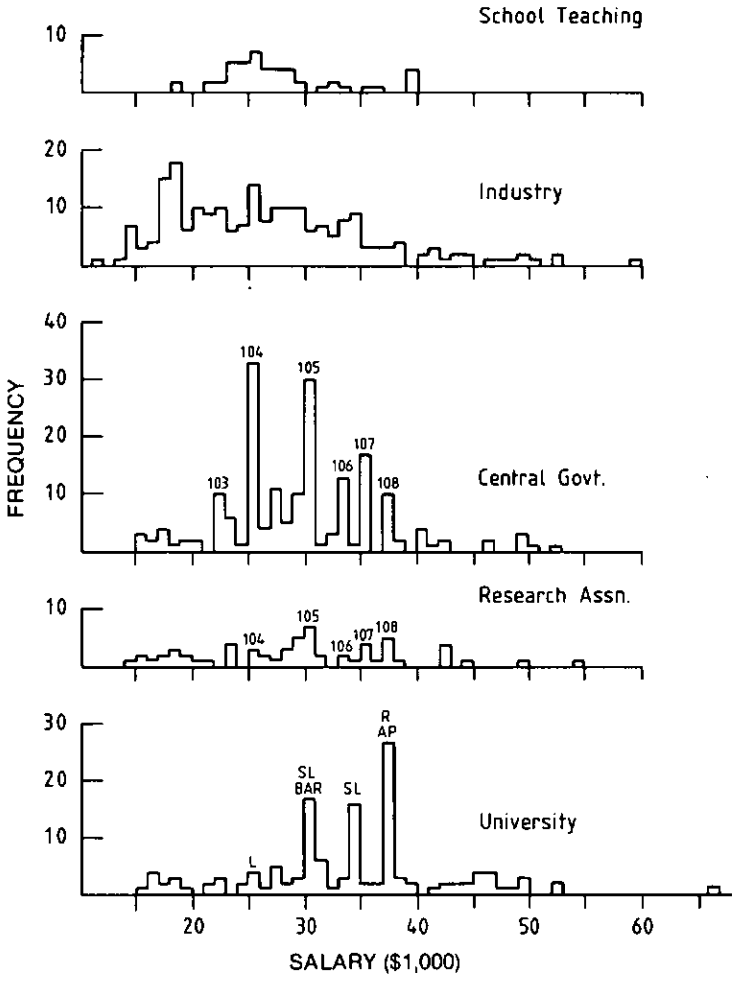
TABLE B. The Mean, Median, Minimum and Maximum Salaries, and the Percent with Allowances for each Employment Group.

Employment Group		Number	Mean	Median	Minimum	Maximum	% with Allowances
School Teaching	S	47	27320	25567	18786	39800	51
	S + A		27514	26565	18786	39944	
Teachers College	S	4	29655	29947	27569	31156	25
	S + A		29755	30147	27569	31156	
University	S	137	33488	34387	8500	63000	13
	S + A		33571	34387	8910	66500	
Technical Institute	S	29	28011	28257	21799	34500	34
	S + A		28189	28257	21799	34640	
Industry	S	217	24033	23177	11960	52000	74
	S + A		26877	25776	11960	59420	
Central Government	S	185	29752	29450	15074	52000	12
	S + A		29795	29450	15074	52150	
Local Government	S	13	26237	25800	19394	30080	62
	S + A		26812	27478	19994	32172	
Research Associations	S	61	29560	29840	14537	49000	28
	S + A		29798	29890	14537	54600	
Self-Employed	S	3	28333	30000	20000	35000	100
	S + A		33236	32208	27200	40300	
Hospital Services	S	12	25332	25684	14206	33333	42
	S + A		25586	25684	14489	33333	
Other	S	16	26900	27150	12000	45889	38
	S + A		29418	29635	12000	49350	

a. S, Salary, S + A Salary + All Allowances.

b. Where Mean different from Median, distribution is skewed. When Mean less than median, more than 50 per cent of sample are below mean.

FIG. 1.



This may be a reflection of a recent expansion of graduate employment by industry, but could also be caused by chemists either moving into senior management positions and dropping their NZIC membership or not staying with industry.

The later two alternatives seems most likely upon checking the age distributions for the 1978 and 1980 surveys and finding the patterns almost identical. Central government and universities show a change in age distribution consistent with a period of rapid expansion and then zero growth.

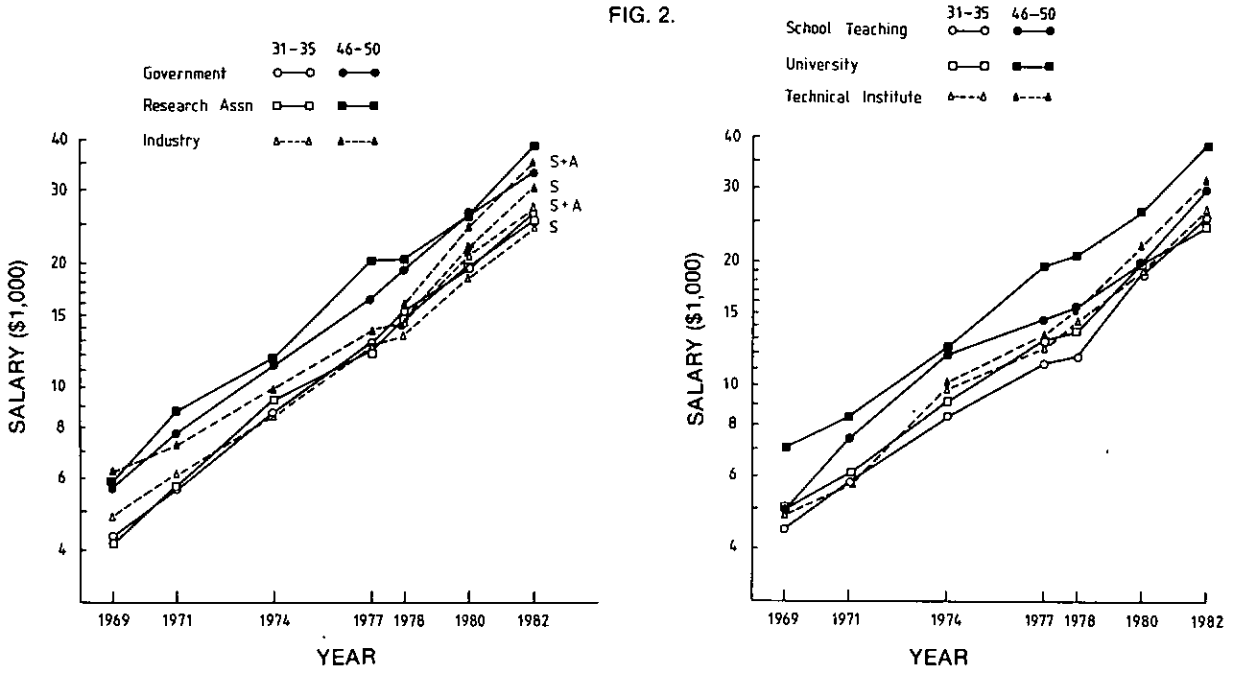
However while some of the salary differences reflect these age differences, it should be noted that the university histogram shows no bar at the top of the lecturer scale, while in central government there are rigid bars at all levels.

Salary details for each employment group are given in Table B. Representative movements in salaries since 1969 are shown in Fig. 2 for the 31-35 and 46-50 agegroups; the two industry lines correspond to plots of salary and salary plus all allowances. The salary scale is logarithmic.

References

1 GENSTAT program suite; Contributors: N G Alvery et al, Statistics Department, Rothamsted Experiment Station, Harpenden, Herts, England.
2 W A Singers & G J Gainsford, Chem. in N.Z. 44, 133-139 (1980).

FIG. 2.



BRANCH NEWS

Auckland

Following significant support for luncheon meetings in a survey conducted last year, the June branch meeting was organised in this way.

Members met at the ATI Training Restaurant, where an enjoyable meal was prepared and served by catering students. Following this an address was given by *Assoc. Prof. John Aggett* entitled The Training of Analytical Chemists for Industrial Careers.

He described the chemistry course structure at Auckland University and gave the audience a clear picture of what they could expect from graduates as potential employees. The role of both the university and the institute in continuing education was also discussed.

Despite the change in approach with the organisation of this meeting, attendance was still relatively low. Sadly this has been a feature of most of this year's meetings.

Dr George Clark, Neil Edmonds and *Bill Peddie* organised the second annual education mini symposium at Auckland University in June. The program, which was attended by 80 secondary school chemistry teachers, featured *Assoc. Prof. Graham Wright* discussing and demonstrating electrochemical processes, *Barry Malcolm* from Mobil talking about the Mobil Process and a lecture on the chemistry of explosives from *Mike Henderson* of ICI.

Manawatu

Dr Stan Simpson gave the presidential address on Modern transmutation — a search for the Elusive Golden Fleece to the May branch meeting. After discussing aspects of membership, finance, the setting-up of consultative sub-committees and the development of a central secretariat for the institute, Dr Simpson described the research effort undertaken by the Wool Research Organisation.

He commented on the relationship between WRONZ and related overseas organisations and research funding of the organisation. The main part of Dr Simpson's presentation consisted of a description of various chemical treatments of wool that have been developed at WRONZ, to modify the properties of the fibre.

This research, essential because of strong competition in the market-place from synthetic fabrics, has led to a better understanding of the chemical and physical properties of wool. The formal presentation was followed by a very active question-time.

Canterbury

The June meeting was addressed by *Professor R N Rowe* of Lincoln College on the subject Horticultural Crops for the Canterbury Area. At the meeting branch prizes were awarded to *Mrs Lynley Hodgson* (top Chemistry 4 student at Christchurch Polytechnic) and *Miss Carol Hulse* (top Stage 2 chemistry student at University of Canterbury). Both prizes include one years student membership of NZIC.

During May/June, *Dr Colin Freeman* gave a series of lectures to sixth and seventh formers in Westport, Greymouth, Timaru and Christchurch on the Chemistry in Action program. He was accompanied by *Dr Peter Steele* who spoke on careers in chemistry.

The branch has also written to local secondary schools offering to send a group of NZIC members to talk informally to senior students about training opportunities and careers in chemistry. The first of such visits was made to Mairehau High School during June.

Otago

At the June meeting a talk on aspects of pollution control associated with the government's Think Big strategy, was given by *R Holden*, principal air pollution control officer of the Department of Health.

A joint NZIC Chemistry Department meeting was also held in June at which the speaker was *Prof R G Bates* of the University of Florida. Professor Bates is best known for his book Determination of pH: Theory and Practice and he spoke on this subject.

At the July meeting *Prof W Carruthers* spoke on aspects of organic synthesis.

UNIVERSITY NEWS

Auckland

Dr Russell Howe, whose special interest is zeolite catalysts, has come from the University of Wisconsin of Milwaukee to join the staff of the Chemistry Department.

Prof Neil Waters also of the Chemistry Department has been elected a fellow of The Royal Society of New Zealand. This may be added to his other success this year in being appointed vice-chancellor of Massey University, a post which he takes up at the end of the year.

Prof R C Cambie is the local representative for the International Organisation for Chemical Sciences in Development. IOCD, which was launched by Unesco in 1981, has issued a bulletin on its aims and programs.

Massey

Prof G N Malcolm spend a fortnight at the University of the South Pacific at Suva in May acting as external examiner and assessor in chemistry for the university. The Chemistry Department at USP is now accommodated in a well-appointed new building provided by the Canadian government.

R. Naidu of the Chemistry staff at USP is now engaged in PhD studies in soil science at Massey University.

A welcome visitor in June was *Prof Roger Bates*, emeritus professor of chemistry from the University of Florida who was in New Zealand to visit friends.

Dr Barbara Brodsky from Rutgers Medical School, New Jersey, recently visited Massey. She presented a seminar on Structural Studies of Connective Tissue, a subject in which she has done collaborative research with *Dr David Parry*.

Dr Dick Walton from Rocky Mountain College in Billings, Montana, is currently spending six months at the university.

Dr Bill Hancock returned after attending the June International Atherosclerosis Meeting in West Berlin and a workshop organised by the US Public Health Department on the Analysis of Proteins by HPLC.

Dr Ted Baker attended a course on crystallography in molecular biology from June 8 to 16. This stimulating intensive workshop-type course, which is held once every six years in Erice, Sicily, brought together people from all the protein and nucleic acid crystallography groups in the United States and Europe.

Dr Baker's main impression of this course is that there have been dramatic advances in the past three or four years in the study of very complex systems (viruses, protein complexes), in the use of high radiation fluxes (eg. synchrotron radiation) and especially in the application of computer graphics systems.

Victoria

Graham Valpy of Pharmacy Department, Central Institute of Technology visited the Chemistry Department as part of his technical refresher leave to further his experience in the area of chemical education.

Dr Brian Halton returned from his sabbatical leave at the University of Utah, in late June.

Dr H D Ellerton of the Biochemistry Department left on July 1 for nine months' study leave. After attending conferences in England and Western Australia, he will spend the remainder of his leave in Adelaide.

Canterbury

Dr Brian Earle of the Chemical Engineering Department is spending six months' leave in Melbourne with the consulting firm Davie-McKee Pacific. This firm is closely associated with the methanol plants to be constructed in Taranaki.

Dr Colin Freeman from the Chemistry Department, is currently on leave in Western Australia. *Drs Rod Claridge* and *Kip Powell* have both recently returned from overseas leave and *Prof Leon Phillips* is back from a trip which included both Japan and Australia.

Dr Alistair Campbell, Department of Soil Science, Lincoln College, has gone to work with *Prof Dr Udo Schwertmann* at the Institute fur Bodenkunde Technische Universitat Munchen until mid February 1983. He will be working on iron oxides in a range of New Zealand soils.

Otago

Dr Graeme Walker the current visiting lecturer in the Biochemistry Department, gave a paper in July at the FEBS/ICRO Advanced Course on the Biochemistry and Genetics of Yeast held at the Institute for Enzymology and Pathology, University of Madrid.

Dr Alan Carne has joined *Prof Merv Smith's* team studying the molecular biology of the mammary gland. Formerly Dr Carne was working at Cambridge on

UNIVERSITY NEWS

the structure of the enzyme 6 — phosphogluconate.

Dr Tony Reeve participated in the Gordon Conference on Chromatin Structure in New Hampshire.

Prof R Laverty of the Department of Pharmacology participated in a Conference on Alcoholism in Munich in July. He also visited a number of pharmacology departments in the UK.

Prof A D Campbell has been appointed by the council of the university to succeed *Prof R E Corbett* as chairman of the Department of Chemistry from February 1, 1983.

Prof W Carruthers of the University of Exeter is a Williams Evans Visiting Fellow in the Chemistry Department for four months.

Prof R Miller of the University of Wyoming visited and lectured to the department on Volumetric Properties of Liquid — Gas Mixtures. *Prof N Berkowitz* of the University of Alberta visited in May and lectured on lignite chemistry.

An extensively revised intermediate course chemistry will be introduced at Otago in 1983. Organic chemistry will feature more prominantly in the new course to make it more suited to the intermediate requirements of the Otago Medical School.

The NZIC Chemistry Department lectures to schools in July involved *R M Carr* speaking on The Utilisation of Southern Lignites and *M R Grimmett* speaking on Chemical Magic.

GOVERNMENT DEPARTMENTS

Chemistry Division Gracefield

L Bruce of the Applied Chemistry Section, recently retired and *V M Williams* has resigned from the Organic Section.

M Ryan, a recent graduate from Victoria University has joined the Physical Chemistry Section.

Two senior technicians, *Mrs J Sibley* and *Mrs P Muirhead* have recently returned after a period of maternity leave. They have been appointed part time to the drug and alcohol section, sharing a full time vacancy.

Dr I Miller of the Applied Chemistry Section is visiting a number of organisations in Europe, Great Britain and the United States. During his trip he will be discussing polymer chemistry.

Dr L Y Foo of the Organic Section recently left for one year's study leave in the United States. Dr Foo will be working on tannin chemistry with *Professor R Hemmingway* at the USDA Forest Service Southern Experiment Station in Lousiana.

A number of seminars examining the research work of the various Gracefield laboratories have been organised by *Dr P Rothbaum*. The most recent of these discussed catalysts, and coal research.

Science Information Division, DSIR

Dr Norman Hawcroft, editor of the New Zealand Journal of Science, addressed a receptive audience of scientists at Chemistry Division, DSIR, recently on the editorial policy of the journal and submission of papers to it and the other six DSIR research journals.

He outlined stages between receipt of manuscript and publication of the journal and stressed the advantages to be gained by submitting papers on floppy discs.

Industrial Processing Division, DSIR

Paolo Zappoli has recently taken up an appointment in the Chemical Engineering Section of the Industrial Processing Division. He is a mechanical engineer and will be working with *Peter Waring* on a continuing project involving the use of methanol in motor vehicles. Previously resident in Sao Paulo, Brazil, he was employed by a Brazilian government agency, CTI, which was responsible for much of the early work in Brazil's program for using ethanol as a transport fuel.

Soil Bureau

Dr Colin Farmer of the Macaulay Institute, Aberdeen, Scotland, has been visiting the Bureau and has given a seminar on the use of infra-red spectrophotometry in a research institute.

Soil Bureau held an internal conference between June 21 and 25 on the theme of Soil Bureau Research Policy. A wide array of research programs grouped within six major research themes, was discussed with a view to formulating a policy suitable for current research needs.

CONFERENCES

The *Royal Australian Chemical Institute* has circulated a list of polymer symposia, conferences etc.

Briefly they are:

Feb 1983 — Structure Property Relationships in Synthetic Polymers, Melbourne.

May 1983 — Transitions and Relaxations in Polymeric Materials, Melbourne.

Feb 1984 — 14th Australian Polymer Symposium, Ballarat.

Feb 1984 — Polymers as Materials; Relating Chemistry to Properties, Sydney and Melbourne.

Feb 1985 — International Symposium on Characterisation and Analysis of Polymers, Melbourne.

For further information contact RACI Polymer Division, P.O. Box 224, Belmont, Victoria 3216, Australia.

CHEMRAWN II — International Conference on Chemistry and World Food Supplies is to be held in Manila, December 1982. Further information from Chemrawn II Secretariat, The International Rice Research Institute, PO Box 933, Manila, Philippines.

The Seventh International Conference on Chemical Education is to be held in Montpellier, August 1983.

Aimed at secondary and tertiary teachers of chemistry, the themes will include the problems of chemistry teaching, frontiers of chemistry and chemistry teaching facing some contemporary problems.

Details from Dr Daniele Cros, Universite des Schiences et Techniques du

Languedoc, Place Eugene Bataillon, 34060 Montpellier CEDEX, France.

The *14th New Zealand Biotechnology Conference*, on the topic of Energy from Biomass, organised by *Dr Vidar Larsen* and staff of the Biotechnology Department, was held recently at Massey University.

In the opening address, *Dr B V Walker* of the Division of Energy presented options for the replacement of imported petroleum fuel products by renewable sources from the biomass.

The need to optimise the net energy ratio to produce the most effective technology was discussed by *J. T. Baines* and *Dr N. J. Peet* in their paper Assessing Alternative Liquid Fuels Using the Energy Ratio Criterion.

The microbial production of alcohols from a diverse array of materials was a natural extension of the Fifth International Alcohol Fuel Technology Symposium held in Auckland a week earlier.

Dr H. Kaspar of the Cawthron Institute discussed the production of volatile fatty acids as well as hydrogen and methane. These acids may be valuable as sources of alternatives to petroleum, eg. their conversion to ketones by pyrolysis of the calcium salts, but care must be exercised in the choice of solvents in the extraction of acids etc. from fermentation systems.

Liquefaction of coal and of biomass materials by hydrogenation or pyrolysis can yield valuable liquid fuels.

These processes, like many others described at the conference, require extensive further research and development work before they could compete economically with currently available materials. Many processes would quickly become "economic" under "disaster" situations, eg. a drastic reduction in the availability of foreign oil supplies. This would be true for glyceride fats and oils in which the cost and problems of production limit their current general use. Alternatively they could be used in specific locations where the raw materials are readily available and they would not need to be transported for long distances.

However much work still needs to be done and funds may be hard to get.

Producer gas, a mixture of carbon monoxide and nitrogen generated by the oxidative pyrolysis of various cellulosic waste products in air, has been used (mainly under war-time conditions) in furnaces and in internal combustion engines.

Interest in this fuel has been revived by *J. P. Humphries* and *D. B. Williams* of Fluidyne Research and Development, Auckland, who demonstrated at the conference a wood-powered station wagon they had developed. Humphries described details of the gas generator and various uses for the gas.

Problems and their solutions in the use of producer gas powered engines on small Pacific islands was discussed in a paper from the Republic of Vanuatu and fuel problems of the world's developing countries were also described in two papers from Costa Rica and Thailand.

Dr C B Johnson

The International Symposium on Dietary Fibre was held at Massey University, Palmerston North, during May. One of the major objectives of this meeting was to encourage an interchange of ideas between investigators of animal and human nutrition.

We were very fortunate in attracting representatives from most of the world's leading fibre research groups. Chemists, while outnumbered by nutiritionists, made a vital contribution to the proceedings. Distinguished overseas chemists attending the Symposium included: *Prof Olof Theander* from Dept of Chemistry and Molecular Biology, Uppsala, Sweden. He presented his work on the chemical characterisation of fibre polysaccharides and discussed the Swedish work on large scale alkaline treatment of straw and its use as a livestock feed. *Dr Robert Selvendran* from ARC, Food Research Institute, Norwich, UK, discussed the types of glycosidic linkages present in various plant polysaccharides.

The area of greatest concern to the chemists present was to resolve the conflict regarding the analysis of dietary fibre. The vigorous debates before, during and after the daily sessions showed that this is still a very active research topic.

Dr P. Harris (Grasslands Research Institute, Hurley, UK) described a useful modification for a rapid GLC analysis of sugars.

There were two schools of thought at the Fibre Symposium. The more traditionally orientated nutritionists who considered that fibre should be considered as a whole entity ie 'a natural packaging of plant foods'. In contrast the more chemically orientated were vigorously attempting to pull plant polymers out of foods and to determine what are the 'active substances' in fibre.

Both groups however did agree that fibre can no longer be thought of as inactive roughage.

Warren Holloway

THE SCEPTICAL CHEMIST

Many manufacturers of cleaners and detergents must have been surprised to get a letter recently from the Government Stores Board informing them that after inviting tenders for a dozen or so different cleaning compounds and detergents earlier this year and despite the fact that the same manufacturers went to a lot of trouble in preparing what seemed to many to be rather excessive quantities and numbers of samples, the Stores Board had decided to change the rules, and did not want the samples!

These samples were all sent to the board to a closing date of March 31, but actual tenders with prices etc were not due until July 20, so one wonders why the board waited until about two weeks before the due date before sending out its bombshell. Was it engaged in an argument with the DSIR about the cost of testing the samples? Was the board unwilling to believe the formulation data that the manufacturers supplied on March 31? Did it get convinced that here was a spendid opportunity for Telarc to get some business?

Manufacturers are now compelled to submit certificates of analysis from a Telarc-registered laboratory and the interesting thing is that when the board sent out its new rules, there was only one labortory in the whole country approved by Telarc for testing cleaners and detergents. This laboratory, is in a company which makes these products and has probably tendered for a number of those wanted.

This sceptical chemist approves the principle of Telarc registration of laboratories in cases where a purchasing organisation is technically ignorant, or where products are exported and the purchaser needs some firm quality assurance; but this hardly applies in the present case.

In fact the NZIC might well be offended that laboratories staffed by its members have to subject themselves to yet another form of government interference, and the DSIR might well be offended that it cannot be trusted to test samples from a government purchasing organisation.

It is this chemist's view that the board could have accepted the word of the manufacturers on their analytical figures and chosen products on the usual factors of price, packaging and availability.

Perhaps the chosen dozen products could then be tested by the DSIR as deliveries commenced, to guard against the remote possibility of fraud. The involvement of Telarc in this curious episode looks suspiciously like a case of empire-building and of course it is ultimately the public (us) who pay. *Anon.*

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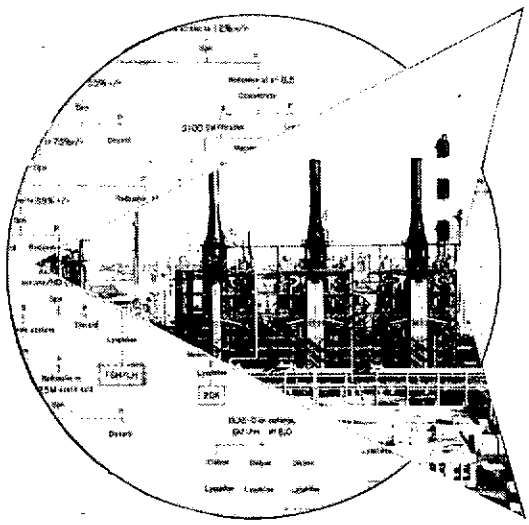

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Formaldehyde resins in New Zealand

Ron Maylor, A. C. Hatrick (NZ) Ltd.

In terms of tonnes per annum, formaldehyde resin is the major adhesive and one of the three major synthetic polymer groups used in New Zealand. Unlike the imported thermoplastic polymers, over 25 per cent of the country's 24,000 tonne yearly requirement for formaldehyde resin is produced locally, manufactured by seven companies at 10 locations throughout the country.

Chemistry of formaldehyde resins

The major raw materials for the production of formaldehyde resins — methanol, urea, phenol and melamine — are all currently imported. Two companies operate continuous processes to convert methanol into formaldehyde. Plants are located at Auckland, Mt Maunganui and Christchurch. The chemistry of the process is summarised by the equation:

$$CH_3OH + \tfrac{1}{2}0_2 \xrightarrow[650\,^\circ C]{\text{silver catalyst}} CH_2O + H_2O + \text{heat}$$

The formaldehyde gas is absorbed in water to give an approximately 44 per cent w/w solution.

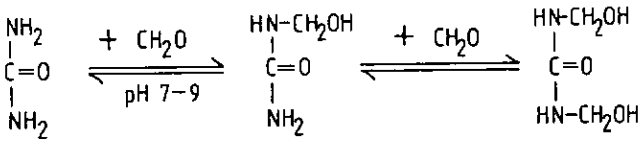
Formaldehyde resins can be divided into two groups — aminoresins and phenolics.

Aminoresins

Aminoresins account for 80 per cent of formaldehyde resins used in New Zealand (see Fig. 1). They are thermosetting polymers formed by reacting urea and/or melamine with formaldehyde in solution to give a low molecular weight polymer. The polymer solution can be concentrated by distilling off solvent or by spray-drying. When used in an application, heat and/or an acidic catalyst causes the resin to polymerise further to give an insoluble and infusible network polymer of high molecular weight.

By varying the conditions used for the reaction with formaldehyde, it is possible to formulate polymers suitable for a variety of end uses. The two major variables affecting resin performance are molecular weight and the molar ratio of formaldehyde to urea and/or melamine: i.e. the F/U or F/M ratio.

In the case of an unmodified urea-formaldehyde (UF) resin, synthesis is accomplished by first mixing urea and formaldehyde under mildly alkaline conditions. This forms an equilibrium mixture of methylolureas:

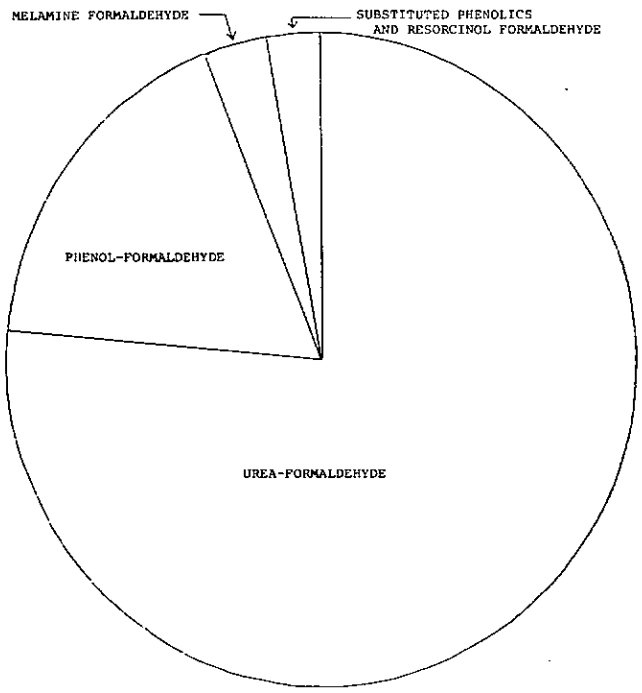


F/U mole ratios of between 2.5/1.0 and 1.3/1.0 are generally used.

Although the methylolureas can be used in some applications, it is more usual to condense them to a higher molecular weight using heat and acid conditions. When the desired molecular weight is achieved (as indicated by resin viscosity), the pH is adjusted to a slightly alkaline value to stop any further polymerisation.

The replacement of part or all of the urea in an aminoresin with melamine will improve the water and chemical resistance, hardness and high temperature properties of the cured polymer. However melamine-formaldehyde resins are more expensive to produce than UF resins and they cannot be satisfactorily produced at as high a molecular weight as the UF resins due to solubility problems. This has limited their application.

Figure 1: Types of Formaldehyde Resins used in New Zealand.



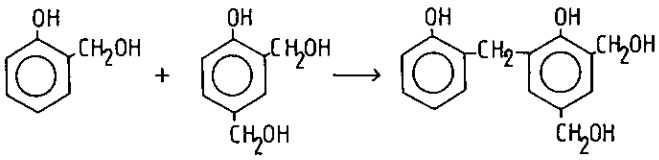
Phenolics

Phenolic resins are low molecular weight thermosetting or thermoplastic polymers formed by reacting phenol, or a phenol derivative such as cresol, with formaldehyde.

Phenolic resins are classified in terms of the molar ratio of formaldehyde to phenol. With F/P ratios greater than one (i.e. formaldehyde in excess) the resin is called a resole. Usually these resins are thermosetting and can be cured to an infusible network polymer simply by heating. Over 90 per cent of the phenolics used in NZ are resoles. With F/P ratios less than one (i.e. phenol in excess) the resin is called a novolak. Such resins are thermoplastic. They can however be easily converted into a thermosetting resin by heating with extra formaldehyde (usually in the form of paraformaldehyde or hexamine).

An alkaline catalyst (such as caustic soda, lime or ammonia) is used for the production of resoles and an acid catalyst (such as hydrochloric acid or oxalic acid) for the production of novolaks.

Unless blocked by some substituent, formaldehyde will react with a phenol at the ortho and para positions. For a resole, the polymerisation sequence starts with methylolation of the phenol. Depending on the reaction conditions and particularly the F/P mole ratio, an equilibrium mixture of mono-, di- and trimethylol phenols is produced. The methylolphenols undergo an exothermic condensation reaction to form methylene or methylene ether linkages. A possible reaction would be:



Viscosity or solvent tolerance measurements are used to monitor polymer growth. When the desired molecular weight is reached, the resin is cooled to retard further polymerisation. Vacuum distillation can be used to produce high solids resins.

To achieve the desired molecular weight with novolak

resins, it is necessary to use acid catalysts. Under such conditions, the methylol groups initially formed are unstable and they condense with the excess phenol present to form a methylene linked polymer. Unlike the resoles, the finished novolak resins contain no methylol groups for self-condensation on heating. They are therefore thermo-plastic resins. Novolaks are supplied as solids or solutions. Shelf life is indefinite unless a crosslinking agent is mixed with the resin.

The following information shows the range of applications of the resins.

Particleboard and MDF

By far the largest application for formaldehyde resins is as particleboard and medium density fibreboard (MDF) binders. These products account for over 70 per cent of the total tonnage of formaldehyde resin used in NZ (see Fig. 2) and for almost 90 per cent of the aminoresin market.

Largely because of cost, unmodified urea-formaldehyde resins are the preferred binders. Resins having F/U mole ratios of 1.3/1.0 to 1.5/1.0 are used for both flooring and standard grade particleboard and MDF.

A small amount of melamine fortified urea-formaldehyde (MUF) resin is used for particleboard to impart improved moisture resistance (the flooring grade product can be recognised by a characteristic green strip in the core of the board).

Some moisture resistant particleboard is also glued with a tannin-formaldehyde binder. The adhesive is formed in-situ from the naturally occurring phenols in the tannin and added paraformaldehyde. The board has a characteristic dark brown colour.

Three companies produce particleboard (at Taupo, Auckland and Kumeu) and one company produces MDF (at Rangiora, near Christchurch). Although the production processes differ considerably, the mode of action of the aminoresin binders is the same.

Typically between seven and ten per cent solid resin on oven-dry wood chips or fibre is used. The resin (supplied as a water based syrup) is used in conjunction with a paraffin wax (up to one per cent on wood weight). The latter imparts a degree of water repellency to the finished panel.

The resin and wax coated wood particles are compressed to the desired thickness in a hotpress. Pressing temperatures of between 150 °C and 210 °C are used to ensure rapid setting of the glue.

Figure 2: Formaldehyde Resins — Classification by end use.

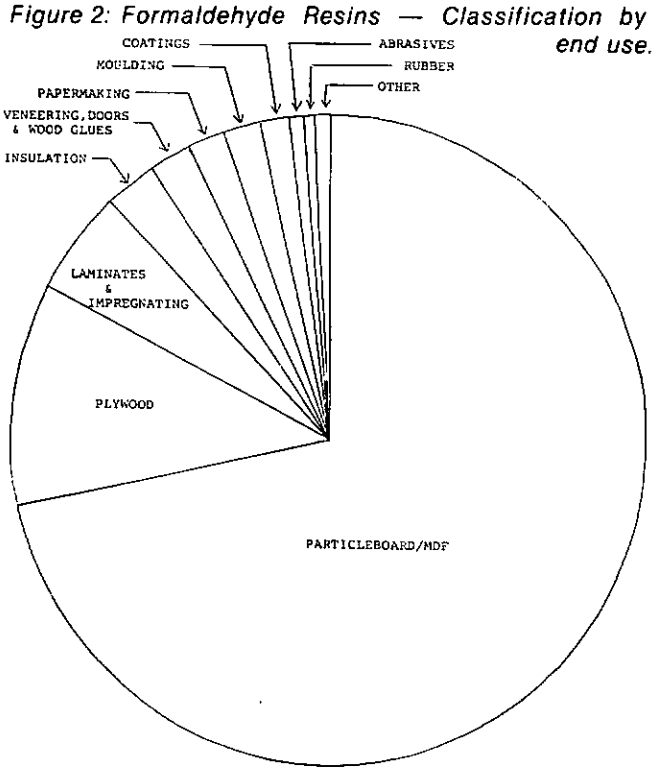
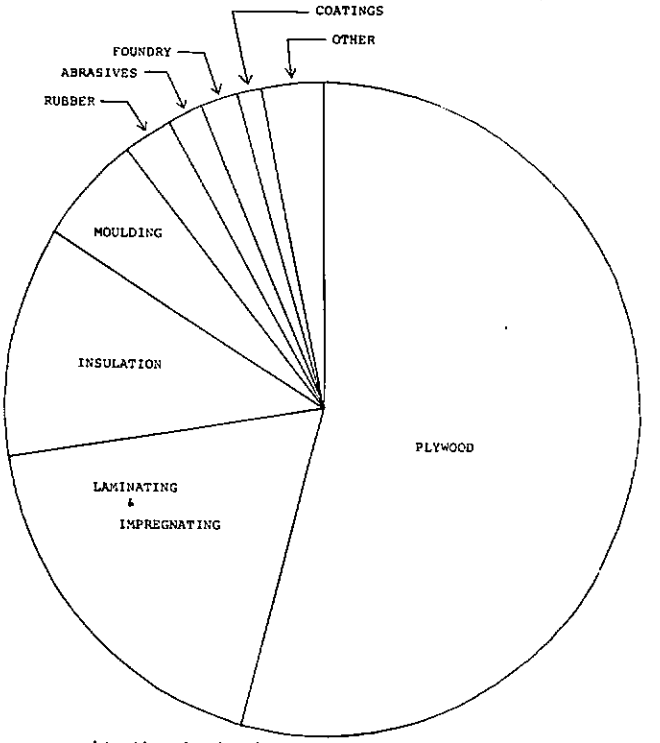


Figure 3: Phenolic Resins — Classification by end use.



Although the natural acidity of the wood will cure an aminoresin, it is usual to speed up the process by adding an acid hardener or catalyst. Ammonium salts are preferred. The ammonium ion reacts with small amounts of free formaldehyde in the resin to liberate acid.

Plywood

Plywood is produced by four companies at Auckland, Kinleith, Mt. Maunganui and Greymouth. Both phenolic and UF resins are used for gluing but the former is now preferred and used in 90 per cent of New Zealand produced plywood (see Fig. 3).

Before use, the resin is mixed with fillers and extenders such as wheat flour to give a cheaper glue mix, improve performance and increase viscosity before spreading on the wood veneer. The glue is cured by heating the multi-ply panels under pressure in a hot-press at 135 to 145 °C. Unlike the phenolic resins, the cheaper UF resins require the addition of an ammonium salt catalyst.

Wood Glues

Formaldehyde resins make excellent wood glues, which are ideally suited to industrial use. However, being a two pack system (needing hardener or catalyst addition before use), they are seldom used in the home; the more expensive PVA's being preferred. Cost, water resistance and durability increases in the order: UF, MUF, MF, phenolic.

Except for plywood, straight phenolics are not used for wood gluing because of the need for high temperature curing. To overcome this disadvantage, polymers are synthesised using a more reactive phenol called resorcinol. The resorcinol-formaldehyde (RF) resins are produced as low molecular weight novolaks having a very long shelf life. When mixed with a paraformaldehyde based hardener the resins can be quickly cured even at room temperature to a fully waterproof phenolic glue bond. RF resins are often termed marine glues. They are widely used for the production of laminated beams and arches in large buildings.

To minimise the use of expensive resorcinol, intermediate temperature setting phenol modified

resorcinol-formaldehyde (PRF) resins are also produced. The PRF resins are used in over a dozen plants throughout the country for fingerjointing and laminating lumber by radiofrequency heating to form weatherboards and exterior joinery.

The UF resins for wood gluing are similar in composition and method of use to the UF plywood resins. The major applications are the wood veneering of particleboard and other panel products and the production of doors. The use of hardeners formulated on acids such as formic acid gives cold setting UF glues suitable for joinery and furniture applications where heating is impractical.

Wood gluing applications represent the second largest use of aminoresins (see Fig. 4).

Papermaking

Urea-formaldehyde resins of relatively high molecular weight are used to improve the wet-strength properties of paper products such as rubbish sacks, brown paper bags and wallpaper base. Only small amounts of resin are used — approximately 1.5 per cent on dry paper. To be effective in the papermaking process, it is necessary to modify the UF resin to achieve good retention on the cellulose fibre. Co-condensation with materials that impart anionic or cationic charge centres on the polymer improves resin efficiency.

Impregnating resins

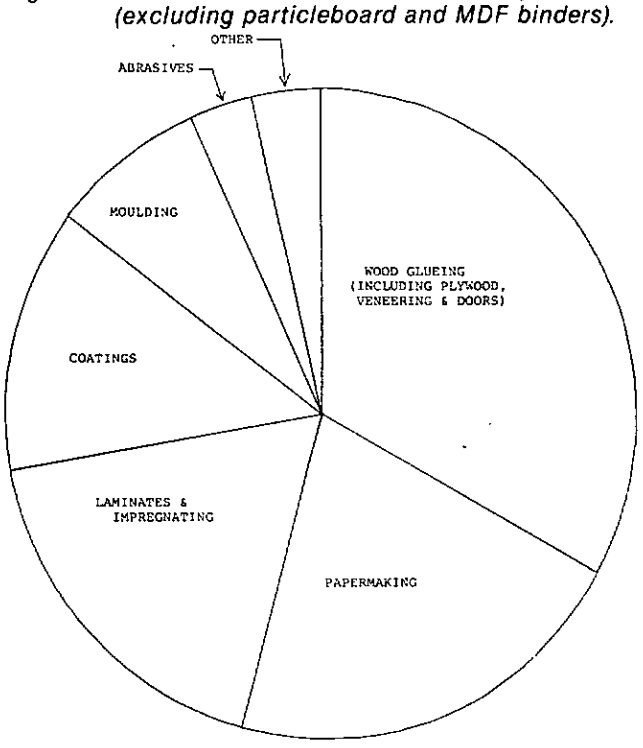
Very low molecular weight, low viscosity impregnating phenolic and aminoresins are used in the manufacture of products such as high pressure laminates, wallboard, oil filters, sign overlays, electrical circuit board, paint rollers and so on.

For these applications, phenolic resins are mainly used. However, large quantities of MF and MUF resins are produced to provide the hard, clear, durable finishes of decorative laminates used in kitchens and work areas. The laminates are produced by heat curing a sandwich of sheets of resin saturated paper under very high pressure.

Insulation

Large quantities of phenolic resin are produced as the binder for pink coloured glass fibre insulation and for other types of industrial insulation. The high F/P mole ratio resins used have a low molecular weight and are specially formulated to give good glass to glass adhesion.

Figure 4: Amino Resins — Classification by end use (excluding particleboard and MDF binders).



Abrasives

A wide variety of abrasive products are manufactured in New Zealand using formaldehyde resins. They include woodworking sandpapers, metalworking papers, grinding wheels, belts for industrial sanding machines and nylon based polishing pads.

Phenolic resins are generally preferred for their excellent heat and water resistance, bond toughness and adhesion to the abrasive grit used.

Rubber

Phenolic resins are used to improve the tack properties and heat resistance of neoprene based contact cements. The major requirement is for solid resoles based on t-butyl phenol. A typical contact adhesive consists mainly of neoprene rubber PF resin and magnesium oxide in an organic solvent. Other phenolic resins are used in rubber processing including tyre manufacture.

Surface coatings

The unmodified water soluble UF and MF resins are of little use in surface coatings because of the brittleness of the cured film. For surface coatings applications, it is usual to use aminoresins in conjunction with other resins that give more flexible coatings on curing, such as alkyds, acrylics and epoxies. For compatability reasons, the aminoresins are formulated having a large proportion of the methylol groups etherified with alcohols such as n-butanol.

Butylated UF resins are used primarily in furniture finishes and metal coatings. Compared to the UF resins, the butylated MF resins are superior in terms of cure rate at elevated temperatures, soap and alkali resistance, colour and gloss retention after stoving and durability. They are however more expensive and cannot be cured with acid catalysts at low temperatures like the UF resins. Uses of MFs include automobile enamels and metal (appliance) finishes.

A wide range of phenolic resins, both novolaks and resoles, are used for surface coatings. The resins are usually modified with other materials to improve flexibility and reduce cost. Substituted phenols are generally preferred to phenol itself. The phenolic resin imparts acid resistance (as in food can linings), exterior durability (as in marine varnishes) and chemical resistance (as in industrial metal primers).

Moulding

Moulding compounds consist of spray dried formaldehyde resin and cellulose filler in combination with release agent and other additives. There is no local production of these materials, which require special manufacturing equipment.

The phenolic (dark brown) and UF (ivory coloured) mouldings are extensively used for light fittings and wall switches. Some MF moulding compounds are used for decorative uses (eg. dinnerware) and utensils.

Born and educated in England, Ron Maylor graduated BSc (Hons) in Chemistry from the University of Leeds in 1968. He continued his studies in chemistry at Leeds and gained a PhD in 1971 for work on non-aqueous solvents. After a period of post-doctoral research and industrial development work, he emigrated to New Zealand.

As technical manager for A. C. Hatrick he is responsible for development, customer technical service and process improvements of the company's locally produced synthetic resins. As well as the formaldehyde resins, these include alkyds, emulsions, epoxies, polyamides, polyesters, polyurethanes, various service coating additives and preservatives.

He is married with two children and is currently serving on the NZIC Auckland branch committee.

NEW PROBLEMS WITH NUCLEAR REACTORS

After 24 years, the world's first atomic power station at Shillingport, Pennsylvania, is scheduled to be shut down at the end of its useful life and the problem of its disposal arises.

There are three options: (i) dismantling piece by piece with remote controlled cutting and blasting equipment and removing the radioactive debris to a safe spot for burial; (ii) unloading the fuel, removing liquids and flushing the plant out, after which it is placed under guard for 30 to 100 years until activity has declined to the point where parts can be safely removed to a low-level burial site; (iii) entombing the plant in concrete, where it may be left without supervision until radioactivity has decayed to a safe level.

None of these processes is cheap and must be provided for in costing.

Up till now it was believed that the operative factor was cobalt-60 which has a half-life of 5.27 years, so that in 100 years it activity drops by a factor of 10^8, but it has recently been found that Ni-59 with a half life of 80,000 years is formed, with an activity above accepted levels for all this period.

Even more lethal is Niobium-94, formed from Nb used to strengthen steel in the plant. It has a half-life of 20,300 years and emits gamma rays.

In the meantime No 1 reactor at Three Mile Island, which was shut down for refuelling when the accident happened to No 2 in 1979, has not been re-started. Reasons include the refusal by the Nuclear Regulatory Commission to allow a start up and court proceedings.

It has also been found that No 1 is badly corroded, due to an unsuspected chemical reaction between radioactive cooling water and steel in the pipes. It is now estimated that it will cost US$10 billion to get TMI on stream again.

Even before TMI the American public was becoming disenchanted with nuclear power. Between 1970 and 75, there were orders placed for 144 new commercial reactors in America. There were two subsequent orders and none since TMI.

For a bit of local colour — to the imponderables raised by the secrecy over the armament and motive power of the USS Truxtun, must now be added the question of how the exhausted power unit is to be disposed of when the vessel is decommissioned.

HERB POTENTIAL BEING INVESTIGATED

Massey University agronomist Dr Ian Gordon is evaluating the potential of the flowering herb Limnanthes, or meadowfoam, under New Zealand conditions.

The oil in the meadowfoam seeds is essentially the same as that of the jojoba shrub, but the meal residue may have value as stock food which is not true of jojoba because of toxins.

The oil can be used as a high temperature lubricant, and also substitute for whale or jojoba oil in automotive transmission fluid, cosmetics, pharmaceuticals, shoe leather, textiles etc.

UE AND UB QUESTIONS

The Manawatu branch of the NZIC is offering for sale to high school students and teachers, two books containing all multiple choice questions from university entrance and university bursary chemistry examinations for the year 1971-1980 inclusive. A separate answer sheet is also supplied with every copy.

Two members of the branch, Dr J S Ayers (chemistry lecturer Massey University) and Dr A Furness (chemistry teacher of Palmerston North Boys' High School) have been responsible for the preparation and comprehensive checking of the two books and the associated answer sheets.

The books cost $3.50 each, including packaging and postage. Bulk orders of 20 or more copies attract 15 per cent discount. Orders are through the branch treasurer, Dr J. Shaw, C/- Applied Biochemistry Division, D.S.I.R., Palmerston North.

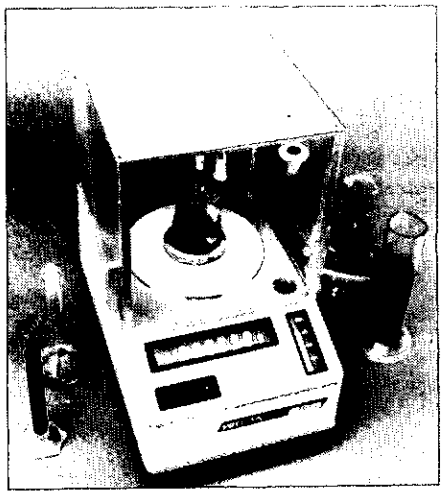
PILOT PLANT FOR ETHANOL

The construction of a pilot plant for ethanol production is nearing completion at the Agricultural Engineering Institute at Lincoln.

The work is part of an ongoing ethanol research program, which includes investigating the extraction of sugars from fodder and sugar beet and the use of the wastes such as pressed pulp and stillage which results from sugar extraction.

NEW PRODUCTS

NEW RANGE OF BALANCES



Pag Oerlikon, manufacturer of the Precisa range of electronic balances, has recently released two new ranges of balances.

As well as the model 80A (pictured) there are eight other new instruments with weighing capacities ranging from 80g (readability 0.0001g) up to 24,000g (readability 1g).

The new balances incorporate all standard features found on their predecessors, such as built in leveling device, weighing in capacity scale and below the balance weighing. In addition the new series offers automatic calibration and integration facilities as standard.

All Precisa balances can be fitted with an RS232/V24, TTY 20 mA current loop, IEC bus or analogue outputs enabling them to be used in conjunction with a wide variety of data capture terminals.

In addition the new series can be equipped with a remote display or a multi function box (standard programs include counting, nettotal function, various calibration standards such as pennyweight, carat, troy ounces or gram).

Precisa claims its balances are ideal for use in environments where ordinary balances would not stand up to the conditions. A two year warranty also applies.

Local agent is Kempthorne Medical Supplies, Auckland.

BECKMAN'S LATEST SPECTROPHOTOMETER

The DU-7 UV-Vis Computing Spectrophotometer is said to combine a high-speed, high-performance spectrophotometer with a graphic spectral data centre, a final-answer computer, a large sample compartment, a complete line of sampling accessories and diagnostic capabilities to save time, simplify operation, improve anaysis capabilities and increase laboratory productivity.

Beckman Instruments' latest addition to its family of DU spectrophotometers is used to identify or to determine the amount of a component in a sample in product development, research, quality control, quality assurance and production laboratories in both industry and educational institutions.

The DU-7 performs high-speed wavelength scanning, time-dependent analyses and fixed-wavelength analytical measurements.

The spectrophotometer reduces data collection and analysis time by scanning samples at up to 1200nm/min and calculates and redisplays spectra in two seconds. The integral video display provides rapid parameter setup and spectral manipulation. The final answer computer automatically calculates peak maxima, peak height, concentration, absorbance ratio and multiwavelength values.

The DU-7's spectral data centre stores and redisplays spectra. It expands abscissa and ordinate axes to examine small spectral details, calculates and displays first and second derivative and the log of absorbance and elminates the necessity to rescan the sample to obtain the desired data. Spectra from different samples can be overlaid on the screen to aid comparison.

Stable beam technology, simplified optics with fewer mirrors and electronics provide 0.05-sec. response time, high S/N and high sensitivity.

The DU-7's data manipulation capability aids in time-dependent analyses, such as liquid chromatography, chemical reactions and continuous in-process monitoring. A time drive mode provides continuous monitoring at a single wavelength, and a repetitive scanning mode scans up to six spectra at predetermined time intervals.

PEOPLE

Peter Dawson runs his own industrial consulting and analysis laboratory in Napier. A Canterbury graduate, Peter has worked with Amalgamated Batteries in Christchurch, Kodak in Porirua and Napier before setting up *P. J. Dawson Laboratories*, which specialises in pesticide residue analyses.

The three main sources of samples are agricultural export companies that must comply with overseas regulations on pesticide residues, the registration of new agricultural chemicals for which residue data is required and the proving of damage claims resulting from negligent application of a chemical.

This last case often but not always involves the chlorinated phenoxyacid group of compounds such as 2,4,5-T.

Dr Don Cook has recently transferred to the newly established *Tairawhiti Community College* in Gisborne, where he is responsible for setting up a science department.

Don graduated from Victoria University, gaining MSc (1967) and PhD (1972). From there, he spent two years as a research worker at the University of Sheffield, followed by a year at Auckland University. After secondary teaching in Auckland and Gisborne, Dr Cook moved to Tairawhiti Community College which caters to the area from East Cape to Wairoa/Waikaremoana. The College offers NZCS courses to intermediate level in the chemistry and food science options, although at present some subjects are done by correspondence. The major local demand for science training is in food processing and in the rapidly expanding horticultural field.

Dr Dennis Nelson has been awarded an *international research fellowship* from the John E Fogarty International Center for Advanced Study in the Health Sciences, National Institute of Health, Bethesda, USA. These fellowships are awarded to young scientists in the biomedical field to undertake postdoctoral training in the US.

The study program will involve identifying the chemical and physical changes in tooth enamel caused by laser irradiance as a possible means of caries prevention and studying atypical regions in tooth enamel using specialised ultra-high resolution electron microscope techniques in order to understand the factors involved in caries susceptibility. These studies will be undertaken at the Eastman Dental Center, Rochester, New York and at the Department of Physics, State University of Arizona.

Dennis is at present a *Medical Research Council of New Zealand* postdoctoral fellow at the MRC Dental Research Unit. He completed a PhD in chemistry last year at Victoria University.

Dr Athol Rafter, an honorary fellow of NZIC, has been appointed chairman of the *Wellington Cancer and Medical Research Institute Trust Board.*

Athol, who has been a board member since 1977, was director of the DSIR's Institute of Nuclear Sciences for 20 years until his retirement in 1978.

Mrs Therese McTague (nee O'Connell) has been appointed as a technician working in the Mass Spectroscopy Section at *Institute of Nuclear Sciences, DSIR.* She had previously worked for six years as a senior technician at the Waitaki (N.Z.) Refrigerating Company at Wairoa and gained her NZCS in 1978.

Dr Bert Quin has recently taken up a newly created position as assistant to the directorate of the *Agricultural Research Division* of the *Ministry of Agriculture and Fisheries* and is involved in co-ordination of agricultural research and liaison with other government departments, universities and industry.

One of his first jobs is to co-ordinate an integrated nation-wide research program investigating the effectiveness of various phosphate fertilisers on pasture. He previously worked at Winchmore Irrigation Research Station (MAF) for eight years.)

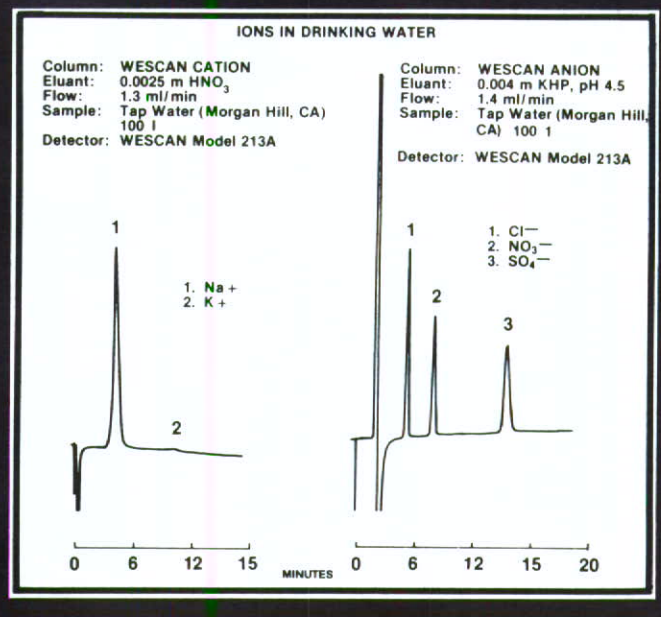
Dr Bruce Sutherland has just returned to New Zealand after touring Scandinavia, Europe, and England for six weeks with a *Dairy Industry Study Group.*

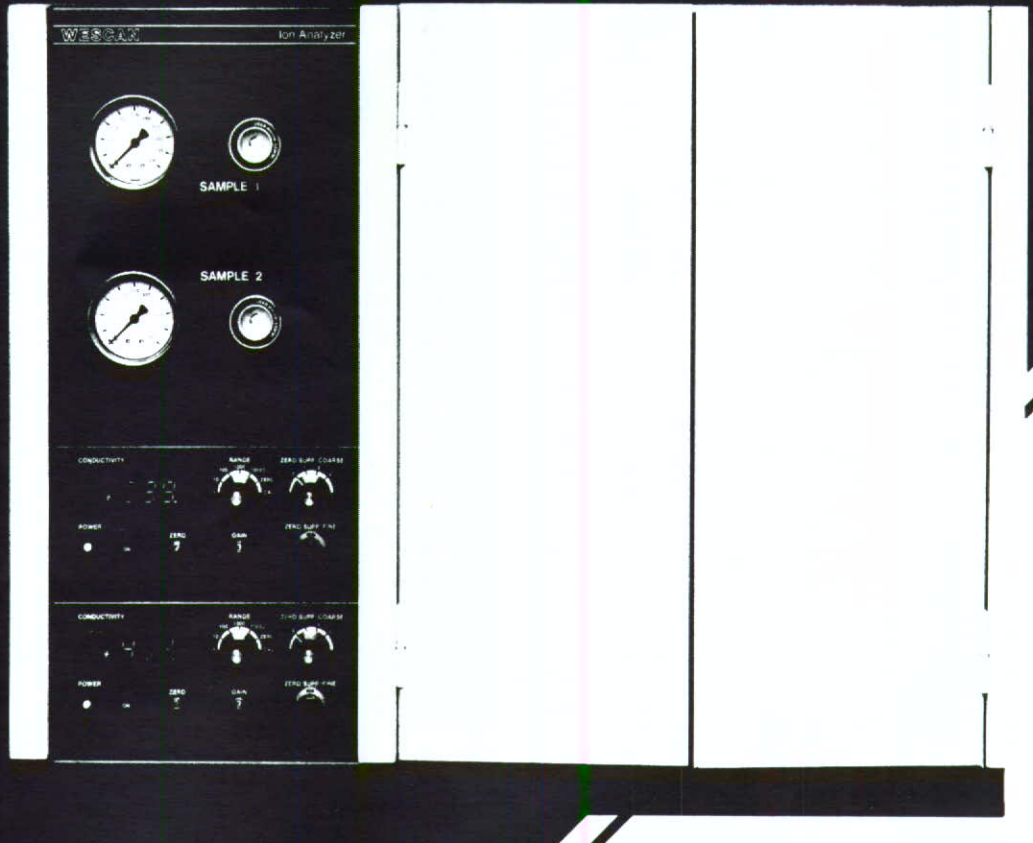
Dr David Chambers has been chosen from 34 applicants to be the first *Cain Memorial Research Fellow* of the Auckland division of the Cancer Society. An Auckland graduate, he has been in the USA studying steroids.

John Templer, managing director of *Dulux New Zealand*, was the keynote speaker at the 20th annual conference of the New Zealand Oil & Colour Chemists Association, in Rotorua recently. The theme of this year's conference was Protection for the Future in the New Zealand Environment.

NEW

The Model 261 Two-Channel ION ANALYZER





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