

JOURNAL OF THE NEW ZEALAND  
INSTITUTE OF CHEMISTRY

Vol. 24    No. 1  
February, 1960





## TALKING SHOP!

They are both research chemists but they work in widely differing fields; their requirements for laboratory chemicals are on the whole distinct. However if you asked them why they obtained their supply of laboratory chemicals from May & Baker they would give you the same answer.

They demand reliability and convenience; M&B brand laboratory chemicals provide just those qualities. There are now well over six hundred laboratory chemicals in the M&B range. The labels on the containers give full individual specifications of the contents.



**LABORATORY CHEMICALS AND REAGENTS**

MANUFACTURED BY MAY & BAKER LTD

DISTRIBUTORS MAY & BAKER (NEW ZEALAND) LTD

P.O. BOX 1395 WELLINGTON TEL: 56-684

LA478

# JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. 24, No. 1

February, 1960

## CONTENTS

	<i>Page</i>
President, 1960 .. .. .	1
Chemical Aspects of Dental Research .. .. <i>C. R. Barnicoat</i>	3
Analysis and Synthesis .. .. . <i>A. D. Campbell</i>	17
Branch Chairmen .. .. .	24
Branch News and Notes .. .. .	26
General Meeting Minutes—August, 1959 .. .. .	29
Council Minutes:	
August, 1959 .. .. .	30
November, 1959 .. .. .	34
List of Officers for 1960 .. .. .	38
Report to Council : Employment Officer .. .. .	40
Book Reviews .. .. .	41

---

*Published for the New Zealand Institute of Chemistry  
(Inc.), P.O. Box 250, Wellington, by*

EDITORIAL SERVICES LIMITED  
Ascot Chambers, 81 Chuznee Street, Telephone 51-416.  
C.P.O. Box 2721 Wellington, N.Z.

*United Kingdom Advertising Representative*  
Walter Judd Ltd., 47 Gresham Street, London, E.C.2.

---

*Edited by DR W. A. MCGILLIVRAY*  
Massey College Post Office, Palmerston North, N.Z.

---

*Registrar, N.Z. Institute of Chemistry (Inc.)*  
D. J. Hogan, P.O. Box 1926, Christchurch, N.Z.

# IT TAKES TEN YEARS TO MAKE A SCIENTIST

*... and sometimes as long to find one. The nation desperately needs many more. We ourselves have none to spare. But we do, in fact, make scientists for others.*



## Our ADIABATIC BOMB CALORIMETER . . .

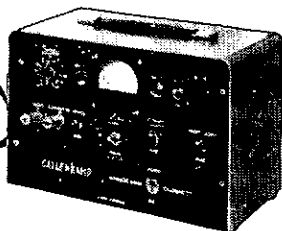
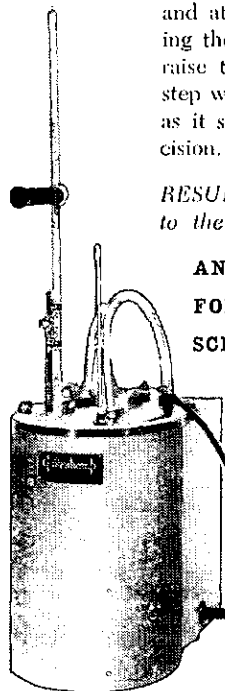
the first and only commercially available set of its kind, reduces by no less than 66% the time

and attention spent on other bomb calorimeters in measuring the calorific values of fuels and foods. The trick is to raise the temperature of the calorimeter jacket exactly in step with the rising temperature of the bomb. Not as simple as it sounds of course. But now achieved, with high precision.

*RESULT: No heat losses, no corrections, no tedious slavery to the thermometer; less fatigue, fewer sources of error.*

**AND 66% OF THE SCIENTIST'S TIME SAVED FOR OTHER WORK. A SCIENTIST SAVED IS A SCIENTIST MADE.**

And the calorimeter sets are available, not in ten years, but now, at a price at which they will pay for themselves in a matter of months.



SEND FOR  
TECHNICAL  
SPECIFICATION  
AND PRICES

**Gallenkamp** SUPPLY  
THE  
WORLD'S  
LABORATORIES

Highest  
grade stainless  
steel - first class  
workmanship -  
unequalled  
efficiency

A. GALLENKAMP & CO. LTD., Sun Street, London, E.C.2., England.  
*Cables: Gallenkamp, London.*

APPOINTED AGENTS FOR NEW ZEALAND

**GEO. W. WILTON & CO. LTD.**

63 Shortland Street, Auckland, C.I.

156 Willis Street, Wellington.

# Laboratory Glassware

*We are just unpacking a  
shipment of*

**"DUWEREX" Grade B**

## **VOLUMETRIC GLASSWARE**

*and can offer  
a full range of*

**PIPETTES**

**BURETTES**

**MEASURING CYLINDERS**

**VOLUMETRIC FLASKS**

*Also*

**"TOWERS" Double Beam Sliding  
Weight BALANCES**

Available in Two types

—Flat circular stainless steel pans

—Stainless steel scoop type pan.

**THE NATIONAL DAIRY  
ASSN. OF N.Z. LIMITED**

THORNDON QUAY,  
WELLINGTON.

BEACH ROAD,  
AUCKLAND.

P.O. Box 28.

P.O. Box 1001.

068/E

**Three decisive points:**

- Purposeful Research
- Careful Manufacture
- Conscientious Control

are the principles forming the reputation of our products.

## Guaranteed reagents *Merck*

are internationally recognized as the guarantee certificate on any package demonstrates their purity and reliability

From our sales range:

Preparations for laboratory use  
 Indicators of all types  
 Universal- and Special-Indicator-Papers  
 Ion exchangers for analytical purposes  
 Preparations for chromatography  
 Spot reagents  
 Titrisols\*  
 Titriplexes\*

Representatives in New Zealand:

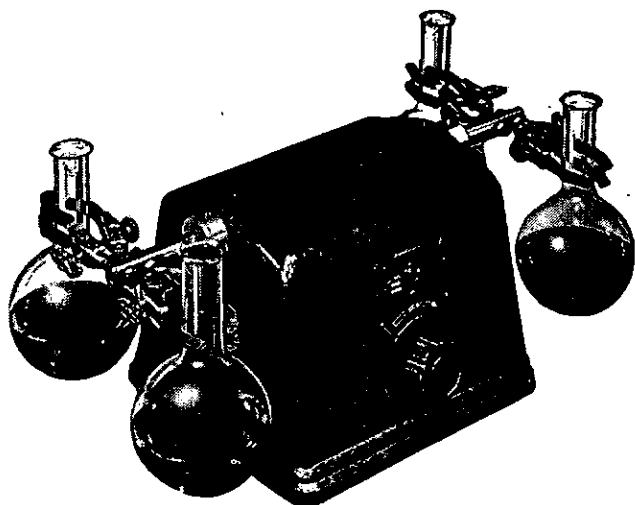
Messrs. Henry H. York & Co. Pty. Ltd.  
 11-13, Ghuznee Street, C. P. O. Box 6434  
 Wellington/New Zealand

Also at Auckland and Christchurch.

E. MERCK AG



DARMSTADT



## Griffin **FLASK SHAKER**

This shaker is one of the most popular items in the Griffin & George range, abolishing as it does the tedium of prolonged shaking by hand, often present in routine laboratory operations; it now enjoys a world-wide distribution.

● **SILENT**

Since it reproduces so many different types of agitation hitherto attainable only by hand, it may be termed a "wrist action" shaker.

● **VARIABLE SPEED**

It carries up to four 500 ml flasks each half full of liquid, is silent in operation, can be used on the laboratory bench and does not need permanent fixing.

● **WRIST ACTION**

Powered by a 1/30 h.p. fan-cooled motor (consumption 60 watts) it may be connected to AC or DC lighting circuits and is continuously variable in speed up to a maximum of 500 oscillations per minute, producing agitation from a gentle slopping to a violent cascade.

● **PORTABLE**

For use on either 100—110 or 200—250 V AC/DC.

**GRIFFIN & GEORGE (SALES) LIMITED**

THE LABORATORY FURNISHERS

Ealing Road, Alperton, Wembley, Middlesex, England.  
Available also from New Zealand laboratory suppliers.



# CHEMICALS

by

**Garrett, Davidson & Matthey (N.Z.) Ltd.**

*The following chemically pure and Analytical Reagent quality "CHEMICALS" are manufactured in our laboratory to the highest "world standards"—*

SILVER NITRATE C/P.

SILVER NITRATE A/R.

SILVER NITRATE  
DENTAL

SILVER CYANIDE  
SINGLE SALT

SILVER SALT  
(ready mix)

SILVER IODIDE

SILVER IODATE

SILVER OXIDE

GOLD METAL C/P.

GOLD CHLORIDE

GOLD PLATING

SOLUTION

GOLD PLATING SALTS

PLATINUM BLACK

PLATINIZED

ASBESTOS

PLATINUM CHLORIDE

RHODIUM SOLUTION

ELECTROLYTIC

CLEANING SALTS

"QUALTEST" OUTFIT

(Testing precious metals)

AMMONIA C/P.

\*

22 Drake Street AUCKLAND P.O. Box 2073

Telephone: 21-786 (2 Lines) Telegraphic Address: "Rollers"

# ACCLAIMED BY USERS in New Zealand Laboratories

The New

# GALLENKAMP

## OVENS - INCUBATORS

### Super Performance

#### Features Include—

- Clean Modern Styling.
- Extensively tooled for precision, quantity, production.
- Flame-proof working space—externally fitted large area Heaters.
- Uniform Temperature distribution. Small temperature fluctuation. Fast Temperature recovery—insignificant overshoot.
- Unrivalled specification and performance at low cost.
- Choice of three sizes.
- Stainless Steel Interior, Shelves and Internal fittings.
- Thermostatically controlled by our new "Compenstat" hydraulic Temperature controller with snap-action contacts.
- Temperature setting not affected by contact wear.
- Adequate ventilation.
- NEGLIGIBLE INTERFERENCE WITH RADIO AND T.V.—APPROVED BY G.P.O. IN UNITED KINGDOM.

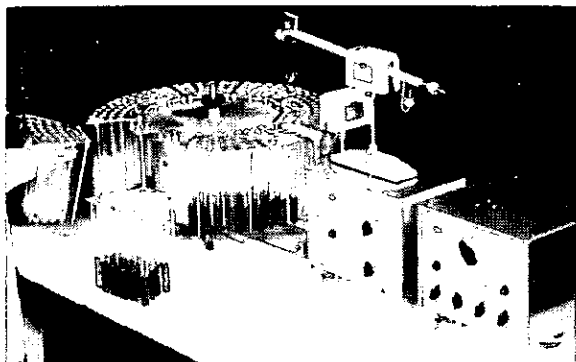
Available From:

## Geo. W. Wilton & Co. Ltd.

P.O. Box 367  
WELLINGTON

P.O. Box 1980  
AUCKLAND

# INSTRUMENTS FOR PHYSICAL CHEMISTRY

L  
K  
B

## **RadiRac Automatic Fraction Collector**

The need for automatic devices for fraction collecting in connection with analytical as well as preparative work in electrophoresis and chromatography is rapidly increasing. Designed to relieve laboratory personnel from a dreary routine work, the RadiRac Automatic Fraction Collector offers a complete system of separate units which can be combined in numerous ways to set-ups with different performance characteristics.

**JUST ONE ITEM FROM THE VERY WIDE RANGE  
OF SCIENTIFIC INSTRUMENTS  
SOLD AND SERVICED BY**

**WATSON VICTOR**  
**LIMITED**  
(INCORPORATED IN NEW SOUTH WALES)

AUCKLAND WELLINGTON CHRISTCHURCH DUNEDIN  
Established over 70 years

# JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. 24, No. 1

February, 1960



E. W. HULLETT  
*President, 1960*

## PRESIDENT

President for 1960 is E. W. Hullett, Director of the Wheat Research Institute, Christchurch. Mr. Hullett is a foundation member of the Institute and was elected a Fellow in 1943. He has been committeeman, secretary, and chairman of the Canterbury Branch and was Conference chairman in 1957.

Before joining the Wheat Research Institute in 1934, Mr. Hullett held a temporary position as assistant chemist at Lincoln College. As an undergraduate he was a student assistant in the Chemistry Department, and held a Charles Cook Memorial Scholarship in his honours year and a National Research Scholarship before going to Lincoln.

Already at Lincoln Mr. Hullett had some contact with the work of the Wheat Research Institute and established friendships with F. W. Hilgendorf and O. H. Frankel, Director and Plant Breeder respectively, that were to stand him in good stead after 1936 when he became Chief Chemist and responsible for chemical, milling and baking activities. Mr. Hullett carried on the policy of his predecessor, H. E. West, of working closely with the industries, but welcomed the insistence of Professor Denham, well supported by O. H. Frankel, that things other than "bread and butter" must be given due attention.

A great deal of investigational work was entailed in sifting the ideas held by men in the industries and thus establishing a body of practical knowledge essential as a background to many activities. First work in the chemical field concerned oxidation in doughs, a subject that took the attention of several colleagues at various times. This work dovetailed into the development of a system of baking process control that has been a cornerstone of the Institute's work in mechanized bakeries.

Work in mass drying of grain widened into a general interest in air/water mixtures. During recent years this turned to the measurement of humidities at high temperatures, and this has led to design modifications for large ovens.

Collaboration with the wheat breeders has been an abiding interest, and the need to have reliable assessments of the quality of new hybrid wheats has provided at least half the motive for a constant concern with methods for determining wheat quality.

We congratulate Mr. Hullett on his election to the Presidency and wish him well during his term of office.

## Vice-President

Vice-President this year is Professor H. N. Parton, Professor of Chemistry, University of Otago, Dunedin.

## CHEMICAL ASPECTS OF DENTAL RESEARCH

C. R. BARNICOAT

*Cawthron Institute, Nelson.**(Based on Mellor Memorial Lecture delivered to the Wellington Branch, September, 1959.)*

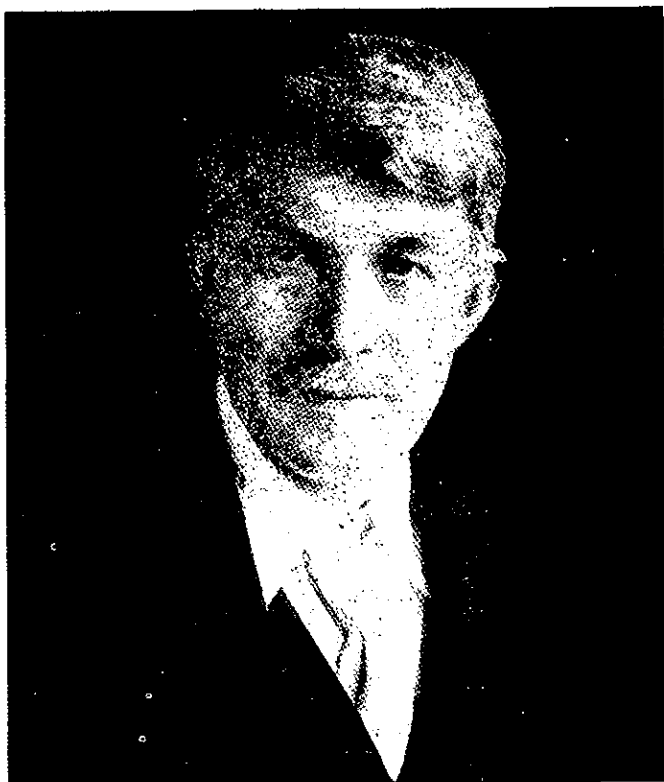
It is indeed an honour to be invited to deliver the Mellor Memorial Lecture. This annual lecture has been instituted to help perpetuate the name of Joseph William Mellor among our younger members, and the scientists of the future, long after his discoveries have become merged with general knowledge, and his textbooks have fallen into disuse. For Mellor's contributions to theoretical chemistry were prodigious and he is generally regarded as having been the most famous inorganic chemist of his day.

Joseph William Mellor is claimed and acclaimed as a New Zealander, but he was, in fact, born in Yorkshire in 1869 and did not come here until he was eleven years of age. His father, a skilled worker in the Roslyn Woollen Mills, brought up his family strictly on evangelical and teetotal lines. After attending school for only one year, young Mellor, at twelve years of age, started working in a boot factory. He was an earnest, studious lad, interested in literature and science, and naturally enough was regarded by his fellows as "a bit queer". He attended technical classes in Dunedin after his day's work, and since there was no accrediting or provisional matriculation in those days, he did not pass the equivalent of University Entrance until about twenty-three years of age.

He won a bursary and attended university lectures as a part-time student. When twenty-eight years old he graduated B.Sc. (and Senior Scholar in Chemistry). The following year (1898) he gained 1st Class Honours in Chemistry and the 1851 Exhibition Science Scholarship. He had to sit the exams twice\* as the *Mataura*, carrying examination scripts, was wrecked off Cape Horn.

Joseph Mellor married, and then went to Owens College, Manchester. From then on his career was assured—D.Sc. and honorary degrees, research in the Potteries district, travelling lectureships to Europe and America, Fellow of the Royal Society, and founder of the Ceramic Society. In addition to many important scientific papers, he was a writer of textbooks, including the 16

\*According to Captain D'Arcy Maxwell of Nelson, who was third officer of the *Mataura*, these unfortunates were later described as "holding the *Mataura* diploma".



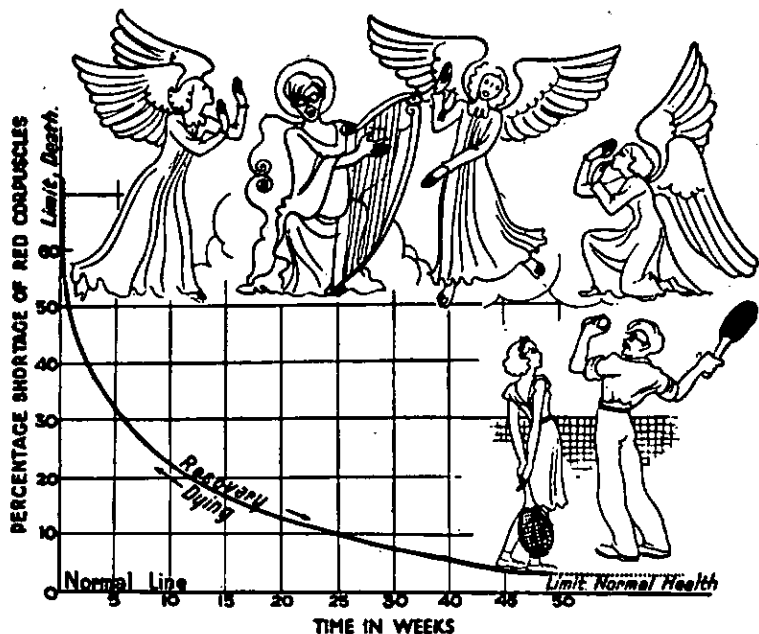
JOSEPH WILLIAM MELLOR

(Acknowledgments to Dunedin Public Library Association.)

volume *Comprehensive Treatise on Inorganic and Theoretical Chemistry*, which he started in 1912 and completed twenty-five years later, one year before his death in 1938 at the age of sixty-nine. He was also a skilled draughtsman, a writer of humorous stories, and a brilliant chess player.

Unlike many of his generation who made sacrifices in order to obtain an education, he never let the iron enter his soul, or became embittered. He was full of fun and high spirits, as one of his works, *Uncle Joe's Nonsense*,<sup>†</sup> will testify. This was written for nephews, as he had no children of his own. A typical illustration reproduced in Fig. 1 shows that he had distinct leanings

<sup>†</sup>*Uncle Joe's Nonsense for Young and Old Children—a Medley of Fun and Philosophy*. Reported by J. W. Mellor, Honorary Secretary of the Ceramic Society, with 129 drawings and 2 photographs. 231 pages. Longmans, Green & Co., London. 1934.



### THE MATHEMATICS OF PERNICIOUS ANAEMIA

The curve taken left to right shows the rate of recovery from pernicious anaemia; and if taken from right to left, it represents the progress of the disease—normal health is one limit of the curve, and the other limit is death.

I have found my thoughts take wildest flight  
 Even at the moment when they should array  
 Themselves in pensive order.—LORD BYRON

Fig. 1: Illustration from *Uncle Joe's Nonsense* by J. W. Mellor.  
 (By kind permission of Mrs. J. W. Mellor.)

towards biochemical investigation! He must have been a delightful person—a brilliant scientist, free from self-importance and scientific cant, of wide culture, and genial. We still have plenty of room for men of his type in the scientific profession in New Zealand.

Because of his wide scientific interests Mellor, one feels, would have been intrigued by many of the problems relating to the crystallization and stability of the calcium phosphates comprising the inorganic portion of the "hard tissues", just as they interest many leading theoretical chemists at the present day. It is hoped that this article will give readers some idea of the fascination of the problem although it deals rather generally only with the main aspects.

## GENERAL AND NUTRITIONAL ASPECTS

Chemical problems of the dental tissues are, on the whole, similar to those of bone, the major "hard tissue" of the animal body, but they have proved much less tractable subjects for investigation.

Nutritional aspects of calcification have been given great attention during the last quarter century, but biochemical aspects have tended to be postponed because of inherent technical difficulties. Recently, however, these studies have gained great impetus, partly because of the problems posed by increases in such ailments as arthritis and other disorders of bone, as well as by problems of ageing and, of course, dental caries; and partly because of the sudden interest aroused in the "bone-seeking" elements, especially  $^{90}\text{Sr}$ , and other radioactive fission products. New techniques, such as histochemistry, electron microscopy, autoradiography, and micro-chemical methods, including chromatography, have fortunately appeared at an opportune time.

An enormous amount of work has been carried out, particularly in the United States of America, on the calcium and phosphorus requirements of animals in order to formulate feeding standards. Numerous factors—the nature of the feedstuff, the amounts and proportions of both inorganic ions (*i.e.*, their

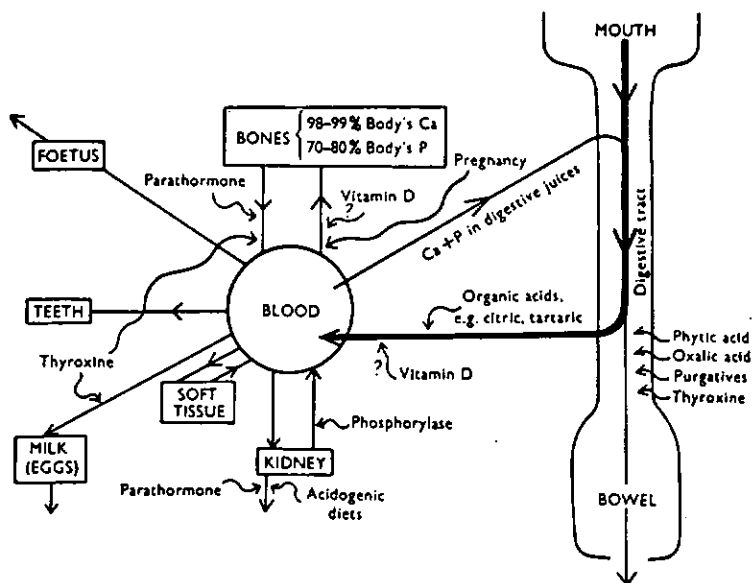


Fig. 2: Diagrammatic representation of metabolism of calcium and phosphorus. (After Owen.)

balance), the effects of antagonistic substances (both inorganic and organic), the activities of vitamins and hormones, and the influence of disease—have been found to influence the degree of retention of the inorganic elements by animals (Fig. 2).

The value of much of this work is now being questioned. Experiments with animals have confirmed observations on man which indicate that the animal organism can adapt itself to intakes of calcium and phosphorus far below those normally regarded as desirable. It has also been recorded that, while members of races on diets poor by civilized standards often develop under-sized bodies and "rickety" bones, they usually have excellent teeth. Members of well-fed, "civilized" populations, however, though physically well developed, and long-lived, frequently have poor teeth very susceptible to caries. Dental caries is, in fact, a disease of civilization, and a serious one.

It is remarkable that the teeth of children which developed during the Second World War in countries on a lowered food standard (*e.g.*, Great Britain and, in particular, Norway) are of much better quality than usual. It is evident that a luxurious diet is conducive to poor teeth.

### CALCIFICATION STUDIES

Early research work on teeth followed closely the lines suggested by results of investigations on bone. This is unfortunate. It now appears that, while at cell level the biochemical processes concerned in calcification are probably similar for bones and teeth, there are distinct and important differences in their characteristics at tissue level, owing to their differences in physiological function.

#### Bone

Bones have three well-defined functions:

- (1) They are the supporting framework of the body, controlling size and rigidity, yet they are marvellously articulated to allow movement.
- (2) Bone is a detoxicating tissue which removes, via the blood, numerous toxic "bone seeking" elements—lanthanides, lead, barium, strontium, etc., and radioactive fission products.
- (3) Medullary bone is a storehouse of major inorganic ions of the animal body, particularly calcium and phosphorus, against sudden demands, *e.g.*, initiation of lactation. As much as 20-30% of the bone is readily available when called on by other tissues.

Bone is, therefore, essentially *labile*, metabolically active, and self-repairing.

### Teeth

Teeth, on the other hand, are primarily designed for the mechanical work of biting and chewing, and are essentially *stable* structures. With the exception of the continually-wearing, tusk-like incisors of rodents, their ability to repair themselves is slight. It is this lack that renders the teeth of man so susceptible to caries, or decay—a matter of importance to many in this country.

Teeth are composed of three layers—enamel, dentine and cementum.

*Enamel*, the thin outside casing on the exposed surface, is the hardest substance in the body, being about as hard as cast-iron. It contains 97% inorganic matter, 0.3% protein (*eukeratin*) and 0.1% citrate, and water.

*Dentine*, the chief supporting structure, is about as hard as brass, and is elastic. It contains about 65% inorganic matter, 20% organic matrix, chiefly *collagen* (a keratin), and a *ground substance*, less than 1% citrate, and 10% water.

The inorganic substance of the tooth is *hydroxy apatite*, of general formula  $[Ca_n(PO_4)_2] \cdot [Ca(OH)_2]$ , where  $n$  varies from 2 to 10. About 6% calcium may be replaced partly by magnesium and sodium; hydroxyl partly by carbonate ("carbonate apatite"), chloride and fluoride. Sodium and citrate appear to "tuck themselves away" into the crystal lattice.

The proteins are albuminoids (keratins) but are distinct and experiments with  $^{15}N$  indicate great stability. (Eukeratin, of enamel, is even more insoluble and resistant to enzymes than collagen, of dentine, which occurs also in bones, feathers and hooves.)

*Cementum* is different from the other two being similar to bone.

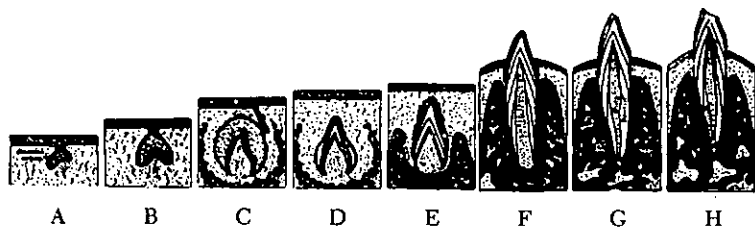


Fig. 3: Diagrammatic illustration of the life cycle of the tooth. (After Schour and Massler.)

GROWTH: A Initiation, B Proliferation, C Differentiation;  
 CALCIFICATION: D;   ERUPTION: E and F;   ATTRITION: G and H.

*Origin of Enamel and Dentine*

Variations in the chemical compositions of enamel and dentine are consistent with their different origins. Figure 3, illustrating the development of a tooth, shows how enamel is formed from epithelial tissues, dentine from mesodermal tissues, the dentine papilla developing into the pulp. Teeth are living structures, permeated by protoplasmic processes in the dentinal tubules (Fig. 4) and by finer extensions in the enamel. Dentine retains its self-repairing properties. Human teeth, for example, can lay down "irregular" or secondary dentine, and carious fissures in the enamel are readily sealed off by this means. In sheep's teeth this is normal. Many old sheep in New Zealand, after wearing out their original teeth, have replaced them with short, but serviceable stumps of secondary dentine which have formed as deposits in the root canal.

Figure 5 shows how  $^{90}\text{Sr}$  is laid down in the continually-growing rat incisor. The rate of uptake of strontium (which is

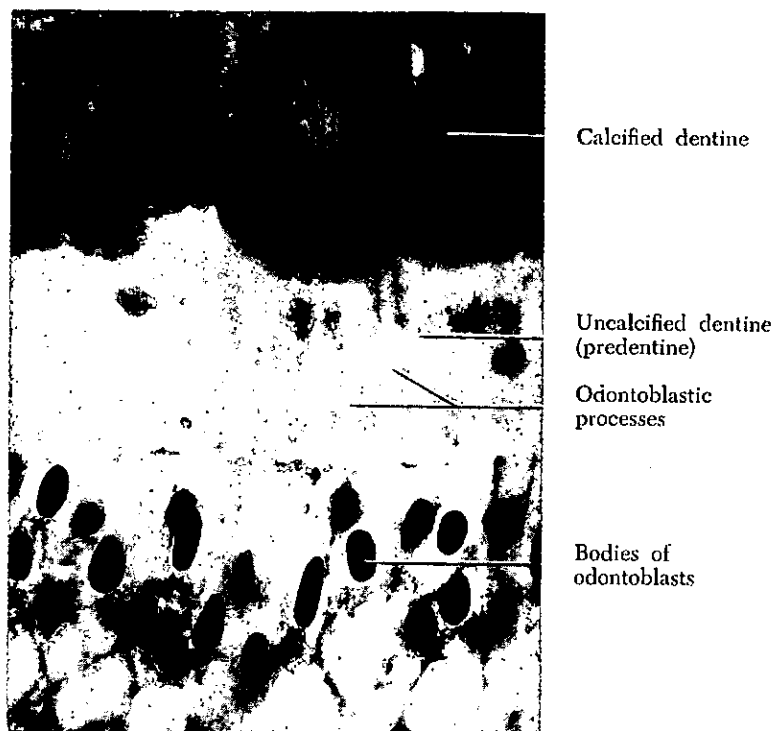


Fig. 4: Odontoblastic processes extending into dentine.

similar to that of calcium) is high in spongy bone and in the odontoblast layer of the incisor.

While mature teeth are rather inert structures biochemically, unerupted developing teeth are extremely active (resembling rats incisors) and their nutritional demands take precedence over other tissues, even the bones. In cases of extreme deficiency of calcium and phosphorus, teeth are much less affected than bones—a wise precaution of Nature.



*Fig. 5: Thin undecalcified section through frontal region of rat killed 15 minutes after intraperitoneal injection of strontium-90. (After Engstrom and others 1957.)*

A (Upper): Radioautogram showing high intake of strontium-90 in spongy bone and incisor.

B (Lower): X-ray photo of same section.

### *THE NATURE OF DENTAL CARIES*

Since teeth are relatively stable structures biochemically, and function and last well in wild animals and in primitive man, why

is dental caries of man rampant in most civilized countries throughout the whole world?

Caries is a surface defect of teeth originating in the oral cavity, and is of dietary origin. This has finally been proved by feeding cariogenic (60% sucrose) diets to animals by means of a stomach tube. By-passing food from the mouth results in complete absence of caries. Caries is initiated by the chemical action of micro-organisms (chiefly Gram-positive lactobacilli), which multiply and ferment in food residues in crevices and folds of enamel, and even on smooth surfaces (as plaques), producing lactic acid which dissolves the calcium phosphate of the tooth. Starchy foods, because of their adhesive nature, are much more cariogenic than sugars. There is evidence that the bacterial proteases also participate by attacking the protein matrix of the tooth, but the attack by acids is generally regarded as the chief factor in caries initiation.

Rigid proof that micro-organisms cause decay comes from elaborate experiments with animals born and reared under germ-free conditions, and fed on synthetic diets. Food residues of cariogenic diets on their teeth, in the absence of micro-organisms, do not undergo fermentation to acids and consequently caries does not develop.

Hereditary factors are also concerned, and there are strains of rodents differing in their susceptibility to caries. It has also been shown that the diet of the mother affects the susceptibility of her offspring to caries—such pre-natal influences of diet in teeth are still unexplained.

An important problem, fundamental to this investigation, is the choice of laboratory animals for this work. The continually growing rodent incisor is too dissimilar from a human tooth, even for "smooth caries," typical of tooth decay in man, but molars give comparable results. The problem of evaluating caries is difficult, too. Most research institutions have developed their own set of empirical standards, but unanimity between workers is essential for future progress.

## *CHEMICAL INVESTIGATIONS ON DENTAL PROBLEMS*

The principal lines of chemical study on dental problems have been concerned with saliva and with tooth structure.

### *Saliva*

Saliva plays an important part in retarding the onset of caries. Removal of the major salivary glands, even before tooth eruption, renders the teeth extremely susceptible to caries. The protective action of saliva is partly a detergent effect. Numerous investigations on its capacity to neutralize acids (pH and buffer capacity), its content of calcium and phosphorus, and other

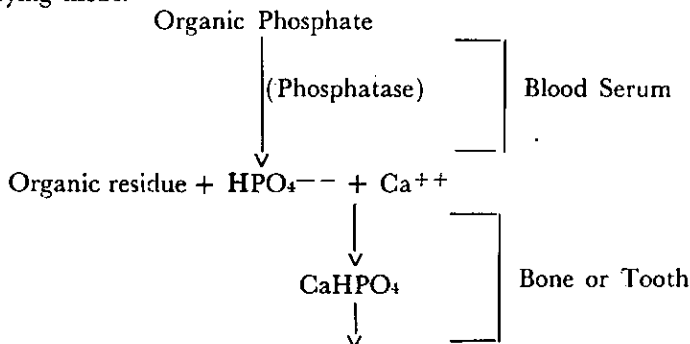
inorganic substances, the presence of antibiotics and bacteriostatic substances, and other potential caries-resistant agents have not so far proved encouraging.

### Tooth Structure

This presents many perplexing chemical problems. The inorganic constituents of teeth, with the exception of fluorine, vary only slightly even between sound and carious teeth. Fluorine tends to concentrate on the surface of the enamel and protect it against caries. Recent researches have tended to concentrate on the precipitation of calcium phosphate and its crystal structure, and on the properties of the organic matrix.

### Precipitation of Calcium Phosphate from Blood Serum

Robison (1923) postulated a simple mechanism for the precipitation of calcium phosphate ("bone salt") in hard tissues, based on the fact that the enzyme phosphatase always occurs in calcifying tissue.



This ingenious theory explained why phosphate and calcium, in concentrations exceeding the apparent Solubility Product, fail to react until  $\text{HPO}_4^{--}$  is released from non-ionized organic combination by the enzyme phosphatase. But there are serious objections to this theory. Phosphatase always appears in calcifying tissue, but it is also normally present in greater concentrations in soft tissues such as the gut wall and the kidneys. Since this enzyme participates in protein synthesis (*e.g.*, wound healing) it is now considered that its function in calcification is concerned with the formation of the protein matrix of bones and teeth. Another suggested function of phosphatase in calcification is that of destroying organically bound phosphates which "solublize" or "complex" inorganic phosphates.

The mystery of the apparent supersaturation of calcium and phosphorus in blood serum vanishes when calculations are based on Activity Coefficients at physiological ionic strengths—*i.e.*, their True Ionic Solubility Products. In terms of  $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$ , the solid phase which precipitates initially, the True Ionic Solubility

Product (Activity Product) is about  $1 \times 10^{-7}$ , a very low value indeed. The precipitated  $\text{CaHPO}_4$  is unstable at "physiological pH"—about 7.4—the only permanent solid phase of the system  $\text{Ca-PO}_4\text{-H}_2\text{O}$  being *hydroxyapatite*.

### Crystallization of Calcium Phosphate

The circulating fluids of the body are normally supersaturated with respect to bone mineral and undersaturated with respect to  $\text{CaHPO}_4$ . This seems incredible! There must therefore be some mechanism which under the influence of cells responsible for calcification causes crystallization of  $\text{CaHPO}_4$  from undersaturated solution, and some mechanism which prevents the hydroxy apatite from being swamped with crystals from the surrounding body fluids supersaturated with respect to it. These mechanisms operate simultaneously.

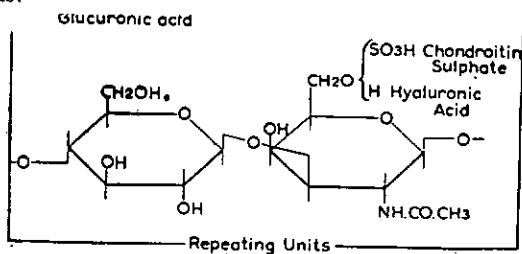
Consider first the problem of crystallization. It has long been postulated that a "local factor" initiates crystallization by causing precipitation of calcium or phosphate by raising the local concentration of one of them (*e.g.*, Robison's theory). This appears to be a function of the organic matrix.

### Nature and Function of the Organic Matrix

The organic matrix of dentine (about 20% by weight) is secreted by the odontoblasts (Fig. 4). It is composed chiefly of fibres of collagen (an albuminoid protein, or keratin), about 800Å wide, of indeterminate length, and cross-banded at about 650 Å. They form a "skeleton to a skeleton", apparently acting as a template for the inorganic crystals (Fig. 6).

The hydroxy apatite crystals apparently link with the NH and  $\text{NH}_2$  groups of the poly-peptide chain, since these groups are not detectable until the inorganic matter has been removed by mild chemical treatment.

About 1/20th of the matrix is *ground substance* filling the spaces between the collagen fibres and the apatite crystals and permeable to ions of the blood serum. It is a *mucopolysaccharide* consisting of protein, carbohydrates, glucuronic acid and hexosans in sulphated (chondroitin sulphate) and non-sulphated (hyaluronic acid) forms:



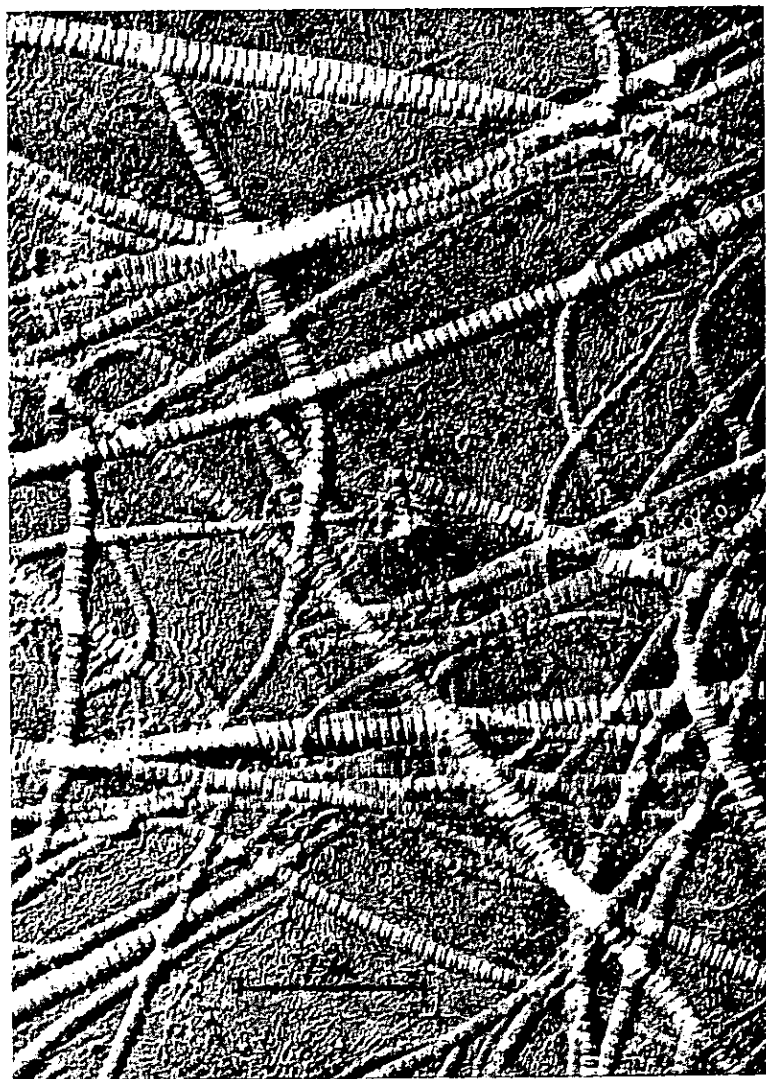


Fig. 6: Electron micrograph of collagen fibres.

#### METACHROMASIA AND CALCIFICATION

Histologists have long known that certain tissues, especially collagenous matrix, are *metachromatic*, i.e., their colour after treatment with certain basic histological stains differs from that of the original dye. Strongly acid groups in organic combination such as sulphate are responsible. Metachromasia disappears as calci-

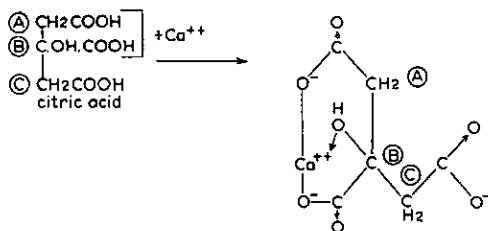
fication progresses. The chondroitin sulphate is spaced along the fibrils of collagen at intervals of 650 Å causing the characteristic banding. Apparently the  $\text{SO}_3\text{H}$  group can fix calcium, and is, therefore, a "local factor," the phosphate group being bound secondarily. This theory differs sharply from older ones, which postulate phosphate as the foundation, binding group.

The theory has been tested by a number of ingenious experiments. It has been shown, for example, that, after exposing the collagenous matrix to metachromatic and other basic dyes, subsequent calcification is inhibited because the dye molecules combine too firmly with the  $\text{SO}_3\text{H}$  of the chondroitin sulphate for calcium to be bound at all. Experiments with  $^{35}\text{S}$  indicate its synthesis into acid groups of the mucopolysaccharide ground substance and distribution in the matrix before the appearance of keratin, which is consistent with the view that it participates in the formation of a matrix which functions as a template for calcification. Once calcification has begun crystals grow by seeding or *epitaxy*, i.e., intergrowth and overgrowth resulting in an intermeshing structure of great strength.

All collagenous tissues do not calcify, of course, and there are other difficulties in the theory. The crystal size and the banding on the collagen do not match properly; and calcification has been observed on matrix devoid of  $\text{SO}_3\text{H}$ , in which case phosphate appears to have been the "local factor."

### CELLULAR CONTROL OF CALCIFICATION

No reference has been made to the mechanism which provides the energy for "driving" the processes involved in calcification, nor to the mechanism which prevents the hydroxy apatite from being swamped by crystallization from the supersaturated blood stream. It is believed that these processes are controlled by certain cells (osteoclasts) of the dental tissues, and that citrate (an important intermediate of cell respiration and universally present in calcified tissues) is of fundamental importance. Citrate has a powerful chelating action on calcium even at physiological pH (7.4). A local concentration can remove calcium ions from solution, and even from insoluble compounds, immobilizing them in the form of a soluble non-ionized chelate:



The concentration of citrate (which removes calcium) is apparently controlled by the hormones of the parathyroid gland. Opposing the action of the parathormone is vitamin D, another product of cell synthesis, which favours precipitation of calcium salts. Under normal conditions the antagonistic activities of the parathormone and vitamin D are maintained in equilibrium. The living protein framework of the tooth—eukeratin of enamel, collagen of dentine—apparently limits its boundary, so that crystallization of calcium phosphate outside the tooth, if it occurs, is restricted to the unorganized encrustation tartar.

In common with other tissues of the body, teeth are in a state of "dynamic equilibrium", constantly breaking down and being rebuilt. The elegant hypothesis of the interplay of citrate and vitamin D provides a logical theory on which to base future investigations, for it explains satisfactorily the functions of various well-known chemical and biochemical reactions, observed in calcifying tissues, which previously seemed to bear little relation to one another.

Problems of calcification present a real challenge to research workers in a number of fields—physics, chemistry, biochemistry, physiology, as well as dental and medical research. If, because of the complexity and scope of the problems, the difficulties appear unsurmountable, let us remember the inspiring example of Joseph William Mellor—the boy who had to start work when only twelve years old, but by ability, pluck and sheer hard work later gained the coveted 1851 Exhibition Science Scholarship, and eventually became one of the world's leading theoretical chemists.

## ANALYSIS AND SYNTHESIS

A. D. CAMPBELL

*University of Otago, Dunedin.*

*(Based on Easterfield Lecture delivered at the Institute of Chemistry Conference, Dunedin, August, 1959.)*

I must thank the New Zealand Section of the Royal Institute of Chemistry for the award of the 1959 Easterfield Medal. We meet in honour of that great scientist, Sir Thomas Easterfield, who contributed so much to our profession as a Professor of Chemistry, as a Research Director, and as an active member of the Institutes which meet at this Conference.

The broad nature of the title of this address is not as conflicting as might at first appear. Since my first introduction to organic chemistry in this department some 16 years ago, I have always been interested in the methods of synthetic organic chemistry. Such work depends to a very large extent on the analyst, and some years later when I was given the opportunity of understudying a microanalyst I quickly accepted.

In 1910 Pregl scaled down, and in following years refined, existing methods of quantitative organic analysis to what we today call milli-gram or micro-chemical methods. These analytical methods he later perfected and spread throughout the world by his many students, his brilliant contribution to chemistry being honoured by the award of a Nobel Prize. But as organic chemists today continue their rapid advance into ever-widening fields they forever bring new problems to the analyst. Not so long ago organic compounds could be defined as containing not more than about six or so of the common elements but this is not so today. One way or another it is now possible to produce compounds containing carbon in combination with one or more of almost any of the known elements. Whether or not you would call all such compounds organic is not clear but all must be analysed sooner or later in the proof of their constitution.

Let us have a look at two problems in microanalytical work which have been considered in our laboratory in recent years. The molecular weight of an organic compound is a very valuable property and we are in our laboratory attempting to perfect what is known as the isopiestic method<sup>[1]</sup> for the determination of molecular weights. When two solutions containing different solutes are placed in a closed space, solvent vapour (*e.g.*, chloroform or acetone) will distil from the solution of higher vapour pressure (the solution of lower molecular concentration) and condense on the one having the lower vapour pressure until equality of vapour pressure is attained. If we determine the weight composition of

the two solutions at this equilibrium point and know the molecular weight of one of the solutes, the molecular weight of the other can be calculated using the expression

$$\frac{W_1}{M_1 S_1} = \frac{W_2}{M_2 S_2}$$

Where  $M_1$  and  $M_2$  are the molecular weights of the two compounds,  $W_1$  and  $W_2$  are the weights of the two compounds and  $S_1$  and  $S_2$  are the weights of solvent associated with each compound. We have shown that for a fairly wide range of compounds a high order of accuracy can be attained by weighing the samples (about 3 to 5mg of unknown and standard) into small platinum crucibles, equilibrating added solvent by rocking in a small desiccator and analysing the resulting solutions by weighing, the attainment of equilibrium being shown by a constant molecular weight in two successive experiments.

There are certain difficulties in the method—equilibrium is attained only slowly, certain compounds are insoluble in suitable solvents at room temperature, and some compounds are very prone to “creep” and crystallize as a crust above the liquid level. We have now designed an apparatus of low internal volume (about 20 ml) which will hold four crucibles. In this apparatus the use of two standard substances enables the attainment of equilibrium to be checked, one standard substance against the other, and also it gives two values for the molecular weight of the unknown—a further check. Experiments are under way to determine the effect of temperature changes on the rate of equilibration.

Let us now look at the Zeisel method as adapted for the micro-determination of methoxyl groups. Tested methods of analysis sometimes break down—reproducible results are not always correct results. The determination of methoxyl groups depends on the ability of boiling hydrogen iodide to split methyl iodide from a methyl ether in various solvents. The methyl iodide being volatile is carried through the apparatus by carbon dioxide, first through a scrubbing solution and then into bromine in glacial acetic acid where, following a series of reactions, thiosulphate titration of iodine gives a quantitative estimation of methoxyl groups originally present. During the analysis of a series of samples supplied by one research laboratory, it was found that methoxyl values were consistently high. The samples were chromatographically pure. The first clue to the trouble was in the structure of the compounds—they were all related to *tert*-butyl substituted phenols and their methyl ethers, types of compounds now frequently used as antioxidants. A large series of compounds

of a similar type were subjected to the various conditions used in modifications of the Zeisel procedure and the results were significant<sup>[2]</sup>. Particularly in the presence of propionic anhydride in the solvent mixture *tert*-butyl substituted phenols give rise to high methoxyl values. However, the presence of methyl, *sec*-butyl or *iso*-butyl groups did not give rise to anomalous results. Of two scrubbing solutions tested, one containing cadmium sulphate and sodium thiosulphate proved to be more efficient than aqueous sodium acetate which is now extensively used.

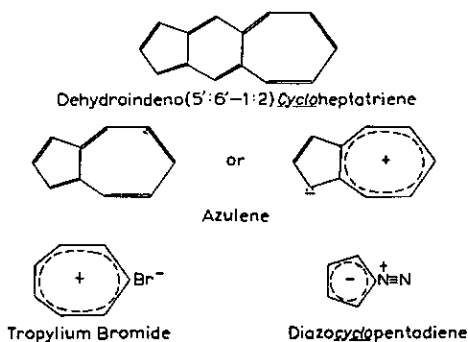
Various workers have shown that the *tert*-butyl group in aromatic compounds is rather labile particularly when it is ortho or para to an activating group such as the phenolic-OH group. This is known to be the case even in the presence of dilute hydrochloric acid.<sup>[3]</sup> If then, under the acid conditions of the Zeisel determination, a *tert*-butyl group splits from a *tert*-butyl substituted phenol as a carbonium ion, it could combine with an iodide ion to form *tert*-butyl iodide. *tert*-Butyl iodide, however, boils at 103°C and is easily decomposed into *isobutylene* and hydrogen iodide by heat and one would expect such a decomposition to occur to some extent under the experimental conditions. The result of a time recovery study<sup>[2]</sup> shows that the theoretical value is exceeded even after five minutes reaction time. This is consistent with the decomposition of most of the *tert*-butyl iodide not distilled during the early part of the reaction. It also explains why a low recovery (18.8%) is obtained from *tert*-butyl alcohol under conditions which give theoretical recoveries of *n*- and *sec*-butyl iodides from the corresponding alcohols. Undecomposed *tert*-butyl iodide is slowly hydrolysed to *tert*-butyl alcohol and hydriodic acid by water and hence any aqueous solution will decompose the iodide to some extent. From our experiments it is apparent that the scrubbing solution containing thiosulphate is the more efficient, probably due to complex formation.

For the remainder of this lecture I wish to consider some applications of synthetic organic chemistry, particularly in the field of polycyclic aromatic hydrocarbons.

We all know that benzene is a remarkably stable compound and nearly all of us use the system of alternating double and single bonds to represent the benzene molecule. Two equivalent Kekule structures may be written and we say that the true structure is somewhere between these two. Polycyclic aromatic hydrocarbons can be looked upon as an extension of the benzene system. Azulene is an interesting case—a very small percentage of the molecules exist in a blue metastable state but in spite of the ring system being made up of a 5-7 membered ring system its ultra-violet spectrum closely resembles that of naphthalene. In fact, it shows quite a number of properties which we associate

with aromatic character. On the other hand *cyclo*-butadiene, *cyclo*-octatetraene and pentalene show no aromatic character whatever—in fact, the last named has defied all attempts at its synthesis.

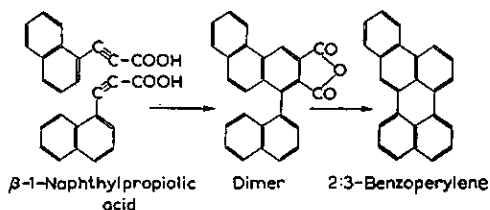
Some years ago, working in conjunction with S. N. Slater, attempts were made to prepare the 5-6-7 ring system dehydroindeno(5':6'-1:2)*cyclo*heptatriene<sup>[4]</sup> and compare its properties with the known isomeric benzo-azulenes.



The ring system involved is not difficult to construct by simple techniques of organic chemistry. Glutaric anhydride was condensed with hydrindene in the presence of anhydrous aluminium chloride and the resulting  $\delta$ -5-indanyl- $\delta$ -ketovaleric acid was reduced by the Clemmensen procedure to  $\delta$ -5-indanylvaleic acid which cyclized with anhydrous hydrogen fluoride to idano-(5':6'-1:2)*cyclo*hepten-3-one. Reduction of the latter ketone gave a hydrocarbon, which defied a wide range of reduction techniques. But this is not surprising when we look at the modern concept of aromaticity. During the past few years, the synthesis of the stable *cyclo*heptatrienylium (tropylium) bromide and diazo-*cyclo*pentadiene ring systems which in their reactions show a certain amount of aromatic character has led to a rethinking of what property is necessary to make a stable ring system. It is a system of 6 electrons (we call them  $6\pi$  electrons) and they may be associated with a cyclic structure having 5, 6 or 7 carbon atoms. The 5-carbon system must gain an electron and the 7-carbon system must lose an electron to give these systems and hence the neutrality of the benzene system. Azulene then has one ring which can lose an electron and one ring which can gain an electron, the resulting molecule being neutral but with a high dipole—which azulene has. Pentalene on the other hand must gain 2 electrons and this obviously cannot be accomplished. Now let us have another look at the 5-6-7 system. Like azulene it

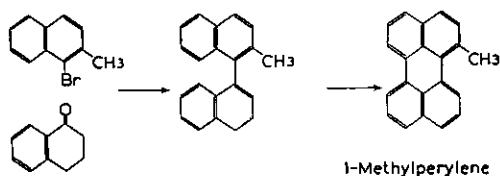
could give rise to a neutral molecule of high dipole but the separation of charge would be a large one—apparently too large for stability. Theory supports experiment. Experiment supports theory.

The dimerization of phenylpropionic acid was first noted about sixty years ago. It is a reaction of the Diels-Alder type and because of the presence of a triple bond in the diene and in the dienophile components the new ring system is aromatic. This dimerization reaction was extended by subsequent workers, particularly Baddar who is interested in the theoretical aspects of the reaction. In 1953, J. W. Cook pointed out the possible use of this reaction as a means of preparing condensed polycyclic aromatic systems and I was immediately successful in synthesising 2:3-benzoperylene from  $\beta$ -1-naphthylpropionic acid.<sup>[5]</sup> Other examples investigated showed the versatility of the reaction and the mixed condensation brought about by reacting the acid chloride of one propionic acid with the acid of another extended the reaction further.



We are at the moment investigating another aspect of this reaction in which one component, the dienophile, is not an aromatic component and we have been successful in extending several ring systems by one further ring. It also has uses in the preparation of methyl substituted aromatic systems; in fact there are many aspects which still require investigation.

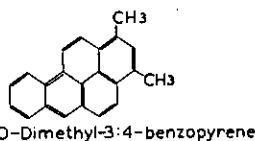
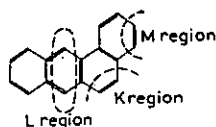
An attempt to use this route for the preparation of a series of methyl substituted perylenes has in the meantime been unsuccessful. Because of varying reactivities in the positions ortho to the propionic acid substituent, one gets a large proportion of one isomer in cases of mixed condensations. In some cases the isomer required for the preparation of perylene (and the method is capable of extension to the preparation of methyl substituted perylenes) is the one which is formed in very small quantity. Other methods were then adopted and these have yielded 1, 2, and 3 methylperylene as well as some dimethylperylene.<sup>[6]</sup>



Interest in this group of compounds arises from the fact that the structures of certain naturally occurring pigments are based on perylene. In this department a compound having ultra-violet spectrum resembling that of perylene was obtained on zinc dust distillation of a fungus pigment,<sup>[7]</sup> but insufficient material was available for the preparation of derivatives for direct comparison. Plausible biogenetic schemes would permit the pigment to be related to a methyl perylene, and hence the interest in such compounds and particularly in the effect of the methyl-substituent on the ultra-violet spectrum.

In recent years much publicity has been given to the carcinogenic properties of certain polycyclic aromatic hydrocarbons. Arising from a high incidence of skin cancer among workers in the coal tar industry (statistical evidence) we have the investigation which led to the isolation in 1932 of one of the most active such principles, namely 3:4-benzopyrene by Cook, Hewett and Hieger. It was a wonderful piece of work starting with two tons of soft pitch. Today we know that this and related compounds are present in tobacco smoke, diesel exhaust fumes and in the products of many slow combustion reactions.

We now have a fairly accurate idea of the type of molecule which is necessary for carcinogenic activity. Quantum mechanical study of hydrocarbons shows two regions of particular importance—the K region corresponding to the reactive 9:10 bond of phenanthrene and the L region corresponding to the reactive 9:10 position of anthracene.



Comparison of the structures of carcinogenic hydrocarbons shows that high carcinogenic activity is determined by the

presence of a K region having a high bond order, *i.e.*, more near to double bond character. A measure or index we use is the B.L.E. (bond localization energy) and this must be small such that B.L.E. + C.L.E. min. (carbon localization energy) is smaller than about 66 kilocalories per gm mol. There is evidence to show that initial reaction is between the K region of the hydrocarbon and its cellular receiver to form an addition complex. The cellular receiver is most likely electrophilic in nature and this fits with the low B.L.E. + C.L.E. min. necessary for activity.

If the molecule also contains an L region this region must be rather inactive for carcinogenic activity. The P.L.E. (para localization energy) + C.L.E. min. should be greater than about 113 kilocalories per gm mol. An active L region will give rise to addition reactions which will cause a disruption of the aromatic system bending the molecule along the axis of the L region. Among the metabolic products isolated from 3:4-benzopyrene are the 8- and 10-hydroxy derivatives formed apparently by hydroxylation followed by dehydration. Can this carcinogenic activity be prevented by blocking the 8 and 10 positions, *e.g.*, with methyl groups? It is not an easy matter to build up such a polycyclic system for laboratory testing—it is an interesting task to set one interested in synthetic organic chemistry. It was accomplished<sup>[8]</sup> by following a series of reactions somewhat similar to the previously explored route of Cook to the 8-methyl derivative.

I hope these few examples have given you some idea of the nature of the research problems investigated by the chemist interested in synthetic work. Although a large number of the problems of organic chemistry now lend themselves to theoretical calculation based on the modern wave mechanical treatment of molecular structure the mathematical treatment is extremely involved. The subject advances as theory explains experiment and experiment confirms theory.

In conclusion I must thank University staff for their guidance, my colleagues for helpful discussion, and my students for their assistance.

#### REFERENCES

- (1) MORTON, CAMPBELL and MA (1953): *Analyst*, 78 : 722.
- (2) CAMPBELL and CHETTLEBURGH (1959): *Analyst*, 84 : 190.
- (3) DACHE, DENZ and KENNEDY (1956): *Biochem. J.*, 64 : 777.
- (4) CAMPBELL and SLATER (1952): *J. Chem. Soc.*, 1952 : 4,353.
- (5) CAMPBELL (1954): *J. Chem. Soc.*, 1954 : 3,659.
- (6) CAMPBELL, ELDER and EMERSON: *J. Chem. Soc.* (in press).  
ANDERSON, CAMPBELL, EMERSON and MURRAY: *J. Chem. Soc.* (in press).
- (7) ANDERSON and MURRAY (1956): *Chem. and Ind.*, 1956 : 376.
- (8) CAMPBELL (1956): *J. Chem. Soc.*, 1956 : 1,938.

## BRANCH CHAIRMEN

## AUCKLAND BRANCH



Dr. Harry Bloom, Chairman of the Auckland Branch, graduated from Melbourne University with First Class Honours in Chemistry in 1945. He was awarded the Beit Scientific Research Fellowship of Imperial College, London and worked on high temperature chemistry for the Ph.D. After graduating in 1947, he joined the staff at Auckland University College as Lecturer in Chemistry. At present he is Associate Professor of Chemistry at the University of Auckland and Dean of the Faculty of Science. His research interests are mainly the structure and properties of molten salts. Dr. Bloom became an Associate of the Institute in 1948.

## WAIKATO BRANCH



K. J. McNaught graduated M.Sc. at Victoria College in 1934. He was Sir George Grey and Senior Scholar in 1933, and Jacob Joseph Scholar in 1935. In 1935 he joined the Department of Agriculture Chemistry Section in Wellington, and moved to Hamilton when the chemical services were reorganized in 1945. He transferred to the newly established Rukuhia Soil Research Station in Hamilton in 1946 to set up a plant analysis laboratory.

At Hamilton he has investigated the relationship between nutrient levels in plant tissues and fertilizer requirements, inter-relationships between nutrients, and the significance and diagnostic values of visual symptoms of malnutrition in plants. In addition, as horticultural

liaison officer, he has given extensive technical assistance to horticultural advisory officers and research workers in soil and plant analysis.

Mr. McNaught's participation in Institute affairs has included service on both the Wellington and Waikato Branch committees. He was elected an Associate in 1935.

### MANAWATU BRANCH



Dr. G. W. Butler, Plant Chemistry Division, D.S.I.R., is this year's Chairman of the Manawatu Branch. After graduating M.Sc. with Honours in Physical Chemistry from Auckland University College in 1948, Dr. Butler joined the staff of the Plant Chemistry Division. While at A.U.C. he was awarded the Senior Scholarship in Chemistry in 1947. In 1950 Dr. Butler attended Biochemistry courses at Otago University and in 1951-53 took his doctorate at Lund University, Sweden, his research topic being mechanisms of uptake of ions by young wheat roots. Since returning to New Zealand his research interests have been in the fields of nitrogen

metabolism and mineral nutrition of grassland plants and the relationship of these to the nutrition of grazing animals.

Dr Butler has served on various Institute committees and has been Branch Secretary for a number of years. He was elected Associate in 1954.

### WELLINGTON BRANCH

J. R. Beck, last year's Chairman, has been re-elected for a further year.

### CANTERBURY BRANCH



This year's Chairman of the Canterbury Branch is J. S. Pollard, Chemical Engineer to British Pavements (Canterbury) Ltd. Mr. Pollard graduated B.Sc. from Canterbury University College in 1946 and also obtained the Canterbury College Diploma in Industrial Chemistry. In 1947 he joined the Chemical Engineering Section of the Dominion Laboratory.

In 1950 he transferred to the staff of the Christchurch Gas Company where, on the retirement of W. O. R. Gilling in 1956, he became Chief Chemist. He resigned this post in 1959 to take up his present position.

Mr. Pollard was made an Associate Member of the Institution

of Chemical Engineers in 1952. He was elected an Associate of the N.Z.I.C. in 1948. His technical interests include the efficient utilization of energy and materials in industrial processes, quality control, instrumentation, and the maximum use of scientific aids in industrial work; his chief technical pleasure is exorcising the gremlins that most operators insist haunt their plants.

#### OTAGO BRANCH



A. H. Lewin, Chairman of the Otago Branch, was educated at Otago Boys' High School and graduated B.Sc. from Otago University in 1951. His university course was interrupted by a year spent working in the Woollen Mills Research Association.

After graduating Mr. Lewin took up the position of Mill Chemist with the Oamaru Woollen and Worsted Mills Ltd., where he established a laboratory. Late in 1952 he joined the staff of Cadbury Fry Hudson Ltd., Dunedin. In 1956 he took charge of the Factory Inspection Department also, so that all aspects of quality control became his responsibility.

Mr. Lewin has previously served on the Branch Committee and successfully carried out his onerous duties as accommodation officer for the 1959 Conference. He was elected an Associate of the Institute in 1953.

### BRANCH NEWS AND NOTES

#### AUCKLAND BRANCH

At the annual meeting of the Branch in October, the retiring Chairman, Dr. A. Odell, addressed the meeting on the subject, "The New Radio-chemical Laboratory at the University of Auckland". At the conclusion of the address, members were invited to inspect the laboratory where they witnessed a series of demonstrations on the applications of radio tracer methods in the chemical laboratory and in industry.

The November meeting of the Branch took the form of a symposium on "Atmospheric Pollution". The speakers were R. Hicks, Auckland Metropolitan Drainage Board, W. E. Russell, N.Z. Farmers Fertilizer Coy., P. R. Parr, Westfield Freezing Co. Ltd., and C. F. Dennead, Chemical Inspector of the Department of Health.

Following the success of visits of sixth-form students to Auckland laboratories in 1958, a further series was arranged by the Branch Committee during November, 1959. The Branch would like to thank those laboratories who participated in the scheme and for their willing co-operation.

### WAIKATO BRANCH

R. J. Lancaster, of Ruakura Animal Research Station, returned recently after eight months in the United States, Europe and Australia, visiting research stations and laboratories engaged in animal nutrition work, particularly examining methods of producing and evaluating silage.

Plans are well advanced for the transfer of the *Journal* to the Waikato Branch in May of this year. N. T. Clare has agreed to act as Editor and a Journal Committee has been set up consisting of Dr. E. B. Davies, K. J. McNaught, R. J. Lancaster and K. W. Loach.

### MANAWATU BRANCH

At the annual general meeting of the Branch, opportunity was taken to congratulate A. J. Weir, an Associate of the Institute, on his appointment as Registrar of Massey College and to welcome him, through his move from Levin to Palmerston North, into closer participation in Institute affairs. Although our Institute is already well represented in University administration, this is the first occasion that a member has become a Registrar and we wish Mr. Weir well in his new and important activity.

Dr. J. C. Hawke, who transferred last year from the Fats Research Laboratory, D.S.I.R., to the Biochemistry Department, Massey College, has now been appointed Head of the Biochemistry Department.

We congratulate Dr. H. R. Whitehead, Director of The Dairy Research Institute on the award of the Gold Medal of the Australian Institute of Dairy Technologists.

### WELLINGTON BRANCH

On Saturday, October 10, about 25 Wellington members availed themselves of an invitation from the Manawatu Branch to visit Palmerston North laboratories at Massey College, The Dairy Research Institute and the Plant Chemistry Division. As the weather was fine we were also shown over the grounds at Massey and taken for a drive round the various sections of the farm. A very pleasant midday function took place in the banquetting hall of the Hostel and the visit closed with afternoon tea and a very sincere vote of thanks to the Palmerston North members for giving up the greater part of a Saturday to our entertainment.

I. R. C. McDonald returned to Dominion Laboratory, Wellington, towards the end of September after a three months' tour of wood laboratories in England, France, Switzerland, Sweden, Australia and the United States.

Dr. O. M. F. Nauen, for 15 years a member of the Institute, recently retired from the Patents Office. He was farewelled at one of our monthly meetings just prior to his departure overseas. After a visit to the British Patents office and a tour through France and Germany to see friends, he and his wife are now staying for a period in Switzerland.

It has been decided that the Annual Conference in 1960 will be held from May 12 to 17 in conjunction with the Royal Society Congress in Wellington, and not in August as in normal circumstances. The Wellington Branch Committee is co-operating and organizing the Chemistry Section. A first circular was distributed to members in November by the Congress Committee and further circulars will be sent to those who enrol.

Peter Williams, ex-Secretary of the Branch, is at Cavendish, Cambridge, and his wife is to undertake the feeding of Antarctic huskies in connection with work at the Department of Experimental Medicine.

The Hon. General Secretary, Dr. W. E. Harvey, and his wife, left Wellington on November 24 in the *Willem Ruys*. Via Callao and Panama they proceed to Miami and thence to Harvard. Dr. Harvey has a Fulbright travel grant and a Research Fellowship in Chemistry for 12 months.

Stan-Vac Laboratory, Wellington, is in the news: C. L. H. Stonyer, has transferred from the laboratory of Standard Vacuum Oil Company to head office where he deals with sales aspects of processed products, solvents, and other specialties. D. S. Adcock is now in charge of the laboratory which will shortly move from Hutt Road to a site at Seaview Road, Lower Hutt.

Z. Demchenko, Industrial Chemist with Lever Bros., Petone, recently returned from a visit to Canada and the United States.

### CANTERBURY BRANCH

Following the organization of three successful lecture-demonstrations especially for upper-sixth form students of chemistry the Canterbury branches of the N.Z.I.C. and the Canterbury Science Teachers' Association have combined to form the Canterbury Junior Chemical Society. The committee of this society consists of three members from each body and E. R. Hounsell, representing the N.Z.I.C., is the first chairman. Mr. Hounsell, a former chemistry teacher, is now Liaison Officer at Canterbury University. The Secretary is R. H. Hickford of Linwood High School, a representative of the Science Teachers' Association.

Christchurch schools have been invited to submit the names and addresses of next year's upper-sixth form chemistry pupils who would like to join the Society and, after some pruning by the teachers, about 150 names have been received; this despite the fact that pupils were warned that a subscription of 5s. each would be demanded. Invitations to attend the first meeting next March will be sent to these 150 pupils and it will be most interesting to see the response at that time. The committee would not be sorry to see the numbers reduced to under 100.

The aim of the society is to provide, for the keen student of chemistry, instruction and stimulation in aspects of the subject not likely to be met in his school curriculum. The society will be controlled by its own committee and will be financially independent of the Institute. The society's meetings are not to be confused with the "Chemistry in Action" series which is aimed at a general, uncommitted audience and which remains the responsibility of the Institute.

### OTAGO BRANCH

Dr. J. Murray, Senior Lecturer in Chemistry at the University of Otago, departed in November to spend a year's study leave at Imperial College, London.

Recently returned from study leave, Dr. F. Fastier, Senior Lecturer in Pharmacology at the Otago Medical School, entertained members at the November meeting with an interesting account of overseas universities and pharmacology departments, well illustrated with colour slides.

It is with regret that we record the death of a Branch member and one of our younger chemists, R. A. J. MacIntyre. Since graduating M.Sc. from Auckland in 1948 Mr. MacIntyre had worked in a variety of industrial concerns including the N.Z. Co-op Rennet Co., Eltham, and, at the time of his death, was a chemist in the Roslyn Woollen Mills, Dunedin.

## GENERAL MEETING MINUTES

ABRIDGED MINUTES OF A GENERAL MEETING OF MEMBERS HELD IN THE CHEMISTRY LECTURE THEATRE UNIVERSITY OF OTAGO, DUNEDIN, ON THURSDAY, AUGUST 27, 1959.

### PRESENT

Professor L. H. Briggs (President, in the chair), Dr. W. E. Harvey (Hon. General Secretary), and approximately 60 members.

### PRESIDENTIAL REMARKS

The President referred to the recent deaths of two members, Harold Vincent Rowe, Christchurch Boys' High School (Associate), and Dr. Lewis Gregory Neubauer, Tasman Pulp & Paper Co., Kawerau (Fellow).

Professor Briggs thanked the various Branches that had invited him to lecture during his term as President, and expressed his pleasure that he had been able to meet so many members in this way.

Decisions made by Council at its last meeting were briefly mentioned, including the fact that N. T. Clare would replace Dr. W. A. McGillivray who wished to relinquish the post of Editor. A new list of members will be published shortly and it is hoped that members will co-operate to their utmost to ensure that the information in the new list is as complete as possible.

The Conference Committee were thanked for the effort they had put into organizing the Conference and members were advised that in 1960 it is proposed to hold the Conference in May in association with the N.Z. Science Congress. In 1960 also many world-renowned chemists will be coming to Australia for the I.U.P.A.C. Conference and the Institute proposes to invite a number of these people to extend their trip to include New Zealand. £300 of the Institute funds will be made available for this purpose if necessary.

Finally the President congratulated members who have recently been elected as Associates or Fellows.

### OFFICERS FOR THE COMING YEAR

E. W. Hullett, Wheat Research Institute, was elected unopposed as President.

Professor H. N. Parton, University of Otago, was elected as Vice-President.

Dr. W. E. Harvey will continue as Hon. General Secretary until he leaves for overseas.

### ANNUAL REPORT

The "Annual" Report covering the period to August 31, 1959, was tabled for discussion, but members had no comments to make.

### BALANCE SHEET AND STATEMENT OF ACCOUNTS

The audited accounts for the 18-month period ending April 30, 1959, were tabled for discussion.

### NOTICE OF MOTION

Due notice of motion having been given it was

*Moved* (Johannesson/Beck (*pro forma*)): That it be a recommendation to Council that the name of the Institute be changed from that of "The N.Z. Institute of Chemistry Inc." to "The N.Z. Institute of Chemical Scientists".

Mr. Johannesson outlined his reasons for putting forward the motion and a number of members including Messrs. Beck, Hughson, McChesney and Keys offered comments mainly opposing the motion.

On being put, the motion was *lost*.

#### RETIRING EDITOR

*Resolved* (Odell/Butler): That a letter of appreciation be sent to Dr. and Mrs. W. A. McGillivray expressing the Institute's thanks for the excellent job that had been done in editing the *Journal*. *Carried*.

#### UNIONS

O. H. Keys requested information on the steps that had been taken to form a union of chemists, and the reasons behind the decision to follow this course. In reply, Mr. Beck explained the legal position and briefly outlined the steps the General Secretary and the Wellington Branch were taking to draw up tentative rules for the proposed union.

W. E. HARVEY,  
Hon. General Secretary.

### COUNCIL MINUTES

ABRIDGED MINUTES OF A MEETING OF THE COUNCIL  
OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY  
(INC.) HELD IN THE SMALL LECTURE THEATRE,  
CHEMISTRY DEPARTMENT, OTAGO UNIVERSITY, ON  
TUESDAY, AUGUST 25, 1959.

#### PRESENT

Prof. L. H. Briggs (President, in the chair), E. W. Hullett (Vice-President), Dr. A. L. Odell (Auckland), Dr. E. P. White (Waikato), Dr. G. W. Butler (Manawatu proxy), J. R. Beck (Wellington), D. J. Hogan (Canterbury, Registrar), Dr. A. D. Campbell (Otago), and Dr. W. E. Harvey (Gen. Secretary). An apology was received from Dr. W. A. McGillivray (Manawatu Delegate and Editor).

#### CONFERENCE 1959

Dr. Campbell reported on the arrangements that had been completed for the Combined Conference. The attendance would be about 140 and the Committee expected to make a small profit. There was some discussion on the question of circulars distributed to all members concerning the Conference and it was

*Resolved* (Auckland/Canterbury): That the cost, including postage, of circulars sent to all members of the Institute in connection with Conferences be met from the general funds of the Institute.

#### EXAMINATIONS COMMITTEE

The Examinations Committee presented recommendations concerning exemptions to be granted to candidates who were applying to qualify for the A.N.Z.I.C. by examination. These recommendations were adopted by Council.

#### AWARD OF L.A.C.

On the recommendation of the Examinations Committee it was

*Resolved* (Otago/Manawatu): That the L.A.C. be awarded to C. P. Croft.

#### JOURNAL

The Editor submitted a brief report on the *Journal*, with comments on the present arrangement whereby Editorial Services Ltd. publish the

*Journal*. Dr. McGillivray stated that following discussion the Waikato Branch had agreed to undertake the editorial work for the *Journal* and it was

*Resolved* (Canterbury/Vice-President): That Council agrees to the change of Editor to a member of the Waikato Branch and that in view of this change the agreement with Editorial Services Ltd. be renewed for a further period of one year.

#### LIST OF MEMBERS

*Resolved* (Vice-President/Auckland): That the Institute publish a revised list of members.

*Resolved* (Wellington/Otago): That the Canterbury Branch be asked to undertake the editorial work for the revised list of members.

#### CHEMISTRY IN ACTION—NEW SERIES

The Canterbury Branch has once again organized a series of lectures for school pupils and the Editor has agreed that the lectures are suitable for publication.

*Resolved* (Canterbury/Auckland): That 2,000 copies of the lectures given to school children in Christchurch be reprinted, as an experiment for one year, and that the copies be offered to secondary schools, if possible at a charge of £1 0s. 0d. for 40 copies.

The Canterbury Branch agreed to organize the distribution.

*Resolved* (Auckland/Canterbury): That in future Branches be invited to submit to the Editor for consideration any lectures which have been delivered to groups of sixth form pupils and which might be suitable for publication.

#### QUESTIONNAIRE TO INDUSTRY

The Auckland Delegate tabled a draft of a questionnaire that the Auckland Branch proposed to send to employers of chemists in the Auckland area seeking information about the number of staff employed, the type of work carried out, and the likely demand for staff, both professional and technical, in the future.

This type of information is required by the Education Department and the N.Z. Council for Technical Education in connection with the setting up of the proposed courses for technicians, and it was agreed that the questionnaire should be distributed throughout the country. The Auckland Branch will finalize the questions and Branches will be responsible for distribution in their areas.

#### INSTITUTE PRIZES

Council agreed to award the Institute prizes for 1959 to the following:

*I.C.I. Prize*: Professor J. Packer and J. Vaughan, University of Canterbury (jointly).

*Morcom Green & Edwards Prize*: Dr. E. L. Richards, Massey College, Palmerston North.

*Chemical Essay Prize*: Dr. R. D. Batt, Medical School, University of Otago.

Council extended its congratulations to Dr. A. D. Campbell who has been awarded the Easterfield Medal by the N.Z. Section of the R.I.C.

#### TECHNICIAN TRAINING

Dr. Odell briefly described the discussion at the meeting called by the Department of Education to discuss technician training. An outline of the agreed proposals has been published in the *Journal* and the resulting minor revision in the system has been carried out.

## MEMBERSHIP

*Election of Honorary Fellow:*

SYMES, LANGFORD PARK, retired, former Chief Chemist, Canterbury Frozen Meat Co. Ltd., Belfast.

*Election of Fellow:*

LAMBOURNE, SYDNEY JAMES, Senior Inspector in charge South Auckland Education District.

*Election of Associates:*

ANSLEY, DESMOND REGINALD, Taniwha Products Ltd., Auckland (Chief Chemist).

CAMPBELL, ALISTAIR SHAND, Lincoln College (Assistant Lecturer in Chemistry).

COLEBROOK, LAWRENCE DAVID, Chemistry Department, University of Auckland (Junior Lecturer).

CRAIGHEAD, PAT WYLIE, Particle Board Factory of N.Z. Plywood (S.I.) Ltd. (Production Manager).

DONOVAN, CHRISTINE LESLEY, City Council Laboratory, Wellington (Chemist).

GAMBLE, THOMAS PALMER JACKSON, Pinchin, Johnson & Co. Ltd., Wellington (Research Chemist).

GRAHAM, PETER JOHN, Dominion Laboratory, Lower Hutt (Scientific Officer).

GRIFFIN, DONALD JOHN, Central Technical College, Petone (Assistant Master).

HANCER, WILLIAMS GEORGE, Toxicology Research Dept., Medical School (Senior Research Officer).

HARRALL, EDWARD DOUGLAS, Christchurch Milk Co. Ltd. (Assistant Chemist).

HAWKE, JOHN CLEMENT, Massey College (Head of Biochemistry Department).

KINGSFORD, MICHAEL, Chemistry Department, University of Auckland (research student).

MACLEAN, DOROTHY MARGARET, Laboratory, Wellington Hospital (Bacteriologist).

MANSELL, JAMES LINDSAY, Standard Vacuum Oil Co. Ltd., Wellington (Chemist).

OATS, OWEN JOHN, Dominion Fertiliser Co. Ltd., Dunedin (Chief Chemist).

PERRY, KEITH DAVID, Dairy Research Institute, Palmerston North (Bacteriologist).

ROBINSON, MICHAEL ALAN, International Paints of N.Z. Ltd. (Chief Chemist).

RUSSELL, DOUGLAS WILLIAM, Plant Chemistry Division, Palmerston North (Facial Eczema Research Fellow).

SUMMERVILLE, OSCAR, B.A.L.M. Paints Ltd., Auckland (Technical Officer, Research and Development Section).

TOPSOM, RONALD DAVID, Chemistry Department, University of Canterbury (Lecturer).

WALPOLE, DAVID HUGH PACET, I.C.I. (A.N.Z.) Ltd., Botany Factory, Matraville, N.S.W.

WELCH, BARRY JOHN, Chemistry Department, University of Auckland (Research Fellow).

WIGGINS, PHILLIPA MARION (Mrs.), 526 Mairehau Road, North Beach, Christchurch.

WILKINS, BRIAN JOSEPH, Naenae College (Teacher).

WILSON, ALEXANDER THOMAS, Institute of Nuclear Science, P.B. Lower Hutt (Scientific Officer).

**Leave**

Applications for leave with remission of subscription were granted as follows:

J. G. Blackman .....	3 years	Miss S. Page .....	3 years
W. E. Harvey .....	1 year	M. H. Panckhurst .....	5 years
Mrs. H. E. Harvey .....	1 year	R. N. Seelye .....	2 years
R. A. Matheson .....	2 years	Mrs. Gwenda M. White .....	2 years
D. F. Nelson .....	2 years	J. C. B. White .....	2 years

**Resignations**

Resignations were accepted from:

V. Armstrong (with regret)	R. W. Munro (as from 1953)
P. G. Harris (as from 1955)	A. M. Murphy (with regret)

**Honorary Membership:**

O. F. Nauen was elected to Honorary Membership.

**Members to be Struck Off:**

*Resolved* (Chair/Secretary): That the following be struck off the roll of members, that arrears of subscriptions be written off and that the persons concerned be requested to return their certificates for cancellation:

R. T. J. Blick	J. T. Murray
P. C. Coates	B. S. Painter
O. F. Haylock	G. S. Walter
A. S. Lawson	

**Deletions:**

The following deletions were made from the list of members:

G. Arkinstall,	M. L. McGlashan
R. L. Blakeley	D. E. G. Sheat
D. R. Boaden	R. J. Woods
W. G. M. Goodwin	

**OVERSEAS VISITORS**

A letter was received from the Registrar of the R.A.C.I. advising about the visit to Australia in 1960 of Professor D. R. H. Barton and Sir Alexander Todd. The President tabled a list of eminent overseas chemists who would be in Australia for the I.U.P.A.C. Conference. It was agreed that the Institute should endeavour to arrange visits to New Zealand of a number of these people and it was

*Resolved* (Auckland/Manawatu): That the Institute set up a Committee with power to invite chemists from the I.U.P.A.C. Conference to New Zealand: the committee to explore the possibility of obtaining financial assistance from the D.S.I.R., the Universities, the Chemical Society and industry and to have authority to spend up to £300 of the Institute funds.

*Resolved* (Auckland/Wellington): That the members of the committee be Professor L. H. Briggs, E. W. Hullett and Dr. W. E. Harvey.

**UNIONS**

The Secretary reported that in association with the Wellington Branch Committee he was drafting regulations for the proposed Union.

**P.O.S.B. ACCOUNT**

*Resolved* (Chair/Manawatu): That in future two persons jointly be required to operate on the P.O.S.B. Account.

**CONFERENCE 1960**

*Resolved* (Auckland/Waikato): That in 1960 the Conference be held in May in conjunction with the Ninth New Zealand Science Congress and

that a general meeting of the Institute be held at that time to discuss policy matters, and further that a formal general meeting be held in Wellington at the time of the August Council meeting.

The Wellington Branch was asked to organize the Institute's portion of the N.Z. Science Congress.

#### FELLOWSHIP REGULATIONS

*Resolved* (Vice-President/Wellington): That this matter be deferred for one year.

#### COMMITTEE ON N.Z. UNIVERSITIES

It was agreed that the Institute should not make any submissions to the Committee but should write expressing the Institute's general satisfaction with the present training given to chemists by the universities.

#### DONATION OF JOURNALS

Dr. H. O. Askew has presented the Institute with a complete set of the *Institute Journal*.

*Resolved* (Vice-President/Waikato): That Dr. Askew be thanked for his generous donation and that the complete set of *Journals* be suitably bound.

#### INSTITUTE PROPERTY

*Resolved* (Vice-President/Auckland): That an Institute property list be established.

#### INCOME TAX

*Resolved* (Chair/Otago): That the Wellington Branch Committee be authorized to act on behalf of the Institute in discussion with other learned societies on a possible concerted effort to obtain tax exemption on subscriptions to learned bodies.

W. E. HARVEY,  
Hon. General Secretary.

### ABRIDGED MINUTES OF A MEETING OF THE COUNCIL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.) HELD IN THE CONFERENCE ROOM, WHEAT RE- SEARCH INSTITUTE, CHRISTCHURCH, ON FRIDAY, NOV- EMBER 6, 1959.

#### PRESENT

E. W. Hullett (President, in the chair), Professor H. N. Parton (Vice-President), Dr. A. L. Odell (Auckland proxy), Dr. E. P. White (Waikato), A. P. Oliver (Wellington proxy), D. J. Hogan (Canterbury, Registrar, Manawatu proxy), Dr. A. D. Campbell (Otago), and Dr. W. E. Harvey (General Secretary). Apologies for absence were received from J. R. Beck (Wellington), Dr. W. A. McGillivray (Editor), and Dr. G. W. Butler (Manawatu).

#### DELEGATES

Delegates from Branches for the present Institute year were confirmed and officers were appointed as set out in list of officers (page 38).

#### SUBCOMMITTEES OF COUNCIL

##### *Conference 1960:*

The 1960 Conference will form part of the N.Z. Science Congress to be held in Wellington, May 12 to 17. Considerable organization has already been done by the Wellington Branch Committee with J. R. Beck

as convener. Three symposia each lasting half a day are envisaged, the topics suggested being:

- (1) Forest Products & the N.Z. Timber Industry.
- (2) Water Supplies and Pollution.
- (3) Modern Food Processing.

Council suggested that topic (2) should be widened to include pollution generally, and that if possible there should be a concurrent session devoted solely to pure chemistry.

*Resolved* (Otago/Vice-President): That the sum of £20 be advanced to the Wellington Branch for Conference expenses.

#### *Employment Officer:*

The Employment Officer furnished a report on his activities during the past year (see p. 40).

*Resolved* (Chair/Secretary): That the report be received, and the Employment Officer be thanked for his report and for the efficient manner in which he had carried out his duties.

It was agreed that the report should be submitted to the Editor for possible publication; and it was suggested that the Employment Officer's name and address should be listed in each issue of the Journal.

#### APPOINTMENT OF SUBCOMMITTEES

Subcommittees as listed on page 39 were appointed. In connection with the membership committee it was

*Resolved* (Chair/Canterbury): That Dr. Gardner be thanked for the extremely valuable service he has rendered to the Institute as a member of the Membership Committee for many years.

#### HONORARIA

The following honoraria were approved for payment:

General Secretary .....	£50
Editor .....	£35

#### CONFERENCE 1959

*Resolved* (Auckland/Canterbury): That the report of the 1959 Combined Conference Committee be received, and the Committee thanked for their work.

*Resolved* (Chair/Secretary): That the Conference profit of £11 5s. 0d. be shared with the R.I.C. in the usual manner.

#### LIBRARY

A letter from S. G. Brooker emphasized the valuable asset the Institute is building up by the exchange of the *Journal* with overseas bodies. The journals we receive are housed at the Auckland Museum Library through the willing co-operation of the Director and the Librarian, Miss Evans.

*Resolved* (Secretary/Canterbury): That S. G. Brooker be appointed Honorary Librarian.

*Resolved* (Secretary/Wellington): That a letter be sent to Miss Evans and the Auckland Museum Library thanking them for the service they render to the Institute.

It was suggested that Mr. Brooker be asked to write an article for publication in the *Journal* describing the collection that the Institute is acquiring, arrangements for borrowing, etc.

#### LIST OF MEMBERS

It is expected that a new list of members will be ready for publication in March, 1960.

### QUESTIONNAIRE TO INDUSTRY

The report for the Auckland area is completed and will be distributed. The Vocational Guidance Service has expressed interest in the report and it was agreed that the report should be made available to them immediately. Other areas of the country will be covered as soon as possible and a summarizing report for the whole of New Zealand will be prepared.

### TECHNICIAN TRAINING

A letter from the Minister of Education requesting a nomination of a person to represent the Institute on a proposed Controlling Authority was received.

*Resolved* (Canterbury/Vice President): That the name of Dr. A. L. Odell be submitted.

It was agreed that the Secretary should enquire about possible further representation on the Controlling Authority.

### OVERSEAS VISITORS

The Secretary reported on discussions and correspondence he had had with representatives of the R.A.C.I. After a full discussion Dr. Harvey was authorized to continue negotiations with the R.A.C.I.

*Resolved* (Auckland/Vice-President): That the Institute investigate the possibility of an appeal to industry to support an education fund which could be used to assist in bringing visitors to New Zealand, and to facilitate travel in New Zealand.

### FUTURE CONFERENCES

It was agreed that the venue of future Conferences should be as follows:

- 1961 Manawatu
- 1962 Auckland
- 1963 Christchurch
- 1964 Waikato
- 1965 Otago
- 1966 Wellington

### CHANGE OF RULES

*Resolved* (Auckland/Wellington): That Rule 18 be modified by the addition of the following sentence: "Except in special circumstances, the Rules shall be altered only at an annual meeting of Council."

### MEMBERSHIP

#### *Election of Fellow:*

MASON, CECIL GEORGE, M.Sc., Chemical Engineer, N.Z. Forest Service, Wellington.

#### *Election of Associates:*

BRASCH, DONALD JAMES, M.S., Ph.D., Dominion Laboratory, Wellington (Scientific Officer).

BURNETT, KENNETH ROBERT, B.Agr.Sc. (Dairy Tech.), Kaipara Dairy Co., Helensville (Chief Chemist and Assistant Manager).

CARNECIE, PATRICK ROBERT, B.Sc. (Hons.), Ruakura Agricultural Research Station (Scientific Officer).

FUTTER, JOHN HERBERT, M.Sc., H. W. Lawrence & Son, Johnsonville (Chemist).

HALL, RONALD BERNERS, M.Sc., N.Z. Forest Products Ltd., Penrose, Auckland (Chemist).

HOOKE, RONALD OWEN, B.Sc., Co-operative Wholesale Soc., Ltd., Longburn (Chemist).

- HUNTER, MAXWELL THOMAS, B.Sc., Christchurch Gas Co. (Analyst).  
HUSHEER, GODFREY ASBJORN, B.Sc., East Coast Fertiliser Co. (Chief Chemist).  
LEIGHTON, FRANCIS ROYDEN, B.Sc., N.Z. Co-op Dairy Co., Hamilton (Senior Assistant Chemist).  
POPPLEBAUM, ADALBERTUS HENRICUS, Westfield Freezing Works, Auckland (Chemist).  
REID, MARY RUTH (Mrs.), M.Sc., University of Canterbury (Demonstrator).

**Resignations:**

The following resignations were accepted:

P. B. D. de la Mare	H. C. Sutton
R. L. Parsons	B. W. Swanton
D. J. Sutor	

**Leave:**

B. W. Swedlund was granted two years' leave with remission of subscription.

**Honorary Membership:**

C. L. Carter was elected to Honorary Membership.

**ADDRESSOGRAPH PLATES**

*Resolved* (Vice-President/Auckland): That the Institute's addressograph plates be not made available to individual persons or firms.

**ANNUAL SUBSCRIPTION**

A resolution moved by the Wellington Delegate lapsed for want of a seconder.

**PROFESSIONAL STATUS COMMITTEE**

*Resolved* (Wellington/Auckland): That the Professional Status Committee be reinstated.

*Resolved* (Secretary/Auckland): That the Wellington Branch be asked to suggest members who would be prepared to serve on the Professional Status Committee.

It was agreed that Branches should be informed of the decision to reinstate the Committee and asked for suggestions as to how the committee should operate and what it should be asked to do.

**BRANCH GRANTS**

*Resolved* (Vice-President/Otago): That Branch Grants be increased to £20 per year.

**SPECIAL GRANT**

*Resolved* (Secretary/Wellington): That a special grant of £30 be made to the Canterbury Branch to assist it in meeting the cost of promoting the "Chemistry in Action" series.

W. E. HARVEY,  
Hon. General Secretary.

---

**NEW YEAR HONOURS**

Members will join in congratulating two Fellows of the Institute included in the New Year Honours List: Dr. H. O. Askew and Dr. F. H. McDowall, both received the O.B.E.

## LIST OF OFFICERS

For the Year November 1, 1959—October 31, 1960.

- President*: E. W. Hullett, Wheat Research Institute, Box 1489, Christchurch.
- Vice-President*: Prof H. N. Parton, University of Otago, Box 56, Dunedin.
- Acting Hon. Gen. Secretary*: A. P. Oliver, N.Z. Breweries Ltd., Box 211, Wellington.
- Auckland Delegate*: Prof. H. Bloom, 62 Portland Street, Remuera, Auckland.
- Waikato Delegate*: Dr. E. P. White, Ruakura Animal Research Station, P.B., Hamilton.
- Manawatu Delegate*: Dr. G. W. Butler, Plant Chemistry Division, P.B., Palmerston North.
- Wellington Delegate*: J. R. Beck, N.Z. Breweries, Box 211, Wellington.
- Canterbury Delegate*: D. J. Hogan, Dominion Laboratory, Box 2112, Christchurch.
- Otago Delegate*: Dr. A. D. Campbell, University of Otago, Box 56, Dunedin.
- Editor*: Dr. W. A. McGillivray, The Dairy Research Institute, Massey College P.O., Palmerston North.  
N. T. Clare (from May 1960), Ruakura Animal Research Station, P.B., Hamilton.
- Past President*: Prof. L. H. Briggs, 63 Brighton Road, Parnell, Auckland.
- Registrar*: D. J. Hogan, Box 1926, Christchurch.

## AUCKLAND BRANCH

- Chairman*: Prof. H. Bloom, 62 Portland Road, Remuera, Auckland.
- Secretary*: J. H. Goodey, Auckland Gas Co., P.O. Box 34, Auckland.
- Treasurer*: R. W. Olliff, Chemistry Department, University of Auckland, Box 2553, Auckland.
- Committee*: Dr. A. L. Odell, Chemistry Department, University of Auckland, Box 2553, Auckland.  
Dr. R. C. Cambie, Chemistry Department, University of Auckland, Box 2553, Auckland.  
L. W. Jagger, Westfield Freezing Co., P.B., Auckland.  
P. J. Gallagher, 74 Station Road, Papatoetoe.

## WAIKATO BRANCH

- Chairman*: K. J. McNaught, Rukuhia Soil Research Station, Box 490, Hamilton.
- Secretary/Treasurer*: F. D. Dorofeeff, Rukuhia Soil Research Station, Box 490, Hamilton.
- Committee*: J. E. Allan Rukuhia Soil Research Station, Box 490, Hamilton.  
M. R. Coup, Ruakura Animal Research Station, P.B., Hamilton.  
R. S. Lancaster, Ruakura Animal Research Station, P.B., Hamilton.  
Dr. E. P. White, Ruakura Animal Research Station, P.B., Hamilton.

## MANAWATU BRANCH

- Chairman*: Dr. G. W. Butler, Plant Chemistry Division, P.B., Palmerston North.
- Secretary/Treasurer*: Dr. J. R. L. Walker, Dairy Research Institute, Massey College, Palmerston North.

- Committee:* Dr. J. W. Lyttelton, Plant Chemistry Division, P.B., Palmerston North.  
Dr. J. C. Hawke, Biochemistry Department, Massey College, Palmerston North.  
G. M. Wallace, Biochemistry Department, Massey College, Palmerston North.  
R. C. Lawrence, Biochemistry Department, Massey College, Palmerston North.

#### WELLINGTON BRANCH

- Chairman:* J. R. Beck, N.Z. Breweries Ltd., Box 211, Wellington.  
*Secretary:* H. R. Penhale, Soil Bureau, Box 8001, Wellington.  
*Treasurer:* Dr. D. J. Brasch, Dominion Laboratory, Box 8023, Wellington.  
*Committee:* Dr. A. J. Ellis, Dominion Laboratory, Box 8023, Wellington.  
J. K. Johannesson, W.C.C. Laboratory, Box 2199, Wellington.  
Dr. R. A. Matheson, Victoria University, Box 196, Wellington.  
Miss J. Mattingley, 59 Bombay Street, Ngāio, Wellington, N.4.

#### CANTERBURY BRANCH

- Chairman:* J. S. Pollard, 66 Fisher Avenue, Christchurch.  
*Secretary/Treasurer:* D. J. Hogan, Dominion Laboratory, Box 2112, Christchurch.  
*Committee:* Dr. J. M. Austin, University of Canterbury, Box 1471, Christchurch.  
F. Barnes, N.Z. Plywoods Ltd., Box 1168, Christchurch.  
A. H. Horn, Lincoln College, P.B., Christchurch.  
E. R. Hounsell, University of Canterbury, Box 1471, Christchurch.

#### OTAGO BRANCH

- Chairman:* A. H. Lewin, 12 Derwent Street, Dunedin.  
*Secretary/Treasurer:* Dr. W. G. Hanger, Toxicology Research Department, Medical School, Box 913, Dunedin.  
*Committee:* Dr. J. C. Dacre, Toxicology Research Department.  
Prof. H. N. Parton, Chemistry Department, University of Otago, Dunedin.  
Dr. A. D. Campbell, Chemistry Department, University of Otago, Dunedin.  
R. M. Carr, Chemistry Department, University of Otago, Dunedin.  
J. W. McChesney, 8 Alison Crescent, Dunedin.

#### COUNCIL SUBCOMMITTEES

- Conference Committee Chairman:* J. R. Beck.  
*Employment Committee:* J. L. Mandeno, 1 Pine Terrace, Wellington, W.3.  
*Examination Committee:* C. R. Edmond (Chairman), 41 Dowling Street, Dunedin; T. H. Kennedy (Secretary), Medical School, Box 913, Dunedin.  
*Membership Committee:* S. G. Brooker, Box 9012, Newmarket, Auckland; Dr. J. K. Dixon, Soil Bureau, Box 8001, Wellington; Prof. S. R. Siemon, University of Canterbury, P.O. Box 1471, Christchurch.  
*Standards Institute of New Zealand:* Representative on N.Z. Standards Institute Council: G. A. Lawrence; Chief Representative for all Standards Institute Affairs: C. L. H. Stonyer.

*Representatives on Special Committees:*

- (a) Chemical, insecticides, refrigeration, etc., C. L. H. Stonyer.  
 (b) Electroplating and electro metal finishes, Dr. R. Gardner.  
 (c) Metal containers, paints, etc., J. M. Tingey.  
 (d) Textiles, Dr. L. F. Storey.

*Unesco Representative:* J. A. D. Nash.

*Standing Committee of Council:* E. W. Hullett, J. R. Beck, and A. P. Oliver.

*Honorary Librarian:* S. G. Brooker.

---

 REPORT TO COUNCIL — NOVEMBER, 1959

by J. L. MANDENO, Employment Officer.

The numbers of vacancies advertised in the Wellington daily papers during recent years (ending August 31) are as follows:

1954	1955	1956	1957	1958	1959
35	62	60	77	125	221

As far as it is possible to determine, these appear to be advertisements for different vacancies. Any error in the figures would not be great.

The table below analyses the vacancies advertised during the last two years (years ending August 31):

	1958	1959
Industry .....	58	69
Government .....	18	32
N.Z. Universities .....	12	13
Research Associations .....	6	8
Post Primary Teaching .....	2	17
Local Bodies .....	2	6
Consultants .....	2	3
Australian (mainly Universities and C.S.I.R.O.) .....	25	73
<b>Total</b>	<b>125</b>	<b>221</b>
<b>N.Z. Vacancies</b> .....	<b>100</b>	<b>148</b>
<b>Technician Vacancies</b> .....	<b>16</b>	<b>50</b>

Enquiries about employment prospects in New Zealand continue to average about two per month. During the last twelve months there seem to have been more enquiries from persons who appear to be nearer to technician status than that of qualified chemists. More and more these enquiries are channelled to the Institute through the Immigration Authorities at New Zealand House, London.

To date I have been advising overseas enquirers that there are plenty of jobs of some sort available here. I assume, from enquiries that are starting to come to me from employers, that there is still an acute shortage of qualified chemists.

I have been informed that the situation regarding technicians is changing and that, while there has been a shortage of such people, they are now becoming more plentiful. It is of interest that about five or six of the overseas enquirers have come to New Zealand and found positions. There may be others of whom I have no details.

It is probable that the large increase in Australian positions advertised here is due to the Commonwealth Government's adoption of the Murray Report.

## BOOK REVIEWS

*PRINCIPLES AND PRACTICE OF GAS CHROMATOGRAPHY*, edited by Robert L. Pecsok. Published by John Wiley & Sons, Inc., New York, 1959. 226 pages. Price 6.75 dollars.

This text, which is reproduced by the photo offset method, is an elaboration of a course of lectures offered at the University of California, Los Angeles, in February, 1959. The contributors are themselves authors of original papers on gas-liquid chromatography, and they have given a comprehensive treatment of the difficulties usually encountered by users of this analytical technique, such as distortion and overlapping of peaks; column packing, liquid phases, effect of temperature and flow rates on separation, and other practical aspects of the subject are well covered. For beginners this book provides an extremely useful introduction to a technique which has made phenomenal advances since James' and Martin's paper in 1952. Workers already using the method will probably prefer to follow the accounts of the regular Symposia on Gas Chromatography. Some errors exist in the extensive bibliography which is given as an appendix. A further appendix lists the U.S. manufacturers of commercial instruments. However, this is one field of instrumentation in which British manufacturers appear to be holding their own, and a more comprehensive list would have been worth giving.

—J.C.H.

*PRECIPITATION FROM HOMOGENEOUS SOLUTION*, by Louis Gordon, Murrell L. Salutsky, Hobart H. Willard. Published by John Wiley & Sons, Inc., New York, 1959.

Anyone who has carefully followed an analytical recipe, "add a dilute solution of the precipitating agent dropwise with vigorous stirring", only to produce an unfilterable goo should be interested in this book which deals with the methods available for generating the precipitant in solution at the optimum rate by means of chemical reactions, with consequent improvement in the physical nature of the precipitate.

The use of several reagents is described in detail, with complete experimental methods and evaluation of the accuracy attainable under various conditions. The major method described is the precipitation of hydroxides, or basic salts, by boiling solutions containing urea, with details given for the determination of iron, aluminium, etc. Also described are methods generating sulphate, oxalate, sulphide, etc., ions in solution, with applications to specific analytical processes. The book includes chapters on coprecipitation and homogeneous fractional precipitation.

This subject is important to those concerned with inorganic gravimetric analysis. The book is well-produced, and written by men responsible for much of the present knowledge in the field, but, at the moment, the method it describes is very restricted because of the lack of suitable reagents.

—N.F.C.

*THE SEQUESTRATION OF METALS*, by R. L. Smith. Published by Chapman & Hall, London, 1959. Price 42s.

The first portion of this book deals with the general principles of coordination chemistry, particularly of chelates, and contains extensive tabulations of relevant data (lists of sequestering agents, tables of stability con-

stants with a variety of metal ions, etc.). The second portion covers a wide variety of industrial applications of sequestering agents, particularly EDTA. Uses in analysis and applied biology are treated briefly.

The author attempts to cover the field of known applications of sequestering agents, with the result that the detail is very sketchy. This is to some extent overcome by the extensive list of references, which is probably the most useful aspect of the book, even if it is inclined to date it rapidly in a field in such a state of rapid change.

—N.F.C.

*ORGANIC SEQUESTERING AGENTS*, by Stanley Chaberek and Arthur E. Martell. Published by John Wiley and Sons, Inc., New York, 1959. 616 pages. Price 25 dollars.

This treatise by two American authorities gives a comprehensive account of the principles underlying the formation of stable water-soluble metal complexes, their industrial applications and functions in living tissues. About half the book deals with fundamentals including the properties of aqueous metal chelates, determination of their formulae, solubilities, metal buffers and metal titrations. A chapter dealing with commercial applications of metal chelates describes their applications in various decontamination and manufacturing processes and the separation of metals. The chapter on metal chelates in biological systems discusses modern concepts of the activities of minor elements, and the use of synthetic chelates in plant nutrition.

This book is profusely illustrated with graphic and structural formulae, graphs, diagrams and photographs. There are many tables and over 1,000 references to original articles (to 1958). At the end of the main sections are useful summaries with further examples (and references) of material outlined in the text.

This comprehensive and informative book should be of interest to all chemists.

—C.R.B.

*THE TRANS-URANIUM ELEMENTS*, by Glenn T. Seaborg. Published by Methven & Co. Ltd., London, 1959. Price 50s.

This is a composite work, divided into four distinct sections. The first deals with the history of the scientific background of the wartime Plutonium project (of which Dr. Seaborg was Chemical Director) with particular reference to the scientists concerned in the work. The story of the early work on the chemistry of plutonium, with only microgram quantities available, and the complications of intense radioactivity and extreme poisonousness, is a fascinating one. The second section summarizes the essentials of the chemistry of the trans-uranium elements, including details of the discovery of the elements up to number 100 (Fermium). The third sections deals with the nuclear properties of the trans-uranic nucleides—rather tough going for anyone not familiar with modern nuclear theory. Finally, the author discusses the prospect of synthesizing “trans-fermium” elements in a slightly fanciful manner, permissible for the man who is already responsible for so many additions to the periodic table.

The book is written in a very readable style, well-produced, and should be of interest to any chemist desirous of gaining an insight into the “goings on” down at the bottom of the periodic table.

—W.F.C.

## INTERNATIONAL UNION OF CRYSTALLOGRAPHY

### *World Directory of Crystallographers*

In 1957, just before the Fourth International Congress and General Assembly of the International Union of Crystallography, a first edition of a *World Directory of Crystallographers* appeared. This directory was compiled by Dr. W. Parrish of Philips Laboratories, and contained biographical information on 2,240 crystallographers from 54 nations.

Last May it was decided that the Union should publish a second edition, and that this edition should appear in time for the Fifth International Congress in Cambridge, August, 1960.

It is intended to again include in the directory all practising crystallographers, including advanced graduate students. As today crystallography is an essential part of many fundamental and applied scientific applications, it is quite difficult to give an exact statement as to what the qualifications of a person should be for inclusion. In many cases therefore, one should judge for himself if he does enough crystallographic work to justify that his name be listed in the directory, the term "crystallographic" to be understood in its widest sense.

Readers of this notice whose names ought to be included in the directory but who have not received a questionnaire by November 1 of the current year, are requested to write to the Secretary of their National Committee, Dr. D. Hall, Chemistry Department, University of Auckland.

Copies of the first edition are still available and can be obtained from the Polycrystal Book Service, G.P.O. Box 620, Brooklyn 1, N.Y., U.S.A., at the price of U.S. \$1.50 per copy, postpaid, if payment accompanies order.

---

## INDUSTRIAL CHEMIST

A vacancy has occurred in our Laboratory for a competent food chemist for non-routine work comprising general analysis of a wide range of raw materials, quality control and applied research.

Minimum qualifications required are B.Sc. or equivalent degree with emphasis on chemistry and biochemistry.

Similar experience is desirable but recently qualified graduates will be considered. There are good prospects of advancement for a person with adaptability and initiative.

A generous salary fully commensurate with experience and ability will be paid.

Applicants should apply in writing, giving details of qualifications, age and experience, and including copies of suitable references to:

The Chief Chemist,  
Griffin & Sons Limited,  
P.O. Box 327,  
LOWER HUTT.

**THE DAIRY RESEARCH INSTITUTE (N.Z.)**

Applications are invited for the following positions in the laboratories of the above Institute:—

**BACTERIOLOGY DEPARTMENT:**

A Chemist or Biochemist for fundamental research work on various aspects of the cheesemaking process with particular reference to cheese flavour. Work along these lines has been in progress in this Department for some time and this position affords an excellent opportunity, particularly for a young graduate, to work in this interesting and rapidly developing field.

**CHEMISTRY DEPARTMENT:**

A Chemist for research work on both fundamental and applied aspects of the manufacture of dairy by-products. This appointment offers good opportunity for interesting scientific activity and for advancement to a position of responsibility. Applicants for both positions should possess an M.Sc. or higher degree. Depending on qualifications and experience commencing salaries will be within the range £825 to £1,275 per annum, with prospects for further advancement.

Further particulars on application to:—

The Secretary,  
The Dairy Research Institute (N.Z.),  
Massey College P.O., PALMERSTON NORTH.

**RESEARCH CHEMIST****MEDICAL RESEARCH COUNCIL**

The Dental Committee of the Medical Research Council is seeking a Research Chemist for developing new methods in trace element analyses in soil and tissues.

Modern equipment includes a recording Beckman D.U. spectrophotometer.

Salary £780-£1,515 according to qualifications and experience. Appointment can be immediately. The laboratory is situated in Dunedin.

Applications should be made to:

The Chairman,  
Dental Committee,  
Medical Research Council,  
P.O. Box 647,  
DUNEDIN.

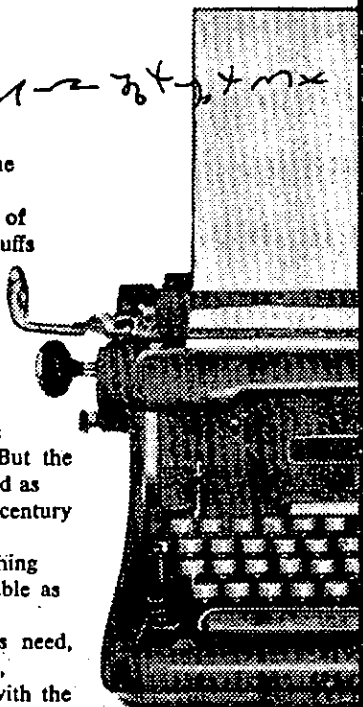
## "Take a letter, Miss Smith"...

That's what you could be saying in a minute or so. But not just yet. Not until you've read another story of



technical achievement from the records of I.C.I. research and development. This is a story of dyestuffs—the "Procion" dyestuffs that I.C.I. chemists discovered in 1956. It was by no means I.C.I.'s first contribution to colour chemistry, for no less than 5 out of the 7 major dyestuffs discoveries of the last 35 years have come from the Company's laboratories. But the "Procion" range has been hailed as the dyestuffs discovery of the century—because it represents the culmination of years of searching for colours as stable and durable as the textiles to which they are applied. "Procions" meet this need, in fabrics like cotton and linen, for they combine chemically with the fabric by becoming part of the molecule, basic structure of the fibre itself. Today, "Procion" dyestuffs are making life better for textile dyers and printers all over the world. I.C.I. research and development—on which the Company spends more than £13,000,000 a year—have done much to make life better in many different fields. And all the many fruits of I.C.I.'s experience are at your service. Call your secretary now.

*"Take a letter, Miss Smith . . . to Imperial Chemical Industries (N.Z.) Ltd."*



**IMPERIAL CHEMICAL INDUSTRIES (N.Z.) LTD.**



## **IF YOUR PROBLEM IS ONE OF SPACE OR TIME . . .**

B.D.H. Concentrated Volumetric Solutions, in glass and polythene ampoules, can be stored for years in any climate without deteriorating, ready for immediate use whenever they are wanted.

The accuracy of solutions prepared as directed is within the factor limits of 0.999 and 1.001. The ampoules are convenient for the laboratory, and particularly useful for portable equipment and mobile units.

*In cartons of six ampoules.*

*Each ampoule, containing approximately two fluid oz, makes 500 ml of accurately standardised solution.*



**THE BRITISH DRUG HOUSES LTD.**

**B.D.H. LABORATORY CHEMICALS DIVISION : POOLE : ENGLAND**

Registered at the G.P.O. as a magazine.

A. K. WILSON LTD.