

# JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

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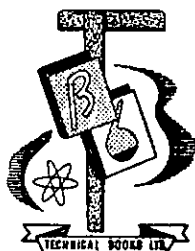
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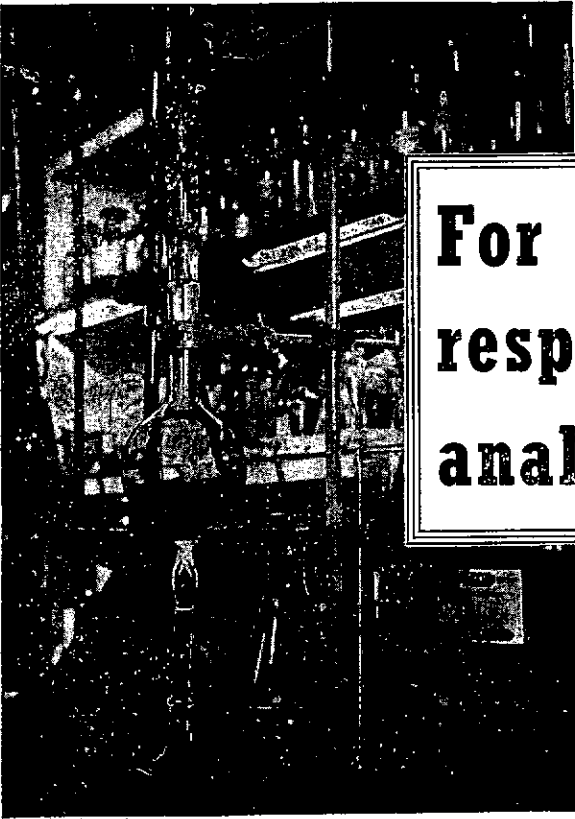


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CONFERENCE, AUCKLAND, AUGUST 22nd-25th, 1949

## THE TEAM FROM AUSTRALIA

We give here some details of the work of the three visitors who are coming to the Conference from the Council for Scientific and Industrial Research, Melbourne, to which body we are indebted for the courtesy of the visit.

The C.S.I.R. Delegation coming to New Zealand for the Conference, consists of Dr. I. W. Wark, Dr. A. L. G. Rees, and Dr. W. O. Williamson.



Dr. Wark is the chief of the Division of Industrial Chemistry at Fisherman's Bend, Melbourne, and is recognised as an authority on surface chemistry and particularly on the flotation of minerals.



Dr. W. O. Williamson

Dr. A. L. G. Rees

Dr. Williamson is a senior research officer who came to Melbourne from the University of Witwatersrand. He has a wide experience of ceramics and has initiated some fundamental work on the properties and utilisation of ceramic raw materials in Australia.

Dr. Rees is a senior principal research officer in the same division and controls the more fundamental physical research, using the methods of X-ray crystallography, electron diffraction, infra-red spectroscopy, the mass spectrograph and the electron microscope.

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Summaries of papers in the various sessions follow. It is possible that there may be some other short papers not to hand at the time of going to press, and copies of these will be available at the Conference.

## SYMPOSIUM ON ANTIBIOTICS

Chairman: DR. T. R. VERNON, Plant Diseases Division, Auckland.

### AN INTRODUCTION TO ANTIBIOTICS

T. R. VERNON, Plant Diseases Division, Auckland.

This paper introduces the symposium on Antibiotics.

The range of biological relationships from parasitism to symbiosis, which may exist between organisms living together, is discussed and examples given. Antibiosis is defined.

The chemical reactions underlying some of these associations and the importance of the production of antibiotic substances in antagonistic relationships are explained.

A brief account of the development of antibiotics, pyocyanase, tyrothricin, penicillin and streptomycin is given.

### THE NATURE OF ANTIBIOTIC ACTION

A. T. JOHNS, Plant Chemistry Laboratory, Palmerston North.

The study of the mode of action of antibiotics of therapeutic value should eventually provide an explanation of their ability to enter the animal body and kill susceptible bacteria without killing the tissue cells of the host.

Ehrlich recognised the bactericidal action of dyes and his first studies were on the distribution of dyestuffs in the animal body. Ehrlich performed his first experiments in chemotherapy in 1891 when, after finding that methylene blue stained malarial parasites very effectively, he tried the effect of the dye on malarial patients and obtained some success.

An aniline-water-methyl violet mixture used by Ehrlich was also employed by Christian Gram for staining bacteria and is now universally known as the Gram Stain.

The Gram process of staining has divided bacteria into two groups—Gram negative and Gram positive, according to whether they retain the aniline dye after suitable treatment.

This grouping is also found to divide bacteria according to their susceptibilities to the action of bacterio-static agents, basic dyes, detergents and antibiotics. Gram positive organisms are attacked under normal conditions by such agents. Gram negative organisms are frequently more resistant, but are more susceptible to enzymic digestion and to lysis.

Bacteria can also be classified according to their synthetic abilities. For synthesis to occur an organism requires (1) Inorganic salts; (2) a source of carbon; (3) a source of nitrogen and, (4) a source of energy. Some organisms can synthesise all their protoplasm from simple sources such as carbon dioxide and ammonia, plus a source of energy, and must therefore be equipped with all the enzymes necessary for the formation of the essentials of their existence from these simple sources. This is not the case with all bacteria as many organisms are lacking in enzymes necessary for certain synthetic processes. When this occurs, the organism in question is unable to grow unless that particular constituent is supplied ready made in the environment. When an organism has such a synthetic disability it is said to be nutritionally "expecting" towards the substance which it is unable to synthesise.

Some bacteria are unable to synthesise all their amino acids from a source of carbon and inorganic nitrogen but can grow in a simple salt-ammonia-glucose medium if the necessary amino acids are added. Others are unable to grow in

such a medium even if a complete mixture of amino acids is added and require the addition of an essential "growth factor" or "bacterial vitamin." It has been shown that there is a parallelism between exactingness and parasitic existence which suggests that the former arises from constant growth in the presence of essential substances of difficult synthesis.

These more exacting organisms are in general the gram positive types more susceptible to the action of chemotherapeutic agents, and the gram negative are non-exacting and resistant.

The sulphonamides, penicillin and streptomycin dominate the field of research concerned with the mode of action of chemotherapeutic agents which have achieved a recognised place in therapy. Only these will be considered in the present paper.

#### **Sulphanilamide action:**

The possibility of preventing growth by interference with growth factor utilisation was brought into prominence by the work of Woods on sulphanilamide action. Sulphanilamide or p-amino benzene-sulphonamide in low concentrations prevents the growth of certain bacteria, particularly the gram positive cocci. Woods showed that 1 molecule of p-amino benzoic acid can neutralise the action of 5,000-25,000 molecules of sulphonamide.

Fildes and Woods proposed that p-amino benzoic acid is an essential "metabolite" for bacteria and that if its metabolism is in any way prevented then growth ceases. Since sulphanilamide and p-amino benzoic acid have similar chemical structures, it was suggested that sulphanilamide acts as a competitive inhibition of the enzyme carrying out the essential metabolism of p-amino benzoic acid.

It now appears that a major effect of sulphonamides as a group is to prevent the synthesis by bacteria of pteroyl compounds, derivatives of p-amino benzoic acid which are related to folic acid.

#### **Penicillin:**

Gale has shown that gram positive bacteria are able to accumulate certain amino acids from their surrounding media and to concentrate them inside the cell so that at equilibrium the internal concentration is greater than the external. After glutamic acid has passed through the cell wall, a portion of it undergoes metabolic change and the level of glutamic acid concentration represents the balance between the rate of entry of that amino acid into the cell, and the rate of its metabolism within the cell.

Comparison of the general properties of normal and penicillin inactivated cells has shown that the respiration, glucose oxidation, glucose fermentation and lysine accumulation are normal. The internal metabolism of glutamic acid is normal in penicillin treated cells, but the passage of glutamic acid across the cell wall is blocked. When the bacterial cell has used up its internal glutamic acid protein synthesis, and hence growth ceases.

It has also been shown that when bacteria acquire resistance to penicillin, they may become gram negative and develop the ability to synthesise glutamic acid.

Current investigations have indicated that penicillin resistance does not necessarily involve the production of penicillinase (penicillin destroying enzyme).

#### **Streptomycin:**

Streptomycin rather unlike penicillin and the sulphonamides appears to modify certain oxidation systems in washed bacteria. There are indications that the result of streptomycin inhibition is to prevent pyruvate and other keto acids from entering the terminal respiration system by way of oxalacetate condensation. This reaction is also an important one in animal metabolism

and so it is difficult to explain why streptomycin is able to kill the bacteria and not the host.

It is to be noted that though the effects of penicillin and streptomycin on the bacterial cell have been observed, the actual enzymes which they inhibit have not been determined.

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#### **ANTIBIOTIC EQUIPMENT AT PLANT CHEMISTRY LABORATORY**

R. L. LEDGER, Dominion Laboratory, Wellington.

This paper gives details of the pilot plant installed at the Plant Chemistry Laboratory to be used for experimental work on the production of antibiotic substances.

The plant includes a deep fermentation unit, filtration, solvent extraction and freeze drying equipment, together with boiler plant, and air compressor and refrigeration unit for low temperature solvent extraction.

In addition, information is presented as to possible uses of portions of the plant for carrying out work on industrial fermentations.

Photographs and drawings of the various portions of the plant are shown.

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#### **PRODUCTION OF ANTIBIOTICS—OPERATION OF PILOT PLANT**

H. B. OAKLEY, Plant Chemistry Laboratory, Palmerston North.

A typical deep fermentation for the production of penicillin is described. Details are given of medium, method of sterilising, control of foaming, aeration and the general course of the fermentation. The latter includes methods of sampling and the determination of pH, lactose, ammonia and total nitrogen.

The methods used for extracting the penicillin from the crude broth are discussed and details given of filtration, adjustment of pH, amyl acetate extraction, the formation of sodium penicillin, second extraction with chloroform and final purification by chromatographic adsorption followed by Seitz filtration and freeze drying.

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#### **CHEMISTS' EMPLOYMENT COMMITTEE—EMPLOYMENT OF STUDENTS DURING VACATIONS**

The Chemists' Employment Committee wishes to obtain particulars of firms or other organisations who may wish to employ chemistry students during vacations, and any member who may be able to assist in this direction is asked to forward, as soon as possible, particulars such as name and address, nature of position, etc., to the Hon. Secretary, Chemists' Employment Committee, P.O. Box 250, Wellington. It is proposed that the list compiled from such information be circulated to the four University Colleges about September in each year in order that students seeking temporary employment during their vacations may be able to finalise such employment before the end of the university year.

**SYMPOSIUM ON FOOD TECHNOLOGY**

Chairman: S. G. BROOKER, Abels Ltd., Auckland.

**SOME OBSERVATIONS ON THE MEAT INDUSTRY IN AUSTRALIA**

F. B. SHORLAND, Fats Research Laboratory, Wellington

**THE PROBLEM OF "BONE TAINT" IN DRESSED CARCASE MEAT**

M. B. RANDES, Auckland Farmers' Freezing Co.

A brief account is given of preliminary work as a contribution towards a logical explanation of "bone taint" as it has been experienced in New Zealand.

The conditions under which bone taint arises and the measures adopted to deal with it in the freezing works are briefly reviewed, and the application of Cambridge Low Temperature Research Station methods involving the determination of pH is discussed. It seems likely that putrefaction of the meat in the femur precedes bone taint in the meat and attempts have been made to identify characteristic bacteria from affected marrow. However, post-mortem bacteriological examinations are fraught with difficulties and are not considered very satisfactory.

Using a glass electrode and a graphical method for estimating the pH of marrow by extrapolation, indications are that the pH of aqueous extracts of marrow is comparatively high, and this factor, together with the good incubation conditions which may occur at the hip joint would give a most favourable condition for the multiplication of bacteria after the death of the animal should anti-body protection be absent. Experiments on the effect of fatigue on the pH of bone marrow are proceeding.

**ANTIOXIDANTS**

By C. R. BARNICOAT, Biochemistry Department, Massey Agricultural College, Palmerston North

Antioxidants retard oxidation of unsaturated chemical compounds such as fats. The term "antioxidant" is usually applied to synthetic substances, whereas "antioxygen" refers to substances occurring naturally in fats.

These are now classified in two groups:—

- (1) **Antioxidants** (and antioxygens).
- (2) **Synergists**.

Antioxidants are phenolic compounds such as hydroquinone, 1:5 dihydroxynaphthalene, gallic acid, nordihydroguaiaretic acid. Antioxygens include the tocopherols and chromane, 5-6 quinone.

Synergists delay autoxidation merely by reinforcing antioxidants. They are di- and poly- basic acids (sulphuric, citric, phosphoric), or their derivatives.

During oxidation of olefinic linkages, peroxides are formed and the antioxidant relieves the peroxides of excess energy and their capacity to start reaction chains. The antioxidant disappears at a fairly rapid rate.

**Applications:** Elsewhere, particularly in the U.S.A., antioxidants are used for preserving fatty substances, including milk products; dried butterfat, meat and eggs; nuts, potato chips, cooking fats and sliced bacon.

Some foodstuffs exported from New Zealand deteriorate in flavour during storage through incipient fat oxidation, but attempts to improve their keeping properties by incorporating antioxidants have so far proved discouraging.

It has been shown, however, that certain constituents of butter curd are antioxygenic, and the resistance towards oxidation of dry butterfat (ghee) is related to its heat treatment, the transfer of antioxidants from the aqueous phase (curd) to the fat being favoured by high temperatures.

## CHEMICAL ENGINEERING ASPECTS OF THE DEHYDRATION OF FOOD

G. MASKILL SMITH, Dominion Laboratory, Wellington.

The removal of water from foodstuffs retards spoilage and reduces weight and bulk. The value of this removal depends to some extent on the amount of water that the food contains. Typical foods subject to dehydration are:—

	Ratio Wet : Dry
Milk .....	6½:1
Vegetables .....	4.16 :1
Fruit .....	5.7 :1
Meat .....	4 :1

This discussion will be confined to the last three as they are all solids and have points of similarity. Milk deserves a paper of its own.

A dehydration factory consists of three essential divisions.

- (1) The preparation of the raw material into a suitable size and condition to be dried.
- (2) The drying process.
- (3) Packaging of the product.

This discussion will deal with (2) only.

The standard method in New Zealand has been the cabinet and the tunnel dryer. Typical examples will be discussed and illustrated. We possess quite full information on them and on their operation. Cost figures have been obtained from the operation of one tunnel at the Hastings factory. These figures were obtained from a carefully observed run of one week in 1943, when the factory was operating on potatoes. While the figures would have been slightly different for other materials and for other factories they are sufficiently close for the purposes of this discussion. The total cost of the products could be divided up as follows:—

Raw material .....	45%
Preparation .....	17%
Drying .....	9%
Packaging .....	18%
General .....	11%

The subdivision of the drying cost was as follows:—

Energy .....	2.5%
Labour .....	3.5%
Overhead (drying equipment) ...	3%

From these figures the following conclusions can be drawn:

- (1) The cost of drying is not a big factor in the cost of the product.
- (2) More complicated, and hence more expensive dryers could be used if
  - (a) Labour or energy costs are less.
  - (b) The product is superior.

Suggested types of dryers will be discussed and illustrated.

**MEAT PRESERVATION**

P. R. PARR, W &amp; R. Fletcher Ltd., Auckland.

A brief survey of the processes involved is first given. This is followed by the discussion in more detail of particular problems of interest or special difficulties which have arisen during the author's experience, e.g., problems in can-making, solders, rubber emulsions, the curing of meats by various methods, packing and processing and the lacquering of cans for their protection.

Raw materials and their quality: Bacteriological difficulties—by-products, e.g., meat extract and finally methods of control employed for the various products.

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**SYMPOSIUM ON ANALYTICAL METHODS**

Chairman: O. H. KEYS, Government Analyst, Dunedin.

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**DETERMINATION OF MOISTURE IN OVENS**

J. O. ELPHICK, Dominion Laboratory

A brief survey is made of the types of ovens employed in moisture determinations with considerations of the suitability of different types for various purposes. Some ideas on construction of suitable ovens and some difficulties that have been encountered are discussed together with considerations of optimum conditions in the oven and the condition and nature of the sample. It is recognised that most moisture determinations do not give an absolute value for water content and consideration is given to the meaning of the results, reproductibility and probable accuracy.

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**THE MEASUREMENT OF THE SURFACE AREA OF POWDERED SOLIDS**

S. R. SIEMON and J. M. WOOD, Canterbury University College

There will be given a very brief account of the theory of the measurement of surface area by adsorption, followed by a detailed account of experience gained in the construction and operation of a sorption balance for this purpose.

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**THE DETERMINATION OF CHLORIDE AND BROMIDE IN ADMIXTURE**

C. J. WILKINS and J. A. DIXIE, Canterbury University College.

The proximity of the standard electrode potentials of chlorine and bromine, together with the rather small differences in the solubilities of chlorides and bromides make the determination of these two elements in admixture a matter of some difficulty. Methods based on selective oxidation of bromide require carefully controlled conditions. In the authors' experience bromate and permanganate are unsatisfactory as oxidising agents, but chromic acid is suitable. The indirect method dependent on the gravimetric determination of silver halide and volumetric determination of silver nitrate required for precipitation can also be recommended. An equally suitable method for bromide developed by the writers involves titration with chlorine water until the colour of bromine no longer appears in chloroform used as the extractant.

- **CHROMATOGRAPHIC ANALYSIS**

L. F. STORY, Woollen Mills' Research Association, Dunedin.

In the last few years, chromatography has developed into a most useful analytical tool because of the ease with which otherwise difficultly separable mixtures can be resolved into their components. The methods used depend on differential adsorption on and elution from a variety of finely-divided solid adsorbents contained in a tube through which a solution of the mixture is allowed to percolate, or on "dynamic" partition between two solvents, one of which is held immobile on a suitable material, e.g., silica gel, in a tube, or on paper. The various techniques used will be reviewed with samples of applications.

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**ION EXCHANGE IN NATURAL AND SYNTHETIC ZEOLITES, AND ZEOLITE RESINS AS A METHOD OF ANALYSIS**

W. S. FYFE, University of Otago.

The phenomenon of base exchange in zeolites has been known for a long time, but until the advent of X-ray analysis, little was known of the process. The present paper discusses the fundamentals of base exchange in zeolites and modern methods in separation using the so-called zeolite resins. These have produced such remarkable results in the case of the rare earths.

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**SOLVENT EXTRACTION**

I. M. MORICE, Fats Research Laboratory, Wellington.

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**DETERMINATION OF MOISTURE**

N. H. LAW, Dominion Laboratory, Wellington.

Chemical and volumetric methods for determining moisture with special emphasis on methods, particularly adaptable to accurate routine control.

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**DETERMINATION OF MOISTURE BY DISTILLATION METHODS**

S. R. SIEMON, Canterbury University College.

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**DETERMINATION OF MOISTURE—THE ISOPIESTIC METHOD**

R. W. GREEN, Dental School, Dunedin.

Biological materials unstable to heat may be dried by isothermal distillation at room temperature, and evidence will be produced that by this method irreversible changes are avoided.

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**ELECTRICAL MOISTURE METERS**

L. H. BIRD, Wheat Research Institute, Christchurch.

Description of some electrical resistance and dielectric constant instruments for use with grain. The value of these instruments depends upon the need for speed, the permissible error, and the degree to which they surpass skilled judgment. They should be tested with "as received" samples. Calibration on prepared samples can be misleading.

The resistance type is the best for wheat.

**SYMPOSIUM ON UTILIZATION OF NEW ZEALAND  
MINERAL PRODUCTS**

Chairman: **G. S. LAMBERT**, Hayes' Metal Refineries, Auckland.

**SULPHUR IN NEW ZEALAND COALS**

W. G. HUGHSON, Dominion Laboratory, Wellington.

For industrial purposes where the sulphur content of coal is under consideration, coals are divided into three groups.

1. Low Sulphur coals containing less than 1% Sulphur.
2. Medium Sulphur coals containing from 1-2.5% Sulphur.
3. High Sulphur coals containing above 2.5% Sulphur.

**PRODUCTION OF COAL FOR 1947 (on a Sulphur Basis) (Tons)**  
(TOTAL PRODUCTION, 2,751,725 TONS).

Sulphur Group	o	Low	Medium	High
Lignite .....		129,182	25,576	149,794
Sub-Bituminous .....		1,071,240	158,220	176,392
Bituminous .....		308,813	404,424	328,084
		1,509,235	588,220	654,270

Low sulphur coal (annual production 1½ million tons) is drawn mainly from the sub-bituminous areas of the Waikato district and the Ohai district, 50 miles north of Invercargill.

Medium and High Sulphur coals (annual production, 1 million tons), come mainly from the bituminous mines of the West Coast of the South Island.

These coals are mined in particular areas and are used mainly in factories, locomotives and for gas production.

Two problems are considered:—

1. The burning of Sulphur Coals in steam-raising plant. The main concern in this case is the formation of SO<sub>2</sub> and corrosion due to sulphuric acid.
2. The utilization of Sulphur Coals for the production of town gas and the removal of sulphur compounds from the gas.

The latter problem is dealt with in greater detail and with particular reference to New Zealand conditions under the following headings:—

1. The possibility of modifying the present day oxide box purification with recovery of sulphur.
2. The merits of liquid purification systems, either alone or in conjunction with iron oxide boxes.

Four liquid processes are considered to be more particularly applicable to New Zealand conditions.

1. The original Seaboard process for small works where no trouble would arise from the discharge of sulphuretted hydrogen to atmosphere and where recovery of Sulphur would not be economic.
2. The modified Seaboard process where the use of a vacuum effects an economy in steam consumption, but where a Claus Kiln would be required to recover the sulphur.
3. The Manchester process (similar to the Ferrox process), which is claimed to purify gas without the subsequent use of oxide boxes.

4. The Thylox process which absorbs sulphur compounds with alkaline thio arsenates and yields a finely divided and clean sulphur.

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## GREENSAND POTASH IN INDUSTRY AND THE OXY-ACETYLENE TORCH IN THE LABORATORY

J. J. S. CORNES, Dominion Laboratory, Wellington.

### 1. Greensand as Source of Potash

Greensand is a sedimentary rock composed mainly of glauconite, a green silicate of ferric iron containing also 6-8 per cent of potash ( $K_2O$ ). The  $K_2O$  may be extracted commercially with  $H_2SO_4$ . (J.I.E.C., 1925, p.1177).

(This suggested a laboratory method of determining alkalis in silicates generally; Nature, 1944, p.237).

### 2. Greensand as flux for Iron-sand

It is suggested that the alkali of greensand may replace that of the Russian nepheline-syenite in fluxing a mixture of Taranaki titanomagnetite and dolomite.

This has been tested by fusions with the oxy-acetylene torch, a laboratory method adapted from the testing of "raw mixes" of limestone and marl at Golden Bay cement works.

The most fusible and glassy slag is formed by heating 1 part iron-sand, 1 part greensand, and about 0.8 parts dolomite, using the reducing flame of the torch, and producing thereby malleable iron, or, if carbon is added to the charge, brittle pig-iron.

The analysis of the slag is compared with the Russian.

### 3. Greensand as flux for phosphate-rock

It is suggested that greensand and dolomite may replace the olivine rock (dunite) used in T.V.A. experiments (J.I.E.C., 1943, p.774), or the siliceous limestone used at Huntly in making Heskett slag.

Preliminary small fusions of mixtures of 1 part Nauru phosphate, 1 part greensand, and increasing proportions of dolomite were made, by heating with the oxy-acetylene torch on a graphite refractory. When the dolomite was increased to 1 part, the mix was still readily fusible, while the silico-phosphate slag became easy to grind, alkaline to phenol-phthalein, and completely soluble in cold 2 per cent citric acid.

Larger fusions were made in a gas-fired ash-fusion furnace. Under reducing conditions the slag formed at  $1250^{\circ}C$ , and completely absorbed the phosphate at  $1400^{\circ}C$ , i.e., at a temperature below that of a Portland cement kiln.

The analysis of the phosphatic slag is compared with that of a typical Basic Slag. It supplies over 2 per cent potash, along with magnesia, while avoiding the expenditure of dollars on Texas sulphur.

Being basic and acid-soluble, it can be used, like serpentine, for the "reversion" of superphosphate.

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## THE CHLORINATION OF TITANIFEROUS IRON-SANDS

I. S. HUNT, Metal Smelting and Refining Co., Auckland.

The utilisation of the iron-sand deposits of New Zealand has been the subject of many attempts during the last hundred years. All published accounts so far have concentrated on the recovery of iron from sand by means

of various smelting processes. The investigation described in this paper approaches the problem from a different angle. Use is made of the physical properties of the chlorides of the three constituents which are of commercial interest. Recent developments in the application of thermo-dynamics to metallurgical processes have been utilised in an attempt to predict and account for the reactions taking place. The process investigated consists of the simultaneous reduction and chlorination of the magnetic concentrates, and the separation of the resulting volatile chlorides by fractional condensation.

The iron chlorides are reduced to metallic iron of more than sufficient purity for use in the direct manufacture of steel. The metal produced has considerable potentialities for the manufacture of materials where iron of a high purity is required. The titanium is recovered as the liquid chloride which may then be used for the manufacture of titanium pigment, or titanium metal, by established processes.

The results of this work show that by means of a gaseous process carried out at a relatively low temperature, it is technically practicable to recover the iron and titanium from a titaniferous iron-sand. Iron powder has been produced containing 98% metallic iron and less than 0.1% of both titanium and vanadium.

The commercial application of the process depends on the development of certain heavy chemical industries in New Zealand for the supply of the necessary raw materials.

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#### UTILIZATION OF N.Z. CERAMIC RAW MATERIALS

D. McCLURE, Amalgamated Brick & Pipe Co., Auckland.

The scope of past and present investigations and surveys of ceramic materials within New Zealand is limited. Much work has been of reduced value because of sampling procedure or incomplete data. New Zealand has reserves of excellent china clay for all industrial purposes, and these are discussed, but is less favourably placed for ball clay and china stones. Low grade feldspars have been improved by treatment. Flint is of poor quality and flint-quartz sinters and other rocks, as well as quartz-amorphous silica podsols have been used for some purposes; they possess interesting characteristics. "Ganisters" of high quality from North and South Islands depend on rock structure for commercial metallurgical properties. Distomaceous earths are freely distributed, but few are of high quality. Highly aluminous clays of the North vary in physical properties; some are characterised by anomalous vitrification features; some are phenomenally high in titanium oxide, others in sulphuric acid; some contain much halloysite; others have gibbitic material, whilst allophane (the amorphous alumino-silicate) appears in some quantity. Glass sands have received recent attention. Brick and pipe clays are secondary deposits of various types. Pumice has been used in light-weight compositions, and the North Island's pumicite reserves for glazes. Chromite of fair chromic oxide content appears and is being developed for refractories. New Zealand talc is steadily used in whiteware and refractories and talc magnesite similarly. Magnesite is being investigated for refractories use. Dolomite of unusual purity has been used experimentally for sinter purposes. The Nelson calcite is largely used in all forms of New Zealand ceramics. Possible uses for high boron coals are suggested. The use of lignitic coals in industrial gas producers has been successful. New Zealand flint pebbles for grinding have proved unsatisfactory. New Zealand bentonite is discussed. Chemical and physical data on the above materials is presented.

**SYMPOSIUM ON BIOCHEMISTRY**

Chairman: DR. C. R. BARNICOAT, Massey College.

**ANTI-VITAMINS**

MARION M. CUNNINGHAM, The Karitane Products Society, Ltd.,  
Wellington.

The existence of substances antagonistic to essential metabolic processes was postulated in the earliest days of vitamin research, when Eijkman, working on polyneuritis in fowls, concluded that the disease was caused by toxic substances present in polished rice, the antidote to which was to be found in the polishings. Somewhat later, Mellanby's hypothesis of the "toxamins" present in cereals followed the same line of reasoning, but proof of the definite correlations existing between specific diseases and deficiencies of various factors in the diet led to neglect of the idea of agents in foodstuffs positively antagonistic to vital processes. In 1940, however, with the elucidation of the sulfonamide-para-aminobenzoic acid antagonism, the anti-vitamin hypothesis assumed new importance, and the past decade has produced an immense volume of research on vitamin antagonists, both naturally occurring and synthesised. Further, the concept of structural antagonism and realisation of the definite correlations to be traced between chemical structure and biological activity have rationalised the whole approach to chemotherapy and opened new fields in the combat of disease.

The existence of anti-vitamins has greatly complicated the task of the chemist endeavouring to estimate the vitamin value of a foodstuff. It is obvious that while the chemical and physical methods available for measurement of most of the vitamins may give an estimate of the amounts of these factors present in a food, they may provide no indication whatever of its real value to the animal. It would appear that in order to assess the total value of a food with regard to any factor, biological assay once more becomes essential. Statements of the requirements of a species for a certain vitamin will also need modification according to presence or absence in the diet of factors antagonistic to the activity of that vitamin.

**STUDIES IN CAROTENE METABOLISM**

W. A. MCGILLIVRAY, Biochemistry Department, Massey Agricultural College,  
Palmerston North

It is well recognised that certain carotenoid pigments are converted, with varying degrees of efficiency, into Vitamin A in the animal body and until recently it was assumed that this conversion took place in the liver, although the evidence supporting this hypothesis was equivocal. Recent experiments have, however, shown that the wall of the intestine is the main site of conversion and that the vitamin formed is transported mainly via the lymphatic system into the systemic circulation from which excess is taken up and stored by the liver. This site has been confirmed by *in vivo* and *in vitro* experiments involving both ruminants and non-ruminants.

The conversion occurs through a symmetrical splitting of the carotene molecule, one molecule of  $\beta$  carotene giving rise, through a number of intermediates of which one is almost certainly retinene, to two molecules of vitamin A.

Despite reports to the contrary, the thyroid state does not appear to affect the efficiency of conversion of carotene to Vitamin A, although a hypothyroid condition may lower the absorption of carotene. Doubt is cast on the claim by Russian workers to have effected the *in vitro* conversion of carotene using

thyroprotein preparations, and it is suggested that isomerisation only occurs. Conditions under which *in vitro* conversion might occur also favour oxidation or isomerisation of the carotene and a special method has been introduced to detect any Vitamin A formed in the presence of these decomposition products.

Other factors affecting the availability of carotene to ruminants, particularly the possible seasonal variation in availability from pasture, are under investigation in this Department at the present time.

### **METABOLISM OF LINOLENIC ACID IN ANIMALS**

F. B. SHORLAND, Fats Research Laboratory, Dept. Scientific and Industrial Research, Wellington.

It is generally considered that linolenic acid (octadeca-trienoic) is not normally found in more than traces in animal depot fats even though present in quantity in the diet (c.f. Bloor, 1943). Recently, however, Beadle, Wilder and Kraybill (1948) showed that rats fed flaxseed equivalent to 6.6% linolenic acid in the diet deposited up to 27.59% linolenic acid in their depots, while yellow fats from hogs contained up to 11.4% of this acid. If, as supposed by these workers, that the linolenic acid content of the depot fats was directly related to the amount present in the diet, it would be anticipated that since grasses and clover fats are rich in linolenic acid, fats from pasture fed animals would also contain a high proportion of this acid. Careful investigation of New Zealand beef and mutton tallow, however, shows the absence of all but traces of linolenic acid. On the other hand, fat from horses fed solely on New Zealand pasture shows about 21% linolenic acid (Shorland, 1949; Shorland and Brooker, 1949).

Consideration of the available evidence suggests that in ruminants, such as the ox or sheep, linolenic acid is either destroyed in the rumen or in the animal body. The fact that some linolenic acid reaches the blood is suggested by the work of Kelsey and Longenecker (1941), who found that 9.2% of this acid in the fatty acids combined with cholesterol in cow's blood. In addition, Hilditch and Shorland (1937) found linolenic acid in sheep's liver, but not in ox liver, indicating possibly a difference between the fat metabolism of the ox and the sheep. Consideration of cow milk fat, compared with the depot fat suggests that the former, but not the latter, is influenced by the dietary fat.

A tentative classification is now suggested for animal fats based on the degree to which they are influenced by the dietary fat.

1. Unaffected—Ox and sheep depot fat.
2. Modified with difficulty—butterfat.
3. Readily modified—horse and rat depot fat.

### **PLANT NITROGEN METABOLISM**

N. O. BATHURST and J. L. MANGAN, Plant Chemistry Laboratory, Palmerston North

The study of protein metabolism in plants has been greatly handicapped in the past, largely because of the lack of suitable specific micro-methods for estimating the different amino acids concerned. In recent years, however, further opportunities for advance have been provided by the development of new techniques such as partition chromatography, microbiological assays, electro-dialysis, etc.

In pasture plants the amides glutamine and asparagine have long been recognised as occupying key positions in the metabolism of protein. The corresponding acids, glutamic and aspartic, are also found in appreciable

quantities in the free state, together with valine and usually proline. It is noteworthy that these six amino acids mentioned make up, in most cases, almost the whole of the soluble amino nitrogen fraction. The amino acid composition of this fraction is thus very different from that of the plant protein.

A third amide, urea, has been found to be a normal constituent of green leaves, along with its enzyme urease, in amounts comparable with those of the other amides. There is a certain amount of evidence for a urea precursor in grass, but the absence of large quantities of arginine indicates that it is unlikely that the Krebs ornithine cycle is in operation.

Under suitable environmental conditions, nitrogen fertilizers such as ammonium sulphate and urea are taken up by the plant from the soil extremely rapidly and are converted into the amides glutamine, asparagine, and urea, appreciable increases being observed within one hour.

Many links in the chain from ammonia to protein are still obscure.

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### OXIDISING ENZYMES OF WHEAT

ROSA STERN and L. H. BIRD, Wheat Research Institute, Christchurch.

Doughs made from high extraction flour, darken considerably during fermentation and yield bread of a greyish crumb colour. This process was traced to the increased germ content of these flours, and was shown to be the result of enzyme activity. Wheatgerm, being the main source of the enzymes concerned, i.e., oxidase, peroxidase, catalase, was used for the study of the darkening process.

The darkening was found to be due to enzymic oxidation of a phenolic substrate present in the germ. There are two possibilities for such an oxidation: (1) An oxidase system using atmospheric oxygen oxidises the substrate directly; (2) The oxidase produces  $H_2O_2$  which is then utilised by peroxidase. As wheat peroxidase is much more stable than the oxidase, it was possible to obtain oxidase free material, leaving the peroxidase intact. Such peroxidase preparations went dark only if  $H_2O_2$  was supplied. So far, it has not been possible to study the effect of the oxidase in absence of peroxidase.

The interpretation (2) in the preceding paragraph assumes the formation and availability of  $H_2O_2$  in spite of the high concentration of catalase in wheat germ. Study of this question showed that, in presence of a substrate of peroxidase or oxidase, catalase activity is largely suppressed until these enzymes have oxidised their substrate, i.e., peroxidase, and possibly oxidase activities, have priority over catalase activity.

The oxidase system has been separated into two fractions, one an apoenzyme insoluble in water, the other containing water soluble and heat stable coenzyme and substrate.

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**SYMPOSIUM ON SILICATES, SOILS & RELATED MATERIALS**

Chairman: W. VOSE, Pottery and Ceramics Research Assn., Wellington.

**QUANTITATIVE APPLICATIONS OF DIFFERENTIAL THERMAL ANALYSIS**

I. C. McDOWALL, Pottery and Ceramics Research Assn., Wellington.

The paper is divided into four sections, in the first of which the nature of the reactions used and the apparatus required to detect and measure them are described. The theoretical basis of quantitative analysis by the differential thermal method is outlined and practical procedures and difficulties discussed.

There follows a detailed examination of the application of the method to clays of the kaolin group and the degree of accuracy attainable under different conditions is indicated.

The detection and estimation of tridymite, cristobalite and quartz by the thermal method is described and the effect of interfering substances on the accuracy of the results is described.

**THE PHYSICAL RELATIONSHIPS BETWEEN CLAY AND WATER**

W. O. WILLIAMSON, C.S.I.R., Melbourne.

The shrinkage of clay during drying shows that the particles in the plastic mass are separated by water-films. These particles are plate-like. Thus, when they possess a common orientation, the aggregate thickness of water-films, and hence the drying—shrinkage, show maxima in a direction at right angles to the broad surfaces of the plates. This is demonstrable by preparing test-pieces, built of orientated clay-flakes, by processes not involving mechanical deformation. The plastic deformation of clay produces systematic variations in the moisture-content of one and the same test-piece. There are corresponding variations in both the linear drying-shrinkage and the particle orientation. Here, however, the two are not strictly correlated as a greater water-content in one part of a specimen may offset the effect of a poorer particle orientation (Williamson).

Adsorption processes cause the initial formation of water-films on clay. However, the great thicknesses which these films can attain do not appear to be determined by adsorption. A force-network permits the clay particles to take up positions relatively remote from one another; the intervening space is filled by water (Houwink; Macey).

There is evidence that, in the vicinity of the clay-crystal surface, water is under constraint. This is provided by studies of aqueous conductivity (Macey), of extrusion (Grim and Rowland) and of the ramming of clay-sand mixtures (Grim and Cuthbert). It is significant that crystalline arrangements of water-molecules can be visualised which have dimensions in common with those of the clay layer-lattice (Hendricks and Jefferson; Macey). Such arrangements resemble ordinary ice in structure and are difficult to relate to the strong compression of the water suggested by the heat of adsorption (Winterkorn), or by the volume changes during deflocculation (Webb). While this difficulty can be overcome by postulating the existence of a dense form of ice at the clay-water interface, such a form of ice is unlikely to show marked structural coincidence with the clay layer-lattice.

It is significant, however, that the base-exchangeable cations control the water-content of the plastic clay. Thus, to cite an extreme case, large organic cations can much reduce the capacity of clay to absorb water (Grim, Allaway and Cuthbert). Further, there is evidence that water adsorbed by metallic salts

has an anomalously high density; water adsorbed directly on the surfaces of clay crystals has a low density (Nitzsch). Thus "ice-like" water of low density may associate with the surface of the clay-crystal proper and "compressed" water with the exchangeable cations.

It has been suggested that the water associated physically with clay-minerals is held, not only by the exchangeable cations, but by the surfaces and edges of the crystals (Kelley, Jenny and Brown). Electron-microscopical studies have shown that positively charged colloidal silver iodide is adsorbed on the basal plane of kaolinite. Negatively charged colloidal gold is adsorbed here only if barium ions or invert soaps have been made available to the kaolinite (Thiessen). Thus ice-like water and metallic cations may compete with one another for adsorption sites on the basal plane, or at least, the structure of this water may be much modified in the vicinity of cations.

Normally, colloidal gold is adsorbed on the edges of kaolinite crystals (Thiessen). This suggests that sites for anion-adsorption may exist. Indeed, it has long been suggested that clay-lattices can adsorb cations and anions simultaneously and in equivalent amounts (Schofield). The part which anions may play in the mechanism of water-adsorption by clays is worthy of further study.

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### CATION EXCHANGE PHENOMENA IN SOILS

A. J. METSON, Soil Bureau, Wellington.

The study of cation exchange in soils dates from the classical researches on the absorptive properties of soil by Thomas Way, about 1850, in England. Early difficulties in interpreting the observed phenomena arose from the failure to appreciate their reversible nature, and the important part played by the hydrogen ion, and from the lack of knowledge of the nature of the fine-grained constituents of soils. Something of an impasse was reached towards the end of the nineteenth century, because existing chemical theory was inadequate to account for the facts. Notable contributions were made by Wiegner and his school in Switzerland, in the twenty-odd years from about 1912. Wiegner approached cation exchange from the point of view of colloid chemistry, emphasizing the importance of ionic size and hydration.

Meanwhile, Gedroiz, in Russia, in an extensive series of papers, had discussed cation exchange properties from the viewpoint of a student of the soils, as well as of chemistry, and had established their great importance in characterising natural soils.

During the last twenty years or so, Mattson in Sweden has developed a theory of soil colloidal behaviour in which he makes use of acidoid; basoid ratios, and the pH. of the medium, and explains cation exchange in terms of ionization. The discovery by Hendricks, Kelley and others in the U.S.A. in 1930-31, of the predominantly crystalline nature of the inorganic matter of soil clays, marked a great step forward in the understanding of exchange phenomena which could now be explained in terms of crystal structure and lattice charges of the "clay minerals."

Present work has been concerned with the further characterization of the clay minerals and improvements in methods for their estimation in soils. The clay membrane technique of Marshall is giving important information of the activities of individual cations on the clay minerals, and Jenny's principle of contact exchange is giving interesting results in the study of inorganic plant nutrition.

**SYMPOSIUM ON STRUCTURAL METHODS**

Chairman: PROF. F. J. LLEWELLYN, Auckland.

**APPLICATION OF THE POLAROGRAPHIC METHOD TO CONSTITUTIONAL PROBLEMS**

T. J. SPROTT, Auckland University College.

Since the development of the use of the dropping electrode by Heyrovsky, Shikata and others, many investigations of various inorganic and organic systems have been carried out. Most of these have, however, been conducted from an analytical viewpoint and few attempts have been made to correlate the polarographic halfwave potential with the substituents and structure of organic molecules.

We are fortunate in A.U.C. in having a large number of pure anthraquinone compounds procured mainly from native trees by Professor Briggs and co-workers, and these proved very suitable for the investigation of the reduction of a series of compounds of one type. The number and position of the various substituents determine the potential at which reduction occurs and the compounds fall into groups of similar potentials at discrete values, the members of one group having marked similarity of structure.

Further than this, however, we find that the differences of potential could all be explained in terms of the constitution of the molecule taken. When reductions were carried out in alkaline solutions in which the hydroxy-anthraquinones were ionised the potential could be predicted from a consideration of the possible structures the ion could assume.

**THE INTERPRETATION OF CRYSTALLOGRAPHIC STRUCTURES**

F. J. LLEWELLYN, Auckland University College

X-ray crystallographic studies of crystalline matter provide the most accurate data in determining the orientation and the interatomic separations within molecules in the solid state. It is possible to obtain directly, within an accuracy of  $\pm 0.02\text{\AA}$ , the co-ordinates of all the atoms in the structure and thereafter to write down bond angles and bond lengths. The subsequent interpretation of these distances in terms of the kind, or kinds, of bonds involved is less easy and in general requires ancillary evidence such as infra red absorption, thermal properties, etc., in order to arrive at an unequivocal solution. The X-ray crystallographic determination of the structure of isatin illustrates this phase of structural studies. Whereas it is possible in this case to state definitely that the lactam form of the molecule predominates in the solid state, it is not possible, except within certain limits, to assess the contribution of the various lactam resonance hybrids. This paper will outline the arguments and results obtained in the specific case of isatin.

**MAGNETO CHEMISTRY**

A. L. ODELL, Auckland University College.

In the formation of most chemical bonds, whether ionic or covalent type, the constituent atoms arrange their electrons so that they are paired and so that the spins of the two members of each pair are opposed.

In both simple and complex compounds of the transition elements, in rare earth compounds, and in organic free radicals, this is not always the case and here the magnetic susceptibility balance is able to detect, in many cases, unpaired electrons.

A magnetic susceptibility-balance of the Gouy type is under construction and efforts are being made to obtain field regulations of a high order with a view to investigating the following types of compounds.

1. Co-ordination compounds of the transition elements:—In this series a count of the number of unpaired electrons gives an indication of the number of unfilled orbitals in the penultimate shell, where, by the Pauling hybrid-orbital rules, one can deduce the configuration to be octahedral covalent, octahedral ionic, square-covalent, tetrahedral ionic, tetrahedral covalent, etc.

2. Organic free radicals:—The existence of transient free radicals during reduction of naphthaquinones has recently been demonstrated by means of a modified magnetic susceptibility balance. Such measurements can be made without introducing any impurities into the solutions and because of the paramagnetic susceptibility of the free radical, can be interpreted with more certainty than other methods of detection of free radicals.

3. Homologous series of organic compounds:—The Pascal constants for specific atoms and bonds which are allegedly additive, have been derived from measurements with instruments in which no great attention was paid to field regulation and there is room for a revision of these values.

4. Individual crystals:—Determination of diamagnetic susceptibility parallel to the various crystal axes can often give an important guide to X-ray analysis of the crystal. This is particularly true in crystals made-up of parallel sheets of aromatic molecules, e.g., hexamethyl benzene.

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#### AN X-RAY SPECTROMETER INVOLVING A GEIGER-MULLER COUNTER, FOR USE AT HIGH TEMPERATURES

H. BLOOM, Auckland University College

When X-rays diffracted by a poly-crystalline powder are photographed, the familiar circles of the Debye-Scherrer pattern are obtained.

There is much evidence to indicate that a liquid can be regarded as containing many small fragments of the solid crystal lattice, i.e., is a partly disordered solid. This hypothesis is further borne out by results of X-ray diffraction studies involving liquids. The object of the present research is to investigate remnants of crystal structure in molten single salts and mixtures of these at temperatures up to 1000°C. For this purpose an X-ray spectrometer has been built using a Geiger-Muller counter with attendant electronic circuits for recording slow, medium and fast counts. The molten salt is contained in a shallow horizontal depression in a platinum covered steel block which is heated electrically. The G.-M. tube is mounted on an arm which can rotate in the vertical plane about the melt, the angle being measured by a scale and vernier. The number of counts per minute is measured in a large number of positions, giving the intensity of the diffracted beam at each angle. From these the "lattice" spacings of the melt are calculated (using the Bragg equation), and are compared with those of the solid salt.

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#### APPLICATIONS OF MASS SPECTROSCOPY OF STRUCTURAL PROBLEMS

A. L. G. REES, C.S.I.R., Melbourne.

Bombardment of molecules in the vapour phase at low pressures with slow electrons results in the production of positive ion fragments by rupture of bonds in the molecule (e.g.,  $\text{CH}_4$  produces  $\text{CH}_3^+$ ,  $\text{CH}_2^+$ ,  $\text{CH}^+$ ,  $\text{C}^+$ ,  $\text{H}^+$ ). Measurement by mass-spectroscopic methods of the relative abundance of these ions and their appearance potentials, that is, the energy which the bombarding electrons must attain before an ion is produced, may be used

to provide information about the chemical structure and behaviour of the molecule. The appearance potential is related to the dissociation energy of the bond which must be broken to form the free radical concerned. Again some features of the structure may be established from the presence or absence of ions of certain mass, although in certain cases ions appear due to rearrangement processes during excitation (e.g.,  $C_2H_5^+$  from  $(CH_3)_3CH$ ). These rearrangement radicals should be identifiable from the appearance-potential curve, that is, the plot of positive-ion current against bombarding electron voltage for a particular ion.

G. R. Hercus and J. D. Morrison, working in Melbourne, have developed experimental methods of sufficient accuracy to use these methods in structural problems. Rearrangement problems have been studied in a number of amino compounds. Appearance potential measurements for C-C bond rupture in molecules of the type  $X(CH_2)_nX$  have confirmed recent X-ray crystallographic evidence that the even members of the series have alternate C-C bonds of length shorter than normal, an effect ascribed to hyperconjugation.

The excitation, rearrangement and dissociation processes are explained in terms of potential energy diagrams.

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## ELECTRON DIFFRACTION AND CHEMICAL STRUCTURE

A. L. G. REES, C.S.I.R., Melbourne

Electron-diffraction methods have not been used for complete structural analysis in crystalline solids to date, mainly because the factors which determine the intensities in single-crystal patterns are improperly understood. The possibility of using electron diffraction in this way is attractive, since minute single crystals may be studied by transmission and the surfaces of larger crystals by reflection without the necessity of a complicated relative motion of crystal and film. Experimental methods of recording all necessary reflections will be outlined.

Little attention has been given to the problem of intensity measurement in electron diffraction, but with recently-developed high-resolution cameras and sensitive recording microphotometers, it is possible to obtain precise measurements of intensities of reflections. These intensities must be corrected for refraction and secondary elastic scattering, the second of which is extremely important in determining the relative intensities in electron diffraction. Secondary scattering may produce forbidden reflections in single-crystal patterns, or forbidden and anomalous "extra" rings and diffuse bands in patterns from random crystallites. These effects will be illustrated for high molecular-weight paraffin hydrocarbons and the methods of correcting the intensity data outlined.

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BOOKS RECEIVED

**"Chymia" Annual Studies in the History of Chemistry.** Tenney L. Davus, Editor-in-Chief. Vol. 1, 1948. pp.190. University of Pennsylvania Press, Philadelphia. 3.50 dollars.

Interest in the history of chemistry can be taken as a sign of culture and maturity and those chemists who are ignorant of the early development of their science and uninspired by the lives of its great leaders must be looked on as scientific barbarians. For this reason the beginning of a regular publication on the history of chemistry is welcome. The editors have decided to publish one volume annually as a memorial to the late Edgar Fahs Smith, a well-known American professor of chemistry, who made a hobby of collecting volumes and manuscripts of interest to the chemical historian. The board of editors—international in scope—present a well-produced volume dealing with a variety of subjects. The reviewer found the articles on Mendeleev (Henry M. Leicester) and Dulong (Lemay and Oesper) the most interesting, but this is a personal matter. The illustrations are particularly well done, and we look forward to further volumes in this series.

**Recent Advances in Organic Chemistry.** 7th Edition, Vols. 2 and 3. By Alfred W. Stewart and Hugh Graham. pp. 447 and 387. London: Longmans Green & Co. 1948. 35/- each.

The late Professor Stewart, who also produced some very readable crime and other fiction under the pseudonym of J. J. Connington, was preparing the manuscript for the seventh edition of his well-known work at the time of his death, and his task was taken over by his colleague, Graham. The topics dealt with in Vol. 1 of previous editions, were considered no longer of sufficient interest to be retreated, so Volume 2 has been revised, and a third volume dealing with such subjects as vitamins, hormones, synthetic high-polymers, deuterio-organic compounds, etc., has been added. An appendix gives the syntheses of Vitamin A and folic acid, with references to 1947. Otherwise the book is hardly well-named as "recent" advances, as there are few other references later than 1940. On the credit side, it may be said that the material is excellently presented in a clear and readable fashion, so that the student can easily understand the nature of the problems discussed. There are good references and indexes, including a useful author index. These volumes are definitely worth a place on our bookshelf.

**Fundamental Processes of Dye Chemistry.** By H. E. Fierz-David and L. Blangey, Zurich. Translated from the 5th Austrian Edition by P. W. Vittum, Eastman Kodak Co. pp. 479. 1949: Interscience Publishers, New York and London. 9.50 dollars.

This excellent book is really a text-book of practical work for a course of study of dye chemistry. It gives details for the laboratory preparation of a large number of dyestuffs and intermediates, with a full discussion of the reactions involved. There is a chapter on practical work in the industrial organic laboratory, and a good section on technical details. The book concludes with a section on analysis, and 21 charts, showing derivatives of several intermediates. While this is of necessity a specialist handbook, it will interest chemists in a wider field, and may even be looked on as a practical book on organic chemistry as exemplified in the dye industry.

**Biochemical Preparations.** Vol. 1. H. E. Carter, Editor-in-Chief. pp. 76, 1949: John Wiley and Sons, New York, 2.50 dollars.

This is the first volume in a new series similar to "Organic Syntheses," and contains details of the preparation of sixteen compounds of biochemical interest. Some of these are natural products, such as casein, lycopene and

adenosine triphosphate, and others are compounds used in biochemical work, such as azobenzene-p-sulphonic acid. The series should prove as useful as organic syntheses, but the price seems a little high.

**Textbook of Wood Technology, Volume 1.** Structure, Identification, Defects and Uses of the Commercial Woods of the United States. By H. P. Brown, A. J. Panshin and C. C. Forsaith. (McGraw-Hill Book Co., 1949).

This revised version of the well known text "Commercial Timbers of the United States," is a welcome edition to the libraries of all scientists dealing with wood technology and, indeed, should prove a valuable reference for all chemists who must, at some time, have recourse to information concerning wood. The volume under review deals with the structure, identification, defects and uses of wood and contains detailed descriptions of the gross and minute features of the bulk of the U.S. commercial timbers. Much of the latter information will rarely be required by New Zealand workers, but this is outweighed by the valuable general text. In particular, chapters dealing with the woody plant cell, the growth of the tree and the main structural features of both coniferous and porous woods are very readable. The number of terms specific to the subject may prove unwieldy to the scientist with only slight interest in the subject, but a well-prepared glossary goes a long way to offset this disadvantage.—A.W.M.

**The Structure of Matter,** by Francis Owen Rice, Professor of Chemistry, The Catholic University of America, and Edward Teller, Professor of Physics, The University of Chicago. Pp. 361, 1949. New York: John Wiley and Sons, Inc., London: Chapman and Hall Ltd. 5 dollars.

This volume, which is the introductory book in the Wiley "Structure of Matter" series, is described as "An Outline of the properties of matter and a guide to their systematic interpretation by quantum mechanics." The authors accurately claim that only a minimum use is made of mathematics. Although the disadvantages of such a treatment in dealing with the subject under discussion are apparent, it has also an advantage in that the book can be followed easily by chemists who, in general, have only an elementary knowledge of mathematics. Viewed in its true light, i.e., as an introduction to the subject, the book succeeds in reaching its goal. After a brief introduction to the basic nomenclature of quantum mechanics, the authors discuss the hydrogen atom, much use being made of diagrams to illustrate its wave functions. These simplest fundamentals lead to a discussion of the formation of chemical bonds. There follows a treatment of forces in the solid state, electrical conductivity and the magnetic properties of matter. A section deals with molecular vibrations and electronic spectra in a very effective even if non-mathematical manner. Finally, a brief account is given of nuclear chemistry and the state of matter in the stars. The book will prove a valuable introduction to the subject and should be of general interest.—H.B.

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#### ITEMS OF GENERAL INTEREST

Professors Parton and Briggs, both returned to New Zealand by the "Aorangi" on June 14th after a most successful tour.

We offer our greetings to the Royal Australian Chemical Institute on being granted the use of the term "Royal" by H.M. the King.

LETTER TO THE EDITOR

Ruakura Animal Research Station,  
Private Bag,  
HAMILTON,  
April 29th, 1949.

Dear Sir,

At recent conferences of the Institute, a large proportion of the papers delivered have been marred by the poor quality of the projected illustrations. I feel, therefore, that before the forthcoming conference, the attention of members should be drawn to the need for better preparation of charts, diagrams and photographs, and the following points are suggested for special consideration.

1. Lantern slides are preferable to epidiascope projection.
2. If use of the epidiascope is necessary, the speaker should be sure the projected illustration shows what he wants the audience to see—not have to explain to them what they should see.
3. Bold plain print in black ink is preferable to script or typescript for reproduction.
4. Lines on graphs should be heavy and not too cluttered with points and legends, and the scale such that lines are not too close together.
5. The illustrations should be part of the story of the paper and not thrown in for use at the end if there is time (there never is). They should be arranged in a pre-determined order which should be made clear to the operator and if needed, a signal for changing arranged with him.
6. Discussion of illustrations should be thought out before presenting the paper and not when the slide appears on the screen—many papers exceed their allotted time because the time taken in verbal explanation is additional to that assessed by the author for his written script.
7. If there is any doubt about projector, illustrations, screen or room, they should be tested together before the paper is given so that verbal correction of any deficiencies can be considered ahead and not have to be thought up at that bad moment when things are found amiss.

These points emerge from eye-strained experience in the audience. Perhaps others who know more about making, using and viewing lantern illustrations may be able to add to or amend them.

Although apparently obvious they seem to be neglected so frequently that a reminder at this time seems opportune, with the hope that at the August Conference we will not spend too many sessions seeing "as through a glass, darkly."

Yours faithfully,

N. T. CLARE,  
Chief Biochemist.

[The staff of the Chemistry Department, A.U.C., is willing to prepare slides for any authors who so desire.—Editor.]

**MINUTES OF A MEETING OF THE COUNCIL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY, HELD IN THE COUNCIL ROOM OF THE DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, WELLINGTON, ON FRIDAY, MAY 20th, 1949, at 10 a.m.**

1. **PRESENT:** Professor J. Packer (President in the Chair); Dr. J. Melville (Vice-President), Mr. B. E. Jackson, Auckland Proxy; Mr. J. L. Mandeno, Wellington Delegate; Mr. F. H. G. Johnstone, Canterbury Delegate; Mr. O. H. Keys, Otago Delegate; Mr. H. K. Palmer, Registrar; Mr. W. G. Hughson, Hon. General Secretary-Treasurer.

2. **APOLOGIES:** Apologies were received from Mr. S. G. Brooker, Auckland Delegate, and from Mr. L. H. James.

5. **EIGHTH PACIFIC SCIENCE CONGRESS:** A letter was received from the Australian Chemical Institute supporting our suggestion for a physical sciences section of Pacific Science Congresses, but offering no further comment. No reply had been received from Canada.

Resolved, Wellington-Canterbury: THAT the President, the Hon. General Secretary, and Dr. J. K. Dixon be asked to investigate what had already been done by the Committee of the 7th Pacific Science Congress relative to the setting up of a separate division for Physical Sciences and that they be empowered to take what further action is considered necessary.

6. **EMPLOYMENT COMMITTEE:** A report was received from the Secretary, Mr. E. S. Borthwick, covering two points:—

1. **Student Employment During Vacations:** The Committee is taking steps to prepare a list of firms willing to engage students. The list should be ready by August and will be forwarded to University Professors in September.

2. **Non-Members Just Leaving School:** The Committee felt that they were outside our scope.

Resolved, Vice-President, Wellington: THAT the Secretary write to the Education Department (Vocational Guidance Section), and to the four professors of chemistry pointing out the scope for employment of post-primary and first-year University students as technicians in chemical laboratories.

7. **EXAMINATIONS COMMITTEE:** The Otago Delegate, Mr. Keys, stated that his branch was agreeable to taking over the Examination Committee in 1950, and had set up the following committee:—

Mr. C. C. Roberts, chairman; A. D. Campbell, H. G. Woolman, O. H. Keys.

At the suggestion of council, two more members will be appointed to the Committee to bring it to the same strength as the present Wellington Committee.

A report was received from the Examinations Committee dealing with three points referred to it by council:—

7. **1. Optional Subjects for Laboratory Assistants' Examination:** The Committee was opposed to the suggestion that candidates be allowed to nominate optional subjects for the examination, but recommended that the new Otago Committee consider the possibility of adding Bacteriology, Librarianship and Electronics to the list of optional subjects.

Council then passed the four following resolutions:—

Otago Vice-President: THAT Elementary Bacteriology be added to the list of Laboratory Arts in the syllabus for the Laboratory Assistant's Certificate and that the Examination Committee be asked to draft a set of examination requirements for this subject.

Auckland-Wellington: THAT it be a recommendation to the Examinations Committee that Librarianship and typing be included as one subject in the Laboratory Arts section of the Laboratory Assistant's Examination.

Vice-President, Canterbury: THAT foreign language translation be recommended to the Examinations Committee for inclusion as an optional subject in the Laboratory Assistant's Examination.

Otago-Auckland: THAT it be a recommendation to the Examinations Committee that Elementary Electronics Construction be included in the syllabus for the Laboratory Assistant's Examination as an optional subject.

After further consideration of item 1 of the Examination Committee's report, the following resolution was passed:—

President-Vice-President: THAT Council refer back to the Committee the matter of the inclusion of an optional special subject in the syllabus with a strong recommendation that provision be made, whereby a candidate may apply to be examined in an optional laboratory art (not being expressly included in the syllabus), provided that such application shall be supported by a statement setting out full details of the proposed art from the candidate, verified by the candidate's employer, and provided further that such application shall be allowed only at the discretion of the Examination Committee.

7. 2. **Standard for Associate Examination (Regulation 1):** In accordance with the recommendation of the Examinations Committee, Council decided to take no action at the present time.

7. 3. **Laboratory "Approved" by Council:**

Resolved, Otago Vice-President: THAT for the purposes of Regulation 1, it is necessary for Council to "approve" the Laboratory in each particular case.

Council agreed with the finding of the Examinations Committee that, in general, it would require that the laboratory should be in charge of a member of the Institute or a chemist of equal standing. In the case where an applicant was in sole charge or where the chemist in charge was not of Associate standing, a report must be obtained from a member of the Institute who has an intimate knowledge of the laboratory. In all cases, a detailed report will be required on the scope of the candidate's work and this must be vouched for by a member of the Institute.

8. **JOURNAL:** The Secretary read the report of the Editor, noting that the Addressograph plates had been procured, that binding of journals was proceeding and that Council was asked to consider the scheme of publishing the list of members annually as an insert in the journal.

After this latter point had been discussed, the following resolution was passed:—

President, Vice-President: THAT the Editor be asked to obtain an estimate of the cost involved in annual publication of the list of members and the relative advantages of publishing as an insert of the Journal as against publication as a separate booklet.

9. **STANDARDS INSTITUTE OF NEW ZEALAND:**

Resolved, Vice-President, Wellington: THAT Dr. L. F. Story, of the Woollen Research Association, Dunedin, be asked to represent the Institute on the Textile Committee of the Standards Institute.

12. **INDUSTRIAL CHEMICAL ESSAY PRIZE:**

Resolved, President, Wellington: THAT Regulation 3.11 be amended to read, "The value of the Prize shall be such sum as Council may from time to time determine."

(The prize is at present awarded periodically, and the value is £25).

Council decided to ask the Editor to give immediate publicity to the Industrial Chemical Essay prize competition which closes on June 30th, 1950, emphasizing the wide scope of the competition which covers both primary and secondary industries (see Regulations).

15. **FOOD PARCELS:** Dr. Dixon's financial statement covering the sending of food parcels for the present season was received, and the Secretary was asked to thank Dr. Dixon for the work he had done.

Acting on a further letter from Dr. Dixon, Council would like branches to advise him as soon as possible what their answers are to the three following questions:—

- (1) Is your Branch interested in continuing the food parcel scheme to members of the Benevolent Fund of the R.I.C.?
- (2) If so, could the money be collected during our winter months while we are in session?
- (3) Would Branches prefer to run their own schemes as Wellington and Auckland have done? This is recommended from an interest point of view, but Dr. Dixon is still prepared to act.

16. **RULES:** Amendment to Rule 21.7.

After some discussion of this amendment, Council decided that visiting members of other Institutes temporarily in New Zealand, could be accorded hospitality without amending the Rules.

Amendments to Rule 8.4 were introduced by the Otago Delegate, and will be on the Agenda for next meeting of Council.

17. **COMMITTEE ON PROFESSIONAL STATUS:** The Committee set up by the Auckland Branch is as follows:—

Dr. J. C. Andrews, F. H. V. Fielder, D. Whillans and J. Ricketts (Convener).

18. **CONTRACTS OF SERVICE AND SUPERANNUATION:**

(1) A report on Superannuation by the committee set up had been circulated. It was taken as read and received.

Resolved, Wellington Vice-President; THAT Branch Secretaries be asked to circularise their members with a resume of the report on superannuation, informing them that full reports are available on request; and that copies of the report and of the questionnaire be lodged with Branch Secretaries.

(Dr. Dixon has agreed to draft a brief statement which will be cyclostyled and sent in bulk to Branches for inclusion with their monthly notice of meeting).

(2) A report on "Contracts of Service for Chemists" was received from the same committee as above.

Resolved, Vice-President, Wellington: THAT the draft contract, be submitted to the Institute's Solicitor.

19. **NEWSLETTER:** The Secretary reported that Mr. Brooker would like Council to arrange for someone to edit the newsletter annually for inclusion in "Chemistry and Industry."

Resolved, Vice-President, Canterbury: THAT the Secretary arrange for a member of the Wellington Branch to edit the newsletter.

20. **PATENTS:** Wellington has arranged that Dr. Shorland will convene the first meeting of the Patents Committee which at present consists of Dr. Shorland, Mr. W. Vose and Dr. M. F. Nauen.

21. **MEMBERSHIP—RESIGNATION:** The resignation of Mr. D. H. Freeman, a past Chairman of the Wellington branch, was received with regret. He is now resident in Australia.

22. **RECIPROCITY BETWEEN N.Z.I.C. AND R.I.C.:** Typed copies of a report from the special committee set up by Otago Branch were made available to members of the Council. The report will be included in next agenda.

Resolved, Otago Vice-President: THAT the Hon. General Secretary write, in the first place, to the Secretary of the Royal Institute of Chemistry asking if the R.I.C. would consider a conjoint scheme of membership with the N.Z.I.C. and on what terms; also informing them that Mr. Grigg, Chairman of the N.Z. Section of the R.I.C., will be in England shortly and will discuss this matter with them.

26. **U.N.E.S.C.O.:** The report as set out on A.155 was received, and the Secretary further reported on proceedings with the Royal Society and the Association of Scientific Workers regarding an abstracting report for the Paris Conference.

27. **INTERNATIONAL CONFERENCE ON BIOCHEMISTRY:** It was reported that both Dr. I. J. Cunningham, and Dr. N. L. Edson would be attending this conference and the Secretary was asked to write and inform them that we would appreciate it if they would be official representatives of the New Zealand Institute of Chemistry.

28. **MEMBERSHIP:**

Resolved, Otago-Canterbury: THAT Council recommends to Branches that consideration be given to the policy of publishing in the Journal the full names of all new applicants for membership, so that all members may have an opportunity of forwarding any personal comments to the Hon. General Secretary before such applications are considered by Council.

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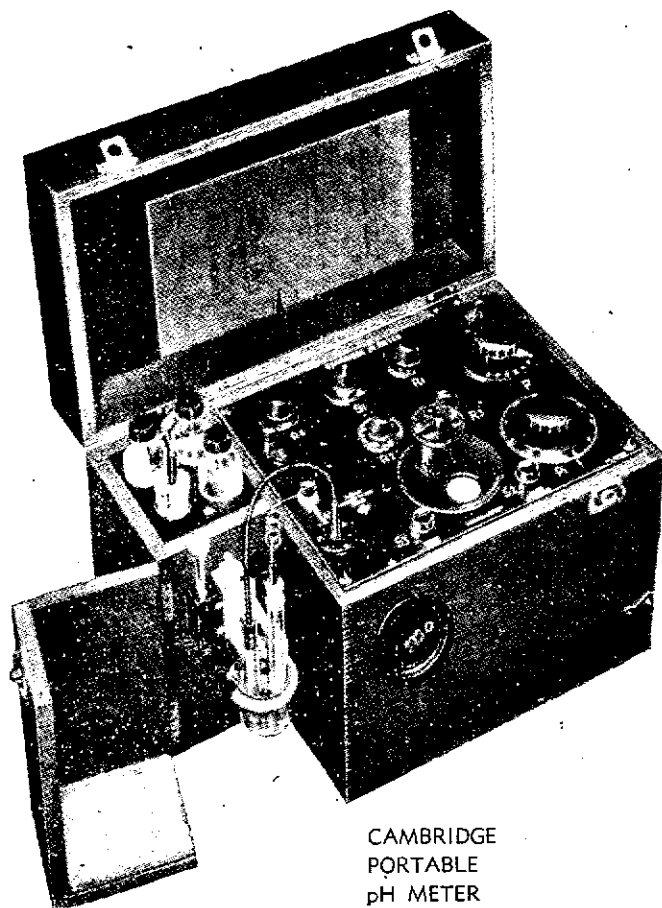
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