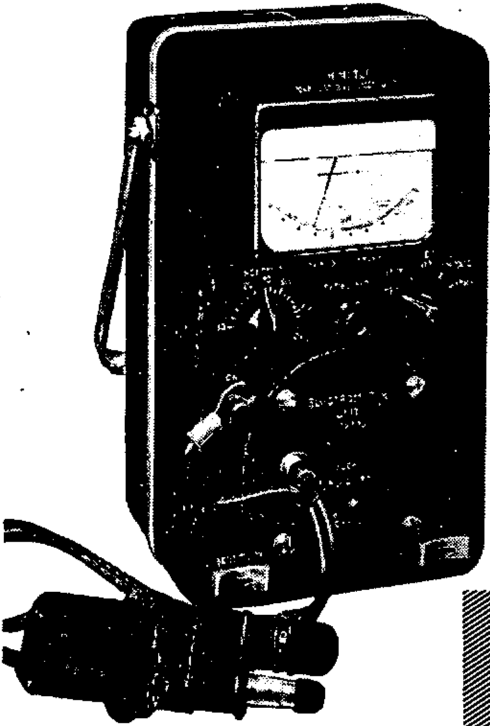
JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

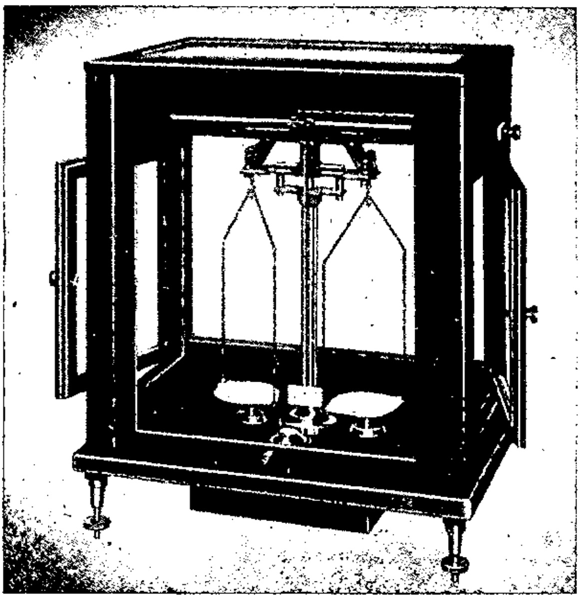
VOLUME XIV. JUNE, 1950. No. 3

CONTENTS

Subscriptions of 2/- per copy, 7/6 per annum should be forwarded to the Registrar, P.O. Box 250, Wellington.

Printed by Percy Salmon, Wills and Grainger Ltd., 64 Fort Street, Auckland, and published by the New Zealand Institute of Chemistry.





STANTON BALANCE—Model CB4

JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

VOLUME XIV JUNE, 1950 No. 3

CONFERENCE, 1950

Christchurch, August 22nd - 25th

N.Z.I.C. - R.I.C.

PROGRAMME

This is well in hand, but is not finalised at the time of going to press.

SOCIAL EVENING

Following the outstanding success of the Social Evening at last year's Conference, special attention is again being given to this function this year. A most attractive setting is guaranteed by the booking of the "Sign of the Takahe" on Cashmere Hills, from where there should be a magnificent view of Christchurch under a conveniently-arranged moon.

INDUSTRIES FAIR

Planned quite obviously for the convenience of Institute members, the New Zealand Industries Fair will be in full swing in Christchurch during the Conference. It'll be a toss-up whether that free evening on the programme should be used for informal discussions, a visit to the Fair, or . . .?

EXCURSIONS

A variety of excursions and exhibitions is being arranged. Those who cannot bear Ovaltine and are tired of breweries may quench their thirst for information in a visit to the rubber factories, etc.

An excellent caterer guarantees that our teas and suppers will leave us all too full for words.

See you at Christchurch in August!

STOP PRESS! *STOP PRESS!*

— CONFERENCE —

Are you coming or aren't you?

If you haven't registered yet get cracking at once, or you will have NO ACCOMODATION!

PROFESSOR P. W. ROBERTSON

M.A., M.Sc. (N.Z.), M.A. (Oxon), Ph.D. (Leipiz), F.R.S.N.Z.

PROFESSOR P. W. ROBERTSON, M.A., M.Sc. (N.Z.), M.A. (Oxon.), Ph.D. (Leipzig), F.R.S.N.Z.

At the close of the last academic year, Prof. Robertson retired from the Chair of Chemistry at Victoria College, and has now taken up permanent residence in England. It is therefore a fitting time to record the many-sided activities of a remarkably gifted man. His chemical studies will be more or less known to our readers, but few will realise that his contributions in other spheres have been of equal or greater worth. It is therefore by no means invidious to devote a considerable portion of this issue to him.

Born in Auckland in 1885, it was in Wellington that his early and later triumphs took place, and his tall, thin figure became something of a landmark. He was dux of Wellington College in 1900, and was the second student at Victoria College to win the Senior Scholarship. Here he conducted his first scientific experiments, and read papers before learned societies at an age when pupils nowadays matriculate. In Wellington, he obtained his B.A. and M.A. with first-class honours in chemistry, while in sports he excelled at hockey and tennis. In his monograph on Victoria College, J. C. Beaglehole has recorded something of the furore created when Robertson got the first of the College's Rhodes Scholarships in 1905. "Admiration for such achievement was almost sentimental; Robertson was 'Robertson of ours.'" At Trinity College, Oxford, he took his M.A. with first-class honours in natural science, and then proceeded to Leipzig, where he studied for his Ph.D. under the famous physico-chemist, Prof. Hantzsch. On the Continent he showed himself to be a remarkable linguist, his German being so good that he easily passed for a native in Germany and Austria.

In 1909 he became professor of chemistry at Rangoon College, Burma, and in 1911 lecturer at the Imperial College of Science, London. Though his period of residence in the tropics was short, it had a permanent effect on his health, and he rarely ventured out in the evenings. This makes his achievements all the more remarkable. In 1920, his old professor at Victoria College, Easterfield, retired, and Robertson was offered the chair, which he held for thirty years. His chemical work is recorded in a separate article in this issue: here we will attempt to deal with his contribution to the belles lettres.

Here his output comprised two books, a number of short stories, and a few poems scattered through New Zealand

and English mazagines, and anthologies. In 1920 he published a collection of five stories under the title, "The Soul's Progress: Mezzotints in Prose." These studies represent five periods in the history of the soul of an imaginary young scientist who has endeavoured to seek a refuge from the too rigid intellectualism of his science in the lyricism of art. The Renaissance period, the city of Danzig in the 17th century, Burma and mediaeval China provide the setting for tales which have been compared with Walter Pater's "Imaginary Portraits," probably to the great delight of the author, who has always considered himself Pater's devoted disciple. In reviewing the book, Richard Le Gallienne wrote: "These mezzotints have to be read as wholes for the full effect of their delicate beauty and rare spiritual atmosphere to be appreciated." "The Soul's Progress" is now something of a rarity, and one can only hope that a new edition may be prepared.

The thread of "The Soul's Progress" is continued in Robertson's later book, "Life and Beauty" (1931), this time in the form of a spiritual autobiography from early childhood to mature age. From the pages of this slender volume emerges clearly the figure of a thinker and untiring searcher after beauty. One of the most remarkable features of the book is the profound yet lucid interpretation of his favourite authors, such as Pater and Marcel Proust, and the insight into a number of foreign cultures and literatures. It can be said without exaggeration that few New Zealand writers have attained this intimate knoweldge and understanding of the non-British world while remaining so truly and essentially British.

As already mentioned the short stories were published in several New Zealand and overseas publications, but the gem among them, "Odyssey in Wellington Harbour," appeared significantly in "New Zealand New Writing, 1945." It has been rightly described as a masterpiece of contemporary New Zealand prose. In the 1944 issue of the same publication appeared another of Robertson's short stories, "Tarawera in Eruption."

Amongst the Professor's critical essays we may mention his study of the interesting English painter, Christopher Perkins, who has painted many striking interpretations of the New Zealand scene and whose portrait work included a study of Robertson himself. This portrait illustrates the article, which appeared in "Art in New Zealand" for September, 1931. This essay is well worth reading by anyone who knew the Professor, not only because it demonstrates his excellent literary style, the extent of his knowledge of art and the vigour of his intellect, but also because it shows that his scientific studies were by no means divorced from his literary and artistic studies. He used the former to interpret the latter and his literary pursuits should not be regarded as a mere pastime. In the preface to his first book he wrote: "There have been some who imagine that the natural sciences by their patient accumulation and correlation of fact will eventually solve the riddle of the universe, while others again have insisted, and perhaps rightly, that art, being pure intuition, is a more certain key to a problem, one at least of whose factors is infinity." In his unassuming way, Professor Robertson has tried to approach the problem from both sides: as a scientist and an artist, and it is not surprising that his forthcoming book is to be called "Art and Psycho-analysis."

THE CONTRIBUTIONS OF PROFESSOR P. W. ROBERTSON TO CHEMICAL RESEARCH

By F. B. SHORLAND, Fats Research Laboratory, Department of Scientific & Industrial Research, Wellington, New Zealand.

(An address to the Wellington Branch)

For a period of fifty years Professor Robertson has continuously made contributions to chemical literature, and it is appropriate on the occasion of his retirement to give an account of his achievements. Edmund Burke has stated, "People will not look forward to posterity who never look back on their ancestors." I do not mean that Professor Robertson is yet an ancestor, but I do believe that he has laid a foundation upon which future generations of chemists may be inspired to build.

Professor Robertson's appointment as Professor at Victoria University College dates back to 1920, and during the period 1920 to the present time he has directed no less than 102 theses. Here we must pay a further tribute to him for the painstaking care he has given to delivering, in a condensed and accurate form, lectures on organic chemistry, which, as the years went by, must have involved at the honours and third year stages, ever-increasing work to keep abreast of the latest developments.

Professor Robertson's book, written with Burleigh, on "Qualitative Analysis in Theory and Practice," is a model of wisdom and conciseness. It has been used without modification since 1918 for teaching students the elements of qualitative analysis as well as supplying them with a background to the ideas of valency and the use of chemical equations so fundamental in the study of inorganic chemistry.

Practically no other New Zealand chemist, and very few chemists in other countries have published research work on their own account until several years after completion of their honours degree. At that stage they have learnt something of experimental techniques and have undergone a maturing process involving the development of an ability to think independently of what they read, to pursue scientific literature and to put forward and to test hypotheses. For many it is also necessary to spend some years in the art of writing papers before they are able to send material which is acceptable to the better classes of journals. By such standards Professor Robertson must be regarded as outstanding. In the period 1901 to 1904, before completion of the M.Sc. degree, and at the early age of 19, he had published eight papers, which are as follows:—

(1) Vapour Densities of the Fatty Acids. T. H. Easterfield and P. W. Robertson, Trans. N.Z. Inst. (1901), **34**, 499.

(2) Latent Heats of Fusion of the Elements and Compounds. P. W. Robertson, Trans. N.Z. Inst. (1901), **34**, 501.

(3) Molecular Complexity of Fatty Acids and Derivatives in Phenol Solutions. P. W. Robertson, Trans. and Proc. N.Z. Inst. (1902), **35**, 452.

(4) The Exhibition of Maximum or Minimum in the Properties of Certain Series of Organic Compounds. P. W. Robertson, Trans. N.Z. Inst. (1902), **35**, 465.

(5) Distillation of Fatty Acids for the Manufacture of Candles. P. W. Robertson, Trans. N.Z. Inst. (1904), **37**, 568.

(6) Atomic and Molecular Heats of Fusion. P. W. Robertson, J. Chem. Soc. (1902), **81**, 1233-1243.

(7) Studies in Comparative Cryoscopy, Part I. The Fatty Acids and Their Derivatives in Phenol Solution. P. W. Robertson, J. Chem. Soc. (1903), **83**, 1425-1440.

(8) Studies on Comparative Cryoscopy, Part II. The Aromatic Acids in Phenol Solution. P. W. Robertson, J. Chem. Soc. (1904), **85**, 161.

From the list of papers it will be appreciated that even at the early age of seventeen, Professor Robertson had in mind his main objective—the study of the relationship between chemical constitution and physical properties. It is obvious that he shaped his own mind, and was not unduly influenced by his teachers. The work he did with Hantzsch at Leipzig on ammoniacal and pyridine complexes of copper salts, had no bearing on his later contributions. There is no doubt, however, that his frequent use of bromo- and chloro-compounds induced him to develop the well-known method for their estimation, while his early observations on the migration of para-halogen atoms may have led to his subsequent fruitful studies on halogen addition.

It is not possible within a short space to give detailed attention to Professor Robertson's work. Some of it is complex and requires study before it can be fully appreciated. My intention, therefore, is to sub-divide his work into appropriate sections and to touch on several aspects, so that we may gain some insight as to the nature of his contributions.

1. Analytical Chemistry.

In this section may be mentioned "Estimation of Cinchona Alkaloids by Means of their Double Thiocyanates" (J. Chem. Soc. Proc. (1905), 242) and "Volumetric Estimation of Mercury" (Chem. News (1907), **95**, 253). By far the most important contribution, however, in this connection, was made in 1915, when he replaced the Carius technique for halogen estimation by a more convenient method. In the Robertson method (J. Chem. Soc. (1915), **107**, 902) now described in most standard works on chemical analysis, the bromine or chlorine is released from the organic halides by chromic acid and conveyed in a current of air to the absorption vessel containing sodium peroxide (cf., Chem. News (1920), **120**, 54). The halides thus collected can be estimated volumetrically by titration of the excess silver nitrate with ammonium thiocyanate in the usual way. In 1916 Robertson extended the method (J. Chem. Soc. (1916), **109**, 215) to include the estimation of carbon as well as halogen.

2. Researches on the Constitution of the Substituted Phenols.

Preceding these investigations it was well known that direct bromination of phenol in acetic acid solution yielded both ortho- and para-bromo-phenol. Robertson (J. Chem. Soc. (1908), **93**, 788) showed, however, that o-cresol or guaiacol under these conditions yield only the para-bromo-compound. To obtain the ortho-bromo-compound it was necessary to proceed indirectly through the para-carboxylic acid, and subsequently eliminate the carboxyl group. Such ortho-bromo-compounds yield on nitration 5-nitro-derivatives which, like nitrophenol earlier described by Hantzsch, formed potassium salts in red and yellow modifications.

Further studies, using thymol, showed that nitration of 6-bromo-thymol or bromination of 2-nitrothymol yields in both cases 2-bromo-6-nitro-thymol. Auwers (Ber. (1902), **35**, 457) had previously shown that the replacement of bromine by nitro-groups in dibromo-p-cresol proceeded through an intermediate compound which he isolated. From this and other similar experimental evidence, Robertson (Robertson P. W., and Briscoe, H. V., J. Chem. Soc. (1912), **101**, 1964) proposed that the migration of the para-halogen atom in 6-bromo-thymol, and certain other similar compounds, on nitration takes place through the intermediate unstable quinoid compound.

3. Physical Properties of Solutions with Special Reference to the Cryoscopic Irregularities of Phenol.

Professor Robertson (J. Chem. Soc. (1903), **83**, 1425) found that the relative association measured by the percentage-change in reciprocals of the molecular depression constants with concentration in phenol increases for fatty acids if the chain branches beyond the α carbon atom, but decreases if substitution occurred on this atom. In the aromatic series (Robertson, J. Chem. Soc., 1904, **85**, 1617) it was found that ortho-substitution reduces the rate of association. A general relationship between the association of an acid and its rate of esterification was also shown to exist.

It is unfortunate that although Professor Robertson did so much to provide useful information on the cryoscopic properties of solutions, he was unable to formulate any general theory. In the meanwhile, Hildebrand (J. Am. Chem. Soc. (1916), **38**, 1452) put forward the view that osmotic phenomena are the observable expression of intermolecular forces induced by (a) internal pressure, and by (b) the polarities of the inter-diffused liquids. Later work by Richardson and Robertson (J. Chem. Soc. (1928), 1775), using the ratio molecular solution volume to molecular volume* to measure the internal pressure, together with the data provided by Dolby and Robertson (J. Chem. Soc. (1930), 1711) on the electrical conductivity of solutions in phenol as a measure of the polarity of dissolved substances, generally confirmed Hildebrand's views.

Richardson and Robertson (J. Chem. Soc. (1925), **127**, 553) found a novel use for cryoscopy in the study of adsorption. Using acetic acid and charcoal in aqueous solution they found that the values for the adsorption ratio of acetic acid with varying concentrations determined by their cryoscopic technique agreed closely with the values found by titration.

---

* Molecular volume is derived from the density of the pure liquid at 40°, and the molecular solution volume is calculated on a simple mixture law from the solution density which produces a depression of 4.50° in the freezing point of phenol.

4. Melting Points of the Substituted Amides of the Fatty Acids.

In 1877 Baeyer showed that considering each member of the normal fatty acid series in turn, the melting points alternately rise and fall. Professor Robertson found that this alternation in the properties of fatty acids is not confined to their melting points, but applied to such other properties as the relative association in phenol determined as described in the previous section. The reason for this alternation in properties which is exhibited only by polar compounds like acids, is not completely understood, but it is suggested that for solids it is related to the molecular configuration in the solid state. X-ray data show that the lengths of the long axes of the crystal spacing alternate as between successive odd and even numbers.

Professor Robertson (J. Chem. Soc. (1908), **93**, 1033-1037; (1919), **115**, 1210) noted that the amides of the fatty acids show even more pronounced irregularities than the fatty acids themselves. Considering the odd and even series of the amides separately and commencing with acetamide, he showed that the melting points showed a sharp rise between the first and second members, followed by a fall from the second to the third and again a rise between the third and fourth members. Many other substituted amides, including anilides, p-toluidides, p-bromoanilides, o-toluidides, o-bromo-p-toluidides, 2:4:6-tribromoanilides, β-naphthylamides and α-bromo-β-naphylamides were also studied. Particular attention was paid to the purity of the preparations and it is significant that Ralston's book on Fatty Acids, published in 1948—28 years later—should include a table of melting points of Professor Robertson's compounds, as well as make repeated references to his work.

5. Halogenation Researches.

Professor Robertson's work on halogenation comprises an extension of the theory put forward in 1931 by C. K. and E. H. Ingold (J. Chem. Soc. (1931), 1354), that the addition of halogens to unsaturated aliphatic compounds is, generally speaking, an electrophilic process. Let us consider, for example, the reaction between propylene and bromine. The slight polarization of the bromine atoms in the bromine molecule and of the carbon atoms in the propylene molecule due to the slightly unsymmetrical distribution of electrons leads to the attack on the more negative or electron rich-CH_2 carbon by the more positive or "electron hungry" electrophilic bromine atom. The reaction is then completed by the remaining negative bromine uniting with the positive-CH-carbon. With substituted ethylenes, groups like -CH_3 which repel electrons increase the rate of reaction by increasing the polarity of the ethylene link. On the other hand, groups which attract electrons slow down the rate up to a point, but if they attract electrons sufficiently strongly, e.g., -CHO then the mechanism of the reaction may become nucleophilic and the rate will then increase again.

Professor Robertson's work examines the kinetics of the reactions involved and although the basic conception of the Ingold theory is upheld, the mechanisms of many of the reactions are shown to be more complex than originally envisaged. For example, bromine addition in acetic acid with increasing concentration changes from a bimolecular to a termolecular and finally to a tetramolecular reaction, suggesting inter alia the participation of Br_4 molecules. In nucleophilic reactions with HBr, HBr_3 is considered to be the active agent. Other complexities involve questions of stereochemistry, polarisability and tautomeric change. The Ingold competitive method for compounds which react quickly was shown to give rates of the right order, but owing to the effect of one compound on another this method did not give precise results.

Much remains to be understood, but the success of the work which Professor Robertson's school has contributed may be judged by the fact that the rates of reactions of many unsaturated compounds with halogens may now be qualitatively predicted. Without entering into details, the list of papers in the appendix gives some idea of the extent of these contributions. For further information the reader is referred to a recent review by P. B. D. de la Mare (Quarterly Reviews of the Chem. Soc. (1949), **3**, 126).

6. **Conclusion.**

It has been said that the conditions of the New Zealand University are not conducive to research, both because of the extensive teaching duties and the shortage of equipment. While admitting these defects they must not be used as excuses. In a paper read before the Annual Conference of the New Zealand Institute of Chemistry last year, I made the point that no true investigator could be stopped from carrying out his researches, and that the mind of the investigator was far more important than the equipment which he uses. Professor Robertson is proof of my contention. His proudest piece of equipment is a half-ounce bottle with a ground glass stopper. In this connection he has outdone Priestly, whose best piece of equipment was a big wooden cask. With such equipment, together with some chemicals, a burette, and a few students, he has made very substantial advances in the elucidation of the mechanism of halogen addition.

In all he has contributed 54 papers, including 20 on halogenation, with more to follow. His work is to be found in some of the modern text books. It is regrettable that modesty prevented him from using his researches as part of the teaching to give greater reality and inspiration to the degree course. The students would then realise that no university can live on imported knowledge alone. Amongst their ranks there need arise scientists like Professor Robertson, who not only lecture, but also advance knowledge, without which there would be nothing new to teach.

APPENDIX.

I. Kinetics of Halogen Addition.

Part I. Bromine Addition:
Robertson, Clare, McNaught & Paul, J., **1937**, 335.
Part II. Iodine Addition:
Bythell and Robertson, J., **1938**, 179.
Part III. Chlorine and Iodine Chloride Addition:
White and Robertson, J., **1939**, 1509.
Part IV. Bromine Addition:
Walker and Robertson, J., **1939**, 1515.
Part V. Hydrogen Bromide Catalysis:
Morton and Robertson, J., **1945**, 129.
Part VI. Lithium Chloride Catalysis:
Swedlund and Robertson, J., **1945**, 131.
Part VII. Bromine Addition in Carbon Tetrachloride, Chlorobenzene and Chloroform:
de la Mare, Scott and Robertson, J., **1945**, 509.
Part VIII. α–β–Unsaturated Aldehydes:
de la Mare and Robertson, J., **1945**, 888.
Part IX. Nitrocinnamic Acids:
Hartman and Robertson, J., **1945**, 891.
Part X. Styrene and Stilbene Derivatives:
Ting and Robertson, J., **1947**, 628.
Part XI. The Halogeno-ethylenes:
Swedlund and Robertson, J., **1947**, 630.
Part XII. Iodine Catalysis:
Waters, Caverhill and Robertson, J., **1947**, 1168.
Part XIII. α–β–Unsaturated Ketones:
Rothbaum, Ting and Robertson, J., **1948**, 980.
Part XIV. Perchloric Acid and Lithium Chloride Catalysis:
McDonald, Scaife, Goodwin, Dixon and Robertson, J., **1949**, 294.

Unpublished Work.

Bromine and chlorine addition to substituted ethylenes; β-unsaturated acids, nitriles and sulphones; allyl halides and acetylenic compounds. Revision of iodine addition and hydrogen bromide catalysis.

II. Kinetics of Aromatic Halogen Substitution.

Part I. Bromination:
Robertson, de la Mare and Johnston, J., **1943,** 276.
Part II. Chlorination of Hydrocarbons:
de la Mare and Robertson, J., **1943,** 279.
Part III. Iodination with Iodine Chloride:
Lambourne and Robertson, J., **1947,** 1167 .
Part IV. Halogenonaphthalenes:
de la Mare and Robertson, J., **1947,** 100.
Part V. Perchloric Acid and Lithium Chloride Catalysis:
Goodwin, Dixon, McDonald, Scaife and Robertson, J., **1949,** 294.
Part VI. Iodine Catalysed Bromination:
Robertson, Allan, Haldane & Simmers, J., **1949,** 933.

Unpublished Work.

Halogen substitution of nitrosobenzene and azobenzene, benzyl halides, hydrocarbons and others.

Hydrogen bromide catalysis.

PERSONAL NOTES

Prof. J. Packer has been granted refresher leave from his college duties and will leave in August for Australia and England.

Dr. T. Hagyard, newly-appointed Senior Lecturer in Applied Chemistry in the Chemical Engineering Department of Canterbury University College, is expected to arrive shortly with his wife and two children. He was previously with I.C.I. and Boots Ltd., Nottingham.

Dr. R. O. Page, of Woolston Tanneries, will leave shortly on a business trip to England.

S. R. Gay has been transferred from Kempthorne, Prosser and Co. Ltd. works at Hornby to Burnside.

J. S. Pollard has resigned from N.Z. Plywoods Ltd. (S.I.) Ltd. and is now Industrial Chemist to the Christchurch Gas, Coal and Coke Co. Ltd

J T. Holloway, of the State Forest Service, has been transferred to the Christchurch area.

G. F. Rainnie, Chief Chemist to Davis Gelatine N.Z. Ltd., Woolston, has resigned from the Canterbury Branch to take up an appointment in South Africa.

PROFESSOR S. N. SLATER

New Zealand chemists and especially those recently trained in Otago will welcome the appointment of Dr. S. N. Slater to the Chair of Chemistry at Victoria University College in succession to Professor P. W. Robertson. Dr. Slater is well known to the N.Z. Institute of Chemistry as a member of the Council and as a past Chairman of the Otago Branch. Within the last few months he has been elected to the Fellowship, both of the New Zealand and of the Royal Institutes of Chemistry.

Dr. Slater graduated from Otago in 1938 with First Class Honours in Chemistry and was awarded the 1851 Exhibition Scholarship which enabled him to go overseas for post-graduate work. He chose the Dyson-Perrins Laboratory in Oxford and for two years worked on the synthesis of substances related to the sterols, under Sir Robert Robinson. With a Doctorate of Philosophy he returned to New Zealand in 1940 and was appointed a Junior Lecturer at Otago. Later, as a Lecturer and then as a Senior Lecturer he continued work on New Zealand natural products, an interest carried over from his student days. He chose as his major interest terpenoid compounds and their oxygenated derivatives and in this field he has published a number of papers, mainly in the Journal of the Chemical Society.

Dr. Slater was recently able to spend a year abroad, of which six months were spent working in the Chemical Laboratories at Cambridge and the remainder visiting places of interest in Great Britain and other parts of Europe, and in the U.S.A. The American tour was made possible by a travel grant from the Carnegie Corporation.

In his new position Dr. Slater is continuing his work on the picrotoxin series and it is of interest to note that this includes the investigation of tutin, work begun many years ago in the same laboratories by Easterfield.

Liked equally well by staff and students, an excellent lecturer and research director and an enthusiastic and successful research worker himself, he cannot fail to give new impetus to teaching and research in Chemistry at Victoria College.

MR. J. M. C. TINGEY

Chairman,

Wellington Branch N.Z.I.C.

Mr. Tingey completed B.Sc. in Chemistry at Otago University in 1935 and spent the following five years learning all aspects of the paint manufacturing business in the firm's paint factory, at that time established behind the premises in Manners St., Wellington.

He left the firm in 1941 to take over the Paint Laboratory of Messrs Lewis Berger & Sons (N.Z.) Ltd., and after two years in this position left to join the Forces.

After several months in Army School, Trentham, he was transferred to the D.S.I.R. and for 18 months was employed in the Radio Development Laboratory as an assistant physicist. At this stage the necessity arose for a large number of meters for the Ministry of Supply Radio Production Section to be treated with phosphorescent paint. A small specialized department was set up adjacent to the Dominion Physical Laboratory at Lower Hutt to handle the radio-active paint necessary for the job. When this project was completed in 1944 he spent a period of 3 months compiling and editing a handbook entitled "Paint and Painting" for the Army Education and Welfare Department.

In 1945 he returned again to R. & E. Tingey & Co. Ltd. as Technical Manager and liaison officer between the factory production and retail trade side of R. & E. Tingey & Co. Ltd. In 1948 he was appointed a director of International Paints (N.Z.) Ltd. Since returning to his own firm he has been instrumental in organising a new Department dealing with acrylic plastics and laminated bakelite sheets of all types, which has now become an integral part of R. & E. Tingey's.

SOME CHEMICAL HAZARDS IN INDUSTRY

F. H. KING, M.D., Ch.B., M.R.C.S., D.I.H. (Lond.), L.R.C.P.

(Lecture delivered to the Auckland Branch, March, 1950)

This evening, we shall be considering some of the commoner chemical hazards to which industrial workers may be exposed. Historically speaking, industry became toxic during the last quarter of the nineteenth century, when the manufacture and uncontrolled use of a number of poisonous metals and their compounds became common in some factories. This resulted in a high incidence of cases of industrial poisoning.

In the year 1882, the Guardians of the Poor in the London parish of Holborn admitted fifty-four cases of lead poisoning from a white lead works to the wards of the Union Workhouse and they complained of the charge which these cases had become upon them. It was not until 1895, however, that the government of the day made lead poisoning a notifiable disease and effectively legislated for the protection of workers exposed to lead and other poisonous substances.

Poisons may be taken into the body by way of the mouth, they may be absorbed through the skin, or they may be breathed into the lungs. In most cases of poisoning in ordinary life, the poison has been taken or administered by the mouth. In industrial poisonings, this rarely occurs. Certain chemical substances can be absorbed directly through the skin, particularly the nitro and amino derivatives of benzene and toluene. In the great majority of cases occurring in industry, the toxic substance has been absorbed through the lungs in the form either of a gas or of a suspension in air (aerosol) of fine dust.

It is necessary to place some limit on the toxic substances to be reviewed in this talk, so, in the first place, only those that are absorbed through the lungs and, secondly, only those that are true gases at ordinary temperatures will be considered.

The breathing apparatus of the body may be conveniently divided for descriptive purposes into three zones—an upper, consisting of the mouth, nose and throat; a mid-zone starting with the windpipe (trachea) and the larger bronchial tubes; and a lower zone comprised of the smaller tubes and their final expansions into saccules which are the functional tissue of the lung. Gaseous exchange takes place in the saccules (alveoli) between the air and the blood. The surface area of these alveoli amounts to a total of some 1,500 square feet.

Noxious gases may be classified into four groups, which will be considered seperately, though some gases may exhibit characteristics of more than one group.

Group 1—Asphyxiants.
Group 2—Irritants.
Group 3—Anaesthetics.
Group 4—Systemic poisons.

Asphyxiants.

To appreciate the mode of action of this class of gases it is necessary to understand how oxygen, which is a vital requirement, is distributed to the tissues of the body. The blood consists mainly of a suspension of small biconcave discs of a light red colour in a clear fluid or plasma. A cubic millimetre of blood should contain in health five million of these discs or red cells. The discs contain a complex protein known as haemaglobin. The latter contains combined iron, which imparts the red colour to the blood.

Haemaglobin has the faculty of combining with oxygen at the higher gaseous tension existing in the lung and parting with oxygen at the lower tension existing in the tissues. This may be represented formally by the balanced equation—

$$\mathrm{Hb} + \mathrm{O_2} \rightleftarrows \mathrm{HbO_2} \text{ (oxyhaemaglobin).}$$

Any condition which causes a state of oxygen starvation in the tissues gives rise to asphyxia. Inert gases are able to act in this way if they replace the normal atmosphere. Death resulting from imprisonment in an air-tight enclosure such as a sunken submarine results from the consumption of the available oxygen and from asphyxia and not to poisoning by the carbon dioxide given off by respiration.

Asphyxia due to replacement of the air or to burning up of the oxygen occurs from time to time in industry; such conditions may be found in tanks, stills, brewers' vats or may be brought about by welding in confined spaces. More commonly, a chemically active asphyxiant gas is responsible and, of these, carbon monoxide is the most important.

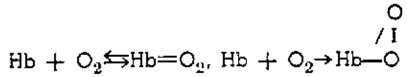
Carbon Monoxide. Carbon Monoxide has an affinity for haemaglobin some three hundred times greater than oxygen and combines with it to form carboxyhaemaglobin. When combined in this way haemaglobin is not available for combination with oxygen and death from asphyxia will result when some 60% of the available haemaglobin is in this form. Carboxyhaemaglobin may best be induced to part with the combined carbon monoxide by promoting deep respiration of pure oxygen and the treatment of such cases is along these lines. Natural elimination by breathing of air alone is slow, about 40% only being changed in one hour.

Cyanogen Compounds: These include cyanogen, hydro-cyanic acid gas and the volatile organic nitriles. These compounds do not affect the haemaglobin to an appreciable extent, but are taken into solution by the blood passing through the lungs. In the tissues they inhibit the enzyme system concerned with oxidation so that the oxygen, though freely available, cannot be utilized. Cyanide poisoning, therefore, is a form of asphyxia caused by the arrest of tissue respiration and is one of the most rapid modes of death. In acute cases, a man falls unconscious after a few breaths of the atmosphere contaminated with the gas, though death is delayed for six to eight minutes. The asphyxial state is indicated by a characteristic gasping respiration and it may be recalled that when Hermann Goering cheated the gallows by taking potassium cyanide, it was the strange sound of his breathing that first attracted his warder's attention.

Nitro and amino Compounds of Benzene: Poisoning by these compounds occurs mainly by absorption through the skin, but their vapours or dusts may be inspired and pass into the body via the lungs. The following are the more common toxic compounds:—

Aniline, mono nitro benzene (oil of mirbane), p-nitraniline, p-chloraniline.

These compounds react with haemaglobin to form methaemaglobin. The latter contains the same proportion of oxygen as oxy-haemaglobin, but in methaemaglobin the oxygen is fixed and is not available for respiratory purposes. The difference may be represented graphically thus:—



$$\mathrm{Hb} + \mathrm{O_2} \rightleftarrows \mathrm{Hb{=}O_2},\quad \mathrm{Hb} + \mathrm{O_2} \rightarrow \mathrm{Hb{-}}\overset{\overset{\mathrm{O}}{/\,|}}{\mathrm{O}}$$

(Oxyhaemaglobin) (Methaemaglobin)

The second reaction is irreversable and no recovery to normal haemaglobin is possible. Cases affected by these compounds turn a violet-blue colour (cyanosis) and death from asphyxia results if more than half of the haemaglobin has been altered to methaemaglobin.

Irritant Gases.

This definition covers a large group of gases differing widely in their chemical and physical properties, but having one property in common: they possess irritant qualities and cause inflammation of the tissues by direct contact. The effect of these gases on the skin, which is normally dry, is slight or negligible and is exerted mainly on the eyes and lining of the respiratory tract which are moist. Gases vary in the part of the respiratory tract upon which they mainly act. The locus of action depends, not on the chemical nature of the gas, but on the physical property of its solubility in water. Those readily soluble will attack the nose, throat and trachea, those of moderate solubility exert their action more or less uniformly throughout the entire tract. Gases of low solubility have little effect on the upper respiratory passages, for little is absorbed there and the main damage is done in the deepest part of the lungs.

Gases of high solubility which act high up in the tract are exemplified by ammonia, hydrochloric acid gas and formaldehyde. Included in the group of gases of medium solubility are chlorine and other halogen vapours and sulphur dioxide. Typical of the action of the last group of low solubility gases are "nitrous fumes" (NO and NO_2) and phosgene. These act insidiously.

A worker may inhale nitrous fumes in the factory for some time without great inconvenience from the mild local irritation of the nose and throat. He returns home, eats his supper and goes to bed feeling perfectly well. An inflammatory reaction of the deep parts of the lung has nevertheless started which results in fluid being formed, filling up the air spaces of the alveoli. During the night the man wakes up with a cough and difficulty with his breathing and by morning he may be dead, drowned in the fluid which his lungs have poured out.

Anaesthetic Group.

This is comprised mainly of the hydrocarbons and their derivatives. They are used extensively in industry as fuels, solvents, degreasants, etc. Their fat solvent properties probably account for their selective action on the brain and nervous system since the latter are lipoid in nature.

All volatile hydrocarbons, whether of the paraffinic, olefinic or aromatic series have a depressant action on the brain. In the early stages of intoxication there may be a temporary state of excitement as is seen in the "fighting drunk" and this occurs commonly after heavy exposures to the lower boiling ranges of petroleum spirits.

It is a general rule that, in any homologous series, the higher the number, the greater the toxic effect. On the other hand, the lower the number, the greater the volatility and, consequently, the higher the concentration in the atmosphere. In industry at least, intoxications result from the breathing of contaminated air and the volatility becomes an over-riding factor in these circumstances.

Hydrocarbon derivatives include the volatile alcohols, aldehydes, ethers and ketones. The presence of a carboxyl group suppresses the anaesthetic action, but esterification restores it. Thus, acetic acid is inactive, but amylacetate has an anaesthetic action.

Halogenation greatly increases the anaesthetic property of hydrocarbons. The gas, cyclopropane, is used in medical practice to give light anaesthesia, but compounds such as ethyl chloride, chloroform and trichlorethylene are potent drugs and require great care in administration.

The addition of hydroxyl groups reduces the potency so that the series ethyl alcohol, ethylene glycol and glycerol exhibit a progressively diminishing effect. Ethylene glycol has deliberately been taken by mouth for the sake of its reputed alcoholic "kick," but those who have tried it out seldom wish to repeat the experiment.

Some hydrocarbons have, in addition to their immediate anaesthetic action, a delayed toxic action on other organs of the body, but these cannot be considered in this context. One gas in the halogenated methane series, however, may be mentioned, as it is an example of a chemical paradox from the toxicologist's point of view. This is dichloro-difluoro methane or "Freon." Chlorine substitution products of methane increase in toxicity with chlorination, and fluorine, both the element and its compounds, exhibits great toxicity. It could reasonably be deduced, therefore, that the compound CCl_2F_2 would possess marked poisonous qualities, yet it is a biologically inert gas and the safest refrigerant on the market. Its inventor, Thos. Midgley, Jnr., frequently demonstrated its harmless nature by inhaling the gas and its non-flammability by extinguishing a candle with his breath.

Systemic Poisons:

Included in this group are a miscellaneous collection of gases and vapours having a great diversity of action on the human body. The list is extensive and it is possible to select a few only for discussion.

The Hydrides. All the volatile hydrides are potentially poisonous. Those which may be encountered in industry are ammonia, hydrogen sulphide, arsine and, less frequently, phosphine.

Systemic poisoning by ammonia gas is rare since it is so intensely irritating that, in high concentrations in the air, a spasm of the throat is induced which prevents inhalation.

It may be of interest at this point to relate the experiences of a homeward-bound ship's company at the beginning of this century. A mysterious illness affected 120 persons during the voyage. The first victim was a canary which was found dead in its cage and, by the time the ship docked, 27 humans and a dog had succumbed. The symptoms included severe gastric and intestinal disturbance and foul play was suspected. The source of the trouble was eventually traced to a cargo of ferro-silicon which contained calcium phosphide as an impurity. Water had entered the hold during the voyage and had caused the evolution of phosphine.

Hydrogen sulphide is an irritant gas which causes an extremely painful condition of the eyes, even in low concentration in the air. This irritant quality is overshadowed, however, by the systemic effects after absorption into the body. Here it exerts a paralysing action on the brain and causes a cessation of respiration. Familiarity with this gas and ignorance of its toxic quality have resulted in many cases of poisoning and some fatalities. H_2S in concentrations of 500 parts per million will poison and in concentrations of 1,000 parts per million will kill rapidly.

Arsine, in industry, is produced accidentally and unexpectedly. Impure zinc is usually incriminated in these cases. Arsine breaks up the red cells of the blood and the liberated haemaglobin passes through the kidneys and imparts a red colour to the urine. The resulting anaemia may be fatal if more than half the red corpuscles are destroyed.

Metallic Poisons. One metal only, i.e., mercury, is a liquid at ordinary working temperatures and exerts a vapour pressure. The air in proximity to a bench where the metal is exposed may contain sufficient vapour to cause mercury poisoning. Apart from its use in philosophical instruments, mercury is employed in vacuum pumps, electronic tubes, switch gears and as a heat exchange medium and in mercury turbines.

Other volatiles in this group are tetra-ethyl lead and the metallic carbonyls. Time, however, prevents further discussion.

In conclusion, a few words of warning and advice may not be out of place. There are many chemical hazards in industry today and research is constantly producing new substances and new hazards. It is as unprofitable to ignore these risks as it is foolish to exaggerate them. Industrial chemists should familiarize themselves with all the toxic risks associated with the processes for which they are responsible, for the health and safety of the process workers are in their hands. The investigation of gassing accidents shows that most of these could have been avoided if the approved precautions had been taken. Accidents occur, nevertheless, in the best of factories and facilities for resuscitation and treatment should always be available.

As regards text books on industrial toxicology, a short list is given below for reference purposes. For industrial chemists, the quarterly safety summary of the Association of British Chemical Manufacturers gives an excellent synopsis of current literature dealing with chemical accidents and toxicology in industry generally. The July-September issue of 1948 includes a comprehensive list of dangerous gases with their physical properties and their reactions on humans at various concentrations.

Books.	**Author.**	**Publisher.**
Industrial Toxicology.	Alice Hamilton.	Oxford Medical Publications.
Toxicity of Industrial Organic Solvents.	Ethel Browning.	H.M. Stationery Office, London.
The Analytical Chemistry of Industrial Poisons, Hazards and Solvents.	M. B. Jacobs.	Interscience Publishers, New York.
Toxicology and Hygiene of Industrial Solvents.	Lehman & Flury.	Williams & Wilkins Co., Baltimore, Maryland.

CANTERBURY BRANCH NOTES

The 1950 session opened on the 20th February, when Mr. S. R. Siemon delivered his Chairman's address on "The Surface of Particulate Solids."

The remaining addresses this year are to be based on the "Food and People" theme suggested by UNESCO. The first of these was in the form of a broadcast address on the 20th March. Discussion of the Food and People problem followed the address, the principal speaker being Dr. H. N. Parton, who amplified the aims of this UNESCO programme.

On 17th April, Mr. N. W. Vere-Jones, of the Dominion Laboratory, continued the series with an address on "The Manufacture of Enzymes."

In addition to these, Sir Henry Dale, during his stay in Christchurch, delivered three addresses, to which members of the Institute of Chemistry were invited. The first was a public address on Lord Rutherford, given on 27th March. On 29th March, Sir Henry addressed a joint meeting of the Institute and the Royal Society, his subject being "The Proper Place of Science in Education," and the following evening spoke to the B.M.A. on "Histamine and the Anti-Histamines." All these meetings were well attended.

STANDARD METHODS OF ANALYSIS

Determination of Organic Carbon in Soils

(Soils and Fertilizer Committee)

It was desired to obtain some idea of the reliability of wet combustion methods of determining organic carbon when applied to New Zealand soils. Accordingly six soils selected by the Soil Bureau were supplied to workers at Massey and Lincoln Agricultural Colleges, the Cawthron Institute and Soil Fertility Research Station. These used either Schollenberger's (1) or Allison's (2) method, the two being essentially the same. The factor 1.15 (following Allison) assuming an 87% oxidation was used by four workers, while a fifth calculated results on a basis of 90%. For the sake of comparison these last have been adjusted into line with the others. One worker carried out determinations in quintuplicate, two in triplicate, one in duplicate and one gave single figures. Replicate results of individual workers were in close agreement. Moisture determinations carried out for converting results to a dry matter basis were shown by three collaborators, one of whom worked in triplicate. The variation between his replicates was considerably greater than in the case of his carbon figures. It is possible that moisture corrections may account for some of the variation between workers. Samples were dried at 105° C. (24 hours, 18 hours and not stated) by three collaborators, the other two not stating the details. Moisture determinations by the three workers cannot be compared, as conditions of storage and grinding would have modified the moisture content.

Results are reported in the tabulation, along with those carried out by a dry combustion method on a micro scale by Mr. E. P. White, of the Ruakura Animal Research Station.

For practical purposes the various collaborators using wet combustion methods are in good agreement. The dry combustion results are lower in all cases. The assumption of 87% oxidation by Allison was made from work on a limited number of soil types, the organic carbon contents ranging from 0.42 to 4.11 per cent., as against 1.71 to 30.2 per cent. in the present series. Smith and Weldon (3), using the same method on 113 samples with carbon contents from 0.28 to 10.34 per cent., found the percentage oxidation to vary from 94.6 to 101.6 with an average of 96.6. In the present comparison the factors necessary to convert the average wet combustion result, unadjusted, to the dry combustion result are shown in the last column. They average 1.065 corresponding to 93.8 per cent. combustion. Two peat soils examined at the Soil Fertility Research Station are included in the table. The oxidation of carbon by the wet combustion method was almost complete in one case.

The particular soils used contained only traces of chloride and no obvious elementary carbon. A small amount of carbonate present in the sample of red-brown loam from North Auckland may have slightly raised the dry combustion result and consequently the factor in the last column.

It is concluded that the wet combustion method as used by Allison will give results sufficiently reproducible for practical purposes, but that the factor he employed, 1.15, is not of general application and that further work on various New Zealand soil types, comparing such results with standard dry combustion determinations, is called for.

(1) C. J. Schollenberger, Soil Science, **59**, 53 (1945).

(2) L. E. Allison, Soil Science, **40**, 311-320 (1935).

(3) H. W. Smith and M. D. Weldon, Soil Sci. Soc. Amer. Proc., **5**, 179 (1940).

E. B. Davies.

ORGANIC CARBON CONTENT OF SOILS

Description.	Locality.	Percentage carbon in moisture free soil.							Dry combustion. Unadjusted wet combustion.
		A	B	C	D	E	Average	Dry combustion.	
Yellow grey loam	Marlborough	1.81	1.8	1.91	1.82	1.80	1.83	1.71	1.08
Brown granular clay	Nth. Auck.	4.90	4.7	4.99	4.9	4.93	4.88	4.78	1.13
Red brown loam	Nth. Auck.	12.1	11.6	11.9	11.9	11.8	11.9	11.5	1.11
Meadow	Gt. Barrier	15.5	15.1	15.1	15.3	15.0	15.2	14.2	1.08
Skeletal	Wellington	23.2	22.8	24.1	22.5	23.3	23.2	19.0	0.94
Podzol	Otago	33.2	32.2	33.6	33.9	32.1	33.0	30.2	1.05
Peat					59.5			53.8	1.04
Peat					62.2			54.5	1.01

COMMITTEE FOR STANDARDISATION OF PLANT ANALYTICAL METHODS

In the Journal of December, 1947 (Vol XI., p. 104, 1947) are set out the recommendation of the Committee for eight different determinations. The following is the second instalment of accepted methods:

PHOSPHORUS.

The following methods are recommended on the assumption that the ash is prepared by incineration and should be satisfactory for all plant materials having sufficient bases to give a distinctly alkaline ash. Collaborative work on the application of the methods to the wet ashing procedure has not been carried out and no recommendation can be made.

(1) Volumetric.

Transfer an aliquot of the solution of the ash from which silica has been removed and which contains about 10 mg. phosphoric acid to a 400 ml or 500 ml round-bottomed pyrex flask. Neutralize with 1:1 ammonia solution until a permanent precipitate appears, then acidify drop by drop with concentrated nitric acid until the precipitate disappears on shaking. Add 30 ml of 50% solution of ammonium nitrate, and make to 100 ml with distilled water. Heat over a gauze until the solution temperature is about 70° C. (not over 75° C.), remove from flame, and swirl the liquid to cool the sides of the flask. Add 30 ml molybdate reagent, swirling the flask continuously. Swirl the liquid vigorously for a minute to ensure complete precipitation. Put aside overnight. Filter on a Hirsch funnel with a Whatman No. 40 filter paper disc. Wash the precipitate 7 or 8 times with 2% sodium nitrate, and twice with cold distilled water (test the filtrate for acidity—if acid, further washing with nitrate solution is required). The precipitate and disc are washed back into the original flask with about 100 ml. of cold water and the precipitate dissolved in a known volume of N/10 NaOH solution. About 2-4 ml. excess of the alkali is desirable. Place a freshly-washed rubber stopper in the neck of the flask. Shake vigorously to completely dissolve the precipitate and to disintegrate the filter disc (the solution should be clear with no sign of yellow). Rinse the stopper and wash down the neck and sides of the flask with distilled water.

After adding 3-4 drops of phenolphthalein indicator titrate the excess alkali with N/10 H_2SO_4 solution.

Each ml. of alkali solution corresponds to to 0.0003004 gm. P_2O_5.

Solutions.

Phenolphthalein: 1 per cent. in 80 per cent. alcohol.

Molybdate reagent: Dissolve 150 gm. powdered ammonium molybdate in 1 litre of distilled water and add this with stirring to 1 litre of nitric acid sp. gr. 1.2. Stand overnight and filter. Keep in a cool place to prevent precipitation of molybdic acid and consequent weakening of the strength of the reagent.

Ammonia solution: Equal parts of ammonia fort. (0.880) and distilled water.

Ammonium Nitrate: 500 gm. in distilled water made to 1 litre. Filter before use.

Sodium Nitrate: 2 per cent. aqueous solution.

(2) **Gravimetric Method.**

Phosphoric acid by Lorenz Method (after Piper, "Soil and Plant Analysis,' Univ. of Adelaide, 1942).

Take an aliquot of the solution of ash, free from silica, containing about 10 mg. of P_2O_5, in a tall 150 ml. beaker and evaporate nearly to dryness on the water-bath. Add 5 ml. of water and 5 ml. of concentrated nitric acid and evaporate to dryness to remove chlorides. Dissolve residue in 15-15.5 ml. of concentrated nitric acid and 34 ml. of water, adding 1 ml. of concentrated sulphuric acid. Heat just to boiling, stirring well to dissolve any calcium sulphate. Remove from flame, stir for 10 secs. to cool the sides of the beaker, rapidly add 50 ml. of Lorenz sulphate-molybdic acid reagent, stir for 30 secs., cover the beaker and leave to stand for 2 hours, or overnight if more convenient.

Filter through a Gooch crucible, fitted with a small circle of Whatman No. 42 filter paper, cut to cover the holes, but not to touch the edges, or a Gooch crucible charged with asbestos.

Before use, wash the crucible with acetone, place in a desiccator without drying agent, evacuate to about 200 mm. and leave for 30 mins. before weighing (longer if asbestos is used). Wash the precipitate 4 times with 2% ammonium nitrate made (if necessary) just acid to litmus with a drop of nitric acid. Wash three times with acetone and draw air through the crucible for half to one minute. Finally dry the crucible under the same conditions as described above.

Multiply the weight of the precipitate by .0.03295 to obtain the weight of P_2O_5.

Solutions.

Lorenz sulphate-molybdic acid reagent: Dissolve 100 gm. of ammonium sulphate in 1 litre HNO_3 of sp. gr. 1.36 at 15° C. in a 2 litre flask. Dissolve 300 gm. of ammonium molybdate in hot water and transfer to a litre measuring flask, cool to about 20° C., and dilute to the mark. Mix well and pour this solution, in a thin stream, with constant agitation, into the solution in the 2-litre flask. Stand for 48 hours at room temp., filter and store in a stoppered reagent bottle in a cool, dark place. (At summer temps. the reagent may deteriorate on long keeping.)

Ammonium Nitrate Solution: Make up a 2% aqueous solution. If not acid to litmus add a few drops of nitric acid.

Acetone: Should be non-alkaline and free from residue. Keep acetone washings, dehydrate with K_2CO_3, decant, acidify with H_2SO_4 and re-distil.

COPPER.

Clare, Cunningham and Perrin (N.Z. J. Sci. & Tech. **26A**, 340 (1945)). Collaborators have had difficulty through coloured contaminants being removed from the rubber stoppers during extraction with iso-amyl alcohol. Where possible glass-stoppered tubes should be used. If these are not available the closest watch should be kept on rubber stoppers.

NITROGEN.

Official Methods A.O.A.C., 6th Edition, 1945, p. 25, et seq. The Committee draws particular attention to the necessity for care in reporting results from samples containing nitrate and to the inaccuracy which is introduced when nitrate-containing samples are digested in the absence of salicylic acid.

CRUDE FIBRE.

Official Methods A.O.A.C., 6th Edition, 1945, P. 408.

J. MELVILLE,
Secretary.

BOOKS RECEIVED

The Chemical Institute of Canada is to be congratulated on the production of the very attractive volume entitled, **A History of Chemistry in Canada**, which has been compiled by C. J. S. Warrington and R. V. V. Nicholls and published last year by Sir Isaac Pitman and Sons, Toronto, at $3.60. The first fourteen chapters deal with the various chemical industries, and are followed by chapters on chemistry in the universities and schools, chemistry and public services, and chemical institutes and journals.

Though naturally this book will be of most interest to Canadians, it is a very readable volume for all chemists, with its thumb-nail sketches of industrial processes, and details from the history of a country which has now been colonised for 350 years. There is, for instance, the story of the King's Brewery at Quebec, where the cellars were cut into the solid rock (the first example of temperature control in an industrial process in Canada!), and how the building became first a brewery in 1668, a prison in 1672, and a palace from 1686 until Wolfe captured Quebec in 1759. The superstructure was destroyed during a sideshow in connection with the American war of independence in 1775, but a modern brewery, which still stands, was built there in 1885.

The book also contains details from the lives of many leading Canadian chemists and industrial leaders. It will be a surprise to many to find how extensive the Canadian chemical industry is, and how many processes often dubbed "American" in this country are really Canadian. Running to 500 pages, the book is admirably produced with good printing, paper and binding. It contains some excellent photographs, drawings and maps. We hope that this venture by our Canadian colleagues meets with the success it deserves.

ITEMS OF INTEREST

Those who met Dr. I. W. Wark at the last Conference will be interested to note that a recent French publication refers to his book as "Principles of Flottation, by Ian Works!"

Mr. D. A. Tait, A.R.I.C., as present on leave in Hamilton, will shortly be returning to the Shell refinery at Estado Falcon, Venezuela.

A general invitation has been extended by the Division of Rubber Chemistry of the American Chemical Society to an International meeting, to be held in Cleveland, Ohio, on October 11, 12 and 13, 1950. Papers are invited and anyone interested can obtain further details from the Hon. General Secretary.

Mr. R. B. Miller, our Wellington Branch Editor, will shortly be leaving to do post-graduate research at Uppsala, Sweden.

◆

BOOK REVIEWS

Elsevier's Encyclopaedia of Organic Chemistry. Edited by F. Radt. Vol. 12B, pages 1-144. 1948. Distributed by Cleaver-Hume Press Ltd., 42a South Audley St., London., W.1. Price £9 (to subscribers to the whole work; higher for single volumes). The systematising of chemical knowledge is a matter of interest to every chemist and we are glad to have the opportunity of reviewing a part of this new work. The editors have chosen to begin with polycyclic hydrocarbons and their derivatives and the book under review covers hydrocarbons with a single naphthalene skeleton and their halogen derivatives. The only comparable work of this nature is Beilstein's Handbuch, and Elsevier shows a number of immediate advantages as follows:—

(1) The system used is simpler and easily explained.

(2) The work is published in English.

(3) Each volume has its own formula index.

(4) More information is given on physical properties than in Beilstein, which, particularly in the Second Supplement, prefers to give references rather than actual figures. The information in Elsevier is so full that consultation of the original reference is usually unnecessary. However, the reviewer did note some omissions in the part under review, i.e., the paper by Gardner and Brewer (Ind. and Eng. Chem., **29**, 179 (1937)) on vapour pressure of solvents is not referred to under tetralin on which it gives a good series of figures. (It is mentioned under decalin.)

(5) It is planned that this and future volumes will cover the literature up to within four years of the date of publication. It is proposed to issue loose-leaf supplements at ten-year intervals.

(6) A less important but definite advantage is that the quality of printing and binding makes it a pleasure to use the work. Though it must increase printing costs, a larger size of type means a good deal less eye-strain.

It is planned to cover the field in twenty volumes, some of which may be issued in a number of parts. Two complete volumes have so far been issued and a third is under way, so that at present about one-tenth of the literature has been dealt with. Beilstein gives complete coverage up to 1919 and in the second supplement covering the literature up to 1929, ten volumes out of twenty-seven have been issued. The usefulness of both works will depend on how fast the gap can be closed. The first volumes of Elsevier have proved immediately useful at Auckland University College, but those of us who have learned to treat Beilstein with respect and even affection, will have some regret at the appearance of a rival. We may also wonder how much further the cataloguing of organic compounds might have gone if the two works could have been integrated.

ACETYLENE AND CARBON MONOXIDE CHEMISTRY. By John W. Copenhaver and Maurice H. Bigelow. 1949. Pp. 357. New York: Reinhold Publishing Corp. Our copy from Technical Books, Wellington. Price in New Zealand, £5.

Undoubtedly the most significant developments in industrial chemistry discovered by the Allied missions in Germany are in the field discussed in this book and particularly associated with the name of Dr. Walter Reppe, a director of the I.G. Farbenindustrie. Dr. Reppe was not at all co-operative, partly because he was detained by the Allied forces. He was also in charge of a large team of research workers and for that reason had a general, rather than a detailed, knowledge of the work. The story had therefore to be pieced together from Dr. Reppe's manuscripts and from the mission's own observations. With this material the authors have produced a fascinating volume, which is not without its dramatic side, though its main value lies in the immense amount of factual detail it contains. When Dr. Reppe started his experiments, Government regulations forbad the use of acetylene at more than 1.5 atmosphere's pressure, and the work had to be done secretly until his results justified the raising of this restriction. The book records how in an early experiment to bring about the direct combination of acetylene and alcohol, the mixture was charged into an autoclave at a pressure of 15 atmospheres, and the temperature slowly raised until at 170° the pressure had doubled. In Dr Reppe's words, "Our tension had reached its peak," and a violent explosion could almost certainly be expected. However, the experiment was continued until at 180°, pressure started to fall, indicating that the desired reaction had taken place. The book records all the work done both on the laboratory and commercial scale with working details. The ramifications of this new branch of organic chemistry are vast enough to leave no doubt that Reppe has enlarged the scope of organic chemistry in a way no text-book can ignore. The book contains a few minor flaws, such as the use of the "k" value several times before it is explained on page 67; otherwise it is well done.

ADVANCES IN CATALYSIS AND RELATED SUBJECTS. Vol. I. Edited by W. G. Frankenburg, V. I. Komarewsky, and E. K. Rideal. 1948. Pp. 321: New York: Academic Press $7.80.

Catalysis is now added to the increasing number of subjects which have "Advances in" books written about them. The purpose of this series is to obtain from scientific and industrial workers complete and detailed surveys of those specific sectors in which the authors are mainly interested, and in which they have worked successfully. Catalysis is certainly a wide field where there are many unsolved problems and many industrial applications worth reviewing in detail, so that this series has very definite possibilities. With continued selection of the right subjects and the right authors as has been done in this volume, the work will be authoritative. The first volume contains the following items:—heterogeneity of catalyst surfaces for chemisorption (H. S. Taylor), alkylation of iso-paraffins (Ipatieff and Schmerling), surface area measurements (Emmett), the geometrical factor in catalysis (Griffith), the Fischer-Tropsch and related processes (Storch), the catalytic activation of hydrogen (Eley), isomerisation of alkanes (Pines), the application of X-ray diffraction data to the study of solid catalysts (Jellinck and Fankuchen). Two of these contributors are English and the rest American; future volumes may be more international in scope.

AUCKLAND BRANCH NOTES

Mr. H. T. Revell, M.A., A.N.Z.I.C., has retired from the position of first assistant science master, King's College, where he had been on the teaching staff for thirty-nine years. Mr. Revell is at present teaching at Dilworth School.

Mr. B. A. Ripley-Duggan, B.Sc., A.R.I.C., has been appointed Chemist, Dominion Laboratory, Auckland, for research work on timber preservation. He was previously on the research staff of British Celanese Ltd.

Mr. A. W. Mackney, M.Sc., A.N.Z.I.C., A.R.A.C.I., Chief Chemist, N.Z. Forest Products Ltd., is at present on a five months trip abroad studying recent developments in pulp and paper manufacture.

Mr. J. D. W. Monigatti, M.Sc., A.N.Z.I.C., previously agricultural chemist, Ruakura Animal Research Station, is now assistant science master, King's College.

Dr. G. A. Nicholls, M.Sc., Ph.D., A.N.Z.I.C. Research Assistant, Chemistry Department, Auckland University College, has been awarded a United States Public Health Service research fellowship, to undertake cancer research under Professor D. A. Tarbell at the University of Rochester, New York.

A refresher course for chemists is being arranged to commence early in June. Dr. H. Bloom, M.Sc., Ph.D., D.I.C., A.N.Z.I.C., A.R.A.C.I., Senior Lecturer, Chemistry Department, Auckland University College, has offered to deliver a series of five weekly lectures on the theory and application of thermodynamics.

WELLINGTON BRANCH NOTES

The first meeting of the year in Wellington was to hear the Chairman's address delivered by Mr. J. M. C. Tingey. It was entitled "The History and Applications of Luminescent Sulphides."

In an address to the Wellington branch of the Institute on April 5th Prof. S. N. Slater spoke on "Some Modern Methods of Isolation and Purification of Organic Compounds." After emphasising the importance of purification in analysis he described the counter-current distribution method of assessing purity. He then dealt with methods of separation by partition chromatography and ion exchange.

Congratulations are due to Mr. A. D. Munro on his recent appointment as an Associate Professor of Chemistry at Victoria University College.

Congratulations are due to Dr. F. B. Shorland, Director of the Fats Laboratory, Wellington, who was recently awarded a D.Sc. from Liverpool University. Dr. Shorland is the only holder of this degree in Australia and New Zealand, and even in Great Britain there are only three scientists working in Food Investigation Laboratories with the distinction. Dr. Shorland did his work for his Ph.D. in the Department of Industrial Chemistry in Liverpool, and since returning to New Zealand has done a great deal of work on the composition of the fats on New Zealand domestic animals and fish. In his papers he has contributed and developed new and fruitful conceptions of biological and other relationships which distinguish animal fats as a whole.

The Wellington Branch co-operated with the Royal Society, the University Council, the B.M.A. and the Association of Scientific Workers in organizing an address by Sir Henry Dale when he was recently in Wellington. The address was entitled "Science in Education."

The Wellington Branch of the Institute was responsible for a number of stands at the recent Royal Society Exhibition "Science and Food" at the Wellington Town Hall. They illustrated scientific advances in the milk industry—from the pasture to the consumer. Co-operating organizations included the Soil Bureau, Plant Chemistry Laboratory, Wallaceville Animal Research Station, Dominion Laboratory, Fats Laboratory and the Fertilizer Manufacturers' Research Association. The Exhibition was visited by 2000 people besides the many groups of school children.

B. D. H.

REAGENTS FOR

CLINICAL ANALYSIS

This series of prepared reagents contains the more important solutions together with special B.D.H. reagents used in conjunction with the Lovibond Comparator to enable tedious analytical procedures to be carried out quickly and conveniently.

As New Zealand agents for the Laboratory Group of Messrs. British Drug Houses Ltd., we can offer ex stock a comprehensive range of their products covering all lines of chemicals and testing apparatus.

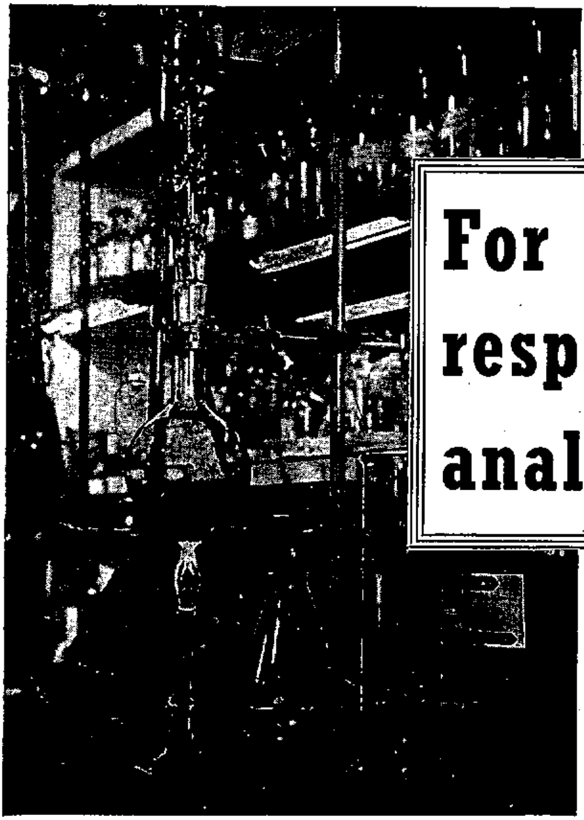
We can also offer for immediate delivery adequate supplies of all everyday requirements as needed in almost every laboratory.

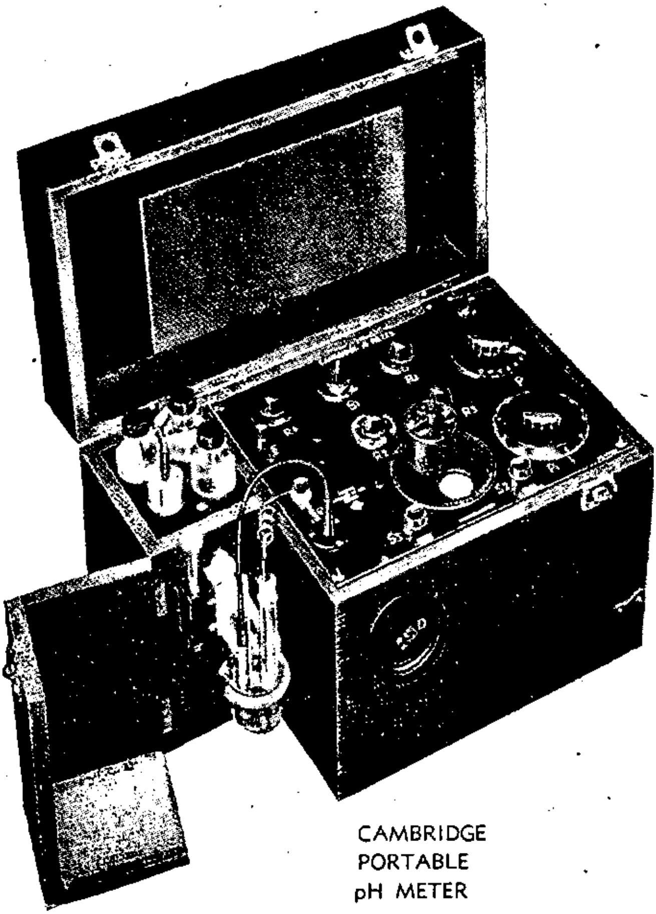
Your enquiries will at all times receive our careful attention and you are cordially invited to visit our showrooms at either of the addresses listed below:

THE NATIONAL DAIRY ASSOCIATION OF NEW ZEALAND LTD.

THORNDON QUAY,
WELLINGTON

FANSHAWE STREET,
AUCKLAND.





Polythene

Polythene was essential for the development of another great achievement of British research — radar. The illustration shows the radar installation at the port of Liverpool. Polythene, or polymerised ethylene, is a tough yet flexible plastic with remarkable qualities as an electrical insulator. The name is generic for a range of solid polymers of ethylene, a gas derived from alcohol or petroleum. Ethylene will not polymerise easily, that is, the molecules will not join together in long chains, but in 1933, I.C.I. chemists found that under extreme pressure they could be made to do so. This was in itself a major scientific achievement, but equal skill and more patience were needed to develop polythene to the stage of commercial production. The pressures used—sometimes exceeding 10 tons per square inch—had never been employed before in chemical processes, and at the beginning there were many explosions, one of which almost wrecked the laboratory. The process was finally mastered in 1936, and the first plant manufacturing polythene came into production on 1st September, 1939, the day the Germans invaded Poland. Never was a product more timely in its arrival. To-day it is finding many uses, one of the most important being the improvement of submarine telegraph cables.

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