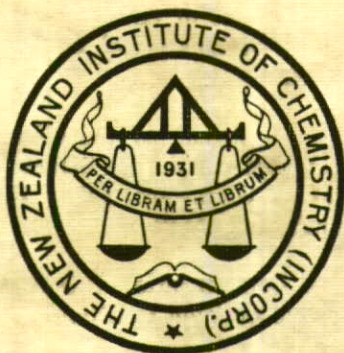


Vol. VII—No. 2

June, 1943

JOURNAL
of the
NEW ZEALAND
INSTITUTE of CHEMISTRY



Published by the New Zealand Institute of Chemistry (Inc.)
Wellington, New Zealand

Scientists !!!

At the present time when supplies are extremely difficult to secure and there is also a definite shortage of laboratory assistants, it is more necessary than ever that laboratory glassware should be absolutely accurate and of the best possible grade, thus saving a repetition of work and unnecessary breakage.

We are pleased to advise that we have in stock a large and comprehensive range of the well-known **"K" EXAX BLUE LINE GRADUATED GLASSWARE.**

A comprehensive range is also carried of **B.D.H. ANALAR REAGENTS**, and clients may rest assured that except in the case of extremely rare chemicals, adequate supplies of Analytical Reagents are at all times procurable.

Pure chemicals are purchased and offered at the best possible price, whilst supplies of Scientific Apparatus, Pyrex Laboratory Glassware, Filter Paper, etc. are always procurable ex stock.

Having its own London office, this Association is in a most favourable position to attend to orders on an indent basis.

ADDRESS ENQUIRIES:

**Dept. Chemicals & Scientific Apparatus
NATIONAL DAIRY ASSN. OF N.Z. LTD.**

**P.O. Box 28
WELLINGTON**

**P.O. Box 1001
AUCKLAND**

JOURNAL
of the
NEW ZEALAND INSTITUTE OF CHEMISTRY

VOLUME VII.

JUNE, 1943

NO. 2

HENRY GEORGE DENHAM, 1880-1943.

The New Zealand Institute of Chemistry has suffered a severe loss by the passing of Dr. H. G. Denham, whose death on February 15th last removed from our midst one of our foundation Fellows, and a man whose enthusiasm for applied chemistry has played a considerable part in expanding the chemical profession here at a time when its services are rapidly becoming even more necessary and valuable. His services to the Institute were many. With the late Mr. A. M. Wright, he played a considerable part in its formation, and presided at the inaugural meeting of the Canterbury Branch, of which he was the first Chairman. He was President of the Institute in 1934 and 1935, and Canterbury Delegate to the Council from 1931 to 1933. While his many activities of recent years prevented him from continuing to assist in the administration of Institute affairs, he attended branch meetings whenever possible, and remained a member of the Fellowship Committee up to the time of his death. Moreover he viewed with great satisfaction the acceptance of office in the Institute by the younger chemists. About one-sixth of our membership is made up of his former students.

His career as a chemist was a distinguished one. He liked to recall that it was the appointment of Dr. W. P. Evans to the Chair of Chemistry at Canterbury College which decided him on his Honours subject. He won the Chemistry Exhibition and graduated B.A. in 1904, and M.A. with First Class Honours in Chemistry in 1905. He then took the M.Sc. degree on research work in 1906, and was awarded the 1851 Exhibition Science Research Scholarship. He intended studying under Sir William Ramsay, but decided finally on the new Muspratt laboratory at Liverpool, where F. G. Donnan was to build up a school of physical chemistry which has produced many notable graduates. After two years at Liverpool, he spent some four terms at Heidelberg under Bredig, and was fond of recalling how he slept in the back seat of the lecture room, and the morning dress formalism associated with the taking of the Ph.D. degree. His honours students will recall the favourite quotation from Bredig: "One experiment is no experiment, do a series of experiments"; then when a series was presented "one series is no series, do a series of series". On his return to New Zealand late in 1910 he spent a year as research student and honorary lecturer at Canterbury College and then went to Queensland as lecturer under B. D. Steele.

When Steele went to England to manage a war industry, Dr. Denham became Acting-Professor, and was made Assistant Professor at the end of the war. The existence at Brisbane of a school of applied chemistry was no doubt one of the factors which developed Dr. Denham's own interest in and enthusiasm for that important field. In 1921 he became Professor of Inorganic Chemistry at Capetown, and two years later accepted an invitation to return to Canterbury College on the retirement of his former teacher, Dr. Evans. Twenty years of fruitful teaching and university administration followed, culminating in his appointment as Rector in 1941.

His research work at Liverpool laid the foundations of his later interests. He applied the hydrogen electrode to the measurement of salt hydrolysis, and lack of stability in the electrode in solutions of polyvalent cations led to the postulate, in a joint paper with A. J. Allmand, that reduction to sub ions e.g. Pb^+ and Cd^+ , was responsible. This led naturally to attempts to prepare suboxides and subsalts, work which he mainly carried out in Brisbane. His careful work with cadmium showed that the results obtained by some of the published methods were doubtful, but that the oxide Cd_2O could be prepared. It may be of interest to note the results of more recent work in these fields. Kolthoff and Kameda (1928) showed that a hydrogen electrode can be made to give reproducible results in these unbuffered solutions, if the active adsorbent platinum black is replaced by plated platinum. They explained the anomalous results with the usual electrode as due to adsorption of the cations, which takes place readily in a hydrogen atmosphere, though not with nitrogen. The equivalent amount of hydrogen ion liberated in the solution upsets the hydrolysis measurement. The existence of suboxides and subhalides of cadmium has been questioned by Hollens and Spencer (1934), on the basis of magnetic susceptibility measurements, and by Hodger and Terrey (1936) using X-ray methods. The substances were prepared by methods which Dr. Denham's work had also shown to be doubtful.

His study of aniline hydrochloride with the hydrogen electrode has become a text book example of hydrolysis measurement by this method. He used to relate how in Germany he met another student chemist, and before names were exchanged, found that his acquaintance had been "repeating the work of a chap named Denham on aniline hydrochloride." Further questions revealed that the work had confirmed Dr. Denham's results, and he then revealed his identity. Some investigations of autocomplexes in cupric solutions were also begun in Liverpool and continued later in Brisbane with S. W. Pennycook and S. B. Watkins. Under Bredig he studied the catalysis of the reaction between titanous and hydrogen ions, by platinum black. Heterogeneous catalysis in the liquid phase has not been extensively studied even now, and H. S. Taylor remarks (Treatise on Physical Chemistry) that this re-

action is a suitable one for a further study.

After his return to New Zealand, increasing administrative responsibilities prevented his pursuing his research problems, though further papers on hydrolysis with N. A. Marris, and two on phase rule studies, with D. A. Dick and J. O. Kidson, were published.

Dr. Denham's other publications were his textbook of Inorganic Chemistry, which ran to three editions, and public lectures. He was President of Section B of the Australian and New Zealand Association for the Advancement of Science in 1928, taking for his subject, Sugden's parachor which, derived from the surface tension-density relationship found by D. B. Macleod of the Canterbury College Physics Department, was making valuable contributions to the study of molecular structure. As the Association's Liversidge Lecturer at the Canberra meeting in 1939, he spoke on his well loved topic "Modern Developments in the Industrial World," and he discussed a similar field as Cawthron Lecturer in 1937.

Dr. Denham's public services, especially during the last fifteen years, have been such that they may too easily obscure the fact that he was first of all a man of the university, graduate of three, and member of the staff of three. As a university teacher he has provided inspiration for many now contributing valuable work in the various spheres to which chemists gravitate, research, university and secondary school teaching, analytical and industrial chemistry. The list of academic successes obtained by his Canterbury students is a notable one, including twelve doctorate degrees of New Zealand and overseas universities. But a better measure of his success as a teacher is to be found in the reliance placed on his recommendation by those who employ graduates in chemistry. He never forgot those who passed through his hands. Their progress and success was a constant source of interest and pride to him. He was truly, as the great teachers of sciences have always been, the father of his department.

His contribution to university administration was a notable one, both in the affairs of Canterbury College and in the University of New Zealand. He was a member of the Academic Board of the University from its inception in 1927, representing the professorial electorate, and a representative of that Board on the University Senate from 1935. He was also convener of the Science Committee of the Academic Board for some years until his death, and so played an important part in the development of university education in the sciences. His educational interests extended also to the secondary schools and he became a Fellow of Christ's College and hence a member of its governing body, in 1932.

Recognition of Dr. Denham's high qualifications for administrative work in scientific research came with the formation of the New Zealand Council of Scientific and Industrial Research, of which he was a member from the beginning of

this important development in New Zealand affairs. He became Chairman in 1934, and served on many important committees directing various phases of the Department's activities. The Wheat Research Institute, of the Committee of which he was Chairman from its inception in 1927, was perhaps the one with which he was most closely concerned. The Institute is controlled by a committee representing the growers, millers and bakers, and Dr. Denham, in his role as independent Chairman, played a large part in securing agreement as to policy among these diverse interests. With the first Director, the late Dr. F. W. Hilgendorf, he set a balance between the service aspects of the Institute's work and the research aspects, so that neither suffered from an overdose of the other. In this, as in other phases of the work of the Department of Scientific and Industrial Research, he strongly upheld the importance of new and forward looking investigations.

Dr. Denham's own skill as an analyst was always at the disposal of manufacturers and others seeking help in their problems. Among other problems brought to him were many on corrosion, in which he was particularly interested.

In addition to his degrees of the Universities of New Zealand, Liverpool and Heidelberg, Dr. Denham was a Fellow of the Institute of Chemistry of Great Britain and Ireland, an original Fellow of both the Australian Chemical Institute and the New Zealand Institute of Chemistry, and a Fellow of the Royal Society of New Zealand and of the Australian and New Zealand Association for the Advancement of Science. He was the recipient also of the Medal of the Liverpool University Chemical Society, awarded for distinguished work by its graduates overseas, and the Coronation and Centennial Medals. No one who knew his work doubted that further recognition of its value would have come to him had he lived to see the end of the war, and it was a source of great joy to his friends and colleagues that he knew the honour which the Society of Chemical Industry conferred upon him in January last. The election to honorary membership "in commemoration of his activities as a Teacher in three of the Dominions and as a Research worker in the field of Inorganic Chemistry," placed him in a select group of chemists which has included Haber and Sorenson in the past, and today includes the well known American organic chemists M. T. Bogert and J. B. Conant, as well as the following representatives of the Dominions who were also elected in January: Professor H. Hibbert (Canada) an eminent cellulose chemist; Dr. H. A. White (South Africa) metallurgical chemist; Professor J. C. Earl (Australia) organic chemist; Sir Shanti Bhatnagar (India) Director of the Department of Scientific and Industrial Research.

In 1936 Dr. Denham took a sabbatical year and with Mrs. Denham visited England, investigating research organisations and renewing old friendships. His return via America was specially arranged by the Carnegie Corporation, to enable him

to make contact with the great developments in scientific research taking place there.

The coming of the war tried him severely. Not that he had any doubt of our ultimate victory, but to a liberal spirit who had known the culture of the old Germany, and who believed in "Science as an Aid to World Civilisation" (the title of his Cawthron Lecture), the fresh onslaught of barbarism could not but be a trial. He threw himself fully into the tasks the war brought, not only those of scientific research but also the problems coming to the university through military duties devolving on the students. These added to an already full life, would try the strongest, and in the words the Archbishop of New Zealand used in his moving tribute at the funeral service in the Christchurch Cathedral, he was a war casualty.

New Zealand chemistry, the university, scientific research, the community at large, are poorer for his passing. No finer epitaph could be given him than the words spoken by Dr. William Cullen, President of the Society of Chemical Industry, on the occasion of the presentation of Dr. Denham's scroll of honorary membership to the New Zealand High Commissioner in London: "His career illustrates to a remarkable degree the influence which a man of high scientific attainment can exert on the general life of a community when he is sufficiently public-spirited to sacrifice all thought of leisure."

BRANCH NOTES

AUCKLAND BRANCH

Dr. McDowell of the Dairy Research Association, Massey College, conducted an informal tour of about 25 members and friends through the Dehydrated Butter Plant at King's Wharf, Auckland in September, 1942.

The process is a continuous one and is briefly as follows. The butter is melted with live steam at low pressure and is fed at 140deg. F. to a gravitational separator where a certain amount of separation goes on. The aqueous serum passes through two stages of centrifugal separation to recover the fat carried away with the serum, and this fat is returned to the gravitational separator. The fat layer passes through a centrifuge, a pasteuriser, two more stages of centrifugal separators, and then to a dehydrator working at about 190deg. F. and 29.5 inches of vacuum. Finally the fat is cooled in a totally enclosed rotary cooler to 90deg. F. and packed into 38lb. tins ready for shipment overseas as ordinary cargo.

Due to war conditions a considerable amount of the plant had to be devised from available machinery, for example, the use of modified creamery separators instead of centrifuges designed for the job. Other parts of the plant, however, were

both designed and manufactured in this country; such parts include the melting chamber, the dehydrator, and the cooler, and Dr. McDowell and his co-workers are to be congratulated on the fine job they have done.

A large number of questions were answered by Dr. McDowell and his assistants which testified to the interest taken in the plant by members. The extensive use of stay-bright steel tubing and fabricated parts was particularly admired.

“The Sulphanilamide Group of Drugs” was the title of an address by Dr. Garlick at the October meeting.

The greatest advance in chemo-therapy since Ehrlich introduced his anti-syphilitic arsenicals at the beginning of the century, has been the development during the past eight years of the Sulphanilamide group of drugs.

These substances are therapeutically active, in varying degrees, against a fairly wide range of bacteria, among the chief of which are the Haemolytic Streptococcus, Staphylococcus, Pneumococcus, Gonococcus, Meningococcus, Bacillus Coli, Bacillus Welchii, and other organisms of gas gangrene and Influenza Bacillus.

The basic Sulphanilamide group, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_2\text{NH}_2$ present in all compounds, is effective as a separate substance but was not the first one to be used. In 1935 Domagk, in Germany, demonstrated that a new azodye Protosil Rubrum $\text{NH}_2\text{SO}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{N} : \text{N} \cdot \text{C}_6\text{H}_4 \cdot (\text{NH}_2)_2$, was effective against Streptococcal infections in mice, and this was later used in man. Since then the aim has been to develop new substances effective over a wider range of bacteria, less toxic to the patient and more soluble.

It was then found that Protosil was broken up in the body into therapeutically active sulphanilamide and an inactive substance so that the simpler substance Sulphanilamide was just as effective a drug. In all later compounds, substituents were added to the amide instead of the amino group as previously; and these compounds were not broken down in the body so that they had some specificity of action. For instance, Sulphapyridine or M. & B. 693, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_2\text{NH} \cdot \text{C}_5\text{H}_4\text{N}$, is effective against the Pneumococcus where previous compounds are not. Sulphathiazole, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_2\text{NH} \cdot \text{C}_4\text{H}_4\text{SN}$, has the same range of activity as its predecessors, plus an action on the Staphylococcus, moreover, it is relatively non-toxic. The sodium derivative of both these compounds is soluble and suitable for injections. Sulphadiazine, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_2\text{NH} \cdot \text{C}_4\text{H}_3\text{N}_2$ is absorbed more quickly and excreted more slowly than the others and, therefore, is easier to build into an effective concentration. Its 2-methyl derivative, sulphamethazine, has a diminished toxic action on the kidney. Sulphaguanidine has recently been introduced for intestinal infections such as dysentery.

The sulphanilamides may be administered orally, injected into veins or muscles, or applied locally as a powder to open wounds, burns, etc. Given by mouth, the drug is absorbed by the small intestine into the blood stream, about 30 per cent is converted into the inactive acetyl form in the liver, and it is rapidly eliminated by the kidneys. A dose has practically disappeared in 24 hours, so that the drug has to be given frequently to maintain an effective blood concentration—usually about every 4 hours.

The two commonest toxic effects are Cyanosis or blueness, (due to the conversion of Haemoglobin into met- & sulph-Haemoglobin) and nausea and vomiting. The former is of little import and the latter can be countered to some extent by the administration of alkalis such as Potassium Citrate and Sodium Bicarbonate, and by giving the drug in a mucilage. There is practically always some destructive action on the red and white corpuscles—sometimes severe and dangerous. Occasionally skin rashes develop and occasionally there is passage of blood in the urine due to deposition of the relatively insoluble acetyl form in the kidney tubules.

It is thought that the mode of action of Sulphanilamide against bacteria is by interfering with the metabolism of para amino benzoic acid, a growth factor essential to the bacterium. By virtue of similar chemical configuration, it can compete successfully with p.amino benzoic acid for certain enzymes which normally act on the latter as substrate.

At the conclusion of the address Mr. Whillans gave a demonstration of the estimation of sulphanilamides in blood.

CHAIRMAN'S ADDRESS, 1943.

Dr. L. H. Briggs discussed "The Pattern of some New Zealand Plant Products" as his chairman's address for 1943. He illustrated, by means of slides, the typical pattern of a variety of compounds isolated from New Zealand plants including a number of alkaloids, resinols, resin acids, terpenes and vegetable dyestuffs.

Alkaloids. The alkaloids from the bark of pukatea are spinal convulsants similar to strychnine with a pattern related to morphine or apomorphine. The alkaloids from the various sophora species (kowhai) consist mainly of cytisine and matrine with physiological actions similar to nicotine. Poroporo contains a sterol alkaloid, salosonine, and Dr. Briggs indicated its relation in the general pattern of the sterols where slight changes in the constitution of the molecule bring about most marked differences in physiological actions. For example, included in the series were the sterols proper, such as cholesterol and ergosterol, the bile acids, the vitamin D series, the male and female hormones, the adrenal hormones, cardiac glucosides, saponins and toad poisons.

Resinols. The general pattern of matairesinol from matai

and isoolivil from maire, is similar to that of podophyllotoxin, an effective purgative and also to sesamin and asarinin, recently shown to have a synergistic effect on insecticide sprays such as pyrethrum..

Resin Acids. The constituents of podocarpic acid from kahikatea and rimu, ferruginol from miro, and possibly the diterpene phyllocladene (from numerous New Zealand essential oils) are directly related to abietic acid, the principal acid derived from rosin. Dr. Briggs indicated how this compound, which is one of the cheapest organic compounds, has been utilised for plastics, and how it could be simply converted to compounds possessing oestrogenic and morphine like properties.

Terpene Constituents from Essential Oils. Manoyl oxide, ketomanoyl oxide, and agathic dicarboxylic acid, the latter from kauri gum, have the same general pattern directly related to vitamin A but devoid of vitamin activity. Leptospermone from manuka apparently has a structure similar to the anthelmintic compounds of male fern, of kamala, an Indian drug, and also to the bitter principle of hops.

Vegetable Dyestuffs. A number of New Zealand trees contain appreciable quantities of tannin which were used by the maoris for black dyes or actually inks, while the bark of a number of the coprosma species contains a series of dyestuffs whose colour can be altered by the use of various mordants.

In the personal notes in the March issue, "Miss M. Stokes" should read "Mrs J. M. Stokes."

WELLINGTON BRANCH

The first meeting of the Wellington Branch of the N.Z. Institute of Chemistry for the 1943 session was held on April 20th when the chairman Mr. G. S. Lambert delivered an address on "Some recent developments in Metallurgy."

Mr. Lambert divided his subject into three sections dealing firstly with "New Metals," a brief survey of the important industrial applications of some of the more uncommon metals such as beryllium, indium, zirconium, lithium, tantalum, thorium and columbium. Secondly the speaker referred to "New Techniques," instancing pressure diecasting as a development which had revolutionized the production of small castings. Special mention was made of zinc-base diecasting alloys and their susceptibility to the influence of impurities such as lead and tin. Powder metallurgy was another rapidly expanding technique which was making possible the production of articles and the fabrication of materials that were impossible by any other method. Ductile tungsten, platinum, molybdenum, tantalum and zirconium, high purity nickel and iron products for radio purposes, porous iron articles, oil-less bearings and speed tools were among the products mentioned as being produced

from powders. The use of refrigeration to control the age-hardening of aluminium alloys used in aircraft products was another recent innovation described in this section. Finally the speaker referred to 'New Theory,' and showed how modern X-ray and other methods of metallurgical investigation were elucidating the nature of metals and alloys and assisting in their development. The factors governing the formation of metallic solid solutions, superlattices and intermediate compounds and the possibility of forecasting the properties of an alloy from the knowledge of the atomic volume and valency relationships of the constituents were briefly discussed. The address was illustrated with a number of slides and exhibits.

E. M. CHRISTIE, M.Sc., A.N.Z.I.C.

The untimely death of Major Elliot Martin Christie, E.D., which occurred at the Wellington Hospital on 12th April, came as a shock to his many friends.

After graduating at Otago University with Honours in Chemistry, he joined the staff of Otago Boys' High School which he had previously attended as a pupil. From there he left to take charge of the Science Department of the Southland Boys' High School, and in 1929 he was appointed science master at Rongotai College, a position he held until his death. He was a respected, honoured and beloved master to his pupils and an esteemed colleague and friend to his associates on the staff. He was kindly and genial in disposition, loyal and willing in service, devoted to duty and an untiring and unselfish worker in the interests of his pupils. He gave of his best unstintingly, in the class room and out of school and in many other spheres quite apart from his work.

He was intensely interested in chemistry and endeavoured to keep himself abreast of all recent developments. He was a Fellow of the Chemical Society and in 1931 he was elected an Associate of the New Zealand Institute of Chemistry. He was an active member and a regular attender at all meetings of the Wellington Branch. He was also a member of the Royal Society.

Since 1932 he was in charge of the Rongotai College Cadet Unit and in 1939 he was placed in command of the 2nd Cadet Battalion, Wellington Regiment. In January, 1942, he was posted to the 2nd Battalion, Wellington Regiment with the rank of Major. Although he realised that sooner or later he must undergo an operation, he shared the hardships of his men on training manoeuvres and made no attempt to spare himself. His devotion to duty, his strict impartiality, his energy and his enthusiasm for his work, endeared him both to his superior officers and to the men in his own company.

His quiet unassuming nature, his kindness, his readiness to help, the spirit of eager and willing co-operation that was

so characteristic of him, the consideration that he showed for others; and his high ideals, were attributes that endeared him to his many friends.

His death at the early age of 45 has robbed New Zealand of a brilliant scholar, an outstanding chemist and an enthusiastic and able teacher.

He is survived by a wife and two children, and to them we express our deepest sympathy in the loss they have sustained.

CANTERBURY BRANCH.

The Chairman's address by Dr. M. M. Burns in March was entitled "Phosphates in Industry and Agriculture." He said that in 1859, in the days before specialisation, Clemson, an enlightened engineer, farmer, scientist, diplomat and author, wrote "There can be no civilisation without population, no population without food, and no food without phosphoric acid." Today, countries wage war for phosphates, farm production is boosted by phosphates, a big proportion of scientific literature is devoted to studies of crop response to phosphates, soil reactions of phosphates, and the nutritional needs of animals and humans for phosphates.

After discussing the distribution and nature of phosphate deposits, Dr. Burns pointed out that high grade reserves are limited, since most of the U.S.S.R. reserves, and those in Western America are of quality below that being used for superphosphate production at present. Methods for using low grade deposits are in operation in the U.S.A. 85 per cent of the world's 1936 production of phosphate rock was converted to superphosphate, and 95 per cent of all phosphate, including by-products of the steel and meat packing industries was applied to the land.

Particular mention was made of problems important to New Zealand, especially reversion of soluble to less soluble forms. This process is determined by soil conditions and is the major factor controlling the efficiency of phosphate fertilizers. Iron and aluminium produce relatively insoluble phosphates, and calcium and magnesium give derivatives of H_3PO_4 , the solubility of which varies. In addition complex colloidal silica phosphates, and organic colloid phosphates are produced. Phosphate fixation is most rapid with finely divided fertilizers and may take place within a few days. The most significant point is that phosphate fixed by calcium and magnesium appears to remain in a form available to plants for a longer period than that fixed in any other combination. Soils high in soluble iron compounds, either naturally as the brown volcanic soils, or artificially as in soils of low lime content, have high fixing power. Colloidal silicic acid seems to increase the effectiveness of phosphate application with the less soluble

forms and in soils where fixation is high. The statement that "if we could prevent fixation of added phosphate in available forms, we could get the same results from less than half the present dressings," presents a challenge to the chemist and a goal for research.

On the 30th April, Dr. W. Bates of the Light Metals League addressed the Christchurch branch of the N.Z. Institute of Chemistry at Canterbury College when he placed before the members his proposals for the production of aluminium and magnesium in New Zealand.

The lecture was illustrated by lantern slides, depicting manufacturing processes for aluminium, and innumerable articles cast and machined from aluminium alloys—articles ranging from domestic utensils to aircraft and thermite bombs. The lecturer maintained that aluminium could be produced more cheaply from clay of which New Zealand has a plentiful supply, not only in Rotorua and on the West Coast, but also in many other parts of the Dominion. This clay contained 39.6 per cent. alumina (aluminium oxide) as compared with bauxite (45-60 per cent) and differed from bauxite only in that it contained more sand.

Dr. Bates outlined the process developed by Professor Hixon of Columbia University for the production of aluminium from clay. This process, which has not yet reached pilot plant stage, involves treatment of the clay with hydrochloric acid to produce aluminium chloride. Iron present as impurity is removed by ether extraction of the chloride. The aluminium chloride is dehydrated and converted to aluminium by thermal decomposition at 1100 deg. C. The alumina must then be reduced to metal by the electrolytic reduction process.

Prof. Hixon claims to be able to make aluminium from clay for £2 per ton less than from bauxite.

Dr. Bates pointed out that cheap electrical power was essential for the establishment of an aluminium industry. New Zealand had this power and could extend it to double the output by uniting Lakes Wakatipu and Manapouri by a tunnel $6\frac{1}{2}$ miles long. This project was not, he maintained, as formidable as it at first appeared, and the tunnel, according to American authorities, could be constructed in eight months; say 2 years under New Zealand conditions.

Dr. Bates said that the estimated cost of establishing an aluminium industry in New Zealand was £15,000,000. Australia could produce aluminium for £2,500,000, so why not N.Z. He maintained that no country became great by agriculture alone and that, hence, New Zealand should build up a light metal industry.

Turning his attention to magnesium, Dr. Bates claimed that magnesium would some day oust aluminium. New Zealand has deposits of magnesite and dolomite and while he did not

favour production from dolomite. Dr. Bates supported production from magnesite by the carbon reduction. (Hansgirg) process used by Kaiser in U.S.A. He considered that this process should be even cheaper than the Dow process for which sea water and lime were the raw materials, and less expensive than production from dolomite.

In conclusion Dr. Bates claimed that steel and iron would become things of the past and that aluminium and magnesium would take their place. Aluminium alloys had three times the strength of steel and were five times more resistant to water.

Very few of Dr. Bates' claims were allowed to pass unchallenged in a lively discussion. In particular, the economic production of aluminium from clay, the cheapness of New Zealand hydro-electric power, and the replacement of steel alloys by light metals were strongly criticised.

DENHAM MEMORIAL LECTURE.

The Canterbury Branch will devote its September meeting, on Friday, 24th, to a memorial lecture paying tribute to the scientific work of the late Dr. H. G. Denham. The speaker will be Mr. J. Packer, Acting-Professor of Chemistry at Canterbury University College, and members of the Institute who may have occasion to be in Christchurch about that date are invited to make a special effort to be present.

OTAGO BRANCH

The Chairman's Address, by Mr. H. G. Woolman, on 14th April, was "Corrosion and Alloys."

The lecturer first emphasised the importance of having available alloys capable of serving structural purposes, and as materials for handling chemicals. Progress made in this field of alloying to withstand specific corrosion had had a profound influence on large scale production of chemicals and chemical processes—not only so in this respect, but also in the lowering of costs and rendering hitherto impracticable operations possible on the large scale.

Mr. Woolman then gave a resumé of modern theories of the mechanism of corrosion and types encountered in practice, including general corrosion, pitting and inter-crystalline corrosion. Typical instances of electro-mechanical reactions causing corrosion were quoted. The role of passivity in corrosion was illustrated and correlated to the existence of a thin film of oxide which is nearly always present on the metal.

Turning next to the general theory of alloys, he said that as iron formed the basis of a large class of corrosion-resistant alloys, he would outline the crystalline forms of this metal, paying particular attention to the solubility of carbon in each

phase, and the effects of applying heat treatment. Then, having outlined the principals underlying the mechanism of producing alloys, and how certain characteristics of the internal structure could be produced, the possibility of producing anti-corrosion properties in alloys was given. The part played by chromium, nickel and carbon in chrome-steel alloys was described, with particular reference to the respective anti-corrosive properties. Examples of the modification of properties by the addition of other elements such as silicon, tungsten and molybdenum were indicated. Dealing later with non-ferrous alloys, the lecturer said that the special properties of non-ferrous metals, with reference to their corrosion-resistant properties, brought out most interesting applications in industry to cope with specific problems, e.g. the self-healing properties of the oxide film of aluminium, and the resistance of various types of wire gauze alloys (particularly the silicon-bronze type used in the paper industry to resist the attack of sulphites).

In conclusion, Mr. Woolman said that in choosing materials for plant construction, not only must mechanical properties be considered, but in addition their corrosion-resistance. Temperature was a vitally important factor, as it influenced the behaviour of certain alloys. Laboratory tests in selecting a material were of very great importance, but a conclusion inferred must be made cautiously. Allowance must be made, for instance, for impurities picked up on the large scale, and stresses might be present in large vessels which did not exist in the test strips. Laboratory tests should be followed by the erection of a pilot plant for final selection. The installation of plant using corrosion-resistant alloys might mean greater initial expense, but the ultimate cost must take into account lower maintenance charges and service rendered.

Mr. C. A. Hassall has transferred to the branch from Auckland.

Pilot-Officer H. W. Henderson has completed his course as a navigator and is in England awaiting posting to an operational station.

At the April meeting, the Chairman, Mr. H. G. Woolman, presented the N.Z.I.C. prize for 1942 at Otago University to Mr. James Murray.

COURSE IN APPLIED CHEMISTRY.

We published in our March issue a letter from Mr. G. A. Lawrence on the subject of a possible course in chemistry applied to industry in New Zealand. Limitation of space prevented the publication of Mr. Lawrence's views on this important topic, as contained in a letter to the Secretary of the Department of Scientific and Industrial Research in 1937.

Extracts from Mr. Lawrence's letter are now published below and have a special interest now that the Canterbury College Council has announced its intention of proceeding with the establishment of a school of applied chemistry as soon as possible.

Mr. Lawrence wrote:

From experience gained in close contact with many different operations in the industries in New Zealand I am of opinion that the time has come when serious consideration should be given to the question of providing facilities for managers, foremen and men in charge of operations to obtain specialised scientific training to assist them in carrying out their work efficiently. I have in mind a number of cases where men are anxious to improve their knowledge of the fundamentals of the operations in the particular industries in which they are engaged. In several cases I have been asked to undertake to coach men in order that they might have a better understanding of some particular operation which at present they are conducting in a more or less blind manner. Many of these people have tried the technical courses and find them too elementary and the University courses have been found to be too theoretical.

If the industries in this country are to be conducted along the best and most efficient lines there should be educational facilities available for training in industrial technology, to turn men out with a basic knowledge of science as applied to industrial processes, men who can avoid trouble in manufacturing operations by anticipating the cause of such troubles, men who can understand analytical results and carry out routine tests, understand flow charts, etc.

In many industries, men with a broad training in industrial technology would be an asset. From my experience industrialists who want men to supervise the operation of a process or plant are afraid to engage graduates because even if they are willing to undertake that class of work, they lack training in the practical application of science in industry. At the present time there are no facilities for a graduate in science of obtaining training in chemical technology, chemical engineering or practical analytical chemistry and as a consequence, if he goes into industry, he has to gain his experience in a haphazard way which is not good for himself, the profession in general, nor for the industry.

I know that it is popularly believed that a graduate in science, with perhaps honours in chemistry, has sufficient grounding to go into industry in control of operations and analytical work, some go so far as to think that it is sufficient training to commence practice as consulting chemists. I think you will agree that this is not the case. In a recent paper on this subject Prof. J. C. Philip, F. R. S. said "a man who leaves the University with a BSc. or even Ph.D. degree is far from

being a mature chemist. Although he may have a sound grasp of fundamental principles and practice, entry into the works laboratory of the factory presents him with problems and conditions of which he has had no experience. His training enters on a new stage." C. M. Whittaker said "the average young chemist must realize that he will not usually earn his salary before he has been in the industry two years, and will certainly not be pulling his full weight for five years."

If science is to take its place, care must be taken that nothing is done to shake the confidence of the industrialists by letting men go in as scientists, not properly prepared for the job. The fact is often bewailed that the best and most able men leave the country because there are not sufficient openings for them. If the positions in the industries were filled by men, who by reason of their training appreciated the value of research, they would be valuable agents for discovering useful avenues for research workers and so tend to lessen this drift.

How can this gap in the training facilities be bridged? In other countries there are facilities for higher technical education available to the man in charge of operations who is anxious to increase or supplement his knowledge in that particular sphere. The larger industries with their own technical organization often provide facilities for post graduates or students on vacation, either by attachment to the technical organization itself or by being put under experienced men in charge of operations. Such facilities are not at present available in New Zealand and to rectify the matter it seems that it would be desirable to:

- (1) Set up a special school attached to one of the University colleges, or:
- (2) To supplement or raise the present technical school courses to include suitable subjects to fulfill this want.

In any case I think that it should be a separate course and not bound up too much with the ordinary curriculum.

The subjects might include:

Engineering.—Selection and operation of plant. Layout of plant. Instruction in the use of various plant such as for grinding, sieving, mixing, drying etc.

Physics.—As applied to industrial operations, theoretical and practical.

Chemistry.—As applied to industry. A series of selected lectures on industrial processes. A series of lectures on analytical chemistry. A selected course in practical analytical chemistry with special reference to manipulation. Preparation of a selection of substances on a miniature manufacturing scale.

General.—A course of keeping works records, costing, etc.

The foregoing is not put forward as being complete or as the most desirable course, but merely to serve as an indication of what is required.

An endeavour should be made to make each subject complete in itself in order that a student desiring special instruction in one phase may obtain it without being forced to take some subjects which are unnecessary to him.

I think the course as a whole should stand on its own and a student taking it should, on passing an examination or giving satisfaction under some test other than examination, be awarded a diploma. For students taking one part of the course and giving satisfaction, a certificate in that subject could be awarded.

Such a scheme would offer,

- (1) The graduate in science a complete course in industrial technology and fit him more completely to take up a position in industry.
- (2) The operator a complete general course in industrial technology and a diploma.
- (3) Facilities for obtaining special instruction in some phase of manufacture by persons not desirous of taking the whole course.

It is not suggested that the training would afford special instruction in the operations of any one industry but rather a broad training in the fundamentals of industry generally, more particularly those peculiar to New Zealand.

In the foregoing I mentioned managers, foremen and others for whom the course would be of special value. In saying this I do not suggest that many of these at present, in such positions would take advantage of such a course as has been outlined, but I do think that as time goes on it would be a distinct advantage to have the positions filled by persons so trained.

I do not put forward the foregoing scheme as being in any way complete, but merely as a preliminary towards achieving something which I feel sure would be of benefit to the country in the long run.

I write to you because I know that you are in intimate contact with the problem and if you consider it worthy of further investigation I shall be glad to pull my weight.

The Institute as a whole is not responsible for statements and opinions appearing in this Journal.

Correspondence should be addressed to Dr. H. N. Parton, Canterbury College, Christchurch.

The address of the Hon. Secretary is P.O. Box 250, Wellington.

P.O. Box 1254

TELEPHONE 30-919

LAW'S SCIENTIFIC & MANUFACTURING CO. LTD.

GENERAL MERCHANTS AND INDENTORS
MANUFACTURERS' REPRESENTATIVES · MANUFACTURING CHEMISTS

124 LICHFIELD STREET, CHRISTCHURCH, C.1.
NEW ZEALAND

Distributors for

CHEMICALS

B.D.H. Analytical Reagents
Towers' Tested Chemicals
Difco Culture Media
Chuit Naef & Co., Geneva

Dr. Grublers' Microscopic Stains and
all pure chemicals in stock

It we do not stock what you require
—we will get it.

Quick Service and a Trained Staff is a
guarantee of satisfaction.

and

APPARATUS

J. W. Towers & Co., England
Barnstead Automatic Stills
Pyrex Glassware
A. H. Thomas, Philadelphia
Hellige Potentiometers
Cambridge Instrument Coy.
Whatman's Filter Paper
Industrial Thermometer Co.
Jena Glassware
S.C.P. Porcelain
Exax Blue Line Glassware
Etc., Etc.

Our business is being
built for your convenience

Help Us to Help You



Scientific Apparatus and Pure Chemicals

Good Stocks of Glassware and Chemicals are being maintained by us, amongst them being:—

"Pyrex" Glassware	B.D.H. Chemicals
"Hysil" Glassware	B.D.H. "Analar" Chemicals
Measuring Glassware	Indicators
Balances and Weights	"Whatman" and
Thermometers and	"Separa" Filter Papers
Hydrometers	Porcelain-ware
and general laboratory apparatus	

INDENT ORDERS . . .

Indents efficiently handled on the lowest terms.
We do not charge commission.

"WILCO" MANUFACTURES

Our workshop has been further extended and we are making:—

"Wilco" Water Condensers	Water Baths
Water and Air Ovens	Incubators
High Temperature Ovens	
(both gas and electrically heated).	

Also Gas Burners, Laboratory Stands, and various types of apparatus in metal or wood, to the customers' specifications

Send your Orders to—

GEO. W. WILTON & CO. LTD.

156 WILLIS STREET, WELLINGTON, C.1