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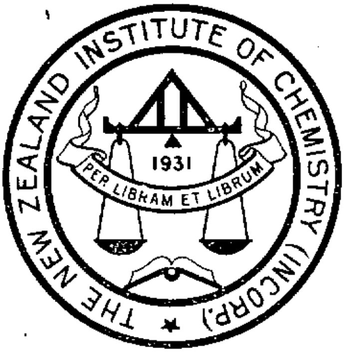

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NEW ZEALAND INSTITUTE OF CHEMISTRY

VOLUME IX. MARCH, 1945 NO. 1

EDITORIAL

The career of the new President, which is outlined in this issue, is one which we hope to see emulated with increasing frequency in the future. Dr. Andrews has passed from the laboratory to adminstration, and we believe that New Zealand industry will benefit if this transition becomes a more common phenomenon. Not that we would claim that adminstrative capacity is to be found more commonly among scientific people than in other groups. It would be enough to show that it is not less frequent. In Britain adminstrative heads have usually been drawn from classically trained men, who in the Civil Service, business and industry, have in the past, played a successful and valuable part in the nation's affairs. Their success proves nothing more than that able and unspecialised minds can master the complexities produced by the work of specialists. We believe that those trained in the schools of science can at least equal the achievements of their classical brethren.

A swing to science is plainly occurring in the schools and universities in New Zealand. All who complete a science degree may not find their livelihoods in the laboratory. If some aim consciously at becoming adminstrators, they may find contentment and the community useful servants. Precisely what course they pursue is of much less importance than how they pursue it. Mr. Churchill has been described as the triumph of the unspecialised mind. His is a mind which is interested in many things and can master what it is interested in. Graduates with a broad scientific training, who realise that what they learn at a university is mainly the art of learning, should have every chance of success in adminstration, if they set themselves to study that difficult art.

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THE PRESIDENT.

Dr. J. C. Andrews, the Institute President for 1945 was educated at King's College and Auckland University College. He was a University Entrance Scholar, and Senior Scholar in 1925, equal with Dr. C. R. Barnicoat. After graduating M.Sc. with 1st class Honours in Chemistry, he held successively

Duffus Lubecki (1925-6) and National Research (1927-8) Scholarships, and obtained the Ph.D. degree in 1928. He was awarded the 1851 Exhibition Research Scholarship, but resigned and joined the staff of R. & W. Hellaby Ltd., establishing. in association with Mr. T. Crosbie Walsh F.I.C., a laboratory and plant control of the firm's Westfield Works, remaining chief chemist till 1936, when he became works manager. In 1941 he was appointed works manager of the Challenge Phosphate Company.

Dr. Andrews has been engaged in important public duties, especially since the outbreak of war. He has been a member of the D.S.I.R. Advisory Council since 1937, and of the Defence Scientific Advisory Committee since 1939. As Scientific Advisor to the Food Controller, he carried out a survey of N.Z. Canneries, and has been particularly associated with the development of dehydrated foodstuffs. In this field he has investigated processes in Australia, U.S.A. and Canada, and supervised the technical development of plants at Feilding, Pukekohe, Christchurch and Motueka.

Professional interests do not exhaust the President's activities. The Auckland branch of the Institute has been built up by the enthusiasm of a group of chemists among whom Dr. Andrews is prominent, and he has taken his full share of committee duties. Other institutions to which he has devoted his energies are the Institute of Refrigeration and the Auckland Orphans' Club, and his interest in tennis has covered active play, and administration.

Dr. Andrews becomes president of a rapidly growing body, which is already large enough to exert an important influence on the development of industrial chemistry in New Zealand. Under the leadership of men of his training and experience, we can look forward to that influence being exerted beneficially for chemists and community alike.

THE MANUFACTURE OF METALLIC SOAPS IN NEW ZEALAND.

(H. H. Edwards)

The heavy metal salts or soaps of the fatty acids occuring in animal and vegetable fats and oils and certain organic acids are used for a great variety of purposes. We are accustomed to regard as soaps only the sodium and potassium salts of fatty acids, rarely stopping to consider how restricted this view is and how many soaps can be made from other metals. Some of these metal soaps have been used for ages past with scarcely any knowledge of their composition. Accident rather than research has been the reason for their discovery. Very little has been published regarding the chemistry of these compounds and information on their preparation is practically non-existent.

The following lists some of the better known compounds and their uses:— Copper Oleate—Timber and textile preservation; Aluminium Oleate—Textile waterproofing, grease manufacture; Lead Oleate—Lubricating greases; Aluminium Stearate—Waterproofing, lubricating greases, flatting agents for paints, anti-settling agent; Magnesium Stearate—Paint, pharmaceutical, and cosmetic industries; Zinc Stearate—Paint, pharmacteutical, and cosmetic industries; Copper Naphthenate—Timber and textile preservation; Cobalt Naphthenate—Paint and varnish drier; Lead Naphthenate—Paint and varnish drier; Manganese Naphthenate—Paint and varnish drier; Zinc Naphthenate—Paint and varnish drier, timber and textile preservation.

In addition to the foregoing there is a recent application in the use of a complex metallic soap for the purpose of converting gasoline into an elastic gel for use in flame throwing guns, used so effectively against the Japanese in the Pacific. This soap is the aluminium salt of a mixture of Stearic Oleic and Naphthenic Acids and will be referred to later.

Copper Oleate finds extensive use as a textile preservative and is used in large quantities in the manufacture of the familiar green canvas tarpaulins. It has been used in New Zealand since the outbreak of war for the preservation of sandbags used in civilian defence revetments, for the preservation of camouflage nets used by the Army, and in the treatment of Army huts and buildings used in the Pacific where they are subject to the ravages of fungoid and insect attack. Large quantities of Copper Oleate were imported from Australia during the early part of the war for the above uses, and Australia became so short of Oleic Acid and Copper salts, that it became necessary to export the necessary Oleic Acid and Copper from this country and then ship it back to New Zealand as the finished product. Shipping space being so scarce it was decided to manufacture the Copper Oleate here. The author together with A. C. Morcom Green established a factory at Onehunga for this purpose. During the period which elapsed between the conception and the completion of this plant, a demand was apparant for Paint Driers, Stearates and Oil thickeners, and the necessary equipment was included in the design to supply this demand.

A great deal of preliminary experimenting was undertaken, and a compromise was arrived at between what was desired in the way of equipment and what was available. To-day the plant is in full operation and is manufacturing the following quantities per month.

Copper Oleate, 12,250 lbs.; Copper Naphthenate, 500 lbs.; Aluminium Stearate, 1,200 lbs.; Gasoline Thickener, 1,200 lbs.; Cobalt, Lead, Zinc, Manganese and Copper Naphthenates, 15,000 lbs. each.

DESCRIPTION OF PLANT.

The factory consists of three floors. The top floor is occupied by eleven tanks used for the preliminary heating of the various acids, salts, and diluents. The liquids are pumped and the solids are elevated by an electric hoist to this floor. The second floor houses the reactors which are fitted with stirring devices and distance thermometers, and are steam heated. The ground floor is occupied by centrifugal separators, separating tanks, and a saveall, and the storage tanks. In addition there is a store for raw materials, bulk storage tanks, a boiler house, drying room, laboratory and offices. Practically all the soaps are manufactured by double decomposition, as by this method a purer and more standard product is obtained. No difficulty is found in turning out products which comply to rigid specifications.

COPPER OLEATE.

A solution of Sodium Oleate is first prepared and Copper Sulphate solution is added slowly with vigorous agitation. When the reaction is completed the diluent which may be either fuel oil, mineral turpentine, or wax is added and the water and by-products removed by settling and centrifuging where necessary. The precipitation of undesirable basic soaps is prevented by the use of repressive agents.

Other metallic Oleates are manufactured by the above method.

METALLIC NAPHTHENATES.

Modern paint driers are compounds of definite metallic content, in contrast with the old types, which were sometimes haphazardly prepared, irregular in composition, and unstable in storage. These older driers were usually the metallic salts of Abietic Acid (Resinates) and later Linoleic Acid (Linoleates) and Tung Oil Acid (Tungates). Naphthenates are now replacing these older driers, as they are more efficient in action, stable in storage and due to the lower molecular weight of Naphthenic Acid, have a higher content of metal. Driers as imported are in the solid form, and must be dissolved in Mineral Turpentine by the Paint Manufacturer before use, taking care to use the exact quantity of thinner to give a definite and known strength of solution. This is a laborious and hazardous operation, as the consistency of certain Naphthenates, e.g.—Lead and Zinc is neither solid nor liquid, but of a sticky toffee like consistency. They usually need heat for solution and the process of heating mineral turpentine, especially in small Paint Factories is somewhat hazardous. Furthermore unless great care is taken to prevent loss from evaporation the metal content of the finished solution will be uncertain with consequent erratic behaviour of the paint itself. Obviously it is advantageous for the paint manufacturer to be able to purchase his driers in the liquid form. Owing however to the mysterious workings of H. M. Customs, such a preparation carries a substantial duty. For these reasons, therefore, the driers manufactured at Onehunga are liquids containing 4% of metallic Manganese, Cobalt, and Zinc, and 10% of Lead.

In the preparation of these driers, Sodium Naphthenate is first formed and the calculated weight of thinner is added at this stage. The metallic Naphthenate is precipated by the slow addition of the metal salt solution and is promptly dissolved in its nascent state by the thinner. The water and Sodium salt is removed by drainage and the upper layer of Naphthenate solution is pumped into settling tanks, the first portions passing through a Sharples centrifuge in order to remove any entrapped water. The final product is crystal clear and anhydrous.

COPPER NAPHTHENATE.

Copper naphthenate, considered by most authorities to be the most efficient timber and textile preservative discovered to date, is manufactured by the foregoing method. In cases where the inflammable nature of the thinner precludes its use Copper Naphthenate is manufactured in the form of Cuprammoniun Naphthenate. Upon evaporation of the water and ammonia Copper Naphthenate is deposited.

ALUMINIUM STEARATE.

The most important stearate from the industrial point of view is that of Aluminium. It is used extensively in the formulation of lubricating greases and in the paint and varnish industry as a flatting agent and to prevent settling of pigment. It is also used in the manufacture of "waterproof" cements and for the waterproofing of concrete surfaces.

When it is used as a thickening agent, e.g. in the formulation of greases the metal content is very important. Theoretically, Aluminium forms three stearates Mono, Di and Tri, but to date it has been found impossible to prepare the tribasic salt either in equeous or in non-aqueous solutions and therefore its existence is now considered very doubtful. The basicity most called for lies between the mono and the di salt but approaching closely to the di-stearate and great care is necessary in its preparation to ensure this result. The finished product; moreover must contain only traces of Iron and water soluble salts and must have a maximum moisture content of 1%.

There are a great number of factors in its preparation which have a pronounced influence on the physical and chemical properties. The concentration of the Sodium soap, the concentration of the Aluminium salt, its temperature and the rate at which it is added, the speed of stirring and the temperature of precipitation which must be carefully controlled.

Its preparation is by the usual method of double decomposition, and after precipitation the product is washed with 200% of water and is then run by gravity to a centrifuge and the excess water removed, it receives a further washing whilst spinning and is then sieved and spread on lead lined trays and dried in a tunnel dryer for 72 hours.

THE ALUMINIUM SALT OF MIXED FATTY ACIDS.

The co-precipitation of mixed acids results in a soap with modified properties which are not possessed by the Stearates of any of the blended acids. It has long been known that Aluminium soaps contain significant quantities of free acids, i.e. free in the sense that they are extractable with acetone. However these free acids are not present in the finished soap in the same ratio as in the original blend, showing preferential precipitation of certain acids. Advantage was taken of this fact in the preparation of a soap used for thickening gasoline for use in flame throwers. It was found that the preferential precipitation of Oleic Acid resulted in a soap which had the property of thickening gasoline at room temperature whereas the usual method of preparing these thickened fuels has been by the use of a straight Aluminium Stearate using a temperature of 60 degs. C. necessitating the employment of pressure equipment. The manufacture of these fuels could therefore only be carried out at a base well behind the firing line and transport of the finished product was troublesome. With the new soap however, a thickened fuel can be prepared in a few minutes without skill, and right in the fighting zone. It has therefore obvious advantages especially in the jungle type of warfare.

Unthickened fuel has a range of only 15 yards, the thickened type has a range of 75 yards, does not fan out, and can be aimed with surprising accuracy.

The foregoing is a brief account of our activities and gives some idea of the accurate work involved and the need for careful laboratory control and research on problems which are constantly arising. The aim of this small new industry is to produce an article equal in every respect to the imported one and using New Zealand raw materials where possible. In addition to this the price must be kept below that of the imported product without the benefit of tariffs or subsidies.

It is the opinion of the author that opportunity must be provided at once by our University to gain a knowledge of Chemical Engineering. There is a grave shortage of men with ability to design chemical plant, supervise its erection and its subsequent operation. In many instances laboratory results are not reproducible in large scale production.

New Zealand's young industries if they are to survive post war conditions will need an ever growing number of those very important persons, Chemical Engineers.

COUNCIL MEETING

Dr. J. C. Andrews, President, presided over the first meeting of Council held in 1945 on February 21st and 22nd.

SALARIES OF CHEMISTS:—Because of the urgency of placing evidence before the Committee set up by the Government for hearing salary claims, it was decided that the Director of the Dominion Laboratory should be asked to convene a meeting of Government Chemists in Wellington (as representing Government Chemists throughout New Zealand) to elect a representative on a Committee which will prepare a case for all Professional Groups within the Civil Service.

A request for such a representative had been received by the Institute from the Professional Engineers' Association.

At the adjourned meeting it was reported that Dr. Dixon had been elected representative of Government Chemists with Mr. Hughson as Deputy.

UNIVERSITY REFRESHER COURSES:—Under Professor Soper, Otago has organised a winter course of 10 lectures entitled "Modern Developments in Chemical Theory."

CHEMISTS' EMPLOYMENT COMMITTEE:—This Committee consisting of representatives from the two Institutes of Chemistry together with a representative in each of the four main centres and the Assistant Secretary D.S.I.R., is at present organising the means of maintaining a Register of Chemists seeking employment or change of employment and the most satisfactory way of making this information available to Chemists and to Industry.

COACHING RETURNED SERVICEMEN:—Victoria College Students Association is considering arrangements for coaching returned servicemen and is willing to accept responsibility for Chemists. The Association will of course cover all subjects.

JOURNAL:—It was decided to authorise the Editor to increase the size of the Journal to 24 pages including 4 extra pages of advertisements. For 320 copies a 24 page Journal will cost £23/11/0 as compared with £21/3/0 for 20 pages and £16/13/0 for 16 pages. The extra pages of advertisements and the increase in membership this year will offset the extra charge.

MEMBERSHIP:—A number of applications for Membership were recommended to be forwarded to the Membership Committee for consideration.

MEMBERSHIP COMMITTEE:—Dr. L. H. Briggs of Auckland University College was re-elected to the Committee for a three year term. Mr. W. Donovan, Wellington and Dr. R. Gardner, Dunedin are also members of this Committee.

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CONFERENCE, 1945.

The Annual Conference of the New Zealand Institute of Chemistry and of the New Zealand Section of the Royal Institute of Chemistry will be held this year at Palmerston North from midday on Tuesday, August 28th, to midday on Thursday August 30th.

The address of the Conference Secretary is G.P.O. Box 250, Wellington, C.1. and Dr. Barnicoat C/o. Massey Agricultural College, Palmerston North has been elected Secretary of the Local Conference Committee.

The outline programme is as follows:—

There will be four Sessions, Tuesday afternoon, Wednesday morning, Wednesday afternoon and Thursday morning.

The general subjects set down for these four Sessions are as follows:—

1. Symposium on "Soil, Plant and Animal Relationship."
2. Papers (to be selected) on any of the following:—
   Trace Elements (in nutrition, metallurgy etc. recent developments).
   Plastics. Die-Castings.
   Metallic Coatings. Building Materials.
3. Symposium on "Physical Methods."
4. Symposium on "Industrial Processes."

Members wishing to contribute papers on any of the above subjects are asked to send a precis only of their proposed paper to the **Conference Secretary** as soon as possible but not later than May 1st. When a programme has been selected full papers will be asked for in order to prepare cyclostyled copies prior to the Conference.

Individual contributions will be limited to a maximum of 15 minutes (approx 2,000 words) thus allowing time for discussion and social breaks.

A meeting of Council-in-person will be held on Thursday afternoon and evening, August 30th.

ELECTION OF FELLOWS

Mr. D. F. Sandys Wunsch, Managing Director of Dairy Products Ltd., Edendale, Southland, a member of the Council for Scientific and Industrial Research and also of the newly formed Manufacturer's Research Committee of that Council has been elected a Fellow of the New Zealand Institute of Chemistry.

Dr. Brian W. Doak, Acting-Director of the Plant Chemistry Laboratory, Palmerston North, has been elected a Fellow of the Institute.

ELECTION OF ASSOCIATES.

The Council has much pleasure in announcing that at its November meeting the following Associates were elected:—

Mr. E. H. Schache was born in Victoria Australia and in 1927 graduated from the School of Mines and Industries Ballarat. He is an Associate of the Australian Chemical Institute and since 1937 Factory Superintendent to Reid (N.Z.) Rubber Mills Ltd. Penrose.

Mr. W. A. McGillivray, Assistant Manager to Sharland & Co., Dunedin, graduated M.Sc. from Auckland University College in 1941.

Mr. H. D. Orchiston took his M.Sc. in Auckland in 1944 and is now Assistant Chemist to the New Zealand Farmer's Fertilizer Co. at Te Papapa, Auckland.

Mr. A. W. Mackney, an Associate of the Australian Chemical Institute came to New Zealand in 1944 to take up the post of Chief Chemist to N.Z. Forest Products, Penrose. Since 1935 he has been intimately associated with research on Forest Products in Australia.

Mr. G. D. Gemmell recently completed his M.Sc. degree and is now engaged as Assistant Chemist, Soil Survey Division, D.S.I.R.

Mr. O. C. Horwich who was born in Czechoslovakia completed his B.Sc. at Canterbury College in 1940. Before leaving Vienna he passed the First State Examination of the Technische Hochschule (Faculty for Technical Chemistry) 1938. For the last four years he has been Assistant Chemist with the Wellington Gas Co.

Mr. E. Freyberger holds the Diploma of Engineering in the University of Vienna and has been awarded the B.Sc. degree from the University of New Zealand.

Prior to 1940 he gained experience in factories in various parts of the world and since that time has been employed as Factory Manager and Chemist to Rubber Distributors Ltd., Petone.

Mr. S. J. Bennett specialised in metallurgy in taking his B.Sc. Tech. (1922) at the College of Technology Manchester. His first three years in New Zealand were spent as Analyst and Assayer, School of Mines, Thames. Since 1929 he has been teaching science and is at present at the Technical College Palmerston North.

Dr. Rosa Stern took her Dr.Phil. in Organic Chemistry at the University of Vienna. Dr. Stern is author or co-author of a number of papers both prior to the time of coming to New Zealand and since taking up the present post of chemist with the Wheat Research Institute, Christchurch.

Mr. S. R. Siemon is an Associate of the Australian Chemical Institute. He is a Master of Applied Science, University of Queensland with first class honours in applied chemistry. We are pleased to welcome him as Lecturer in Applied Chemistry, Canterbury University College, Christchurch.

Mr. J. T. Linzey took his B.Sc. degree in 1941 and has since been engaged as Chemist to the Dunedin Engineering and Steel Co.

Mr. G. L. F. Martin, who is now Assistant Chemist to the Dominion Compressed Yeast Co. at Auckland, was previously with R. & W. Hellaby Ltd., Westfield.

Dr. O. M. F. Nauen is a Chemist with S. W. Peterson and Co., Wellington. He is a "Doktor-Ingenieur" of the Technische Hochschule, Munich, the degree being awarded in 1926 for a dissertation on the electrolytic oxidation of cellulose.

Dr. C. J. Wilkins is lecturer in Inorganic Chemistry at Canterbury College. He is a graduate of Canterbury College and the Imperial College of Science, London, where he worked on fluorine compounds.

Mr. Egon F. Schwarz took his university course in Prague. He was Chemist to the Agar Factory of the Davis Gelatine

Co., and is now with A. C. Nottingham Ltd., Christchurch.

We extend to all new members a very hearty welcome and trust they will take an active interest in Institute affairs.

BRANCH NOTES

AUCKLAND BRANCH

THE CHEMISTRY OF ANAESTHETICS.

Capt. R. E. Edmondson, M.C., U.S. Army 13th July, 1944

Reviewing general anaesthetics Capt. Edmondson said that ether was still largely used and was the standard with which other anaesthetics were compared. The halogenated compounds were no longer favoured as they are too toxic. Cyclopropane is becoming very popular as it is very potent, it has a wider operating margin, it is more readily absorbed and eliminated than ether, and it allows a very high concentration of oxygen to be maintained in the blood Nitrous oxide, on the other hand, could be best described as an asphyxiant.

Capt. Edmondson then described the action of the barbiturates which are used as intravenous injections. They are hypnotics which depress the nervous system and produce sleep. They are used in short operations, in obstetrics, and also prior to general anaesthetics in certain cases. In general they are eliminated or destroyed by the liver or kidneys so they cannot be used when these organs are diseased.

Local anaesthetics, such as procaine or novocaine, have a certain field of usefulness as they give complete nerve deadening in the region where they are injected. They are used in dentistry, in operations on the limbs, as spinal anaesthetics, and in obstetrics. They are all more or less toxic and have varying anaesthetic powers.

THE ELECTRON MICROSCOPE.

Mr. F. H. Sagar,
Auckland University College. 10th August, 1944.

Mr. Sagar led up to the study of the electron microscope by first explaining the theory of the optical microscope and examining its limitations. For instance a good oil immersion objective microscope with yellow light will give a resolving power of 1700 Angstrom units and a maximum profitable magnification of about 650.

Turning to the corpuscular theory of radiation Mr. Sagar showed that all moving particles can be considered to have a wavelength which varies with the reciprocal of the mass and velocity. Thus fast electrons can have an equivalent wavelength of as low as .03 Angstrom units in a practical instrument giving a resolving power of .075 Angstrom units and a maximum profitable magnification of about 15 million. However, due to imperfections in the instruments these very high magnifications cannot normally be realised, nor are they always desirable or necessary.

Mr. Sagar then described, with the aid of lantern slides, the construction and operation of the electron microscope in some detail, in particular the electro-magnetic and electrostatic lenses. As an instance of the exacting requirements placed on the electrical equipment it is necessary that the supply voltages be kept constant within 1 to 50,000. He pointed out that one of the problems, as yet not completely solved, is the preparation of specimens, particularly those of an organic nature, as these cannot stand up to the fierce electron bombardment, nor, for that matter, the high vacuum either. Due to the low penetrating power of the electron beam many opaque substances cannot be viewed directly but a collodion facsimile will give information about the surface condition of the object.

OFFICERS

The Officers of the Auckland Branch for the forthcoming year are as follows:—

Chairman—K. M. Griffin; Hon. Secretary-Treasurer—S. G. Brooker, C/- Abel's Ltd., P.O. Box 12, Newmarket, Auckland; Committee—B. E. Jackson, E. D. Pain, P. R. Parr, R. Stansfield; Delegate to Council—K. M. Griffin; Hon. Auditor—A. J. Parker.

CORRECTION

Dr. F. B. Shorland has supplied the following correction to the first paragraph of the report of his address on Fish Liver Oils, published in the Journal for December, 1944.

"There are two main factories, namely Messrs. Karitane Products Ltd. of Wellington and Messrs. R. Greenwell & Co. Ltd. of Auckland in addition to several smaller factories in the far north. The estimated annual potential production, based on the known weight of fish landed, equivalent in vitamin A content to 300,000 gallons of cod liver oil, has been exceeded. The Auckland factory alone produces for the greater part of the year 150 gallons per day."

WELLINGTON BRANCH

At the August meeting Dr. F. J. Filmer, Director of the Animal Research Division, Agriculture Department, gave an address on "Photosensitization in Animals". The lecturer gave a general account of the conditions necessary for photosensitization to take place and classified photosensitisers as simple plant products, porphyiers, and the icterogenic type. The third class is the most important from the practical point of view and is characterised by the excessive production of some normal product of digestion, phylloerythrin being the best-known substance of this type. The pathological symptons of the disorder known as facial eczema were next described, and the conditions under which it has occured in New Zealand. Methods of research on the problem were next outlined, and the problems facing the chemists discussed. Mr. Clare, on the Chairman's invitation gave a short account of the identification of phylloerythrin and coproporphyrin in the bile of affected animals, which provided an interesting addition to the general address.

At the meeting on 26th September, Mr. L. R. L. Dunn spoke on "Cement Chemistry with reference to Concrete Construction". The lecturer outlined the desirable properties of concrete made from Portland cement, with special reference to the question of volume change. The inadequacy of ordinary chemical analysis of cement and the modern method of stating the composition in terms of the compounds which have been identified in cement clinker were explained. The influence of these compounds on the properties of the concrete was explained and it was shown how a cement of given characteristics would be made. The lecturer then gave an account of the part played by the minor cement constituents with special reference to high alkali contents. Certain aggregates of the andesitic type containing opaline silica react with high alkali cements. One New Zealand cement is high in alkali, but to date there is no record of any trouble with any New Zealand aggregate. Recent developments were described such as the use of synthetic resins, e.g. vinsol as a water repellant, and other agents to give increased weather resistance and diminish shrinkage effects.

The Annual Meeting held at Victoria College on October 31st was attended by 34 members. Among the matters of general business discussed by the members were the necessity for greater precautions in the large scale handling of inflammable solvents in the laboratory, the Branch prize fund, annual conference, and Industrial Essay Prize. The election of Officer

Bearers resulted as follows:—

Chairman and Delegate to Council—Mr. D. H. Freeman; Secretary Treasurer—Mr. N. P. Alcorn; Committee—Messrs. K. S. Birrell, E. S. Borthwick, D. Fraser, L. Wilkinson; Hon. Auditor—Mr. G. Lawrence.

At the conclusion of the business demonstrations of apparatus etc. were given by members as follows:—

Mr. R. L. Andrew showed figures for iodine content of iodised salt and the distribution of iodine in the bag itself.

Mr. S. H. Wilson showed a micro-chemical test for fluorine.

Dr. Shorland demonstrated a pump for continuous ether extraction.

Dr. Davies showed a conductivity method for finding the reactivity of limestone.

Mr. J. K. Johannesson illustrated the use of the Fisher photo-electric colorimeter.

CANTERBURY BRANCH.

Mr. R. C. Lawry addressed the July Meeting on "Polarographic Analysis." This important tool has been developed mainly since 1926, when Heyrovsky in Prague interpreted current-voltage curves in the electrolysi of electro reducible or oxidisable substances to show both their species and concentration. A solution is electrolysed in a cell, one electrode, of which, usually the cathode, consists of small mercury drops from a capillary. The applied voltage is varied continuously, only a small residual flowing, until a cathode potential is reached appropriate to the discharge of one of the ions present, when a sharp increase in the current occurs, up to a limiting value. If the cathode is small, the concentration of the discharging ion low, and there is no stirring, a slight increase in applied voltage beyond the deposition potential will completely electrolyse the solution near the cathode. No further current can flow with further voltage increase, and the "limiting current" is attained. During deposition, the current is proportional to the number of ions discharging. The number moving up to the cathode is governed by diffusion and electrical migration. The influence of the latter is eliminated by an excess of indifferent salt, leaving diffusion as the governing factor. The rate of diffusion depends on the concentration of the discharging ion which is thus measured by the limiting current. The potential which gives a current half the value of the limiting current for a particular ion is called the "half wave potential," and is characteristic of that ion.

Optimum conditions for the qualitative detection of ions in solution by the half wave potentials, and their quantitative determination by limiting currents are obtained by eliminating the migration current by means of excess of indifferent electrolyte, eliminating maxima in the curve which often occur, quite reproducibly, and by good temperature control. Diffusion currents may be reproduced within 1 per cent, giving 2 per cent accuracy in determining concentration above 10^{-4} M, and 10 per cent for concentrations above 10^{-5} M and 10^{-4}M.

Various applications of the method were discussed, both in inorganic and organic analysis.

At the August Meeting, Mr. E. C. Smith of the Public Works Department showed an excellent film of the construction and operation of the Rangitata Irrigation Scheme, and provided an explanatory talk before and during the showing of the film.

Dr. R. Gardner addressed the September Meeting on Plastics. The lecture is reported elsewhere in this issue.

Dr. H. N. Parton was the speaker at the October Meeting, discussing some of the factors which control the solubility of ionic crystals. The calculation of the solubility of a salt involves the calculation of the free energy change of the solution process. This in turn can be obtained if the changes in heat content and entropy can be found. The physical significance and relationships of these thermodynamic quantities was explained. The solution process may be split up into two steps. If the crystal is first broken up into its constituent gaseous ions, the heat absorbed is given by the so called lattice or crystal energy, and this has been calculated with considerable accuracy for simple crystals. If the gaseous ions are dissolved in a solvent, heat is liberated. The calculation of this heat of solvation is much more difficult. Early attempts were based on an equation due to Born, which relates the free energy of solvation to the radius of the ion and the dielectric content of the solvent. More recent calculation, such as those of Bernal and Fowler, and Eley and Evans, take into account the structure of the solvent in a much more detailed way. The change of method is typical of what has occured in all parts of theoretical chemistry in the last two decades.

The variation in solubility in a group of similar compounds such as the alkali halides, may be due to differences in lattice energy, or difference in energy and entropy change in the solvation process, or all these factors may be important. The "abnormal" solubilities of lithium fluoride, silver fluoride and calcium fluoride were discussed on this basis.

OFFICERS FOR 1945.

Chairman—Mr. H. V. Rowe; Hon. Secretary—Mr. F. H. G. Johnstone; Committee—Messrs. W. L. Dearsley and F. J. Grigg. Drs. M. M. Burnes, R. J. McIlroy and H. W. Parton.
Grigg. Drs. M. M. Burnes, R. J. McIlroy and H. N. Parton.
Delegate—Mr. F. H. G. Johnstone; Hon. Auditor—Mr. G. D. Low.

PRIZE ESSAY COMPETITION.

A prize of £10 (in books or instruments) is again offered this year for the best Essay of from 6,000 to 8,000 words dealing with Industrial Chemistry in New Zealand. The Essay may deal with a single industry or with a group of industries or with any consideration affecting chemical industry as a whole. Regulations governing the Essay may be had from Branch Secretaries or from Box 250 Wellington. The completed Essay in a form suitable for publication must be in the hands of the General Secretary P.O. Box 250 Wellington not later than June 30th, 1945. Subsequent to 1945 the prize will be offered periodically only according to the number of entries.

OTAGO BRANCH.

AUSTRALIAN IMPRESSIONS.

At the June Meeting, Mr. H. L. Longbottom gave some experiences of his recent trip to Australia.

After describing the Tasman air journey and the trials of the accomodation-seeker in both Auckland and Australia, Mr. Longbottom spoke of present day Australian industry which is fully organised for war. Noteworthy is the wide use made of experts in an advisory capacity. Industrial expansion since the outbreak of war is amazing—explosive requirements are met by factories costing more than £20,000,000; many pharmaceutical products and drugs are manufactured; Australian steel for shells is £8-14-0 a ton cheaper than English and £2 cheaper than U.S.A. steel; Australian optical glass is equal to the finest in the world; there is also an extensive non-ferrous metal industry.

Mr. Longbottom described some of the activities of the I.C.I. Already about four new nitrogen fixation plants are working. The new plant at Botany is primarily for the production of NaOH from NaCl by electrolysis, and isolation of the sodium as sodium amalgam. The chlorine by-products are to be used in the manfacture of hydrochloric acid and trichlorethylene and as liquid chlorine. There seems to be in New Zealand an antipathetic attitude towards such concerns as I.C.I., Broken Hill Proprietary, etc. Their value lies not only in producing raw materials, but also in introducing new ideas and stimulating efficiency in other industries.

Australia's industrial advantages are not so much natural as due to better trained personnel. Aptitude tests are widely used to ensure workmen being employed in a branch to which they are suited. The future foreman is given a special course of training in Industrial Management Classes and it is significant that Sydney Technical School had an evening class roll of 390 in 1941 and 1450 in 1944. By paying technical school fees, some firms encourage their employees to study. Broken Hill Proprietary train all their employees over a number of years. They train even the officers for their Mercantile Fleet.

Australian industry takes a sane view of the university graduate. It is recognized that to solve its difficulties, industry needs the help of the academic man. It is also recognised that there can be no substitute for practical experience—that the man with the shovel often knows far more about certain practical points than the university fledgling. Mr. Longbottom quoted from an address by the President of the Bethlehem Steel Co. "And yet there is still no substitute for experience. There never can be. Our organisation has faith in the university man. We need him in our business, and he needs us . . He must have the ability to realise that in various instances, men without formal educational background may have acquired superior commonsense, knowledge and judgment."

Professor F. G. Soper addressed the July Meeting on—

"THE CONCEPTION OF AN ACID."

He referred to early conceptions of acid and base and the redefinition in terms of hydrogen and hydroxyl ions following Arrhenius' demonstration of extensive ionisation of electrolytes in water. It was soon agreed the the term acid described the ability to produce hydrogen ion rather than their actual presence and it thus became convenient for the term acid to include negative ions such as the bisulphate ion. What was surprising was that whereas these anion acids were so quickly accepted, cation acids, such as the ammonium ion, have only been recognised as acids comparatively recently.

The inconsistencies of defining acids and bases by the equation; acid + base = salt + water, were pointed out and some of the evidence for the unifying generalisation of Bronsted and Lowry that acid = proton + base, was dealt with.

The relative strengths of acids and bases, which has always been a matter of interested concern to the physical chemist, remains perfectly definite on Bronsted and Lowry's conception.

The weakness of this theory, according to some workers, was that it limited acids to proton donors. Workers in non-aqueous solvents had been led to express their concept of an acid as a solute which gives rise to a cation characteristic of the solvent and a base as a solute which gives rise to an anion characteristic of the solvent, but this was placing as much emphasis on ions as the early school of physical chemists had done in insisting on hydrogen and hydroxyl ions. On the Bronsted Lowry theory, the acid base relation should exist even if the solvent were absent.

The theory of G. N. Lewis was then described in which an acid is any substance which can accept electrons and a base is any substance which can donate them. This was illustrated by showing that acetone (an electron donor) can cause colour changes in certain indicators similar to those caused by pyridine. The possibility of several new volumetric estimations had been brought to light in this way.

The conflict between the Bronsted Lowry conception and the Lewis conception was dealt with. The idea of a base was similar in both theories, but there was some doubt as to whether the more limited Bronsted acid was satisfactorily accomodated within the wider Lewis view. Whilst the Lewis idea unifies and clarifies catalysis by a number of substances, such as aluminium trichloride and boron trifluoride, it clouds the idea of acid and basic strength. These latter terms on the Lewis conception can have no universal meaning, for hydroxyl ions constitute a stronger base than ammonia towards hydrogen ion, whilst the reverse is true towards the silver ion.

At the August meeting Professor Eccles discussed the high specificity of some substances in their action on living cells or particular parts of cells. Having discussed the reasons for this, he illustrated the theories by the action of acetyl choline.

The living cell is a watery solution of proteins and salts within a plasma membrane. This is composed essentially of a double molecular lipoid layer with the hydrocarbon chains inwards and the hydrated polar groups outwards, i.e. a bimolecular leaflet. In Pharmacology, while the Van der Waal's and dipole forces are unimportant, the hydrogen bond and molecular structure are important. Similarity in molecular shape permits interlocking of cell and drug, giving maximum effect to intermolecular forces.

This explains antibody formation in immunity reactions. The synthesis of antibodies is that of normal globulins, except that the carbon chain is so folded as to be most stable in the presence of the antigen. Consider an example: 3-amino benzoic acid combines with a protein, and produces an antibody, A; 3-amino-4-chloro benzoic acid combines with a protein, and produces an antibody, B. While B will combine with the first azoprotein, A will not combine with the second azoprotein because there is no place for the chlorine.

Professor Eccles then discussed acetyl choline, a substance very active in very small concentrations on many body tissues. With striated muscle it works at, and only at, neuro-muscular junctions. A concentration of 1 in 10^6 applied to the junction exerts a considerable affect, 1 in 10^3 one mm. away has none. Acetyl choline is normally liberated by nerve impulse and part at least of their action is due to it - apparently by combination with a surface receptor on muscle fibre. The alkaloid curarine can fit into the cavity accupied by acetyl choline, and blocks its effect. Not only other quaternary ammonium, but also phosphonium, arsonium, and iodonium bases similarly block the activity of acetyl choline.

Professor Eccles concluded by saying that much research must yet be done on the actions of such substances. Why does acetyl choline have such a marked action, while other substances equally effectively anchored (e.g. curarine) have none, and others again (e.g. nicotine) first excite and then paralyse? These are some headaches for the chemist.

Dr. R. Gardner spoke on Plastics to a joint meeting of Otago Branch, Royal Society of N.Z. and Otago Branch, N.Z. Institute of Chemistry on 12th September, 1944 and to Canterbury Branch, N.Z. Institute of Chemistry on 22nd Sept., 1944.

The term "Plastics" covers a group of materials which are organic in origin (either synthetic or obtained from naturally occuring organic materials) and which, although hard and usually somewhat brittle as used, are in a plastic state at some stage of manufacture, and can therefore be brought into useful shapes by methods of moulding which are comparatively cheap in labour cost. This fact, with their smooth surfaces and attractive colours, accounts for the present wide and increasing use of the materials. Within this definition the materials vary widely in nature, in the raw materials from which they are made and in methods of production and fabrication. The various groups of plastics (Thermosetting plastics, including phenol-formaldehydes and aminoplastics, synthetic thermoplastics including the glass-like ethenoids and the nylons etc. other thermoplastics, including the cellulose derivatives, and miscellaneous kinds including lignin plastics and casein plastics) were dealt with and the principal methods of fabrication, including casting, compression moulding, injection moulding, extrusion and the production of laminated materials were explained. Numerous samples were exhibited, illustrating the various kinds of plastics and methods of production and working. Some very attractive articles made in New Zealand from casein proved of particular interest. It was pointed out that although the production of plastics had reached large proportions and is still rapidly increasing, there are definite limitations to the use of these materials. They are comparatively expensive and likely to remain so, and they do not compare with metals for strength. In the case of structures built of, for example, resinbonded plywoods the structure depended for its strength on the woods used and it was misleading to describe it as being made of plastics. While it is likely that an increasing number of small articles for various purposes will be made of plastics, the speaker did not think that these materials would displace glass, wood or metals to any large extent for structural purposes. As to manufacture in New Zealand, the opinion of the speaker was that while there is considerable, though not unlimited, scope for the fabrication of articles in New Zealand, it was unlikely that anything like the whole range of plastics would be actually manufactured here. The manufacture of casein plastics is a natural industry for New Zealand and some other kinds could be made, but most types would have to await the wider general development of the chemical industries which would come only with time and increased population.

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

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