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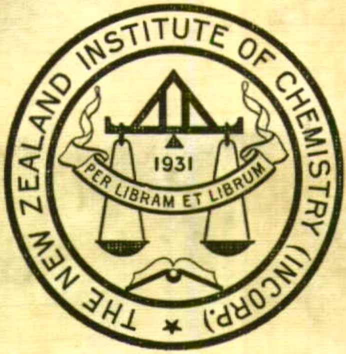

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EDITORIAL

Members will have by now had time to read and appreciate the Centennial review. We wish to congratulate the writers of the articles, for their work should do much to acquaint interested people with the nature of the contribution the science of chemistry can make to our industries. The contributors have varied widely in the treatment of their subjects, for some topics have clearly lent themselves to an historical treatment while in others, such as tobacco, activity has been too recent for the application of that approach. We found equally interesting, the history of scientific agriculture and the meat industry on the one hand, and the properties of tobacco and bituminous materials on the other.

The number of articles required to make the booklet reasonably complete is encouragingly large. We wish it could have been larger. There is no avoiding the fact that New Zealand's resources are limited. There are enthusiasts who believe great things could be done in New Zealand with, for example, the production of aluminium and magnesium. Such undertakings will involve large capital expenditure, justifiable only if either an export trade can be developed or a large internal market should arise. With regard to the former, the end of the war will see a surplus of plant available for light metal production in most countries. As for the internal market, New Zealand families are small, and immigration of the type most New Zealanders would consider desirable, is unlikely. On the other hand, the Centennial review shows clearly that industries concerned with the processing of our raw materials have advanced greatly, and gives every justification for a sober optimism about the future. We feel safe in forecasting, if only because the year 2040 seems a long way off, that when the second centennial review is written, New Zealand economy will still be dependent on the productivity of the soil, and particularly of the grasslands.

CHEMISTRY IN NEW ZEALAND INDUSTRY.

We are indebted to Mr. G. A. Lawrence for the following note on the history of chemical service to industry in New Zealand. Similar contributions from other senior members would be welcome. Mr. Lawrence writes:

"The publication of 'Chemistry in the Development of New Zealand Industry' is a welcome and valuable contribution to the Centennial Literature. Had it not been for the Centennial celebrations, which stimulated and quickened the memories of those who had their roots firmly established in the first century of New Zealand's development, there would have been many matters of historical interest which would otherwise have been lost. Future generations interested in the part chemistry played in the first hundred years of our history will find valuable information in this publication. As it is, there must be a considerable quantity of interesting data relating to the progress of chemistry in this country locked up in private records of past workers and in the records of firms which have in the past availed themselves of the services of workers in chemistry. Of the earlier workers in chemistry one may mention the late Hon. G. M. Thompson of Dunedin, and the late Mr. Macindoe of Invercargill. The former, as well as being an able chemist, gave long service to his country in an administrative capacity. The latter gentleman's name is still mentioned with something akin to reverence by the older inhabitants of the district in which he resided and worked. Another name which comes to mind is that of the late Mr. Pond, whose obituary appeared in a recent issue of the Journal. One of the older workers, whom happily we still have with us, and who is still actively engaged in chemical work, is Mr. George Bagley. His early work in chemical control in the soap industry is well known to the old school. Then there is his vast knowledge of the drug and cosmetic industries, and perhaps it is not too much to say that in this particular sphere his knowledge is still preeminent in this country. It is of interest to call to mind that the late Dr. Gilruth, with H. W. Lawrence, carried out some of the earliest experimental work in this country, on stock foods, and these two men also tackled the question of producing starter cultures for use in the dairy industry and established a system of supplying standard starters to dairy factories. Shortage of supplies in World War No. 1, introduced a number of problems which gave scope to the ingenuity of the chemists of the day and it is curious that many of these same problems have cropped up again during the present conflict. In this connection many will remember the work of Professor Easterfield in the production of carbon pencils for use as arc light electrodes, and also his work on the recovery of morphine from opium confiscated under the anti-drug laws. Mention was made previously of the amount of data which must be buried in the records of firms and an interesting example of this came to light just after the beginning of the present World War. A firm using large quantities of sodium sulphide for fellmongery purposes, getting anxious about the possible shortage of this commodity, wrote reminding us about a report we had made in 1915 on the question of the production of sodium sulphide in New Zealand and the use of substitutes. Turning back the leaves of old records we found notes somewhat yellow with 25 years burial. They referred to experiments on the production of sulphide from caustic soda and sulphur and also experiments with a number of other substitutes which would act as depilatories. At the time it was thought that local imports of caustic soda might also be in short supplies and lime as an alternative was tried, and it was decided that lime sulphur could be used as a last resource substitute if the supply of caustic soda should fail. It just happened that about that time experimental work was being carried out in connection with the establishment of what was probably the first plant for the production of lime sulphur for fruit spraying and this data worked in very well with the depilatory enquiry. Happily the position did not deteriorate to the extent that lime sulphur had to be used but small quantities of sulphide were made from caustic soda and sulphur.

These instances afford some interesting side lights on the past and show that in peace, as well as in war, the chemist is unobtrusively playing his part."

N.Z. CHEMISTS IN AUSTRALIA

Letters received from members who have gone to Australia on munitions work make reference to the welcome extended by our colleagues in Australia. In Melbourne, they were invited to attend meetings of the Australia Chemical Institute, and heard what one described as a stirring speech by Sir David Rivett. We appreciate very much the spirit of co-operation our Australian colleagues are showing, and our admiration for their industrial effort is heightened by the knowledge that our own men are welcome collaborators in it.

A MESSAGE FROM THE RETIRING PRESIDENT.

I should like to thank all those members who have, in one way and another, helped to make my term of office a very pleasant one and at the same time I take the opportunity of saying a few words about the work of the Institute generally.

Unfortunately we are still at war. I believe it is correct to say that the Institute as a body, and its members as individuals, are doing their fair share in the war effort, and will continue to do so for as long as may be necessary.

The work of the Institute generally is going steadily forward. The achievements of such a body are not and cannot be spectacular. The real test of its value—and one that is not easy to apply—is a comparison of the position in, say, ten or twenty years from now with what it would have been had no such body existed. My own feeling is that the increase in personal contacts among chemists at Conferences and Branch Meetings, would, without anything else, justify the existence of the Institute, and the work has many other important aspects besides that.

It has been a source of particular gratification to me to see the Journal established on a satisfactory footing. I believe that this is a very big step forward and I appeal to members to give the Journal every possible support. I would point out particularly, that country members who do not have many chances of expressing their opinions at Branch meetings, can use the correspondence columns of the Journal and I know that the Editor would welcome a more free use of this right.

Finally, I bespeak for my successor the same loyalty and the same universal kindness and helpfulness that have made my own term of office one on which I can look back with pleasure.

Dunedin, November, 1941. R. Gardner.

RESUME OF MINUTES OF THE FOURTH COUNCIL MEETING

Held on the 19th November, 1941.

Present: Professor F. G. Soper (in the Chair), Messrs R. L. Andrew (Canterbury Proxy), R. M. Bruce (Auckland Proxy), G. S. Lambert (Wellington) and J. A. D. Nash (Hon. Secretary-Treasurer).

The examination requirements were redrafted to embody the motions passed at the previous Council meeting.

The Secretary reported that a reciprocal arrangement had been made with the Australian Chemical Institute whereby our Branch Secretaries would receive the Journal of the A.C.I. in exchange for our own Journal. A letter of appreciation and thanks has already been received from the Western Australian Branch.

The Public Service Commissioner has been approached and asked to consider the following suggested scales of salary on appointment to the Public Service: B.Sc., £255; M.Sc., £280; M.Sc. 1st Class Honours, £305. The suggestions were received very favourably by the Commissioner and he agreed to consider them.

The following Associates were elected: Miss M. P. Bartrum (Christchurch) and Mr. J. E. Brundell (Auckland).

An offer of the proceedings of the Institute of Chemistry of Great Britain and Ireland for the past 20 years, from Dr. H. E. Annett, of the Auckland Branch, was accepted with thanks.

The price of extra copies of the Centennial publication to members was fixed at 1/6.

It was agreed that all suggested alterations to rules should be forwarded to the Dunedin sub-committee for consideration.

Misleading Advertising.—Messrs R. L. Andrew, O. H. Keys and Dr. J. K. Dixon were appointed a sub-committee to consider this matter with a view to interviewing the Prime Minister on the subjects of undesirable ingredients in drugs, etc, and on misleading advertising.

The Annual Report and Balance Sheet were approved for circulation to members.

Sir Theodore Rigg was elected President for the ensuing year.

The resignations of Miss Davies, who is now in Australia, Dr. F. G. Shepherd, Auckland, and Messrs R. P. Worley and A. E. McGraty were accepted with regret.

The following motion was passed at the Council Meeting:

"That this Council places on record its appreciation to Dr. R. Gardner for his services as President of the Institute for the past two years and for the excellent way in which he has led the Institute during that period." Carried unanimously.

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BRANCH NOTES

AUCKLAND.

The July meeting was addressed by Dr. R. A. Robinson on "Oxidation-Reduction Indicators." He said that when we consider the potentiometric titration of an acid with a base, and plot the E.M.F. against the ml. of alkali used, we find that the E.M.F. changes very slowly at first, but alters abruptly at the point of neutrality, followed by another slow rate of change. A suitable indicator may be used to show when this costs (due to the tax on petrol rather than to any greater efficiency) the only real advantage lies in the availability of the fuel.

Two types of burner are in common use—the up-draught and the down-draught. The former produces good gas and starts easily from a high grade fuel. The down-draught produces a poorer gas and is harder to light, but will use a low grade fuel.

The cleaners play a very important part in removing the abrasive dust and the tar from the gas. A 30 h.p. car requires 80 cubic feet of gas a minute. The first cleaner is a series of baffles to precipitate dust, and the second, such as sisal or oiled coke to dissolve the tar and also to remove dust not precipitated in the first cleaner.

Fuels were fully discussed. Anthracite is a good fuel, but is not worth considering in this country as the deposits are too small. Waikato coke is a good fuel and is largely used. Gas works' coke is not sufficiently reactive. Charcoal is very good but is too bulky. Compressed charcoal briquettes are probably the best fuel, but considerable difficulties lie in the way of its local manufacture. In summary, the ideal fuel must be: (1) reactive, i.e. easy to light; (2) dense, (3) must be cheap, (4) must have tar as low as possible, below 12 ounces per ton, (5) volatile matter must be below 12 per cent, and (6) have a low percentage of non-clinkering ash.

Gas producers as we know them today can only be considered as emergency alternatives to petrol, and it is doubtful whether they would ever be a serious rival to petrol, were it obtainable in normal quantities.

WELLINGTON.

On July 29th, a symposium on "The Alkaloids of Perennial Ryegrass" was held.

The first of the series of three papers was given by Mr. R. E. R. Grimmett, Chief Agricultural Chemist, who outlined the history of investigations which led to the independent discovery of a series of alkaloids in perennial ryegrass at the Animal Research Chemical Laboratory in Wellington, and the Plant Chemistry Laboratory at Palmerston North.

The alkaloid so far crystallised in greatest quantity is peculiar in exhibiting a bright yellow colour and strong green fluorescence as the base dissolved in alcohol or chloroform. Solutions of the salts are also coloured but not fluorescent.

Several closely related alkaloids were described whose solutions as base in chloroform differ in their colour, varying from yellow to red, and also in the crystal form and solubility of their hydrochlorides.

An alkaloid has also been isolated in small amount, which differs from the first group in being colourless, and soluble as base in sulphuric ether. Its solution in chloroform is non-fluorescent but solutions of its hydrochloride in water or alcohol show strong blue fluorescence in daylight. It has been sublimed at about 180°C. under high vacuum and gives a number of well crystallised salts. Its reactions indicate that it is probably an acid as well as a base.

A steam volatile alkaloid also occurs in considerable relative proportion and has been purified by fractional distillation. It gives analysis and molecular weight agreeing with a picoline; but though resembling gamma picoline, physical constants and properties are not quite identical. It is possibly alpha picoline, but until the latter has been synthesised and compared, a final conclusion can not be reached.

Lantern slides were shown of a number of microphotographs of the crystalline hydrochlorides and characteristic complex salts of the alkaloids and of picolines.

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Dr. J. Melville of the Plant Chemistry Laboratory said that the discovery of a fluorescent alkaloid in perennial ryegrass by the Plant Chemistry Laboratory was a result of investigations into the basic nitrogen fractions of aqueous extracts. The alkaloid can be obtained by standard procedures of alcoholic or aqueous extraction, and is purified through shaking between chloroform and water, and finally by recrystallisation of the hydrochloride.

The most spectacular property of the alkaloid is its strong fluorescence in solution in alcohol or chloroform. The fluorescence can be detected at dilutions as low as one part in five millions. In dilute solutions in chloroform the alkaloid is golden yellow with a green fluorescence. A micro-analysis of the hydrochloride gives the formula $C_{36}H_{22}O_3N_4(OCH_3)_4 2HCl$. The alkaloid is easily and quantitatively reduced by titanous chloride to a colourless compound which is reoxidised by ferricyanide.

The concentration of the alkaloid in ryegrass varies between wide limits—from less than 10 gamma to 0.1gm per Kgm dry matter. No single environmental factor has been found which can be directly correlated with high alkaloid content, but it seems certain that a slow rate of growth never results in alkaloid elaboration.

The alkaloid is toxic to mice in fairly large doses, while injection of lower amounts leads to mild photosensitation.

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Dr. I. J. Cunningham discussed the pharmacological actions of ryegrass alkaloids. He said that the alkaloids produce toxic actions in mice, rabbits and sheep after intraperitoneal or intravenous injection, but no toxic effects follow oral administration to sheep. The lethal doses to mice are very much higher than alkaloids such as strychnine. Sublethal doses administered intraperitoneally or intravenously produce collapse and diminution of body temperature. High doses, still sublethal, produce intermittent convulsions. Death usually results after a period of convulsions. There is no characteristic pathological change in any of the organs.

On intravenous injection of sufficient quantities into a sheep, photosensitisation occurs, but no such result follows oral administration. There is a rapid destruction of perloline in sheep whether administered intravenously or orally. The destruction does not occur in the alimentary tract. It has not been possible to obtain any evidence that perloline is a causative agent in the disease known as Facial Eczema.

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The August meeting was addressed by Mr. G. S. Lambert on "Froth Flotation.

The lecturer commenced with a general outline of the applications of froth flotation as an ore-dressing process. He dealt briefly with some of the early processes from which modern froth flotation had developed. Flotation was defined as "the separation of one or more desired constituents of an ore from those not desired by attachment of the former to air bubbles which, rising through the ore pulp, form a mineralised froth sufficiently stable to be removed as a more or less rich concentrate." The two main types of machine in use, the pneumatic and the agitation, were described.

The phenomenon of variable wettability of mineral particles and its quantitative estimation by measurement of contact angles was discussed. The problems of producing or accentuating variable wettability and of producing suitable froths led to a consideration of the various reagents used in flotation practice. These were classified as frothers, promoters. or collectors, modifiers or depressants and regulators. The chemical nature of each type of reagent was described, and current theories for their operation discussed.

Finally the speaker gave an indication of the extent of the present application of the process which includes the recovery and selective separation of metallic sulphide and oxide minerals, the concentration of gold ores, the removal of detrimental elements such as arsenic from tin ores, the concentration of non-metallic minerals such as phosphate rock, fluorspar, baryte, calcite, magnesite, talc, mica and coal, the modification of cement rock and a recent development in the separation of sodium and potassium salts.

In September, Mr. F. Morgan spoke on "Patent Medicines, their Formulation and Production."

Packeted medicines which may be obtained at various retail stores are frequently termed "patent medicines," although the term "proprietary medicine" is more correct and is coming more into modern use. The consumer of such medicines is protected, to a degree, by the law, under:

(I) The Sale of Food and Drugs Act, by means of which a check may be kept on the purity and safety of the product.

(II) The Poisons Law, which governs the composition and nature of the active ingredients, and

(III) The Quackery Act, which is designed to guard against false claims in the use and advertising of the product.

Most proprietary medicines receive their birth in the form of a medical prescription. It may then follow that:

(I) The medical practitioner achieves such success with a remedy that he covers it with proprietary rights.

(II) The patient tries out a prescription on his friends and is induced to manufacture it and then obtains proprietary rights.

(III) The pharmacist may note the popularity of a certain prescription and for manufacture covers it with proprietary rights.

Kruschen Salts, Clements Tonic, Bonnington's Irish Moss, Maclean's Stomach Powder, received their birth in such a manner.

Taking a cough mixture as an example of a "patent medicine" a conventional formula would be:

Tinct. Opii, Camph.	20 minims
Oxymel. Scillae	60 minims
Tinct. Ipecac	10 minims
Syrup. Tolutani	60 minims
Aq. Chloroformi	to dose

If the ingredients are studied it is found that each has a function which may, in theory, relieve a cold or cough, e.g. the functions include a hypnotic and sedative effect, expectorant effects and ingredients giving a pleasant taste. However, the actual effectiveness of these ingredients is much in doubt, as although Tinct. Opii. Camph., because of its morphine content, has now been prohibited as a dangerous drug, it is the most active principle in the mixture, but its absence has apparently not reduced the apparent effectiveness nor the sales of the medicine. To convert such a prescription as the above into a form suitable for mass production as a patent medicine, various modifications have to be made, with a view to simplification of the manufacturing process as much as possible. By altering the concentrations of the alcoholic solutions of the ingredients, a saving in alcohol may be effected and also, some of the above ingredients may be substituted by others to obtain the desired cheapness, appearance, etc. of the product.

The cost of pharmaceutical manufacturing equipment, such as vacuum fillers, cappers, labelling and cartoning machines is always high, but with modern materials for equipment, such as stainless steel, and the automatic machine packaging, production can be maintained at the level necessary to make the installation of such plant worth while.

The position regarding patent medicines in New Zealand is liable to considerable change in the future. With the stringent legislation in America to give a lead, it is likely that advertising and the manufacture of many "patent" medicines will be much more strictly controlled here in the future than has been the case previously.

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CANTERBURY BRANCH.

The July meeting was addressed by Mr. Philip White, who was the Branch's visiting lecturer for the year. The chairman and a number of members met Mr. White for lunch, and the Committee had the pleasure of his company at their monthly meeting. In his address, Mr. White discussed the chemistry of tanning, with particular stress on the importance of molecular size of the tanning material. The chrome tanning compounds have been studied in the light of Werner's co-ordination theory, notably by Stiasny. Some progress has been made in determining the average molecular weight of tannin solutions by freezing point measurements, but an average may be misleading unless the distribution of the actual molecular weights around the average value is known. The facts put forward by the speaker impressed his audience both with the progress that has been made in applying science to this ancient art and the complexity of the problems awaiting solution before scientific control is perfected.

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The August meeting was addressed by Mr. E. A. Jutasi, of the Marathon Rubber Company, his subject being "Latex."

Latex, the milky juice of the rubber tree, is a water emulsion of rubber particles, and was used by the Maya Indians to make balls for a kind of golf. Later tribes dipped their feet in it, and after drying, it formed a boot. The most important rubber trees were the hevea brasiliensis of South America, the castelloa elastica of Central America, and the landolphia and the ficus elastica of Africa. The discovery of vulcanisation caused a rubber boom in the Amazon valley, where big cities grew in the jungle. In 1876 Wickham took some 70,000 seeds of hevea brasiliensis to England, and from them came the plantations of Malaya and the Dutch East Indies. Production today is over one million tons, 99 per cent of it plantation rubber. A recent development is the discovery of plants yielding a juice similar to latex, but capable of growth in temperate regions. Tyres have been made from the juice of kogh sagyz shrubs, grown in Southern Russia.

Rubber latex is a typical colloidal emulsion showing Brownian movement. The particles are negatively charged, and may be discharged anodically. Being lyophobic, the latex coagulates easily, but may be preserved by ammonia, since selective adsorption of hydroxyl ions increases the negative charge, making the colloid more resistant to positive ions.

Untreated latex coagulates in a few hours by bacterial action. The ammonia changes the properties of the latex, reducing the viscosity and surface tension and increasing the rate of vulcanisation. Lyophilic colloids such as casein, glue, gelatine, and soaps also stabilise latex.

The rubber content is usually about 40 per cent, and other solids present are nitrogenous materials, resins and sugars, with about 0.4 per cent of ash. Enzymes are always present, and they are partly responsible for spontaneous coagulation. Rubber has a specific gravity of 0.92, and the dry rubber content of latex is almost proportional to the specific gravity and can thus be found by special hydrometers. The low surface tension of latex is of great importance, especially in the impregnation of textiles, which are more easily wet by it than by water, and further improvement is obtained by surface tension depressors such as sulphonated alcohols. The wetting agents, however, cause frothing which gives trouble in some applications. Normal latex has too little rubber and is too fluid for most purposes, but today the problem of concentration has been largely solved, three methods being in use, and a fourth being developed. Centrifuging is the most common method, giving a concentrate with 60 per cent total solids. The latest method, still in the experimental stages, is electrodecantation.

For most applications latex must be vulcanised. The exact nature of the process is still disputed but it consists mainly of the addition of sulphur to the unsaturated bonds of rubber, also connecting the long thread-like chains in two-dimensional patterns. Raw Rubber, which is a plastic material, is changed into an elastic material.

Articles made from latex are usually vulcanised after drying. Latex has certain advantages and also disadvantages compared with milled and masticated rubber. Advantages are the elimination of solvents, and of mastication, reducing fire risk and power consumption. Disadvantages are higher costs, less uniformity between shipments, greater hygroscopic tendencies, increased stiffness and lessened resistance to abrasion. The most important uses are for dipped articles, such as surgical gloves, toy balloons, overshoes, bathing caps, and similar thin-walled articles. Electrode position is used for articles of complicated shapes. Impregnation of textiles is an important process, as is the manufacture of rubber threads.

The testing of latex comprises the determination of total solids by drying at 70°C, the dry rubber content by coagulation with acetic acid, total alkali, ammonia, hydrogen ion concentration, mechanical stability, and various physical properties.

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In September, Mr. E. F. Scott, of the staff of the Christchurch Drainage Board, addressed a good meeting on "Sewage Disposal." Mr. Scott remarked that he hoped such a meeting with members of the Institute of Chemistry might result in some helpful suggestions concerning some of the Drainage Board's problems.

The Canterbury plains consist of stratified sedimentary deposits. There are rows of sand dunes with peat bogs in between, the peat being from 2 to 10 feet thick, and underground streams exist. Agitation for a body to control drainage began 65 years ago, and by 1882 there were 34 miles of sewer. All sewage has to be pumped as excavation is limited to 10 feet by the nature of the ground. Flush tanks are used in the streets on account of the flat grades which also render ventilation difficult. It has been found that gas does not flow easily in the pipes. No intercepting traps are used, but a ventilator at the top of each house sewer makes a satisfactory ventilating system.

In 1924, a scheme was started for the outer area, independent of the central area scheme, and the sewage is carried through two chains of pumping stations, taking about 24 hours from the outskirts to the drainage farm. About 40 gallons per head per day are pumped from the outer area, and twice that amount from the central area. In 1929, ventilation troubles were experienced in the pumping stations, due partly to intermittent pumping. Vent shafts were tried with some success. In 1932, on the advice of Dr. H. G. Denham, rings of gas burners were installed in vent shafts and proved successful in destroying odours. Ozonisers, using about one unit of current per day, and giving one part of ozone in 600,000 have also proved effective.

The Drainage farm now covers 900 acres, with three septic tanks, each of two million gallons capacity. Mr. Scott briefly discussed the bacteriology of sewage, and demonstrated a detector lamp for sewage gas.

OTAGO BRANCH.

On August 13th, Mr. H. D. Kerr gave a lecture on "The Responsibility of the Fertiliser Industry to the Farmer."

The lecturer said that those who are concerned in the chemical fertiliser industry should have as an objective the supplying of those elements that are deficient in the soil, in a form that is readily available to the plant in order that the farmer might produce better pastures and farm products. Results obtained hereby will exert an influence throughout all branches of the community.

Mr. Kerr said that in general, New Zealand soils are very deficient in phosphoric acid, the response from super-phosphate being so great that super-phosphate manufacture in New Zealand has increased from 25,000 to 550,000 tons in 20 years.

It soon became obvious that superphosphate which naturally has an acid reaction, is not suitable for all soil conditions. It was found however, that dicalcic phosphate (which is non acid) gave satisfaction in many cases. The reason for this is that in acid soils, the monocalcic phosphate in super-phosphate tends to form insoluble phosphates with iron and alumina, thereby becoming unavailable to plants. The necessity for tests of soil acidity is therefore obvious. The use of pH indicators has simplified work in the field, and reference to tables enables the amount of lime required to correct any given soil condition to be readily estimated; thus enabling the greatest benefit to be gained from the fertiliser. In general, superphosphate would not respond in soils of pH4 and it is necessary to bring the soil to pH6.0 to 6.5 with lime before good pastures and crops are obtained.

A realisation of the relationship between lime and superphosphate in the soil is of extreme importance in New Zealand under war conditions, as the supply of phosphate is rationed. However, soil analysis before adding superphosphate enables the correct amount of lime to be calculated, and thus valuable phosphate is saved. The lecturer said rarer elements such as boron, cobalt, manganese, copper, and iron have established themselves in the agriculture of this country. Borax, for example is used largely to prevent diseases in turnips, while manganese exerts a beneficial influence on some North Island soils.

Mr. Kerr then gave a short description of the manufacture of superphosphate in a modern factory.

Research work on heat control, sulphur burning and other points have reduced the size of acid plants with consequent economies in manufacturing costs. During all stages of acid and super-phosphate manufacture, rigid chemical control is exercised; e.g. sulphur dioxide and oxygen determinations, and phosphate estimations are made continuously. Colorimetric methods are used wherever possible. These are found to be quick and accurate and readily understood by chemists and attendants.

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On September 10th, three short lectures were given on "Current Research at Otago University," the speakers being Professor F. G. Soper, Dr. S. N. Slater, and Mr. L. C. Baker.

On October 8th, Mr. W. S. Metcalf surveyed the present state of knowledge about the structure of the atom. This lecture was arranged to give members who were more or less out of touch with academic chemistry, a chance to hear some of the advances of recent years.

Starting from the familiar model of the atom consisting of a heavy nucleus surrounded by planetary electrons, recent advances in the elucidation of the energy states of the electron shells were discussed by the lecturer and applied to the periodic table. The stability of certain electron states accounted for the inactivity of some elements, and the unreactive nature of some ions. Electron diffraction of gases gave a nice confirmation of the fundamental assumptions.

The most spectacular success of the modern extranuclear theory was the unravelling of the various types of spectra. Some qualitative considerations were first given, followed by a discussion of the various steps in the quantitative calculation of spectral lines by the postulation of circular and elliptical orbits and electron spin. Magnetic considerations give independent support to this last postulate.

The tendency to move away from physical pictures was discussed. Just as the equation $x^2 + y^2 = a^2$ described a circle, and from it many of the properties of a circle could be deduced, so also could properties of an electron be described and others predicted from the Schrodinger wave equation. Since we only knew what electrons did, and not what they looked like—that being meaningless—we were hardly justified in going further than the equation that described what they did.

The nucleus was considered to be composed of neutrons and protons. Various combinations accounted for isotopes and isobars. It was shown that the forces which held together the nucleus required new postulates to explain them. The new method of separating isotopes by means of a thermal gradient was mentioned. The address concluded with a short discussion of nuclear reactions, artificial radioactivity, and a tabulation of the ultimate particles and other particles of interest in connection with atomic structure.