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H. W. LAWRENCE, 1865-1942.

Mr. Henry William Lawrence was born in London in 1865 and received his early education at the College of Preceptors. He later studied science at the Royal College of Arts, the Royal School of Mines and finally at the University of London, where he was associated with the late Professor H. E. Armstrong. For a short time he was engaged in his step-father's business, that of a merchant jeweller, but the urge to a scientific career induced him to accept a position under the late Dr. Voelcker Sen., in the laboratory of the Royal Agricultural Society, where he remained for 8 years. During this period he was intimately associated with agricultural experimental work at Woburn. From there he accepted a position as assistant to the late Sir Henry Gilbert at the famous Rothamsted Experimental Station at Harpenden where he remained for ten years. During this period he carried out most of the chemical work in connection with animal feeding experiments being conducted at that time and later worked on the fixation of atmospheric nitrogen by soil and nodule organisms. Mr Lawrence acted as demonstrator to Sir Henry in the numerous lectures on agricultural science which he gave to visiting scientists and students from various parts of the world. As these lectures were delivered to classes of mixed nationalities the language difficulty was no small obstacle and Mr. Lawrence used to recount many humorous situations which arose in endeavouring to interpret to Chinese and Japanese visitors. Mr. Lawrence was the last survivor of the chemists who worked under Gilbert at Rothamsted when the work was carried out almost entirely at the expense of the station's famous founder and benefactor Sir John Lawes.

Mr. Lawrence came to New Zealand in 1901 and after serving for a few years in the agricultural department entered into private practice as a consulting chemist. By his early experience in agricultural science he played no small part in introducing science into the agriculture of this country. In connection with the late Dr. Gilruth he carried out, what were probably the first animal feeding experiments in New Zealand. He toured New Zealand delivering lectures to farmers on the importance and use of fertilizers and through his endeavours the first shipments of basic slag were introduced into this country. In his private practice Mr. Lawrence had a very wide clientele in the primary and secondary industries of the country, and much of the pioneering work of introducing science into industry is due to his efforts. Mr. Lawrence was a fellow of the Institute of Chemistry of Great Britian and a fellow of the Chemical Society.

In his early life Mr. Lawrence was a keen cyclist and on several occasions rode from London to Glasgow on the old penny farthing bicycle. Later he became a keen motorist and was a foundation member of the Motor Cycle Club and the Wellington Automobile Club, and served on the executives of both bodies. He took a keen interest in local politics and gave service on the Johnsonville Town Board and the Hutt Valley Electric Power Board.

Note: Although Gilbert is known to the present generation as Sir Joseph, he was never known by this title in his life time, his second name Henry always being used, hence the use in the above notes.

Minutes of a Meeting of Council held on Tuesday, 25th June, 1942.

Present: Sir Theodore Rigg (President), Professor F. G. Soper (Otago), Dr. J. K. Dixon (Wellington), Messrs L. R. L. Dunn (Auckland Proxy), S. H. J. Wilson (Canterbury Proxy), and J. A. D. Nash (Hon. General Secretary).

A suggested syllabus for the Laboratory Assistants' Certificate was considered and it was decided to circulate it to Branches for comment.

It was reported that a Register of Technical and Scientific workers in New Zealand was being prepared by the Department of Scientific and Industrial Research and it was resolved that the Secretary co-operate in ensuring that a full register of chemists was made.

The following were elected to the Associateship: S. G. Brooker (Auckland), P. D. Horne (Auckland), Isobel M. Morice (Wellington), P. A. Ongley (Wellington), D. Whillans (Auckland).

It was resolved that on receipt of an application all members joining the armed forces would be granted leave of absence provided that their current subscription is paid.

The resignations of Mrs. E. M. Clare, Wellington, and Mr. H. G. Black, Otago, were accepted with regret.

A report on the finances of the Institute was received and it was resolved that the report be circulated to the Branches for comment.

Alterations to Rules.

Suggested alterations to the Rules were published in the June issue of the Journal last year, and these were considered at a Council Meeting held in May. The main effects of Council's resolutions are as follows:—

A new rule has been included whereby Council is given power to elect Honorary Fellows and also Honorary Life Members, either Fellows or Associates.

The standard for election to the Fellowship has been raised but the period for which a person must have been practising chemistry has been reduced to five years from ten years.

A new office, that of Vice-President, has been created.

It was decided to take no action in regard to the formation of a Country Members' Branch.

A copy of the complete alterations will be distributed to all members as soon as possible.

Supplies of Apparatus.

It has been brought to the notice of Council that some members are experiencing difficulty in obtaining the necessary apparatus to carry on their work. Also it was felt that there may be members who have apparatus for which they have no further use. Council has agreed that the Secretary-Treasurer should act as a channel for exchange. Members should send details of the apparatus they have need of or wish to exchange or sell, to the General Secretary, N.Z. Institute of Chemistry, P.O. Box 250, Wellington, who will endeavour to satisfy their needs.

BRANCH NOTES

AUCKLAND BRANCH

Microbiology.

(Dr. T. R. Vernon, 14th May, 1942)

Dr. Vernon opened his remarks by stating that the study of microbiology had always had a twist in certain directions, depending on whether it is studied in connection with medicine, food stuffs, or industry, and it was only recently that industry had found the necessity for the study of this subject. In New Zealand the more obvious industrial problems were chemical and so chemists were engaged to solve them, and when biological problems cropped up it was usually the chemist who had to deal with them the best way he could.

Factories require chemists, not only for laboratory work, but also to take the part of works managers, and this means that their training should be wider than that required for the laboratory only.

The wastage due to biological decay in factories, especially where food stuffs are manufactured, is large in New Zealand, and it could be prevented by some biological knowledge on the part of the chemist or works manager. Hence it is up to the Universities to teach some biology to all chemical students, and acquaint them with the knowledge of how to handle "bugs".

Microbiology is not the precise study of reactions that chemistry is, as the results are influenced by a very large number of factors. In fact the results cannot be guaranteed, and sometimes it is only by applying statistical analysis that any rational results can be found. One of the main things about practical microbiology is the technique, and this is found in neither chemistry or botany. Fairly large quantities of rather specialised apparatus are also required.

The speaker said that he had noticed that the smaller the firm the more secretive it was about its formulas and processes. Whereas in England this secretiveness had been broken down by Chemical and Biological Societies, in New Zealand this had not occurred to a very large extent. Small firms, especially, had more to gain by co-operating than they would lose by giving away their secret formulas, which, in many cases, are common knowledge. Thus New Zealand firms should combine to form a Biological Research Association to help them with their problems.

Dr. Vernon then showed a publicity film dealing with the pasteurisation of milk in which stress was given to the necessity for cleanliness and sterilisation.

In the discussion that followed several questions were answered dealing with problems related to the pasteurisation of milk.

The Metallurgy of Iron and Steel
(Professor T. Leech, 11th June, 1942).

At its third meeting the Auckland Branch were priviledged to hear a very interesting address given by Professor Leech, Professor of Engineering at the Auckland University College.

In his opening remarks Professor Leech stressed the importance of the chemical engineer in modern heavy manufacturing industries. New Zealand founders and engineers had not appreciated the value of chemical engineers and even today they were unable to produce large steel castings free from porosity.

Since the war Australia has made large strides in her iron and steel industries. However, her resources of iron ore are sufficient for only 50 years at the present rate of consumption. On the other hand New Zealand has enough iron ore, including the iron sands, to supply both Australia and New Zealand for 500 years at this rate. Therefore it is up to New Zealand chemical engineers to solve the problem of the successful utilisation of these iron sands.

Professor Leech then dealt with the various physical properties of iron and steels, the methods used for testing them, and the significance of the results obtained in relation to the composition and uses. Such properties are tensile strength, ductility, compressive strength, hardness, torsion strength, and impact resistance. Both lantern slides and exhibits were used to make the position clearer.

The lecturer then dealt with the physical properties of iron and steels in relation to their carbon content. Pure iron exists in three different forms having different properties at different temperatures, but the introduction of carbon greatly alters the properties. By adding another metal, such as nickel or cobalt, to form an alloy, the desirable properties of the high temperature form, Austenite, can be retained on cooling. This effect can also be produced to a large extent in ordinary steels by quenching.

A number of slides were then shown demonstrating the effect on crystal structure of tempering and annealing different steels. In general small crystals are required for high tensile strength and are obtained by only gentle heating. The heat treatment of steels profoundly influences the properties, so rigid control must be exercised in this process.

An interesting film was then shown covering the production of iron and steel in Australia at the present time. It also showed their processing into finished articles, such as railway irons, galvanised sheet and pipes, wire netting, and wire ropes.

Personal Items

We wish to apologise for an error we made in the June issue of the Journal. Mr. J. E. Brundell is not in camp as previously stated but is in an administrative post in Suva. Mr. W. J. Blackie, the Government Analyst in Suva, has been on leave in New Zealand and in his absence Mr. Brundell has been carrying on his work.

We are sorry to hear that Mr. L. Osgerby has left Auckland. He has taken a position with Messers Glendermid Ltd. at Dunedin.

Pilot Officer E. A. Blair.

We regret to announce the death on active service of Pilot Officer E. A. Blair, R.N.Z.A.F., a local member of the Auckland Branch. He was educated at Takapuna Grammar School, and before joining the Air Force was in the employ of Reid Rubber Ltd. Pilot Officer Blair is the second member of the Institute to be killed on active service.

WELLINGTON BRANCH

On May 26th, a visit was paid to the National Carbon Pty. Ltd., and Mr. D. H. Freeman gave a survey of the more important physical and electro chemical aspects of the Leclanché cell, after members had inspected the factory and seen a table demonstration of the manufacture of dry cells with samples from the production line.

The fundamental cell reaction is $Zn + 2NH_4^+ = Zn^{++} + 2NH_3 + 2H$ and the mechanism of ammonium ion discharge on the surface of graphite particles was discussed. Depolarisation, on which the efficiency of the cell depends was treated in relation to the products of reaction, hydrogen and ammonia. Hydrogen is oxidised to water by manganese dioxide. The mechanism appears to be that hydrated ions of tetravalent Mn are reduced to the trivalent state, the electron coming from the hydrogen atom liberated by the discharge of the ammonium ion. This mechanism explains the effect of pH on the cathode potential. If lower oxides of Mn are produced, as during an unusually heavy drain of current, the voltage drops considerably.

The accumulation of NH_3 constitutes a serious problem. It reacts with water to form ammonium ions, with development of alkalinity, and with zinc ions to form a complex ion.

Three regions in the cell contribute to the voltage, carbon-core voltage, core-paste voltage, paste-zinc voltage and each was discussed in the light of Nernst's theory of electrode processes.

Over 600 tons of chemicals of particularly high purity are used in the manufacture of cells, whose average weight is about 80 gms. Technical control is of the greatest importance. It is doubtful if there is any other article marketed for a few pence, which requires as many as 17 major chemicals undergoing 11 different primary processes, and from 25 to 40 production stages.

Dr. C. R. Barnicoat was the speaker at the June meeting, his subject being, The Biochemistry of Milk Secretion.

Milk, sometimes described as the "perfect food", is a remarkably complex secretion, specifically designed by Nature for the nurture of the mammalian young.

The secretion of milk is under hormonal control and the lactation process follows an orderly sequence of changes. As lactating animals draw freely on their supplies of reserve fat, as well as on the Calcium and Phosphorus of their bones, and as the modern dairy cow secretes several times the amount of milk which would be required of her if she were merely fulfilling the natural function of rearing her calf, the necessity for correct and ample feeding is imperative.

It has long been believed that milk is derived from the blood, with which it is isotonic, but very different in composition. Proof was obtained by the Kaufmann and Magné technique, and particularly its later improvements. In this method comparative analyses are made of blood drawn from arteries supplying an active mammary gland, and from the blood leaving it through the mammary vein. In this way it has been possible to show that glucose is the precursor of lactose (and possibly also of the volatile fatty acids typical of all milk fats), and also that milk proteins are derived from amino acids of the blood. The mineral composition of milk resembles that of the tissues, rather than that of blood, and the presence of calcium phosphate in the colloidal state is noteworthy.

By far the greatest amount of attention has been directed towards the biochemical problems connected with the derivation of the commercially valuable fat content of milk. Many theories have been advanced, none of which has proved entirely satisfactory. Recently workers in the U.S.A., using an ingenious modification of the Kaufmann-Magné technique, have shown that milk fat is mainly derived from the "neutral fat" of the blood (as others have also postulated), but by eliminating large sources of error not formerly suspected, they have demonstrated that the absorption of blood fat by the mammary gland (which is controlled by the pituitary gland) does not reach its maximum rate until several hours after milking. On the contrary, the synthesis of the proteins and mineral matter of milk proceed at a steady rate throughout the entire secretory phase.

CANTERBURY BRANCH.

Dr. H. G. Denham spoke on "The Future of New Zealand Industries" at the June Meeting. Of the four main primary products on which our export trade depends, two are definitely threatened by competitive products. Butter has to meet the challenge of vitamin enriched margarine sold at 8d. a lb., and wool, already competing with artificial fibres based on cellulose, which have, however, often acted as a complement to it, is directly threatened by lanital, the fibre derived from casein, which dyes well, is moth proof, and almost as strong as wool. Meat may be endangered in the future by protein foods obtained direct from grass without the aid of the sheep or bullock. Such developments will require a more diversified type of farming than employed hitherto, and probably the marketng of a much higher percentage of our dairy produce as cheese. Linen flax is a new crop capable of development, both for fibre production and linseed oil. Sugar beet could provide 30 lbs of sugar per head from 8000 acres of good arable land. Somewhat doubtful is the production of 5-10 per cent of our motor fuel requirements by an alcohol industry based on potatoes or artichokes.

The only metal deposits of commercial value are the Onekaka iron ore, and the main difficulty is to produce a good metallurgical coke in adequate amount. For a light metal industry, our magnesite deposits are only of about 50 per cent purity, compared with the 95 per cent England imports, and production from sea water by the American process could only be justified by proximity to a large market. Aluminium production on an economic basis still relies on bauxite, and our only asset would be low power costs. Actually our power costs can not be classed as very low. Electro-chemical industries based on the conversion of salt offer possibilities, but there is no indication that we can produce salt at a cost comparable to the imported material, and the extent of such an industry depends on the amount of chlorine we can find a use for. The best prospect is the chlorine process for converting straw, which we waste now, into pulp. A plastic industry based on casein can not be developed if it is more profitable to use skimmed milk for pig food.

Dr. Denham concluded by saying that chemical engineers will be needed, and suggested that the time is overdue when the claim put forward two years ago by Canterbury College for a Department of Chemical Engineering should be recognised.

The Branch was looking forward to the visit of Mr. S. H. Wilson of the Dominion Laboratory, who was to address the July meeting on "Spectrographic Analysis." The lateness of the inter-island steamer prevented Mr. Wilson actually delivering his lecture, and members regret the long journey he made for the short time he was able to be present. Mr. Wilson had sent the script of his lecture in advance, and the reading of it was completed in time for him to discuss the tables and slides.

After an introduction dealing with the importance of new physical methods for the analysis of small amounts of substances, the lecturer explained the fundamentals of spectrographic analysis, covering the excitation of an emission spectrum by the flame, spark, and arc, the analysis by the quartz spectrograph, and the examination of the photographic record. The role of spectrographic methods in the analytical laboratory was then discussed. Spectrographic analysis is a micro method, a 5 or 10 mg. pellet being used for a general examination, making the method unapproachable for forensic work. It can be used where the chemical method is troublesome and unreliable, as in the estimation of strontium. A great saving in time is accomplished, as in the estimation of lead in alloys. The electrolytic separation as PbO_2 required 20 gms and 2 hours, a colorimetric method 2 gms and one hour, the spectrographic ten minutes, and other metals were checked at the same time. This last fact shows another advantage. To exploit the advantages to the full it is necessary to limit chemical treatment to a minimum, and record the lines of all elements sought as far as possible on one spectrogram.

The method used for trace elements in biological samples was explained in detail, and a table shown comparing the results with chemical methods. Twenty minor elements can be detected in addition to the six major ones, and a number of familiar metals have not been found in such material.

The composition of igneous rocks was shown and the postulate of I. and W. Noddack of the universal presence of all the elements in any reasonably sized portion of any mineral was discussed. The lecture concluded with some observations on future developments.

In the discussion, Mr. Wilson was congratulated on the skill he has shown in developing this valuable method of analysis in its application to New Zealand problems.

OTAGO BRANCH

FERMENTATION

Mr. D. A. Dick

After a short introduction on the historical aspect and general nature of fermentation the speaker went on to describe the chemical mechanism involved in anaerobic alcoholic fermentation. The intermediate products, side reactions and the enzymes producing the reactions were discussed. The whole is a delicately balanced system containing equilibrium reactions and compensating oxidation-reduction reactions. If the balance is upset by inhibition or acceleration of particular enzymes or by altering oxidation potentials, different end products could be obtained—reference was made to glycerine production, lactic acid and other fermentations. The object of alcohol production etc. is the liberation of energy from organic matter by breakdown to substances non poisonous and readily eliminated from the organism. Respiration, i.e. breakdown by oxidation, frees much more energy than fermentation and the effect of air on increased growth of yeast and the disease organisms of beer was mentioned.

The growth of yeast was then discussed—the absorption of ammonia from certain types of amino acids, the residue of the amino acid becoming an acid or alcohol by oxidation or reduction, e.g. succinic acid and amyl alcohol. Most of the cell structure is synthesised from ammonia and sugars or their degradation products but there are certain substances which must be supplied and are essential in quantities of the order of parts per million. Notable among these are; Bios 1 Inositol obtained from its phosphate, Phytin the main source of phosphate in cereals; Bios 2 A "pantothenic acid", possibly beta-alanine or compound of it: Bios 2 B vitamin B 1, the pyrophosphate of which is cocarboxylase one of the enzymes responsible for liberation of CO_2: Vitamin B 2 which in phosphate protein combination is one of the oxidation—reduction enzymes; Vitamin B 3 which with ribose phosphate and adenine is co-oxymase; ribose and adenine are obtained from nucleic acid, one of the cereal sources of phosphate which plays so important a part in fermentation reactions. Of particular interest and significance are the points of similarity between different forms of fermentation and growth, and those processes occuring in animal tissue.

Industrial Temperature Measurement and Control

Mr. R. V. Peryman

The lecturer briefly pointed out disadvantages of the mercury glass thermometer and went on to describe the mercury-in-steel thermometer. The basic construction of the latter instrument consists of a steel bulb connected by a very fine uniform metal capillary to a well made bourdon gauge the whole being filled with mercury. Corrections for expansion of the steel containing parts are made by the insertion of small blocks of material with low expansion coefficient (invar). The instrument is really a pressure gauge calibrated in degrees of temperature. The mercury-in-steel thermometer is robust but expensive in quantity and liable to error.

The vapour pressure theremometer is broadly similar in construction to the mercury-in-steel type.

The lecturer then described and demonstrated uses of "bimetal" strips, which consist of two strips of metal of greatly differing coefficient of expansion welded together. On heating such a strip a bending movement takes place and this movement can be used to operate electric devices etc.

While single electrical thermometers of the thermocouple and resistance types are expensive their construction enables a great number of thermometer units to be connected to one reading device thus showing a saving in cost (the thermometer units being inexpensive while the reading device is not) over the mercury-in-steel type and of course showing gain in convenience. Thermocouples derive their effect from the thermal variation in electric contact potential which occurs between dissimiliar metals. Copper and constantan; copper and iron; copper and nichrome are frequently used to form the thermocouple and the voltage variations produced by thermal fluctuation can be measured by a galvanometer (very low resistance type or better by a low resistance potentiometer). For temperature measurement one generally calibrates the thermocouple using for reference a graph of e.m.f./temp. The electrical resistance thermometer depends on the measurement of resistance variation with temperature. The electrical circuit is a Wheatstone's bridge one arm of which is a wire whose thermal coefficient of resistance is high (platinum alloys or pure nickel). This wire is exposed to heat (usually in a silica tube) and the balance of the Wheatstone's bridge is upset. By calibrating the bridge in degrees of temperature a very accurate thermometer is obtained. Both the thermocouple and resistance thermometers are capable of being used over wide ranges of temperature.

In the latter part of the lecture industrial methods of recording and controlling temperature were discussed. A common type of recorder consists of a clockwork driven drum on which a stylus actuated by a suitable thermometer leaves an inked line on a chart. Use is sometimes made of photographic records of the position of the mercury thread in the common thermometer.

One of the chief problems in temperature control is lag in effect of heating devices; that is the thermostat control may be very precise but cannot allow for lag in the effect of the heating element being felt. This difficulty applies specially where large spaces are to be maintained at steady temperature.