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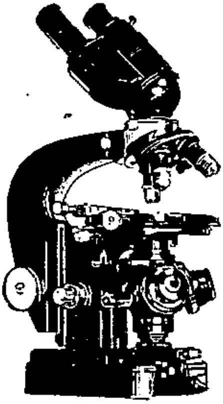

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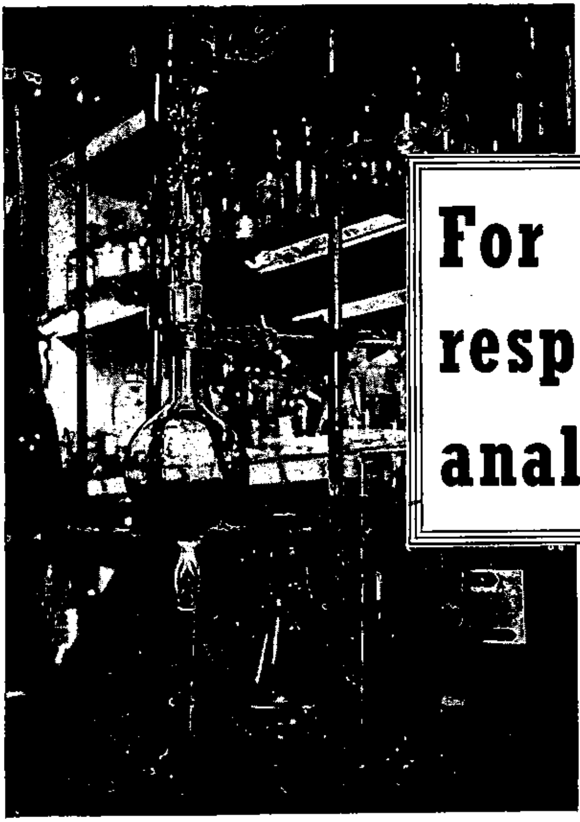

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SOME FACTORS AFFECTING FLOUR QUALITY

By L. H. BIRD, M.Sc., A.N.Z.I.C.

Wheat Research Institute, Christchurch.

(Chairman's Address to Canterbury Branch, June, 1948.)

Under the title "Some Factors Affecting Flour Quality" I propose dealing only with those which are common and have a pronounced influence on flour. Flour is judged usually on its suitability for bread-making, though other industries such as biscuit, cake, starch, gluten and adhesives use flour, and the requirements differ for each.

In breadmaking, quality will depend on whether we seek good baking performance with maximum palatibility or maximum nutritional value. The present-day trend, with the nutritional aspect to the forefront, is to have a flour which has a nutritional value as high as possible without reducing palatibility, and efforts to achieve this in New Zealand will be discussed later.

The first requirement is to have a flour which will withstand the various baking procedures and produce a loaf having good volume, crumb texture and colour, and reasonable keeping quality. In discussing quality we must first go back to the wheat from which the flour is produced. Some varieties inherently give flour of poor baking quality; others are good to excellent, though there is considerable variation within each variety depending on soil and climatic conditions in the locality where it is grown. Baking quality is generally considered as being fairly dependent upon protein (gluten) content and in some countries this is taken as a measure of the suitability of each line of wheat for any particular purpose. Wheats with a high protein content are classed as "strong" and excellent for the purpose of making bakers' flour, while those with low protein are considered as "weak" and suitable for certain types of biscuit.

This is a simple—perhaps over-simplified—means of selecting wheats, but, nevertheless, under conditions where a wide range of protein content is available, affords a rapid though broad classification. Analysts often do not go even to the trouble of determining protein by chemical means, but simply wash out the gluten and on this test alone pay premium prices for wheats wtih high gluten yield. In New Zealand, however, the grading is not so simple. The protein content of all our flour ranging from the best to the poorest, falls within a very narrow range, and if the new wheat, Hilgendorf, is omitted, then the range of existing commercial flours is narrowed still further. With this in mind it is obvious that we cannot judge flour quality merely by carrying out a protein determination. In our case quality depends on protein quality rather than quantity, and our only means of evaluating flour quality from the baking point of view is by actually baking each flour. This is done under standard conditions, and if the test indicates any abnormality, further tests using modified procedures are carried out in order that a flour should be judged on its inherent merits.

Apart from the quantity and quality of protein present in any particular flour, we have to contend with a characteristic known as the "maturity" of the flour. Under standard baking conditions some flours produce a loaf of poor volume with very open crumb texture composed of thick-walled cells. Such flours are said to be "green" and if the flour has sufficient "strength" can be overcome to a large extent by longer fermentation or the use of improvers such as Potassium Bromate or ascorbic acid. It has been overcome experimentally by exposing freshly harvested wheat to a very low concentration of ethylene. This condition is often associated with flour milled from new wheat shortly after harvesting and gradually disappears with ageing of either the wheat or the flour if it is "green" when milled. In general, gluten from such flours lacks elasticity and tends to flow readily. Other flours give a loaf of good volume with a soft, close, thin-walled crumb texture and these are said to be "mature." Gluten from such flour is very elastic—rubber-like. A third major group of flour is known as "over-mature." In this case the loaf has poor volume with torn crust and a poor crumb texture. Gluten from such flours tears readily if stretched. These flours can be used to best advantage by blending with those showing greenness. In a normal season we encounter all three major types together with various intermediate ones.

At the beginning of each season we expect flours to exhibit "greenness" unless millers have been fortunate enough to carry over sufficient stocks of wheat from the previous season so that they can use smaller proportions of new wheat. For the greater part of the year, the majority of flours are mature and towards the end of the season we expect to encounter a few lines showing over-maturity to varying degrees. With the introduction of 80% extraction there has been a tendency towards more greenness than at the lower extraction rate. This is due to inclusion in the flour of higher proportions of bran dust and pulverised wheat germ and is accentuated if the wheat contains too little moisture at the time of milling. Wheat germ, particularly, has a pronounced greening effect due to its glutathione.

Wheat germ and lower grade mill streams have a high content of reducing matter and it is probably through slow oxidation that a maturing effect with age is noted. Overseas workers have found that low-grade flours show improvement if the dough is mixed in an atmosphere of oxygen instead of air.

Dr. Stern recently checked all low-grade flour streams from a local mill for reducing matter with the object of correlating this with the damaging effect of such flours when added to normal flour. Unfortunately some of these flour streams are rich in thiamine and a compromise between elimination of the damaging effect and retention of thiamine will have to be made.

I will now mention some abnormalities which are encountered from time to time. The most serious abnormality which we encounter is excessive alpha-amylase due to sprouting of wheat in seasons with unfavourable weather at the time of harvesting. The germination is accompanied by a rapid rise in the amount of alpha-amylase present, while the β-amylase content remains constant. A period of three days' sprouting increases the alpha-amylase activity by 1,000 times. Higher extraction also enhances the proportion of alpha-amylase passing in to the flour. Dough made from flour which has a high alpha-amylase activity handles normally, but during the early part of the baking the temperature is very favourable to a high rate of starch degradation, with the result that the loaf has a doughy crumb. If the alpha-amylase is very high, the crumb may be very doughy and sticky, in which case the flour is entirely unfit for bread-making. Such flours also lead to difficulty when used for thickening gravies or making paperhangers' paste. The most effective means of overcoming this difficulty is strict control of the proportion of sprouted wheat used in the grist.

A rather unusual fault with New Zealand flours is due to low β-amylase activity. In this case the loaf has an underfermented appearance and a pale crust colour. The difficulty can be readily overcome by addition of drastatic malt. A very rare abnormality in recent years is brought about by excessive proteinase (bug wheat) which has been injected into the grain by insects at a late stage in its ripening. Flours milled from such wheats are entirely unfit for bread-making.

Before passing on to current problems concerning 80% extraction, I will discuss the nutritional aspect of flour quality.

Since flour in one form or another forms a relatively large part of the human diet, it has been realised for some years that any move in the direction of raising the thiamine content of flour would improve national health. This has been done in some overseas countries by the addition of synthetic thiamine to all flour. In New Zealand an early effort was made by devising a method whereby a large addition of wheat germ could be made to white bread so that those who desired it could have the higher thiamine level. The other alternative is to use only wholemeal but that course has the disadvantage of increasing at the same time the phytic acid content to a dangerous level and thereby reducing calcium assimilation. Normal white flour consisting principally of endosperm contains about 1.8 γ/g. thiamine whereas wholemeal contains 4-5 γ/g. The richest source of thiamine in the wheat grain is the scutellum, this small portion of the grain accounting for 50-60% of the total. Wheat germ contains only 1½-3% of the total, though germ itself contains about 15 γ/g. The scutellum normally passes out of the mill in some of the pollard streams. During the war, a successful attempt to extract thiamine from certain pollard streams was made in New Zealand with the result that by the addition of about 1½% of a low-grade flour to the normal flour, the thiamine content was raised to about 2.5 γ/g. —a significant increase in view of the fact that the baking quality of the resulting flour was in no way impaired. Moreover, the phytic acid level was not appreciably raised. Before this process—the treatment of selected pollard streams in a simple centrifugal detacher—was put into general use, the shortage of wheat necessitated an increase in extraction rate to 80%. The machine designed for production of high vitamin white flour was then used to recover sufficient extra flour from pollard streams to increase the extraction rate to 80%.

With the increased extraction the thiamine content rose to about 3.3 γ/g., but not without some deterioraion in the baking quality of the flours produced. The phytic acid content was roughly doubled, but was still considered to be at a safe level. So, with the increased rate of extraction we have lost some of the former palatability, but at the same time have doubled the thiamine content. This level of thiamine is considered by nutritional authorities to make up the former deficiency in a normal New Zealand diet. All mill streams from a typical mill have been checked for both thiamine content and damaging effect on baking quality, so that in the event of a lowering of extraction rate it will be possible to compromise between elimination of damaging effect on baking quality and retention of a satisfactory thiamine level.

In conclusion, mention is made of a problem associated with 80% extraction flour which is at present being investigated.

It was seen that there was no direct correlation between the freedom of flours from bran specks and the colour of the bread crumb produced from it. In many cases, a flour was judged as being of satisfactory colour and yet the crumb of bread produced from it was very dark in colour. On the other hand many flours which were considered to contain too high a proportion of small brain specks gave a crumb colour which was satisfactory. This was soon proved to be due to an enzymic oxidation of some substrate present in the low-grade portion of the flour. Investigation showed that wheat germ at a suitable pH produced a dark purple colour in the presence of oxygen and that similarly bran produced a dark brownish-black colour.

All low-grade flour streams contributing to the increased extraction rate are now being checked for the oxidising enzymes, catalase, peroxidase, tyrosinase and ascorbic acid oxidase with a view to correlating their enzyme content with the production of a dark crumb colour. Information gained from this investigation will be applied along with that mentioned above, when the question of lowering the extraction rate arises. We hope to be able then to select mill streams so that the resulting white flour will have a thiamine level higher than that of former white flour.

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The following item, taken from the Industrial Edition of the Journal of the Indian Chemical Society, states the aims of our sister body in India, the Institution of Chemists (India):—Minimum pay for graduates in science with adequate technical experience be fixed at Rs 250/- per month. (The present rate of exchange is about 10 rupees to the £1N.Z.) Occupation of chemist to be deemed a hazardous one. Hours of work to be limited to six a day. Total period of service in laboratory and works qualifying for full old age benefits to be 25 years.

Mr. R. W. Green, Associate, formerly of R. Greenwell Ltd., Auckland, has been appointed research physical chemist at the Dental School, Dunedin.

Mr. D. S. Cumberbeach has left Donaghy's Rope and Twine Works, Auckland, and has taken up teaching.

Miss Marion Harrison is taking Ph.D. at the University of Cambridge. Working under Dr. McCance of the Department of Medicine, she is carrying out research on mineral metabolism.

THE UTILIZATION OF ORGANIC WASTES IN THE MAINTENANCE OF SOIL FERTILITY

Summary of a lecture delivered to the Auckland Branch at its May meeting by Dr. J. K. Dixon, President New Zealand Institute of Chemistry.

The organic content of soil follows climatic factors such as rainfall and temperature. Its quality is governed by the type of vegetation that has produced it. For instance Kauri forest gives much organic matter of poor quality which is slowly weathered with the production of considerable amounts of organic acids which leach plant nutrients from the soil, while Taraire forest gives a small amount of rich humus which is destroyed quickly, leaving an abundant mineral residue.

In practice a high organic and high mineral content of the soil is ought. Humus is desirable in that it increases the water-holding power of the soil, thereby stabilizing the water supply to the plant and giving a greater resistance to drought. This is very important. Humus has a marked effect on soil structure in granulating and lightening clays and binding sandy soils, thereby allowing diffusion of air and the "breathing" of the soil through temperature. changes. Humus supplies nutrients, especially nitrogen, and holds nutrients supplied from other sources. It supplies energy for nitrifying bacteria and supplies a suitable medium for mycorrhizal associations where these are necessary. As shown by hydroponics, none of these features of humus are absolutely necessary, but may be likened to an insurance policy which is a buffer in times of need.

New Zealand is not primarily a fertile country and owing to its munificent rainfall its soils have been extensively leached of essential plant nutrients, especially lime and phosphate. In the change-over from forest to pasture little humus has been lost where this change has been made quickly. This is not the case, however, where erosion has set in, or where the soil has been cultivated and humus has been lost through more rapid oxidation. Good grass cover with its attendant root dying will maintain or even increase the humus content of the soil and the only problem here is the supply of plant nutrients. This type of farming is therefore the most suitable for New Zealand conditions and it follows that good prices for wool, meat and dairy products are conducive to the maintenance of New Zealand soil fertility.

Cropping such as wheat growing and market gardening on the other hand depletes humus reserves and it is essential that these be restored. This may be achieved in several ways such as sowing down in temporary pastures, green manuring and the return of all plant residues to the soil. The latter is not always easy and may be accomplished through composting.

Composting is an artificial process which hastens decay by employing high temperatures, aeration and adequate moisture. A simple form of nitrogen supply for the bacteria is required in the heap and the ratio of carbon to nitrogen is the dominating factor in the processes of decay. Mature humus has a carbon-nitrogen (C/N) ratio of 10 which is that found in bacterial bodies. Humus, with a higher ratio than this, will utilise free nitrogen in the soil for bacterial growth at the expense of higher plants thereby causing a relative nitrogen deficiency.

The reaction going on in the compost heap may be visualised as follows—during bacterial growth twice as much carbon is expired in metabolism as is used in the formation of the microbial cell. Cycles occur of growth of bacterial organisms followed by death and decay, and fresh growth of bacteria which utilise the bacterial remains and excess organic matter from the previous cycle. For instance at the end of the first cycle in the decay of organic matter containing 1000 lbs. of carbon and 12.5 lbs. of nitrogen (a C/N ratio of 80) there will be 12.5 lbs. of nitrogen and 125 lbs. of carbon as microbial cells, 250 lbs. of carbon lost in expiration and 625 lbs. of undecomposed carbon. The C/N ratio of the heap will now be $(125+625)/12.5=60$. Similarly at the end of the second cycle the C/N ratio will be $(125+375)/12.5=40$. This process will continue until a C/N ratio of 10 is reached.

Further decomposition and bacterial growth will lead to the liberation of free ammonia, which will be available to higher plants as follows: 125 pounds of bacterial carbon, two-thirds expired and one-third (42 pounds) utilised in the formation of microbial cells. This requires 4.2 pounds of nitrogen and the remaining 8.3 pounds of nitrogen is now liberated and is available for higher plant growth (where the initial C/N ratio is 10). While any compost mixture will rot down in time, it will be seen that the lower C/N ratio (below 10) will result in loss of free ammonia if composted, so that mixtures such as these are either applied directly to the soil or composted with materials having a high carbon content. In practice materials with a high carbon content and low nuisance value are composted with materials having a high nitrogen content and usually a high nuisance value (e.g., sewage) as these latter become available so that the initial nitrogen content of the mix is about 1.7% and the C/N ratio is therefore about 20.

In the manufacture of compost the amount and quality of the waste materials available are most important. Some of these available in New Zealand are garbage, sewage sludge, saw-dust, hop waste, grain offal, flax strippings, straw, street grasses and fish and meat offal. Household garbage is best composted by the householder himself. The wastes available will produce about 100,000 tons of compost a year and this applied to market gardens alone at the optimum rate of 10 tons to the acre will supply only 10,000 acres, which is two-thirds of the market gardens of New Zealand. Whether large-scale composting in New Zealand can be a sound economical proposition at the present time has yet to be proved and a considerable amount of research on our own materials is required. The Dannevirke scheme, which is already operating, is providing much valuable information, and the development of the proposed pilot plant in Auckland will be awaited with interest.

In the discussion which followed the lecture Dr. E. B. Davies, of the Soil Fertility Research Station, Hamilton, described pot experiments in which the effect of compost obtained from the Dannevirke Scheme was compared with that of "artificial" fertiliser. Pots containing compost gave yields somewhat less than those containing added amounts of essential plant nutrients. However, pots containing both compost and added plant nutrients gave yields far greater than those of any other, and these yields could not be accounted for merely by the summation of minerals present.

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Dr. L. H. Briggs, Associate Professor of Organic Chemistry at Auckland, and Mr. A. D. Munro of Victoria College, are both leaving shortly on a Sabbatical year.

Mr. W. S. Metcalf, Physical Chemistry Lecturer at Victoria College, is marrying Miss Simmers, of the Soil Research Bureau, and they are then leaving for Oxford where Mr. Metcalf will be studying for his Ph.D.

Mr. L. G. Neubauer, of the Dominion Laboratory, who is studying at the McGill University, Montreal, under a National Research Scholarship, recently topped his class in Wood and Cellulose Chemistry, obtaining 94%.

Mr. T. A. Rafter, of the Dominion Laboratory, is to leave shortly for overseas for further study on radiochemistry. He will be visiting Massachussetts Institute of Technology and Columbia University.

Mr. W. L. Barr has left N.Z. Plywoods, and is now with N.Z. Forest Products, both of Auckland.

BRITISH CHEMICAL CONTRIBUTIONS TO SOIL SCIENCE AND PLANT NUTRITION

Fourth Mellor Memorial Lecture,
delivered to the Wellington Branch by
Sir Theodore Rigg, Director, Crawthron Institute, Nelson.

Chemists of different nationalities have played a major role in the development of knowledge concerning the properties of soil and the nutrition of plants. In no country is the contribution of chemists to soil science more outstanding than that of Great Britain. Among the early British chemists who added to our knowledge of soils and the nutrition of plants may be mentioned Joseph Priestly, J. B. Lawes, J. H. Gilbert, J. T. Way and R. Warington. All these men were associated with the Chemical Society and were responsible for much basic knowledge on which later contributions have depended. Towards the end of the 19th century and in the early part of the 20th century B. Dyer, A. Voelcker, A. D. Hall and E. J. Russell carried on the close connection of chemistry with soil science, and were responsible for considerable advances in our knowledge of soil properties and the nutrition of plants. In quite recent times, chemists throughout the British Empire have made a splendid contribution on a new aspect of plant nutrition, namely the role of minor elements in relation to both yield and quality of crop. With the exception of the early observations made by R. Boyle, John Woodward, Francis Home and Joseph Priestly, it may be said that systematic work in soil science and plant nutrition started with J. B. Lawes and J. H. Gilbert at the Rothamsted Experimental Station in 1843. For over fifty years commencing with Lawes' work on superphosphate, the history of soil science in Great Britain is the story of the achievements of the Rothamsted Experimental Station. About 1890 other workers not so closely associated with Rothamsted began to make important contributions, but Rothamsted still maintained its place as the great centre of research for all aspects of soil and plant relationships. It is only within the last forty years that the development of agricultural science in Great Britain and in other parts of the Empire has brought into the research field a vast increase of qualified scientists engaged in soil and plant nutrition research.

Early Investigations

Among the early British contributors in soil and plant science may be mentioned R. Boyle, John Woodward, Francis Home and J. Priestly.

Boyle repeated Van Helmont's experiment by growing an Indian squash in soil which was weighed at the commencement and the end of the experiment. He came to the same conclusion as Van Helmont that the substance of the Indian squash plant was made from the water. He failed to note the significance of the small loss in the weight of the soil at the end of the experiment and the possible influence of air on the growth of the Indian squash.

In 1699, John Woodward carried out a quantitative experiment on the growth of spearmint, weighing his plants at the commencement and at the end of the experiment. He showed conclusively that growth was greater in drainage water or water impregnated with garden mould than with rain water. He considered, therefore, that growth of plants was dependent on certain properties of terrestrial matter.

Francis Home in 1757 advanced knowledge on this point one stage further by showing in his pot experiments that various substances had the property of accelerating plant growth. Among the substances tested by him with good results were saltpetre, Epsom's salts, vitriolated Tartar and oil. He concluded that growth of plants was not dependent on the supply only of one particular substance, but depended on several.

J. Priestly in 1775 discovered that sprigs of mint made air purer and exercised the opposite effect on air to that of animals. At this stage he had not discovered oxygen, so was at a loss to explain his result.

About this time great advances were being made by European scientists concerning the physiology of plant growth. Ingen-Housz and Jean Senabier in 1782 gave the correct explanation of the action of plants on air and explained the results obtained in the early experiments of Van Helmont and R. Boyle.

De Saussure in 1804 demonstrated clearly the respiration of plants and the utilization of carbon di-oxide in their development. He introduced the quantitative method of laboratory experiment and showed the importance of nitrogen and alkalis obtained from the soil.

It was Boussingault in 1834 who first applied the new knowledge of plant growth to agriculture. He adopted the quantitative methods of De Saussure and weighed manures and crops and determined nitrogen. He was able to compile accurate statistics over a rotation of crops, showing thereby that nitrogen of the air must be utilized by some crop in the usual four or five-year rotation.

In 1840 Liebig made his famous report to the British Association. He ridiculed the older school of plant physiologists who believed that plants obtained their carbon from the soil and not from the air. He emphasized the great importance of the mineral plant foods and laid increasing stress on his view that plants secured their nitrogen mainly from the air and not from the soil.

Rothamsted Experiments

John Bennett Lawes, who had become interested in chemistry while a student at Oxford, established a chemical laboratory at Rothamsted Manor. At first his attention was directed to the composition of drugs. He sowed on his farm poppies, hemlock, bane and belladonna with a view to obtaining material for his experiments. He commenced experiments in pots with agricultural plants in 1837. Spent animal charcoal was a waste product at that time and he was asked if it could be converted to any profitable use. He experimented with it in various ways and soon discovered that with treatment with sulphuric acid it became of considerable value in the growth of certain crops. He then treated apatite and other mineral phosphates in a similar manner, laying the foundation for the great superphosphate industry of today.

The application of sulphuric acid to bones had been practised before Lawes' patent was taken out. The novelty of Lawes' invention was its application to mineral phosphates and its use for farm crops.

At this stage Lawes' time was devoted in part to the development of superphosphate manufacture, to which was added in a few years the manufacture of citric and tartaric acids and in part to the development of the agricultural experiments at Rothamsted. In 1843 he secured the services of a first-class chemist in the person of Dr. J. H. Gilbert and from this date for 57 years the partnership was continued.

Although Lawes and Gilbert were strong supporters of the importance of minerals in the growth of crops, they were at variance with Liebig on the value of his prepared mineral manure and his belief in atmospheric nitrogen as the source of nitrogen for plant growth.

The early Rothamsted experiments were carefully planned to obtain information on both these questions and were continued without serious alteration throughout the whole period of Rothamsted experimental work.

They adopted Boussingault's quantitative method in their field experiments. Manures and crops were weighed and analysed. As a result of their careful work, they quickly obtained data which proved conclusively that certain crops did not obtain nitrogen from the air but were dependent on the soil and added manure for this plant food. The experiments laid down by Lawes and Gilbert have continued to give information of great value on many aspects of soil science and of plant nutrition. For the most part the experiments are still maintained on the exact plan laid down by Lawes and Gilbert.

By 1885 Lawes and Gilbert were able to summarize the more important results from their experiments. They were as follows:

(1) Crops require phosphates and salts of the alkali elements, but the composition of the plant ash does not afford reliable information as to the amounts of each constituent needed by the crops. e.g., Turnips require large amounts of phosphoric acid, although comparatively little is present in the ash of the crop.

(2) Non-leguminous plants require a supply of some nitrogenous compounds, nitrates and ammonium salts being almost entirely good. Without an adequate supply of nitrogen, no increase of plant growth is obtained even when ash constituents are added. The amount of ammonia obtained from the atmosphere is insufficient to supply the needs of crops. Leguminous crops behave abnormally in regard to their needs for nitrogen.

(3) Soil fertility may be maintained, for at least some years, by means of artificial fertilizers.

(4) The beneficial effect of fallowing lies in the increase of available nitrogen in the soil.

It must be added that farmers were slow in adopting the use of artificial manures, many maintaining that the new fertilizers acted only as stimulants and finally exhausted the soil.

Exchangeable Bases in Soil

An important contribution to our knowledge of soil properties was made by J. T. Way in 1852. He showed that nitrates were present in soil, but still believed that ammonium compounds were the chief source of nitrogen in the nutrition of plants.

He followed up an observation made by a Yorkshire farmer that soil prevented the loss of ammonia from farmyard manure. Way demonstrated clearly that the observation was correct and that the absorbing power of the soil resided in the clay fraction of the soil. He showed that ammonia displaced from the soil an equivalent amount of calcium. Although little practical use was made of this discovery, the determination of exchangeable bases in soils has become standard practice in many laboratories in recent years.

Nitrification in Soils

Another valuable contribution to soil science was made by R. Warington in 1878. Warington, following on the discovery of the French chemists Schloesing and Muntz that nitrates could be produced from ammonia by bacterial action, investigated the occurrence of nitrates in Rothamsted soil. He showed that there were two distinct stages in the bacterial conversion. In the first stage ammonia was converted to nitrite, and this compound was then transformed by another species of bacteria to nitrate. He established conclusively that nitrates, not ammonia compounds, were the main source of nitrogen in the growth of many plants. The puzzle concerning the nitrogen nutrition of leguminous plants was solved ten years later by Hellriegel and Wilforth who discovered the special role of symbiotic bacteria in the nutrition of legumes.

Available Plant Food

Bernard Dyer in 1894 investigated the possibility of obtaining more precise information concerning the status of phosphates and potash in soils and the response which different soils were likely to make when treated with these manures. He determined the acidity of the cell sap of a large number of plants and then selected a .1 per cent. solution of citric acid as a suitable extracting fluid for what he termed "available" plant food. Although subsequent work by Cameron and Whitney showed that plants obtain plant foods direct from the soil solution and not by a solvent action of the cell sap, Dyer's method of determining the more easily available phosphate and potash in the soils has proved very useful and the method is still employed in many soil laboratories throughout the British Empire and in some foreign countries.

Dyer examined the Rothamsted wheat soils which had been in continuous cultivation with a set manurial programme for fifty years. The results of determination of available phosphoric acid and potash gave a much clearer picture of the fertility status of the wheat plots than the determinaion of total phosphoric acid and potash contents. While differences in the total content of these plant foods varied some 80 to 100 per cent. on different plots, the determinations with 1 per cent. citric acid showed differences of 700 to 800 per cent. on the same plots.

It is interesting to note that E. M. Crowther of the Rothamsted Experimental Station recently has been able to correlate response to phosphatic and potassic manures with the level of 1 per cent. citric solubility of these plant foods in the soils. Crowther showed that the use of the 1 per cent. citric acid solution for the extraction of phosphate and potash was very helpful in estimating the response which was likely to be obtained from manurial treatment.

Interaction of Manures with Soil

The work of J. T. Way and A. Voelcker had previously shown that the fertilising constituents of manures were absorbed by soil and that with the exception of nitrates little loss occurred in drainage waters of the fertilizing constituents.

A. D. Hall in 1909 invesigated in greater detail the interaction of manures with soil, particularly in the case of ammonium sulphate and nitrate of soda. He was able to show that applications of ammonium sulphate resulted in the loss from the soil of an equivalent amount of calcium carbonate. The production of soil acidity by the use of this manure on soils deficient in calcium carbonate resulted from the action of soil fungi on ammonia. It was found that many soil fungi throve on acid soils and used nitrogen from ammonium sulphate for their nutrition, liberating sulphuric acid.

Hall's investigations relating to the interaction of nitrate of soda with soil were likewise of great interest. He showed that the "stickiness" associated with the use of nitrate of soda and to a less extent with some potassic salts, on clay soils was due to the production of carbonates of sodium and potassium respectively which caused deflocculation of the clay particles. He showed that the continued use of nitrate of soda on the wheat plots at Rothamsted was associated with a reduction in the clay content of the soil, caused by the deflocculation of the clay particles. This was accompanied by a relatively great increase in the turbidity of the drainage water from plots treated with this manure.

Soil "Sickness"

Sir John Russell opened up a new line of investigation on microbiological aspects of soil when he followed up the result of a chance experiment which he had arranged to show the cessation of bacterial activity in soils when heated to a temperature of 130° C. In one experiment the soil was heated only to 100° C. and instead of the expected reduction in bacterial activity, as measured by oxygen absorption, he obtained a great increase in bacterial activity.

Prior to this experiment it had been assumed that the micro-organisms of the soil consisted mainly of bacteria concerned in cellulose decomposition and the production of nitrates.

Russell was able to show that the micro-flora of the soil was exceedingly complex and that some organisms were harmful to bacterial development. He concluded that the treatment of soils by heating to 98° C. or with certain antiseptics eliminated protozoa which attacked soil bacteria.

Although it is now known that "partial sterilization" of soil effects much greater changes than the elimination of protozoa, Russell's work has been the starting point for many investigations relating to the micro-flora of soils and their response to heat and antiseptics. These treatments have had a very wide application in glasshouse culture of tomatoes, cucumbers and other crops. In Nelson, for example, the steam sterilization of tomato houses is now standard practice and has resulted in the case of tomatoes of an increase in yield of 3 lbs. per plant.

Minor Elements in Plant Nutrition

Although the importance of certain minor elements, e.g., iron, manganese and boron, had been demonstrated by physiologists for plant nutrition, very few cases of such deficiencies had been noted on farm soils of any country prior to 1933. Among the few cases which were known at this time were those of iron deficiency in fruit trees on calcareous soils. During the last fifteen years notable advances have been made in the identification of minor element deficiency affecting a wide range of crops in many countries of the world, e.g. copper deficiency known as "reclamation" disease of crops in Holland and "die-back" of fruit and other crops in Florida; and manganese deficiency of oats in Holland and Australia and of pineapples in Hawaii.

Chemists throughout the Empire have made a most important contribution in this field of work. Methods for the rapid detection of minor element deficiency have been worked out; data have been assembled concerning the content of minor elements in different plants and practical methods have been devised for overcoming deficiencies in the soils.

Perhaps deficiency of boron in crops has proved the most widespread deficiency among the minor elements. Following on the work of Brandenburg in Germany on "Crown-rot" of sugar beet which he identified as a boron deficiency, investigations have shown deficiencies of boron in many parts of the Empire. Fruit, market garden crops and root crops have been shown in New Zealand, Canada and, to a less extent in Great Britain and Australia, to be affected with boron deficiency.

Copper deficiency has been shown to affect large areas of country in South and Western Australia and to reduce greatly pasture and crop production. In South Africa copper deficiency has been identified in fruit trees, while in New Zealand large areas of peat soils have been shown to respond to copper sulphate applications.

Zinc deficiency originally identified in fruit trees in United States of America has been shown by Australian workers to be widespread in both South and Western Australia and to be a factor of importance in wheat production in Victoria.

Manganese deficiency has been identified in several parts of the Empire. South Australia and Great Britain have made very important contributions to our knowledge of manganese deficiency in different crops.

The progress which has been made in this very important field of plant nutrition reflects great credit on both soil and plant chemists throughout the Empire. It may safely be anticipated that a more critical examination of our soils and crops will reveal further cases of minor element deficiency.

Although it has been possible in this brief review to mention only the more outstanding developments in the history of British achievements in soil science and plant nutrition, it is quite clear that very valuable contributions have been made by British scientists. Chemists have played an outstanding role in these achievements. By their knowledge of chemistry and their critical approach to many problems of high complexity, they have arrived at a solution, frequently opening up in the course of their investigations entirely new fields of research in the subject.

The work of Rothamsted has been extended during the past forty years by investigators in many scientific institutions in Great Britain and in other parts of the Empire. Among these investigators chemists continue to play a very distinguished part in advancing knowledge of soil properties and the nutrition of farm crops.

VITAMIN A.

Summary of Lecture delivered to the Wellington Branch, New Zealand Institute of Chemistry, at Victoria University College, on March 3rd, 1948, by Dr. F. B. Shorland.

Vitamin A has a special interest to New Zealand because in the form of butter we export some three billion international units per annum, while as fish liver oil there are now produced annually some two billion units, much of which is exported. The total production of Vitamin A in New Zealand is considerably in excess of local requirements. In most other parts of the world the local supplies of Vitamin A, even in normal times, are insufficient to meet local demand, and the present situation, with general shortages of milk, butter, and eggs, is such that not more than one-third of the world demand can be met by existing supplies.

The value of New Zealand fish liver oils was first recorded by F. A. Denz and the lecturer, in 1934, when it was shown that the larger edible fish of Cook Strait, including ling, and especially groper and bass, yielded liver oils far richer in Vitamin A than those normally produced in the North Sea. This fact aroused little or no attention for some time, apart from the fact that J. O. Shorland rendered annually some 100-144 gallons of ling liver oil for export to London, between the years 1934-1938, indicating that in the event of wartime emergency New Zealand would be able to replace at least part of the normally imported cod liver oil by local production. The full exploitation of the local fish oil resources did not begin until early in 1942, when R. Greenwell Ltd., Auckland, set up their factory, to be followed by the opening of the Karitane Products factory at Island Bay, on March 3rd, 1943. These two firms together handle practically all the available livers which are collected at various depots and transported frozen in ten-gallon cans to the factories concerned.

It might be wondered how the fish industry in New Zealand with an annual catch of less than 400,000 cwt. per annum, last year provided more than one-quarter of the vitamin A output of Great Britain, where the annual catch is fifty times as great. The explanation of this apparent paradox lies in the fact that the New Zealand School Shark contains approximately twice as much oil and sixty times as much vitamin A weight for weight, as the North Sea Cod, on which the British industry almost entirely depends.

The value of the local industry is further enhanced by the fact that the school shark liver oil is some thirty times richer in vitamin A than ordinary cod liver oil, and the price paid per unit of vitamin A increases with its concentration in the oil. It was with this thought in mind that the lecturer, in 1943, proposed to increase still further the concentration of vitamin A in the oil by application of molecular distillation.

This process was first achieved on a semi-industrial scale in the Fats Research Laboratory early in 1946, using a new type of glass falling film still developed by the lecturer. From fish liver oil, thirty times as rich in vitamin A as cod liver, there was produced 70 lbs. of concentrate, some 300 times as rich as cod liver oil, urgently required in Australia. From this experiment, fostered by R. Greenwell Ltd., there has developed a local industry using a still manufactured by the Dominion Physical Laboratory.

Apart from U.S.A., New Zealand is the only country in the world producing vitamin A concentrates by direct distillation of fish liver oil.

The early history of vitamin A is interesting, in that different groups of workers established that the fat soluble yellow colouring matter, carotene, had vitamin A activity, as did the colourless concentrates from fish liver oil. It was later established by Moore at Cambridge, that rats deprived of vitamin A, when fed carotene, produced vitamin A in the liver. This yellow colouring matter present in butter and carrots was therefore converted in the animal body to vitamin A.

Vitamin A has been prepared as a pure crystalline material from fish liver oils, and the thoughts of many chemists for more than a decade have turned towards its synthesis.

No published synthesis has been completely satisfactory. All workers have started with β-ionone, a substance found in lemon grass oil, and this provides thirteen of the twenty carbon atoms required for vitamin A. The main difficulty is that β-ionone does not react normally under most conditions, when attempts are made to lengthen the side chain required for the synthesis of vitamin A. Many workers, therefore, have sought to alter the position of the double bond in the side chain of β-ionone for the purpose of condensing the necessary carbon atoms to the side chain to correspond with vitamin A. Having thus assembled the molecule, by the process of splitting out water the double bond is restored to the required position, yielding a mixture of substances which have vitamin A activity.

Perhaps the most successful work so far has been that of two Dutch workers, Arens and Van Dorp, who produced synthetic vitamin A aldehyde, and a vitamin A having the biological characteristics of the natural product. These workers managed to add in three steps to unmodified β-ionone the fragments required to build up the vitamin A molecule—an operation which so many prominent chemists in Europe and America had failed to accomplish. β-ionone is an expensive material as obtained from natural sources, and before a cheap synthetic vitamin A can be prepared, it will be necessary to start from less expensive materials.

The physiological functions of vitamin A are varied. Visual purple required for perception in dim light is a compound of a proteinoid substance with vitamin A, which in the presence of light breaks down to give vitamin A. In the dark the vitamin A recombines with protein to give visual purple.

Another function of vitamin A is to secure the orderly deposition of bone. The inco-ordination of movement exhibited by puppies deprived of vitamin A was shown by Mellanby to be due to distortion of nerve fibres brought about by irregular deposition of bone. Vitamin D enables bone deposition to take place, while vitamin A determines orderly deposition and removes surplus calcium and phosphorus compounds. In view of this action of vitamin A, it is not surprising to note that experiments on rats made at the Home Science School at Otago, involving the feeding of 20,000 times the daily requirement of vitamin A, resulted in bone fracture.

Vitamin A is concerned with the healing of wounds. Deficiency caused degenerative changes in mucous membranes, which then no longer have the power to resist bacterial infection. There was, however no justification for the belief that vitamin A confers general immunity to disease, or was clinically effective in infections caused by specific pathogenic organisms.

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Sir Thomas Easterfield, late Director of the Cawthron Institute and previously Professor of Chemistry at Victoria College, receives our hearty congratulations on reaching his jubilee as a Fellow of the Royal Institute of Chemistry.

We have seen a very interesting letter from Mr. A. J. Metson, of the Soil Bureau, Wellington, and now on a "rehab." bursary at the University of Missouri, addressed to Dr. Dixon, and giving an account of a visit to a tremendous nitrogen fixation plant at Pittsburg, Kansas. This plant was built during the war as an ordnance plant, but is now making fertilisers and other nitrogen products.

BOOKS RECEIVED

Encyclopedia of Chemical Technology. Edited by R. E. Kirk and D. F. Othmer, Polytechnic Institute of Brooklyn, New York. Vol. 1—A to Anthrimides, pp. 982, 1947. London: Interscience Publishers Ltd., 2a Southampton Row, W.C.1. £5/5/- sterling.

The introduction of a large scale work such as this is an important event, and this volume has been studied with considerable interest. The plan is to issue two or three volumes a year and finish the work in ten volumes (which seem optimistic in view of the short distance covered in vol. 1). The printing and binding are excellent: the articles and sub-headings are clearly set out so that they are easily found.

The Editors' intention is apparently to concentrate the information in rather long articles, the length of each averaging over ten pages. This will make the user more dependent on the index for which presumably he will have to wait until the last volume. The grouping of information under Unit Processes more familiar to Americans than to us also makes the index more necessary. One looking up aniline would probably be unaware that useful charts on its mutual solubiliy with water given under "Amination by Reduction."

The information is right up to the minute with references to 1947, and the F.I.A.T. reports from Germany have been made good use of. As far as we can judge the information appears to be accurate, but several minor errors were noted. The work is naturally largely concerned with American practice and standards, which would make it slightly less useful outside that country. The references are adequate without being excessive. It is definitely a work on technology and very little space is given to laboratory methods and preparations.

The selection of topics seems a little arbitary. There are full articles on "Alcohol, Industrial," and "Alcoholic Beverages, Distilled," but no mention of brewed alcoholic beverages. There are no articles or cross-references to minerals, though several should come within this range. Aluminium and its salts come together, but sodium is discussed under "Alkali Metals," but its salts will be under "S."

For those who can finance it, this work should certainly receive their consideration.

Science of Plastics. Ed. by H. Mark and E. S. Proskauer, Vol. I, 632 pp., 1948 London: Interscience Publishers Ltd. 54s. This volume contains abstracts of papers published during 1942-46 dealing with plastics generally; a second volume will deal with specific kinds of plastics. The abstracts are very full, averaging over 2½ pages each, and include tables and figures from the original. This is a useful volume, but the field for it in New Zealand will be very limited.

Qualitative Analysis by Spot Tests. By Fritz Feigl. Third English Edition translated by R. E. Oesper. 574 pp., 1947 London: Cleaver-Hume Press, 42a South Audley St., W.1. 43s. This book, which ought not to be confused with two other books on spot tests by the same author, is one that should be in every laboratory. Under modern conditions, the usefulness of spot tests of which Dr. Feigl is the recognised authority, is inescapable, and the reviewer found immediate use for this volume. There are seven chapters as follows: (1) Working methods; (2) Tests for metals; (3) Tests for acid radicals; (4) Tests for free elements; (5) Systematic analysis of mixtures; (6) Use of spot tests in qualitative organic analysis; (7) Applications of spot reactions in tests for purity of various technical materials (e.g. water, leather, paper, fats, glass, minerals, metals, ink and fine chemicals). Then follows a full bibliography (in addition to about 800 references in the text), a summary of reactions and their sensitivities, and finally author and subject indexes. Each reaction is clearly set out showing the reagents required, procedure, limit of identification (which in several cases .001 gamma), and where it is known, the chemical reaction involved.

Chemistry of Acetylene and Related Compounds. by Ernest D. Bergmann; pp. 108. 1948: Interscience Publishers, London, 18s. This book contains three lectures delivered in New York in 1946 and contains a very useful summary of the chemistry of acetylene, a subject which has become prominent recently, partly because of the tremendous synthetic edifice built up on this substance by Reppe in Germany. This is fully done justice to, as is also the lesser known scheme of Weizmann—now President of Israel. Only a brief reference is made to the work of Heilbron and his school, apparently because the English workers are publishing their own monographs. The physical chemistry of acetylene compounds is adequately handled. In a book of this size, not much detail can be given, but there are copious references. There are a few errors: on p. 27 oxazole should be isoxazole, and on p. 52 benzoyl acetylene should be acetyl acetylene. The book can be recommended as a very readable outline and it is one of those inspiring volumes which open up new fields by the suggestions made.

Traité de Chimie Analytique Qualitative Minérale. By Paul-E. Wenger and Roger Duckert, University of Geneva. pp. 467, 1946. Geneva: Georg et Cie. This treatise gives a clear, orderly, and concise exposition of the theoretical basis and practical aspects, both on the macro and micro scale. There are several commendable features: the treatment is modern in that all precipitations are discussed as reactions between ions, and solubilities as ionic products; it also pays more than usual attention to the so-called minor elements, frequently relegated to back pages or footnotes. This is important when the number of elements finding use in the arts is constantly increasing. There are also unusual features. The elements considered first are those cations precipitated by the SH cation at pH below 3. This group surprisingly includes Se and Te, even though they form no cations, because selenites and tellurites are reduced by SH in acid solution to the elements which are precipitated. They come therefore amongst the metals. In addition all derivatives of the metals, whether anions or cations, are considered together, e.g., the reactions of chromates immediately follow those of chromic cations. This means that many acid radicals are scattered through the earlier part of the descriptive section and only those left over such as sulphates, carbonates, etc., are grouped together. The last twenty pages are given up to a new system of separations in which the usual H_2S is replaced by potassium xanthate. Previously unpublished, this scheme, which is essentially one for the semi-micro scale, is worth the further investigation the authors ask for it. The book is well printed, but the binding is poor. There is no index.

Synthetische Methoden, Repertorium 1 and 2. By W. Theilheimen, pp. 224 and 329. Basle: S. Karger 1947, 1948. Price 25 and 35 Swiss francs. The first repertorium of this series was well reecived and has now been reprinted. For those unfamiliar with it, the idea is the classification of reactions and the conditions under which they are brought about. Each volume covers a definite period in the literature; 1 covers the period 1942-44; for 2 the war prevented access to American journals and it deals mainly with European references for 1945-6, leaving the American work to No. 3. For each reference there is set out the type of reaction, the agent used, the particular reaction, details, yield and reference. As an example: Addition of H to N and C. Agent: Ni. Particular case: amines from nitriles. Details: Benzyl cyanide in methanol saturated with ammonia at 80-100 atmos. and at room temp. is hydrogenated with Raney Ni to phenyl ethyl amine. Yield: 73%. Reference: Ruggli and Prijs, Helv. **28** (1945) 674. It will be seen that the details are sufficient. The work will prove very useful to teachers, students and research workers, and even those just interested in organic chemistry, and is likely to become one of the standard reference works.

Life, its Nature and Origin. By Jerome Alexander. pp. 291, 1948: Reinhold Publishing Corp., New York, 5 dollars. This book will appeal to those who would mix philosophy with science. The living cell and its many products have yielded to scientific investigation. This has led to the abandonment of the concept of a fundamental vital force. Now we can speculate upon the origin of life itself. The author develops the thesis that life is a series of continuous enzyme-like chemical processes, and in his argument has drawn lavishly from every branch of science. Although his deductions are sometimes extravagant the general theme is impressive. The author opens with a description of the universe and the ultimate particles which compose it, and then, from a speculation upon the purely chance combination of molecules to form the original primitive biont, goes on to the function of enzymes in metabolism, reproduction and evolution. He shows that we are progressing towards a rational understanding of our material surroundings including life itself, but that we are still completely ignorant about the just-as-real world of thought. The last chapter is devoted to considerations of that mental and spiritual world.

Organic Syntheses, Vol. 27, 1947. R. L. Shriner, Editor-in-Chief. New York: John Wiley and Sons; London: Chapman and Hall. This volume follows the usual well-known lines and gives methods of preparation for 39 compounds. A new method is included for o-toluic acid which has previously appeared, while directions are given for two compounds, 1-methyl 1- (1-naphthyl) 2-thiourea and 1-methyl 2-imino beta naphthothiazoline, which have not appeared elsewhere in the literature. Amid such a wealth of precise preparative detail, it is a little surprising to find Raney nickel measured out by the teaspoonful (pp. 14 and 33.)

Our next issue will contain a further section of Dr. Shorland's review on fats, and we hope also to include a suggested salary scale.

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Glass Tubing, a lecture given by Richard E. Threlfall to the British Assn. of Chemists in 1946, has been reprinted by that body at 2/6 a copy. It contains much useful information, tables of properties of the various British glasses, several tips on handling glass, and a good deal of wit, so that any chemist can combine business with pleasure in investing in a copy.

Dr. S. N. Slater is spending a year visiting research establishments abroad, and is at present at Oxford. He is representing the University of Otago at the 21st Congress of the Society of Industrial Chemistry to be held at Brussels in September.

Mr. S. J. Bennett, who is with Unraa in China, is now at the Baillie School, Sandan, Kansu Province, according to a very interesting letter received by Jock Mandeno of Wellington.

Mr. P. de la Mare, studying at University College, London, under Prof. C. K. Ingold, has obtained the degree of Ph.D.

ITEMS FROM THE MINUTES OF COUNCIL

MEETING HELD IN WELLINGTON, 20/5/48.

Salary Scales: The full report on the results of the salary survey which was abridged in our last issue, was presented, and Dr. Dixon and Mr. Mandeno were asked to draw up a scale of salary ranges, based on present ruling industrial rates.

Members struck off for subscription arrears:—S. C. Denham, Auckland; W. Moss, Wanganui; J. W. Shiels, Auckland.

UNESCO: Full report to be circulated before Conference.

IMPORT LICENSES: Reported that licenses for 1948 to the full value of 1947 licenses being allowed. Any members having difficulty to advise Branch Secretaries.

NEW ASSOCIATES

BARKER, Geoffrey Herbert, M.Sc., 615 Mt. Eden Road, Mt. Eden, Auckland.—Mr. Barker is Chemist to the Colonial Ammunition Co. Ltd.

CUNNINGHAM, Ira James, M.Sc. (1928), Ph.D. (Aberdeen), B.V.Sc. (Sydney), Animal Research Station, Wallaceville, Private Bag, Wellington.—Dr. Cunningham was re-admitted to the Associateship of the Institute. He is the Superintendent of the Wallaceville Animal Research Station.

GALLAHER, Philip James, B.Sc. (1945), c/o N.Z. Farmers' Fertilizer Co. Ltd., Te Papapa, Auckland.—After a year as chemist with the N.Z. Plywood Co. Ltd., Mr. Gallaher is now assistant chemist with the N.Z. Farmers Fertilizer Co. Ltd.

HUTCHINSON, Robert Lewis, M.Sc. (1936), Box 992, Christchurch—After holding positions as Biochemical Assistant, Animal Research at the Massey Agricultural College, and Chemist, Investigational Sub-Section, General Chemistry, Munition Supply Laboratories, Australia, Mr. Hutchinson is now chemist to Lane, Walker, Rudkin Ltd.

RUSHWORTH, George Edward, M.Sc. (Leeds) (1934), 88 Kauri Street, Wellington.—Past experience includes positions with the Anglo-Iranian Oil Co., Persia; Tokalon Ltd., London; and Salmond and Spraggon Ltd., Wellington. Mr. Rushworth is now Chemist to the British Petroleum Company of N.Z. Ltd.

TAYLOR, William Irving, M.Sc. (1946), Pakuranga Road, Panmure, Auckland.—At present Duffus Lubecki Research Scholar at the Federal School of Technology, Zurich, Switzerland.

VOSE, Wilfred, B.Sc. (London) (1936), A.R.I.C. (1945), 111 Sydney Street, Wellington.—Past experience includes positions with the Consett Iron Co. Ltd., Durham, Steatite and Porcelain Products Ltd., Stourport, Taylor Tunnicliff and Co. Ltd. (Porcelain Manufacturers), and with the Thermal Syndicate, Wallsend-on-Tyne (Refractory Porcelains). Mr. Vose was recently appointed Director of the New Zealand Pottery and Ceramic Research Association.

THE FOLLOWING STATEMENT IS PUBLISHED AT THE REQUEST OF THE ROYAL SOCIETY OF NEW ZEALAND

At the request of "UNESCO" and by agreement with the International Union of Chemistry, the International Bureau of Physico-Chemical Standards of Brussels has accepted the task of establishing a collection of pure chemical substances of every kind (metals, alloys, mineral and organic substances, plastics, samples of biological interest, etc.) to place them at the disposal of the laboratories and research workers of all countries, so as to enable them to control the nature and the purity of their own samples, or for any other research work.

The expenses for conservation, manipulation and distribution of the samples will be met by a subsidy from "UNESCO", but to constitute the collection it has been decided to make an appeal all over the world, requesting the laboratories and the research chemists who have prepared or have at their disposal such substances in state of sufficient purity, to send a sample to the new centre thus created for the common interest of all men of science. To the sample should be attached a concise notice showing its method of preparation and purification as well as its principal constants. However, please do not send any sample to Brussels without first getting in touch with the International Bureau of Physico-Chemical Standards.

There may be cases when the author of an original research wishes to keep for himself the sample of the substance he has prepared. In this case it would be of great help if he would give us a description of the sample with its constants so as to enable us to establish a register showing where one could eventually obtain these substances.

It must be well understood that this institution, purely scientific in character, wishes in no way to compete with the chemical industry, and that products easily obtainable on the market fall outside our scope. Nevertheless, some research laboratories of the chemical industries possess samples of rare substances, prepared for their own use in small quantities, and which therefore are not included in the catalogues of industrial and commercial firms. Such laboratories could also render a great service to science if they were willing to play their part in the realization of our project.

We hope that this appeal will find a large response all over the world, so that the international solidarity of men of science shall manifest itself once more.

For more detailed information, please write to the Director of the International Bureau of Physico-Chemical Standards, Professor J. Timmermans, Universite Libre de Bruxelles, 50 Avenue Franklin Roosevelt, Bruxelles, Belgium.

October, 1947.

PERSONAL NOTES

Dr. R. J. McIlroy, senior lecturer in Organic Chemistry at Canterbury College, has not only secured a Professorship, but has had a book on carbohydrate chemistry published. After graduating from Victoria Colege, he took his Doctorate at Birmingham, and after some research experience in the Dept. of Agriculture, he took up his present position at Canterbury College eight years ago. He has now been appointed Professor of Chemistry at the new autonomous University of Ibadan, Nigeria. Dr. McIlroy has specialised in the carbohydrates, and we hope to review his book on the polysaccharides (just published by Edward Arnold) in our next issue. He has another volume on Plant Glycosides in the press. He is married and has three children, one son and two optical isomers (both cis). He expects to leave in October. Dr. McIlroy is an F.R.I.C. and was chairman of the Canterbury branch in 1946.

FOOD PARCELS

THE ROYAL INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND
30, Russell Square, London, W.C.1.

31st March, 1948.

The Secretary,
New Zealand Institute of Chemistry,
P.O. Box 250,
Wellington, N.Z.

Dear Sir,

Dr. J. K. Dixon, until recently Honorary Secretary of the New Zealand Section of this Institute, has informed me of the major part that members of the New Zealand Institute of Chemistry have taken in providing food parcels to persons named from this office.

When the most generous offer to send such food parcels to needy members of the Institute was received last year, my Council concluded that in the absence of any method of assessing the relative needs of our 10,000 members, the best procedure would be to give the names of those members or their dependents who were in receipt of regular help from our Benevolent Fund. This has proved a wise decision, for I have received numerous letters expressing the deepest gratitude for these parcels. Every person listed seems now to have received a succession of these most highly-appreciated gifts, and I understand that every recipient has written to you or to Dr. Dixon.

Most of the beneficiaries are elderly, being retired members or their widows, but some are younger people, mostly widows with children. All of us in this country know what it means to receive a food parcel from the Dominions, and I can assure you that the generosity of your members in this matter is most highly appreciated not only by those who have received parcels but also by my Council and members of the Benevolent Fund Committee who realise the very great value of the work that you are doing.

Yours sincerely,
H. J. T. ELLINGHAM,
Secretary.

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Mr. P. A. Ongley, who is studying at the University of Glasgow, has been granted a Coates Fellowship.

Mr. M. Rands has left Westfield Freezing Works and has crossed the slough to the Southdown ditto.

Miss Monica Lindsay now holds an assistant lectureship under Professor Krebs at the Dept. of Biochemistry, Sheffield University.

On the nomination of the Public Service Association, the president of the Institute, Dr. J. K. Dixon, has been invited by the Minister of Scientific and Industrial Research to join the sicentific manpower committee.

Mr. N. H. Burton, who was previously at Challenge Phosphate in Auckland, is at present a student at the Library School in Wellington.

Mr. K. S. Birrell, of the Soil Research Bureau, is attending the second International Conference on Soil Mechanics and Foundation Engineering at Rotterdam. He is also visiting laboratories and research stations dealing with soil mechanics in England and on the Continent.

AUSTRALIAN AND NEW ZEALAND ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

HOBART MEETING JANUARY 12-19, 1949.

Enrolments are now being sought for the above meeting.

Forms of application for enrolment may be obtained from the Local Honorary Secretary of the Association in the State or Dominion in which the applicant resides, as indicated below:—

NEW ZEALAND: Gilbert Archey, O.B.E., M.A., F.Z.S., D.Sc., Auckland Museum, Auckland.

In view of the restricted accommodation available in Hobart, it is advisable that all who intend to be present at the meeting should make application to the undersigned as soon as possible.

GEO. C. ISRAEL
F. H. C. KELLY
Joint Hon. Secretaries, Section B (Chemistry).

University of Tasmania,
Box 647-C, G.P.O.,
HOBART.

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Textbook of Physical Chemistry by Gasstone, 1947, 91/6.
Chemistry for the Executive by Strong, 1946, 57/-.
Colorimetric Methods of Analysis by Snell, Vol. 1, 1945, Vol. 2, 1937, 145/- the two volumes.

Send for our Science book list and ask for regular lists on this subject (also showing newly published titles) to be sent as prepared.

BOOKS EXPECTED

Durrans—Solvents; Frigl—Lab. Manual of Spot Tests; Fieser & Fieser—Organic Chemistry; Furman—Scott's Standard Methods of Chemical Analysis; Francis—Boiler House & Power Station Chemistry; Getman & Daniels—Outlines of Physical Chemistry; Gilman—Organic Chemistry; Hilditch—Chemical Constituents of Natural Fats; Huntress—Identification of Pure Organic Compounds; Karrer—Organic Chemistry; Kaye and Laby—Physical & Chemical Constants; Lange—Handbook of Chemistry: Lea & Desch—Chemistry of Cement & Concrete; Matthews—Boiler Feed Water Treatment; Silman—Chemical & Electric Plated Finishers; Perry—Chemical Engineers' Handbook; Rice—Electronic Structure & Chemical Bonding; Sandell—Colorimetric Determination of Traces of Metals; Schmidt—Organic Chemistry; Stott—Electric Theory & Chemical Reactions; Tongue—Chemical Engineering.

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Robert of Chester

brought the science of chemistry to Western Europe, 800 years ago. Of this remarkable man's origin little is known except that he was probably born in Rutland. He was certainly educated at the then flourishing school at Chester, after which, following the custom of the times, he studied at the Moorish universities in Spain. The Moors or Arabs were the world's leading scientists at that period. On February 11th, 1144, Robert completed the translation into Latin of an Arabic treatise on chemistry. This was Europe's first chemical textbook.

No doubt he also brought with him from Spain one of the flowing Arab robes which, as the "gown" of British universities, still serves to remind us that a close bond once linked the scholars of East and West. He could no more have dreamed of the place this garment was to occupy in later years than he could have imagined the future of another Arabic treatise he translated. This was a work by a celebrated mathematician, Khwarizmi, on a branch of mathematics developed by the Arabs and still known to us by its Arabic name, algebra. Besides his extensive works in mathematics, Robert made the first Latin translation of the Koran. Europe owes an immeasurable debt to this Englishman. But for him, the knowledge of the East of chemistry and mathematics might have remained a closed book to the Western world for centuries afterwards.

No. 2 in the "Ancestors of an Industry" series inserted by

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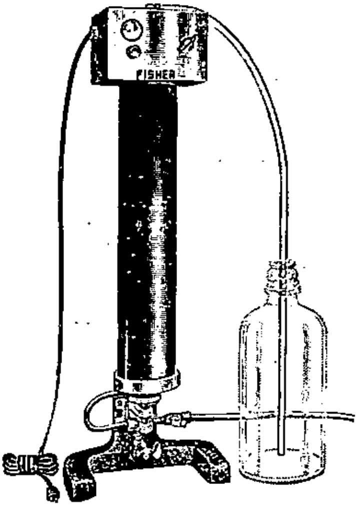
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