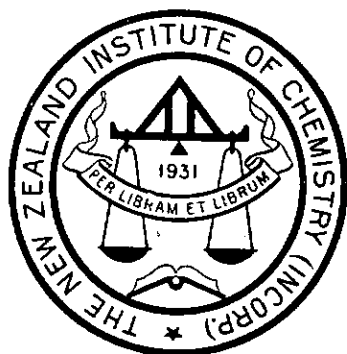


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No. 5.



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FOOD AND THE CHEMIST
(Presidential Address)

P. R. Parr

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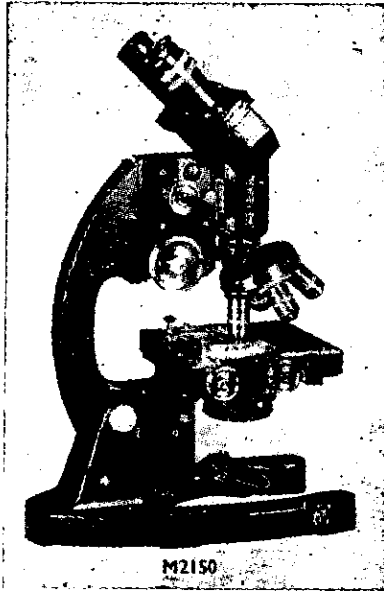
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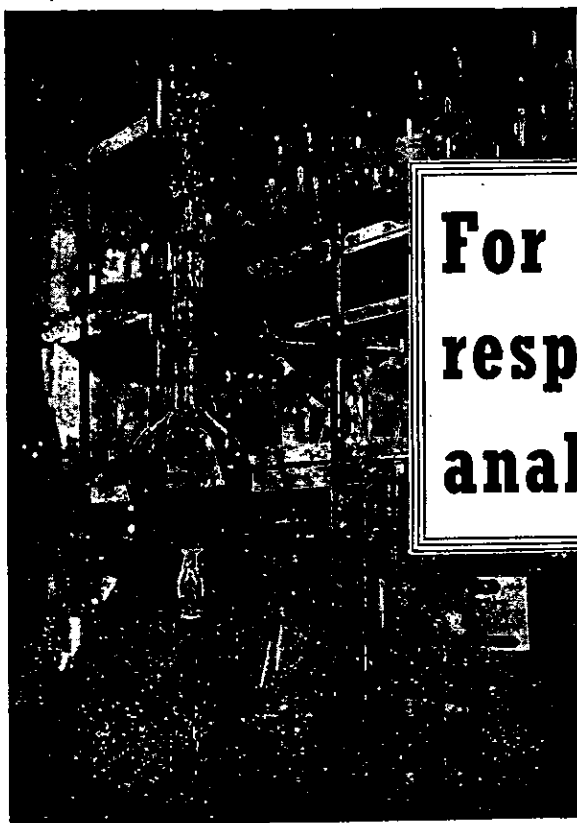
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FOOD AND THE CHEMIST

**PRESIDENTIAL ADDRESS DELIVERED BY MR. P. R. PARR AFTER
AN EXCELLENT BUFFET TEA AT PEACHGROVE ROAD HALL,
HAMILTON, ON AUGUST 21st, 1951.**

The problem of an adequate food supply is one which ever confronts a shrinking world—allied with that other problem of the supply being in the right places when required. This latter problem is beyond the chemists sphere, but the problem of adequate supply is one in which the chemist can and does give considerable help; help which becomes more urgent when we consider a world population growing at the rate of 60,000 per day and an area of cultivable land which tends to shrink rather than increase.

Let us now consider the various phases of the food problem and the point at which the interests and skill of the chemist make contact therewith.

The matter may be considered under the following headings:

1. The production of food by agriculture or other means.
2. The preservation of this food till required for use.
3. What constitutes good food.
4. The purity and safety of food.
5. Its utilisation and enjoyment.

1. PRODUCTION OF FOOD:

The main concern of the caveman and the nomad was the procuring of food, as it still is to-day with the aboriginal in the northern districts of Australia.

When man deserted his nomadic mode of life and adopted a more or less settled abode, the production of food became a major part of his activities. In the most primitive conditions this involved clearing a piece of land, growing what crops it would produce and then moving to another piece of land, leaving nature to restore the lost fertility of the first.

Agriculture as we know it developed later, but little was done to maintain or increase fertility. In 1510 Wynkin de Worde in the *Boke of Husbandry* quotes yields of wheat in a good year of about $7\frac{1}{2}$ bushels per acre. Great progress was made in England in practical agriculture in the 18th century with new and better crops and improved livestock, although there was little or no scientific basis and nothing was known of the principles involved. Moses, of course, had quite sound ideas in this matter, for he instructed the Israelites as follows: "Thou shalt not let thy cattle gender with a diverse kind or sow thy field with mingled seed." The fundamental problems of agriculture, soil fertility and manuring were not clearly revealed as scientific problems until the new chemistry was born at the end of the century.

In 1755, Francis Holme was invited by the Edinburgh Society "to try how far Chemistry will go in settling the principles of Agriculture." He found that nitre and vitriolic tartar brought increased growth, and wrote: "the more the farmers know of the effects of different bodies on plants the greater chance they have to discover the nourishment of plants." Later in the century the Earl of Dundonald pointed out the value of alkaline phosphates and of humus.

From 1803-1812, Sir Humphrey Davy gave a course of lectures on "Agricultural Chemistry" for the Board of Agriculture and showed the importance of soil analysis and drew attention to the value of lime, magnesia, alumina and iron. In 1840 Liebig published a report prepared at the request of the British Association, entitled "Chemistry in its Application to Agriculture and Physiology." Liebig shattered the old idea that plants got most of their nutriment from the humus of the soil and showed that atmospheric carbon dioxide was the chief source of carbon. Nitrogen he found was absorbed usually by the roots as ammonia, and he made clear the function of lime in regulating the soil acidity. He laid the foundation of artificial manuring and actually attempted to market a chemical manure which did not prove very successful, as he had not realised that a source of nitrogen was essential.

The fact that Liebig's views made a definite impression on English agriculture arose from the enterprise of a young man, John Lawes, who had inherited a considerable estate in Hertfordshire about the time Liebig published his book. Lawes decided to test some of the manuring practices suggested and engaged young John Gilbert, who had trained under Liebig, to carry out the necessary analytical work. Thus was laid the foundations of the famous Rothamstead Experimental Station and of a col-

laborative effort, extending over 40 years, in the practical investigation of manuring, crop yields and food values. It is true that for a long time their research failed to influence the great body of farmers, for in those days the farming community was resentful of scientific intrusions and suspicious of the new developments. But even the most conservative farmer could not long ignore the fact that by supplementing an appropriate mineral fertiliser with $\frac{3}{4}$ cwt. of artificial nitrogenous manure per acre, more than double the crop of wheat was produced.

New Zealand is primarily an agricultural and food-producing country, and scientific work connected therewith rightly occupies a very important place in the country. Basically this is not a fertile country, but we have a land bounteously blessed with rain—rain which, while encouraging generous pastures, also leaches out minerals essential to plant growth. All food production on land ultimately depends on the living plant. Hence a sound knowledge of our soils and their composition is of prime importance. The Soil Bureau in New Zealand has as its object the investigation and solution of this problem. Together with the primary field survey, the Bureau determines the chemical status of the soil, its pH value, available phosphate content, carbon and nitrogen values, the exchangeable bases, etc. From these results maps can be prepared showing the abundance or deficiency of a particular element, enabling some estimate to be made of fertiliser requirements. There are organisations directly interested in plant growth who are also working in this sphere—the Soil Research Station, the Plant Chemistry Laboratory of the Grasslands Division, with a branch at Lincoln College, Cawthron Institute, and the Fertiliser Research Association. Here we find investigations on the fixation of phosphorus in the soil—by organic and inorganic fixation, in an endeavour to reduce the present inefficient utilisation of the phosphate applied to many soils. A very useful tool in this work is the use of the radioactive isotope of phosphorus P.32, to trace the movement of phosphate in the soil and its assimilation by the plant. The question of how much plant nutriment is carried away by drainage waters is also receiving attention. Equally important is the work done on the role of the grazing animal in maintaining soil fertility by return of nitrogen and phosphorus to the soil and the manner in which this material is again utilised by plants—a return which under high fertility conditions is very great.

Even if present in sufficient quantities, plant foods can be utilised only if other conditions are correct. Thus investigations into the effect of hardness and fineness of grinding of phosphate and limes have been carried out. It is found that the utilisation of our very acid peat swamps can be very much accelerated if

conditions of soil pH are corrected as the primary measure. The peat soils are poor in plant nutrients and very deficient in some trace minerals—e.g., copper; while manganese deficiency can be induced by overliming.

Trace minerals have been shown to be deficient in many places for best plant growth to be produced, the most recent being molybdenum, which is necessary for the growth of clover and cauliflowers. In the Nelson district, boron deficiency has been found for apples and raspberries and suspected magnesium, zinc and copper deficiencies are being investigated, while the general changes in mineral constituents of pasture and orchard trees under different manurial programmes have also received attention.

Extensive work on plant biochemistry has been carried out on nitrogen metabolism and nitrogen fixation, and on the production of poisonous glucosides and alkaloids by important fodder plants.

Research in animal production is covered by Ruakura Research Station, Massey College, and Wallaceville, where various chemical problems are being tackled. The digestibility and intake of grass by grazing is being examined, using chromium oxide as an inert reference substance, a technique which when used on sets of identical twins enables the efficiency of utilisation of feed for growth and milk production to be correlated with different standards of management. An attempt is being made to correlate the excretion of oestrogens and androgens by ewes, to determine normal and abnormal states and what factors influence the disturbances. The aim here is a higher fecundity of ewes producing more lambs per acre. One problem which still proves stubborn is to isolate and identify the toxic substance in autumn flush pastures which causes the typical liver damage of facial eczema. Securing and preserving toxic pastures is difficult, as grass is known to have been toxic only after sheep have grazed it and developed external symptoms. Attempts are being made to recover a toxin which produces similar symptoms from a grass *Panicum miliaceum*.

Mineral deficiencies in animals are as important as those in plants, and here we would like to make reference to the pioneer work of B. C. Aston on "Bush sickness on our pumice country." Originally thought to be due to iron deficiency, this wasting disease was found to be due to a lack of cobalt. If cobalt were supplied by application with fertiliser or by means of a lick, the animal recovered good health.

It has been suggested that an indication of copper deficiencies in sheep is the loss of crimp and the growth of straight, lustrous wool at low levels of copper in the blood. Iodine deficiencies also have been shown to occur in some areas.

Concentrate feeding is relatively unimportant in New Zealand although it has a definite and increasing use at certain seasons of the year. Overseas, where protein foods are relatively expensive, much work is carried out to see which proteins are most efficient, and why. In most cases a certain amount of animal protein is necessary for best results, while dried yeast has a tendency to produce rickets in pigs.

Fertilisers:

Efforts to increase production of food by way of plants and animals (even fish) involve the increased use and a greater efficiency in the use of fertilisers—work which is receiving much attention in this country. In the manufacture of all types of fertiliser the chemist has a definite role to play to develop new types where the old are not completely satisfactory; e.g., sulphate of ammonia, or alternatives when supplies become difficult; e.g., sulphur for superphosphate manufacture.

It is of interest to note that the potash beds of North Germany are believed to stretch beneath the North Sea to North-east England, where sylvinitic beds containing 34% KCl have been found at a depth of some 3500-4000 feet. If workable, these beds would provide a most useful addition to potash resources.

In America large quantities of nitrogen are applied as ammonia solutions, while Levy considers the use of nitrochalk has possibilities in New Zealand.

The chemical evaluation of fertilisers is still not entirely satisfactory, and it has been suggested that more emphasis should be placed on declaration of the materials used and less on statements of plant food "strength."

Veterinary Medicines:

Diseases among stock cause heavy losses each year. Of those affecting sheep, parasitic diseases cause most loss; e.g., intestinal worms, hydatids, and liver fluke. The worm infections can be controlled by phenothiazine, while hydatids can be successfully dealt with by keeping dogs free from tapeworms by using arecoline.

Coccidiosis in poultry, fowl cholera, and salmonellosis in ducks can be successfully treated by sulphamethazine and sulphamerazine.

In the dairy industry the most spectacular results have derived from the use of penicillin in treatment of bovine mastitis: the resultant saving of many cows for continued production must represent a great gain to the industry. The use of penicillin is

attended by some difficulties in cheese districts, as its presence in milk can seriously upset cheese-making operations. Other antibiotics have also given promising results in experimental trials.

Hormones:

In recent years our knowledge of plant and animal hormones has increased rapidly and their use, especially in horticulture, has greatly extended. We have hormone preparations which will promote germination of seeds, the rooting of cuttings, and prevent the falling of fruit, while the use of 2,4D for broad leaf weeds and 2,4,5T for blackberry promises control of some difficult weeds. Methyl naphthyl acetate will prevent the sprouting of potatoes, while ethylene chlorhydrin (although not a hormone) stimulates shoot growth.

Tomatoes sprayed with hormone produce seedless fruit, and figs sprayed with 3 indolylacetic acid give crops of seedless fruit—a boon to those who dislike fig-seed. The use of iodo-protein and thyroxine for increasing milk yield and rate of growth has been found to produce no significant improvement in the nett production of milk, as more food was needed, which offset any increased production: while in the case of pigs much more food was required per unit of increase in live weight when iodinated casein was fed. Physiological disturbances also occurred causing digestive upsets and abnormal bone structure.

Control of Pests:

In this field the chemist can claim some definite advances, and much work has been done on the relationship of toxicity to chemical structure, especially among the insecticides. It is interesting to note that interest in the chemistry of pyrethrum and rotenone is again increasing, due to the failure of D.D.T. against sucking insects and the development of strains of insects resistant to it. A new class of insecticides based on organophosphorus compounds, e.g., TEPP, HETP and parathion, is developing. Systemic insecticides which can be absorbed by the plant and prove toxic to sucking insects, but harmless to predatory insects, have also been developed in this class. One unexpected factor has emerged, namely, that if leaves are maintained in a moisture-saturated atmosphere they remain non-toxic, while neighbouring leaves in a normal atmosphere are toxic to test insects.

Soil fumigation for both insect and fungus pests has developed: steam is still widely used, but chloropicrin is becoming more commonly used, while a mixture of dichloropropylene and dichloropropane, or D.D., has been tried extensively against nematodes. The search for alternatives to sulphur and copper compounds continues, and the dithiocarbamates are coming into use

in U.S.A., though they seem of lesser value in damper climates. The organomercuric compounds are still best for control of seed-borne cereal diseases, while chlorinated quinones are finding use in protecting out-of-season vegetables.

These newer products are, however, not without their dangers, and their possible after-effects when used on food crops need careful investigation. Fumigation with gammexane may taint food, and it is much more toxic to bees than D.D.T. D.D.T. and other chlorinated insecticides are secreted unchanged in the fatty tissue of animals, and in the butterfat of milk.

2. PRESERVATION AND PROCESSING OF FOODS:

Most foods when produced contain a high percentage of water, and if not required for immediate consumption, prompt steps must be taken to ensure the preservation of surplus food. Success in this direction has greatly enhanced the range of food-stuffs available throughout the year.

All methods of preservation depend on rendering water unavailable to moulds and bacteria, and the methods may be summarised as follows:—

The very old method of *salting and pickling*.

The closely allied *preservation with sugar*.

More recently preservation by *cold-freezing*, and by *heat-sterilisation*, have developed into large-scale industries.

Lest we appear to have laid our emphasis so far on food from pastoral sources, we would mention here the work of the Wheat Research Institute—work which spreads into the several spheres of production, preservation, processing and utilisation of our staple wheat. The Institute assists the farmer in harvesting the wheat in the best possible conditions, advises upon its storage, and tests its baking quality as a service to industry and the people. It also tests out new and potentially better strains of wheat prior to their use on a large scale.

The Dairy Research Institute, too, has done much work in the sphere of food processing. Work on the stability and storage properties of butter, starter cultures for cheese and all problems associated with cheese quality, and on the production of anhydrous butterfat from butter which would otherwise have been lost, have been undertaken. Other products which require careful chemical control are derived from what may be regarded as primary by-products of the Dairy Industry. Dried skim milk and dried buttermilk powder require careful control of drying conditions and moisture so that they may store and reconstitute properly.

During the war much chemical work was done on the dehydration of meat and vegetables, care being necessary in the case of vegetables to ensure (1) inactivation of enzymes, (2) preservation of vitamin content and colour—and in the case of meat to ensure (1) avoidance of bacterial contamination, (2) production of a satisfactory flavour, and (3) avoidance of fat rancidity.

Curing by salting and pickling persists in the ham and bacon trades and in preparing corned beef. These have their problems of salt penetration and production of excess nitrites. Pickles for vegetables depending on a preliminary fermentation require careful adjustment of conditions.

Research into the preservation of foods by cold goes on at the Cambridge Cold Temperature Research Station, and the cold used can range from a cooler at 40° F to a sharp freezer at -40° C, and many problems arise from chemical changes produced in meat proteins under such different conditions.

When we consider the scope of the work required of the chemist in the Food Industries, we find that although much of his time will be taken up by routine matters, the job exists only as a sound commercial proposition, and to be worth his salt he must be much more than a routine analyst. His work covers a wide range and can be roughly classified as follows:—

To examine all kinds of raw materials for quality and purity.

To establish scientific control of manufacturing processes and to study the principles underlying those processes with the object of making improvements in quality and cost of production.

To find use for waste or by-products.

To devise new methods and new products.

To keep watch upon the finished product.

To ensure good standards of quality, and to ensure also that the goods comply with the Sale of Foods and Drugs Act or with other laws which control the sale of foods.

To ascertain causes of faults and failures, and if possible suggest remedies.

In other words, the chemist should have a finger in every manufacturing pie, and a good practical knowledge of operational procedure.

3. GOOD FOOD:

We should now consider what constitutes good food. Good food should provide adequate nutriment for growth of the organism.

It is no exaggeration to say that the opening of the 20th century saw malnutrition more rife in England than it had been since the great dearths of medieval and Tudor times. The minimum height for army recruits in 1883 was reduced from 5ft. 6in. to 5ft. 3in. In 1902 it was reduced again to 5ft., and the army rejections in some districts were as high as 60%. Investigation showed infant mortalities of 250 per 1000, and parents trying to rear large families on little more than white bread and tea. The most important cause, rather than poor housing, worse sanitation and factory conditions, was semi-starvation due to sheer poverty; rickets, bad teeth and stunted growth showed everywhere. One medical witness deplored the fact that the poor now ate white bread and drank tea, whereas in the past they had lived on oatmeal and milk. Another, however, held the view that white bread was as rich in nutritive properties, as any form of brown breads. In terms of analytical figures for proteins, fat, carbohydrate and minerals, there is no significant difference, and they are equally digestible.

Although Lavoisier had proved that the combustion of food in the body is the source of heat, it was not until Grove and Joule established the relationship between heat and energy expended as mechanical work that the significance of the energy value of foods was realised. Voit and Pettenkofer made the first scientific assessment of the food requirements of an adult using a respiration chamber, and they suggested that for eight hours' light work a man required 118 grams protein, 56 grams fat, 500 grams carbohydrate, giving 3055 calories. Voit also suggested experiments on nutrition, using purified protein, fat, sugar, starch and mineral constituents. He seems to have suspected that there might be other necessary substances present in natural foods.

Lunin working under Bunge at Basle in 1881 carried out such experiments, but thought that he could make this diet adequate by adding the mineral ash of milk. He found, however, that young mice died as they did in an absence of milk minerals. Mice fed on milk itself flourished, and he wrote: "Does milk contain, in addition to protein fat and carbohydrate, other organic substances which are also indispensable to the maintenance of life? It would be worth while to continue the experiments." He was on the threshold of the discovery of the Vitamins. By almost identical experiments, evidence of the existence of a new class of dietary essential was obtained 25 years later.

Thus good food must provide adequate amounts of protein of suitable quality for growth and maintenance, fats and carbohydrates, mineral substances, and certain other essential organic substances, chief of which are the vitamins.

Proteins differ greatly in their value. Their content of the possible amino acids may vary considerably, some being markedly deficient in particular amino acids. Thus zein contains no lysine or glycine, while gelatine has no valine or tryptophane.

Since these amino acids and certain others are essential to animal growth, a diet of the protein from maize or of gelatine would be most unsatisfactory. Theoretically the best protein should be one which most closely matches the requirements of the animal. As this requirement is not accurately known, an intelligent mixture of proteins is good practice, for it is not economical to raise the diet level of a single protein until the weakest amino acid is present in sufficient amount.

Methods of assay of the various amino acids have developed rapidly in recent years. Microbiological methods and the newer chromatography hold great promise for determining the nature and quantity of amino acid rapidly and accurately, and hence enabling us to formulate diets much better balanced in amino acid composition.

Carbohydrates and fats form an important part of a diet. Carbohydrates supply energy—so do fats in even greater amount. Carbohydrates are digested rapidly and transformed into fat or energy. Ingested fats are digested only with difficulty, and large quantities of fat retard the digestion and absorption of food. Certain unsaturated fatty acids, such as linoleic acid, are believed to be necessary for good nutrition. Rancid fats are unpalatable and undesirable as foods, unless you live in Tibet, where rancid butter is the necessary concomitant of tea.

Minerals, or ash content of foods, though only a small part of the diet, are absolutely essential. Minerals—

- (1) Maintain the necessary osmotic pressure of the body fluids.
- (2) Control the pH value of tissues: e.g., HCl in gastric juices.
- (3) Influence the irritability of muscle and nerve tissue.
- (4) Form an integral part of living protoplasm and blood.
- (5) Constitute the greater part of the bony skeleton.

A wide range of elements is necessary for proper health, calcium and phosphorus in largest amounts, but in minute quantity, such elements as boron, zinc and vanadium.

The last group of essential factors in good food consists of the vitamins, a name given to these indispensable substances by Funk, who considered them related to the amines, and termed the substance postulated a vitamin. Though no longer accurate, the term had acquired general acceptance and was retained minus the final -e. No diet, however well constructed, will produce satisfactory health without the addition of adequate amounts of the correct vitamins. The discovery that there was a substance present in rice polishings which would prevent and cure beriberi was made by Eickman in 1901, and arose from the fact that the chickens kept for experimental work at the hospital where he was studying were fed on food left over from the wards. Their research budget was very meagre.

Pekelharing, at Utrecht, then began a series of experiments to prove whether a properly balanced diet of protein, fat, carbohydrates and minerals would maintain health. His conclusions were that "if food is to have its true value something more than these must be present. Such a substance occurs in milk. If white mice are fed on bread baked from casein, albumen, rice meal and all the salts which should be present, and if water is their only drink, they die. But if milk be given instead of water they keep in health notwithstanding that the quantities of albumen, lactose and fat they take with the milk are insignificant." Finally in 1912. Hopkins convincingly demonstrated the existence of essential "accessory factors of the diet."

Since that day the chemist has extended his knowledge to such an extent that we have a very good picture of the vitamin status of most foodstuffs, and can decide if a diet is adequate in this regard. The number of substances now recognised as being vitamins, or at least as being essential in very small amounts for good health, is large and increasing. I would like here to pay tribute to the work of the Fats Research Laboratory for their work on fish liver oils, which led directly to the establishment of a flourishing fish oil industry in this country.

4. PUBLIC HEALTH AND SAFETY OF FOOD:

Some rulers in times long past took an interest in the food of the people. Moses found it sufficient to provide a detailed list of foods which might be eaten, and the conditions under which they were to be considered contaminated or unfit for human consumption. He also laid down regulations concerning weights and measures, stating that just balances and just weights shall ye

have, and ye shall do no unrighteousness in judgment, weight or measure.

In primitive societies no systematic sophistication of food is possible. Commerce must develop before adulteration commences. Greek and Roman traders undoubtedly practised sophistication. Pliny refers to the frauds of bakers who added white earth to bread. He also states that it was impossible to obtain the pure wines of Salerno while certain wines from Gaul were artificially coloured by means of aloes and other drugs.

In England measures were taken quite early to prevent fraudulent practices. The brewers, bakers and butchers, and the "pepperers," were most frequently accused of corrupt practices. The penalty for a first offence was the pillory; for the third or fourth, expulsion from the town. In the 16th century there were appointed ale tasters, who not only tasted but tested by spilling some on a wooden seat. On the wet patch the taster sat attired in leather breeches. If he adhered to the bench, sugar had been added to the ale. Bakers added alum, and Collins in 1758 states that adding bones is an old-established custom, and quotes the old rhyme:

Fe Fa Fum,

I smell the blood of an Englishman.

Be he alive or be he dead,

I'll grind his bones to make me Bread.

Truly the food of men and giants, and indicating that the bakers were well aware of the necessity of adding calcium and phosphorus in the correct ratio.

Food adulteration increased during the industrial revolution, but at no time was it so bad as between 1800 and 1850.

Frederick Accum was a prolific writer on the chemical examination of foods, culinary chemistry, brewing and breadmaking. In 1820 he published a "Treatise on the Adulteration of Food and Culinary Poison," supporting his denunciations by chemical analyses and naming offending parties. A few years later there appeared a booklet "Death in the Pot or Deadly Adulteration, and Slow Poisoning, By an enemy of Fraud and Villany." The book is sensational and gives a lurid picture of the condition of water drawn from the Thames for domestic use.

In 1850 *The Lancet* set up an Analytical and Sanitary Commission, the members being Hassall and Letheby, "to report on all solids and fluids consumed by all classes of the public," and in 1851 published a report on coffee with the names and addresses

of offenders. In 1855 Hassall published a report, "Food and its Adulteration." *Punch* gave enthusiastic support and published a series of "Sermons to Tradesmen" describing the imps who infest the food trade:—

The Grocer imp, who enriches his chocolate with brick dust.

The Milkman imp, with chalk against the customer and chalk inside him.

The Confectioner imp, who paints Twelfth Cakes with Emerald Green and plays Herod among the innocents.

The Publican imp, whose head of beer is green copperas, whose ale is sharpened with the fiery edges of vitriol, and whose grains of paradise are gifts of the serpent.

In 1860 the first Food and Drugs Act was published in England, giving power to appoint analysts, but only six or seven were appointed, and the Act became a dead letter. The Act was drastically amended in 1872, but it worked far from smoothly. Many analysts were inexperienced, and there was no clear understanding of what did constitute adulteration. In 1874 a meeting was held in London under Dr. Theophilus Redwood at which the most important resolution passed was that an association of Public Analysts be formed for the purpose of mutual assistance and co-operation.

One of the first considerations of the society was to draw up definitions of adulteration as follows:—

An article of food shall be deemed to be adulterated if—

- (1) It contained an ingredient which may render the article injurious to the health of the consumer.
- (2) If it contained any substance which sensibly increases its weight, bulk or strength, or gives it a fictitious value.
- (3) If any important constituent has been wholly or partly abstracted or omitted unless, so stated at time of sale.
- (4) If it be an imitation of or be sold under the names of another article. Standards were laid down; for milk, a minimum of 2% fat, 9% solids not fat, and 80% fat in butter; not more than 8% ash in tea, at least 20% cocoa fat in cocoa, and 3% acetic acid in vinegar.

This work has continued ever since until in 1951 the Society of Public Analysts and other Analytical Chemists can publish a small book which sets out the official methods of analysis for all types of food products.

The actual standards are set out in the Public Health Act and in Regulations thereunder and administered in New Zealand by the Department of Health. The Dominion Laboratory, however, is responsible for the analysis of samples of food drawn by the Health Department, and in a year does analyse many thousands of samples, milk representing the greatest number. The use of chemical preservatives is rigidly controlled, many being completely prohibited—e.g., formalin; while others, e.g., sulphites, are permitted only in specified amounts. Boric acid is still permitted in bacon. The general trend, however, is to exclude preservatives, and to insist on better methods of production.

The rise of large food-manufacturing concerns has played a part in improving the quality of food sold to the public. As these organisations grew there was more and more reason for keeping on the right side of the law, and less incentive to tamper with foods. The housewife, however, still preserves passion fruit with quantities of salicylic acid which would get a manufacturer into serious trouble.

5. ENJOYMENT OF FOOD:

It has been pointed out that the interest of man (and the chemist) in foods is concerned first with obtaining an adequate supply at all times; second, in paying adequate attention to their sanitation and freedom from disease; thirdly, in their nutritive value; and fourthly in achieving palatable foods.

It is well known that a desire to eat aids in the digestion of food. It is also well known that the enhancement of colour, odour, flavour and appearance serves to produce such desires. In recognition of this fact, these attributes are used in estimation of the grade of foods and in judging the desirability of a food. To realise how deep rooted and of what ancient custom are these modes of judgment, we need only consider the value placed upon spices and upon salt. There is the story of the king's daughter who, when asked what was the sweetest thing in the world, replied "Salt." Banished to the kitchen, she served a state banquet where every dish was prepared without salt, and she won a father's reluctant agreement.

If one were to attempt to use a diet composed of purified isolated proteins, fats, carbohydrates, minerals and vitamins, i.e., a diet containing all the essential food factors, while such a diet might provide for growth and sustenance, it would prove quite inadequate because of its lack of interest and its insipidness. The factor of palatability cannot be overestimated, and a proper and skilful use of colours and flavours is a most important part of good food.

The chemist has borne his part by the provision of many synthetic substances or highly purified extracts from natural resources to assist in the production of palatable food. Not many years ago there were two schools of thought. Some people considered the addition of any synthetic material to food reprehensible, while others thought the ultimate goal in food technology to be a tablet capable of supplying an adequate meal. Fortunately neither view is correct. Wiley, in the States, fought an unremitting battle against the inclusion of any substance in food unless it was known to be harmless, a stand which has fully proved its value in the careful selection of synthetic food adjuncts.

The discovery, isolation, synthesis and commercial utilisation of synthetic vitamins is one instance of the significance of synthetics in the diet. That does not mean we should forgo wholesome natural foods for synthetic substitutes, nor as the other extreme ban the use of synthetic substances entirely. °

The advantages of synthetics (where suitable) are:—

1. *Cost.* When the constitution of, say, a vitamin has been determined and its synthesis achieved, the cost of production may rapidly fall to a low figure.
2. *Purity.* As synthetics and isolates are manufactured as fine chemicals, their standards of purity are high and the quality constant. Quality can be maintained in natural food adjuncts but not easily; furthermore, the terms "natural" and "pure" are not synonymous.
3. *Strength and Stability.* Synthetic colours usually have high colouring power, while synthetic flavours can, if necessary, be used at higher concentration because of cheapness, but the flavour is, however, almost invariably inferior to that of the natural product.

Colour:

Through natural association we are accustomed to associate a given colour with a given product—red for cherries, brown for chocolate, purple for grapes, but who would favour purple tomatoes or bluish green whiskey?

The colouring matters that go into foods may be divided into two classes: secondly and most important the coal tar colours, first the colours of animal and vegetable origin.

Colours of vegetable origin are tumeric and anatto, whilst cochineal is one of animal origin.

The list of permitted coal tar colours and aniline dyes is very strictly limited, as many dyes are poisonous. This fact was real-

ised as long ago as 1858, and later the necessity of carefully testing dyes before their use is permitted was emphasised. Furthermore, much care must be exercised in their manufacture to ensure that no harmful substances such as lead or arsenic are introduced and no dangerous intermediates or by-products remain. Water-soluble dyes normally contain 86-92% pure dyestuff, the balance being principally salt and water. Oil-soluble dyes are from 95% to 99% pure dyestuff.

Flavour:

The flavour of food is compounded of many parts and is based on our senses of taste, smell and touch. Taste and smell are considered to be chemical senses, but any detailed discussion of their character is beyond our scope.

It is generally accepted that there are four fundamental tastes: sweet, bitter, sour, and salty. Dyson considers pungency an independent taste.

No satisfactory theory has yet been evolved to explain why some substances are sweet and some not: why substances as dissimilar as saccharin, sucrose and cobalt chloride dimethylglyoxime should be sweet.

A salty taste is normally associated with a chloride ion, but not always, as sodium glutamate has a pronounced salty taste. The salt sensation is diminished by higher temperatures. Sodium chloride also has the effect of reducing the sourness of acids and increasing the sweetness of sugar. This effect is especially marked with lactic and tartaric acids.

A bitter taste is usually associated with glucosides and alkaloids, but coumarin and several derivatives of saccharin are bitter.

The acid taste is probably associated with the hydrogen ion, but the buffer capacity of the solution has considerable effect. Mineral acids, though giving a much lower pH, are not usually as sour as citric acid, which has a minimum sourness at pH 3.7-3.9. If well buffered at 3.9 the solution tastes much more acid than the pure acid, and the sensation lasts longer. The minimum for citric acid sodium hydroxide mixtures occurs at pH 6.3. A sour taste is less perceptible at high temperatures, so that the sour taste of lemon-flavoured tea is subordinate to the sweetness of the sugar.

Some also will claim that the pronounced meaty flavour of a well-cooked steak, attributable to certain amino acids and their salts, is also a true sapid sensation.

Odour:

The sense of smell is a chemical sense like taste, and in most people exceedingly sensitive. It has been estimated that only a few molecules are necessary to produce the sensation. Butyric acid can be detected at 9 milligrams per litre. There are other nerves in the nose which also give rise to sensations, irritating, acrid, cooling. Thus the smell of menthol is a combination of odour plus a sensation of coolness. The pungent odour of ammonia is partly a pain sensation.

Various classifications of odour have been attempted, but no really scientific system has so far been evolved; but general classes such as fragrant, burnt, acid or sour, and caprylic have been suggested. Chemicals of entirely unrelated structure may have similar odours. Thus the garlicky odour of mustard gas does not mean a similarity to the chemical producing the garlicky odour of garlic. There are, however, marked chemical and odour relationships. Odour normally increases with increase in molecular size to a maximum and then diminishes. Isoamyl alcohol has about 10,000 times the odour intensity of methyl alcohol. Cetyl alcohol is practically odourless. The members of an homologous series having the more intense odours have boiling points falling within the range of 180-280° C.

The final flavour of a food, then, is a composite and consists of four separate sensations:

First—True taste or sapidity.

Second—Smell or olfactory sensation.

Third—Feel or tactile sensation.

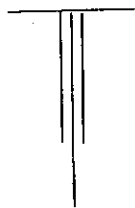
Fourth—The temperature sensation.

The synthetics available for use in flavouring cover a wide range of organic acids, alcohols, hydrocarbons, esters, aldehydes, ketones, ethers, acetals, phenols, pungent bodies such as piperine and capsaicin, and the synthetic sweetening agents.

There yet remains another important group of synthetic food adjuncts which, while contributing nothing to its flavour, may affect its texture or keeping qualities. Such are the various bacteriostatic substances propionates, ethylene glycol and ethylene oxide, and the antibiotic substances such as penicillin and the spice oils of pimento and cloves. Antioxidants have been proposed for fats. These are usually phenolic in type. The browning of cut, fresh fruits can be prevented by the use of thiourea.

We have reached the stage of being almost embarrassed by the variety of substances available, and I would suggest that as an experimental art the chemist try his hand in the kitchen producing those delicate nuances of flavour which render good food and drink much more attractive.

This survey has, I hope, indicated some of the ways in which the chemist contributes to solving the food problem of the world. Let us not forget, however, that the chemist can not actually make food, and in all humility remember the daily miracle of the green and living plant. Remember, also, that in spite of his work and knowledge, he must still rely upon the tiller of the soil, upon the keeper of flocks and herds, and that the ancient doom spoken in the Garden of Eden still stands: "In the sweat of thy face shalt thou eat bread till thou return unto the ground"!



AMERICAN CHEMICAL SOCIETY YOUNGER CHEMISTS' INTERNATIONAL PROJECT

A good deal of excitement was caused when it was known that the American Chemical Society was offering two free passages to United States in connection with the meeting of the International Union of Pure and Applied Chemistry and the 75th (Diamond Jubilee) meeting of the Society in September. Included in the offer was a three weeks' tour of chemical institutions in United States after the meeting. Only those under forty years of age were eligible. In order to make the selection, a committee of ex-Presidents of the Institute was set up, and the selection limited to six names which were sent to Washington. From these the A.C.S. selected Professor F. J. Llewellyn, of Auckland, and Dr. A. T. Johns, of Palmerston North. Subsequently Mr. J. Vaughan, of Canterbury College, was also selected.

Professor F. J. Llewellyn, D.Sc., Ph.D., F.R.I.C., graduated with first-class honours from the University of Birmingham in 1935, and Ph.D. from that University in 1938. From 1939 to 1945 he was Senior Lecturer in Structural Inorganic Chemistry (Final Honours Course) at Birkbeck College, University of London. During that time he was also Director of a Ministry of Supply Extra-Mural Research Team at the University of Birmingham, and did a considerable amount of research on explosives. From 1945 to 1947 he was Lecturer in General and Crystal Chemistry and Senior Foundation I.C.I. Research Fellow at the University of Birmingham. In 1947 he was appointed to the chair of chemistry at Auckland University College, where he has continued research on X-Ray Crystallography. Professor Llewellyn has published many papers on structural chemistry, and the degree of Doctor of Science was recently conferred on him by the University of Birmingham for his work on X-Ray crystallography.

Dr. Johns graduated with first-class honours in Chemistry from Canterbury in 1939 and was awarded a National Research Scholarship in that year. During 1940 he worked with Dr. Barnicoat at Massey College until he went into camp in October with the 4th Reinforcements. In 1941 he was removed from the regular forces in order to undertake the special Radio-Physics course at Canterbury College, and from then until late 1944 he was attached to Army headquarters for radar work. He resigned his commission towards the end of 1944 and served with the artillery in Italy. He was discharged from the Army in October with a rehabilitation bursary and spent three years (1945 to 1948) in the Department of Biochemistry at Cambridge. He was awarded a Ph.D. degree at the end of his period at Cambridge. On arrival back in New Zealand Dr. Johns took up the question of the nodule bacteria in clovers. He came to the conclusion that in most districts in New Zealand clover growth was, generally speaking, not inhibited because of lack of suitable bacteria in the soil. Most cases of failure were probably due to lack of essential nutrients, and until the nutritional status of the plant had been improved inoculation of clovers was unlikely to pay dividends. He then went on to a study which he had started in Cambridge, namely, the biochemical processes which go on during ruminant fermentation. He is primarily concerned with the fate of the various constituents of herbage when they are ingested by ruminant animals.

Mr. J. Vaughan, Senior Lecturer in Organic Chemistry at Canterbury College, was born at Porth, Wales, in 1920. He graduated B.Sc. (Wales) with First-class Honours in Chemistry in 1941. From 1941-46 he was research chemist in the Ministry of Supply, being concerned mainly with varnish resins and explosives. After the war he returned to the University of Wales to complete his M.Sc., and was then employed as a research chemist in the Crookes Laboratories (London), 1946-47. He occupied the position of Assistant Lecturer in general chemistry at the University College of Swansea until 1949, when he was appointed to Canterbury College. He has held his present position since the beginning of this year. Besides the above qualifications,

Mr. Vaughan is an Associate of both the New Zealand and Royal Institutes of Chemistry. He has published eight papers, including one war-time patent still classified as secret, and his special interests are the mechanisms of organic reactions. He is married and has one child.



Mr. W. G. Hughson.

The Hon. General Secretary of the Institute has also been invited to a World Conference of Executive Secretaries of Chemical Societies being held in New York at the same time, and he has proceeded to America, but at his own expense. Mr. Hughson, who is Senior Fuel Chemist at the Dominion Laboratory and Secretary of the Coal Research Committee, also hopes to visit various institutions connected with coal utilisation.

Mr. J. B. Brown, a former member of the Journal Committee, has resigned from the position of biochemist, Auckland Hospital, having been offered the post of biochemist to the Clinical Endocrinology Research Unit established by the British Medical Research Council. Mr. Brown is at present in England doing post-graduate research under Professor G. F. Marrian, a world authority in the field of endocrinology.

Dr. G. L. Bridger, Professor of Chemical Engineering, University of Iowa, is in New Zealand at the request of the Government, to report on the phosphate fertiliser industry here. Mr. R. L. Ledger, of the Chemical Engineering Section, Dominion Laboratory, is acting as his escort during his stay in New Zealand. Dr. Bridger addressed members at Conference on "Methods of producing Phosphate Fertilizer," and later addressed the August Meeting of the Auckland branch on "T.V.A. and Associated Chemical Engineering Projects."

I.C.I. PRIZE TO MR. E. P. WHITE

It was announced at the Conference at Hamilton that the Imperial Chemical Industries Prize for 1951 had been awarded to Mr. E. P. White for his researches on the alkaloids of leguminous plants. Mr. White graduated M.Sc. (Hons.) at Victoria in 1938, and was Jacob Joseph Scholar in the same year. He was demonstrator in chemistry at V.U.C. until 1941, when he joined the staff of the Chemical Laboratory, Department of Agriculture, and has been at Ruakura Animal Research Station since 1945. His studies on the alkaloids of leguminous plants commenced some twelve years ago with the aim of obtaining information on the nature and distribution of alkaloids in all leguminous species obtainable in New Zealand. Several new alkaloids have been



Mr. E. P. White.

found and the structure of one of these has been proved, though so far efforts to synthesise it have been unsuccessful. Twenty-two parts of this series have been published in the *New Zealand Journal of Science and Technology*. Mr. White was also associated with Dr. Reifer in studies on the grass alkaloid, perfoline; he has published papers on micro-analytical methods which he used in his work on alkaloids, and has done collaborative work on tutu, and p-cresol in sheep urine. At present his official work is on the isolation of the toxin of *paspalum ergot*, and studies on oestrogen and androgen in sheep urine. The work on legume alkaloids has been done mostly in his own time. His other hobbies include gardening and experimenting with ways and means of obtaining high-fidelity reproduction of classical music.

We apologise to the President, Mr. P. R. Parr, for not having mentioned in our previous issue that he was the Institute's official delegate to the meeting of the A.N.Z.A.A.S. meeting in Brisbane in May.

The address of Mr. S. R. Siemon, on leave from Canterbury College, will be as follows until 30th September, 1952:—Department of Chemical Engineering, Tennis Court Road, Cambridge, England.

After four years at the Lister Institute, London, Dr. J. Lyttelton has arrived to join the staff of the Chemical Laboratory, Grasslands Division, Palmerston North. This laboratory has just installed the only ultra-centrifuge in New Zealand. It is an air-driven model designed and built by the Dominion Physical Laboratory.

FIRST AWARD OF MORCOM GREEN AND EDWARDS PRIZE TO MR. I. K. WALKER

The first award of the Morcom Green and Edwards Prize, which is limited to chemists under 35 years of age, was announced at the Conference, the successful applicant being Mr. I. K. Walker. The recipient was born in Auckland in 1917, and received his secondary education at Auckland Grammar School. He graduated B.Sc. from Auckland University College in 1939, and M.Sc., with Honours in Chemistry, from Victoria two years later. He was employed in the laboratory at Westfield Freezing Works from 1933 to 1935, and since 1938 he has been on the staff of the Dominion Laboratory, Wellington. During the war he was engaged on radar work



Mr. I. K. Walker.

for the armed forces both in New Zealand and on the Pacific front, where he held a temporary commission and was seconded for duty with the U.S. Navy. In 1944 he went to England on loan to the British Ministry of Supply, and was engaged in research work at Malvern, in Worcestershire. After the war he was transferred to Montreal University and later to Chalk River Atomic Energy Establishment, with several other New Zealanders. In 1946 he returned to England to work at Harwell Atomic Energy Research Station in the erection of the first atomic pile. He came back to the Dominion Laboratory in 1949 and took charge of the physical chemistry section. The work for which he was awarded the prize was in connection with spontaneous combustion in wool.

Mr. K. W. Kiddle, Associate, has resigned from N.Z. Plywoods (S.L.) Ltd. to join Commercial Cleaners, Ltd., Christchurch.

Dr. R. L. Blakley, who was a Medical Council Research Fellow in Biochemistry at the Medical School, Dunedin, has left for London, where he will study at the National Medical Research Institute. He is travelling on an Australian National University Research Scholarship, and from London he will go to Australia.

Dr. Ralph Grim, Research Professor Clay Mineralogy at the University of Illinois, arrived last month in Dunedin as a guest of the University of Otago. He was to address members of the Otago Branch and kindred societies on "Some Engineering Applications of Clay Mineralogy."

EDITED MINUTES OF THE ANNUAL GENERAL MEETING OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY, HELD AT HAMILTON HIGH SCHOOL ON AUGUST 20, 1951

1. *Present:*

The President, Mr. P. R. Parr, presided over a meeting of members.

2. *Apologies:* Apologies were received from the Vice-President, Professor S. N. Slater, Mr. J. L. Mandeno, Dr. A. T. Johns, Mr. F. H. Fielder, Dr. McDowall, Professor F. J. Llewellyn, Mr. J. Beck.

3. *Confirmation of Minutes:*

The minutes M.545 and 546 of the Annual General Meeting held on August 24th, 1950, were read and confirmed.

4. *Presidential Remarks:*

Mr. Parr commented on the continued increase in membership. Forty new members were admitted during the year, while seven members had resigned and four had died. The deceased members were Miss E. D. Swanberg, Mr. B. C. Aston, Mr. W. Donovan, and Mr. I. Ting. Members stood for a moment as a mark of respect.

The President presented Associate Certificates to the following members who were present:—Mr. Alton, Dr. Jackman and Mr. Hall, and announced that during the year Mr. N. H. Law and Mr. A. K. R. McDowell had been elected Fellows.

The Council had been strengthened by the addition of Drs. Annett and Barnicoat, representing the new branches Waikato and Manawatu, respectively.

The President announced that Professor Llewellyn, Dr. A. T. Johns and Mr. J. Vaughan had been selected by the American Chemical Society to proceed to the International Conclave in New York in September, from the list submitted to them by the New Zealand Selection Committee, which consisted of Prof. Slater (Chairman), Prof. Packer, Drs. Melville and Dixon, and Messrs. Joiner, Lawrence and Hughson.

The President read the following summary of a report to him from Prof. Slater:—"As in your absence I chaired the selection committee, it may be a help to have a report from me. In the first place, the basis of our discussions was an official circular sent by the American Chemical Society in which the conditions governing the award were, briefly, as follows:—'The projects were undertaken specifically for chemists up to 40 years of age who would not otherwise have the means to visit United States and were designed to help young foreign chemists to solve problems arising from the world dollar shortage by providing funds to defray their subsistence and travel expenses in the United States. Assistance will be available to young chemists in universities, government departments and independent institutions, as well as to those working in plants or industrial laboratories. The focal point of the visit of the young foreign chemists will be the International Chemical Conclave. . . . With this as its only guide, the Selection Committee was immediately faced with two problems of interpretation. First: Did the American Chemical Society intend the awards to be to chemists in the 20-30 age group, or was it looking for "younger chemists" as opposed to the really senior members of the profession, that is from the point of view of age? Both the phrases "young chemists" and "younger chemists"

were used in official communications. The committee reached the conclusion that if the American Chemical Society had wanted chemists under 30 it would have said so. Accepting the instructions at their face value, the committee in the first instance attempted to arrange the applicants in order purely of chemical merit without at this stage considering other factors. It had no justifications for excluding any candidate over 30.

"Secondly: Did the phrase 'who would not otherwise have the opportunity of visiting America' refer to opportunity at *any* time or opportunity at the specific time of the 75th anniversary celebrations of the American Chemical Society, with which event the project was clearly linked? The committee had no means of reaching an informed decision on this point.

"The final result of the committee's discussion was the forwarding of five names to America, arranged as fairly as possible in order of purely chemical merit, along with a sixth name, that of a person not long resident in New Zealand but of high priority on chemical grounds, who might or might not, in the eyes of the American Chemical Society, qualify as a New Zealand chemist. With this list went a very clear report of the difficulties the committee found in interpreting the American Chemical Society circular and a frank statement that certain nominees, placed high in the list, would normally be able to visit America in the course of their professional careers at some other time, and, if the scheme was not intended for such people, we asked the society to take this into account. Similarly, there was an equally frank statement on the age problem in which it was explained that if the society wished to sponsor more particularly chemists under, say, 30, then the Institute would give very strong backing to some of the younger chemists lower on the list.

"It will be clear, therefore, that the committee specifically asked the American Chemical Society to take into account these two factors. The final selection was made in America, not in New Zealand, and the New Zealand Selection Committee could do no more than forward the names of the six most outstanding candidates who fulfilled the conditions laid down by the American Chemical Society.—(Signed) S. N. Slater."

Dr. Gardner said he thought an unfortunate position had arisen, and felt impelled to say so, although with some diffidence, because he was in no way criticising the three people chosen.

The President in reply quoted extracts from the letter sent by the Selection Committee to the American Chemical Society, showing that an approval of the candidates' chances of future overseas travel had been made.

Dr. Andrews and Dr. Briggs thought that the Selection Committee had carried out its duties in a very satisfactory manner in difficult circumstances, in that the terms were laid down by the American Chemical Society. The two speakers felt that we should be pleased that our profession in this country had been recognised to such an extent that three members had been invited on such a generous scale.

On the motion of the President, seconded by Dr. Richardson, it was decided to send official greetings to the American Chemical Society on the occasion of their Jubilee.

5. REPORTS OF THE SUB-COMMITTEES:

Reports received from the Sub-committees:—

Examinations Committee:

In addition to the Examinations Committee Report, it was reported to the meeting that discussions with the University of New Zealand had made it clear that those wishing to qualify for the New Zealand Institute of Chemistry Associateship examination will not be examined by the University unless they matriculate and keep terms in the usual way.

The following motion was moved by Dr. Richardson, seconded by Mr. G. M. Wallace:—

"That this General Meeting of the New Zealand Institute of Chemistry, having regard to Rules 3.1 and 3.2 of the Institute's Rules, requests those members who are also University Teachers to give thought to the needs of unqualified persons, who, being engaged during usual working hours 'in the science and practice of Chemistry,' desire to promote their 'usefulness and efficiency' or to 'raise their status.' Furthermore, that this meeting requests the aforesaid members to consider ways of encouraging this desire within the constituent Colleges of the University, and to prepare a report of their findings for circulation to Branch Committees, for discussion at Branch Meetings prior to the next Annual General Meeting, and at the next Annual General Meeting."

In support of his motion, Dr. Richardson said he regarded the present double mode of entry into the Institute as undesirable, and that there was an exclusive attitude to education from the point of the University. In the past part-time students were well catered for, but their facilities have been gradually removed by three stages: (1) A campaign directed against what were called "glorified night schools." (2) The giving of bursaries by the Government for full-time study. (3) The exclusion of part-time students is said to result in little hardship.

Dr. Richardson considered that the part-time student deserves encouragement, and that the continuance of bursaries depends on stable economic conditions.

Mr. Wallace agreed that the interests of those who, in the future, may be unable to attend full-time courses should be safeguarded.

Dr. J. C. Andrews said he would support the motion if the position was really as stated by Dr. Richardson, but the present rules give ample opportunity to qualify.

Dr. L. H. Briggs said he was sympathetic with Dr. Richardson's aims, but did not agree with the facts put forward, as he did not know of any students who have been debarred from the study of chemistry at the University by lack of finance. He had found employers willing to allow their part-time employees to attend classes at times set by the University. Day bursary holders cannot pass stage 1 subjects, so that any unsuccessful applicant for a full-time bursary could have little chance of success. Further sources of finance for full-time students are vacation work and employment as University Laboratory Assistants at £100 per year. Dr. Briggs said it was worth noting that these latter posts were not much sought after.

Mr. Rands stated he was in favour of the motion, and in reply to Dr. Briggs said he would like to believe that the present favourable circum-

stances would continue, but felt that there was a distinction between part-timers and other more fortunate groups, there being too great a distinction between the Pure Chemist and the Applied Chemist.

The President felt that the Institute should provide the means for Technicians to qualify further, and asked whether this course should lead to the Associateship.

Mr. Keys said that since C.O.P. without terms could not be obtained from the University; the Institute must now conduct its own Associateship examination. Care must be taken that this does not have a lower standard than the corresponding Royal Institute of Chemistry examination.

Professor Worley felt that the motion could bring adverse criticism from the University. From the University point of view, there is insufficient staff to cater for part-time students who wish to take classes in the evenings. He thought the Technical Colleges should expand the scope of their adult classes.

Professor Worley moved by way of amendment that the matter be referred to the Examinations Committee for a report to the next Annual Meeting. The motion lapsed for want of a seconder.

In reply to a question by Mr. J. K. Johanneson, it was stated that holders of ordinary bursaries were not forced to work in Government laboratories. Dr. Richardson's motion was put to the meeting and carried.

Standards Institute:

Mr. M. L. Stewart, convenor, asked the representatives on the various committees to speed up their reports. The President announced that a meeting of the Chemistry Technical Committee of the International Organisation for Standardisation will be held in Milan, Italy, on November 5th, 1951. Any members likely to be present are asked to advise the Hon. General Secretary.

In connection with the Patents work, Dr. Shorland wishes to pass on the perusal of the *Patents Journal* to some younger member. Any interested member should contact Dr. Shorland.

Unesco:

A report was received. Mr. J. A. D. Nash added that Professor Soper led the New Zealand delegation to the recent Unesco Conference in Paris.

6. FINANCE:

The President reviewed the financial situation of the Institute. Over the years 1946-1950 the membership has increased from approximately 300 to 400, the income from £500 to £650, and the expenditure from £200 to £510 per annum. The total expenditure for 1951 would be about £600, that for 1952 at least £650. The total assets of the Institute amount to about £1400, which sum the President considered not too great: Owing to increased costs the *Journal* for 1951 would cost £200 instead of the estimated £120. The surplus of income over expenditure was decreasing year by year, and although the estimated income for 1952 would be about £700 the Institute would be fortunate to strike a favourable balance in that year. The President stated he was not in favour of curtailing Institute activities, and suggested that a rise in the subscription rate was warranted. Instances were given of the much higher costs of membership in other professional bodies in this country. Mr. Parr intimated that the Registrar had found

it necessary to ask for an increase in salary to about £200. This was considered to be a reasonable request when all the circumstances were considered. For the benefit of members, Mr. Hughson outlined the duties of the Registrar. It was pointed out that the sum spent on travelling expenses was kept down because employers allowed members of their staffs to combine Council meetings with trips on official business, with a corresponding reduction in the expenses. The effect of this was that the Institute was being subsidised by employers to the extent of about £180 per year. The President considered that a professional body should not budget on the assumption that this state of affairs would continue indefinitely. Mr. Clare expressed his surprise that the New Zealand Institute of Chemistry could operate successfully on such a small subscription, and reminded the younger members that they had most to gain from the continued activity of the Institute. The President recommended branches to discuss subscriptions.

8. TIMBER PRESERVATION:

Mr. C. G. W. Mason, New Zealand Institute of Chemistry representative on the Timber Preservation Committee, reported that the interest of the Institute had had a stimulating effect in bringing standards into operation. A draft specification of 86 pages, entitled "New Zealand Standard Specifications for Timber Preservation and Code of Recommended Practice" had been prepared. A specification had been issued for the preservation of tawa and taraire for furniture and dowels.

9. PRIZES:

The President announced the winners of the following prizes:—

I.C.I. Prize: E. P. White, for work on alkaloids.

Morcom Green and Edwards Prize: I. K. Walker, for work on the spontaneous combustion of wool.

10. AMENDMENTS TO THE RULES:

Progress is being made by the Auckland Sub-committee.

11. RECIPROCITY WITH OTHER EMPIRE INSTITUTES:

The suggested subscription scheme with the Royal Institute of Chemistry was reported to have come to nothing because of legal difficulties with the Royal Institute of Chemistry constitution.

12. GENERAL:

It was resolved that the Hamilton High School be thanked for all the facilities provided for holding the 1951 Conference.

EDITED MINUTES OF A MEETING OF COUNCIL-IN-PERSON HELD IN HAMILTON ON AUGUST 19, 1951

Present: Mr. P. R. Parr, President (in the chair); Professor S. N. Slater, Vice-President; A. W. Mackney, Auckland delegate; Dr. H. E. Annett, Waikato delegate; Dr. C. R. Barnicoat, Manawatu delegate; A. P. Oliver, Wellington delegate and assistant secretary; F. H. G. Johnstone, Canterbury delegate; O. H. Keys, Otago delegate; G. M. Wallace, proxy for Editor; W. G. Hughson, hon. general secretary; E. E. Jackson, Auckland proxy, present by invitation.

REPORT FROM SUB-COMMITTEES**1. JOURNAL COMMITTEE:**

Mr. Wallace reported that the *Journal* expenditure for 1951 would probably be £80 in excess of the £120 granted by Council on M.548. Lengthy consideration was given to the many factors contributing to the increased costs, and it is considered unlikely that costs in 1952 will be less.

Resolved (Vice-President, Wellington):

That the Editorial Committee, before September 30th, furnish to the Hon. General Secretary for distribution to Branches a detailed report on the following matters for consideration at the Annual Meeting of Council, on November 30th, 1951:

- (1) A survey of the *Journal* finances.
- (2) Desirability of reverting to four issues per year.
- (3) Advertising.
- (4) Increased income to be expected if all local members subscribe to the *Journal*.
- (5) Relative costs of reprints as against additional copies of the *Journal*.

Biennial List of Members:

Resolved:

That early in 1952 a supplement to the 1950 List of Members be printed as a loose sheet for insertion in the 1950 list.

2. PROFESSIONAL STATUS COMMITTEE:

A report was received stating that the appeal by the Hotel, Restaurant and Related Trades' Union, which was to have been heard in March, 1951, has not yet been heard. The hearing will be the subject of a further report.

The Committee is at present investigating the following matters:—

- (1) The standards of admission to Commonwealth Chemical Institutes.
- (2) Salary scales and conditions of appointment and employment of technicians.

3. EXAMINATIONS COMMITTEE:

A report was received from the Hon. General Secretary of detailed discussions held between Professor I. A. Gordon, Vice-Chancellor of the University of New Zealand, Professor S. N. Slater, Vice-President of the New Zealand Institute of Chemistry, and the Hon. General Secretary, regarding the examination of candidates for the Associateship. It has now been definitely established that the New Zealand Institute of Chemistry will have to conduct its own examinations in future.

4. STANDARDS INSTITUTE COMMITTEE:

An additional report was received from Mr. M. L. Stewart on the following topics:—

Timber Preservation:

A letter was received from Mr. R. T. Wright stating that the drafting of Standard Specifications for Timber Preservatives and Code of Recommended Practice for Timber Preservation was proceeding satisfactorily.

See minutes of General Meeting.

Rodent Poisons:

A draft New Zealand Standard Specification, entitled Requirements for Rat and Mouse Poisons, has been circulated.

GENERAL

FOOD PARCELS:

The Branches are continuing the scheme.

FINANCE:

The estimated income and expenditure for the current year up to 31st October, 1951, was set out on A.231.

The estimated surplus was shown as £100, but the report by Mr. Wallace on *Journal* affairs showed that the grant of £120 made to the *Journal* had been overspent by £80. The estimated surplus will therefore be £20. Considerable discussion took place on the financial policy and situation of the Institute, including ways by which expenditure could be reduced. The main headings were as follows:—

Registrar.—The Registrar is due for reappointment next November, and he has intimated that he would require an increase in salary from £125 to £200 per annum. It was agreed that rising costs and membership would make some increase necessary, and that the reappointment of the Registrar would be desirable.

Resolved:

That Council considers that the reappointment of the Registrar for a further three years' term is warranted, and that a considerable increase in salary will be necessary, probably up to £200 per annum.

Travelling Expenses.—Auckland suggested that the basic policy should be the payment of a first-class fare and sleeper, but not of air travel, in cases where only one night's travelling is involved. This policy was agreed to, it being considered that meetings of Council were a necessary part of Institute's activities. It was agreed that the total travelling expenses would not normally exceed £100 per annum but could possibly reach a maximum of £200.

Subscriptions.—The opinion of the Council is that the continuance of activities at the present level may soon make an increase in subscription rates necessary. Although it would be possible to maintain subscriptions at the present level for a short time by drawing on the Trust Fund and National Savings Account, it was agreed that these reserves are not substantial enough for this course to be followed.

LIFE MEMBERSHIP:

The Registrar's draft to the Rules Sub-Committee was received.

Resolved:

That Clause 6.2 in the draft be amended to read: ". . . shall be liable at the date of such transfer to pay a further lump sum covering the compounded amount of the difference between the Associateship and Fellowship subscriptions at his age at the time of transfer of status."

Resolved:

That Rule 6 and Regulation 9 be redrafted as amended by Council, and forwarded to the Rules Sub-Committee for checking, and that they be subsequently registered to take effect on and from November 1951."

ASSOCIATES:

Resolved: That the following be admitted as Associates:—

HARPUR, Robert Peter	HURRAN, Walter John
WATSON, Thomas Robert	CHAPPELL, Peter Lyndsey
SHEAT, David Edwin Gordon	JESSOP, Edwin Charles
DASENT, Wilfred Effingham	DUNCKLEY, James Vivian
WHITESIDE, Merle Margaret	BUTCHERS, John Barnard
KITT, Watson	BARR, Helen Elizabeth
BROWNING, Allen Ransome	McKEEGAN, William Ralph
HAYLOCK, Owen Fillbridge	ALLAN, James Eric
WILL, Graham Melville	JONES, Brian Ogilvie
PARSONS, Robert Louis	SWINDALE, Leslie Denis
	KARTUZ, Romana

Resolved:

That the resignations of Mr. S. H. Wilson and Mr. J. S. McHarg be received with regret.

Resolved (President, Canterbury):

That Mr. W. G. Hughson, Hon. General Secretary, be granted leave of absence, and that the Assistant Secretary, Mr. A. P. Oliver, carry out the duties of Secretary during the absence of Mr. Hughson.

A. P. OLIVER,

Acting-Secretary.

BOOK REVIEWS

ORGANIC REACTIONS, Vol. VI. Roger Adams, Editor-in-Chief. 517 pages. 1951: John Wiley & Sons, New York; Chapman & Hall, London. \$8.00. The latest volume of this well-known series contains chapters on the Stobbe condensation; the Bischler-Napieralski, Pictet-Spengler and Pomeranz-Fritsch reactions, all of which apply to the synthesis of the isoquinoline ring; the Oppenaur oxidation; the synthesis of phosphonic and phosphinic acids; the halogen-metal interconversion reaction with organolithium compounds; the preparation of thiazoles; the preparation of thiophenes and tetrahydrothiophenes; and reductions with lithium aluminium hydride. The chapters like the one on the preparation of phosphonic and phosphinic acids cover a number of reactions which are used for the purpose and the usual exhaustive tables show the compounds for whose preparation they have been used and the yields in each case. It is sufficient to say that the standard of the previous volumes has been maintained.

PREPARATION OF ORGANIC INTERMEDIATES. By David A. Shirley. 328 pages. 1951: John Wiley & Sons, New York; Chapman & Hall, London. \$6.00. This book contains directions for the preparation of 500 organic compounds with reactive groups making them useful for synthetic purposes. The compounds chosen are not readily available commercially and are not dealt with in "Organic Syntheses." All starting materials are readily available commercially, are given in "Organic Syntheses," or are given elsewhere in the volume under review. The procedures given have not been tested by the author, who has taken them from the literature and selected them "by a careful and critical examination." Only use can show how good the author's judgment is. This is the only possible weak point in what seems to be an excellent scheme, but the transcription of the details is accurate and all the procedures should be worth a trial. This should prove a useful book, and we hope it will be the forerunner of a series.

INORGANIC MICRO-ANALYSIS. By H. V. A. Briscoe and P. F. Holt. 171 pages. 1951: Edward Arnold & Co., London. 12/6. This is a text-book containing methods which it is claimed can be self-taught in case of need. This is an important point in a country where there are no courses available in inorganic micro-methods, and the rather bold claim seems to be justified, so far as the book goes. The first part covers qualitative analysis, with separation schemes for the various elements, and here the coverage is reasonably complete. In the quantitative section, however, the methods given are reduced to illustrative examples of the various types of analysis, such as gravimetric, volumetric, etc. This section could have been expanded with advantage, and deals almost entirely with pure substances with practically no reference to the removal of interfering substances likely to be present. More references to the original literature could have been included. There are, however, many excellent illustrations and the book is well printed.

NEWS AND NOTES

Professor J. Packer addressed the Canterbury Branch on 16th July on "Some Observations on Institutions and Current Research Work Overseas." He gave a most interesting account of his recent trip overseas, dealing particularly with current research, and the problems and administration of overseas institutions. Of added interest was the informal report on the work of many New Zealand chemists engaged in furthering their studies overseas.

On 13th August, Professor P. A. S. Smith, Fullbright Scholar from the University of Michigan, spoke to the Canterbury Branch on "Some Aspects of the War-time Penicillin Project."

The August issue of the "New Zealand Science Review" takes the form of a Rutherford Memorial Number and contains a series of excellent articles and photographs. Many of the articles are by former students of Lord Rutherford and the issue is designed to create interest in the Rutherford Memorial Foundation. Copies are available from the Business Manager, Box 3001, Wellington, at 2/- each.

The July meeting of the Waikato Branch was addressed by Mr. A. W. Mackney, Chairman of the Auckland Branch and Chief Chemist, N.Z. Forest Products, on "Chemical Conversion of *Pinus radiata*." Two films were also shown.

A detailed catalogue of their scientific publications has just been issued by Interscience Publishers, Inc., 250 Fifth Ave., New York, who will supply copies on request.

The following publication should be added to the list of the Institute's journals housed at the Auckland Museum: *Transactions of the Chalmers University of Technology, Gothenburg, Sweden*. All these journals are available through the Country Library Service.

Dr. F. B. Shorland addressed the Otago Branch in July on "The Importance of Fats in the Economy of New Zealand." He comprehensively surveyed our oil and fat-containing products, including milk products, tallow, linseed oil, fish-liver oils and whale oil. In the same month, Mr. A. C. Holmes spoke on "Milk as a Raw Material for Chemical Industry." He described in detail the manufacture and use of the products obtainable from cows' milk, and pointed out the difficulties of preventing the fullest use of waste products from butter and cheese making. The chief problem was how to get rid economically of some 87 per cent. of water. In general, this was at present too costly to compete with products available from other sources.

At the August 9th meeting of the Waikato Branch, Dr. H. E. Annett delivered the Chairman's Address on "The Romance of Indigo." He pointed out that natural indigo was produced in India from two species of *Indigofera*. The plant was placed in vats with water, where the glucoside indican was broken up by bacterial action to indoxyl and glucose. Indoxyl was oxidised to indigotin by oxygen from the air, and the purple precipitate was filtered off, using cotton cloths. Reference was made to the allied "Tyrian Purple." Indigo was synthesised as early as 1890 by the Heumann process, which required anthranilic acid and chloroacetic acid. By 1895 about 650 tons of synthetic indigo had been exported from Germany, where it was made mainly by the Badische factory. The discovery of the mercury catalysis of the naphthalene to phthalic acid oxidation allowed a great expansion of manufacture, and a lowering of the cost of the synthetic material. Indigo was made on a very large scale by Badische in 1913. The contact process for sulphuric acid developed largely as a means of recovery of the sulphur dioxide from the naphthalene oxidation. The decline of production of natural indigo was outlined; the indigo-producing areas of Bihar gradually becoming available for food production. Some of Dr. Annett's experiences with problems of indigo at the Pusa Research Institute were outlined. One factor which hastened the decline of the indigo plant was a disease due to phosphate deficiency in the soils.

The July meeting of the Auckland branch was given a very interesting address by Mr. S. G. Brooker, Chief Chemist, Abels Ltd., on "Flavour."

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