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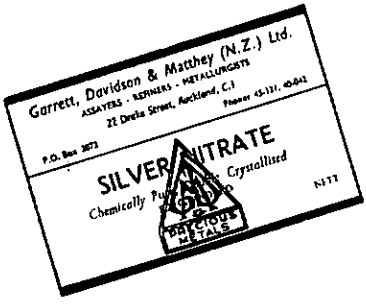

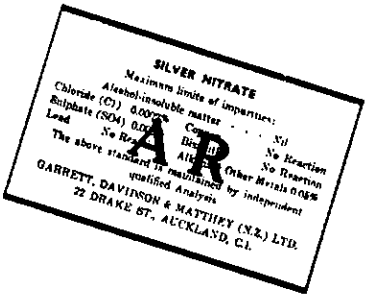

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EDITORIAL

For several years workers in the sciences and representatives of industry and agriculture have expressed dissatisfaction with the organization of Government-financed research in New Zealand. Difficulties in recruiting and retaining first class scientists have been attributed not only to comparatively low salaries but to lack of flexibility of the Public Service machinery for appointment and training of staff and purchasing of equipment. Two years ago it appeared that a commission to investigate the organization of state scientific services and research groups would shortly be appointed. Instead, the investigation was shelved until the Royal Commission of Inquiry into the State Services, which was expected to consider some aspects of this subject within its much wider terms of reference, had expressed its opinion.

After hearing some evidence which included "some forceful adverse criticisms of the conduct of research" the Commission considered that much of this criticism was outside the scope of its inquiry. In an honest but somewhat hesitant statement the Commission's report (page 136) says:

> We lean in favour of the consolidation of Government research, particularly in agriculture, but the question is obviously one on which we should not make a firm recommendation, not only because of the detailed investigation needed but also because it raises issues about which only a body having strong scientific representation on its membership could express a confident and useful opinion. We are not such a body and any recommendation which we might make could be harmful. Though these issues call for specialised consideration, the question finally is one of the allocation of functions in the machinery of government, a matter which we have already said is properly the function of a State Services Commission to advise upon. We recommend therefore that this whole question of the consolidation of scientific research now conducted within State Departments be taken up by the State Services Commission. As that Commission will not itself have the necessary scientific knowledge, this will be a proper case for it to establish a special advisory body composed of select and suitable persons. The State Services Commission

> would, no doubt, seek to have included in the advisory body the members of the proposed National Research Council, or a sub-committee of them, supplemented if necessary by such other scientific personnel as may be wanted. We do not wish it to be thougnt, however, that we consider that the problem is necessarily one for scientists alone. The primary industries and others closely affected (or who have special knowledge) must be considered when the advisory body is constituted.

The Commission of Inquiry made three specific recommendations: (1) Replacement of the present Council of Scientific and Industrial Research with a National Research Council consisting of not fewer than 5 members appointed by the Government and 4 official members representing D.S.I.R., Treasury and the Departments of Agriculture and Industries and Commerce. (2) Appointment of a Minister of Science and a Cabinet Research Committee including the Ministers of these 4 Departments. (3) The instruction of the State Services Commission "to investigate at the appropriate time (preferably with the help of a select expert committee): (a) whether research should remain distributed among Departments of State, or whether it should be the responsibility of a single agency; (b) if a single agency, whether this should be a department or a statutory corporation".

These recommendations appear reasonable actions to achieve better co-ordination of research at present conducted by a number of departments, which seems to have been the main aspect which the Royal Commission considered itself competent to discuss within its terms of reference. However, many scientific workers think that the proposed constitution of the N.R.C. is potentially dangerous. The representatives of departments could easily be administrators with no research training or experience and several of the other members could be chosen from industry or agriculture with little regard for their scientific background, so that scientists could be in the minority on the Council. A training in scientific research does not itself impart the breadth of vision or advisory ability which are desirable in members of the N.R.C.; but a National Research Council not constituted largely of men with experience in research is not likely to inspire confidence in the scientists whom they must control. It seems naive also to expect a States Services Commission to pursue enthusiastically an inquiry which is likely to result in removing important departments, or sections of departments, from the Commission's control. Above all, the proposed reorganizations do not remove the major diffi-

culties, such as procedures for staffing and purchasing, alleged to hamper scientific research within a public service system developed for the more predictable needs of essentially clerical departments. There is a suspicion that the Royal Commission, finding it necessary to pass a buck that it should never have been asked to handle, has passed it to the wrong agent, and in so doing has delayed action still further.

The Royal Commission of Inquiry reported in June, 1962. In the concluding stages of the 1962 session of Parliament the Government introduced a Bill which appeared designed to give effect to these recommendations. Had it been passed, the result would likely have been a series of renovations rather than a reconstruction of research along lines which allow scope for the scientific imagination and enterprise needed to attract and hold scientists of high quality. In the meantime protests against this legislative action preceding a further inquiry were registered by the Institute of Chemistry through motions passed at the Annual Meeting in August and again at the Council meeting in November. These motions, which were transmitted to the Prime Minister and other Ministers, expressed the Institute's opinion "that an inquiry into New Zealand science should be held forthwith and that the committee should consist of a majority of eminent overseas scientists". Similar protests have been voiced by the Royal Society and other scientific bodies. Fortunately, because further action on the Bill is held up until the next Parliamentary session, there is further opportunity to consider and, if necessary, oppose, the enactment of a measure which may delay indefinitely the comprehensive overhaul of the conduct of scientific research under Government control.

THE PRESIDENT

The President of the New Zealand Institute of Chemistry for 1962–63, Mr W. G. M. Hughson, graduated M.Sc. from Canterbury College in 1927, specializing in physical chemistry. During 1927 and 1928 he was National Research Scholar for the newly-formed Scientific and Industrial Research Department, working on the low temperature carbonization of blended New Zealand coals. In 1928 he was appointed Assistant Fuel Research Chemist at the Dominion Laboratory, and for the next five years studied the yields on carbonization of coals from all over New Zealand. This work included pilot scale production of briquettes for locomotive trials. In 1932 he became chemist to the Waikato Carbonisation Company which undertook the conversion of waste slack coal into briquettes. When the Government initiated a survey of the coal resources of the country, in 1936, Mr Hughson was appointed to take charge of the chemical side of the investigation. In 1948 he was appointed Secretary to the Fuel Research Committee and since that time the chemical service and developmental work which the Dominion Laboratory has contributed to industries producing and using coal have been under Mr Hughson's direction. Over the past thirty years he has visited nearly every coalmine in New Zealand in connection with projects on coal utilization and safety in mines, his work being published in a series of D.S.I.R. bulletins. He visited Australian coalfields in 1946 and fuel research centres in the United States and Canada after attending the Fuel Division of the American Chemical Society Jubilee Conference in 1951. In 1956 Mr Hughson spent several months in Europe studying the latest methods for chemical and physical analysis of coal and was New Zealand representative on the Commonwealth Committee on Fuel Research. Last year he was New Zealand delegate to the third meeting

of this Committee in Sydney and attended the Sixth World Power Conference in Melbourne.

Few if any of our members have given so full and consistent service to the Institute as "Mick" Hughson has. As a foundation member he was early active in Wellington Branch, being Branch Chairman in 1940. He became Honorary General Secretary-Treasurer in 1944, when the Institute was thirteen years old, and it was twice that age when he retired from the secretaryship. These were years of consolidation during which membership increased about three-fold and the number of branches from four to six; the annual conference, which had been discontinued during the war, was resumed on a much larger scale, the Trust Fund started, prizes established. The post-war resumption, on a much larger scale, of the annual conference, establishment of the three Institute prizes in their present form, and the setting-up of most of the existing committees, were all activities which fell within this period. In all these activities Mr Hughson, as General Secretary, played a leading part. An especial interest of his was the establishment of closer relations with chemical organizations in other Commonwealth countries, including discussions which paved the way for visits from overseas chemists and for the collection of exchanges to form a library. It was appropriate that he was able to attend, in 1951, the international meeting of secretaries and a meeting of the International Union for Pure and Applied Chemistry at the invitation of the American Chemical Society on the occasion of the 75th Anniversary Conference of the Society.

The present Secretary and Registrar should not find that this year's President needs much briefing in the administration of the Institute. During 1963, Mr Hughson hopes to visit branches and to renew acquaintance with a large proportion of the membership of the Institute.

THE VICE-PRESIDENT

The Vice-President for this year is Mr S. G. Brooker, Chief Chemist for Abels Ltd., Auckland.

SOME CHEMICAL ASPECTS OF LUBRICATING OILS

WALTER FREITAG
BP (New Zealand) Limited

SUMMARY

The chemical nature of mineral lubricating oils and their associated additives, as applied to general machinery, is outlined and its effect upon desirable lubricant properties discussed. Chemical and physical degradation processes operative during use are described and laboratory methods of assessing their nature and extent, using readily available equipment, are critically reviewed. Examples in general interpretation of test results conclude this paper.

INTRODUCTION AND SCOPE

The sight of a stream of black, viscous fluid — spent lubricating oil — being drained from a piece of machinery or an engine, is probably as familiar as the often accompanying sentiment: "Compared to the cost of mechanical failure due to inadequate lubrication, oil is cheap! Let's throw it away and put in new oil."

Multiplied by the number of vehicles and machines in present-day use, many of which have individual oil capacities of several hundred gallons, this picture, viewed from a national basis, shows that currently some 8.5 million gallons of lubricating oil for industrial and automotive use are imported into New Zealand annually, representing an overseas expenditure of £1.5 million (1). Current estimates of industrial and transport expansion predict this figure to increase by about 15% per annum (pers. comm.) and, since local production is at present considered uneconomical in relation to current demand, importation of this essential commodity must continue to involve the expenditure of valuable overseas funds. Under an economic policy aimed towards the conservation of overseas assets, the problem of efficient utilization of existing resources becomes of vital concern to everyone.

The main article in this issue has been condensed from last year's Prize Essay. Mr Freitag received his early education in England but graduated M.Sc. with Honours from Victoria University College in 1952. From 1947 to 1951 and again from 1953 to 1954 he was employed with Boracure (N.Z.) Ltd, and during this time spent a period with the Division of Forest Products, C.S.I.R.O., in Melbourne studying timber drying and preservation. In 1954 he joined BP (N.Z.) Ltd., and is engaged on general petroleum chemistry, particularly the application of new analytical methods. Elected an Associate in 1960, Mr Freitag is also a Member of the Institute of Petroleum, and has been a Branch Chairman and Council member of the Association of Scientists.

This problem is particularly pertinent to lubricating oils, the application of which is still often incorrect and wasteful. Efficient utilization may be considered under four main headings:

(1) Use of a correct grade of oil for a specific application.
(2) Subjecting the oil to correct operating conditions.
(3) Extending the use of an oil up to, but not beyond its useful life.
(4) Reclamation and reconditioning of an oil following withdrawal from use.

This paper discusses the chemist's role in assessing these requirements by means of laboratory examination of samples taken before and during use. The discussion is limited to "non-synthetic" petroleum oils as used for the lubrication of engines and general machinery; space does not permit discussion of numerous specialized products and applications. Although spectrochemical and other instrumental techniques are extensively used in this type of work overseas, particularly where the number of samples justifies their cost, the tests here described can be carried out in a regional laboratory using equipment obtainable for approximately £400.

THE NATURE AND MANUFACTURE OF LUBRICATING OILS

Basically, lubricating oils are complex mixtures of hydrocarbons within the approximate range C_{18} to C_{35}, containing varying proportions of straight and branched chain paraffins, naphthenes, aromatics and lower (2–5 unit) polynuclear ring systems. They are obtained from vacuum distillation of residues from the atmospheric distillation (to approximately 360° C) of selected crude oil. The resultant distillates are then further refined by:

(1) *Propane Deasphalting*: Precipitation and removal of asphaltenes — defined as dark, polynuclear aromatic material, insoluble in *n*-paraffins but soluble in benzene.
(2) *Solvent Extraction*: Use of suitable solvents (*e.g.*, liq. SO_2; furfural) in which the relative solubilities of hydrocarbons decrease in the order: Polynuclear aromatics → aromatics → naphthenes → cyclic compounds with side chains → *iso*-paraffins → *n*-paraffins. This permits separation of "paraffinic" and "naphthenic" base stocks, the degree of separation being very sensitive to physical conditions.

(3) *Solvent Dewaxing*: Removal of "wax" (*n*-paraffins C_{22} to C_{30+}) by filtration of a chilled solution of the oil stock in a suitable solvent. Because of its low solvency for wax, M.E.K. is commonly used.

(4) *Sulphuric Acid Treatment*: Removal of unstable unsaturated compounds.

(5) *"Active" Clay Treatment*: Removal, by adsorption, of last traces of coloured impurities and products carried over from previous operations.

Products obtained from these processes are then blended to lubricating oils possessing specific properties. For a detailed description of lubricating oils and their production, the reader is referred to the many comprehensive texts available on this subject today (2, 3, 4, 5).

PROPERTIES DESIRABLE IN A LUBRICATING OIL

Basically, the function of a lubricating oil is "to form a lubricating film between two moving surfaces, capable of reducing friction between them". This film must be capable of adequate performance throughout the entire range of operating conditions. This, in effect, means that the oil must be capable of:

(1) Free or assisted flow to the points of application at an adequate but not excessive rate within all extremes of operating temperatures.

(2) Forming a lubricating film, stable under conditions of maximum temperature and load without imposing excessive load due to thickening at low temperatures.

(3) Resistance to chemical reaction, particularly under the influence of heat and oxygen.

(4) Use without creating an undue fire or explosion hazard.

(5) Use without deleterious effects on metal surfaces.

In order to assess the ability of an oil to meet these requirements under given conditions, the following properties, capable of measurement in the laboratory, together with their dependence upon chemical composition may be considered. (A description of test methods follows.)

Viscosity: This measures the resistance to flow of a fluid at any given temperature and is of prime importance in determining the rate of application and subsequent film stability of an oil. Generally, viscosity increases with molecular weight; for given molecular weight, viscosity decreases in the order: Polycyclic aromatics→aromatics→naphthenes→

cyclic compounds (short side-chains)→cyclic compounds (long side-chains)→cyclic compounds (olefinic side-chains) →*iso*-paraffins →*n*-paraffins→olefinic paraffins.

If oil flow is visualized as molecular layers "sliding over one another", as do "plates" of graphite, the effect of molecular shape on viscosity will be appreciated.

Viscosity-Temperature Relationship: This must be considered when determining viscosity requirements over the entire range of operating temperatures. It is usually expressed as "viscosity index", an arbitrary quantity determined by comparison with two theoretical oils having a common viscosity with the oil in question at one temperature (usually 210° F), but exhibiting maximum and minimum changes in viscosity on cooling to a lower temperature (usually 100° F). A high viscosity index corresponds to a small change in viscosity with temperature and vice versa. Viscosity index is determined solely by the relative amounts of hydrocarbon types present in the oil, and these are listed in decreasing order of viscosity index: *n*-paraffins→*iso*-paraffins → cyclic compounds (long side-chains) → cyclic compounds (short side-chains)→naphthenes→aromatics→ polycyclic compounds.

This order is the reverse of that for viscosity and may be illustrated by comparing molecular movement in "naphthenic" (symmetrical) and "paraffinic" (unsymmetrical) hydrocarbons, having similar viscosity at some low temperature at which molecular movement is restricted. The more symmetrical "naphthenic" molecules achieve random movement within a much smaller temperature rise. Such oils thus exhibit greater "thinning out" on warming, *i.e.*, a lower viscosity index.

Mechanical Load-Bearing Capacity: This is the resistance of the oil film to "squeezing out" under load with consequent mechanical seizure and is usually measured by simulating given operating conditions on a laboratory scale. Paraffins are superior to their cyclic counterparts in this respect, and this, again, is evident from steric considerations.

Oxidation Stability: Under the influence of heat and oxygen oxidation stability can be compared by simulating service conditions in the laboratory and measuring the formation of decomposition products. Generally, oxidation stability decreases in the order: *n*-paraffins→naphthenes→*iso*-paraffins→aromatics→olefins.

Thermal Stability: The resistance to "cracking" into smaller fragments and higher carbon content residues under the

influence of heat alone can also only be compared. Cyclic compounds show greater resistance to this form of degradation than corresponding paraffins. Generally, stability decreases with increasing molecular weight.

Flash Point: This is the temperature at which an oil evolves sufficient vapour to ignite upon application of a flame under the test conditions. The temperature at which combustion is maintained under these conditions is the "fire point". For use, a flash point above the maximum operating temperature is desirable. The flash point of an oil depends directly upon its volatility and is therefore determined by the lowest molecular weight component, although, for a given molecular weight, aromatic and naphthenic oils tend to be more volatile than paraffinic oils.

Pour Point: The minimum temperature at which an oil remains fluid is of importance in low temperature applications, values at least 10° to 20° F above minimum operating or storage temperatures being desirable. The "cloud point", or temperature at which the first trace of solid material separates, must be considered when dealing with applications involving distribution systems having fine dimensions. While, generally, components of higher molecular weight raise the pour point of an oil, paraffins solidify and precipitate at higher temperatures than corresponding cyclic compounds and are also inferior solvents for wax.

Lubricating Oil Additives: These may be defined as specific organic or metallo-organic substances, small quantities of which impart new, or enhance existing properties of the oil to which they are added. The main types of additives in use today include: Detergents and dispersants (Ca, Ba, Mg salts of organic acids); oxidation and corrosion inhibitors (organic compounds containing active S, P, N); film strength improvers (organic S, Cl, P compounds; organometal salts); viscosity index improvers (poly-olefins; polymethacrylic esters); pour point depressants (polymerized alkylated naphthalenes or methacrylic esters).

DETERIORATION OF LUBRICATING OIL DURING USE

During use, lubricating oil undergoes chemical and physical changes, the extent of which is largely determined by the efficiency with which its chemical composition has been chosen in relation to operating conditions. Deterioration processes can be divided into:

(1) Chemical decomposition of (a) Oil components; (b) Additives.
(2) Contamination with extraneous material.

(1) *Chemical Decomposition*

(a) *Oil Components*

Oxidation and Polymerization: Under the influence of intermittent heating, with agitation, in the presence of dust-laden air, the following sequence of catalytic oxidation is promoted (Fig. 1):

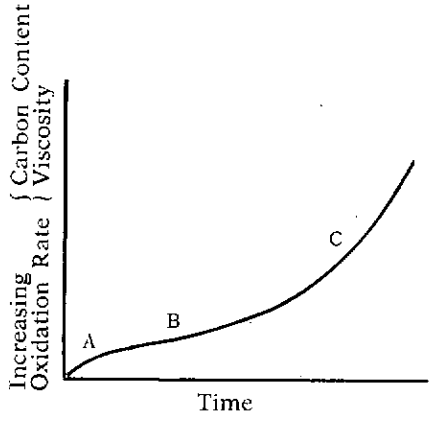

Fig. 1

A: Oxidation (abstraction of hydrogen) of small quantities of less stable components whose removal is uneconomical.
B: Slow oxidation of major components.
C: Increasing rate of oxidation and polymerization with ultimate precipitation of "tars" and "varnishes" for which molecular weights 3,000 to 100,000 have been reported (6, 7). Carbon is the end-product of this process.

Apart from their inferior lubricating properties, oxidation products reduce and ultimately prevent the flow of remaining oil, resulting in sudden failure. Although the full mechanism of oil oxidation is still subject to conjecture, several typical sequences of reaction have been shown to occur under mild to moderate conditions. A number of excellent reviews of oil oxidation mechanisms are available (8, 9).

Thermal Cracking: Repeated contact with surfaces at excessively high temperatures leads to thermal "cracking" with the production of low viscosity, volatile fragments which constitute a hazard due to their high vapour pressures and low flash points. Thermal cracking also results in the formation of higher carbon content residues containing a considerable degree of unsaturation, which, in turn, promotes rapid oxidation and polymerization with the consequences already referred to. The review by Sachanan (4) outlines reactions, occurring under mild to moderate conditions, which involve rupture of naphthene rings, cleavage and hydrogenation of paraffins, polymerization of olefins, and condensation of aromatics.

(b) *Additives*

Additive Decomposition: Organic additives slowly decompose during prolonged use and their beneficial effect is correspondingly reduced. Metallo-organic additives decompose into oil-insoluble salts which, apart from blocking oil-ways, form efficient abrasives and in the presence of water induce electrolytic corrosion. Fatty oil additives are particularly susceptible to rapid oxidation, forming insoluble "varnishes".

(2) *Contamination with Extraneous Material*

Apart from the decomposition products already referred to, a lubricating oil will have continuously added to it during use:

Products of Wear: Usually finely divided metal particles.

Atmospheric Dust: The nature of this is varied and depends upon the operational environment, silicates being a common feature. Unless these contaminants are effectively removed, they form good abrasives, accelerating the process of wear.

Water: By atmospheric condensation; condensation of combustion products; or coolant leakage. Apart from forming undesirable emulsions, small amounts of water accelerate additive hydrolysis, often with formation of acidic compounds.

Products of Combustion: Engine fuels contain varying amounts of sulphur compounds as impurities which upon combustion form SO_2 and SO_3, normally removed with exhaust gases. However, sulphuric acid is formed if these gases cool below the dew-point.

Unburnt Liquid Fuel: In a worn or maladjusted internal combustion engine, unburnt fuel finds its way into the lubricating oil past worn rings, seals, etc., and decreases its viscosity, flash point and effective additive concentration. In sufficient quantity fuel dilution seriously impairs the load-bearing capacity of the oil.

Now that the processes by which lubricating oil deteriorates have been described, it is possible to consider steps that can be taken to reduce such deterioration:

(1) Choosing an oil of chemical composition adequate to lubricate and withstand decomposition under extreme conditions of operation.
(2) Ensuring operating conditions are kept normal.
(3) Providing for the continuous removal of suspended impurities.
(4) Judicious use of additives.
(5) Assessment of the nature and extent of deterioration at regular intervals during use, in order to:
    (a) Determine if a suitable grade of oil is being used and to assist in making alternative recommendations.
    (b) Detect abnormalities in operating conditions.
    (c) Assess the efficiency with which solid contaminants are being removed.
    (d) Assess the qualitative and quantitative effects of additives.
    (e) Establish a period of useful life after which the oil should be withdrawn.

Procedures involved under paragraph (5) will now be considered in detail.

LABORATORY TESTS ON NEW AND USED LUBRICATING OILS

Details of standard test methods may be obtained by reference to the current publications of the Institute of Petroleum, London, and of the American Society for Testing Materials, Philadelphia. References for each test are given.

Viscosity: This is the resistance offered to shear under laminar flow conditions. *Kinematic viscosity* (IP-71; ASTM-D445) is a commonly used method of measurement. It is defined as the quotient of dynamic viscosity (the tangential force on unit area of either of two parallel planes at unit distance, when this space is filled with the fluid and one plane moves relatively to the other at unit velocity — g/cm/sec) and density (g/cm^3), the unit being the Stoke

(or centistoke — $cm^2/sec/100$). It is determined by timing the flow of a fixed volume of oil through a calibrated capillary at controlled temperature. The method is applicable only to fluids exhibiting true newtonian flow, a condition which for hydrocarbons is usually not fulfilled at temperatures approaching solidification point or exceeding approximately 250° F. Care in manipulation enables extremely accurate results to be obtained. Accuracy is quoted as *repeatability* 0.2%, *reproducibility* 0.5% of test result.

Redwood Viscosity (IP-70): This is an arbitrary measurement used when high accuracy is not required. The flow of 50 ml of oil through a standard aperture in the base of a cup surrounded by an oil-bath is timed, the result being expressed directly in seconds at a specified temperature. Reported accuracy is *repeatability* 1%, *reproducibility* 2% of test result. Whilst kinematic viscosities may be converted to Redwood, the converse is not justified.

Viscosity Index (IP-73; ASTM-D567): An empirical number expressing the change of viscosity with temperature and is defined by:

$$100\ (L-U)/(L-H),$$

where U = kinematic viscosity of sample at 100° F.

L = viscosity at 100° F of an oil of zero viscosity index, having the same viscosity as the sample at 210° F.

H = viscosity at 100° F of an oil of 100 viscosity index, having the same viscosity as the sample at 210° F.

Values are determined by application of kinematic viscosities at these temperatures to prepared tables. Accuracy is limited by that of individual viscosities; occasions demanding accuracy beyond one unit are rare.

Flash Point (IP-34; ASTM-D93): This is determined by application of a small pilot flame to the oil while it is heated at a prescribed rate within specified apparatus, and measuring the temperature of ignition. The test may be carried out in an open or closed apparatus, the result being expressed accordingly. The test is extremely sensitive to traces of volatile materials. Steam formation from approximately 160° F falsifies results obtained on wet samples. Reported accuracy is *repeatability* 5°, *reproducibility* 10° F.

Fuel Dilution (IP-23; ASTM-D322): This can be measured by straight or steam distillation of a measured sample. Accuracy is limited by volatility of the oil itself over the test period; transport of oil droplets in the vapour stream; oil

"cracking"; and loss of volatile components prior to, or during sampling. Whilst the method is useful for indicating excessive dilution, such contamination is commonly estimated indirectly by its effect upon viscosity or flash point.

Water Content (IP-74; ASTM-D95): Water is determined by the Dean and Stark method in which a volume of sample is refluxed with a petroleum solvent of B.P. 120–150° C, water in the condensate separating into a graduated receiver. Reported accuracy is *repeatability* 1%, *reproducibility* 2% of test result. Traces of water may be determined by one of the many modifications of the Karl Fischer method (ASTM-D1744) with a ready accuracy of 10 p.p.m.

Acidity (IP-1): Acidity is expressed as mg KOH required to neutralize the total acids present in one gram of sample, and is determined by direct titration of an alcoholic extract, prior extraction with water permitting separation and subsequent examination of inorganic acids. Dark-coloured constituents often mask a colorimetric end-point. Precision limits have not yet been established, but results to approximately 0.2 are sought. Potentiometric titration curves in selected solvents (IP-139; ASTM-D664) permit quantitative resolution of strongly and weakly acidic components, but precision limits have not been established. Certain commonly-used additives may falsify results.

Saponification Value (IP-136; ASTM-D94): This is defined as mg KOH consumed by one gram of sample when refluxed with excess alcoholic KOH. Under test conditions, animal and vegetable oils are saponified and readily estimated by back-titration of excess alkali. If necessary, the saponification products may be isolated and identified. All acidic constituents and ester-type additives react under these conditions, and additives containing S, Cl and P may also react, so that their presence may limit the scope of this test. A potentiometric technique is useful for dealing with dark-coloured samples but difficulties may arise from adsorption of oil on electrode surfaces. Precision limits for used oils are *repeatability* 0.5, *reproducibility* 1.0.

Ash Content (IP-163; ASTM-D874): Ash is determined by slow burning of a sample followed by ignition to 700° C in a muffle furnace. Residues may be stabilized by sulphation prior to ignition. The method is commonly employed for the routine estimation of metal-containing additives. If required, residues may be subjected to chemical analysis. Care in manipulation permits improvement in the reported accuracy which is, *repeatability* 8%, *reproducibility* 12% of test result.

Insoluble Material (ASTM-D893): In used lubricating oil this is determined by direct weighing of the dried residue obtained from centrifuging a sample in *n*-pentane. This residue may be extracted and centrifuged using benzene, removing asphaltic decomposition products. Whilst quantitative ignition of this residue will remove carbon, this method of assessing it is limited by the accompanying change in composition of the inorganic residue which, however, may be taken for subsequent analysis. Finely divided material, resulting from the use of dispersant additives, may be difficult to separate and, for low values, removal of last traces of oil may limit the accuracy of the test which is reported as *repeatability* 0.7%, *reproducibility* 1% of result.

Foaming Tendency (IP-146; ASTM-D892): The foaming tendency of different oils can be compared by aeration under specified conditions and measuring the volume of foam and its rate of collapse. The profound influence of traces of certain oil decomposition products limits the application of this test which, in certain instances, enables useful comparisons to be made. No precision limits have been established for this test.

Demulsification Characteristics (IP-19): These can be compared by emulsification of a fixed volume of oil with steam under specified conditions and measuring demulsification time. The test is applied to oils for operation in the presence of water or steam, where emulsification is undesirable. The effect of contamination products renders this test of little value for used oils.

Carbon Residue (*Ramsbottom*) (IP-14; ASTM-D524): The residue resulting from ignition of a sample with limited access to air under controlled conditions is determined. It is dependent upon the mean C/H ratio of the oil and the presence of certain additives may cause erroneous results. Accuracy is dependent upon the efficiency with which the critical test conditions can be maintained and is reported as *repeatability* 10%, *reproducibility* 15% of test result.

Pour Point (IP-15; ASTM-D97): This is the temperature 5° F above the solidification point of an oil when cooled under prescribed conditions. Pour point is governed by the precipitation of wax crystals, their size and rate of growth. Strict adherence to test conditions is therefore essential to reproducible results. The effect of traces of decomposition products and water limits application of this test to used oils. It has a reported accuracy of *repeatability* 10°, *reproducibility* 10°F.

Miscellaneous Tests

Chromatographic Spot Techniques: A drop of sample is allowed to fall on to a filter paper and is then successively washed out with selected solvents. The zones are examined by dimensional measurement, transmitted, reflected and ultra-violet light and chemical spot tests (10). These methods require considerable experience in their interpretation.

Tests for Hydrocarbon Types: These tests are seldom necessary after manufacture, since their proportion is predetermined by the properties imparted to the oil. Where required, many absolute and arbitrary methods are available, the choice of which depends upon the problem and time and equipment available. Methods include: Absorption of olefins by sulphuric acid (11); absorption of aromatics and naphthenes by oleum (IP-145); chromatographic techniques (IP-156); quantitative halogenation of unsaturateds (IP-130; IP-84); and *aniline point* (IP-2; ASTM-D611).

Reviews of these methods are given by van Nes and van Westen (3) and Sachanan (4).

Tests for Specific Additives: Tests for additives include:

1. Measuring the effect of the additive upon the oil, provided this is proportional to its concentration. Possible effects of decomposition products may limit application to used oils.
2. Chemical analysis of a characteristic element or functional group. This method is applicable to used oils provided the analytical method is specific, the element or functional group cannot be introduced by extraneous contamination, and the element or functional group from the decomposed portion of the additive can be effectively removed.

Service Tests: For these the oil is subjected to artificial service conditions simulated in the laboratory and either lubrication efficiency or the extent of oil decomposition is measured. Examples are:

Air Ministry Oxidation Test (IP-48), in which the sample is aerated during two 8-hour heating periods to 200° C, after which increases in viscosity and carbon residue are measured.

Load-bearing Capacity Test (IP-166), in which a sample is subjected to a series of cycles in a laboratory gear-rig operated at increasing load to the point of failure.

[REFERENCES: The numerals in the text refer to references which will be supplied in the concluding section.]

(To be concluded)

MATANGI DAIRY PRODUCTS EXPERIMENTAL UNIT

A new venture in the manufacture and marketing of dairy products was recently inaugurated with the opening of the Matangi Dairy Products Experimental Unit, which has been founded jointly by the New Zealand Dairy Production and Marketing Board, Welington, and the New Zealand Co-operative Dairy Company, Hamilton.

The purpose of the Unit is to undertake investigations in that comparatively new branch of dairy technology that is concerned with the preparation of domestic milk products with anhydrous milk solids as raw material. Experiments will be carried out in plant design and technology to improve the technical knowledge and the types of plant best suited for the manufacture of recombined condensed and evaporated milks, reconstituted wholemilk and allied products.

The basic work will involve the study of problems related to the redispersion of dehydrated proteins and the forming of stable emulsions. Of vital importance also is the study of flavour development and other factors influenced by storage.

In the wider field of industrial applications, the Experimental Unit will be expected to formulate detailed programmes for recombining operations and thus give technical support to the marketing organization in the distribution of dairy produce, particularly in new or developing markets.

Simultaneously with the development of processing methods, the Unit will be working on the development of suitable plant and equipment, either in the form of new designs or modifications of available items.

The Experimental Unit is located at Matangi (about 7 miles from Hamilton), a site chosen because of its proximity to a large factory with ample power and water services and to Hamilton City with the facilities of the N.Z. Dairy Company's Technical and Laboratory Departments. The building, erected in 1962 and officially opened on December 19, comprises a pilot section with facilities for extensive series of experimental work, and an industrial section — a replica of a commercial manufacturing plant — for final testing of both plant and processes. There is a laboratory with adequate facilities for the examination of prepared products and also a visitors' room featuring a

panoramic inspection window to allow a clear view of the plant lay-out and line of flow in the industrial section.

Finally, the Unit will serve as a training institution for technical officers designated to take up overseas appointments in projects affiliated with the New Zealand dairy industry.

It is intended that overseas buyers will visit the centre and be offered every facility to inspect the various processes and to purchase plant. The services of trained technical staff will be available for the installation and maintenance of such plant in the buyers' country and the training of staff in its operation. New Zealand in return would expect to secure sales for the concentrated butterfat and milkpowder that these plants will utilize in the production of milk products in those countries.

ROYAL AUSTRALIAN CHEMICAL INSTITUTE PUBLICATIONS

The Royal Australian Chemical Institute may be prepared to supply copies of some of their publications to members of the New Zealand Institute at drastically reduced prices, provided the New Zealand Institute takes a minimum of 20 copies of each issue of these publications. This offer is likely to be applied particularly to the series *Reviews of Pure and Applied Chemistry*, but may be extended to other publications.

It is hoped to publish a list of recent titles in the *Reviews* series and other details about the R.A.C.I. publications in the next *Journal*. Meanwhile members who are already familiar with the *Reviews of Pure and Applied Chemistry* and who wish to take advantage of this offer should communicate directly with the N.Z.I.C. Secretary, Dr Harvey.

The possibility of obtaining R.I.C. publications under a similar arrangement is being explored.

BRANCH NEWS AND NOTES

AUCKLAND BRANCH

The Vice-President of the Institute, Mr S. G. Brooker, has been invited to attend all Branch committee meetings as an ex-officio member.

After the Annual Meeting, three films, *Control of Evaporation, The Biological Control of Insects* and *The Mallee Fowl*, were enjoyed through the courtesy of the C.S.I.R.O., Melbourne.

Dr B. W. Doak, Director of the N.Z. Fertilizer Manufacturers' Research Association at Otara, has returned from an overseas trip during which he visited Japan, Europe, Great Britain and America. At the International Superphosphate Manufacturers' Association Conference held off the bridge at Avignon he presented two technical papers.

Dr D. Hall has returned to the University of Auckland after a study period at the University of Pittsburgh, Pittsburgh, Penn., and has been promoted to Associate Professor. He is eagerly awaiting the arrival of a computer.

Dr P. S. Rutledge has left New Zealand to undertake post-graduate research at the University of Michigan, Ann Arbor, Mich.

Mr A. W. Mackney, N.Z. Forest Products Ltd., Penrose, will be a director of a new local company formed to manufacture moulded pulp products such as the trays used in packaging export apples.

Mrs Megan Thompson has gone to the University of Wisconsin at Madison where her husband is doing post-graduate research in physics.

Mr R. G. Jamieson recently returned from Australia after a study period at the C.S.I.R.O. Forest Products Division in Melbourne.

WAIKATO BRANCH

Miss A. E. Stevenson, of Ruakura Animal Research Station, has returned after four months visiting agricultural research institutions in the United Kingdom and attending training courses in automatic analysis in London and New York. While in England she was elected a Fellow of the R.I.C.

Dr H. E. Annett has returned recently from an extensive trip to Europe.

CANTERBURY BRANCH

Mr M. Hunter has been appointed Chemist at the Department of Agriculture Dairy Produce Grading Stores, New Plymouth.

Mr R. W. Cawley, of the Wheat Research Institute, is spending six months working in Sydney. Mr T. A. Mitchell, also of the Wheat Research Institute, spent a fortnight there towards the end of last year. Dr P. Meredith returned to the Institute in December after holding a post-doctorate fellowship in Winnipeg.

At the University of Canterbury, Mr J. Wright has been promoted to Lecturer, Dr A. Fischer to Senior Lecturer, Dr T. Hagyard to Reader, and Mr J. Vaughan has been appointed to the newly-created second Chair of Chemistry.

BRANCH CHAIRMEN 1962–63

AUCKLAND BRANCH

The Auckland Branch Chairman, Mr P. J. Gallaher, was educated at New Plymouth Boys' High School and Auckland University College, graduating B.Sc., after a period in the armed forces, in 1945. He entered industry as a chemist with the New Zealand Plywood Co., but in 1946 joined the staff of the New Zealand Farmers' Fertilizer Co. Ltd., at their Te Papapa works, and was appointed Chief Chemist in 1954. Since 1957 he has been with the Fertilizer Manufacturers' Research Association as Senior Chemist, and is carrying out research on the properties of superphosphate fertilizers and methods for their manufacture and on pesticide-fertilizer materials.

Mr Gallaher was elected an Associate in 1948 and has had previous service on the Auckland Branch Committee.

WAIKATO BRANCH

Mr F. D. Dorofaeff, Chairman of the Waikato Branch for this year, was born in Christchurch where he received his education, in 1945 graduating B.Sc. from Canterbury University College. He was then drafted to the Chemical Laboratory of the Fields Division, Wellington. Soon after he moved to Hamilton, becoming a part of the new Rukuhia Soil Research Station. Apart from the two years 1956–57 as Agricultural Chemist under the Colombo Plan in Bogor, Indonesia, he has served as a Scientific Officer in the Research Station.

His interests have been pot experiments, soil analysis and assistance in the establishment of methods of analysis. A

period was spent in setting up a radio-isotope section for the Station but owing to pressure of other work this was not continued. Since his return from overseas, Mr Dorofaeff's work has been in the investigation and study of major nutrients in plants. Field work and pot work relating to these studies are carried out and a special study is being made of sulphur and sulphate sulphur in pastures and crops.

Mr Dorofaeff was elected an Associate of the Institute in 1947 and has been Branch Secretary for the last three years. He has also been chairman of the Waikato Branch of the Royal Society.

MANAWATU BRANCH

The Manawatu Branch Chairman, Dr R. W. Bailey, completed his M.Sc. training at Canterbury University College in 1944 and joined the Dairy Division of the Department of Agriculture at Wallaceville in 1945. He transferred to the Rukuhia Soil Research Station in Hamilton in 1947 to carry out investigations on soil and peat organic matter. From 1952 to 1955 he was at Birmingham University and was awarded the Ph.D. degree for work on the enzymic synthesis of bacterial polysaccharides under the direction of Professor M. Stacey. Dr Bailey returned for a short time to Rukuhia but later moved to the Plant Chemistry Division, D.S.I.R., at Palmerston North. In 1959 he went to the University of London to take up a D.S.I.R. (U.K.) Fellowship with Professor E. J. Bourne at Royal Holloway College, and came back to the Plant Chemistry Division in 1960. Since 1956 Dr Bailey's research has been concerned mainly with pasture carbohydrates, their degradation by rumen micro-organisms and their role in ruminant nutrition. This work has included biosynthesis of polysaccharides by rumen bacteria and the development of chromatographic techniques for oligosaccharides. Among his 41 publications are review articles on "Chromatography of Oligosaccharides" (*Chromat. Revs*, 1962) and "Oligosaccharides" (*Adv. Carb. Chem.*, 1962).

Dr Bailey has been an Associate since 1947 and was elected to the Fellowship of the Institute last year. He has served on the Manawatu Branch Committee since 1960.

WELLINGTON BRANCH

Miss Joan Mattingley graduated B.Sc. from Victoria University College in 1948, then completed the three year course for the Health Department Certificate of Proficiency in Hospital Laboratory Practice at Wellington Public Hospital, where she is now engaged as Biochemist. The years 1954 to 1956 Miss Mattingley spent in England as Research Assistant to Professor Morgan in the Biochemistry Department of the Lister Institute, London. Since returning to New Zealand she has specialized in the application of chromatographic and electrophoretic techniques to hospital laboratory requirements, and in the study of chemical factors associated with mental defects.

Miss Mattingley is a member of the Professional Status Committee and is also on the Council of the New Zealand Institute of Medical Laboratory Technology.

CANTERBURY BRANCH

The Chairman for the Canterbury Branch is Dr J. M. Austin. A biographical note on Dr Austin will be published in the April issue.

OTAGO BRANCH

Chairman of the Otago Branch for 1963 is Dr A. D. Campbell, Senior Lecturer in Chemistry at the University of Otago. In 1948, following graduation with M.Sc. at Otago, he was appointed to the Chemistry Department, at the same time pursuing research towards his Ph.D., which he completed in 1952. Dr Campbell studied at the Organic Chemistry Laboratories of Glasgow University in 1954 as Corday-Morgan Commonwealth Research Fellow and in 1961 at the Analytical Laboratories of Birmingham University as a Nuffield Foundation Commonwealth Research Fellow. He was awarded the Morcom Green, Edwards Prize in 1955 and the Easterfield Medal in 1959.

Apart from various aspects of the chemistry of polycyclic compounds, Dr Campbell's interest is organic microanalysis and microanalytical techniques. During recent study leave he studied micro and submicro analytical methods at Birmingham University and visited organic microanalytical laboratories in the British Isles, Switzerland and Holland.

Dr Campbell was elected a Fellow last year. He has served as Delegate for the Otago Branch, and as Secretary of the Examinations Committee, and was Chairman of the 1959 Conference Committee.

LABORATORY ASSISTANTS CERTIFICATE AWARDS

On the report of the Examinations Committee to the December meeting of Council, Laboratory Assistants Certificates were awarded to David R. Greenwood (Wheat Research Institute, Christchurch) and Joanna Mary Thomason (Soil Bureau, Lower Hutt).

EASTERFIELD MEDAL, 1963

Closing Date for Nominations

The Secretary of the New Zealand Section of the Royal Institute of Chemistry has requested that the attention of members be drawn to the award of the Easterfield Medal this year. Nominations must be in the hands of the Secretary, N.Z. Section, R.I.C., by April 15.

COUNCIL MINUTES

ABRIDGED MINUTES OF A MEETING OF THE COUNCIL HELD IN WELLINGTON, NOVEMBER 27, 1962

PRESENT

W. G. Hughson (President, in the Chair), S. G. Brooker (Vice-President), P. J. Gallaher (Auckland), N. T. Clare (Waikato, Editor), Dr R. W. Bailey (Manawatu), Miss Joan Mattingley (Wellington), T. A. Mitchell (Canterbury), Dr W. S. Hanger (Otago), D. J. Hogan (Canterbury, Registrar) and Dr W. E. Harvey (Hon. General Secretary).

APPOINTMENT OF OFFICERS AND SUBCOMMITTEES

The full list of officers and subcommittees was published in the December, 1962, Journal.

Trustees: It was agreed to ask Sir Theodore Rigg and Dr J. C. Andrews to continue in office.

Membership: Prof. R. D. Batt was appointed until October 31, 1965. Dr McGillivray continues until October, 1963, and Mr Brooker until October, 1964.

RULES REVISION

Resolved: That the Rules Revision Committee be thanked for its work. The Rules as they would appear with all the proposed changes will be circulated to branches for comment before being finally adopted.

JOURNAL

The Editor commented on the financial status of the *Journal*. Advertising rates have been increased slightly and this together with a concerted effort to attract more advertisers should result in a considerable net saving in the cost of the *Journal*. It was considered that local committees may be able to assist in obtaining additional advertisers. *Resolved*: That branch editors be asked to forward a list of possible advertisers to Editorial Services Limited.

Note: Members of Council considered that it would not be in accordance with the professional status of members to solicit advertising directly but it would be helpful if Editorial Services Limited could be advised of possible advertising business.

Several members of Council pointed out that every effort should be made to ensure that the *Journal* was issued on time. This is of paramount importance with the Conference issue. *Resolved*: That the Editor be authorized to make a trip to Wellington if necessary to ensure that the Conference issue of the *Journal* is produced on time.

EXAMINATIONS

The Auckland delegate reported that the Examinations Committee had almost completed re-drafting the regulations for A.N.Z.I.C. by examination.

Resolved: That the Auckland Delegate be asked to stress to the Examinations Committee the urgency of re-drafting the Regulations.

It is hoped that this matter can be settled before the end of the year.

AWARD OF L.A.C.

On the report of the Examinations Committee the Laboratory Assistants Certificate was awarded to:
GREENWOOD, David R., Wheat Research Institute, Christchurch.
THOMASON, Joanna Mary, Soil Bureau, Lower Hutt.

TECHNICIANS CERTIFICATION AUTHORITY

The Executive Committee for Science of the T.C.A. is to be reconstituted early in 1963. At Mr Dasent's request, Council considered the question of which groups or organizations should be represented on the (reconstituted) committee. *Resolved*: That this Council considers it essential that the Institute be represented on the Executive Committee for Science and that other organizations should be considered in the following order: N.Z. Institute of Physics, a representative of biologists, N.Z. Institute of Science Technicians, Manufacturers' Federation, N.Z. Association of Scientists.

Members raised the question of incentives for prospective students to study for the National Certificate in Science and it was agreed that the Secretary write to the T.C.A. and if necessary the Public Service Commission.

CONFERENCE 1962

The final report of the 1962 Conference Committee was received together with an interim financial statement indicating that there is likely to be a surplus of approximately £70.

Resolved: That the 1962 Conference Committee be thanked for its services and congratulated on the manner in which it had organized the Conference.

Resolved: That the profits from the 1962 Conference be paid into the Overseas Visitors' Fund.

CONFERENCE 1963

Dr Bailey reported on preliminary discussions and arrangements for the 1963 Conference which will be held at Massey College, August 20 to 23, 1963.

Resolved: That £20 be advanced to the 1963 Conference Committee.

BRANCH GRANTS

Resolved: That branch grants for the 1962–63 Institute year remain at £20 per branch.

CHEMISTRY IN ACTION

Resolved: That the Canterbury Branch be reimbursed £30 towards the cost of *Chemistry in Action*.

RULES AND REGULATIONS

The Secretary is to prepare a draft incorporating all the proposed amendments for circulation to branches.

TRUST FUNDS

Resolved: That the trustees be asked to agree to the suggestion that the interest from Trust Fund moneys be paid into the General Fund as from May 1, 1962.

ROYAL SOCIETY OF NEW ZEALAND

Some discussion was held on the type of association which was considered desirable between the N.Z.I.C. and the R.S.N.Z. It was

agreed that if the N.Z.I.C. was to become affiliated with the R.S.N.Z. then it would be most desirable that:

(1) The R.S.N.Z. should become an interdisciplinary body.
(2) The control of the R.S.N.Z. should rest with recognized scientists.
(3) The N.Z.I.C. should have the right to nominate some members of the Council of the R.S.N.Z.

The Vice-President (who is a member of the Council of the R.S.N.Z.) agreed to discuss these matters with officers of the R.S.N.Z.

COMMITTEE ON NEW ZEALAND SCIENCE

The following resolution, to be communicated to the Prime Minister, the Leader of the Opposition and Ministers of D.S.I.R. and Agriculture, was carried:

> "This meeting of the Council of the New Zealand Institute of Chemistry Inc. views with dismay the proposed change in the administration of Government-supported scientific research, without prior investigation by a competent committee of enquiry and in the face of objections by responsible scientific bodies."

A.N.Z.A.A.S.

The Secretary reported briefly on the General Council Meeting of A.N.Z.A.A.S. held in Sydney in August. It was agreed that the N.Z.I.C. should approach A.N.Z.A.A.S. regarding possible corporate membership or affiliation.

SCIENTIFIC INSTRUMENTS

Council discussed a resolution passed at the Conference relating to assistance for chemists who may wish to compare instruments from various manufacturers. It was agreed that a critical survey of competing instruments would be very difficult to compile but it was felt that it would be useful to compile a list of instruments available in New Zealand. It was agreed that Mr Horn should be approached to organize the collection and collation of this information.

I.C.I. PRIZE

The Secretary reported that he had been informed that Imperial Chemical Industries (N.Z.) Ltd. had decided to increase the monetary portion of the I.C.I. Prize to £50. It was resolved that a letter be sent to I.C.I. thanking them for their generous action.

NEXT MEETING

The next meeting of Council will be held in May, 1963.

W. E. HARVEY,
Hon. General Secretary.

CONFERENCE COMMITTEE REPORT

The report to Council from the 1962 Conference Committee shows that registrations for the Conference held at Lincoln College in August numbered 158, including 4 non-members and 22 students, and that 53 members were from Christchurch. In residence at Lincoln were 71 members and 4 wives, and about 150 people attended the Conference dinner and social. On the financial side the Committee reported an unexpectedly high favourable balance of over £70, mainly because expenses for several items were lower than estimated, including some of the provisions for the social. Pointing out that, because the Trade Exhibition was sponsored jointly with the 10th New Zealand Congress, only half the exhibition profit was credited to the N.Z.I.C. this year, the report indicates that "provided labour costs are held to a minimum, a Conference Committee should have no difficulty in paying for a guest lecturer from Australia".

The following extracts of direct interest to Institute members are quoted from other sections of the report:

Papers

"Members were asked to give the time required both for presentation and for discussion and to indicate the type of audience to which the paper was addressed. Programming was done on the basis of these replies and in every case the time asked for was allowed. The authors' indications as to type of intended audience and the abstracts themselves were not always reliable."

Information for members

"The Committee now feels that it would have been well worthwhile to have distributed a resumé of the papers to all N.Z.I.C. members in July, particularly as the printing of the August issue of the *Journal* can easily be delayed."

Relations with the Royal Society

"Having the Conference in conjunction with the Congress had both advantages and disadvantages. The main advantages were (a) the joint invitation to a guest speaker; (b) the reduced Congress fee arranged for N.Z.I.C. members; and (c) a diversity of papers for the chemist with other scientific interests.

"The main disadvantage was the increased difficulties experienced by the Committee. Several of the organisers of the Congress were very helpful but there was a general lack of information available to us and this made the job much harder than otherwise and was at times both confusing and annoying. Examples of this were the sudden cancellation of tours for Congress wives and the lack of information as to arrangements for the public lecture. These difficulties might have been partly overcome if one member of the Conference Committee had also been on the Congress Executive Committee.

"Although we observe that liaison incurs extra duties, nevertheless we feel that the principle of co-ordination with a Royal Society Congress is good *provided* that the N.Z.I.C. Conference maintains its identity."

Recommendations

(1) That Conference should normally be of 4 days' duration.
(2) That consideration be given to arranging at Conference a session of "refresher" lectures designed to bring chemists up to date with modern theoretical developments.

BOOK REVIEWS

THE CHEMISTRY OF THE HETEROCYCLIC COMPOUNDS. VOLUME 16, THE PYRIMIDINES, by D. J. Brown. Interscience Publishers, New York, 1962. 774 pages. £14.

Practical organic chemists need these days up-to-date works of reference similar to Beilstein. Great help could be gained in a book like *The Pyrimidines* if information was as easily obtained as in the famous encyclopedia. On these standards it must be said that Dr Brown's book is a disappointment.

The reviewer has been unable to read the book throughout and also been unable to find important facets of pyrimidine chemistry, *e.g.*, the transformation of 4,6-dichloro-5-nitropyrimidine in the presence of alkali and an active methylene group to 5-amino-4,6-dichloro-2-methylpyrimidine. The last 276 pages comprise tables of compounds, without empirical formulae, with misleading headings (*e.g.*, p.588) and nomenclature serving little practical value that could not have been incorporated into the main text.

Despite these criticisms, Dr Brown has compiled a treatise in which a vast amount of information is to be found. Used in conjunction with other monographs the research worker will be able to find most of what is known in the pyrimidine field. It is refreshing to see a book of this magnitude from an Australasian laboratory.

—A.T.

THE OPIUM ALKALOIDS — SELECTED TOPICS, by D. Ginsburg. Interscience Publishers, New York, 1962. 111 pages.

This little book presents a history of the structural elucidation of the morphine group of alkaloids and of papaverine. It provides instructive reading for advanced students and is a reminder of what can be achieved without modern physical techniques.

—E.P.W.

SCREENING OF CHEMICALS FOR BIOLOGICAL ACTIVITY

An international pharmaceutical Company would like to make contact with scientists who are willing to submit chemicals to be screened for biological activity. The chemicals may be old or new, simple or complex in structure and the quantity required is reasonable. A wide variety of screening programmes is available and if no particular test is desired, then the chemical will be circulated amongst the research groups of the organization and they will select the tests most likely to reveal activity.

Those who would be interested in participating in this scheme can obtain full details from Dr D. J. McHugh, Box 4198, G.P.O., Sydney, N.S.W., Australia.

MATTHEY GARRETT (N.Z.) LTD.

The Auckland firm known to many members of the Institute as Garrett, Davidson and Matthey (N.Z.) Ltd., dealers in precious metals and their salts and suppliers of platinum ware, advise that they have changed their name to Matthey Garrett (N.Z.) Ltd. This is a change of name only, all other details remaining as before.

UNIVERSITY OF CANTERBURY
CHRISTCHURCH, NEW ZEALAND

LECTURER IN CHEMISTRY

Applications are invited for the above-mentioned post in the Department of Chemistry. Applicants should have qualifications and experience in the general field of inorganic, structural and physical chemistry.

The salary attached to the position will be at the rate of £1,250 per annum, rising by annual increments of £75 to £1,700 per annum. Commencing salary will be in accordance with qualifications and experience.

Approved fares to Christchurch will be allowed for the appointee, his wife and children. In addition actual removal expenses will be allowed within certain limits.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, Marlborough House, Pall Mall, London, or from The Registrar, University of Canterbury, Christchurch, New Zealand.

Applications close, in New Zealand, on March 31, 1963.

G. G. TURBOTT,
Registrar.

P.O. Box 1471,
Christchurch,
New Zealand.

RESEARCH CHEMIST OR BIOCHEMIST

Applications are invited from suitably qualified chemists or biochemists for appointment to lead the Chemistry Section of the Hydatid Research Unit of the New Zealand Medical Research Council.

This Unit has its laboratories at the Taieri Agricultural Centre near Dunedin and is associated with the University of Otago Medical School.

The Chemistry Section is engaged in work directed towards finding ovicides, scolicides and anthelmintics. The appointee should have had considerable research experience in organic chemistry or biochemistry. He will be required to undertake a research programme which includes studies on the chemistry of tapeworm eggs in connection with ovicides and penetration of ova, and on the chemistry of tapeworms in connection with anthelmintics, scolicides and vaccines.

The appointment carries a grading of Senior Scientific Research Officer, and the salary offered is £NZ.2,350 p.a. The appointment is for a minimum of three years. The current grant for the work ends on December 31, 1967. Approved fares for the appointee and family will be paid, plus actual removal expenses up to £NZ.100 for a married man and £NZ.40 for a single man. Subsidized superannuation is available. Four weeks' annual leave.

Further information and conditions of appointment may be obtained from the Secretary, The Association of Universities of the British Commonwealth, Marlborough House, Pall Mall, London, S.W.1, or from the Secretary, Hydatid Research Committee, New Zealand Medical Research Council, Box 913, Dunedin, with whom applications close on March 10, 1963.

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