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EDITORIAL

FELLOWSHIP OF THE INSTITUTE

(Contributed by The President, Dr. M. M. Burns).

Over the period 1947-1954 the membership of the Institute increased from 340, including 60 Fellows to just over 500, including 65 Fellows. Over the same period the number of new Fellows listed was 11 made up of five who qualified and were elected automatically as being already Fellows of the Royal Institute and six who were elected direct. This ratio of Fellows to Associates does not fairly represent the status of chemists in New Zealand and there are very many Associates who fulfil all the qualifications for election to the Fellowship.

I believe that the standing of the Institute would be enhanced with other professional groups and with the public if Associates who feel that they have the qualifications of the Fellowship made application for election to this status. It is true of course that some may not qualify on their first application but may well do so after gaining further experience.

In some Professional organisations it is almost expected of members that they seek the honour of election to the Fellowship as soon as they attain the necessary qualifications. Chemists tend to be modest—many who are Associates in our Institute could be Fellows. Are you or your colleagues in this category? What about reading through rule 9 (the relevant sections of which are re-printed below) and, if you feel that you can qualify, making application for election to the Fellowship?

Election to the Fellowship is an honour to you and a service to the Institute.

Rule 9—(Abridged.)

FELLOWSHIP.

9.1. No Person shall be elected a Fellow unless he has attained the age of twenty-five years, is connected with New Zealand by birth, education or domicile, and has produced evidence satisfactory to the Council of having reached the required standard of attainment.

9.2. An Associate who is a candidate for the Fellowship must have been engaged for at least five years subsequent to his election to the Associateship in the study or practice of Chemistry or Chemical Technology, and must have shown therein a substantial measure of ability or achievement.

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9.3. Persons other than Associates may be elected to the Fellowship in the following cases only:—

9.3.1. An applicant who is a Fellow of the Royal Institute of Chemistry or of the Royal Australian Chemical Institute or of the South African Chemical Institute shall be deemed to have reached the required standard of attainment and shall be eligible for the Fellowship.

9.3.2. Any other person not being an Associate but able to comply in other respects with the requirements for the Fellowship may be elected a Felow in exceptional circumstances. . . . .

9.4. Every candidate for the Fellowship shall be required to submit a full account of his chemical interests, experience and studies. He may also submit other relevant evidence such as patents, published papers, a thesis embodying the results of experimental work or a dissertation or critical review of some topic within his field of work. Such evidence shall be referred to and considered by the Membership Committee which shall further take into account the nature and responsibility of the position held by the candidate.

9.5. The Membership Committee may recommend that one or more Assessors be appointed for any particular application. The appointment of Assessors shall be made by the Council, or, between meetings of the Council, by the President and the Honorary General Secretary-Treasurer. Where Assessors have been appointed they shall examine the evidence submitted by the candidate and report thereon to the Membership Committee through the Honorary General Secretary-Treasurer.

9.6. After having considered the evidence submitted by a candidate for the Fellowship, together with the report, if any, of the Assessors appointed for the particular application, the Membership Committee shall report thereon to the Council.

9.6.1. The Membership Committee may recommend that any applicant be required to sit an examination prescribed by the Council. The applicant shall be deemed to have given satisfactory evidence of attainment only on receipt by the Council of a favourable report from the examiners.

75th ANNIVERSARY OF THE SOCIETY OF CHEMICAL INDUSTRY

On 10th July last, the New Zealand Institute of Chemistry joined kindred bodies from the British Commonwealth, the United States and many European countries in offering congratulations and good wishes to the Society of Chemical Industry on the occasion of its 75th Anniversary. The ceremony, at which our Institute was represented by the Vice-President, Mr. W. A. Joiner, was held at the Royal Institution, London, and was a simple but colourful one. Following the presentation of their scrolls or addresses, delegates were invited to attend a luncheon at the Dorchester Hotel.

The scroll presented on behalf of the Institute was prepared by the Registrar and Mr. J. A. D. Nash and carried the following wording:—

TO THE SOCIETY OF CHEMICAL INDUSTRY

GREETINGS

The President Fellows and Associates of the New Zealand Institute of Chemistry extends greetings to the Society of Chemical Industry on the celebration of its 75th Anniversary, and congratulate the Society on its achievements during the past years and the contributions which its members have made to the application of Chemistry to Industry, Great Britain, the Commonwealth, and the World.

CRYSTALLINITY IN LIVING SYSTEMS.

BY B. R. PENFOLD.

(Chairman's address delivered to Canterbury Branch, N.Z.I.C., on 21st May, 1956.)

DEFINITION OF CRYSTALLINITY (1).

Crystallinity was once a description in terms of external shape. A piece of material was crystalline if in its natural state it was bounded by flat faces inclined at certain angles to each other. These interfacial angles were constant for different crystals of one particular substance. Thus we should find, if we allowed a solution of sodium chloride in water to evaporate, there would remain salt "crystals" whose faces were exactly at right angles. If we carried out the same experiment with sucrose the interfacial angles would not be right angles but they would be the same for every sugar crystal regardless of its size.

We know now that the external form of a crystal is but one of the consequences of the nature of its *internal* atomic arrangement. So we may now define crystallinity in terms of *internal* structure and say that a solid object is crystalline if its internal structure is periodic, *i.e.* it consists of a repetition in space at regular intervals of a fixed group of atoms. In salt the group is four sodium ions and four chloride ions arranged in a particular manner, there being 10^{19} such groups in a 0.1 mm cube. In sugar the group is an arrangement of two molecular units of $C_{12}H_{22}O_{11}$, there being 10^{18} such groups in a 0.1 mm cube. In protein we have a different order of complexity again and find regular arrangements of molecular units containing several thousand atoms. In all cases the repeating groups may be considered as contained within volume units (of characteristic size and shape for each substance) which fill the space inside the crystal completely and are known as *unit cels.*

There are degrees of crystallinity. A solid is more or less crystalline as its internal atomic arrangement is more or less regular. I want to distinguish here between a fully crystalline substance or three dimensional crystal in which the regularity is undisturbed throughout (e.g. salt and sugar), and a *FIBRE* such as a wool or nylon fibre. We may regard fibres as consisting of large numbers of smaller units called *CRYSTALLITES,* themselves fully crystalline, which have been rotated with respect to one another about the *FIBRE AXIS* so that in only one direction, parallel to this axis, do we have complete regularity.

X-RAY DIFFRACTION.

We may very rapidly distinguish between these two degrees of crystallinity by observing how the substance will *scatter* a beam of X-rays. X-rays are scattered by atoms in all directions, but it is found that it is only for certain definite directions that the crystal as a whole (which is a regular arrangement of atoms) will scatter the X-ray beam. For all other directions the scattering from individual atoms interferes in such a way that there is complete cancellation. This is the phenomenon of *diffraction* which is dependent on the periodicity of the diffracting medium. We may observe this phenomenon by means of a simple experiment. If you look at a point source of white light through a stretched white handkerchief you should see a number of rows of spots of light which correspond to the particular directions in which the material will scatter the light it receives. The material consists of regularly spaced cotton strands the spaces between which function like the regularly spaced atomic groupings in crystals, and it is really a two dimensional diffracting medium.

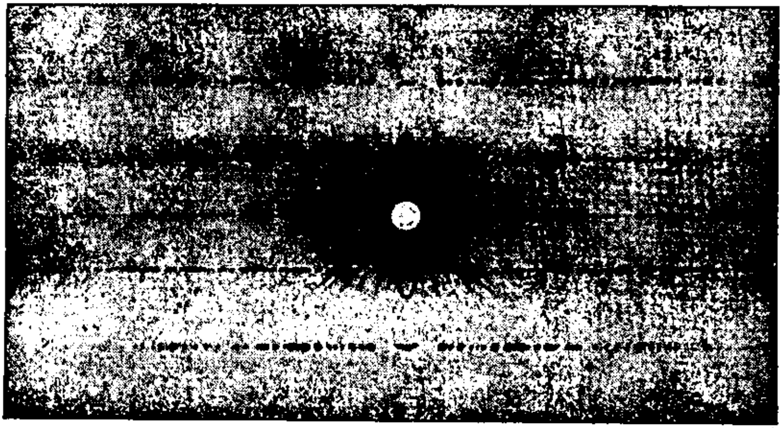

FIG. 1.

Single crystal rotation X-ray diffraction photograph of benzamide on cylindrical film.

It is this power of crystals to diffract X-rays that makes it possible to find out many details of their structures. In Figs. 1 and 2 are shown X-ray diffraction patterns from a typical single crystal (complete three dimensional regularity) and a typical fibre. The sharpness of spots on a fibre photograph depends on a number of factors, the most important being the degree of orientation of the crystallites with respect to the fibre axis, and the size of the individual crystallites.

Fig. 3 shows another type of X-ray pattern, that from a crystalline powder. Imagine a large single crystal crushed down to a powder. We then have an infinite number of tiny crystallites in *all possible orientations*, so for the bulk sample, the crystallinity is lower than for a fibre. There are certain specific repeat distances (or spacings) for the fundamental atomic grouping, but in a powder these spacings are quite randomly oriented in space. In all the cases we have considered, the angular spacing of the diffracted beams is inversely proportional to the spacing of the repeating unit, or the size of the unit cell.

Having presented these basic facts, I want to show you how they may be used to reveal the nature of two parts of the anatomy of animals. I shall consider firstly dental structure and secondly, that part which consists of fibrous proteins.

THE CRYSTALLINE STRUCTURE OF TEETH.

(The work discussed in this field is mainly that of Trantz and co-workers at the New York University College of Dentistry (2)).

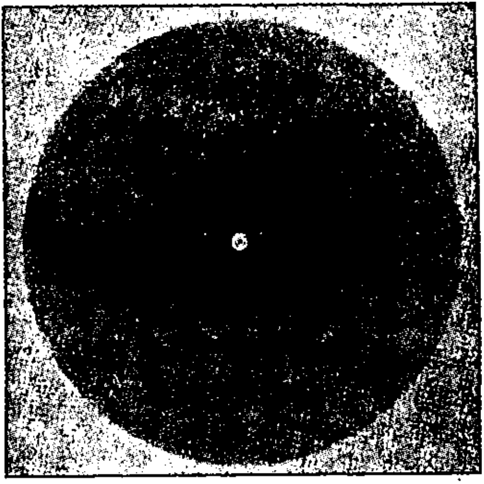

FIG. 2.

X-ray diffraction photograph of linen fibres on flat film.

We shall be concerned only with the outer layers of tooth structure, i.e. enamel and dentine. The X-ray diffraction pattern of a thin section of human enamel is similar to that obtained from a crystalline powder, indicating that enamel consists of a large number of tiny crystals packed together in random orientation.

The spacings of the lines, which give the dimensions of the unit cell, correspond with those observed in one of the group of minerals called "apatites", which constitute one form of crystalline calcium phosphate. This particular apatite is hydroxy apatite whose unit cell ideally contains $Ca_{10}\ (PO_4)_6(OH)_2$ groupings. Chemical analyses of enamel show that it contains significant quantities (several per cent.) of other material, such as magnesium, sodium, carbonate, citrate and fluoride, but only apatite diffraction lines are obtained so there is no other *crystalline* component. A likely explanation of the presence of magnesium and fluoride ions is that they are accommodated in the apatite lattice by substitution of calcium and hydroxyl respectively. The extent of such substitutions can be followed by the consequent small contractions of the unit cell, bearing in mind that magnesium and fluoride are smaller than calcium and hydroxyl. Complete substitution of fluoride for hydroxyl to give Ca_{10} $(PO_4)_6$ F_2 containing 3.8% fluorine would be accompanied by a shortening of one edge of the edge of the unit cell by one half per cent.

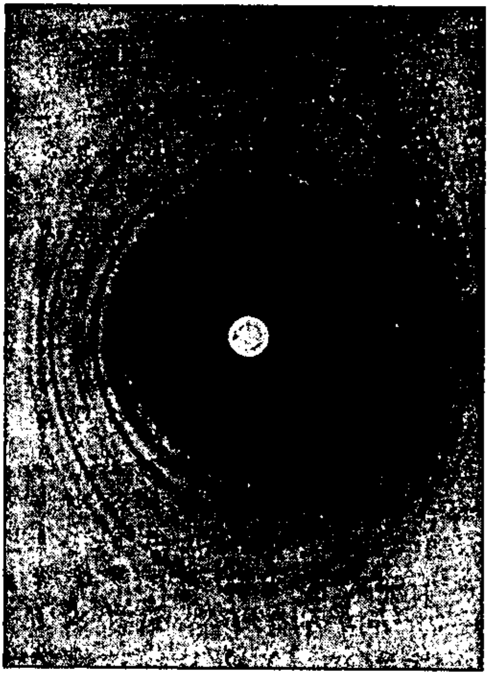

FIG. 3.

Powder X-ray diffraction photograph of benzamide on cylindrical film.

SHARK ENAMEL AND HUMAN ENAMEL.

The apatite of shark's enamel differs from that of human enamel in two important respects and poses some interesting problems. Firstly, the fluoride content is about 100 times larger in sharks, and secondly, the unit cell is significantly smaller than this amount of fluoride substitution would cause. A magnesium substitution was predicted to account for this anomalous contraction, but no such magnesium containing apatite is known elsewhere or has so far been synthesized.

The very high fluoride content prompts the question, "where does this fluoride come from?" It is either taken in by the mature tooth from sea water *or* is taken in by the tooth as it is being formed before eruption and is a consequence of a high fluorine content in the shark's plasma. The latter view seems the more acceptable when we remember that the fluorine content of sea water (one part per million) is no higher than that of average human drinking water. This view could of course be put to the test, as Trautz suggests, by examination of shark's teeth before and after eruption.

CRYSTALLITE SIZE IN ENAMEL, DENTINE AND BONE.

The larger the individual crystallites of any powder specimen, the sharper are the diffraction lines. Using this property as a qualitative estimate only, we can observe that the crystallites in human enamel are considerably larger than in dentine and bone—about three times as large. Moreover they are larger from the earliest stages in the foetus and do not just grow large.

This difference in crystallite size is a consequence of the different functions which these tissues are called upon to perform. Enamel plays no part in metabolism. It has chiefly a structural and protective function for which it is particularly suited on account of the smaller surface area and lower reactivity of the large crystallites. Bone on the other hand has a metabolic function in addition to its structural function. The relatively large surface area and the increased reactivity of the small, distorted crystallites facilitate the mobilization and redisposition of the mineral matter for which bone serves as a reservoir.

THE STRUCTURE OF FIBROUS PROTEINS (3).

The proteins of the structural material of living animal systems, are fibrous. Among the most important are *collagen* of cartilage, tendons and fish scales; *myosin* of muscle; *keratin* of hair, horns and feathers; *fibrinogen* of clotted blood. This fibrous nature is of prime importance in the physiological functions which these proteins perform, in particular, as we shall see, the operations of contraction and stretching.

From the nature of X-ray diffraction patterns, Astbury classified fibrous proteins into two groups,

(1) the keratin-myosin-fibrinogen group (k-m-f.).

(2) the collagen group.

Fibres in the k-m-f group can be stretched, the stretched fibre giving a distinct diffraction pattern. All members of this group have pairs of diffraction patterns (for normal and stretched) which are closely related, i.e., α-keratin and β-keratin types. Members of the collagen group will not stretch. They have diffraction patterns quite distinct from the k-m-f group.

INTERPRETATION OF DIFFRACTION PATTERNS.

The most important features of a fibre diffraction pattern are the spacing of spots, (a) on the meridional axis of the pattern and (b) on the equatorial axis, which give the spacings of the repeating group of atoms along and perpendicular to the fibre axis respectively.

The β-keratin pattern has a simple interpretation. The meridional spacing of 3.3 A corresponds to a nearly fully extended polypeptide chain (3.64 A). There are two equatorial spacings which correspond to (a) the lateral spacing of hydrogen bonded chains, and (b) the spacing perpendicular to planes of zig-zags between adjacent parallel chains, this spacing being maintained by the side groups of the polypeptide. The evidence therefore is that in β-keratin fibres, there are nearly fully extended polypeptide chains lying parallel to the fibre axis.

The α-keratin structure has been a subject of much controversy. Its final elucidation, in broad outline only, was the result of some brilliant deductions by Pauling and his associates at California Institute of Technology. X-ray fibre diagrams give such limited information that it is sometimes impossible to proceed directly from them to a unique structure. Instead, models may be proposed for the molecule which are the most reasonable on chemical grounds. Those which do not satisfy the X-ray data may be rejected immediately. After many postulated structures for α-keratin had been tried and found wanting, Pauling, Corey and Branson, in a series of papers published in 1950-52, summarised fifteen years of structural work on polypeptides and proposed four conditions which any polypeptide structure must fulfil.

(1) all amino acid residues are equivalent except for differences in the side chain.

(2) the amide bond system is planar due to resonance, i.e. the peptide bond and the 4 other bonds originating from it are coplanar.

(3) bond lengths and angles are closely defined.

(4) every $C = O$ and $N - H$ group is involved in hydrogen bonding.

Applying these conditions, they produced their "α-helix" which is now believed to be the basis of the structure of not only α-keratin but also many synthetic polypeptides and crystallised globular proteins. The α-helix has 3.7 amino acid residues per turn and each amino nitrogen is hydrogen bonded to the third residue beyond it in the chain.

The α - helix, although clearly basically true for α - keratin did not explain all details of the X-ray diagram. Pauling and Corey introduced a refinement which involved making the axes of the helices themselves helical and these helical helices can pack together to form "cables" and "ropes".

MACROMOLECULAR STRUCTURE FROM LOW-ANGLE SCATTERING.

So far we have been concerned only with high angle scattering originating from spacings less than 20 A. Superimposed on this regularity there is a much larger scale regularity involving repeating units up to 600A apart. Special fine focus techniques are required to investigate spacings of this order which give rise to very low angle X-ray diffraction. Particularly interesting effects are found in the α-keratin-like structure of muscle fibre. It is found that on muscle contraction these large repeat distances decrease markedly. However the high angle α - keratin pattern remains unaltered. This suggests two crystalline orders in protein fibres—that in the individual crystallites making up the fibre, there are recurring units of highly organized structures responsible for the high angle pattern. These units are separated by less highly organized regions responsible for the more variable low angle pattern. So it seems that the complex phenomenon of muscular contraction, of such critical biological importance, is at least partly due to the serial occurrence of less regular regions in the fibres of the myosin complex.

I have been able to consider only one or two cases of naturally occurring crystals and how X-ray diffraction makes it possible to determine their structures, but the crystalline state is everywhere around us and X-rays help us to reveal an underlying simplicity in this architecture of nature which is often unsuspected.

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ADVANCES IN METHODS OF PEROXIDE ESTIMATION IN FATS

BY L. HARTMAN,

Fats Research Laboratory, Department of Scientific and Industrial Research, Wellington, New Zealand.

Amongst the numerous methods of detecting rancidity in fats the determination of peroxide values is one of the tests most frequently used. Some recently developed methods such as the thiobarbituric acid test are being used rather in conjunction with the peroxide estimation than as its replacement. The peroxide test depends on the fact that autoxidation of fats produces invariably substances of peroxidic character which are precursors of rancid flavours. In common with peroxides proper, fat peroxides liberate iodine from iodides in an acid medium and this and some other oxidizing reactions form the basis of their determination. The iodometric method is closely associated with the name of Lea (1) who introduced a simple and quick mode of carrying out the estimation. Although the original so called "hot" method (heating the fat with powdered potassium iodide in acetic acid-chloroform solvent and titrating the liberated iodine with sodium thiosulphate) is still used by some conservative analysts, it is regarded by its author as obsolete. The most satisfactory iodometric method seems to be the "cold" method (2) which deserves the name of Lea-Wheeler test, owing to Dr. Wheeler's contribution (3) towards its development. According to this method the fat is dissolved in a 3:2 mixture of acetic acid-chloroform containing some aqueous solution of potassium iodide and previously deaerated with an inert gas, and the whole left in the dark for 1 hour. The iodine is titrated as usual. In this form the test gives fairly reproducible results. Numerous modifications have been suggested, aiming chiefly at the elimination of blank titration attributed to the use of acetic acid. Thus acetic anhydride (4), isopropyl alcohol (5) solution of citric acid in tertiary butyl alcohol (6) and other solvents have been advocated, but have not succeeded in replacing the original solvent mixture.

The only serious competitors of the Lea-Wheeler test are some recently developed colorimetric methods which will be now discussed more fully since their introduction has raised problems not only of analytical nature, but also in relation to the structure of fat peroxides.

The most common colorimetric method used for the estimation of fat peroxides is the ferric thiocyanate method (7). In its modification, due to Loftus Hills and Thiel (8), benzene-methanol is used as solvent, the peroxides are reduced with ferrous chloride, and after addition of ammonium thiocyanate the resulting colour of the ferric thiocyanate complex is measured visually or photometrically. Since the method gives good reproducibility, and makes possible the detection of incipient rancidity on a semimicro scale, it is potentially more useful than the iodometric procedure. There remained, however, the puzzling fact that the ferric thiocyanate method gave values 2-3 times higher than the iodometric method. Lea (9) solved this puzzle by proving that the ferric thiocyanate method was subject to a considerable "oxygen error", i.e., interference of atmospheric oxygen, and that its results were reduced to one-third or one-quarter of the original values by rigorously excluding all oxygen. This was confirmed by one of the original authors of the method, R. A. Chapman (10), who admitted that the method is of value only when comparative results are required.

This, however, was not the whole story. Dubouloz and coworkers introduced a new colorimetric method (11) which consisted in reducing the iodine liberated by peroxides with thiofluorescein (TSH) according to the equation:

2 TSH (intensely blue) + I_2 → TSST (colourless) + 2HI
and measuring the resulting decrease of colour.

This method is too complicated for routine estimations, but has some theoretical interest as it gives results about twice as high as the iodometric method despite a rigorous exclusion of oxygen. For example, the following peroxide values are obtained on oxidation of ethyl oleate at 100°C.:

Time of oxidation hours	*Milliequivalents of peroxide per 1000g esters* *Lea method*	*Thiofluorescein method*
3	48.5	115
6	121	260
18	325	800
24	377	810
38	243	684

The main reason given by Dubouloz *et al.* for the above discrepancy was the instantaneous removal of the liberated iodine by thiofluorescein, which resulted in a stronger reducing medium as compared with the iodometric method, viz., HI against HI + I_2, and prevented the reabsorption of iodine by unsaturated fatty acids.

Shortly afterwards two Scandinavian authors Hartmann and Glavind (12) developed another colorimetric method based on the use of the leuco-base of the oxidation-reduction indicator 2:6 dichlorophenol-indophenol which is converted by peroxides into the dye. The method was described as sensitive, and yet little influenced by variations in external experimental conditions, which made the use of an inert gas superfluous. The results were 2-3 times higher than those obtained with the iodometric procedure.

This seemed to bring the reliability of iodometric results as a measure of true peroxide values into doubt, but not for long. Hartman and White (13) of the Fats Research Laboratory in Wellington, showed that the dichlorophenol-indophenol method of Hartmann and Glavind was affected by "oxygen error" to an even greater extent than the ferric thiocyanate method. The similarity of names of the senior authors in each team led to some amusing misunderstandings, but did not alter the fact that by applying highly purified nitrogen the results obtained with the dichlorophenol-indophenol method could be reduced to one-quarter or less of the original values.

This was followed by an important investigation by Lea (14), in which the relative efficiencies of the iodometric, ferric thiocyanate and dichlorophenol-indophenol methods were compared on oxidizing pure fatty acid esters and measuring the quantity of oxygen absorped. The iodometric method indicated 71-91% of the actual oxygen absorption, the ferric thiocyanate method (Loftus Hills and Thiel modification) 119-194% and the dichlorophenol-indophenol method 154-252%

The above results seem to signify that the iodometric method is a true measure of the primary oxidation products such as hydroperoxides (and possibly also of cyclic peroxides if such compounds are really formed), since hydroperoxides are believed to account for up to 90% of oxygen absorbed during autoxidation of fats under mild conditions (15). The ferric thiocyanate and dichlorophenol-indophenol methods gave results which were much higher than could be accounted for on the basis of actual oxygen absorption. This was evidently caused by the interference of atmospheric oxygen during the estimation. Nevertheless, Lea admitted that the ferric thiocyanate method is a very useful analytical tool. In comparison, the dichlorophenol-indophenol method was declared less suitable because of some inherent disadvantages such as higher oxygen error, less good reproducibility and intereference of traces of copper. However, the work of the Scandinavian authors was at least instrumental in giving rise to a new colorimetric method for the estimation of peroxides in the presence of phospholipids (16) which interfere with the ferric thiocyanate method. Phospholipids in analogy to phosphates inhibit the colour of ferric thiocyanate by forming a complex with the ferric iron). In the new method, a measured amount of ferrous chloride is used to reduce the fat peroxides and the excess of the reagent is estimated by oxidation with dichlorophenol-indophenol, which is not impeded by either phospholipids or phosphates.

The thiofluorescein method was not investigated in Lea's work previously mentioned (14), but the results of his work provide an explanation for the high peroxide values obtained by Dubouloz and co-workers. It seems that when employing the thiofluorescein method, not only true peroxides but also oxido-and hydroxy-keto groups are reduced in analogy to the action of gaseous HI (17). There is little doubt that with fats oxidized under mild conditions, i.e., with preponderance of hydroperoxides, results obtained with thiofluorescein and iodometric methods would not differ greatly. Opinions might vary as to the desirability of estimating other oxidation products besides peroxides. It would seem, however, that the term "peroxide values" should be restricted to results which account for true peroxides only.

The latest development in the field of peroxide estimation is a suggestion by Glavind and Hartmann (18) to carry out both the ferric thiocyanate and the dichlorophenol methods under anaerobic conditions and thus to obtain true peroxide values. This suggestion is based on a mistaken interpretation, in the present author's view, of a paper by Kolthoff and Medalia (19) which deals with the reaction between organic peroxides and ferrous iron. Glavind and Hartmann (18) believe that by selecting suitable conditions the above reaction can be made stoichiometric. This seems questionable, but certainly more work is required on this point. The most valuable result of Glavind and Hartmann's (18) latest work is the suppression of phospholipid interference in the ferric thiocyanate method achieved by greatly increasing the amount of ammonium thiocyanate used in the estimation. However, even this point requires further scrutiny.

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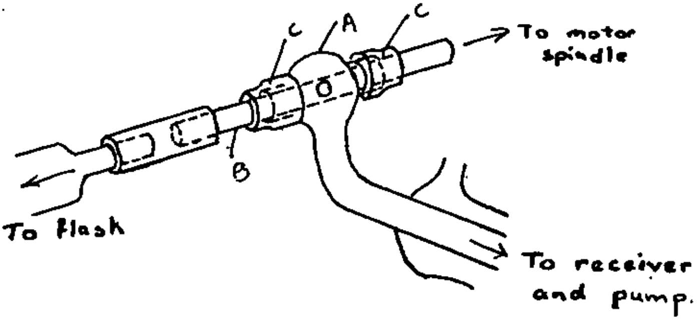
LABORATORY EQUIPMENT

(Contributed by Dr. J. C. Hawke, Fats Research Laboratory, D.S.I.R., Wellington.)

Gas-liquid or vapour phase chromatography is finding increased use as an analytical method in both industrial and research laboratories. For once chemists have a new technique of wide application which is simple in operation and can be readily tailored to fit the purse. The chromatographic columns are packed with a non-volatile liquid distributed over the surface of a suitable finely divided inert solid such as Celite. At first the method was restricted to the separation of volatile acids and bases. These were continuously neutralized either manually or automatically as they emerge from the column. However, the method is applicable to the separation of a wider variety of volatile chemical substances, e.g., hydrocarbons, aldehydes, etc., when the vapours in the gas stream are estimated by thermal conductivity measurement or by a detector depending on differences in gas density.

Both these methods of detection have been fully described in the chemical literature, but in most publications apparatus of relatively high cost is described. Recently a member of this laboratory saw a very simple apparatus operating as a class experiment at Stanford University (H. Mosher and R. Eastman, Org. Chem. Dept.), and a similar apparatus has since been operating satisfactorily in this laboratory. The detector is a stretched tungsten filament, e.g. from a 0.3 amp., 6.5 volt light bulb, which is soldered on to nichrome and tungsten leads, and these leads sealed to a separate section of tubing with spherical joints at both ends. One end of the detector unit is connected to the column and the other to a sample collector if required. Nitrogen, hydrogen or helium can be used as carrier gases. Of the gases readily available in New Zealand, hydrogen is preferred, because it has a high thermal conductivity. Organic vapours are much poorer thermal conductors than hydrogen and when a component of the mixture emerges from the bottom of the column and passed over the conductivity cell, the element warms up, its resistance increases and this can be observed as an unbalance in a Wheatstone bridge. This unbalance can be measured as a tracing from a suitable recorder or with a millivolt meter if a recorder is not available.

Rotary film evaporators are extremely useful for removing water or non-aqueous solvents rapidly and at moderate temperature from heat sensitive materials. Numerous commercial models are now available in a wide range of sizes, but the apparatus can be easily constructed in the laboratory from readily obtainable components. An all-glass version which we have found particularly useful for concentrating acid hydrolysates and solvent extracts is described by Lea, Hannan & Rhodes (Biochem. Biophys. Acta, (1951), 7, 366). The apparatus consists of a glass T piece A (Fig.), of which the cross piece of 11 x 9 mm. tubing is expanded in the middle into a bulb, clamped in a slightly inclined position. Through this cross piece passes a length of 8 x 6 mm. tubing B, sealed at the upper end and carrying one or two holes in its side opposite the side limb of A. Two pieces of rubber tubing C approx. 2 cm. long, fit the inner tube fairly tightly and are forced over the ends A. The vacuum seal is thus obtained, with easy rotation of the spindle B. A lubricant such as Silicone stop-cock grease can be used on the rubber glands if desired. Attached to the lower end of B by a short length of rubber tubing is a B19 cone on 15 cm. of glass tubing. The drive is applied at the top of B by attaching the closed end to a stirrer spindle by a short length of rubber tubing. Any low speed gear-driven stirrer can be used. The side limb of the T piece leads from the underside of the bulb via a short water jacketed condenser to the detachable solvent receiver and water pump.



The scope of paper chromatography has been widened by the availability of fibre glass paper. This permits the use of strongly acid or alkaline sprays to develop spots without damaging the support medium. For example, mixtures of lipids, e.g., cholesterol, cholesterol acetate, mono-, di- and tri- glycerides can be separated on silicic acid impregnated glass paper. After spraying with 20% H_2SO_4 and heating gently over an open coil hot plate, the sterols appear as pink spots. After more drastic heating, all lipids appear as black spots on a white background.

NEWS AND NOTES.

WAIKATO BRANCH.

Mr. R. R. White has left the staff of the Ruakura Animal Research Station and is now Chemist at Waikato Breweries Ltd., Hamilton.

All members of the Institute will be grateful to Mr. N. T. Clare and his associates from the Waikato Branch, who have undertaken, over the past few months, the preparation of the Journal Index which is published in this issue. The need for an Index has been long recognised and merely the sheer labour involved has delayed its preparation.

MANAWATU BRANCH.

Dr. R. W. Bailey has transferred from the Soil Research Station at Hamilton and is now at the Plant Chemistry Laboratory, Palmerston North. A graduate of Canterbury University College, Dr. Bailey returned to New Zealand last year after working for some time on the enzymatic synthesis and structure of bacterial polysaccharides at Birmington University where he gained his Ph.D.

We also welcome to this area, Dr. J. R. L. Walker, who has joined the staff of The Dairy Research Institute (N.Z.) to work on Cheese flavour and the metabolism of Lactobacilli. A graduate of the University of Leeds, Dr. Walker was previously employed as a Research Assistant in the Biochemistry Department at Leeds working on the bacterial oxidation of fatty acids.

WELLINGTON BRANCH.

The Wellington Branch notes with regret the death of one of their members, Mr. D. R. Boaden. Mr. Boaden, who took his B.Sc. degree at Auckland, was interested in textiles, and worked at the Korma Mills, Auckland, before taking up his later position with the Institute of Launderers, Drycleaners and Dyers at Lower Hutt.

We congratulate Mr. N. H. Law on his appointment as Director of the recently established Meat Industry Research Institute of New Zealand. Mr. Law has been in charge of the Meat Research Section of the Dominion Laboratory since its inception. He is a fellow of both the New Zealand and the Royal Institutes of Chemistry, and is a member of the present committee of the Wellington Branch.

CANTERBURY BRANCH.

The degree of Ph.D. of the University of New Zealand has just been conferred on Dr. J. M. Austin, of the Chemistry Department, Canterbury University College. Dr. Austin has also been granted a year's refresher leave which he will spend in the Edward Davies Chemical Research Laboratory, University College of Aberystwyth, working on problems associated with the theory of electrolyte solutions.

OTAGO BRANCH.

We offer our congratulations to Dr. R. E. Corbett on the award of the 1956 Easterfield Medal. The medal, which is provided by the Royal Institute of Chemistry is an award in honour of the late Sir Thomas Easterfield, first Chairman of the N.Z. Section of the R.I.C. and second President of our own Institute.

HONORARY FELLOWSHIP.

Honorary Fellowship of the N.Z. Institute of Chemistry has been conferred on Sir Theodore Rigg, who retired this year from his position as Director of the Cawthron Institute, Nelson. In announcing this, our President, Dr. M. M. Burns paid this tribute to Sir Theodore:—

"The Council of the New Zealand Institute of Chemistry by its election of Sir Theodore Rigg as an honorary fellow, honours one of its most distinguished members and one of the outstanding scientists in the country.

"As Chairman of the Council of the Department of Scientific and Industrial Research for many years, as Director of the Cawthron Institute, and as President of many scientific societies, Sir Theodore has a fine record of leadership in service to science and to the community.

"His contributions to agricultural science have been of immeasurable value to primary production and they have further enhanced the international reputation of the Cawthron Institute.

"Though perhaps best known for his fine work on trace element deficiencies, Sir Theodore has made important contributions in many related fields. He pioneered in New Zealand the modern concepts of soil classification and he carried out a whole series of investigations on the many soil types in the Nelson area which have stimulated better land use and led to marked improvements in crop and pasture production.

"His colleagues honour him for his scientific work, his leadership, and his fine service to the community."

INSTITUTE PRIZES.

THE I.C.I. PRIZE.

The I.C.I. prize for research published during the past five years has this year been awarded to Dr. C. J. Wilkins, senior lecturer in inorganic chemistry at Canterbury University College.

The recipient is a Canterbury College graduate and gained the Ph.D. degree in 1941 for work under Professor H. J. Emeleus at Imperial College. He subsequently did chemical work on wartime projects in England before joining the Canterbury College staff. In 1950-51, on a Nuffield Fellowship, Dr. Wilkins spent a year at Oxford in Dr. L. E. Sutton's electron diffraction laboratory.

Dr. Wilkins' researches have centred on silicon halides. With Dr. Sutton he studied bond lengths in silicon compounds. A paper in collaboration with P. W. Craighead and D. J. Panckhurst describes new silicon thiochlorides. Other papers deal with the degradation of disilane derivatives with trimethylamine, with phase equilibria in the system silicon tetrafluoride-trimethylamine (with D. K. Grant), and with the kinetics and mechanism of the reactions of Grignard reagents with trimethylhalogenosilanes (with A. F. Reid).

THE MORCOM GREEN, EDWARDS PRIZE.

Mr. I. R. C. McDonald is this year's winner of the Morcom Green, Edwards prize, which is awarded for original research by younger chemists. Mr. McDonald received his early education at Scot's College, Wellington, and then continued with part-time study at Victoria College while working at the Dominion Laboratory, first in the Metals Section and then, after a two year break in the Air Force, in the Bitumen laboratory. In 1949, he obtained his M.Sc. degree after a year's full-time study, and returned to the Organic Section of the Dominion Laboratory of which he is still a member.

From 1950-52, Mr. McDonald spent two years at the Forest Products' Research Laboratory at Princes Riseborough, England, where he worked on the chemistry of wood. Latterly, among other work of an organic nature, he has been working on compensation techniques in infra red analysis, and it is for work in this field that he has been awarded this prize.

A.N.Z.A.A.S., 1957

Section B. (Chemistry).

Tentative Programme as at 3/7/56.

THURSDAY, JANUARY 17th.

Morning: 9.30-10.45:—

Presidential Address. "Terra Incognita: the Surface of Reacting Solid."

Professor J. S. Anderson, F.R.S. (University of Melbourne).

11.15-12.45: *Structural Chemistry.*

"The Hydrates of Organic Chemical Compounds". H. H. Hatt (C.S.I.R.O., Melbourne).

"Anomalous Magnetic Susceptibilities in some Co-ordination Compounds of Nickel". A. L. Odell (Auckland University College).

"The Crystal Structure of Benzamide". B. R. Penfold and J. C. B. White (Canterbury University College).

Afternoon: 2.15-3.30, 4.00-5.00:—

Inorganic Raw Materials (Joint with Section C).

"The Ceramic Resources of New Zealand". I. C. McDowall (N.Z. Potteries and Ceramic Research Association).

"New Zealand Ironsands". W. R. B. Martin (Victoria University College).

"Chemicals from Sea Water". S. R. Siemon and T. Hagyard, (Canterbury University College).

"Australia's Major Inorganic Raw Materials". S. K. Dickinson (Dept. of Mines, South Australia).

"The Geochemical Research Programme of the Australian National University and its bearing on Problems of Ore Genesis". J. F. Lovering (Australian National University).

"The Mineral Resources of New Zealand". H. E. Fyfe (Geological Survey, Wellington).

FRIDAY, JANUARY 18th.

Morning: 9.30-10.45, 11.15-12.45:—

Mechanism of Reactions.

"Some Aspects of the Quenching of Fluorescence". W. S. Metcalf (Canterbury University College).

"The Alkaline Isomerisation of Unsaturated Fatty Acids". J. B. Davenport (C.S.I.R.O. Homebush, N.S.W.).

"Sulphur Hypofluorites". F. B. Dudley (University of New England).

Title not yet available. J. Vaugan (Canterbury University College).

Title not available. J. Miller (University of Western Australia).

"Cyclic Transition States in Grignard Reactions". C. J. Wilkins (Canterbury University College).

Afternoon: 2.15-3.30, 4.00-5.00:—

Reactions at High Temperature and Pressure (with Section C).

"The Chemistry of Very High Pressures". S. D. Hamann (C.S.I.R.O., Sydney).

"Progress and Problems in Mineral Synthesis". W. S. Fyfe (University of Otago).

"Experimental Work on Geological Important Acid Gases in High Temperature Water". A. J. Ellis (University of Otago).

"Ionic Polymerisations at Elevated Temperatures". D. R. Teplitsky (University of Sydney).

"Mineralogical Changes in Refractories at High Temperatures". E. R. Segnit (University of Adelaide).

"Sintering and Chemical Reaction involving Refractory and Inorganic Materials". W. O. Williamson (C.S.I.R.O., Melbourne).

MONDAY, JANUARY 21st.

Morning: 9.30-10.45, 11.15-12.45:—

Concurrent Sessions.

Liversidge Lecture. Professor R. H. Stokes. "Molecular Hydrodynamics".

(a) *Geochemistry.*

"Tracer and Isotope Analysis in Geochemistry". J. F. Lovering (Australian National University).

"Chemical Problems of the Geothermal Investigations". S. H. Wilson (Dominion Laboratory, Wellington).

(b) Nucleic Acids (Section N).

Afternoon: 2.15-3.45:—

Concurrent Sessions.

(a) Papers on Surface Chemistry and Analytical Chemistry from the Ministry of Supply, Melbourne.

(b) *Use of C^{14} in Chemistry and Biochemistry* (Joint with Section N).

"Steroids and C^{14}". C. W. Emmens (University of Sydney).

"The Oxidation of 3-C^{14} Propionic Acid by Nocardia Corallina". R. D. Batt and J. K. Martin (University of Otago).

"The Counting of C^{14} from Biological Material". R. L. Blakely (Australian National University).

TUESDAY, JANUARY 22nd.

Morning: 9.30-10.45, 11.15-12.45:—

Concurrent Sessions.

(a) *Electrolytes.*

"Transport Processes in Concentrated Electrolytes". R. H. Stokes (University of New England).

"Ion Self Diffusion Measurements". R. Mills (Australian National University).

"The Determination of Transference Numbers in Non-Aqueous Solutions". M. Spiro (University of Melbourne).

"Ion Association". R. A. Matheson and H. N. Parton (University of Otago).

(b) *Organic Chemistry.*

"Heartwood Constituents". L. H. Briggs (Auckland University College).

"Chemical Studies on Ants". G. W. Cavill, D. L. Ford and H. D. Lockley (N.S.W. University of Technology).

"A Fungus Pigment". J. Murray (University of Otago).

"Advances in Glyceride Synthesis". L. Hartmann (Fats Laboratory, Wellington).

Afternoon: 2.15-3.30, 4.00-5.00:—

Concurrent Sessions.

(a) *Organic Chemistry* continued.

"The Separation of Sugars and Related Compounds by Paper and Column Chromatography". R. W. Bailey (Soil Fertility Research Station, Hamilton).

"Synthesis of Some Heterocyclic Compounds". J. Miller (University of Western Australia).

"Polystictin". G. W. Cavill, P. S. Clazy and J. R. Tetaz (N.S.W. University of Technology).

"Xanthorrhoea Resins". H. Duewell (N.S.W. University of Technology).

(b) *Agricultural Chemistry.*

"Some Chemical Aspects of Plant Growth Substances". G. W. Mason (Ivon Watkins Ltd., New Plymouth).

"The Fungicidal Activities of Chlorphenols". F. Kaufler (Timbrol's Ltd., Australia).

"The Spectrophotometric determination of Molybdenum, Vanadium and Tungsten in Plants and Soils". J. H. Watkinson (Soil Research Station, Hamilton).

"The Availability and Uptake of Phosphates from two South Australian Soils". C. S. Piper (Waite Institute, Adelaide).

"The Composition of the Soluble N fraction from Aphid Susceptible and Resistant Brassicae". R. M. Allison (Crop Research Division, Lincoln).

WEDNESDAY, JANUARY 23rd.

Morning: 9.30-10.45, 11.15-12.45:—

Chemical Education.

"Chemistry in New Zealand Schools". E. V. Searle (Auckland Teachers' College).

"Chemical Education for Agricultural Research and Servicing". N. T. Clare (Animal Research Station, Hamilton).

"Post-Graduate Training and Post-Graduate Courses". A. E. Alexander (N.S.W. University of Technology).

"Molecular Statistics". G. A. Eliott (University of Western Australia).

"Isoelectric Molecules: A Common Denominator in Organic and Inorganic Chemistry". R. G. Gillis (Ministry of Supply, Melbourne).

EXCURSIONS.

No specifically chemical excursions are being arranged. Many general excursions will be available and information about them will be contained in a forthcoming circular from the Central Committee.

GENERAL MEETING

ABRIDGED MINUTES OF A GENERAL MEETING OF MEMBERS OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.) HELD IN THE CHEMISTRY LECTURE THEATRE, AUCKLAND UNIVERSITY COLLEGE, ON WEDNESDAY, AUGUST 22nd, 1956, AT 4 P.M.

PRESENT:

Dr. M. M. Burns, President (in the Chair), Dr. W. E. Harvey, Acting Hon. General Secretary, and approximately 50 members.

PRESIDENTIAL REMARKS:

The President drew attention to the fact that he had called the meeting to order with the gavel recently presented to the Institute by S. G. Brooker. He welcomed members to the meeting and gave a brief survey of the year's activities.

The Institute had been specially pleased to hear that Prof. W. P. Evans had been honoured by Her Majesty the Queen in the Birthday Honours' List. The election of Sir Theodore Rigg to an Honorary Fellowship of the Institute was a fitting recognition of the valuable serives Sir Theodore had rendered to the profession and the community, and Dr. F. J. Llewellyn's appointment to the Rectorship of Canterbury University College would be welcomed by all chemists. Among members overseas, the President mentioned the Vice-President, W. A. Joiner, and the Hon. General Secretary, W. G. Hughson, both of whom were on their way back to New Zealand from England. Mr. Joiner had presented an illuminated scroll from the Institute to the Society of Chemical Industry on the occasion of the 75th Anniversary of that body. In the absence of the General Secretary, extra work had fallen on the Registrar (V. J. Wilson) and the Acting Secretary (Dr. W. E. Harvey) and the Institute was grateful to these two officers for the way they had carried out their duties.

The President pointed out that the principle of having meetings of Council-in-person had operated for the first time over the past year and expressed satisfaction with this arrangement.

Finally, Dr. Burns thanked all those members who had served on the various sub-committees of Council, and paid a special tribute to the Editor and the Journal Committee for the capable manner in which they had supervised the production of the Journal.

PRIZES:

The President announced that Council had awarded Institute Prizes as follows:—Morcom Green, Edwards Prize: I. R. C. McDonald, Dominion Laboratory, Wellington; I.C.I. Prize: Dr. C. J. Wilkins, Canterbury University College. No award was made in the Chemical Essay Competition. The Morcom Green, Edwards Prize, was presented to Mr. McDonald by Mr. Harry Edwards, who congratulated him on the infra-red spectroscopic investigations for which the prize had been awarded.

The President announced that the Easterfield Medal had been awarded to Dr. R. E. Corbett, University of Otago. Dr. Corbett unfortunately had not been able to give his address at the Conference owing to pressure of work which had kept him in Dunedin.

SUB-COMMITTEES OF COUNCIL:

The President remarked briefly on the activities of the Membership, Journal, Professional Status, Salaries, Examinations, Standards Institute and Employment Sub-Committees, and expressed the appreciation of members of the work done by the Conference Committee under the chairmanship of Prof. L. H. Briggs.

ANZAAS:

Prof. H. N. Parton outlined the arrangements made for the ANZAAS Conference in Dunedin in January, 1957, and stressed that members of the

Institute should make an early decision as to whether they will attend or not. The Institute will be asked to act as hosts to the visiting chemists.

SCIENCE TECHNICIANS:

It was agreed that members had not had adequate time to digest the Registrar's report on the Status of Science Technicians and it was *Resolved:* THAT the "Notes on the Status of Science Technicians" be referred to branches so that delegates could be fully instructed by branches before the next Council meeting.

REPRESENTATION ON SPECIALIST COMMITTEES:

It was moved: THAT in view of the Ministerial statement of 11th February, 1956, detailing the combination of Government research institutions formed to attack the alleged near-monopoly of timber preservation in New Zealand this General Meeting considers that the Institute cannot take part in such proceedings and should therefore withdraw its representative from the Timber Preservation Committee until the position is rectified.

During the course of discussion on the motion, the President quoted the resolution passed by Council at its meeting on 21/8/56. The motion was *LOST.*

It was then *Resolved:* THAT this meeting express its appreciation of the resolution carried by Council at its meeting yesterday relating to the appointment of members to represent the Institute on technical committees, and expresses its complete confidence that such members will discharge their professional and scientific duties in an ethical manner.—*CARRIED* unanimously.

RULES:

A number of speakers, including Prof. Parton, Dr. Fastier and Mr. Clare, expressed dissatisfaction with the present Rules relating to the election of officers of the Institute. In particular, it was suggested that the President should be elected by a ballot of all members. Further, to ensure a greater degree of continuity in the Council it may be desirable to appoint delegates for two years instead of one, not more than one-half of the delegates to retire in any one year. It was further felt that the Institute year should be changed so that it ended at the time of the Annual Conference.

It was *Resolved:* THAT in order to resolve some of the administrative difficulties arising from the present size of the Institute, this meeting recommends that the Council review the method of election of officers of the Institute and delegates to the Council, and the relation of the Institute's year to the General Meeting held at the Annual Conference.

TIMBER PRESERVATION AUTHORITY:

I. S. Hunt pointed out that the T.P.A. has no Institute representative on it.

Resolved: THAT this General Meeting draws the attention of Council to the situation that a Government constituted controlling authority, controlling an industry in which chemistry plays a key role has no representative of the Institute on it, and requests Council to do all in its power to obtain representation on the Timber Preservation Authority.

GENERAL:

It was agreed that letters be sent to Dr. J. W. Mitchell and Professor R. M. Barrer, two former students of Canterbury University College, congratulating them on their election to Fellowship of the Royal Society of London.

THANKS:

J. A. D. Nash proposed a vote of thanks to the Chair, and to the President for his service to the Institute, which was carried by acclamation.

COUNCIL MINUTES

ABRIDGED MINUTES OF A MEETING OF COUNCIL IN PERSON HELD IN THE COUNCIL ROOM, AUCKLAND UNIVERSITY COLLEGE, ON MONDAY, 20th AUGUST, 1956, AT 9.30 A.M. AND FOLLOWING AN ADJOURNMENT ON TUESDAY, 21st AUGUST, 1956, AT 2 P.M.

PRESENT:

Dr. M. M. Burns, President (in the Chair), W. E. Russell (Auckland Delegate); N. T. Clare (Waikato Delegate); C. B. Radcliffe (Manawatu Delegate): J. A. D. Nash (Wellington Delegate); Dr. R. M. Allison (Canterbury Delegate); Prof. H. N. Parton (Otago Delegate); and Dr. W. E. Harvey (Acting Hon. General Secretary). Dr. W. A. McGillivray (Editor) was present for part of the meeting.

CONFERENCE, 1957:

The 1957 Conference will be held in Christchurch and Dr. Allison reported that the Conference Committee has already been set up. The membership is as follows:—E. W. Hullett (Chairman); A. F. Fischer (Secretary); M. S. Carrie, N. P. Alcorn (R.I.C. representatives); Dr. W. S. Metcalfe, Dr. R. M. Allison (programme); R. H. Shepherd (accommodation); A. F. Johnson (social).

The Canterbury delegates suggested that Council should consider whether it might be desirable to introduce some type of regional association into the Conference programme. Thus, for example, if the Conference is in Otago the emphasis might be placed on biochemistry, pharmacology, nutrition, etc., and similarly for the other branches. After some discussion it was *Resolved:* THAT the Canterbury Branch be asked to prepare for circulation to branches a memorandum concerning the desirability of introducing a regional association into Conference programmes.

EXAMINATIONS:

The Examinations Committee recommended to Council that the following paragraph be incorporated in the Regulations covering the L.A.C.:—"Where the candidate satisfies the Institute that it is not possible to attend a course of instruction in Practical Physics, the Institute may accept a certificate from the chemist under whom the candidate is working; such chemist shall provide opportunity for the candidate to do Practical Physics according to the requirements as laid down in the Regulations." It was agreed that the idea embodied in this amendment to the Regulations was sound, and to advise branches that Council will consider this matter at its next meeting.

Resolved: THAT Council notes with appreciation the good work done by the Examination Committee, and will bear in mind the Committee's suggestion that another centre may wish to take over this work.

JOURNAL:

The Editor presented a brief report on Journal affairs, and asked for an expression of opinion on a number of matters concerning material for forthcoming issues. It was generally agreed that book reviews should continue to be included but that this section could be cut down somewhat by a careful selection of books suitable for reviewing. It was further generally agreed that the Branch Notes were interesting to a large proportion of the readers and should be continued. Opinions expressed regarding the Equipment Page were all most favourable. It was agreed that extra pages should be made available for the publication of the Index (probably in the October issue), the additional cost to be regarded as being a special contribution to the Journal for the 1957 financial year.

INSTITUTE REPRESENTATION ON SPECIALIST COMMITTEES:

Resolved: THAT in the opinion of Council a member's association with a commercial organization should not debar him from representing the Institute on a technical committee whose findings may concern that organization.

ROYAL CHARTER:

The Manawatu delegate raised the matter of a Royal Charter for the Institute. The Acting General Secretary produced the report presented in 1948 by a committee set up to examine this question. One of the recommendations of this committee was that Council should review the situation from time to time and it was *Resolved:* THAT the Manawatu Branch be asked to review the situation and report to Council at a later date.

MEMBERSHIP:

Elections: The following were elected Associates on the recommendation of the Membership Committee:—

COOPER, David Edward, M.Sc., 7 Crescent Rd., Epsom, Auckland (Asst. Chemist, A.F.F. Co.).

McLELLAN, Graham Herbert, M.Sc., Flat 3, 252 Armagh Street, Christchurch (Chemist, Christchurch Drainage Board).

OLLIFF, Raymond Walter, M.Sc., 38 Queen St., Islington, Christchurch (Ph.D. student, C.U.C.).

RICHARDS, Edward Leonard, M.Sc. (N.Z.), Ph.D. (Bristol), Dairy Research Institute, Massey College P.O., Palmerston North (Captain, Defence Scientific Corps).

WATERS, Thomas Neil Morris, M.Sc., Chemistry Dept., Auckland University College, Auckland (Junior Lecturer).

WILLIAMS, Peter Prior, M.Sc., Dominion Laboratory, Box 8018, Wellington (Asst. Chemist).

Resignation: The resignation of Mrs. F. B. Fox was accepted with regret.

ANZAAS:

A letter was received from the Secretary of ANZAAS requesting the names of N.Z.I.C. delegates to the ANZAAS General Council Meeting in January, 1957. The N.Z.I.C. is entitled to nominate three delegates and it was agreed to ask Prof. L. H. Briggs, Dr. F. B. Shorland and W. A. Joiner to represent the Institute.

BOOK REVIEWS.

HIGH-TEMPERATURE TECHNOLOGY.—MATERIALS, METHODS, MEASUREMENTS. Edited by I. E. Campbell. Published by John Wiley & Sons, Inc., New York, 1956. 526 pages. Price 15.00 dollars.

The development of jet engines, rocket propelled missiles and atomic energy plants together with advances in other fields of engineering has created a demand for load-bearing materials and refractories to serve under conditions at which existing materials were quite inadequate. This demand has stimulated extensive research in high-temperature technology. Progress, particularly since the war, has been rapid. It is the purpose of this monograph to summarise recent developments in this field and to indicate important materials and techniques.

The scope of the book is indicated by the second part of the title. The 35 contributors represent several different research laboratories and a number of industrial firms and so have been able to bring together a wide range of experience on the subject.

The section on materials has chapters on metals, oxides, carbon and graphite, carbides, borides, silicides, nitrides, sulphides and cermets (combinations of ceramics and metals). Details are given of the preparation and properties of each of these types of materials and extensive data on their physical, mechanical and electrical properties are presented.

Under the heading of methods, there are chapters on sintering of metallic and non-metallic refractory materials, means of achieving high temperature, resistance and induction-heated furnaces, arc furnaces, solar furnaces and the electronic torch. The descriptions given cover both research and industrial applications.

The final section, on measurement, deals with temperature and its measurement, the measurement of physical and mechanical properties at high temperatures, high-temperature microscopy and X-ray diffraction.

This book is a very creditable production and should fill a need for all those in a wide range of fields—metallurgy, ceramics and branches of physics, chemistry and engineering—whose work involves the use of high-temperatures. A noteworthy feature of this monograph is that its scope is not restricted to established materials and methods. It also points out materials, as yet untried, which because of their particular properties, may be useful for special purposes and gives some space to methods still in course of development. For this reason, and in spite of the rapid advances in its subject, it should not soon go out of date.

—R.M.D.

MECHANISMS OF ORGANIC CHEMICAL REACTIONS, by E. de Barry Barnett. Published by Blackie and Son, Ltd. (London), 1956. 289 pages. Price 30/-.

Advanced students in organic chemistry and, as the preface puts it, "the older generation of organic chemists who have got somewhat out of touch with modern academic work", will find this text a most valuable one. The author has confined himself to the more familiar reactions and these he has covered briefly but clearly, choosing throughout simple and familiar examples. While no attempt is made to provide a complete bibliography of the subject, there are sufficient references to other texts and review articles to provide an introduction to a more detailed study of particular sections. After a brief general introduction, subsequent chapters deal with substitution at a saturated carbon atom, nuclear substitution, lateral-nuclear migration, addition to double bonds, elimination and cyclisation, molecular rearrangements, miscellaneous reactions not involving re-arrangement, and specific methods of oxidation, reduction and halogenation.

—W.A.McG.

THE CHEMISTRY OF PHENOLIC RESINS, by Robert W. Martin. Published by John Wiley & Sons, Inc., New York, May, 1956. Price 9.50 dollars.

In the author's words, "this book was written to present in a single source, the chemistry not only of present-day phenolic resins but also of a great many related products that may be obtained as more or less pure compounds." This is an excellent review of the literature, extremely well documented, and amplified lavishly with formulae and tables. The author is a specialist in condensation polymerisation. The book can be recommended as a reference manual for the organic chemist or resin chemist interested in "the formation, structure (chemical), and reactions of phenolic polymers". It does not discuss the engineering applications or properties of the polymers.

—G.M.W.

THE HISTORICAL BACKGROUND OF CHEMISTRY, by Henry M. Leicester. Published by John Wiley & Sons, Inc., New York, June, 1956. 260 pages. Price 6 dollars.

Scientific discoveries are seldom the spontaneous and original contributions of one man—rather do they represent the slow development and modification of a concept to which many workers in many different places contribute. This book is an attempt to follow the development of chemistry through the thoughts and ideas of chemists rather than through the details of the lives of a few. To achieve success in this direction would, as the author points out, require a massive volume, a volume which as yet is lacking for the history of chemistry. There is, however, also scope for smaller works such as that under review and in this Dr. Leicester has presented a brief but very readable account of the development of chemistry from pre-historic times. About one-third of the book is devoted to the earlier periods when chemistry was not recognised as a science in its own right and the subject is then developed through to the systematization of inorganic chemistry, the structional theory of organic chemistry, the growth of physical chemistry and finally the chapters on Radioactivity and Atomic Structure and Biochemistry. Of particular interest is the chapter dealing with the development of chemistry as a profession during the nineteenth century.

The book is well illustrated and each chapter adequately referenced.

A LIFE OF SIR WILLIAM RAMSAY, by Morris W. Travers. Published by Edward Arnold (Publishers) Ltd., London, 1956. 308 pages, 10 plates. Price £2/10/-.

This is a book which I would like to recommend to all chemists. It is an outstanding contribution to the all too limited literature concerning the great men of chemistry. To me the story of Ramsay's work has always seemed a fascinating one—an idea which stems no doubt in part from my early reading of Professor Travers' previous publication, "The Discovery of the Rare Gases". Since writing this book in 1928, Professor Travers, now in his eighties, has acquired an immense collection of papers and letters relating to Sir William Ramsay. Many of these had been preserved and carefully arranged by Lady Ramsay in the hope that they might form the basis of a new biography of her husband. In this book Travers draws for the first time on these Ramsay Papers, now housed in the Library of University College, London, to present a very clear picture of Ramsay's work as a chemist and educationalist, of the experimental methods he employed, of the current knowledge and opinions of his time and above all of the man he knew and respected so much.

The book is well produced and illustrated, including many facsimile reproductions of pages from Ramsay's notebook and letters. For a book of this quality the price is extremely modest.

INTRODUCTORY QUANTITATIVE CHEMISTRY, by A. R. Olson, C. W. Koch and G. C. Pimental. Published by W. H. Freeman & Co., San Francisco, 1956. 480 pages. Price 5.00 dollars.

This book is one of a series of chemistry texts published under the editorship of Prof. L. Pauling, and conforms to the high standard of production exhibited by its companion volumes. It is concerned with introducing the student to both the principles and practices of quantitative analysis and according to the authors it is to be considered as a teaching aid rather than as a reference book. The number of exercises included is thus not large, but each is designed to introduce important principles and techniques. An interesting feature is the frequent interspersion of questions throughout the laboratory directions; this represents on the part of the authors 'a conscious attempt to awaken the student's interest in the design of a quantitative procedure'. While the greater part of the book is concerned with the principles and techniques of gravimetric and volumetric analysis, some consideration is given to physicochemical methods in the final chapters and experiments to illustrate the analytical applications of such methods are presented. These involve an electrolytic separation, colorimetric analysis, carrier separations and ion exchange separations.

—C.V.F.

LABORATORY CONTROL OF DAIRY PLANT, by J. G. Davis. Published by Dairy Industries Ltd., London, 1956. 395 pages. Price 30/-.

Dr. Davis is well known in the dairy world as author of "A Dictionary of Dairying" and "Milk Testing". In the present work he has most successfully provided a handbook for the laboratory staff of the dairy plant, and a reference book for the plant manager. Actually, in many respects the book provides a link between a non-technical manager and the laboratory staff, indicating how the most effective use may be made of the laboratory in the efficient operation of a plant. The widest possible field is covered, from hygienic control of the milk processing equipment to chemical and bacteriological aspects of refrigeration, steam raising, and waste disposal. The book is written primarily for the modern pasteurizing and bottling dairy but much of the information will be found useful by managers of cheese and butter factories. "Laboratory control of Dairy Plant" will be most valuable addition to the technical library of every dairy factory and plant.

—H.R.W.

THE CHEMICAL CONSTITUTION OF NATURAL FATS (3rd Edition) by T. P. Hilditch. Published by Chapman and Hall, Ltd., London, 1956. 664 pages. Price £4/15/-.

The first edition of this book, published in 1940, was the first comprehensive treatment of the fundamental chemistry of fats and, with a second edition in 1947, has been generally accepted as the standard text in this field. The comprehensive nature of the work is maintained in the third edition but, while it still follows the general pattern of earlier editions, such advances have been made in our knowledge of glycerides and fatty acids during recent years that it has been necessary to completely rewrite many parts of the book which now includes the more important results up to the end of 1954 or early 1955. This revision applies particularly to the three chapters dealing with component glycerides present in natural fats and to the chapter dealing with the constitution of natural fatty acids.

As in previous editions, the emphasis in this book is still chemical rather than biochemical. In fact the one brief chapter devoted to the biochemistry of fats has been restricted to one aspect of the subject only—a consideration of the possible means whereby fats may be synthesised in living tissues. In the reviewer's opinion this failure to deal in more detail with other aspects of the biochemistry of fats limits to some extent the value of the book especially relative to other comprehensive treatises of a similar nature which have appeared recently. Nevertheless all familiar with the earlier editions and chemists interested in glycerides and fatty acids will welcome this new edition as a valuable addition to the literature of fats.

—W.A.McG.

"METHODS OF CHEMICAL ANALYSIS FOR SOIL SURVEY SAMPLES", by A. J. Metson, N.Z. Soil Bureau, Bull. No. 12, Government Printer, Wellington, N.Z.; 1956. 208 pages. Price 30/-.

This bulletin, which is intended primarily as a laboratory manual, should find wide acceptance among soil chemists in many parts of the world. Although the methods described are limited to those which have been used either continuously or occasionally by the N.Z. Soil Bureau over the last fifteen years, it is not to be inferred that the bulletin is in any way limited in scope on this account; in fact it is one of the most comprehensive publications of its kind which has appeared up till the present time. The subject matter covered in the five chapters includes the preparation of soil samples for chemical analysis, the determination of moisture pH and calcium carbonate; the determination of total phosphorus, citric acid-soluble phosphorus and total sulphur; the determination of organic carbon, total nitrogen, ammonia and nitrate nitrogen, and the analysis of composts and forest litters; cation exchange methods; determination of soluble salts.

Excellent introductions are given to the subject matter of each chapter and add much to the attractiveness and usefulness of the bulletin; the introductory section to the chapter dealing with cation-exchange methods calls for particular mention. The text is heavily annotated by footnotes in which alternative procedures, limitations of methods, precautionary measures, minor modifications in technique, etc., are discussed. A guide to the interpretation of chemical analysis on New Zealand soils is included as appendix I. In appendix II an account is given of the determination of pH by the quinhydrone electrode. Surprisingly enough eight pages including five of tables for the conversion of millivolt readings to pH values are devoted to this topic. Appendix III on the operation of the Beckman flame photometer is contributed by L. D. Swindale and N. Wells. The bibliography contains more than 450 references.

—C.V.F.

TECHNISCHE THERMODYNAMIK, by E. H. W. Nusselt. 144 pages. 15 x 10 cm. Paper bound. 1956. Berlin. Walter de Gruyter Co., DM 2.40. Price 4/2.

This little book is one of a uniform series of several hundreds dealing with all aspects of learning, religion, literature, science, foreign languages, and technology. It is not just a popular treatise, the calculus being introduced on the fourth page, and the whole treatment is mathematical. With the present astronomic prices of many serious scientific works in English (and in German!), it is interesting to see these books being produced so cheaply and apparently successfully. We would like to see more of them.

—S.G.B.