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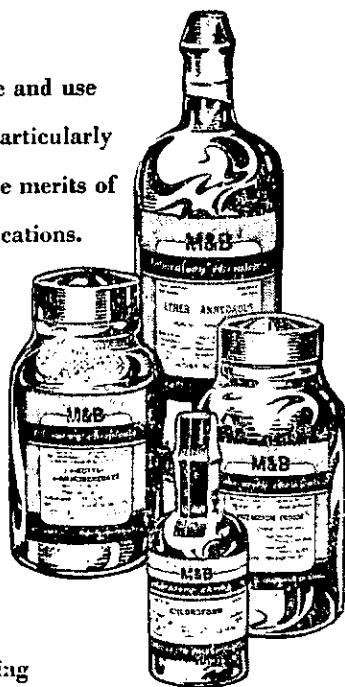
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THE NEW PRESIDENT

Dr. J. MELVILLE, M.Sc. (N.Z.), Ph.D. (Lond.), D.I.C.



Our President for 1949-50 is another member of the Great Migration from south to north, for he was born in Otago and attended the Milton District High School, Otago Boys' High School and the University of Otago, where he graduated with first-class honours in organic chemistry in 1930. Both for his thesis work and the John Edmond Fellowship, which he subsequently held, his research work was on the essential oils of New Zealand native plants. On his record he was awarded a travelling scholarship in science and spent the years 1932-4 at the Imperial College of Science and Technology

under Prof. A. C. Chibnall, F.R.S., working on the synthesis of labile glutamine peptides. After he had graduated Ph.D. (Lond.) he was awarded a Commonwealth Fellowship, and in 1934-6, he worked at Yale University and the Connecticut Experiment Station with Professors L. B. Mendel and H. B. Vickery on protein chemistry and plant metabolism. On his return to New Zealand in 1936, he was appointed Assistant Chemist at the Wheat Research Institute, Christchurch, and investigated the action of flour improvers, particularly ascorbic acid, on bread quality.

In 1938, Dr. Melville was appointed Biochemist at the Plant Chemistry Laboratory, Palmerston North, and in the next year was confirmed as Director of this Laboratory, a post he still holds. During the war years 1941-5, he was absent from the laboratory on army service, holding first a post of G.S.O.3,

Army Headquarters, for chemical warfare, with the rank of captain, and was attached subsequently to the Operational Research Station, H.Q., Australian First Army. On his demobilisation in 1945, he spent a period in America, mainly at the Squibb Institute for Medical Research, studying antibiotics, and on his return to New Zealand, developed, with Dr. T. R. Vernon, the antibiotics section of his laboratory.

Although Dr. Melville is a country member of the Wellington Branch of the Institute, he has always taken an active part in Institute affairs whenever he was able. He was a foundation member of the Otago Branch, Secretary of the Canterbury Branch, 1937-8, and is Secretary of the Plant Analysis Committee set up by the Institute to co-ordinate standard methods of analysis. He is favourably known to his many friends, extending from student days at Otago to the present, for his scientific leadership, his energy and for his able way of presenting his case. He is a remarkably good speaker in any audience, and this, combined with his excellent scientific background, fits him well to lead the Institute and to act as its spokesman in the coming year.

CONFERENCE — 1950 — CHRISTCHURCH

The Conference is being arranged as a four-day gathering from Tuesday, 22nd August, to Friday, 25th August inclusive, with a meeting of the Council of the N.Z.I.C. on Monday, 21st August. The choice of dates has been influenced considerably by the availability of transport for North Island members, particularly those from Auckland. The Conference will be held at Canterbury College, and arrangements have been made to avoid a clash with a Musical Conference held regularly at the College during August. Plans for accommodation (at several of the best hotels) are well in hand.

On the programme side, consideration is being given to a symposium, possibly on some such topic as "Isotopes," but the Committee particularly desire that there should be room in the programme for a very wide variety of papers if these are forthcoming.

"Papers on any topic will be welcome, but sessions will be arranged according to the material available.

"Sessions are already contemplated on—

1. Availability of phosphate in soils.
2. Bio-chemical techniques.
3. Physical and structural chemistry.
4. Industrial chemistry and chemical engineering."

OBITUARY

We regret to announce the death of Mr. G. C. De Ath, Secretary to the Editorial Committee of this Journal. He graduated M.Sc. at Auckland University College, and studied bacteriology at Otago. Latterly he had been engaged in chemical investigations at the Dairy Produce Grading Station, Auckland, working particularly on copper in butter. Mr. De Ath, who was in his 43rd year, had been married only a few days before his sudden death.

ITEMS OF INTEREST

The Conference of the International Union of Chemistry at Amsterdam last September fixed official names for the following elements, other proposed names being shown in brackets:—

No. 4 Beryllium (Glucinium); No. 41 Niobium (Columbium); No. 43 Technetium (Masurium); No. 61 Promethium (Prometheum); No. 71 Lutetium (Lutecium); No. 74 Wolfram (Tungsten); No. 85 Astatine (Alabamine); No. 87 Francium (Virginium); No. 91 Protactinium (Protoactinium); No. 93 Neptunium; No. 94 Plutonium; No. 95 Americium; No. 96 Curium.

Dr. J. Woodward, Chief Chemist to the Dept. of Agriculture, Ottawa, recently called on the Hon. General Secretary, bringing greetings from the Canadian Institute.

Mr. I. S. McHarg, Associate, has relinquished the post of Inspector of Post-Primary Schools, Wellington, and has been appointed principal of the Whakatane Post-Primary School.

Mr. L. V. Eriksen, who is an associate of the Royal Australian Institute of Chemistry, has been appointed head brewer to Waikato Breweries Ltd.

The Fertilizer Research Association, directed by Dr. M. Burns, has found suitable premises for its laboratory at Otahuhu, and it is expected that certain other research establishments may be quartered in the same buildings.

We congratulate the Hon. General Secretary on the arrival of his third son.

MR. A. I. BIGGS, B.Sc., A.R.I.C., A.N.Z.I.C., of the Government Department of Chemistry, Singapore, is spending nine months' furlough in New Zealand

SOME DEVELOPMENTS IN THE THEORY OF ORGANIC REACTIONS

Prof. J. Packer, Canterbury College.

Presidential Address to the Annual Conference, August, 1949.

For my address tonight I have decided to review certain developments in theory in that part of chemistry in which I am myself more particularly interested and, because I am a University man, also to say something at the end concerning the bearing of these developments on the teaching of organic chemistry. Some of you whose interest lies in the practical and applied sides of chemistry may consider this too academic a subject for the present occasion. To such I would say that the past makes it abundantly clear that the purely theoretical developments of today may become the basis of the practice of tomorrow, and that there are reasons for believing that this may be true of the electronic theories of organic reactions which I wish to speak about tonight.

The ultimate goal of organic chemistry, to be able to deduce from fundamental theory, in advance of experimental trial, a satisfactory method of synthesis of any compound and to predict all its properties, is very far from being reached. Such an Utopian state may be impossible of achievement, at least for a very long time. However, a very small start in this direction appears to have been made in the modern development of the so-called electronic theory of organic reactions. This theory was first developed more than twenty years ago on the basis of the earlier electronic theories of valence and has been successful to no small degree in unifying organic chemistry. The reality of many of the electronic processes which the theory postulated have since been established by physical measurements. The new quantum mechanics of Heisenberg and Schrödinger have also given a solid physical foundation to the electronic theory, as well as influencing and directing its more recent developments.

In order to appreciate fully the contribution of electronic theory to organic chemistry, it is necessary to analyse briefly the theoretical situation in regard to the 'classical' theory of molecular structure of organic compounds, as it was before the development of the modern theory.

The 'classical' structural theory was built on the views of Kekulé and in part also of Couper, first formulated just after the middle of last century, and was so successful as a working hypothesis that it led, as every chemist knows, to an extraordinarily rapid development in synthetic organic chemistry during the last half of last century. The theory of the quadrivalency of carbon and of the ability of C atoms to form stable chains and rings, when extended by van't Hoff and Le Bel to three dimensional spacial arrangement, proved a sufficient basis for predicting the kind of structures that might be built, and hence became the guiding principle in directing synthetic work and in deducing the molecular structures of naturally occurring organic substances. This theory of Kekulé and van't Hoff represented the atoms in the organic molecule as held together by directed valence bonds, possessing unit character and likened to unit rods (as indeed they are represented in the familiar "models"). The theory made no attempt to explain the nature of the forces holding the atoms in the molecule or the mechanism by which reactions occur. Organic chemists learnt by experience the kind of properties and reactions to be expected for different kinds of molecular structures and developed what G. N. Lewis described as an "uncanny instinct" in such matters.

The classical Kekulé-van't Hoff structural formulæ also failed to offer any explanation of the influence of one reactive group upon another in the same

molecule—what is conveniently termed group interaction. This group interaction becomes great when unsaturated groupings are conjugated (i.e., directly linked to one another by a single bond). The failure of the theory to offer any explanation of the properties of such compounds led to such developments as Thiele's theory of partial affinities (based on earlier views of A. Werner and Claus). Strictly this meant abandoning the theory of a unit type of directed valence bond in favour of an undirected non-unit type of valence force, a point not always appreciated since both theories were often used as convenience dictated, as though they were fully consistent with one another. Thiele's theory found widespread acceptance in discussing the properties of conjugated unsaturated compounds until the earlier electronic theory of the nature of the covalent bond gave a physical basis to the Kekulé-van't Hoff concept of unit and directed valence bonds, and at the same time an alternative explanation of group interaction. In recent years Thiele's views have thus become discredited; yet, as we will see later, the newer theory can almost be said to incorporate Thiele's ideas of partial bonds.

In the time available I can only give the barest outline of some small part of the modern electronic theory of organic reactions. To give a satisfactory treatment would require many lectures and perhaps I have been unwise to attempt this at all.

In the reactions of carbon compounds we are concerned essentially with the formation and the breaking of covalent bonds. In the earlier electronic theory of valence, the covalent bond was represented as formed by the sharing of a pair of electrons, of opposite spin, between the two atoms linked, and the double and triple bonds of olefines and acetylenes and other unsaturated compounds, as the sharing of four or six electrons between the pair of atoms. Thus the classical structural formulæ and the electronic formulæ, except in a few cases, corresponded, the old link being the co-valent bond or shared electron pair of the newer formulation.

In the quantum or wave mechanics of Heisenberg and Schrödinger an electron or a system of electrons is represented by a wave function ψ ; the value of ψ^2 at any point represents the probability that the electrons will be there. Hence ψ^2 may be taken as the measure of density of an 'electron gas' representing the average electron distribution over a comparatively long period of time. This is all we know about the position of an electron; hence the modern picture of an electron in an atom as a somewhat indefinite 'electron-cloud.' Once the wave function ψ is known in terms of the co-ordinates of a system, it is possible in principle to calculate the physical properties of the system. In practice because of the tremendous mathematical difficulties involved, this can only be done for the very simplest systems, such as the one electron hydrogen atom or the two electron hydrogen molecule. For more complex atoms and molecules very approximate treatments only are feasible. These, however, have proved of great significance, since they give a clear physical basis for the chemical theory.

Two methods of simplifying the mathematical problems have been used (i.) the valence-bond (V-B) method of Heitler and London, applied by Pauling, Wheland and others to organic molecules, and (ii.) the molecular orbital (M-O) method of Hund, Mulliken and others. The first of these has led to the now familiar wave-mechanical resonance treatment which has been so widely used in discussing the properties of conjugated unsaturated organic substances. Taking benzene as an example, according to this treatment the actual structure of the benzene molecule is a hybrid of the possible classical structures (fig. 1), with the Kekulé forms predominating, and is more stable than the most stable of the forms represented.



Fig. 1

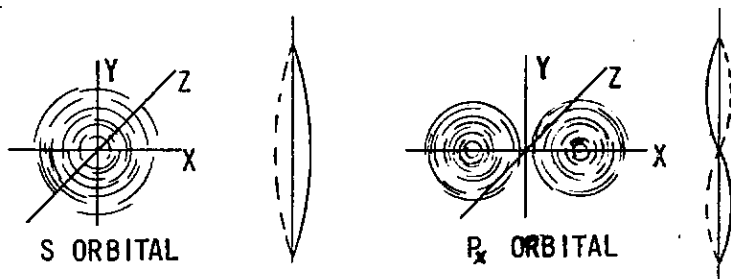


Fig. 2

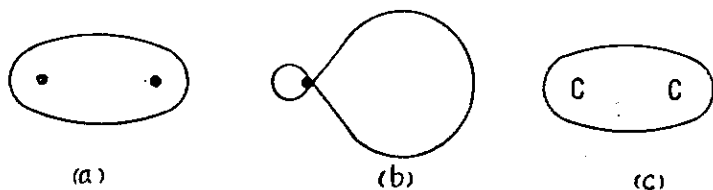


Fig. 3

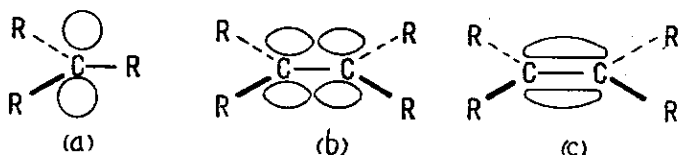


Fig. 4

On this theory, for such resonance to occur between two or more classical bond structures, the structures should have practically identical positions for the atomic nuclei (so that they differ only in electron distribution), their energies must be comparable and the total number of electrons and the number of pairs of electrons with opposite spins must be the same in both. If these conditions are fulfilled, the theory requires that resonance not only can, but must, occur. The actual electronic distribution or structure of the molecule, the so-called resonant or mesomeric form, is different from any of the depicted structures and is a hybrid of them all, but more like the more stable of the classical forms. This Valence-Bond (V-B) method, although difficult to apply quantitatively, is simple enough to use in a qualitative way. In the words of Dewar, "It has found great favour with many chemists

since the rules of the game are so simple that it can be played happily by almost anyone without any knowledge of the underlying principles involved."

The second method, the molecular orbital (M-O) method, which is also the newer one, promises to be of great value to organic chemists. Its picture of molecular structure is also in many ways closer to that of classical organic chemistry.

Its application to carbon goes something like this: A carbon atom has four valence electrons in the second or L electron shell and there are available, as in the atoms of all the elements in the first short period, four atomic orbitals in the uncombined atom, designated s, px, py, pz, as in the earlier theories. The s orbital is spherically symmetrical, the three p orbitals have axial symmetry and shape as shown in fig. 2 (only the one p orbital, symmetrical about the x-axis is shown in the diagram). (c.f. the fundamental and first harmonic waves in a violin string). The p orbitals each have a nodal plane, passing through the centre of the atom at right angles to their axis. Each of these orbitals can accommodate two electrons (if they have opposite spins) and two only. In the Neon atom all the orbitals are completely filled, but in the C atom there is room for four more electrons.

According to the M.O. theory, if two atoms are brought together so that their atomic orbitals overlap and each orbital contains one electron only, and the electrons have opposite spins, the atomic orbitals may be replaced by a molecular orbital which is a combination of the atomic orbitals. This orbital holds the two electrons and constitutes a covalent bond between the atoms. Thus the overlapping of the two s orbitals of two H atoms (if the electrons have opposite spins), gives a molecular orbital or bond between the atoms. This bond has axial symmetry along the line joining the H atoms, as shown in fig. 3a, and is called a σ bond.

The four orbitals of the isolated C atoms are expressed as s, px, py, pz. This is the arrangement of lowest energy in the isolated atom, but other orbitals which are certain combinations of these are possible provided they fulfil certain mathematical conditions. These are termed hybrid orbitals, and although of higher energy than the s and 3p orbitals described above, may be more suited geometrically for bond formation if they overlap more efficiently with the orbitals of other atoms. Thus the three p orbitals of the C atom would form three strong bonds with three other atoms, but the fourth bond formed from the s orbital would be comparatively weak. For C the greatest total overlap is obtained by means of four identical bonds obtained by hybridising the s and the 3p orbitals. These orbitals are symmetrically, i.e., tetrahedrally, arranged, and have the form shown in fig. 3b. (A single tetrahedral orbital.)

By the overlap of these orbitals with the s orbitals of H or the corresponding hybrid orbitals of other C atoms, single or σ bonds which are axially symmetrical are formed. This type of bond between two C atoms is represented as in fig. 3c and in similar fashion for the σ bonds between C and H, C and O, etc.

By the hybridisation of one s and two p orbitals, C can also form planar trivalent compounds. This leaves over one p orbital, with its axis at right angles to the plane of atoms (fig. 4a). This orbital contains only one electron and the molecule or radical is highly reactive and unsaturated (e.g., CH_2 radicals). If two such trivalent C atoms are linked together, as in fig. 4b, their odd p electron orbitals overlap, if the configuration is planar. The two electrons (of opposite spin) can then occupy a new orbital, called a π orbital, which is double bun shaped (fig. 4c), with a node in the plane of the atoms.

This is then the second bond of the so-called double bond of ethylene and olefinic compounds. It is quite unlike the first bond, which is a σ bond. The π bond obviously prevents rotation, since it can only be formed with the planar configuration. It is a strong bond, but not as strong as the σ bond. The classical double bond is thus now recognised as a $\sigma + \pi$ bond. Similarly the triple bond of acetylenic compounds is a $\sigma + 2\pi$ bond, the two π bond orbitals being at right angles to one another.

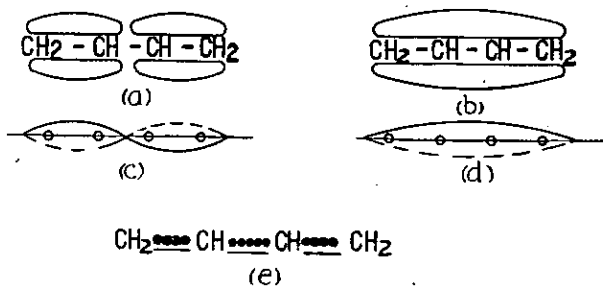


Fig. 5

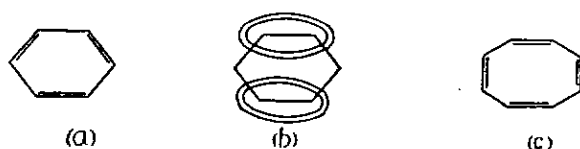


Fig. 6

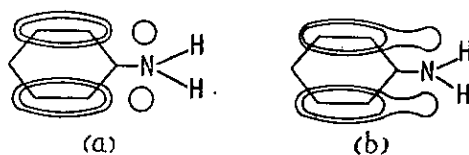


Fig. 7

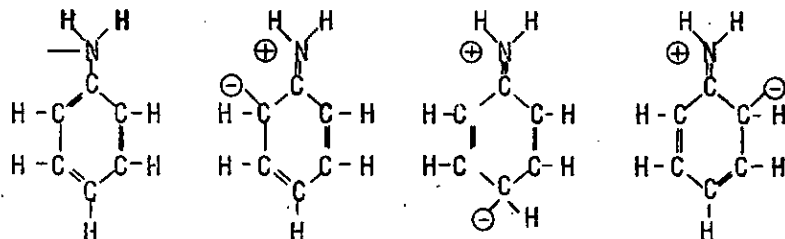


Fig. 8

In butadiene, of classical formula $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$, if the whole molecule is planar, the π orbitals of the $=$ bonds shown overlap (fig. 5a) and two new stable orbitals become available for the four electrons in place of the two shown; the one with lowest energy bonds all four C atoms (fig. 5b; violin string analogy fig. 5d), whilst the one of higher energy bonds the end pairs only and because it has a node between the centre C atoms, anti-bonds them (fig. 5c gives violin string analogy). All the atoms are thus linked by π bonds of sorts, but the end ones more strongly than the middle. Butadiene may thus be written as in 5e. Thiele would say we had reinvented his partial valency theory!

This theory can be extended to benzene. The orbitals of the classical double bonds overlap and the six π electrons occupy instead three low energy orbitals. These molecular orbitals are symmetrical, forming rings above and below the C ring (fig. 6a and b). The symmetry and planarity of the ring are necessary for these orbitals to be possible. The bonds between the C atoms of the ring are thus of intermediate order between single and double bonds.

The application of the theory to cyclo-octatetrene (fig. 6c) is interesting.

Cyclo-octatetrene is not aromatic and is highly unsaturated. It has a puckered or non-planar ring and only a low energy of resonance. The C atom orbitals would be of the s and two p hybridised type (as in benzene and olefines) and the undistorted valency angles 120° . For aromatic properties, i.e. the extended π orbitals, the ring must be planar. In such a ring the annular valency angles would be 130° . Evidently the strain so produced would be greater than the resonance energy gained by a planar aromatic structure, with the result that the ring is non-planar and cyclo-octatetrene olefinic in properties.

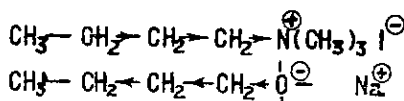
For p- or π -orbitals to coalesce into extended orbitals (with consequent decrease in energy, i.e. increase in energy of resonance) it is necessary that they should overlap; this can happen only if the molecule has an appropriate stereochemical configuration. For instance, in aniline the N p-orbital can overlap efficiently with the annular π -orbitals only if the NH_2 group is coplanar with the benzene ring (fig. 7a and b). Under these conditions mesomerism occurs and the basic properties of the NH_2 group are reduced as well as the reactivity of the benzene ring towards the usual substituting agents increased. If, however, the amino group is forced out of coplanarity with the ring, the overlap and hence the mesomerism will be reduced. Thus in o-substituted dimethyl-anilines, the steric factors (size of groups) prevent coplanarity and reduce orbital overlap and hence mesomerism. Such "hindered" anilines are found to be more strongly basic and the ring less easily substituted than expected.

The alternative picture, the valence-bond or resonance picture, of aniline (fig. 8) having an intermediate or hybrid structure, with a partial positive charge on the N and partial negative charges on the o- and p- carbon atoms. It is because of these negative charges that aniline is so readily substituted in the o- and p- positions, but not in the m- position. The M.O. and this resonance (V.B.) formulation are just different ways of depicting the same condition of the aniline molecule. The M.O. formulation is superior in bringing out the importance of stereochemical configuration; the V.B. formulation in indicating the effective distribution of partial ionic charges on the atoms in the molecule. In the discussion of reactions which follows the formulation which brings out the points desired most simply, has been used.

Returning to aniline, it is clear that the mesomerism depicted leads to electrical polarisation within the molecule. Groups like NH_2 are said to have a mesomeric effect. (In this case the mesomeric effect is related to the unshared electrons on the N atom in the ammonia molecule.) (Symbol: M effect.)

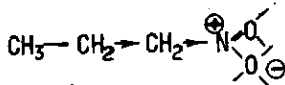
Electrical polarisation in a molecule can arise in other ways:—

(1) By the presence of an ionic charge, as in an alkyl ammonium salt or an alkoxide or phenate, thus



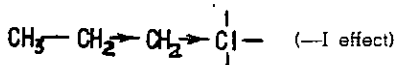
The arrow-heads on the bonds denote displacement of the bonding electrons, i.e. deformation of the electron orbitals. These are relative to the condition in the unsubstituted parent substance $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{H}$ and are called Inductive displacements or Inductive effects—(Symbol I effect).

(2) By the presence of dipolar groups, e.g. $-\text{NO}_2$ gr.



(ignoring the mesomerism in the NO_2 group itself).

(3) By the presence of atoms of greater electronegativity than C, e.g. halogens, oxygen, nitrogen, sulphur.

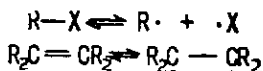


The magnitude of this effect is in the decreasing order F, Cl, Br, I and OH, NH_2

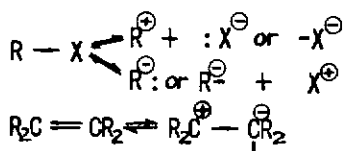
In unsaturated compounds, polarisation due to mesomerism (mesomeric effect) is usually more important than that due to inductive effects.

As stated earlier, in organic reactions we are concerned with the forming and breaking of covalent bonds. Theoretically there are two ways in which this can happen, whether the bonds concerned be of the σ or π kind:—

(1) Non-ionic or homolytic mechanism (free radical reactions)



(2) Ionic or heterolytic mechanism.



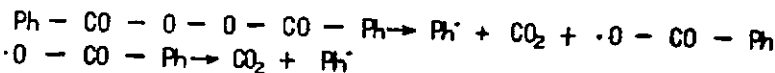
In (2) if the atoms concerned are neutral to start with, they acquire charges by the fission of the bond—hence the term ionic mechanism.

The first mechanism is likely in homogeneous gas reactions and in solvents of low ionising power, the second in solvents of good ionising power and in the presence of polar catalysts such as acids, bases and polarised surfaces.

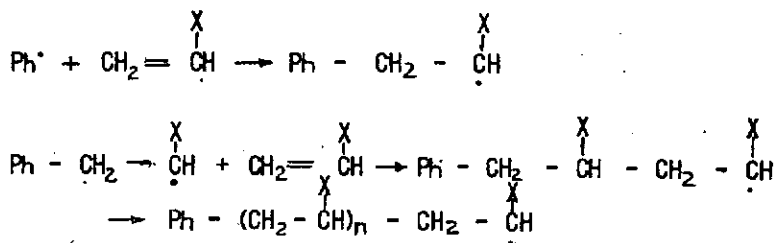
Both mechanisms are important in organic reactions, but the second is the more common and the theory of such reactions was developed first. For these reasons I will deal almost wholly with reactions of the ionic type in what follows and just mention one type of non-ionic or free radical reaction here, viz., the polymerisation of olefinic compounds under the catalytic influence of organic peroxides, a process of great technical importance in the manufacture of various plastics and elastomers.

The olefinic compounds most easily polymerised in the liquid phase in this way are vinyl compounds of the general formula $\text{CH}_2 = \text{CHX}$ or $\text{CH}_2 = \text{CXY}$ where X and Y are electron attracting groups such as $-\text{Cl}$, $-\text{CO}_2\text{R}$, $-\text{CN}$, and $-\text{Ph}$. The polymerisation may be carried out in homogeneous solution or in emulsions in an aqueous medium.

There is much evidence that the organic peroxide by its decomposition yields a reactive free radical,



and that this radical initiates a chain reaction thus:—

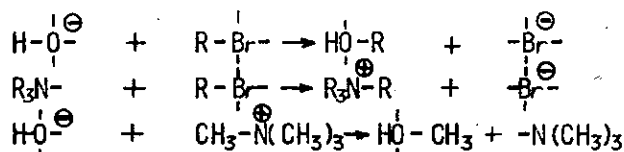


the chain reaction being finally broken by the union of this free radical with another free radical, such as Ph. or another polymer radical or by the transfer of hydrogen from one radical to another. Kinetic studies give strong support to this theory of the mechanism, e.g. after an initial period during which the catalyst free radical builds up to an equilibrium concentration, the reaction is of zero order (i.e. independent of the concentration

Type (2), since Y is an electron deficient or electrophilic reagent molecule or ion, is called **Electrophilic substitution** on the C atom of the group R and is represented by the symbol S_E .

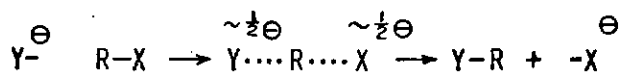
The common substitution reactions of saturated compounds are of the nucleophilic or S_N kind and these only will be considered.

In these substitutions, there is a change in the charge distribution on the atoms such that the substituting group becomes one unit more positive and the displaced group one unit more negative as a result of the replacement.



Two detailed mechanisms are possible for these S_N reactions:—

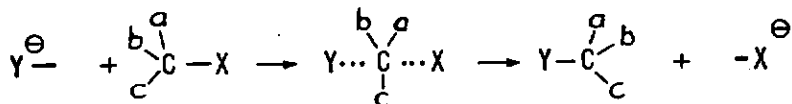
(a) the "bimolecular" mechanism, symbol S_N^2



(transition complex)

where bond formation and bond fission are synchronous processes. Such reactions exhibit second order kinetics, i.e. the rate of reaction $\propto [\text{RX}] [\text{Y}]$.

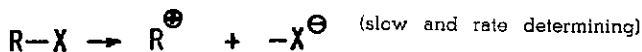
Theoretical calculations of the energy required to form the transition complex show that this is least when Y approaches the carbon atom of R on the opposite side from X. This means that whenever substitutions occur by this mechanism on an asymmetric C atom inversion of configuration, i.e. Walden (or optical) inversion results:—



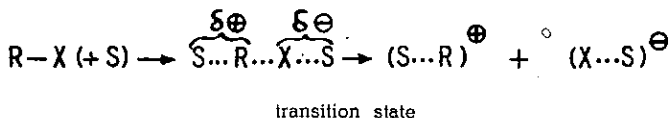
Examples of this bimolecular mechanism are given by the hydrolysis of primary alkyl bromides in aqueous-alcoholic alkali solutions. The rate of hydrolysis to alcohols is found to be proportional to concentration of the alkyl bromide and of the OH^- ions so that the hydrolysis is of course much faster in alkali solutions than in water.

(b) the "unimolecular" mechanism, symbol S_N^1 .

This is a two stage process



In the first step the solvent molecules of course play a very important part and no doubt stabilise the cation by solvation, but for simplicity they are omitted from the above equation. The more complete equation could be written

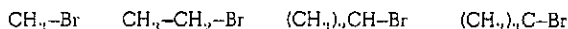


where S represents several molecules of solvent.

Such reactions have first order kinetics, i.e. the rate of reaction v \propto $[RX]$ only and is independent of the concentration of the reagent molecule or ion.

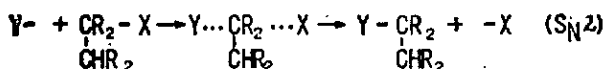
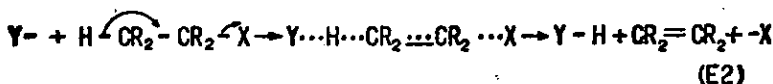
Tertiary alkyl halides, e.g. *t*-butyl bromide $(CH_3)_3CBr$, undergo hydrolysis by this mechanism. Thus the rate of hydrolysis of *t*-butyl bromide is not increased by the addition of alkali, in fact it is the same in water as in alkali solution, a state of affairs quite different from that found for ethyl bromide.

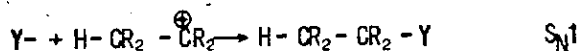
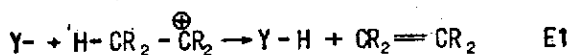
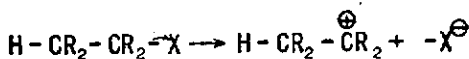
In the series



the rate constant for hydrolysis in alkaline aqueous-alcohol falls in passing from methyl bromide to isopropyl bromide and then increases again for *t*-butyl bromide. This minimum is the result of the change from the bimolecular (S_N2) mechanism for the first three to the unimolecular mechanism (S_N1) for the last member of the series. The effect of replacing H by CH_3 groups in this series can be explained theoretically in terms of the inductive effect and relative volumes of the groups. The theory can also explain in a qualitative way the effect of different solvents on the rates of various substitution reactions, and the effects of other types of groups attached to the C atom on which substitution is occurring.

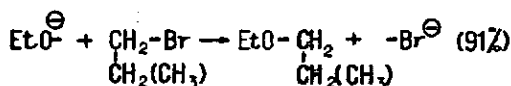
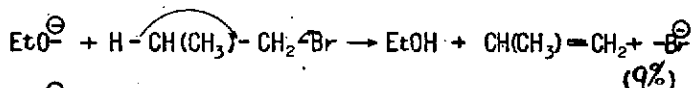
Recently Hughes and Ingold have extended the theory to elimination reactions and have obtained ample experimental evidence that these reactions involving a nucleophilic reagent may be of two types also, called E2 (bimolecular) and E1 (unimolecular) corresponding to the substitution types S_N2 and S_N1 . The formation of olefines to a greater or less extent is frequent during substitution reactions and it is not surprising therefore that both processes have similar mechanisms:—



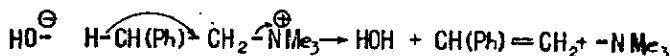


Examples of E2 eliminations are:—

- (1) Action of ethanolic sodium ethoxide on primary or secondary alkyl halides to give olefines. Ethers are formed by S_N2 substitution at the same time:

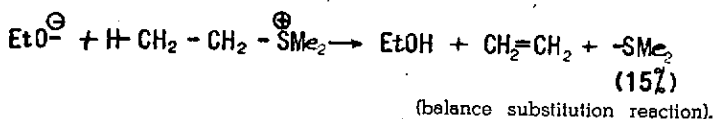


- (2) Action of alkali on quaternary ammonium salts:



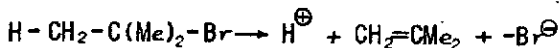
(Hofmann degradation)

- (3) Action of ethanolic ethoxide on sulphonium salts:



Examples of E1 eliminations are:—

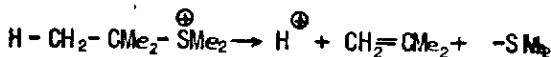
- (1) Reaction with a base of t-butyl bromide



(combined with base present)

In this case the rate of reaction is independent of the base used.

- (2) Reaction with a base of certain sulphonium salts



(combined with base used)

In this case also the rate is independent of the base used.

It has been pointed out that elimination reactions occur as alternatives to substitution and certain general conclusions can be drawn from the theory:

(a) That where the reactions occur by the bimolecular E2 and S_N2 mechanisms, since both rates are proportional to the concentrations of the reagent and the organic reactant, the ratio of olefine to substitution product must be independent of both these concentrations.

(b) That where the reactions occur by the E1 and S_N1 mechanisms, since the initial stage is the same for both, the proportion of olefine to substitution product will be nearly independent of the group X being eliminated.

(c) Strong bases, because of their high affinity for protons, will favour olefine formation (elimination) and weak bases substitution.

(d) In the bimolecular mechanisms, for reasons connected with the nature and distance apart of the charges on the atoms in the transition states, solvents of high dielectric constant favour replacement more than elimination.

These and other deductions have all been confirmed experimentally and give a theoretical basis to the procedures that organic chemists have devised. For example, to bring about hydrolysis of halides weakly basic reagents in a medium of high dielectric constant are used, such as acetate or formate ions in water or aqueous alcohol; whilst to effect olefine formation, strong bases in weakly ionising solvents, such as potash in alcohol, are selected.

Where elimination may follow more than one course, the theory also affords an explanation of the effects of structure on product. Two different rules were discovered empirically in the past:

(i.) Hofmann's rule, that in the degradation of quaternary alkyl ammonium hydroxides, the main product was, the ethylene having the smallest number of alkyl substituents, and

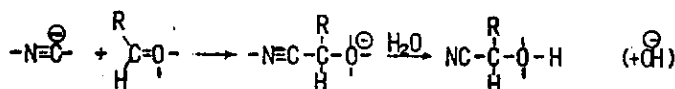
(ii.) Saytzeff's rule, that in the conversion of alkyl halides to olefines, the main product was the ethylene carrying the largest number of alkyl substituent groups.

Explanations of these apparently contradictory generalisations can now be given in terms of inductive and mesomeric effects, but to discuss this subject further would take too long.

Addition Reactions

Lapworth showed nearly fifty years ago that in the reaction of an aldehyde with hydrogen cyanide to form a cyanhydrin, the reaction was accelerated by bases, not appreciably effected by neutral salts and retarded by strong acids. Hence, he concluded that the active agent in the reaction was not the HCN molecule but the CN⁻ ion.

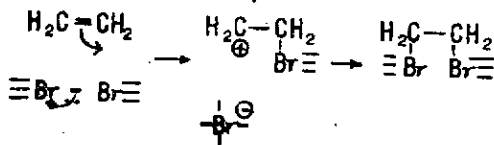
The reaction is thus represented



A consideration of the reagents which add on to or condense with aldehydes and ketones shows that they are all of the electron donating type, i.e. anionoid or nucleophilic.

The same reagents do not in general add to olefines—instead olefines add cationoid or electrophilic molecules or ions and so the centre of reaction of the olefine molecule is represented as electron donating, i.e. anionoid or nucleophilic.

Thus the addition of halogen to an olefine has come to be represented as for example



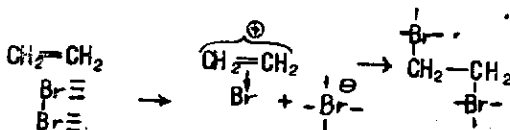
That the process is at least a two-stage one has been shown by carrying out the action in the presence of salts like NaCl and NaNO₃ where the Cl or NO₃ ions compete with the Br⁻ ions in the second stage, to give as well as the dibromide the chlorobromide or bromonitrate.

Similarly Br₂ in alcohol gives also the bromoether CH_2-CH_2
 $\begin{array}{c} | \quad | \\ \text{OEt} \quad \text{Br} \end{array}$

where the neutral Et-O-H molecule adds instead of

the Br⁻ ion in the second stage (a proton being afterwards expelled to give the neutral OEt group).

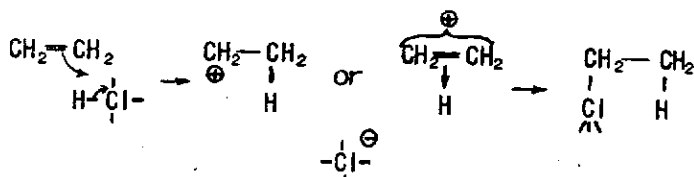
Dewar represents the mechanism of addition as



with a dative bond formed between the π electrons of the double bond in the first stage. This explains simply the usual trans-addition of halogens.

The simple theory just presented has been modified in detail somewhat to explain the results of kinetic studies, but the basic ideas here given are retained.

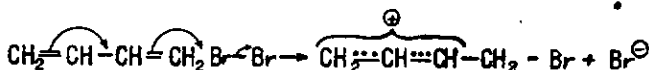
In the addition of strong acids, such as HCl, the initial step is the addition of the proton from the acid,



In $\text{CH}_3 \rightarrow \text{CH}=\text{CH}_2$, due to the inductive effect of the CH₃ gr. (+I), the right hand C rather than the left is the nucleophilic centre where the H is added, so that the product is mainly $\text{CH}_3-\text{CH}-\text{CH}_2$ with the halogen on the
 $\begin{array}{c} | \quad | \\ \text{Cl} \quad \text{H} \end{array}$
 more substituted C atom (Markownikoff's rule).

In the addition of halogens to conjugated di-olefines, e.g. butadiene $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$, two products are obtained, the 1:2- and 1:4-dihalides.

The first step is

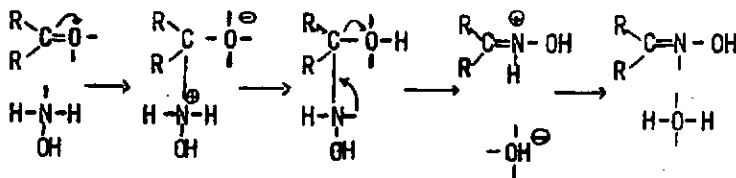


followed by addition of a Br^- ion to either end of the mesomeric system to give either $\text{CH}_2 = \text{CH} - \text{CH} - \text{CH}_2$ or $\text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_2$

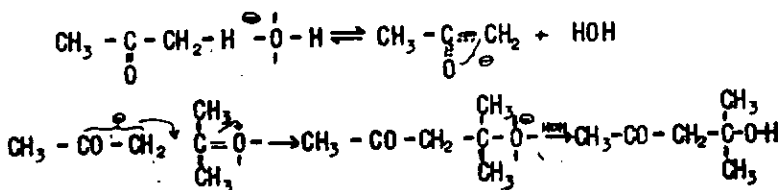
$$\begin{array}{cccc} | & | & | & | \\ \text{Br} & \text{Br} & \text{Br} & \text{Br} \end{array}$$

Because the positive charge is more diffuse in the mesomeric cation and the cation therefore more easily formed than the simple ethylenic cation, butadiene reacts more readily with bromine than does ethylene.

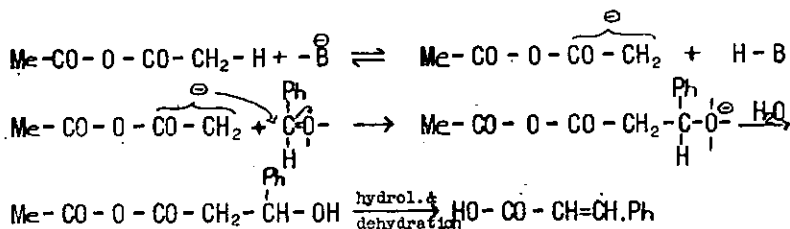
The addition of the CN^- ion to the $\text{C} = \text{O}$ group of aldehydes and ketones has been formulated above. The other reagents such as NH_3 , NaHSO_3 , Grignard reagents, hydroxylamine, which add or condense with aldehydes and ketones, all have unshared electrons which are readily shared with the C atom of the CO gr., i.e. are all anionoid or nucleophilic. Condensation is the result of further changes in the sharing of electrons (electromeric changes) following the addition. Thus in oxime formation



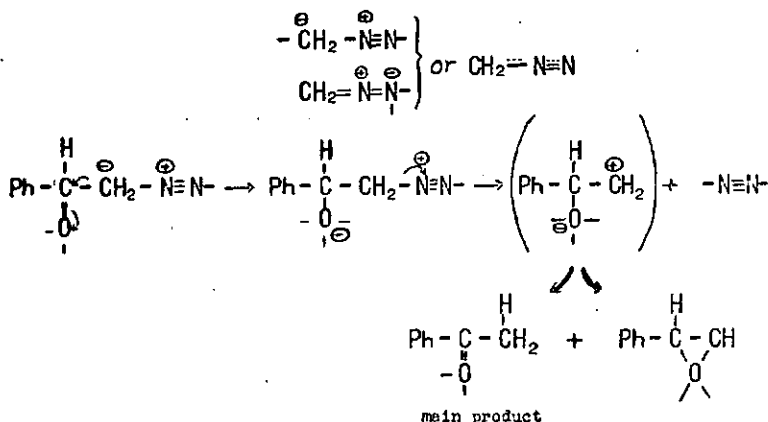
Other types of condensation reactions of aldehydes and ketones can also readily be understood; for example the aldol type condensation as illustrated in the conversion of acetone with alkali to diacetone alcohol, is formulated



The Perkin reaction between an aldehyde and an acid anhydride in the presence of a base (usually the sodium salt of the acid) is a similar process, e.g.:

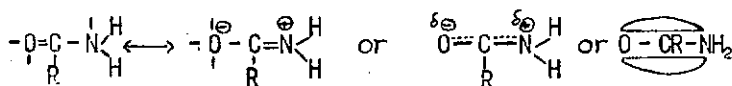


The reaction of diazo-methane with an aldehyde is represented:



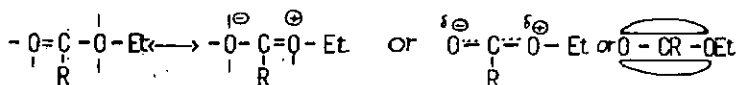
The net result is methylation.

When the CO group is directly attached to a non-carbon atom such as N or O, with unshared electrons on it (as in amides and esters), the additive properties of the CO group are largely neutralised. This is represented (as already shown earlier) thus



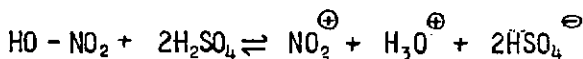
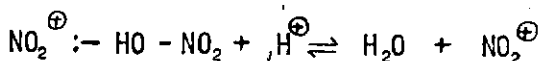
In so far as the C atom of the CO group has received electrons from the N atom, it is unable to accept electrons from a reagent molecule or ion; and to this extent the NH₂ has lost its basic properties, which are due to its readiness to share the unshared electron pair with a proton. Hence the weak basic properties compared with ammonia or an amine.

Similarly for the ester group



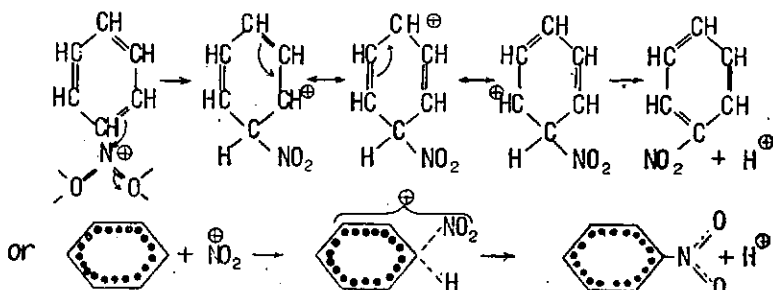
Such systems are called neutralised systems.

(iii.) nitration takes place readily in mixtures of nitric acid with strong acids, which are now known to convert HNO_3 into the nitronium ion



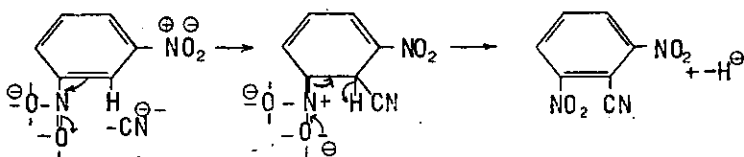
Perchloric acid is also a powerful nitration catalyst, giving with HNO_3 the salt $\text{NO}_2^{\oplus} \text{ClO}_4^{\ominus}$.

The mechanism of nitration is thus represented:—



The orienting effect of substituent groups on further substitution by electrophilic reagents and their effect on the rate of such substitution can now be explained in terms of their inductive, mesomeric and electromeric effects. This part of the theory is readily available from many sources, and so I will omit it here.

Anionoid or nucleophilic agents do not attack benzene itself, but they will attack the benzene ring when groups capable of withdrawing electrons sufficiently strongly by the mesomeric or electromeric mechanism are present.



The H^- ion will reduce some of the original material or product unless an oxidising agent is present to react with it.

This theoretical treatment of benzene substitution can be extended to condensed aromatic systems and to heterocyclic compounds, giving a theoretical basis and unity to a large body of experimental facts.

The electronic theory has also thrown new light on such subjects as molecular rearrangements and colour in organic compounds and examples of its value in these and other parts of organic chemistry are many and varied, but these fields are too big to develop here.

The outlook in organic chemistry is changing. Organic reactions are now seen to conform to certain general principles, and the differences in behaviour among various classes of compounds which organic chemists have long recognised but which have often been so puzzling, are now explained in terms of a theory of their mechanism which is of general application.

It therefore seems to me that the time is ripe for a reorganisation of the teaching of organic chemistry, with the electronic theory as the basis of the treatment.

If students were introduced early in their courses at the university to the electronic theory of the mechanism of organic reactions, they would find the factual matter of organic chemistry less empirical and less a strain on the memory than it is now. I do not suggest that the orderliness of the subject which has come from the study through classification according to structure, should be abandoned—in fact, I think this would be unnecessary and undesirable—but rather that the underlying and unifying theme should be 'mechanism.' Since classification according to structure is also classification according to functional groups, the change in many respects would not be as radical as might at first be supposed. Nevertheless the gain in appreciation and understanding of the facts by students would, I think, be great. It might be compared with what happened in elementary inorganic chemistry some thirty to forty years ago when the study of elements and their compounds first became generally based on the periodic table; or with the changes now being effected in many places in the teaching of elementary general chemistry by developing chemical theory around modern views of the structure of atoms and molecules and the electronic theory of valency, exemplified by Pauling's new book, "General Chemistry."

For some years at Canterbury, an introduction to the electronic theory of the mechanism of organic reactions has been given in the third year and used as a basis for more advanced studies of various parts of organic chemistry. It is hoped next year to try the experiment of developing elementary organic chemistry early in the second year course around the central idea of mechanism. Such experiments in teaching are being tried, I believe, in some American Universities, but with what success it has not yet been reported. However, chemistry is essentially an experimental science and the teaching of the subject should not be excluded from experimentation. Perhaps at some future Conference of the Institute I may have an opportunity of reporting the results.

CANTERBURY BRANCH NOTES

Mr. S. R. Siemon, B.Sc., M.App.Sci. (Queensland), A.R.A.C.I., has been elected chairman for the current year. He came to Canterbury College from Australia some six years ago to take up the post of lecturer in Applied Chemistry, which he has filled very capably ever since. He has had practical experience as a chemical engineer in the meat industry in Queensland.

SCIENCE AND THE MEAT INDUSTRY.

Lecture delivered to the Wellington Branch of the New Zealand Institute of Chemistry on April 26th, 1949, by Dr. E. H. Callow.

In the June, 1949, issue of the Journal an account was given of Dr. Callow's career. It is now proposed to give a resume of the lecture which he delivered to the Wellington Branch of the New Zealand Institute of Chemistry.

Like all fields of good science, a study of meat must be conceived in very wide terms. It begins with the breeding herd and ends up with the plate. The way the animal grows determines the composition of the tissues in terms of fat, protein and bone. After slaughter there are immediate post-mortem changes in the tissue and their invasion by micro-organisms has to be considered.

A carcass consists mainly of three kinds of tissue—muscular tissue, fatty tissue and bone, and the percentage of each varies with the fatness. With carcasses containing over 18% of fatty tissue, the relation between the percentage fatty tissue (FT/C), muscular tissue (MT/C) and bone (B/C) can be expressed by the following equations, which apply equally well to cattle, sheep and pigs, provided that the carcass has no head, feet or skin:

$$MT/C = 76.1 - 0.684 FT/C \pm 1.0$$

$$B/C = 20.3 - 0.264 FT/C \pm 0.8$$

Parallel with variations in the anatomical proportions of a carcass are variations in the tissues themselves. Fatty tissue consists of rounded connective tissue cells, in which chemical fat (triglycerides) is stored. With growth the number of cells do not change, but each cell increases in diameter from 20μ to 200μ . With increasing proportions of fatty tissue the fat content of this tissue increases, so that with carcasses containing 20% fatty tissue there will be 70% chemical fat, which increases to 86% for a carcass with 40% fatty tissue.

Muscle tissue is more complicated than fatty tissue. The muscles are enclosed in a soft skeleton of connective tissue—both collagen and elastin—and themselves consist of very thin muscle fibres, held together in bundles, also by connective tissue. Some of the collagenous tissue is really fatty tissue (the intra-muscular or marbling fat) and, during fattening, this changes in its composition in the same way as the other fatty tissues and each muscle fibre increases in diameter from about 20μ to 50μ . Muscular tissue from a lean carcass containing 20% fatty tissue will contain $4\frac{1}{2}\%$ chemical fat.

Dr. Callow has shown that meat from sheep, pigs or cattle contains approximately 77% water on a fat-free basis. This enables the composition of meat to be stated in terms of the following equations:

$$1. W = 77 - 0.77 F$$

$$2. R = 23 - 0.23 F$$

(Where, W = % water, F = % chemical fat, R = dry fat-free residue, P = protein and X = other dry fat-free substances.)

If it be accepted that 9/10ths of the dry fat-free residue is protein, then

$$3. P = 20.7 - 0.207 F$$

$$4. X = 2.3 - 0.023 F$$

In the dead animal glycogen present in the muscular tissue changes into lactic acid. The quantity of lactic acid thus formed and hence the pH of

the dead muscle, depends on the quantity of glycogen at the moment of death. In fatigued muscles the glycogen is depleted and the ultimate pH of these muscles after death is therefore high.

The ultimate pH of meat varies with different species. It is lower in beef than in lamb. The ultimate pH is important because (a) it profoundly affects the risk of bacterial attack, the rate of growth of bacteria can be greatly diminished by a fall of 0.1 pH and the growth becomes progressively less probable as the pH falls below 6.0. (b) Shortly after death the muscles have a 'close' microstructure, characterised by such properties as high electrical resistance, slow penetration by salt and sugar. With the post-mortem production of lactic acid the pH falls and the microstructure of the meat becomes open and the lower the pH the more the tissue weeps in chilled storage. In lamb the pH does not fall sufficiently to cause drip as is the case with beef.

The above summary is not intended to give a full account of Dr. Callow's address, but selects certain aspects which serve as an introduction to some of the general principles of the newly-developed meat science.

NEW ASSOCIATES

- BROWNE, William Edward, B.Sc.**, Pathological Laboratory, Auckland Hospital (Bacteriological Trainee).
- CAWLEY, Robert William, M.Sc.**, Massey Agricultural College, P.O. Box 601, Palmerston North. (Assistant Lecturer in Biochemistry.)
- CURRIE (Miss), Kathleen Elizabeth, B.Sc., M.H.Sc.**, Cawthron Institute, Nelson. (Tobacco Chemist.)
- DOBSON, Alexander, B.Sc.**, N.Z. Paper Mills Ltd., Mataura. (Chemist.)
- EDMOND, Charles Ross, M.Sc.**, c/o Dr. R. Gardner, 41 Dowling Street, Dunedin. (Assistant Chemist.)
- FORSYTH, David Courtney, M.Sc.**, Shell Co. of N.Z. Ltd., P.O. Box 1663, Wellington. (Industrial Chemist.)
- GAPPER, Harry Richmond, M.Sc.**, Shell Co. of N.Z. Ltd., P.O. Box 1663, Wellington. (Chemist, Sulphonating Plant.)
- MACINTYRE, Ross Alfred John, M.Sc.**, Donaghy's Rope & Twine Co. Ltd., Dunedin. (Chemist.)
- MARTIN, William Reginald Bulmer, M.Sc.**, Dominion Physical Laboratory, Private Bag, Lower Hutt. (Research Engineer-Chemist.)
- MORRIS, Harley Alton Lyal, B.Sc.**, Dominion Laboratory, Box 562, Dunedin. (Assistant Chemist.)
- PENHALE, Hugh Russell, M.Sc.**, Soil Bureau, D.S.I.R., Wellington. Assistant Soil Chemist.)
- SELKIRK, Ronald Charles, M.Sc.**, Dominion Laboratory, Durham Street West, Auckland (Assistant Chemist.)
- SMITH, David Yuile, A.R.A.C.I.L.**, c/o Imperial Chemical Industries (N.Z.) Ltd., P.O. Box 990, Wellington. (Technical Service Officer to Textile and Leather Industries.)
- STANLEY, Bernard George, M.Sc.**, c/o Shell Co. of N.Z. Ltd., P.O. Box 1084, Auckland. (Chemical Products Adviser.)
- WALLACE, Garth Morton, B.Sc.**, Dominion Laboratory, Durham Street, Auckland. (Bacteriologist.)
- WILSON, William Joseph, M.Sc.**, Chemistry Department, University of Otago, Dunedin. (Student.)

THE NINETEENTH ANNUAL REPORT

FOR THE YEAR ENDING 31st OCTOBER, 1949.

Council has pleasure in presenting to members the 19th Annual Report, setting out a record of events for the year ending 31st October, 1949.

OFFICERS FOR THE YEAR.

President: Professor J. Packer.

Vice-President: Dr. J. Melville.

Delegates: Auckland, S. G. Brooker; Wellington, J. L. Mandeno; Canterbury, F. H. G. Johnstone; Otago, O. H. Keys.

Hon. General Secretary-Treasurer: W. G. Hughson.

Editor of the Journal: S. G. Brooker.

Registrar: H. K. Palmer.

Membership:

Membership figures over recent years are as follows:—

	1946	1947	1948	1949
Auckland	75	71	76	88
Wellington	113	122	132	137
Canterbury	46	51	55	54
Otago	43	47	44	55
Overseas	25	29	40	36
	<hr/>	<hr/>	<hr/>	<hr/>
	302	320	347	370

Registrar:

The Registrar has now completed three years with the Institute and the Balance Sheet (which will be published in our next issue) is visual evidence of the continuous effort required, attending to the financial side of our work.

A report was submitted to the General Meeting of members in Auckland indicating the extent of the work covered by the Registrar in maintaining regular contact with all sub-committees and in carrying out the day-to-day work of the Institute.

Institute Committees:

A list of the officers of the Institute, including members of sub-committees and representatives on various other bodies, now covers three foolscap pages, but the important fact to note is that such a large proportion of our membership is actively engaged in running the affairs of the Institute. It is also of interest to note that younger members are prepared to take on jobs in connection with both Branch and Institute activities.

Notes on the work of the various sub-committees are included for the information of members.

Conference 1949:

The Annual Conference was organised and run entirely by a Committee of the Auckland Branch, together with representatives of the Royal Institute of Chemistry (N.Z. Section). The Conference, which was held from August 22nd-25th at Auckland University College, was attended by three Australian representatives from the Council for Scientific and Industrial Research, Melbourne, and Professor S. R. B. Cooke, of Minnesota University, U.S.A.

A total of 199 attended the Conference and the Committee was sincerely thanked for the tremendous amount of time and energy devoted to the running of a most successful Conference.

7th Pacific Science Congress:

This Congress was held in Auckland and in Christchurch in February, 1949, and was attended by a number of eminent chemists, although there was no specific Chemistry Division.

The question as to whether future Congresses should have a Division of Physical Sciences or a Division of Chemistry is under consideration. All Branches of our Institute were privileged to be addressed by visiting chemists as detailed in the journal.

Contract of Service:

Wide interest has been shown in a "Contract of Service" which has been prepared by a special Wellington Committee. This "Contract" is now with Council and should be available in final form early in 1950.

Employment Committee:

During the year 16 circulars have been sent out covering 127 vacancies. This indicates the service provided by this committee to members wishing to receive notification of vacancies for chemists.

Examination Committee:

The main task of this Committee is to arrange examinations for Laboratory Assistants under a special syllabus prepared specifically for our own purposes. This examination has received recognition by the Public Service Commission and is meeting with general approval from chemists in charge of technicians and junior laboratory staff.

Preliminary work has been done by a Wellington Committee, but in 1950 an Otago Committee takes over. Candidates enter from all over New Zealand and we are indebted to Senior Associates and Fellows who act as Supervisors and Examiners in the various subjects.

Finance:

The Balance Sheet shows that we are in a very steady and sound financial position. There was a surplus of Income over Expenditure amounting to £99.

The cost per issue of the Journal has increased, and we are now publishing five issues per year.

Conference showed a surplus of about £17. Membership has expanded and subscriptions have increased by £44.

The Registrar's salary has been fixed at £125 p.a. for three years.

The Trust Fund has now been built up to £391 and Balance in Hand elsewhere amounts to £763.

A Travelling Fund aims at accumulating sufficient money to allow more frequent meetings of Council-in-Person, i.e., the personal attendance of Branch Delegates at Council Meetings.

Journal:

The official organ of an Institute such as ours must maintain a progressive and vital policy. It influences in a large way the vigour of our Institute activities and Council has been pleased to subscribe to the suggestions of the Editor and his Auckland committee in providing additional services at no increase in subscription rate. The rate for students has been reduced from 7/6 to 5/-.

A fifth issue dealing mainly with papers for Conference was introduced this year and proved a valuable Conference hand-book.

Advertising by chemical firms assists us financially to the extent of £190 and the advertisements keep chemists informed on latest developments.

Membership Committee:

Three Fellows of the Institute constitute this Committee, which has critically examined applications for enrolment of Fellows and Associates.

Three Fellows and thirty-four Associates have been elected during the year.

Patents Committee:

This is a new Committee set up by Wellington branch to safeguard public interest by scrutinising the list for chemical patents and drawing attention to any processes not considered patentable.

Professional Status Committee:

This Committee was recently set up by the Auckland Branch to study such matters as Union Membership and Registration, Graduate Membership of the Institute, the position of Laboratory Assistants and Technicians and any developments relating to the Charter.

Standards Institute of New Zealand:

We are very well and very fully represented on both the Standards Council and on Standards Institute Committees. At the General Meeting in Auckland Timber Preservation was discussed and the matter has been taken up with the Standards Institute.

Standard Methods of Analysis:

Work on Standard Methods has been confined to collaborative work on the estimation of organic carbon by wet combustion methods and samples are being collected for work on pH determinations.

Superannuation Schemes:

Various superannuation schemes which would be available to members of the Institute were fully elaborated by a special committee and communicated through Council to the various Branches.

U.N.E.S.C.O.

Since we subscribe to the fourth letter in the above title (Scientific) our Institute is interested in United Nations' programmes for advancing the educational, scientific and cultural welfare of all nations and particularly of other countries not as fortunately placed as ourselves.

We have been interested in the Conference on "abstracting" and propose to discuss "Food and People" during 1950.

A large amount of literature comes to hand and we have an able representative on the New Zealand National Council for U.N.E.S.C.O.

Food Parcels:

All four Branches have been active in despatching food parcels to members of the Royal Institute of Chemistry benevolent fund in Great Britain, particularly during the winter months. We are pleased to say that several sets of parcels have been forwarded to arrive by Christmas time.

I.C.I. Prize:

This is the first year of award of the new prize of 25 guineas offered by Imperial Chemical Industries (N.Z.) Ltd., for the best contribution to some branch of Chemical Science, judged by research work published over the previous five years.

The first award was made to Dr. L. H. Briggs, of Auckland University College, for his work on New Zealand Plant Products.

Industrial Chemical Essay Prize:

This Institute prize of £25 is open for competition up to June 30th, 1950. It was not offered during 1949.

Empire Institutes:

It has been our pleasure to welcome a number of members from other Empire Institutes during the year, particularly those attending our Conference and the 7th Pacific Science Congress. We also exchange Journals and thus keep in touch with activities elsewhere.

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

Our Institute was well represented by four of our members at the Tasmanian Meeting of the Australian and New Zealand Association for the Advancement of Science in February, 1949. In addition, papers prepared by other members were read.

Thanks:

Our thanks are due to all those members of the Institute who have assisted in the very wide field of activities which we now cover and again we specially thank Mr. W. A. Joiner for inscribing all Associate and Fellow Certificates.

For and on behalf of Council,

J. PACKER, President.

W. G. HUGHSON, Hon. General Secretary.

ITEMS from the MINUTES of a MEETING of COUNCIL IN PERSON held at Dominion Laboratory, Wellington, on NOVEMBER 25th, 1949, at 10 a.m.

Conference 1949: A full report on the 1949 Conference held in Auckland was received from the Conference Committee. Since copies had already been sent to Branches, it was taken as read and received. Professor Packer again congratulated the Committee on a very successful conference.

Conference 1950: Dr. R. O. Page is unable to represent the R.I.C. on the Conference Committee. The Secretary was asked to see Mr. N. H. Law and obtain a further nomination to the Committee.

Professor Packer said that the Royal Society would be holding a Congress in Christchurch in May, 1951, and it was proposed to invite the N.Z.I.C. to organise the Chemical Division of the Congress.

It was moved by Canterbury, seconded by Otago—"That the 1950 Conference be held in August in Christchurch, that we co-operate in running the Chemical Division of the Royal Society's Congress in 1951, also in Christchurch, and that the offer of the present Committee to organise both events and to remain in office as long as necessary, be accepted, and that our Annual Conference be held as usual in August, 1951, in perhaps one of the smaller centres."—Carried.

A letter from R. M. Allison introduced the question of publishing Conference papers in full prior to the conference. After discussing a number of the factors involved, it was decided to leave the matter in the hands of the Conference Committee, of which Professor Packer is chairman.

Eighth Pacific Science Congress: Professor Packer said he had discussed with Professor Soper the suggestion to form a Division of Physical Sciences at the next Pacific Congress. Professor Soper has agreed to bring down suggestions.

Employment Committee: It was reported that the Secretary had written to the Education Department explaining what opportunities existed for boys leaving school to work in laboratories as technicians.

Examinations Committee: November examinations are in progress. Professor Llewellyn stressed the necessity of consulting with Directors of laboratories where special equipment would be required in an examination. The Otago Committee is preparing prescriptions for the new subjects.

Journal: A report was received from Mr. S. G. Brooker, the editor, and adopted by Council.

It was moved by the President, seconded by Auckland—"That Council place on record its appreciation of the work of the Editor and his committee in producing the Journal over the past year."—Carried.

It was moved by Auckland, seconded by Wellington—"That Council recommends to Branches that the Editor attend the August meeting of Council-in-person, with expenses paid as for delegates."—Carried.

It was moved by Canterbury, seconded by Auckland—"That publication of the list of members be undertaken by the Editorial Committee and that a further quotation be obtained."—Carried.

It was suggested that Branch secretaries be given a list of members as prepared for statistical purposes, and that they and their committees check any alterations in address, status, etc., for "list" purposes.

I.C.I. Prize: It was moved by Canterbury, seconded by Wellington—"That it be a recommendation to Branches that the following clause be added to the regulations governing the I.C.I. Prize: 'A member to whom the prize has been awarded shall not be eligible for nomination for a further award until five years have elapsed.'"—Carried.

Industrial Chemical Essay Prize: Attention was drawn to suggestions made by Auckland in 1948.

It was decided to reconsider the conditions of award after this year's competition, which closes on June 30th, 1950.

Prize Offer: A letter was received from Mr. H. H. Edwards offering to donate a prize to the Institute.

After discussion on how best to utilize such a prize, Professor Llewellyn was asked to discuss the various suggestions with Mr. Edwards prior to next Council meeting.

Medical Advertisements: Wellington suggested that radio advertising should be investigated, the new committee to report on possible action.

Professional Status Committee: A letter was received from Mr. J. Ricketts (Sec.) re Laboratory Technicians being included in Union awards. The matter has been discussed with Mr. Ellison, of the Association of Bacteriologists, and a reply has been forwarded to Mr. Ricketts. The matter is still under consideration.

Standards Institute of New Zealand: A letter was received from the Standards Institute through Mr. G. A. Lawrence, saying that a special committee had been set up to investigate standard methods of timber preservation.

Standard Methods of Analysis: A report was received from Dr. E. B. Davies, Sec. of the Soils and Fertilizer Sub-committee.

It was moved by the President, seconded by Wellington—"That Dr. Melville be asked to review the situation and report on ways and means of proceeding with the work."—Carried.

Superannuation and Contract of Service Committee: It was moved by Wellington, seconded by Otago—"That this Committee be thanked for its services and that the 'Contract of Service' be submitted to our solicitor, Mr. A. E. Hurley."—Carried.

The Committee was not re-appointed.

U.N.E.S.C.O.: It was moved by Otago, seconded by Canterbury—"That Mr. J. A. D. Nash be reappointed our representative on UNESCO affairs and that he be asked to supply to each Council meeting a summary of matters which concern us as chemists."—Carried.

The Secretary was asked to write to the International Union of Chemistry, Paris, asking for details of membership.

Mr. Nash attended a preliminary meeting of the "reconstruction committee." A special committee has been set up by UNESCO to raise money for educational reconstruction in devastated countries.

UNESCO is prepared to arrange for speakers to address Branches if sufficient notice is given.

Patents Committee: A report was received from Dr. Shorland.

It was moved by Otago, seconded by Wellington—"That the Patents Committee be asked to investigate the reason for appointing Dr. F. Nauen (a professional chemist) as Patent Examiner in the Clerical Division."—Carried.

Food Parcels: Auckland reported that one set had been forwarded and Dr. Dixon, on behalf of the other three Branches, had despatched two sets and had money on hand for a third set.—Report received.

Compounded Subscription: The question of introducing compounded subscription for members over 50 years of age was discussed. The Registrar was asked to report on the financial implications of such a policy.

Bookplates: These are now available for all N.Z.I.C. book prizes and may be obtained for present and past prizes on application to the Registrar.

Manpower Report: Wellington submitted a lengthy report in support of their motion, originally set out on A.168/29, concerning the possibility of Ph.D. candidates doing their research for the degree in a recognised research institution outside of the University.

It was decided to forward the report to Branches for further consideration at next meeting.

Accounts for Payment: On the motion of the President, seconded by Auckland, the accounts, amounting to £539 2s 11d, were passed for payment.

Election of Fellow: Council is pleased to welcome Professor Joseph Ivon Graham to New Zealand, where he has recently taken up the Chair of Coal-mining at the School of Mines, University of Otago. Besides being a Fellow of the R.I.C., Professor Graham is M.A. (Cantab.), M.Sc. (Lond.), F.R.C.Sc.I., F.Inst.F., M.I.Min.E.

He was unanimously elected a Fellow of the N.Z.I.C.

Election of Associates: The following Associates were elected by Council:—

Owen Thomas Dalley, M.Sc., N.Z. Forest Products Ltd., Penrose, Auckland.
Michael Irwin, Ph.D. (Lond.), Chemistry Dept., University of Otago, Dunedin.
Charles George Martin, M.Sc., Vacuum Oil Co., Hutt Road, Wellington.
Mrs. Gloria Isabelle Anne Dunne, B.Sc., Dominion Laboratory, Sydney Street, Wellington.

Hugh Joseph McCoach, M.Sc., Dominion Laboratory, Sydney St., Wellington.
Henry William Sandle, B.Sc., McSkimming and Son, Box 1, South Dunedin.
Russell Mowbray Grigg, M.Sc., British Australian Lead Manufacturers, Hutt Park Road, Petone.

Membership:

Deceased: Miss M. J. Browne, Wellington, and Mr. G. C. De A'ith, Auckland.
Leave of Absence granted Miss J. B. Ross, with remission of subscription.
Resignation accepted from Miss Monica Lindsay, subject to payment of past year's subscription.

Amendments to Rules: Wellington submitted the following amendments:—

1. Rule 21.8.1. Add at end of rule—"with special reference to the applicant's character and suitability for membership."

2. Rule 8 to commence—"Provided always they are not less than 21 years of age, are of good character, and are connected with New Zealand . . . etc."

It was moved by the President, seconded by Auckland—"That all suggested amendments to the Rules, including the above and those listed on A.178/15, be referred to Dr. R. Gardner, who is revising the rules pertaining to membership."—Carried.

International Congress of Biochemistry: The Secretary tabled letters from Professor Edson and Dr. Cunningham, and was asked to obtain brief reports for next meeting.

Abstracting: A letter was received from the D.S.I.R., Wellington, re abstracting of N.Z. chemical publications.—Letter referred to Editor for comment.

Honoraria: Council approved the payment of honoraria to:—

Hon. General Secretary, W. G. Hughson, 25 guineas.

Editor of the Journal, S. G. Brooker, 10 guineas.

Stationery: Envelopes "addressographed" in Auckland will be a charge to headquarters, but no grants will be made where a Branch procures supplies of its own locally.

Journal Grant: It was moved by the President, seconded by Auckland—"That for the coming year, the Journal grant be raised from £120 to £140."—Carried.

Trust Fund: It was moved by the President, seconded by Wellington—"That £50 be transferred from the General Fund to the Trust Fund."—Carried.

National Savings: The Registrar was asked to investigate the advantages of placing a part of our funds in National Savings.

OTAGO BRANCH NOTES

Dr. Roy Gardner, the new chairman of the branch, will be well known to members of the Institute, of which he is one of the foundation members. He graduated from Auckland in 1921 after having practiced as a pharmacist for a number of years. He gained his M.Sc. at Otago in 1922, after which he held a position as science teacher at the King Edward Technical College in Dunedin for ten years, except for a year when he was John Edmond Research Fellow at Otago. In 1933 he left the Technical College to set up practice as a Consulting and Analytical Chemist in Dunedin. Dr. Gardner was elected F.R.I.C. and has been a Fellow of the New Zealand Institute since its inception. He worked for some years on the essential oils of New Zealand plants, and his researches were recognised in 1930, when he was granted the degree of D.Sc. by the University of New Zealand. He has been on committees associated with the local branch and with the New Zealand Institute for many years, and was president of the latter in 1940-1. He has also been chairman of the Otago branch previously.

THE NEW ZEALAND INSTITUTE OF CHEMISTRY.

LIST OF OFFICERS

FOR THE YEAR 1st NOVEMBER, 1949 — 31st OCTOBER, 1950.

President: Dr. J. Melville, Plant Chemistry Laboratory, P.O. Box 623, Palmerston North.

Vice-President: P. R. Parr, 7 Atarangi Road, Greenlane, Auckland, S.E.4.

Hon. Gen. Secretary: W. G. Hughson, P.O. Box 250, Wellington.

Auckland Delegate: Professor F. J. Llewellyn, Auckland University College, Auckland.

Wellington Delegate: S. E. Wright, Pharmacy College, 59 Cambridge Terrace, Wellington.

Canterbury Delegate: F. H. G. Johnstone, P.O. Box 325, Christchurch.

Otago Delegate: O. H. Keys, P.O. Box 562, Dunedin.

Editor of Journal: S. G. Brooker, P.O. Box 12, Newmarket, Auckland.

Past President: Professor J. Packer, Canterbury University College, Christchurch.

Registrar: H. K. Palmer, P.O. Box 250, Wellington.

Assistant Secretary: A. P. Oliver, P.O. Box 250, Wellington.

—Auckland Branch.—

Chairman: P. R. Parr, 7 Atarangi Road, Auckland, S.E.4.

Secretary: G. S. Lambert, Box 29, Newmarket, Auckland, S.E.1.

Treasurer: W. E. Russell, P.O. Box 759, Auckland, C.1.

Committee: Prof. F. J. Llewellyn, Auckland University College, Auckland, C.1; Dr. H. Bloom, Auckland University College, Auckland, C.1; A. W. Mackney, P.O. Box 1884, Auckland, C.1; M. B. Rands, 252 Mt. Smart Road, Auckland, S.E.5.

Auditor: A. J. Parker, 10 Ardmore Road, Auckland, W.1.

—Wellington Branch.—

Chairman: J. M. C. Tingey, P.O. Box 545, Wellington.

Secretary-Treasurer: Miss F. B. Hurst, Soil Bureau, 54 Molesworth Street, Wellington.

Committee: R. C. Bell, P.O. Box 288, Wellington; A. P. Oliver, P.O. Box 250, Wellington; B. E. Swedlund, P.O. Box 1580, Wellington; S. E. Wright, Pharmacy College, 59 Cambridge Terrace, Wellington.

Auditor: G. A. Lawrence, Johnsonville.

—Canterbury Branch.—

Chairman: S. R. Siemon, 252 Grahams Road, Christchurch.

Secretary-Treasurer: F. H. G. Johnstone, P.O. Box 325, Christchurch.

Committee: N. P. Alcorn, Government Analyst, P.O. Box 1290, Christchurch; W. R. Elder, 9 Weston Road, Papanui, Christchurch, N.1; A. H. Swaney, Canterbury Frozen Meat Co., P.O. Box 2, Belfast, Christchurch.

Auditor: G. D. Law, 124 Lichfield Street, Christchurch, C.1.

—Otago Branch.—

Chairman: Dr. R. Gardner, P.O. Box 271, Dunedin.

Secretary-Treasurer: J. Rogers, University of Otago, Dunedin.

Acting Sec.-Treas.: Mrs. R. P. Painter, Chemistry Department, Otago University, Dunedin.

Committee: O. H. Keys, P.O. Box 562, Dunedin; G. Beath, 45 Belmacewen Road, Dunedin, N.W.1; T. H. Kennedy, Thyroid Research Department, Medical School, Dunedin; C. C. Roberts, King's High School, Dunedin, S.2.

Auditor: T. A. Thomson, 4 Cromwell Street, Dunedin, N.W.2.

WELLINGTON BRANCH NOTES

At the Annual Meeting it was decided to raise the Branch subscription from 2/6 to 5/.

The Mellor Lecture was given by Mr. W. Vose, Director of the N.Z. Pottery and Ceramics Research Association and dealt with Dr. Mellor's contributions to the ceramic industry.

Other lectures delivered include "Electric Smelting of Titaniferous Iron Ores" by Mr. F. C. Collins, Metallurgist to Elektrokemisk A/S, Oslo, Norway; "Lipid Chemistry" by Dr. F. B. Shorland; and "Methods of Separation based on Surface Properties" by Dr. I. W. Wark, of Australia. Dr. Wark also gave this lecture to the Auckland Branch and it has been published in the Royal Australian Chemical Institute's Journal, Vol. 16,387 (1949).

THE USE OF OXYGEN IN THE IRON AND STEEL INDUSTRY.

Lecture delivered on October 17th, 1949, by Prof. Robert F. Lemoine
(Consultant to the New Zealand Government on Onekaka).

An informal talk was given by Prof. Lemoine to a combined meeting of the Wellington Branch of the Institute of Chemistry and the Technology Section of the Wellington Branch of the Royal Society. The utilisation of oxygen on a large scale has been made possible since the war by the more efficient production of liquid oxygen by methods developed by the Germans. They needed liquid oxygen in very large quantities for use in the V1 and V2 rockets. In the mining of iron ore Prof. Lemoine instanced two ways in which oxygen was used to improve efficiency. The first was as an explosive in combination with sawdust and charcoal for blasting. The mixture was very safe and the proportions could be easily adjusted to give explosives of the power required. The second was in drilling, where by using a flame with oxygen, holes could be drilled in the ore at speeds up to 2ft. per minute.

In the iron industry the use of oxygen enriched air in blast furnaces led to much more efficient and economical operation. Smaller furnaces, less heat loss, faster operation, and the possibility of using lower grade coke were among the advantages. In the making of steel the processes were similarly improved, and up to 20% gain in efficiency have been reported when the oxygen content of the air has been increased to 33%.

THE NEW ZEALAND INSTITUTE OF CHEMISTRY.

SUB-COMMITTEES 1/11/49 — 31/10/50.

1. CONFERENCE COMMITTEE 1950:

Prof. J. Packer (Chairman), Canterbury University College, Christchurch.
L. Wilkinson (Secretary), Dominion Laboratory, P.O. Box 1290, Christchurch.
N. P. Alcorn (representing R.I.C.), Dominion Laboratory, P.O. Box 1290, Christchurch.
R. M. Allison, and A. F. R. Adams, S. R. Seimon (representing N.Z.I.C.) (with power to add).

2. CHEMISTS' EMPLOYMENT COMMITTEE:

L. H. James (Chairman), P.O. Box 250, Wellington.
E. S. Borthwick (Secretary), P.O. Box 250, Wellington.
G. M. Smith (Acting Secretary), P.O. Box 250, Wellington.

Wellington Representatives:

B. E. Swedlund (University), G. M. Smith (Govt.), F. Morgan (Industry).

Auckland representatives:

Prof. F. J. Llewellyn, K. M. Griffin (Govt.), P. R. Parr (Industry).

Canterbury representatives:

S. R. Seimon (University), L. Wilkinson (Govt.), F. H. G. Johnstone (Industry).

Otago representatives:

Pro. F. G. Soper, O. H. Keys (Govt.), H. G. Woolman (Industry).

3. EXAMINATION COMMITTEE:

C. C. Roberts (Chairman), King's High School, Dunedin, S.2.
A. D. Campbell (Secretary), Chemistry Department, University of Otago, Dunedin.
G. B. Beath, R. W. Green, H. G. Woolman, and O. H. Keys.

4. JOURNAL EDITORIAL COMMITTEE:

S. G. Brooker (Editor), P.O. Box 12, Newmarket, Auckland.
A. G. Frieberg (Business Manager), P.O. Box 1500, Auckland.
G. L. Calnan (Distribution Manager), Dominion Laboratory, Durham Street West, Auckland.
D. Whillans, c/o. Public Hospital, Park Road, Auckland.
G. W. Stace, Dominion Laboratory, Durham Street West, Auckland.

Branch Editors:

Auckland: G. W. Stace, Dominion Laboratory, Durham Street West, Auckland.

Wellington: R. B. Miller, Soil Bureau, 54 Molesworth Street, Wellington.

Canterbury: To be appointed.

Otago: J. Murray, Chemistry Department, University of Otago, Dunedin.

5. MEDICAL ADVERTISEMENTS COMMITTEE:

L. H. James (Convener), P.O. Box 250, Wellington.
N. H. Law, Dominion Laboratory, Sydney Street, Wellington, N.I.

6. MEMBERSHIP COMMITTEE:

Dr. R. Gardner, P.O. Box 271, Dunedin.

W. A. Joiner, Department Scientific and Industrial Research, Sydney Street, Wellington.

Dr. L. H. Briggs, 63 Brighton Road, Parnell, Auckland.

7. PATENTS COMMITTEE:

Dr. F. B. Shorland, Fats Laboratory, Department Scientific and Industrial Research, Wellington.

S. E. Wright, Pharmacy College, 59 Cambridge Terrace, Wellington.

Dr. M. F. Nauen, 5b Upland Road, Wellington.

8. PROFESSIONAL STATUS COMMITTEE:

Dr. J. C. Andrews, 63 Onslow Avenue, Auckland, S.E.3.

J. Ricketts (Secretary), 113 Valley Road, Auckland, S.2.

F. H. V. Fielder, 29 Adam Street, Greenlane, Auckland, S.E.4.

D. Whillans, Pathological Laboratory, Public Hospital, Park Road, Auckland, C.3.

9. STANDARDS INSTITUTE OF NEW ZEALAND:

9.1 Representative on N.Z. Standards Institute Council:

G. A. Lawrence, Johnsonville.

9.2 Chief Representative for all Standards Institute Affairs:

M. L. H. Stewart, P.O. Box 1663, Wellington.

9.3 Representatives on Special Standards Institute Committees: Chemical Insecticides, Domestic Refrigeration and General:

M. L. H. Stewart, P.O. Box 1663, Wellington.

Road Making Materials and Methods: Road Material Testing:

J. B. Hyatt, Dominion Laboratory, Wellington.

Electro-Plating and Protective Metal Finishes:

Dr. R. Gardner, 41 Dowling Street, Dunedin, C.1.

Rodent Poisons, Refrigeration and Timber Preservation:

C. G. Mason, P.O. Box 632, Wellington.

Metal Containers: Paints:

J. M. C. Tingey, 20 Cavendish Square, Wellington, E.5.

Textiles:

Dr. L. F. Story, Woollen Research Association, University of Otago, Dunedin.

10. STANDARD METHODS OF ANALYSIS:

10.1 Plant Materials:

Dr. H. O. Askew (Chairman), Cawthron Institute, Nelson.

Dr. J. Melville (Secretary), P.O. Box 632, Palmerston North.

10.2 Animal Tissue:

Dr. C. R. Barnicoat (Chairman), P.O. Box 601, Palmerston North.

I. G. McIntosh (Secretary), Animal Research Station, Wallaceville, Private Bag, Wellington.

10.3 Soils and Fertilizers:

Dr. J. K. Dixon (Chairman), Soil Bureau, 54 Molesworth Street, Wellington, N.1.

Dr. E. B. Davies (Secretary), P.O. Box 490, Hamilton.

11. U.N.E.S.C.O. REPRESENTATIVE:

J. A. D. Nash, P.O. Box 250, Wellington

12 FOOD PARCELS:

Dr. J. K. Dixon, Soil Bureau, 54 Molesworth Street, Wellington, N.1.

AUCKLAND BRANCH NOTES

MR. R. HICKS, A.R.I.C., A.R.T.C., has recently taken up his appointment as Sewage Works Chemist to the Auckland Metropolitan Drainage Board. Mr. Hicks is a Fellow of the Institute of Sewage Purification and a Member of the Institute of Sanitary Engineering. His experience has included five years with Messrs Melling and Ardern, consultants, five years at the Manchester Sewage Works, eight years at Gravesend Sewage Works as both Manager and Chemist, and nine years at Hamilton Sewage Works, Scotland, as Manager and Chemist.

MR. G. H. BARKER, M.Sc., A.N.Z.I.C., has returned to New Zealand after 18 months with the Anglo Iranian Oil Co., Abadan, Iran.

MR. G. M. WALLACE, B.Sc., A.N.Z.I.C., has been appointed chemist in the Auckland Branch, Dominion Laboratory. Mr. Wallace was previously with Dunlop (N.Z.) Ltd., Christchurch, and has recently completed a course in Dairy Bacteriology and Dairy Chemistry at Massey College.

MR. G. R. MUIR, B.Sc., A.N.Z.I.C., previously Works Chemist, W. Sutherland and Co. Ltd., Tanners, Auckland, has taken a position with W. Paltridge and Sons, Tanners, Mt. Barker, South Australia.

MR. P. R. PARR returns to the Chairmanship of the Branch after a period of several years. Mr. Parr is well known as the chief chemist to W. & R. Fletcher Ltd., a large company controlling three freezing works. He has had considerable experience as a teacher of evening classes in chemistry at Seddon Memorial Technical College. He played an integral part in the founding of the Institute and for the past few years has been an examiner for the Laboratory Assistant's Certificate, and has just been elected Vice-President of the Institute.

BOOKS RECEIVED

A Scheme of Qualitative Organic Analysis. By F. J. Smith, Liverpool castle. 320pp. 1948. Blackie and Son, London. 17s 6d. This useful book Technical College, and Emlyn Jones, Rutherford College of Technology, New-may be said to give a modern treatment of the subject on orthodox lines. The compounds are first divided according to their elementary analysis, which must be decided with certainty, and are then separated into various classes by classification and confirmatory tests, many of which are quite recent. The book contains 88 tables with data on some 2400 compounds, which is rather more than in a comparable American work. The omission of triethanolamine was noted, but otherwise the choice of compounds seems reasonable. The inclusion of trivial as well as generic names in the index given, would be a help, and also literature references to the tests. The binding and printing are good and the price reasonable.

Methods of Quantitative Micro-Analysis. Collected and edited by R. F. Milton, Consulting Analyst and Biochemist, London, and W. A. Waters, Oxford University. 599pp. 1949. London: Edward Arnold and Co. £3. This book is divided into six parts covering every aspect of the subject as shown by the following brief table of contents:—Part I.: Gravimetric analysis and general micro-chemical techniques. Part II.: Micro-analysis of organic compounds. Part III.: Volumetric analysis. Part IV.: Colorimetric analysis, including nephelometry and fluorimetry. Part V.: Electro-chemical methods of micro-analysis, including polarography. Part VI.: Gasometric methods of micro-analysis. A large number of methods for particular elements, substances or groups are given in detail and these are supplemented with numerous tables, covering the other determinations, and giving the references and a very

brief outline of the procedure. Thus the user can readily find if there is a method available for the particular analysis in which he is interested. The book is so arranged that it can be used as a text-book, but will find its greatest use in the laboratory of the practising analyst and industrial chemist, where it will take its place alongside the standard works on analysis. It contains several useful tables and five indexes for ready reference.

The third volume of Theilheimer's **Synthetische Methoden der Organischen Chemie** (S. Karger, Basle, 1949. See our issue for September, 1948) has now come to hand, covering the period 1946-7, with earlier references to American literature which was not available during the war. Every new volume makes this series more valuable. The system of cross-references already takes about one-third of the book and can hardly be continued in future volumes.

Scientific Instruments II. is the second of a series issued by Hutchinson's Scientific and Technical Publications (30/-) and contains a rather popular account of a variety of things, including optical, electrical, electronic, recording, astronomical, navigational and ship model testing instruments. Any reader will find something of interest, particularly the laboratory "gadgeteer." Profuse illustrations increase its value.

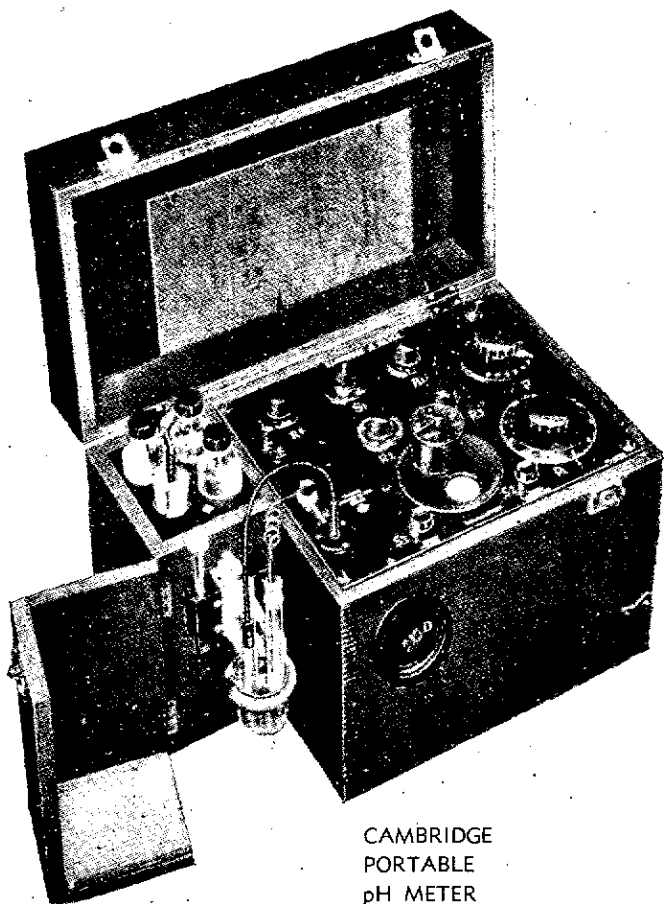
Electronic Interpretations of Organic Chemistry. By A. E. Remick. John Wiley & Sons. 1949. \$6.00.

The first edition of this book was published in 1943 and was intended to help organic chemists in the task of co-ordinating physico-chemical advances with electronic theories of organic chemistry. In this aim the author undoubtedly achieved a large measure of success. Dr. Remick has evidently expended much time and thought in the compilation of the new edition. Fresh developments have been incorporated smoothly, some rearrangement of material has resulted in a marked improvement in the presentation of certain subjects, and many more studies of organic reaction mechanisms have been added. The chapter on chemical physics has been largely rewritten and extended, its value being considerably enhanced in the process. A new chapter on stereochemistry has been included, and its 50-odd pages are filled with material which has been carefully and wisely chosen. An interesting feature is the rearrangement of the account of the English electronic theory. Fundamental postulates are now considered briefly at an early stage, and extensive discussion of the application of the theory is left until the various contributions from more specialised fields have been covered. This appears to be a more logical method and has certainly resulted in a more lucid presentation.

Subject matter is critically reviewed where the author considers it advisable to do so, but Dr. Remick's criticisms are careful, tolerant ones with the merit of being free from that bias which is apt to present a completely distorted picture to the reader. The expansion of many portions of the book has made it necessary to abridge the historical introduction and to exclude those sections of the original appendix which were intended as additional aids to the student weak in Physical Chemistry. The application to reaction mechanisms of the Hund-Mulliken method of quantum-mechanical calculation (Molecular Orbital Method), which has proved so fruitful in recent years, has been virtually neglected. This may be considered as a major omission in an otherwise well-balanced book.

The second edition can be recommended as a desirable addition to the library of all organic chemists wishing for a readable account of modern developments in the theories of their subject.

J.V.



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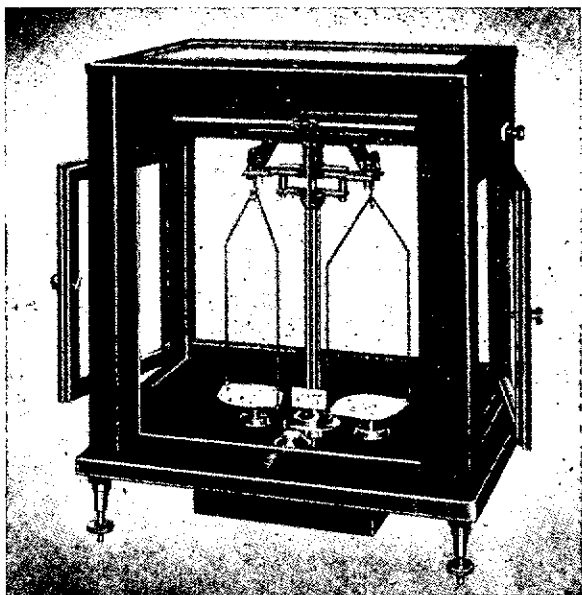
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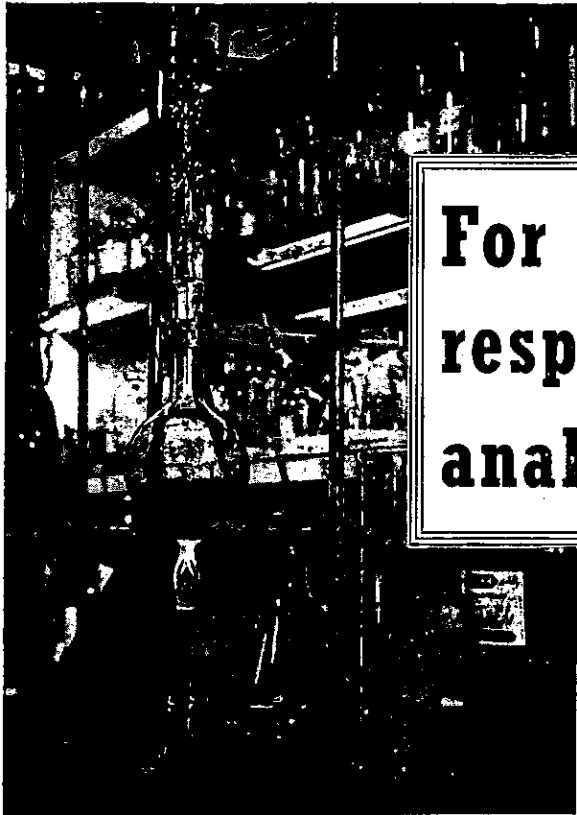
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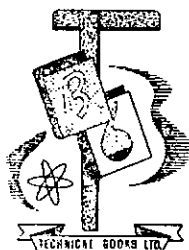
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Sir William Perkin

founded the modern synthetic dyestuffs industry. He began his chemical career as an assistant at the Royal College of Chemistry, but his first great discovery was actually made in his spare time in a rough laboratory at home when he was no more than eighteen.

This took place in 1856, when Perkin was trying to prepare quinine artificially. He failed to produce synthetic quinine, but by oxidizing crude aniline with potassium dichromate obtained a dark solid which turned out to be a good purple dye. It was, in fact "mauve" the first of the great family of aniline dyes. Perkin took out a patent for the manufacturing process and, in 1857, set up a factory near Harrow. This was the beginning of the aniline dye industry, which has since become of key importance to the civilized world.

Born in London in 1838, Perkin was educated at the City of London School before proceeding to the Royal College of Chemistry. As well as discovering "aniline purple" he also invented a process for manufacturing alizarin (the red dye of madder root). Achieving financial independence as a result of his discoveries, he was able to devote his attention to pure chemical research. He was President of the Chemical Society in 1883 and of the Society of Chemical Industry in 1884. He was knighted in 1906, the jubilee of his discovery of the first aniline dye.

