JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. 26 No. 4
August, 1962

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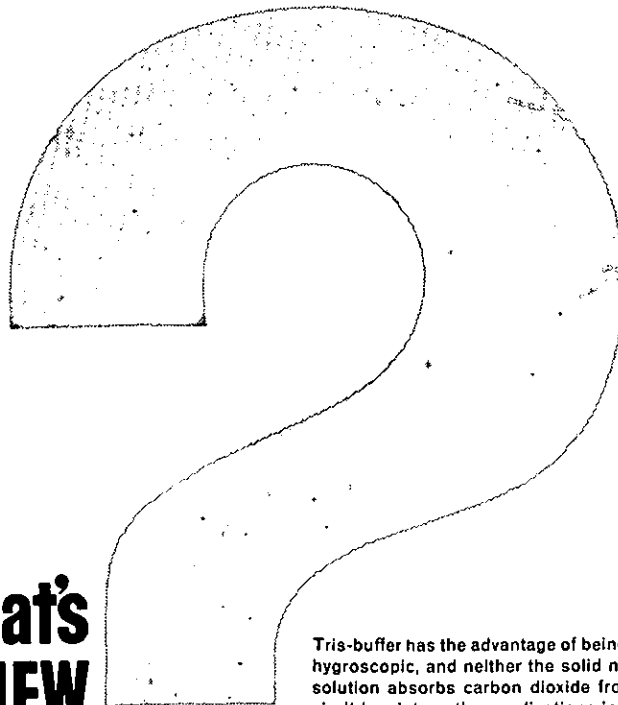

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1. Whitehead, T. H., *J. Chem. Educ.*, 1959, **36**, 297.
2. Williams, T. R. and Harley, J. D., *Chemist-Analyst*, 1961, **50**, 114.
3. Davies, M. T., *Analyst*, 1959, **84**, 248.

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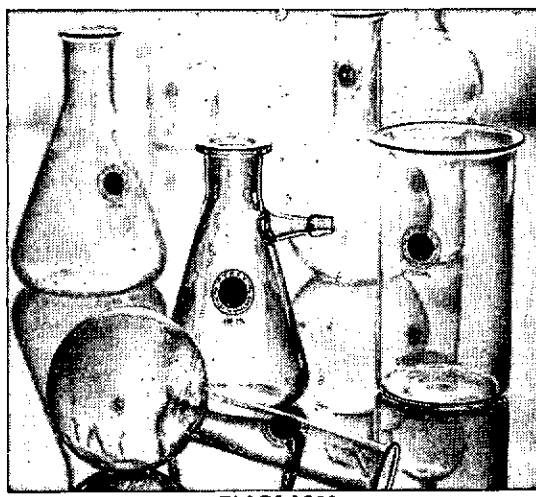

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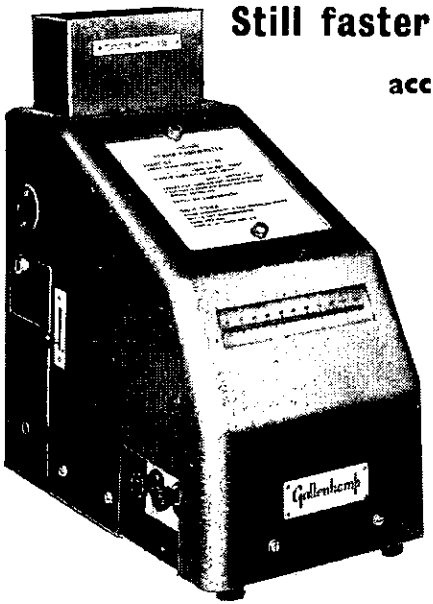

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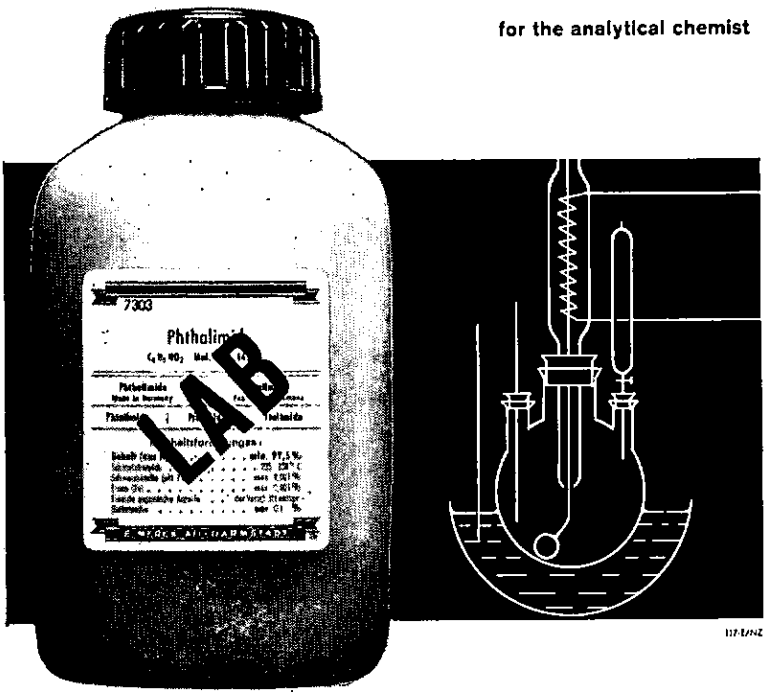

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JOURNAL OF THE NEW ZEALAND
INSTITUTE OF CHEMISTRY

Vol. 26, No. 4 AUGUST, 1962

1962 CONFERENCE AND 10th SCIENCE CONGRESS

(Contributed by the Conference Committee.)

This issue contains the abstracts of papers to be presented at the 1962 Conference of the New Zealand Institute of Chemistry. It includes also abstracts covering the meetings of the Chemistry Section of the Tenth New Zealand Science Congress. The convenient arrangements made regarding the timing of these two meetings should meet with the approval of members and is only one result of the close and happy co-operation which has existed between the two organizing committees. The provision for members to take part in the Congress excursions and the joint financing of the visit of a guest lecturer have been of great help to the Institute Conference Committee, while the participation of so many of our members in the Chemistry Section of the Congress must strengthen the Congress as a whole.

The Conference this year is to be held at Lincoln for the first time and a very large proportion of the Conference delegates will be "in residence". This should give ample opportunity for those informal discussions, not only of chemistry but of other common interests as well, which enable members to appreciate and understand the work of their fellow chemists.

In the formal sessions the papers to be presented cover a very wide spectrum of chemical interest, with topics as diverse as the possible biological origin of chemicals in meteorites and the properties of man-made polymers. The Committee is confident that the programme includes contributions of real interest and value to all those who will attend.

We wish you a very pleasant and instructive week in Canterbury.

DOCTORATE OF SCIENCE AWARD

Dr F. N. Fastier

Dr F. N. Fastier, Associate Professor of Pharmacology in the Department of Medicine at the Otago University Medical School, was recently awarded the degree of Doctor of Science of the University of New Zealand. An account of Dr Fastier's training and career was published in the *Journal* in 1956 (April issue, page 56) when he was Chairman of the Otago Branch. Since then he has continued his research on the influence of chemical structure on pharmacological activity and is author or part author of about fifty papers, mainly concerned with this subject.

ROYAL INSTITUTE OF CHEMISTRY MONOGRAPHS FOR TEACHERS

The first three monographs published by the Royal Institute of Chemistry to provide "concise and authoritative accounts of selected well-defined topics in chemistry for the guidance of those who teach the subject at G.C.E. Advanced Level and above" were reviewed in the *Journal* in October, 1960. Two further monographs are now available from the Registrar of the New Zealand Institute of Chemistry. *Principles of Metallic Corrosion,* by J. P. Chilton, and *Principles of Chemical Equilibrium,* by P. G. Ashmore, are Nos. 4 and 5 of the series respectively, and others on Volumetric Analysis, The Colloidal State, and the Classification of the Elements are in preparation.

It is to be hoped that the initiative of the N.Z.I.C. Council in importing these monographs will be followed by teachers of chemistry buying them for their own use, and seeing in addition that a set is available in their school libraries. It is true that two of the monographs (No. 3, Ives on Extraction of Metals, and No. 5, Ashmore on Chemical Equilibrium) require, for their full comprehension, a sound basis of elementary thermodynamics. But such a basis has now for many years been provided in the universities in New Zealand, usually at Stage II and not later than Stage III. Despite the shortage of science teachers, there are many schools with at least one chemistry teacher with such a background, for whom Ashmore's monograph is an admirable refresher course in the principles of equilibrium.

The case for having a full set of the monographs in a school library, despite the fact that Nos. 3 and 5 in particular are well above the level of scholarship chemistry, is a strong one. All should be available to the teachers, and there are parts of each, except perhaps Ashmore's, which a keen scholarship candidate could read. Such booklets reveal to the pupil that there is more to chemistry than is contained in the standard high school texts. Chemistry must compete with subjects such as mathematics and physics for the interest of the abler pupils. These are often mathematically minded, and the presence of the more advanced monographs in the school library should show them that chemistry also offers scope for their talents. The prices of the monographs (from 3s. 6d. to 6s.) do not excuse their absence from the school library.

H. N. PARTON.

Conference, 1962

Professor C. W. Shoppee, F.R.S., Conference Guest Lecturer. (A biographical note on Professor Shoppee was published in the April, 1962, issue of the Journal, *page 62.)*

ABSTRACTS OF PAPERS

A CHEMICAL APPROACH TO THE ORIGINS OF LIFE

MICHAEL H. BRIGGS and A. T. WILSON
Victoria University of Wellington.

A detailed outline of the the theory of chemical evolution will be presented. Evidence regarding probable surface conditions on the primitive earth will be discussed. Simulation of these conditions in the laboratory leads to the production of numerous organic compounds of both low and high molecular weight. Most of these compounds are constituents of modern organisms. The possible evolution of cellular life-forms from undifferentiated organic matter will be discussed.

STRUCTURE-ACTION RELATIONSHIPS IN PHARMACOLOGICAL CHEMISTRY

F. N. FASTIER
Department of Medicine, University of Otago, Dunedin.

To help elucidate more complex structure-action relationships, studies have been performed in which (1) the prototype drug is of simple structure, (2) it possesses distinctive pharmacological properties, (3) it is not readily metabolized, and (4) enough of its chemical relatives are readily available to permit systematic modification of the physical and structural attributes of the prototype. The results of such a study will be described.

THE CHEMICAL CONSEQUENCES OF IONIZING RADIATION

J. E. PACKER
University of Auckland.

The last 20 years have witnessed the rapid growth of radiation chemistry, the study of the formation of chemical products on absorption of ionizing radiation in a medium. When it was realized, soon after the last war, that large quantities of radioactive materials would become available, considerable efforts were made to find useful applications of the emitted radiation. The approach of irradiating all sorts of materials in the hope of inducing useful new properties failed, and it was realized that an understanding of the fundamental processes involved was required. This, together with the importance of radiobiology, supplied a stimulus which has resulted in radiation chemistry becoming such a vigorous and exciting part of physical chemistry.

The interaction of radiation with matter can be divided into four stages:

(1) The physical stage, 10^{-17} to 10^{-15} sec, in which energy is transferred to the medium, with the formation of ions and excited molecules.

(2) The physico-chemical stage, 10^{-12} to 10^{-11} sec, in which thermal equilibrium is reached.

(3) The thermal chemical stage, 10^{-3} sec, in which the newly-formed species react to form the ultimate chemical products.

(4) The biological stage which encompasses the response of the organism to the foreign chemical substances produced.

The physical stage is the best understood, and it is the job of the radiation chemist to attempt to elucidate the second and third stages. This involves reactions of the intermediate species, ions, excited molecules and free radicals. The radiation chemist thus calls upon many other branches of chemistry to help him understand the processes occurring.

All living matter is made up largely of water and therefore aqueous systems have received more attention than any other as an understanding of these systems is fundamental to radiation biology. The general features of the system are now well understood, but even after 17 years of intensive research some very basic questions remain to be answered.

FATTY ACIDS OF PLANT LIPIDS IN RELATION TO TAXONOMY

ISOBEL M. MORICE
Fats Research Laboratory, D.S.I.R., Wellington.

Fatty acids from plant lipids vary both in types and proportions. Certain unusual fatty acids such as chaulmoogric and petroselinic acids have been obtained only from certain plant families. In other families or genera it is the proportions of the ordinary fatty acids which appear to be characteristic. Work on seed fats in this laboratory shows that amongst monocotyledons it is the overall pattern rather than the presence of any unusual acids which appears to correspond with the botanical classification.

FACTORS AFFECTING THE ECONOMICS OF CHEMICAL MANUFACTURE IN NEW ZEALAND

W. I. WHITTON
I.C.I. (N.Z.) Ltd.

The aim of this paper is to consider the most important factors affecting the economics of chemical manufacture, and hence to suggest ways in which the chemical industry might develop in New Zealand.

The possibility of manufacturing for export or the desirability of making chemicals for the local market are both governed by the cost of production in New Zealand relative to world prices. For export, products must be near to or below world prices. For the local market they can be made and sold above imported price only if given the necessary protection.

The major factors affecting cost of production per ton are level of output; costs of raw materials, services, labour and distribution; certain works general charges; and the capital charges, depreciation,

maintenance and return on capital. Among these the first is of particular importance because of the bearing it has on the others. Whilst level of output does not greatly affect raw material, service and distribution costs, it can have a very significant effect on labour, works general charges, and, above all, capital charges per ton.

Thus the fixed capital cost of many chemical plants varies according to the 0.6 rule; that is:

$$\frac{\text{Cost of plant B}}{\text{Cost of Plant A}} = \frac{(\text{Size of plant B})^{0.6}}{(\text{Size of plant A})}$$

Hence a plant B three times the size of A costs only about twice as much as A; a plant B ten times the size of A costs only about four times as much as A. Since the capital charges are a certain percentage of the fixed capital cost, these vary also according to this rule, and capital charges per ton of product therefore become significantly higher for a smaller plant.

In some processes, especially those involving the use of small vessels, the 0.6 rule is not obeyed, and capital cost becomes more closely proportional to size. Cost per ton of product from such a plant is therefore less dependent on level of output, and the small plant is more nearly competitive with the large plant. It is probably this type of plant which can most easily be established in New Zealand.

However, very careful consideration should be given to establishing the high capital cost, or capital intensive sections of the industry, for in these the value of output per man can be £6,000 to £8,000 per annum, against the average for all New Zealand industry of about £1,500 per man per annum. The contribution to the Gross National Product of a capital intensive industry can thus be of considerable value, and such an industry may well justify a higher degree of protection than is at first apparent.

A REVIEW OF SOME CHEMISTRY RELATED TO WOOD UTILIZATION

G. A. NICHOLLS

N.Z. Forest Products Ltd., Auckland.

The influence of chemical pulping on lignin distribution across wood fibres is described prior to outlining the cyclic nature of the kraft pulping process. In this process sodium hydroxide and sulphide cause lignin to split into fragments which dissolve in the digesting liquor from which can be derived some useful products, including dimethyl sulphide and dimethyl sulphoxide. Lignin removal from unbleached kraft pulp is discussed with particular reference to chlorination.

KRAFT PULP BLEACHING

W. W. OLSEN
Tasman Pulp and Paper Company Ltd., Kawerau.

The removal of residual lignin and colouring matter on or within the fibre structure of kraft wood pulp can be accomplished by the following methods:

(1) Chlorination, involving mainly substitution reactions forming chlorinated products of the non-cellulosic residues which are largely soluble in hot alkaline solution.
(2) Alkaline hypochlorite bleaching, involving both chlorination and oxidation reactions, and
(3) A wide variety of special bleaching agents including as the most important commercially, peroxides, chlorine dioxide and chlorites.

THE PREPARATION OF RAYON GRADE PULPS FROM PINUS RADIATA

D. J. BRASCH, K. W. FREE, D. H. TUCKER and T. A. VINCENT
Dominion Laboratory, Wellington.

The technical aspects of the pilot plant production of high alpha-cellulose pulps from New Zealand grown *Pinus radiata* are discussed. A three-step process involving a prehydrolysis cook, a kraft cook and multistage bleaching is used. Variations in the severity of the pre-hydrolysis lead to a wide range of dissolving pulps. Standard kraft pulping conditions are used throughout, and pulp purification involves chlorination and alkali extraction followed by a series of oxidizing bleaches. Pulps suitable for dissolving purposes are obtained in good yield.

INDUSTRIAL ASPECTS OF RAYON PULP PRODUCTION IN NEW ZEALAND

D. H. TUCKER
Dominion Laboratory, D.S.I.R., Wellington.

Engineering, economic and marketing aspects of a possible rayon pulp industry, based on the technical information given in the preceding paper, show that such an industry is the logical next step in forest utilization for export purposes. Topics discussed include dissolving pulp uses and production, world market factors, possible markets for New Zealand production, production costs, alternative and secondary products, and comparisons, on a net export earning ability basis, between dissolving pulp and other wood-based industries.

BIOCHEMICAL ADAPTABILITY OF A SOIL MICRO-ORGANISM

R. D. BATT and G. G. MIDWINTER
Medical School, University of Otago, Dunedin.

The indigenous microbial population of the soil includes a group of organisms which are characteristically aerobic, biochemically versatile and nutritionally non-exacting. A typical representative of this group is *Nocardia corallina* which may be enriched from soil by using a pyrimidine (uracil, thymine or cytosine) as the main source of carbon and nitrogen. The ability of this micro-organism to survive and multiply under the variable conditions likely to occur in soil has been considered in interpreting the results of studies on the biochemical versatility of the organism.

The large endogenous reserves in soil micro-organisms such as *N. corallina* have the effect of stabilizing them against lysis and death under conditions of prolonged nutrient depletion. The mechanisms by which the endogenous reserves are synthesized and subsequently degraded in *N. corallina* have been studied using radioisotopes. A comparison of the rate of incorporation of ^{14}C from labelled nutrients into cellular fractions, with the subsequent release of the isotope during respiration in the absence of external nutrients, has shown that assimilation rates are much higher than the rates of mobilization of endogenous reserves. Cells grown under a variety of conditions have been analysed for fluctuations of cellular reducing sugars, amino acids, peptides, ammonia and lipids. Approximately half of the endogenous substrate is lipid in nature. The turnover of these lipids has been studied during endogenous respiration and active assimilation by gas-chromatography of isolated fatty acids with the simultaneous determination of ^{14}C in the fractions leaving the columns.

The ability of a soil micro-organism to utilize for growth the types of organic substances likely to occur in soil will presumably determine, in part, the survival of the organism in mixed cultures with other soil micro-organisms. The versatility of *N. corallina* has been examined by testing its ability to grow on or oxidize (as cell suspensions) a total of 160 compounds which may be the hydrolysis products of biological tissues or compounds related chemically to such natural products. Of the 88 compounds oxidized, 28 were attacked initially by induced enzymes. The induction of enzymes in soil micro-organisms may represent a process for economy in the utilization of cellular nitrogen, *i.e.*, an enzyme for substrate attack is synthesized by the cell only when the cell has the substrate available for oxidation.

SOME ASPECTS OF LIPID METHODOLOGY WITH SPECIAL REFERENCE TO THE LIVER LIPIDS OF SHEEP DOSED WITH SPORIDESMIN

J. ANDREW PETERS
Fats Research Laboratory, D.S.I.R., Wellington

Because of the labile nature of many simple and complex lipids their isolation and subsequent identification depend to a large extent on the methods by which they are isolated from the tissue.

With the development of more refined techniques many of the conclusions of earlier workers have been found to be erroneous. Thus, the information obtained within the last 20 years has changed significantly many of the older accepted concepts of the structure, stability and reactivity of the naturally occurring lipids.

Several methods of lipid extraction are discussed, with emphasis on the fact that choice of a particular method depends on the nature of the problem and the type of biological material under study. The method is so chosen as to minimize degradation.

Chemical analysis of lipid mixtures from tissues indicates the presence or absence of structural groups. However, this type of analysis does not necessarily provide evidence on the extent of degradation of the lipid molecule during the extraction procedure.

More refined macro procedures, such as column chromatography, for the isolation of various classes of lipids are discussed, together with some of the pitfalls encountered.

Identification of the individual lipids on a microscale can now be accomplished by a combination of infrared spectrometry, paper chromatography and gas-liquid chromatography.

A combination of these recent developments of lipid extraction, isolation and identification have been applied to the liver lipids of normal sheep and of sheep dosed with sporidesmin.

SOME REACTIONS OF 3,5-CYCLO-STEROIDS

M. P. HARTSHORN
University of Canterbury, Christchurch.

Earlier workers have shown[1] that direct bromination of 3,5-cyclocholestan-6-one (i-cholestan-6-one) gave only products in which the cyclopropyl ring system had been destroyed by the addition of bromine. Thus reaction with one mole of bromine gave 3β,5α-dibromocholestan-6-one, while reaction with two moles of bromine gave mainly 3β,5α,7β-tribromocholestan-6-one.

7α-bromo-3,5-cyclocholestan-6-one, in which the reactive cyclopropyl ring system is still present, has now been prepared. The reaction scheme will be described.

REFERENCE

[1]SHOPPEE, REES, SUMMERS, and PHILLIPS (1959): *J. Chem. Soc.*, 2786.

THE LADENBURG REARRANGEMENT OF N-ALKYL PYRIDINIUM HALIDES

L. K. CREAMER, A. FISCHER and J. VAUGHAN
University of Canterbury, Christchurch.

The Ladenburg rearrangement, as normally reported, is one in which an N-alkyl pyridinium halide rearranges, on heating, to yield a mixture of α- and γ-alkyl pyridines. The reaction is formally similar to other known rearrangements, but analogy would lead us to expect the major products to be β-substituted pyridines.

No systematic study of the rearrangement has been reported since Ladenburg's initial experiments last century. We have now developed methods for the quantitative analysis of product mixtures; we have studied the response of the product mixture to variation of time, temperature, halogen and alkyl group. Results to date are presented and discussed.

ISOTOPIC ANALYSIS OF THE OXYGEN ATOMS OF ENRICHED CARBOXYLIC ACIDS

MISS C. J. BISHOP, D. R. LLEWELLYN and A. L. ODELL
University of Auckland.

In general, carboxylic acids exchange their oxygen atoms at a measurable rate with solvent water and this rate can be followed by using enriched water as solvent and precipitating the acid as insoluble metal salt.

Most organic compounds containing oxygen, including carboxylic acid metal salts, can be decomposed by heat to carbon monoxide or carbon dioxide for mass spectrometric analysis, but if this decomposition is carried out at a high temperature in glass apparatus ^{18}O of the liberated gas is likely to be lowered by exchange with the normal oxygen of the glass container. A new pyrolysis apparatus has been designed in which the organic compound is decomposed by heating on a carbon block and in which the memory effect, which has previously been the main disadvantage of this method, has been eliminated. This has enabled the pyrolysis method to be used as a single sample technique with as little as 5 mg of most compounds.

The carbon dioxide from carboxylic acid salts is contaminated with organic products which interfere with the mass spectrometric analysis, but the products which cannot be condensed out by solid carbon dioxide can be converted to less volatile and therefore condensable compounds by mixing with bromine and passing through a carbon tube at dull red heat.

The rates of exchange of acetic acid, aminoacetic acid, trimethyl acetic acid and oxalic acid have been followed over a hydrogen ion concentration of 4M to 10^{-12}M between 0°C and 126°C and have been related to the various species present in solution.

THE ENTROPIES OF MELTING OF CRYSTALLINE POLYMERS

G. N. MALCOLM
University of Otago, Dunedin.

The determination of the entropies of fusion of isotactic vinyl polymers is of considerable interest as a means of examining their molecular structure. If these substances possess comparatively stiff molecular chains (as has been suggested), their entropies of fusion should be comparatively small. However the entropy of fusion of isotactic polypropylene has been found to be 5.8 ± 0.2 e.u. per mole of crystalline repeating units which is almost as large as the value 5.85 e.u. which has been reported for poly-(ethylene oxide). The latter polymer should possess considerable chain flexibility. But both these entropy values include not only the change of configurational entropy on melting but also the entropy of volume change on melting. Only if this latter quantity can be determined will a comparison of the changes of configurational entropy on melting be possible.

The entropy of volume change on melting is given by the expression $\Delta S = (\delta P/\delta T)_v . \Delta V_u$, where $(\delta P/\delta T)_v$ is the thermal pressure coefficient of the polymer at its melting point and ΔV_u is the volume change on melting per mole of crystalline repeating units. The latter quantity is related to the total entropy of fusion by the Clapeyron-Clausius equation

$$dT_m/dP = \Delta V_u/\Delta S_u$$

where T_m is the temperature of melting.

Measurements have been made of the thermal pressure coefficients and the changes of melting point with pressure for isotactic polypropylene, poly-(ethylene oxide) and linear polyethylene (Marlex 50). The results have been used to calculate the configurational entropy of melting in each case.

PARAMETERS IN THE CALCULATION OF ASSOCIATION CONSTANTS FROM SOLUBILITY MEASUREMENTS

M. H. PANCKHURST
Department of Chemistry, University of Otago, Dunedin.

Information about association reactions in solution can be obtained from measurements of the solubility of a sparingly soluble salt in electrolyte solutions. Measurements of the solubility of thallous chloride in dilute aqueous chloride solutions have been reported in the literature. These measurements are analysed in detail paying particular attention to activity coefficient assumptions. It is shown that the measurements can be represented equally well by a range of parameters and the possibility of narrowing this range by ultra-violet absorption spectra measurements is discussed. An alternative method of analysis (that of "corresponding solutions") recently introduced by Smith, 1962, (*Trans. Faraday Soc. 58*, 350) is also discussed.

HEATS OF MIXING OF SOME NON ELECTROLYTE SOLUTIONS CONTAINING FLUOROCARBONS

A. G. WILLIAMSON
Department of Chemistry, University of Otago, Dunedin.

Mixtures of n-alkanes + perfluoro-n-alkanes have large positive heats of mixing consistent with the weak interactions between compounds of these types.

Heats of mixing have been measured for the systems $C_7F_{15}H$ + acetone and $C_7F_{15}H$ + dioxan, in which hydrogen bonds may be formed between the two components of the mixture. The heats of mixing for these systems are positive at low mole fractions of fluorocarbon and negative at high mole fractions of fluorocarbon. These results are in striking contrast with the heats of mixing in the similar systems chloroform + acetone and chloroform + dioxan in which the heat of mixing is everywhere negative.

Previous attempts to explain the behaviour of the chloroform-containing systems have been based solely on the formation of hydrogen-bonded species of the type AB and AB_2. Explanations of this type fail for the fluorocarbon systems because they cannot account for a positive heat of mixing. Attempts to account for the behaviour of these systems in terms of a non-specific interaction giving a positive contribution to the heat of mixing and a specific (hydrogen bond) interaction giving a negative contribution, are discussed.

STUDIES ON THE BIOSYNTHESIS OF MOULD TROPOLONES

W. SEGAL and A. G. ANDREW*
Victoria University of Wellington.

The biosynthesis of stipitatic acid (6-hydroxytropolone-4-carboxylic acid) and stipitatonic acid (6-hydroxytropolone-4,5-dicarboxylic anhydride) by *Penicillium stipitatum* has been investigated using labelled acetate, glucose and glycine. Other evidence suggests that stipitatonic acid is the immediate biological precursor of stipitatic acid. Samples of active metabolites have been degraded and the results compared with those of other workers.

On the basis of early results using labelled acetate, glucose and formaldehyde, a biosynthetic pathway was proposed involving direct condensation of small aliphatic precursors to a seven-membered ring. This pathway was based on what is now believed to be an untenable assumption in the alkaline rearrangement of stipitatic acid to 5-hydroxy*iso*phthalic acid. This assumption concerns the origin of the new carboxyl group, which is now believed to come from C_1 rather than C_2 of stipitatic acid. A new degradation scheme designed to test this assumption has been developed. Activity from 2-^{14}C-glycine in the culture medium was found to be incorporated well into stipitatic acid, but only to a minor extent into C_1 and C_8, and this will be shown to invalidate the proposed condensation theory for biosynthesis.

It will be shown that our results with glucose, acetate, and glycine lend support to the currently popular theory of mould tropolone biosynthesis, namely, ring expansion from an acetyl-CoA- and malonyl-CoA-derived benzenoid precursor such as orsellinic acid. Such metabolites have been found in other species of *Penicillium*, but not yet in *P. stipitatum*.

*Present address: Plant Chemistry Division, D.S.I.R., Palmerston North.

AMINO ACID ACTIVATING ENZYMES IN PLANT TISSUES

ESAM MOUSTAFA
Plant Chemistry Division, D.S.I.R., Palmerston North.

Amino acid activating enzymes were found in cell-free extracts prepared from both wheat germ and root nodules. The action of these enzymes was demonstrated by two methods: (a) phosphate exchange between ^{32}P pyrophosphate and adenosine triphosphate and (b) formation of ^{14}C amino-acyl-ribonucleic acid.

Wheat germ was found to be a good source of amino-acid activating enzymes, comparable with animal tissues, such as liver and pancreas, known to be rich sources for these enzymes. The enzymes prepared from wheat germ can catalyse phosphate exchange between ^{32}P pyrophosphate and adenosine triphosphate in the presence of each of the amino acids that naturally occur in proteins. These enzymes can also catalyse the formation of amino-acyl-ribonucleic acids in the presence of ribonucleic acid prepared from either wheat germ or pea seedlings.

THE ROLE OF PHENOLIC ACIDS IN APPLE FRUIT

J. R. L. WALKER
Cawthron Institute, Nelson.

Apple fruits have been shown to contain the following phenolic compounds: chlorogenic acid, *p*-coumarylquinic acid, catechin and *epi*-catechin. These compounds are acted upon by the enzyme polyphenol-oxidase to yield complex brown pigments; they are also responsible for the astringent taste of certain apple varieties. The results of a survey of the "browning capacity" and other closely related factors such as chlorogenic and ascorbic acid levels and total phenolic content in several local apple varieties will be mentioned, and the importance of phenolic compounds in plants discussed.

THE AVIDIN-BIOTIN COMPLEX

P. D. JONES and M. H. BRIGGS
Department of Chemistry, Victoria University of Wellington.

The raw white of hens' eggs is toxic to many mammals, as it induces biotin-deficiency. The toxic constituent of egg-white is a basic protein present in only small amounts (c.0.06%) that has been named "avidin". Similar proteins are present in egg-whites of the goose, the duck, and the turkey. Avidin combines with biotin to form a biologically inert complex both *in vivo* and *in vitro*. Two molecules of biotin combine with one molecule (M.W. 66,000 to 68,000) of avidin.

Avidin has been separated into three components: two water-soluble glycoproteins and a deoxyribonucleoprotein. All combine with biotin.

Biotin is not released from combination with avidin by proteolytic enzymes, or by any reagent other than 0.45% H_2O_2. It can be completely released by steaming the complex.

The present studies have been undertaken to investigate the chemical linkage between biotin and avidin. The complex has been hydrolysed enzymically, and also by acid, and the resulting peptides and amino acids separated by chromatography. Experiments have been conducted to determine the nature of the protein fragment combined with biotin.

A comparative investigation of bird egg-whites for the presence of avidin will be reported.

ADDUCTS OF THE GROUP V TRIHALIDES

W. R. ROPER and C. J. WILKINS
Chemistry Department, University of Canterbury, Christchurch.

A number of crystalline adducts have been prepared by addition of the base 2,2'bipyridine to Group V trihalides in non-aqueous solvents. The compounds are slightly soluble in nitrobenzene and, apart from the bismuth compounds, form conducting solutions in this solvent. In cases where it was difficult to isolate a pure crystalline derivative it was shown by conductimetric titration that halide and base reacted in equimolar proportion. The phenyldihalostibines, $PhSbX_2$, and the phenyldihalobismuthines, $PhBiX_2$, retain acceptor properties but the diphenylhalostibines, Ph_2SbX, and the diphenylhalobismuthines, Ph_2BiX, have no acceptor properties towards bipyridine. Replacement of a halogen by a phenyl group reduces the degree of ionization of the resulting adduct. Ionization of the compounds decreases from phosphorus to bismuth and increases with increase in atomic weight of the halogen. These trends and the probable manner in which the compounds ionize will be discussed.

STRUCTURAL EVIDENCE FOR THE REACTION OF BERYL WITH SOME FLUORIDES

J. M. WATERS
University of Auckland.

An X-ray examination has been made of the products of the reaction of beryl with sodium fluoride, silicon tetrafluoride and sodium fluorosilicate. The evidence, taken with that from chemical analysis, has enabled three stages in the reaction of beryl with sodium fluorosilicate to be recognized. The first of these leads to a soluble fluoroberyllate, cryolite (Na_3AlF_6) and cristobalite (SiO_2) and the second to albite ($NaAlSi_3O_8$). The third stage, occurring when all the beryl has decomposed, produces albite, sodium fluoride and silicon tetrafluoride by reaction between cryolite and cristobalite.

THE SEPARATION OF SULPHUR COMPOUNDS FROM FUMAROLE GASES

S. H. WILSON

Institute of Nuclear Sciences, D.S.I.R., Lower Hutt.

Sulphur can occur in a number of compounds in the transition by way of volcanic steam from the sulphide form in the earth's depths to sulphate stable at the surface. When, as well as the determination of the forms present, separation of the sulphur in the different compounds is required to measure the stable isotope ratios, the problems are rather more difficult.

Two types of fumarole (or boiling pool) occur. The first in volcanic craters is fed directly by magmatic steam, the second indirectly, for the steam comes from hot chloride water at 200 to 300°C.

Problems are simplest with the second type. If bores are available, only the hydrogen sulphide and the sulphate in the chloride water need consideration, and the problems are in sampling not in separation.

In many areas only boiling acid springs can be sampled, and polythionates may also be present in the waters. R. M. Golding suggested that owing to the stability of the dithionate ion, and the difficulty of its determination, its natural occurrence might have been overlooked. This worker did indeed find dithionate in samples from acid pools, and the author has separated enough barium sulphate from dithionate for stable isotope determinations.

The separation of the sulphur compounds in volcanic gases is of much greater difficulty and interest. Sulphur occurs in the forms, free sulphur, sulphur dioxide, hydrogen sulphide, and sulphuric acid. Unfortunately, on condensing the steam, sulphur dioxide and hydrogen sulphide give sulphur and polythionic acids.

The collection flask is extracted with water, and sulphur filtered off. An unsolved problem is the distinction of sulphur in the gas from sulphur formed on condensation.

Separation of sulphur dioxide and hydrogen sulphide removed from the extract by a current of nitrogen is effected by Tutweiler's method of oxidizing sulphur dioxide only in an acid hydrogen peroxide solution. Sulphate can then be removed from the extract as barium sulphate.

If one determines x in the average formula of the polythionic acids, H_2SxO_6, it is then possible to calculate the original amounts of hydrogen sulphide and sulphur dioxide. Two different methods of determination are required. The first is titration in 4N HCl with KIO_3, the second the precipitation of the sulphur formed as barium sulphate.

An example of problems on which further work on these lines is required is whether appreciable amounts of polythionates in boiling

pools can be reliably taken as evidence of sulphur dioxide in the steam, and hence of direct magmatic origin.

SOME CO-ORDINATION COMPOUNDS OF RHENIUM

J. E. FERGUSSON and J. GAINSFORD
University of Canterbury, Christchurch.

Some problems associated with the characterization of co-ordination compounds of rhenium will be discussed.

A spectrophotometric analytical method for rhenium has been recently published[1] which involves the formation of a rhenium α furildioxime complex. This complex as investigated by Martin and Meloche[2] has been formulated as Re^{II} (α-furildioxime)$_2$. However, a further study by us shows that the rhenium is in the oxidation state IV and that it is doubtful whether the ligand in the complex is in fact the dioxime, owing to the conditions in the preparation of the co-ordination compound.

The preparation of other oxime complexes of rhenium and the methods used to deduce the composition of these types of compounds will be discussed.

REFERENCES

[1]MARTIN, MELOCHE and WEBB (1957): *Ind. Eng. Chem.*, Anal Ed., *29:* 527.
[2]MARTIN and MELOCHE (1958): *J. Inorg. Nucl. Chem., 6:* 210.

THE MANUFACTURE OF EDIBLE AND INEDIBLE TALLOW AND ITS CHEMICAL CONTROL

M. S. CARRIE
The Canterbury Frozen Meat Co. Ltd., Christchurch.

Animal fats can be extracted from the meat tissues by one of three methods or by a combination of them: (a) by heat treatment, (b) by mechanical methods, and (c) by solvent extraction.

The methods used commercially usually involve heat treatment at some stage of the extraction. Purification of the extracted tallow consists of the removal of suspended matter and water either by settling under gravity or by means of centrifugal separation.

Tests done regularly on tallow include: (a) free fatty acid, (b) titre (m.pt. of the fatty acids), (c) colour, and (d) moisture.

Of these, the titre is determined solely by the nature of the raw material. The others can be controlled to some degree during processing.

The stability towards oxidation and amount of oxidative rancidity are also of interest. Methods of processing have an effect on rancidity, but there is an increasing tendency to control it by the use of anti-oxidants.

SOME RECENT TRENDS IN THE UTILIZATION OF ANIMAL FATS

L. HARTMAN

Fats Research Laboratory, D.S.I.R., Wellington.

Although New Zealand output of animal fats appears small compared with world production, nevertheless the export of tallow from cattle and sheep (some 50,000 tons annually, worth approximately £4,000,000) represents a welcome addition to the national income. Most of New Zealand inedible tallow is used in the manufacture of soap both here and overseas and the shrinkage of this market, due to the rapidly expanding demand for synthetic detergents, calls for investigations of other possibilities for tallow. These possibilities include the preparation of various tallow derivatives for edible and technical purposes. Some of these avenues have already been successfully explored in this country; others, especially the preparation of synthetic detergents based on tallow, still present problems, mainly owing to the comparatively high molecular weight of the main fatty acid constituents of tallow. The most important recent outlet for tallow is in the field of poultry and other livestock feeds. A major development in this regard began some ten years ago in the U.S.A. where the increased use of tallow and grease in animal feeds has more than made up for the decline of the consumption of these fats in soap manufacture. The commercial possibilities in New Zealand, especially in the "broiler" raising industry, are considerable, and problems and research needs involved will be discussed on the basis of the limited work carried out in the Fats Research Laboratory in collaboration with the Department of Agriculture.

FATS AND THE INCIDENCE OF HEART DISEASE

G. G. DUNCKLEY

Medical School, University of Otago, Dunedin.

Clot formation arising at sites of atherosclerosis in the heart's own blood vessels is one of the major recorded causes of death in Western countries today. Diagnosis during life of the cause of heart disease from this kind of arterial degeneration had scarcely been possible until the electrocardiograph came into more general use in the last three decades. In spite of the widespread occurrence of this disease it is still not known why or how atherosclerosis develops. It is known,

from analyses, that cholesterol is a major constituent of the lipid deposit formed on the artery wall. Workers in the U.S.A. have been preoccupied with the theory that diets containing excessive amounts of saturated fats (*e.g.*, butter, mutton and beef fat) and too little unsaturated fat (as in corn oil) raise blood-cholesterol levels, and hence, so these workers allege, these diets increase the risk of deposition of cholesterol in the arterial lining. There is no doubt about the effect of types of dietary fat on blood cholesterol level in the majority of human cases, but what connection this has, if any, with coronary heart disease is, as yet, unknown. Recent evidence from animal experiments in New Zealand and elsewhere, and also from studies of races of differing dietary habits, does not give unequivocal support to the hypothesis that reducing the fat content of the diet or changing the fat from saturated to unsaturated will reduce the risk of developing coronary heart disease when the total caloric intake is kept constant.

Something more than infiltration—which is what is implied by the philosophy of too much in the diet, leading to too much in the blood and this in turn leading to too much of something in the arterial wall—is required to explain the natural history of atherosclerosis.

Active metabolic processes on the part of the cells in the inner layer of the arterial wall may explain the intracellular accumulation of abnormal lipids. Many abnormalities of enzyme systems in atherosclerosis have been reported. Hormonally controlled enzyme systems may determine turnover rates of metabolites including lipids in the arterial wall. Present evidence for the various theories will be reviewed.

ORGANIC CHEMISTRY OF METEORITES

M. H. BRIGGS and G. B. KITTO
Victoria University of Wellington.

A group of aerolites, known as the carbonaceous chondrites, contain small amounts of organic matter of extra-terrestrial origin. There are currently two conflicting hypotheses on the nature of this organic matter[1]. One hypothesis suggests that the meteorites contain the debris of an extra-terrestrial life-form; the other that the organic matter is abiogenic and was formed in space by radiation-induced reactions. These meteorites consequently raise two separate problems, first, the nature of organic compounds present; secondly, whether these compounds were once constituents of living cells.

Several studies of the nature of the meteorite organic compounds have been undertaken[2,3]. The studies are difficult for several reasons. First the amount of meteorites available for investigation is strictly limited, secondly, the organic matter is present only in small amounts and is a complex mixture of compounds. Among the compounds so

far identified are linear and cyclic paraffins, aromatic compounds, low molecular weight organic acids, chlorinated aliphatic acids, purine derivatives and other heterocyclics, and traces of urea and acetamide. Many of these substances could be formed by the partial destruction of living cells though others are not normal cell constituents. No amino acid or sugar derivatives have been detected. The mixture is optically inert. Most of the above compounds can be formed abiogenically by radiation-induced reactions[4,5]. It is clear that the chemical evidence is inadequate to decide between the two alternate hypotheses of origin for these compounds.

Arguments for a biological origin are based upon two types of observation. First, the meteorite hydrocarbons resemble those of petroleum and of terrestrial organisms[2]. However, the resemblance is not identical and has been criticized[4]. Moreover, it is known that high molecular hydrocarbon polymers can be formed by discharges and by radiation[5]. This material on thermal cracking could well give rise to a hydrocarbon mixture such as that found in meteorites. It is apparent that this argument for a biogenic origin is inconclusive.

The presence within meteorites of micro-structures resembling organisms has been known for many years. Recently, Nagy and coworkers at Fordham University have provided what they believe to be strong reasons why many of the microstructures of the carbonaceous chondrites are indigenous microfossils[6]. However, this conclusion is based largely on personal interpretations of the morphology of the microstructures. Other workers[1] have shown that many of the microstructures are rounded silicate particles with organic coatings, fragments of hydrocarbon polymers, troilite granules, droplets of fluorescent hydrocarbons, and particles of elementary sulphur. Consequently, the identification of most of the microstructures is at present controversial. A small number are thought to be biological, but are probably terrestrial spores and pollen (E. Anders, pers. comm.).

The balance of evidence favours the hypothesis that the organic constituents of meteorites are not biological in origin, but were formed in space by radiation. This conclusion is of importance for theories on the origins of terrestrial life, the chemical nature of planetary surfaces, the formation of terrestrial petroleum, and the evolution of planets from the primitive solar nebula.

REFERENCES

[1]Symposium, *Nature, 193:* 1119-33 (1962).

[2]NAGY, B.; MEINSCHEIN, W. G.; HENNESSY, D. J. (1961): *Ann. N.Y. Acad. Sci. 93:* 25.

[3]BRIGGS, M. H. (1961): *Nature, 191:* 1137.

[4]ANDERS, E. (1961): *Enrico Fermi Institute preprint,* No. 61-51.

[5]WILSON, A. T. (1960): *Nature, 188:* 1007.

[6]NAGY, B.; CLAUS, G.; HENNESSY, D. J. (1962): *Nature, 193:* 1129.

TENTH NEW ZEALAND SCIENCE CONGRESS

Tentative Programme for Section B. *Christchurch.*

Monday Morning, August 13

Registration and Official Opening of the Congress.

Monday Afternoon — Pages 113-5

2.00 p.m. A Chemical Approach to the Origins of Life. (M. H. Briggs and A. T. Wilson).
2.50 p.m. Structure-action Relationships in Pharmacological Chemistry. (F. N. Fastier).
3.15 p.m. Afternoon Tea.
3.45 p.m. The Chemical Consequences of Ionizing Radiation. (J. E. Packer).
4.50 p.m. Fatty Acids of Plant Lipids in Relation to Taxonomy. (Isobel M. Morice).

Tuesday Morning, August 14 — Pages 115-8

9.30 a.m. Factors Affecting the Economics of Chemical Manufacture in New Zealand. (W. I. Whitton).
10.15 a.m. A Review of some Chemistry Related to Wood Utilization. (G. A. Nicholls).
10.45 a.m. Morning Tea.
11.15 a.m. Kraft Pulp Bleaching. (W. W. Olsen).
11.40 a.m. Industrial Aspects of Rayon Pulp Production in New Zealand. (D. H. Tucker).
12.05 p.m. The Preparation of Rayon-grade Pulps from *Pinus radiata.* (D. J. Brasch, K. W. Free, D. H. Tucker and T. A. Vincent).
An abstract of a paper to be presented in Section F, entitled "Biochemical Adaptability of a Soil Micro-organism". (R. D. Batt and G. G. Midwinter) is also included.

OFFICIAL NOTICE

A General Meeting of members of the New Zealand Institute of Chemistry (Inc.) will be held at Lincoln College, on Wednesday, August 15, 1962, at 10.30 a.m.

AGENDA

(1) Apologies, welcome, etc.
(2) Confirmation of the Minutes of the last General Meeting held at University of Auckland, on Friday, September 1, 1961.
(3) Institute Prizes for 1962.
(4) Officers for the coming year.
(5) Annual Report for the year ending July 31, 1962.
(6) Balance Sheet for the year ending April 30, 1962.
(7) Alterations to Rules.
(8) General.

W. E. HARVEY,
Hon. General Secretary.

N.Z.I.C. CONFERENCE PROGRAMME

At *Lincoln* unless otherwise stated.

Tuesday Evening, August 14

Informal gathering and registration of Lincoln residents.

Wednesday Morning, August 15

8.45 a.m. Registration.
9.30 a.m. Opening of Conference.
10.00 a.m. Morning Tea.
10.30 a.m. Annual General Meeting, N.Z.I.C.
11.45 a.m. Annual General Meeting of the N.Z. Section of the Royal Institute Chemistry.

Wednesday Afternoon

Organic Chemistry

Pages 119-20

2.00 p.m. Some Aspects of Lipid Methodology with Special Reference to the Liver Lipids of Sheep dosed with Sporidesmin (J. Andrew Peters).
2.20 p.m. Some Reactions of 3,5-cyclo-steroids (M. P. Hartshorn).
2.50 p.m. The Ladenburg Rearrangement of N-alkyl Pyridinium Halides (L. K. Creamer, A. Fischer, and J. Vaughan).
3.05 p.m. Isotopic Analysis of the Oxygen Atoms of Enriched Carboxylic Acids (Miss C. J. Bishop, D. R. Llewellyn, and A. L. Odell).

Physical Chemistry

Pages 121-2

2.00 p.m. The Entropies of Melting of Crystalline Polymers (G. N. Malcolm).
2.30 p.m. Parameters in the Calculation of Association Constants from Solubility Measurements (M. H. Panckhurst).
3.00 p.m. Heats of Mixing of some Non-electrolyte Solutions Containing Fluorocarbons (A. G. Williamson).
3.30 p.m. Afternoon Tea.

Biochemistry

Pages 123-4

4.00 p.m. Studies on the Biosynthesis of Mould Tropolones (W. Segal and A. G. Andrew).
4.30 p.m. Amino Acid Activating Enzymes in Plant Tissues (Esam Moustafa).
4.45 p.m. The Role of Phenolic Acids in Apple Fruit (J. R. L. Walker).
5.15 p.m. The Avidin-Biotin Complex (P. D. Jones and M. H. Briggs).

Inorganic Chemistry

Pages 125-7

4.00 p.m. Adducts of the Group V Trihalides (W. R. Roper and C. J. Wilkins).
4.25 p.m. Structural Evidence for the Reaction of Beryl with some Fluorides (J. M. Waters).
4.45 p.m. The Separation of Sulphur Compounds from Fumarole Gases (S. H. Wilson).
5.10 p.m. Some Co-ordination Compounds of Rhenium (J. E. Fergusson and Miss J. Gainsford).

Wednesday Evening

8.00 p.m. Public Lecture (in collaboration with Royal Society Science Congress) at the Civic Theatre, Christchurch, by Professor C. W. Shoppee, F.R.S., entitled "The Carbon Atom".
(Transport will be arranged from Lincoln).

Thursday Morning, August 16

Animal Fats

Pages 127-8

9.00 a.m. The Manufacture of Edible and Inedible Tallow and its Chemical Control (M. S. Carrie).
9.30 a.m. Some Recent Trends in the Utilization of Animal Fats (L. Hartman).
10.00 a.m. Fats and the Incidence of Heart Disease (G. G. Dunckley).

General

Pages 129-36

9.00 a.m. Organic Chemistry of Meteorites (M. H. Briggs and G. Barrie Kitto).
9.30 a.m. A New Technique for Studying Adsorption on Solid Surfaces (A. T. Wilson).
10.00 a.m. The Correlation of Structure with some Properties of Copper Co-ordination Compounds (T. N. Waters).
10.30 a.m. Morning Tea.

Animal Fats

Pages 136-7

11.00 a.m. Monoglycerides based on Tallow (S. G. Brooker).
11.30 a.m. Correlation between Various Methods of Measuring the Colour of Tallow (K. Alcock). (No Abstract).
12.00 noon Variations in the Iodine Values of Fats from the Fatty, Muscular and Bone Tissues of Mature Romney Ewes (R. A. Barton and F. B. Shorland).

General

Pages 137-8

11.00 a.m. Some Experiments on the Spontaneous Combustion of Acetylene (E. F. Hubbard).
11.45 a.m. Light from Reactions in Liquids (T. I. Quickenden).

Thursday Afternoon

(*Christchurch—transport will be arranged from Lincoln*).

2.00 p.m. Presidential Address.
3.00 p.m. Visit to Exhibition and Afternoon Tea.
4.00 p.m. The Application of Physical Methods to the Determination of the Structure of Natural Products (Professor C. W. Shoppee, F.R.S.—Guest Lecturer).

Thursday Evening

(*Lincoln*)

6.30 p.m. Conference Dinner and Social.

Friday Morning, August 17

Pages 138-42

9.00 a.m. Theoretical Chemistry and the Research Chemist (R. Olliff).
9.45 a.m. The Historical Development of the Concept of π-bonding in Chemistry (J. E. Fergusson).
10.30 a.m. Morning Tea.
11.00 a.m. The Flow of Hydrogen/Sulphur Dioxide Gas Mixtures through a Microporous Barrier (C. G. Pope).
11.30 a.m. Arthropod Visual Pigments (M. H. Briggs).
11.55 a.m. Radiolysis of Aqueous Solutions of Sulphydryl Compounds (J. E. Packer).

Friday Afternoon

Pages 143-5

2.00 p.m. Recent Methods of Organic Analysis (A. D. Campbell).
2.45 p.m. The Chemist Customer (A. H. Horn).
3.30 p.m. Afternoon Tea.
4.00 p.m. The Laboratory Investigation of Upper Atmosphere Reactions (L. F. Phillips).
5.00 p.m. The Metabolism of Vitamin C in Schizophrenia (G. Barrie Kitto, E. David Andrews, Venise Graham, L. Segal, Natalie Harvey, and M. H. Briggs).
5.30 p.m. Conference Ends.

CONFERENCE COMMITTEE

M. S. Carrie (Chairman), A. F. R. Adams (Lincoln Liaison and Accommodation), Dr J. E. Fergusson (Exhibition), D. J. Hogan (Secretary, Local Branch, N.Z.I.C.), Dr W. S. Metcalf (Programme), Dr W. P. Mulcock (Accommodation), Dr B. R. Penfold (Secretary, Section B, Science Congress), Dr L. F. Phillips (Travel and Publicity), Dr R. D. Topsom (Secretary-Treasurer).

A NEW TECHNIQUE FOR STUDYING ADSORPTION ON SOLID SURFACES

A. T. WILSON
Victoria University of Wellington.

The technique of studying simultaneous exchange reactions has been developed at Victoria University of Wellington in order to study surface phenomena—for example, the adsorption of water on clay, wool and other textile fibres.

The sample is placed in the bottom of a gas geiger counter outside of the sensitive volume. The sample is then brought into equilibrium with a saturated salt solution or a sulphuric acid solution of known relative humidity. At the beginning of the experiment a small amount of tritiated water is injected into the counter. The activity in the sensitive volume is plotted continuously on a strip chart recorder. The specific activity of the tritiated water injected is so great that the change in the water vapour in the geiger counter is negligible.

Mathematical analysis of the problem shows that the activity as a function of time consists of a constant term plus a number of logarithmic terms. Thus, in practice, the logarithm of the activity is plotted against time and graphically resolved into a constant plus a series of straight lines. Then, from the intercepts at time equal to zero, the amount of each type of water can be calculated as a function of the amount of water vapour in the counter (which is known from the volume and relative humidity) and from the slope and intercepts the specific rate constant of each type of water can be calculated. By doing experiments at different temperatures it is possible to determine activation energies for the different types of water.

The advantage of this technique is that the experiment is carried out at chemical equilibrium and therefore data are obtainable which are not confused by wetting or drying phenomena. A disadvantage is that one is studying the $^{3}H^{1}HO$/adsorber system, but this would not be expected to be qualitatively different from the H_2O/adsorber system.

The technique described above is being applied to the long-standing problem of the adsorption of water on to surfaces. Model systems such as terylene, nylon, wool, montmorillonite and allophane are being studied with the hope of developing a theory to cover all adsorbing systems. Some of these data will be presented and discussed...

THE CORRELATION OF STRUCTURE WITH SOME PROPERTIES OF COPPER CO-ORDINATION COMPOUNDS

T. N. WATERS
University of Auckland.

A number of co-ordination compounds of Cu(II) with salicylaldehyde and its derivatives have been examined. Although they supposedly have a 4-co-ordinate planar arrangement of ligands about the copper atom a number of physical properties (namely their solubilities, mode of crystallization and in particular their colour and absorption spectra) suggest that modifications to this structural arrangement may occur. A number of these modifications have been investigated by X-ray methods. Their effect on the spectra and mode of crystallization will be briefly mentioned.

MONOGLYCERIDES BASED ON TALLOW

S. G. BROOKER
Abels Limited, P.O. Box 9012, Auckland, S.E.1.

Tallow itself may be used in the manufacture of monoglycerides, but it is more usual to fractionate the tallow by crystallization into oleo oil (melting point *ca.* 35°C) and oleostearine (*ca.* 55°). This latter is then hydrogenated to iodine value less than 2 and converted to monoglycerides by heating with excess glycerine and a catalyst. The hydrogenation makes the product more stable and more useful in edible products such as ice-cream and bread.

Alternatively, the tallow may be split to give fatty acids which are distilled and fractioned to give "oleine" (crude oleic acid) and "stearine" (a mixture of palmitic and stearic acids) both of which can be converted to monoglycerides. Whichever process is used the result is an equilibrium mixture containing approximately 40% mono-, 40% di-, and 10% triglyceride with up to 10% of unaltered glycerine. A more concentrated monoester may be obtained by molecular distillation and the value of this will be discussed.

The properties and uses of monoglycerides will be reviewed and reference made to some interesting products made by esterifying the free hydroxyl groups with other acids such as acetic and lactic.

Because they are a normal stage in the metabolism of fats in the human body, monoglycerides derived from edible fats are free from any health hazards.

VARIATIONS IN THE IODINE VALUES OF FATS FROM THE FATTY MUSCULAR AND BONE TISSUES OF MATURE ROMNEY EWES

R. A. BARTON and F. B. SHORLAND
Massey College, Palmerston North: Fats Research Laboratory, D.S.I.R., Wellington.

Iodine values have been used by various workers as a convenient means of following changes in the composition of fats. By this technique, for example, it has been shown that whereas the iodine values of fats of non-ruminants are raised by feeding oils of high iodine values, the fats of ruminants remain unchanged.

In the present work the fats from the different tissues of 48 mature Romney ewes have been studied. It has been found that the mean iodine values of the fats were as follows: Perinephric 39.8, loin subcutaneous 41.7, loin intermuscular 44.4, longissimus dorsi muscle 53.1, femur 45.1, tibia tarsus 54.3, and metacarpus 79.9. A distinctive feature of the fats was their variability in iodine value for a given tissue. Thus the iodine values for perinephric fat varied between animals to the extent of 15.3 units.

Although the iodine values of the fats have been examined from the point of view of growth rate and order of development of the tissues, and the temperature of the depot, no correlation has been found, nor can any reason be given for the remarkably high iodine value of the fat from the metacarpus.

SOME EXPERIMENTS ON THE SPONTANEOUS COMBUSTION OF ACETYLENE

E. F. HUBBARD
New Zealand Railways, Hutt Workshops, Woburn.

Some explosions of acetylene generating equipment led to an inquiry into the conditions under which the spontaneous ignition or explosion of acetylene may occur.

Experimental studies were made as follow:

(1) Conditions under which spontaneous combustion may occur in acetylene generated by the reaction of calcium carbide with water in the presence of air or oxygen.
(2) The effect of temperature and pressure on the polymerization and dissociation of acetylene.
(3) The effects of impurities in acetylene gas.

(4) The reactions of metals commonly used in industrial equipment with acetylene gas.
(5) The effects of shock.
(6) The effects of corrosion products frequently associated with commercial gas handling equipment.

The results of the above experiments will be described and it will be demonstrated how the conclusions apply to industrial equipment used for the generation of acetylene and to applications in lighting and welding processes.

LIGHT FROM REACTIONS IN LIQUIDS

T. I. QUICKENDEN
University of Canterbury, Christchurch.

Some chemical reactions in liquids give products possessing excess electronic energy which is sometimes emitted as light. The reactions of hydrogen peroxide with phthalic cyclo-hydrazides or biacridinium salts, if catalysed by potassium ferricyanide or osmium tetroxide shine especially brightly. These and other such reactions are briefly reviewed, and the conditions for and mechanisms of light production are discussed.

Very sensitive detectors of light indicate that many chemical and biological reactions emit light in quantities too small to detect with the eye. Some recent attempts to investigate this phenomenon are outlined.

There are a number of technical applications of chemiluminescent reactions. For example, the emission of light is often sensitive to pH and redox potential. In such cases a chemiluminescent reaction may serve as an indicator in volumetric analysis.

Several demonstrations will accompany the paper.

THEORETICAL CHEMISTRY AND THE RESEARCH CHEMIST

R. W. OLLIFF
University of Auckland.

Until recently, theoretical chemistry has been the Cinderella branch of chemistry in New Zealand. Today, however, this need no longer remain so. Two avenues are open to the research chemist:

(1) *Research in Theoretical Chemistry.* This requires the more mathematical approach of the two, but even so a deep knowledge of mathematics is not required. Most calculations are tedious rather than difficult, and it is for this reason that the subject has tended

to be neglected. With computer facilities now available in New Zealand this could be a profitable field.

(2) *Theoretical Chemistry as an Aid to Research.* The research chemist need not be a theoretical chemist himself, but can make considerable use of the results obtained by others to systematize and correlate his results. One example is the use of crystal field models to correlate rates of exchange reactions with electronic absorption spectra. Such applications require understanding of the ideas rather than detailed knowledge of the calculations.

THE HISTORICAL DEVELOPMENT OF THE CONCEPT OF Pi-BONDING IN CHEMISTRY

J. E. FERGUSSON
University of Canterbury, Christchurch

If one was searching for an adjective to describe the π-bond, the best would probably be "elusive".

The necessity for double bonds became apparent when in the mid-19th century chemists such as Gerhardt, Frankland and Kolbe demonstrated variable valency for elements like nitrogen, and compounds like C_2H_2 suggested bivalent carbon. Fortunately, owing to the persistent efforts of Kekule to establish the constancy of the quadrivalency of carbon, some tangible ideas were evolved on double bonding.

From those early ideas on double bonding the concept was developed by organic chemists in relation to unsaturation in organic compounds. In the 1930's the concept was put on a quantum mechanical basis and a new "dative" π-bonding was proposed for the inorganic co-ordination compounds.

π-bonding has, since the 1930's, had a chequered life, sometimes being popular, sometimes unpopular, and opinions have differed as to its steric arrangement. The true nature of the bond is still in doubt and this perhaps reflects the fact that attempted experimental investigations give only indirect evidence for the presence of the bond.

THE FLOW OF HYDROGEN/SULPHUR DIOXIDE GAS MIXTURES THROUGH A MICROPOROUS BARRIER

C. G. POPE
University of Otago, Dunedin.

A microporous plug of high specific surface area was prepared by the compression of Carbolac I carbon black powder in a steel holder. The flow of hydrogen and sulphur dioxide, both as pure

gases, and as gas mixtures of several compositions, through this barrier was then studied in the temperature range 0 to —33°C. The condensability of the sulphur dioxide ensured that it was transported largely as a surface flux, whereas the virtually non-sorbed hydrogen was found to flow in the way predicted by Knudsen's equation for molecular flow in the gas phase. Experiments with gas mixtures showed that the sulphur dioxide flux was unaffected by the presence of hydrogen, but that the hydrogen flux was very sensitive to the presence of sulphur dioxide. This was attributed to the occupation of a significant part of the pore space by adsorbed sulphur dioxide, and this was confirmed by the observation that when the permeability of the plug to hydrogen was corrected to a single temperature by Knudsen's equation, this permeability became the same function of the concentration of adsorbed sulphur dioxide for the complete temperature range studied. When capillary condensed sulphur dioxide was present in the plug, hydrogen flow was reduced to a negligible value, and the plug then acted as a membrane permeable to the sulphur dioxide alone.

For this reason, calculation of gas mixture separation from the results of experiments with the pure gases alone always indicated considerably less separation than was in fact observed.

This work has also shown that the calculation of surface fluxes on the assumption that the flux of a sorbable material, in the gas phase, is independent of adsorbate concentration, is not justified experimentally under conditions of moderate or high sorbate concentrations in microporous media. A semi-empirical correction to the gas phase flux to allow for the effect of pore blockage by adsorbed material, suggested by Gilliland *et al.*, has been shown to be inadequate for this purpose in the present case.

ARTHROPOD VISUAL PIGMENTS

M. H. BRIGGS
Victoria University of Wellington.

Vertebrate visual pigments are a group of closely related photosensitive macromolecules[1]. All consist of a protein with a retinene chromophore in the hindered 11-mono-*cis* configuration. The relations of structure to spectral sensitivity may be summarized as follows: Rhodopsins (rod opsin + retinene-1) $\lambda_{max} \sim 500\ m\mu$, porphyropsins (rod opsin + retinene-2) $\lambda_{max} \sim 522\ m\mu$, iodopsins (cone opsin + retinene-1) $\lambda_{max} \sim 562\ m\mu$, cyanopsins (cone opsin + retinene-2) $\lambda_{max} \sim 620\ m\mu$. On exposure to light all types of pigment undergo an

isomerization of the retinene chromophore to yield a *lumi*-pigment with an unhindered, all-*trans* chromophore. The *lumi*-pigment is highly unstable and at physiological temperatures a thermal rearrangement of the opsin occurs to give a *meta*-pigment. This also is unstable and rapidly hydrolyses to give free retinene and opsin.[2]

It is interesting to compare these vertebrate visual pigments with those of invertebrates. Only the molluscs and arthropods of this group possess well-developed, image-forming eyes. All invertebrate pigments are so far of the rhodopsin type.

The spectral sensitivities of molluscan visual pigments are as follows: *Sepia officianalis* (cuttlefish) λ_{max} 492 mμ; *Octopus vulgaris* λ_{max} 475 mμ; *Loligo pealii* (squid) λ_{max} 493 mμ. Under physiological conditions, these molluscan pigments all bleach to give *meta*-rhodopsins that are quite stable and only very slowly hydrolyse to give free retinene-1.

Visual pigments have been isolated from a variety of arthropods. The available spectra sensitivity data may be summarized:

CRUSTACEANS: *Euphausia pacifica* (shrimps) λ_{max} 462 mμ; *Homarus americanus* (lobster) λ_{max} 415 mμ; *Meganyctiphaues norvegica* (euphausiid) λ_{max} 460-465 mμ; *Thysanoessa reschii* λ_{max} 460-465 mμ; *Thysanopoda acutifrons* λ_{max} 480 mμ; *Nematoscelis megalops* λ_{max} 465 mμ; *Stylocheiron maximum* λ_{max} 470 mμ; *Sergestes arcticus* λ_{max} 475 mμ; *Sergestes robustus* λ_{max} 470 mμ; *Acanthepyra haeckeli* λ_{max} 480 mμ; *Hemigrapsus edwardsii* (crab) λ_{max} 515 mμ; *Leptograpsus variegatus* (crab) λ_{max} 515 mμ; *Porcellio scaber* (woodlouse) λ_{max} 480 mμ.

INSECTS: *Locusta migratoria* λ_{max} 440-445 mμ; *Apis mellifera* (honeybee) λ_{max} 440 mμ; *Musca domestica* (house fly) λ_{max} 437 mμ; *Bombus terrestris* (bumble bee) λ_{max} 440 mμ.

ARACHNIDS: *Limulus polyphemus* (horseshoe crab) λ_{max} 520 mμ.

The chromophore of all these pigments appears to be retinene-1, though evidence for the presence of vitamin-A_2 in the house-fly has been published[3]. The crustacean pigments bleach to yield stable *meta*-rhodopsins; the insect and arachnid pigments yield unstable *meta*-rhodopsins that spontaneously hydrolyse to give free retinene.

Acetone extracts of *Paracolletes fulvescens* (N.Z. native bee), *Uropetala carovei* (dragonfly), *Cicindela tuberculata* (tiger-beetle), *Nyctemera annulata* (magpie moth), and *Cutelia sedilotti* (N.Z. cockroach), all contain retinene-1 and their visual pigments are probably rhodopsins[4]. It has been reported (R. J. Barker, pers. comm.), that house-flies raised on a carotenoid-free diet have normal vision. As the species cannot synthesize retinene, the explanation of this phenomenon is at present unknown. Acetone extracts of two species of

spiders *Tegenaria domestica* and *Aranea crassa* contained both retinene-1 and vitamin A_1[5].

All visual pigments known to date are proteins with hindered retinene chromophores. There seem to be large differences in stability of the photoproducts. *Meta*-pigments of one group (from vertebrates, insects and arachnids) are readily hydrolysed at physiological temperatures. Those of the other group (from molluscs and crustaceans) are much more stable.

REFERENCES

[1]WALD, G. (1961): in *Comparative Biochemistry, 1:* 311, Acad. Press, N.Y.
[2]HUBBARD, R., *et al.* (1959): *Nature, 183:* 442; PITT, C. A. J.; MORTON, R. A. (1961): *Biochem. Soc. Symp., 19:* 67.
[3]WOLKEN, J. J., *et al.* (1960): *Biochim. et Biophys. Acta, 43:* 531.
[4]BRIGGS, M. H. (1961): *Nature, 192:* 874.
[5]———(1962): *Life Sciences,* in press.

RADIOLYSIS OF AQUEOUS SOLUTIONS OF SULPHYDRYL COMPOUNDS

J. E. PACKER
University of Auckland.

Cobalt-60 gamma-rays interact with water to form H atoms and OH radicals in the tracks of the photons. Some of these combine to form H_2, H_2O_2 and H_2O and some diffuse away from the tracks and can react with solutes. Both H and OH can abstract a hydrogen atom from a sulphydryl compound RSH to give a sulphenyl radical RS· In the absence of oxygen these combine to give the disulphide, or in the case of H_2S, sulphur. If oxygen is present short chain reactions occur and the yields of radiolytic oxidation products are much higher. It is suggested that peroxy radicals of the type RSOO· are formed and that these radicals can further abstract a hydrogen atom from RSH thus propagating the chain reaction. This latter reaction is thought to be relatively slow and to be the factor controlling the chain length.

It is suggested that a similar mechanism involving peroxy intermediates might account for the rapid autoxidation of alkaline solutions of H_2S and thiols. Here the reactions are initiated by electron transfer between RS· and O_2 to give the sulphenyl radical RS: which then undergoes the reactions described above.

RECENT METHODS OF ORGANIC ANALYSIS

A. D. CAMPBELL
University of Otago, Dunedin.

During recent years numerous improvements and developments have been introduced into organic analysis. In the determination of carbon and hydrogen, cobalt oxide or silver permanganate decomposition product is now widely used as the combustion catalyst while manganese dioxide is now used to absorb oxides of nitrogen in place of lead dioxide. Few major changes have been introduced into the methods of nitrogen estimation but it has been shown that the digestion temperature is important in Kjeldahl's method. Nitrogenous chars which occur in Dumas' method may be removed by introducing a small quantity of oxygen into the carbon dioxide stream or mixing the sample with pure cobalt oxide.

The direct determination of oxygen has received considerable attention. Several variations of the method in which oxygen in the compound is converted quantitatively to carbon monoxide are now used and with the availability of reliable high temperature furnaces this determination presents no difficulties for most organic compounds.

The most notable advance is in the determination of the halogens, sulphur, phosphorus, boron and many metals in organic-metallic compounds. The oxygen flask method has been revived by Schoniger who reduced it to the micro scale. The only apparatus required is a conical flask having a stopper into which is sealed a length of platinum wire carrying a platinum gauze. The sample is burnt on the platinum gauze and the products of combustion are absorbed in a small volume of solution in the flask and estimated. Sulphur as sulphate is titrated, in ethanol, with barium perchlorate, and chlorine as chloride is titrated with mercuric nitrate. Bromine and iodine are oxidized to bromate and iodate which may be estimated iodometrically. Fluorine gives fluoride, while phosphorus gives phosphate, both of which may be estimated by standard methods.

Methods are now being developed for the analysis of organic compounds using samples very much smaller than those currently used in organic microanalysis. Kirsten in Sweden has developed a series of methods in which the sample required is about 0.2-0.3 mg while Belcher at Birmingham has aimed still lower, his methods requiring about 50-80 micrograms of sample—just large enough to be seen without the aid of optical equipment. Balances having the required precision are available commercially for both these series of methods. Although they are unlikely to replace current micro methods there seems to be a demand for analyses on this minute scale.

THE CHEMIST CUSTOMER

A. H. HORN
Lincoln College, University of Canterbury.

Considering their cost, commercial instruments often have a surprising number of imperfections both in function and convenience. There is also a notable lack of standardized interchangeable fittings, *e.g.*, cuvettes, electrodes.

It is suggested that the N.Z.I.C. form a (nucleus) User Interests Committee to:

(1) Find and make known, in a general sense, what chemists require in their instruments.
(2) Publish practical guides for the chemist, useful particularly to anyone entering an unfamiliar field of instrumentation, or for assessing possibilities from the information in makers' catalogues.
(3) Gather objective reports on commercial instruments accessible in this country, and make these available to N.Z.I.C. members, perhaps on a financial basis.

The committee, perhaps made up from one representative in each Branch, would organize, execute, and maintain continuity. It would solicit technical information from people with direct personal experience and understanding of whatever type of instrument was currently under investigation.

If enough interest is shown it is hoped that some effective formal proposal will be made to initiate action.

THE LABORATORY INVESTIGATION OF UPPER ATMOSPHERE REACTIONS

L. F. PHILLIPS
University of Canterbury, Christchurch.

The paper is in two parts, of which the first comprises a review of present knowledge concerning the properties and constitution of the atmosphere, with particular reference to the region between 30 and 160 km above the earth's surface. Topics to be discussed include the light emitted by the night sky, the chemical reactions which are believed to be responsible for this light, and some results of experiments with rockets and satellites.

The second part of the paper is concerned with the description and discussion of kinetic studies on gaseous systems containing such

species as H, N, O, OH, O_3, NO and NO_2. The reactions have been carried out in a fast-flow system, the reaction mixture being analysed with a mass spectrometer. Several of these reactions are of theoretical interest in that secondary processes involving vibrationally excited molecules may be observed.

THE METABOLISM OF ASCORBIC ACID IN SCHIZOPHRENIA

G. B. KITTO, E. D. ANDREWS, VENISE GRAHAM, L. SEGAL, NATALIE HARVEY and M. H. BRIGGS

Victoria University of Wellington.

Schizophrenia is a very widespread mental disease: some surveys have estimated its incidence at 0.5 to 1.0% of the adult population of most Western nations. Characteristic symptoms are gross delusions and hallucinations of many of the senses. Similar symptoms can be artificially induced in normal persons for short periods by administering various drugs (*e.g.*, mescaline, lysergic acid, bufotenin, etc.). It seems a reasonable working hypothesis that the symptoms of schizophrenia are produced by the abnormal *in vivo* formation of some compound structurally resembling one of the above psychotomimetic drugs.

Numerous biochemical changes have been reported to occur in schizophrenic patients[1] and there is at present no agreement as to which are basic and which secondary. This paper presents evidence of a disturbed metabolism of ascorbic acid. There is considerable evidence of a tendency towards raised plasma ceruloplasmin in schizophrenics. Ceruloplasmin is a cuproprotein involved mainly in the regulation of tissue copper levels. Preparations possess *in vitro* oxidase activity against many substrates, but show the greatest catalytic activity with ascorbate. Hence raised serum ceruloplasmin could imply excessive breakdown of ascorbate in blood. To determine whether excess breakdown of ascorbate actually occurs in schizophrenics, a comparative survey of ascorbate metabolites in urine from a variety of normal and hospitalized subjects has been made. Ascorbate, dehydroascorbate and diketogulonate were determined by a differential 2,4-dinitrophenylhydrazine assay. The presence of excess breakdown products of ascorbate in the schizophrenics' urines was apparent from the results.

It is to be predicted from these findings that schizophrenics will suffer from chronic hypovitaminosis C, with some continuous impairment of all ascorbate-dependent metabolic processes. There is already considerable clinical evidence of low blood ascorbate in schizophrenics,

even among patients receiving adequate dietary amounts of the vitamin. Poor dietary habits would intensify the metabolic disorder. There is evidence of dietary lack of vitamin C in patients from some hospitals.

The adrenal gland contains large amounts of ascorbic acid and the vitamin is thought to be concerned in the biosynthesis of various adrenal steroid hormones. There is strong evidence of impaired adrenal steroid hormone formation in schizophrenia. Another function for ascorbate is in the tryptophan hydroxylase system, an impairment of which could lead to low brain serotonin levels. There is some evidence that schizophrenics have an impaired ability to hydroxylate a tryptophan load.

However, there is a widely accepted view that a disorder in adrenaline metabolism is basic to schizophrenia. Excess urinary excretion of adrenaline and related metabolites by schizophrenics has been reported. It seems possible to relate excess adrenaline with excess ascorbate breakdown by postulating an imbalance in aromatic transformations produced by an impairment of the phenylalanine oxidase system at the p-hydroxyphenylpyruvate oxidase level. This enzyme is activated by ascorbate. A complete blockage of the enzyme system occurs in scurvy where increases in tissue adrenaline have been reported, while pigmentation commonly results due to the conversion of the excess dihydroxyphenylalanine to melanins.

To investigate the hypothesis that impairment of p-hydroxyphenylpyruvate oxidase occurs in schizophrenia, a search has been made for urinary metabolites of tyrosine known to be excreted when this enzyme is inactive (p-hydroxyphenylpyruvate and p-hydroxyphenyllactate). Results are: Male schizophrenics 15/15, 12/15; male non-schizophrenic psychotics 4/12, 4/12; normal males 5/18, 3/18 (figures give ratios of number of positive detections of urinary metabolites to number of subjects examined; first ratio is for p-hydroxyphenylpyruvate, the second for p-hydroxyphenyllactate). Other unusual aromatic compounds also were detected.

These results indicate an impairment of p-hydroxyphenylpyruvate oxidase in schizophrenics. It is suggested[2] that this impairment creates a chronic imbalance leading to high tissue levels of adrenaline and its precursors, some of which are converted to compounds with hallucinogenic properties.

The results of a clinical trial into the therapeutic use of daily massive doses of ascorbic acid in schizophrenia will be reported.

REFERENCES

[1]Briggs, M. H. (1961): *Science and Culture, 27:* 316.
[2]Briggs, M. H. (1962): *N.Z. Med. J., 6:* 229.

THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.)

BALANCE SHEET AS AT APRIL 30, 1962

1961							
	Current Liabilities:						
53	Sundry Creditors		90	7	6		
15	Provision for Taxation		16	19	1		
63	Subscription received in Advance		73	10	0		
131						180	16	7
	Provisions and Special Funds:						
302	Provision for Overseas Visitors' Travelling		106	9	6		
75	Education Fund		75	0	0		
38	Compounded Subscriptions		32	13	11		
150	Provision for Printing			—			
30	Provision for Essay Prize			—			
595						214	3	5
	Trust Fund:						
1224	As per Statement Attached					1274	16	10
	Accumulated Funds:						
	Balance as at 30/4/61		590	3	6		
	Add Transfers: Provision for Printing		150	0	0		
	Provision for Essay Prize		30	0	0		
			770	3	6		
	Less Excess of Expenditure over Income for Year		109	5	3		
590						660	18	3
2540						£2330	15	1

1961							
	Current Assets:						
33	Petty Cash Funds			11	13	4	
447	Bank of New Zealand			30	11	9	
705	National Savings Account			729	10	1	
8	Sundry Debtors			25	0	0	
	Subscriptions in Arrears	176	2	1			
54	*Less* Provision for Overdue Subscriptions	50	0	0			
					126	2	1
20	Advance, Conference				20	0	0
—	Monographs on Hand				44	1	0
1267						986	18	3
	Trust Fund Investments at Cost:						
	Post Office Savings Bank		230	14	4		
	Hutt County Council Debentures		500	0	0		
	Lyttelton Harbour Board Debentures		500	0	0		
	Cash in General Account		44	2	6		
1224						1274	16	10
	Fixed Assets at Cost:						
	Office Equipment	93	16	6			
	Less Depreciation	25	16	6			
48					68	0	0
	Addressograph Plates	31	3	6			
	Less Depreciation	30	3	6			
1					1	0	0
49						69	0	0
2540						£2330	15	1

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED APRIL 30, 1962

1961							1961						
	Administration Expenses:						1270	*Subscriptions*:	1196	13	11		
241	Travelling Expenses	279	10	0			9	Proportion Compounded Subscriptions	5	1	7		
200	Salary, Registrar	200	0	0								1201	15 6
239	Printing, Stationery & Postages	164	19	5									
130	Branch Expense Allowances	128	0	0				*Interest Received*:					
50	Honorarium to Secretary	50	0	0				National Savings Account	24	12	10		
25	General Expenses	38	18	2				Bank of New Zealand	8	15	7		
21	Audit Fee	21	0	0			35					33	8 5
7	Depreciation	7	13	6									
20	Conference Expenses		—					Commissions on Journal Subscriptions				16	17 3
933					890	1 1	9						
222	Cost of Journal	361	19	4			4	Monographs—Net Surplus					—
35	Honorarium to Editor	35	0	0									
257					396	19 4	1327					1252	1 2
24	Chemistry in Action—Net Cost				25	11 0		Excess of Expenditure over Income for Year transferred to Accumulated Funds					
25	Chemistry Essay Prize				25	0 0	30					109	5 3
7	Examination Expenses, Net Cost				6	15 11							
75	Membership List					—							
21	Expenses of Questionnaire					—							
15	Provision for Taxation				16	19 1							
1357					£1361	6 5	1357					£1361	6 5

TRUST FUND ACCOUNT

1224	Balance 30/4/62		1274	16	10		
1224			£1274	16	10		

1183	Balance 30/4/61					1224	6	6
	Interest: Lyttelton Harbour							
5	Board Debentures	24	7	6				
	Hutt County Council							
20	Debentures	19	15	0				
16	P.O. Savings Bank	6	7	10				
						50	10	4
1224						£1274	16	10

OVERSEAS VISITORS' TRAVELLING FUND

498	Travelling Expenses Paid during Year	200	8	6			
302	Balance of Fund as at 30/4/62	106	9	6			
800		£306	18	0			

125	Balance 30/4/61					302	8	1
—	Conference Surplus Credited to Fund					4	9	11
375	Donations Received					—		
300	Transfer from Accumulated Funds					—		
800						£306	18	0

AUDITOR'S REPORT

I have audited the books of the New Zealand Institute of Chemistry (Inc.) for the year ended April 30, 1962, and have received all the information and explanations I have required. In my opinion, according to the best of my information and the explanations given to me and as shown by the books of account, the Balance Sheet, Income and Expenditure Account, and Trust Fund Account are properly drawn up so as to give a true and fair view of the state of the Institute's affairs as at April 30, 1962.

Christchurch,
June 22, 1962

J. W. SHANAHAN, A.P.A.N.Z.,
Auditor.

COUNCIL MINUTES

MINUTES OF A MEETING OF THE COUNCIL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.), HELD IN THE CHEMISTRY DEPARTMENT, VICTORIA UNIVERSITY OF WELLINGTON, ON FRIDAY, MAY 11, 1962, AT 10.00 a.m.

PRESENT

Dr F. B. Shorland (President in the Chair), W. G. Hughson (Vice-President), R. W. Olliff (Auckland proxy), N. T. Clare (Waikato proxy, Editor), Dr A. T. Johns (Manawatu), Dr A. J. Ellis (Wellington), R. W. Cawley (Canterbury), Dr W. G. Hanger (Otago), and Dr W. E. Harvey (Hon. Gen. Secretary). Apologies were received from Professor D. R. Llewellyn (Auckland), R. J. Lancaster (Waikato), and D. J. Hogan (Registrar).

AWARD OF L.A.C.

The following candidate for the L.A.C. has now completed the requirements and was awarded the certificate.

JOHNSON, James Peter; W. Sutherland & Co., Auckland.

REVISION OF RULES

The suggested changes to the Rules having been circulated to Branches, it was agreed that Branches be asked to forward any comments preferably by June 15. It is hoped that the changes may be dealt with at the next meeting. It was also agreed that the amended Rules should include some provision for the automatic remission of subscription of members at age 65 (or earlier, at the discretion of Council).

JOURNAL

The Editor reported briefly on *Journal* affairs. Costs appear to be rising slightly and the delay in publication is annoying. Efforts are still being made to get the *Journal* out on time regularly and the Editor now has a reasonable amount of material in manuscript form and is trying to plan the contents of each issue as far in advance as possible.

CONFERENCE

The Canterbury delegate reported on progress to date with the arrangements for Conference. A record number of papers have been submitted and the exhibition by industrial organizations will be arranged jointly with the R.S.N.Z. Exhibitors will pay a fee and the proceeds from this source will be shared 50/50 by the R.S.N.Z. and the N.Z.I.C.

FINANCIAL POSITION OF THE INSTITUTE

A report from the Registrar pointed out that in the past financial year expenditure had exceeded receipts and it appeared to him inevitable that the subscription should be raised. Council members in general were opposed to raising the subscription until avenues for decreasing expenditure had been fully explored. It was pointed out that the expenditure on overseas visitors, in particular, had been unusually high in the last financial year. It was agreed that

in the immediate future, the cost of overseas visitors should be kept to a minimum and that whenever visitors from overseas are sponsored by the Institute efforts should be made to obtain financial assistance from university and Government sources. The Secretary pointed out that this had in fact been done in the past.

A considerable sum is expended in travelling expenses for Council meetings and it was agreed that considerable savings could be made if the number of full Council meetings was reduced.

Resolved: That Council meet twice during the year but that provision be made for a third meeting if necessary.

It was agreed that with this arrangement the Standing Committee of Council should be free to act at its discretion in all routine or semi-routine matters.

The immediately available cash in the Institute's cheque account is too low. *Resolved*: That the sum of £250 be transferred from the Institute's National Savings Account to the Institute's cheque account.

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

The following were appointed to represent the Institute at the General Council Meeting of A.N.Z.A.A.S.: Professor J. Packer, Dr W. E. Harvey, and Dr F. B. Shorland.

ROYAL SOCIETY OF NEW ZEALAND

The President outlined discussions that had taken place with officers of the R.S.N.Z. about possible closer association of the R.S.N.Z. and the N.Z.I.C. It was pointed out that the R.S.N.Z. is at present re-writing its Rules and Regulations and that N.Z.I.C. members in Christchurch were in touch with the R.S.N.Z. Committee doing this work.

Resolved: That the Standing Committee of Council be instructed to keep in contact with the R.S.N.Z. but to take no major step in committing the Institute to any particular course of action.

DIRECTOR-GENERAL OF AGRICULTURE

Council discussed the motions passed by the Waikato Branch at a meeting earlier this year.

Resolved: That no action be taken. The Waikato delegate opposed this motion.

HONORARY MEMBERSHIP

Resolved: That Dr Howard, Rowett Institute, be granted Honorary Membership of the Institute for the duration of his stay in New Zealand. Dr Howard is attached to the D.S.I.R. in Palmerston North.

W. E. HARVEY,
Hon. General Secretary.

BRANCH NEWS AND NOTES

MANAWATU BRANCH

Dr E. Wong leaves this month to work for a year with Professor T. A. Geissman at the University of California.

Mr Peter Peterson has been awarded a National Research Fellowship and leaves this month to work with Dr L. Fowden at University College, London.

Dr R. Brooks has been awarded a Nuffield Grant of £2,650 in order to equip a spectrographic laboratory.

The Branch held a Schools' Evening in May. Sixth form students from eight local schools were invited to the laboratories of Massey College, Dairy Research Institute, and Plant Chemistry, D.S.I.R., where various research projects were outlined and equipment was demonstrated.

WELLINGTON BRANCH

Mr J. B. Butchers, Head of the Science Department at Hutt Valley High School, has accepted a professional appointment at the University of Liberia to assist with the organization of chemistry teaching there, and has recently left for Monrovia.

Mr Z. Demchenko is now with Griffin and Sons Ltd., Lower Hutt.

The death occurred recently of Mr A. T. Seelye, who retired in 1953 after over 30 years service with the Dominion Laboratory during which he won international reputation for his analytical work on minerals. (*An obituary note on Mr Seelye will be published in the October issue of the* Journal).

CANTERBURY BRANCH

The Junior Chemical Society organized by the Canterbury Branch for upper sixth form students is again having a very successful year. Membership has remained at about 150. Lectures have been given by Mr T. A. Rafter, Institute of Nuclear Sciences, on "Sulphur Isotopes"; Dr G. N. Malcolm, University of Otago, on "Polymer Chemistry"; and Mr W. E. Dasent, Victoria University, on "How Big is the Atom?". In addition, a Saturday morning field trip was made to the Departments of Animal Husbandry and Plant Science at Lincoln College. A special evening was held to view the Manawatu Branch production "Chemistry in Action", and members of the Society have been invited to attend Professor C. W. Shoppee's public lecture to the Royal Society Congress and N.Z.I.C. Conference in August.

Lever Bros. (N.Z.) Ltd. again offered an award for four members of the Society to spend two days in Wellington during the August vacation visiting Lever Bros. and D.S.I.R. establishments. The winners of these awards, selected by examination early in the second term, were G. Lane, Cashmere High School; E. Janus, Xavier College; R. East, and G. J. Gainsford, Christchurch Boys' High School.

OTAGO BRANCH

Dr F. N. Fastier has been awarded the degree of Doctor of Science of the University of New Zealand.

NEW ZEALAND SCIENCE MEDAL

Award to Dr A. J. Ellis

The New Zealand Science Medal of the New Zealand Association of Scientists has again been awarded to a member of the Institute. The recipient this year is Dr A. J. Ellis, head of the Inorganic Section of the Dominion Laboratory; the award is in recognition of his research into the chemistry of high temperature water in the Wairakei thermal area. A biographical note on Dr Ellis, who is the present Chairman of the Wellington Branch, was published in the February, 1962, issue of the *Journal*.

OBITUARY

W. O. R. GILLING

The death occurred on May 30, 1962, of Mr W. O. R. Gilling, who was until his retirement in 1956 Chief Chemist to the Christchurch Gas Coal and Coke Company. Mr Gilling was a foundation member of our Institute, a Fellow since 1937, and an Honorary Member.

He was born in Christchurch in 1891 and was educated at Little River Main School, Christchurch Boys' High School, and Canterbury College. In 1910 he was awarded a University National Scholarship and a Gammack Scholarship, and in 1911 an Exhibition in Chemistry and a Sir George Grey Scholarship. After completing B.A. in 1914, he held a Government Research Scholarship in Chemistry, and proceeded to the degrees of M.A. and B.Sc. During 1917-18 he was Senior Science Master at Waitaki Boys' High School, and subsequently was appointed a Special Research Assistant to the Professor of Chemistry, Dr Evans, at Canterbury College. In this capacity he carried out work on the use of New Zealand brown coals in gas producers, and this work, which remains a valuable contribution to our literature on coal, was published in collaboration with Mr H. Rands, as *Bulletin No.* 1, Board of Science and Art, Wellington, "New Zealand Brown Coals".

In 1921 he was appointed Chief Chemist to the Christchurch Gas Company. In this capacity his duties related to such matters as the development of routine methods in works control, quality control, analyses of coal, gas and by-products, and in the production of ammonia as a commercial product. He also used extensively a pilot plant for assessing the quality of New Zealand coals before the introduction of the present Gray-King assay.

Mr Gilling was a regular attender at the earlier meetings of the Canterbury Branch of the Institute. He was also a Foundation Member of the Gas Institute of New Zealand, a Trustee for many years and was in 1958 elected an Honorary Life Member.

He will be especially remembered as a good friend by a succession of young men trained in his laboratory. Dominion Laboratory staff at Christchurch remember with pleasure his collaborative work on gas quality control and many interesting discussions on his work in the gas industry which he enjoyed pursuing on such occasions.

Mr Gilling was a man of retiring disposition and of strong religious convictions. His main off-duty interest was his religious work, which he pursued actively before and after his retirement. He leaves a family of two sons and four daughters.

—F.J.T.G.

BOOK REVIEWS

PROTEIN STRUCTURE, by Harold A. Scheraga. Academic Press Inc., New York, 1961. 305 pages. Price 8 dollars.

This volume is the first of a proposed series of monographs in molecular biology. It is the only advanced monograph on this subject known to the reviewer. It offers a new cross-section of the field from one man's point of view and is therefore more coherent if less exhaustive than the multi-author volumes now so common. The author is a well-known protein physical chemist, a pupil of Edsall whose treatise, co-authored with Cohn, is now classic. His research interests in the field of interpretation of hydrodynamic and optical data in terms of molecular size and shape are strongly represented in the book.

The opening chapter is a very useful discussion on the hydrodynamic properties of protein solutions. The interpretation of these data is at present somewhat controversial, the author being one of the protagonists. He warns against the dangers of mixing hydrodynamic and thermodynamic functions. There are chapters on the effect of hydrogen bonding on side chain activity and the kinetics of limited proteolysis. There is a long chapter on denaturation and a very detailed study of the fibrinogen-fibrin transformation. A wide range of experimental methods are dealt with from the point of view of application rather than of technique. Among these are optical rotatory dispersion, hydrogen-deuterium interchange and UV difference spectra.

The final chapter deals with configurational studies on insulin, lysozyme and ribonuclease. It is surprising that the very imperfectly known structure of lysozyme is included while that of β-corticotropin, completely resolved in 1955, is omitted. The volume just misses the completion of the high accuracy resolution of myoglobin and the exciting achievement of almost complete sequence determination by X-rays alone.

Two shortcomings of the work are that there is only passing reference to the contribution of X-ray studies, and a complete absence of discussion on the elegant chemical techniques that have made complete sequence determination possible. Taken however as the treatise of a physical chemist it is a valuable and unique contribution to protein literature.

—R.H.L.

REVIEWS IN FOOD TECHNOLOGY, Vol. 2. Association of Food Technologists, Mysore-2, India.

The Association of Food Technologists (India) has a major activity in the presentation, at regular intervals, of a number of reviews of food technology subjects. Volume 2 contains reviews of the following fields: Bakery fats; fish hydrolysates, pastes and sauces; heat transfer in food industries; cereal gums; infant foods; advances in the analysis of fresh and processed fruits and vegetables; thermal processing of canned foods with special reference to heat sterilization by agitation. Each of the seven reviews is descriptive in character, and they have an intermediate level of treatment which should favour wide use of the information in the food processing industries. References given at the end of each review number 50 to 300, depending on the subject, and are drawn from standard journals and texts, together with a sprinkling of less well-known information sources. Thus, each review is most useful in giving a broad coverage of a field, together with a valuable starting point for the more specialist worker.

A feature of this volume (and the previous Volume 1 also) is the information available on unusual foods or foods not currently featured in English and American journals. Particularly this applies to foods indigenous to Asiatic countries and fruits of tropical origin.

—J.K.S.

BOOKS RECEIVED

ORGANIC REACTIONS, Vol. 12, Arthur C. Cope, Editor-in-Chief. Published by John Wiley and Sons, Inc., N.Y., 1962. Price 13 dollars.

Cyclobutane derivatives from thermal cycloaddition reactions; The preparation of olefins by the pyrolysis of xanthates; The Chugaev Reaction; The synthesis of aliphatic and alicyclic nitro compounds; Synthesis of peptides with mixed anhydrides; Desulfurization with Raney nickel; Indexes, Vol. 1 to 12 and Vol. 12.

GLOSSARY OF ORGANIC CHEMISTRY (Including Physical Organic Chemistry), by Saul Patai. Interscience Publishers (John Wiley and Sons), New York, 1962. 227 pp. Price 7.50 dollars.

This book gives definitions or brief explanations of terms commonly encountered in reading papers on organic chemistry, including the more widely used name reactions. It is intended for use by students and workers in fields associated with organic chemistry rather than for specialists in this subject. There are about 900 entries with good cross-referencing and references to more ample treatments of most items in standard text books and recent reviews.

METHODS OF BIOCHEMICAL ANALYSIS, Vol. 9, edited by David Glick. Interscience Publishers (John Wiley and Sons), New York, 1962. 452 pp. Price 14.50 dollars.

This volume covers the following fields: Deoxyribonuclease activity, ribonuclease characterization and activity; plant hormones; adrenal steroids in blood by countercurrent methods; column electrophoresis in granular media; spectrophotometry of opaque biological materials; biochemical applications of magnetic resonance spectroscopy. The majority of these articles give a critical assessment of the main methods in each for each material and sufficient practical details to carry out the test by the method considered most satisfactory by the writer of the review.

MEDICINAL CHEMISTRY, Vol. 5, edited by Walter H. Hartung. Published by John Wiley and Sons, New York, 1961. 432 pp. Price 18 dollars.

This volume is devoted to "Anticonvulsant Drugs" (349 pages) and "Bis-(4-amino phenyl) Sulphone and Related Compounds in Tuberculosis and Leprosy" (77 pages). It contains 280 pages of tables listing the formulae, often in structural form, of a wide range of drugs and activity as tested by standard methods together with the source reference for the test data. There are brief accounts of the physiology and chemistry including toxicity, of the main classes of these drugs. The number and spaciousness of the tables no doubt accounts for the high price.

1962 LIST OF MEMBERS

The Committee from the Canterbury Branch responsible for preparation of the *List of Members* for 1962 will not this year send the current listing to each member for correction. Apart from addition of new members or alteration of status within the Institute, revision will be confined to changes and corrections notified to the Registrar by members.

All members are requested to check the entry in the 1961 *List* (*Journal* for December, 1961) and to inform the Registrar (Mr D. J. Hogan, P.O. Box 1926, Christchurch), immediately of any alteration of degree, title or, especially, address.

BRITISH SOCIETY FOR VISITING SCIENTISTS

The activities of this society were briefly indicated in a note in the *Journal* for February 1961. Recent information from the President of the Society states that the membership is now about 3,000, and that the facilities extended to scientists visiting England are being continued. The importance attached to the work of the Society is indicated by the gracious acceptance by H.R.H. Prince Phillip, Duke of Edinburgh, of the position of Patron of the Society.

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L. O. DESBOROUGH,
Registrar.

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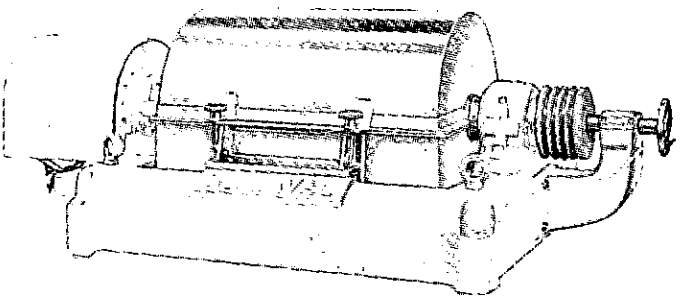

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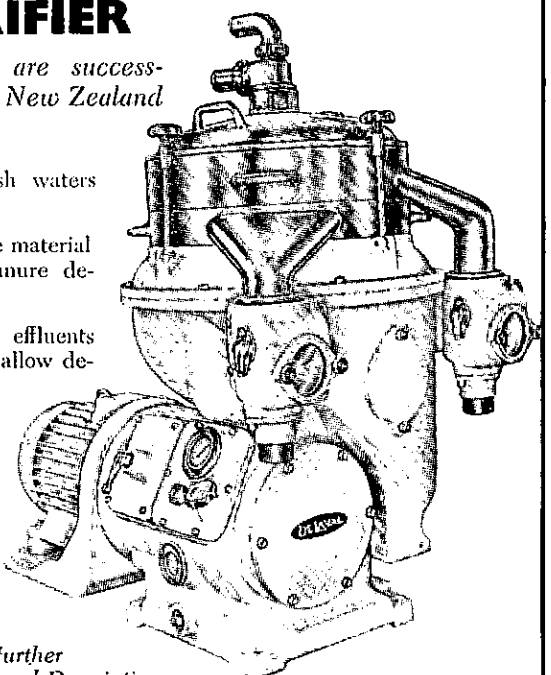

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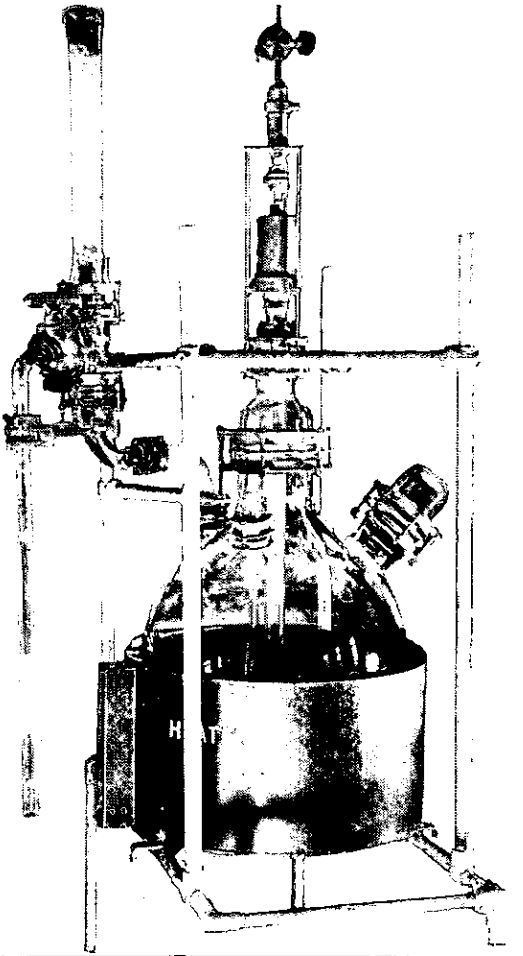

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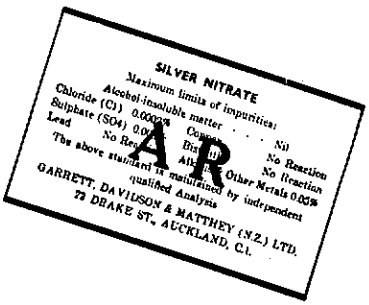

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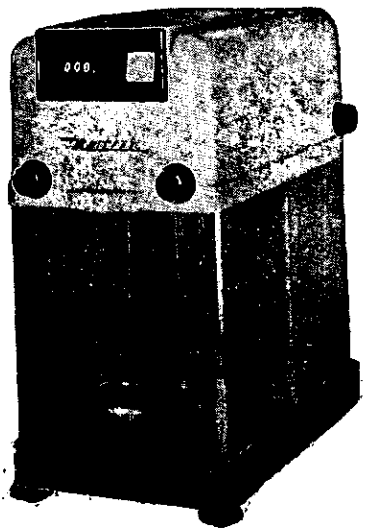

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