JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. 30 No. 6
December 1966

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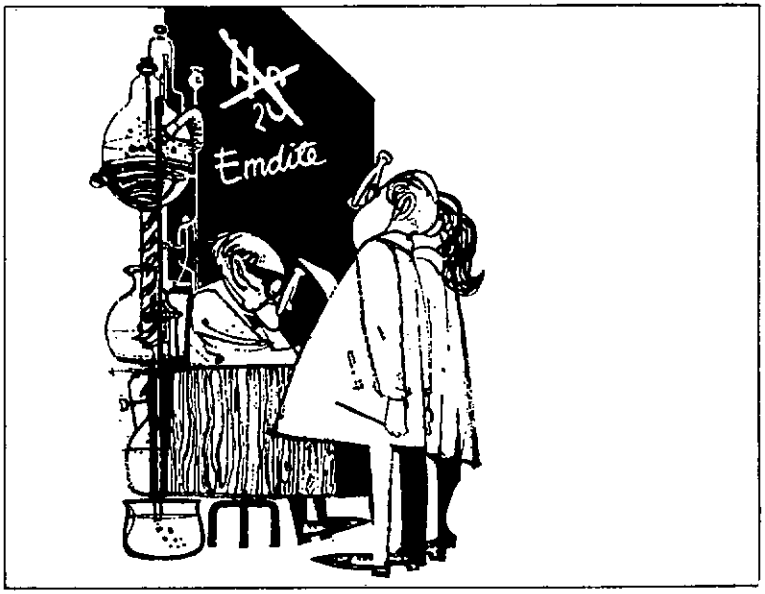

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1. Hart, K.K., Hill, A.G. and Savage, B., J. Roy. Inst. Chem., 1964, 418-23 (reprints are available on request).

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JOURNAL OF THE NEW ZEALAND

INSTITUTE OF CHEMISTRY

Vol. 30, No. 6 DECEMBER, 1966

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JOURNAL OF THE NEW ZEALAND
INSTITUTE OF CHEMISTRY

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EDITORIAL

The Institute is now concerned about its public relations. Any type of relations requires some form of communication; but to communicate adequately is not easy. To communicate means to inform, to reveal, to share, and implies an extension of knowledge, insight, perception, sympathy or awareness from one person or group to another. Could it be said that the Institute would now like to share its information, knowledge and attitudes with the public in order to engender sympathy for chemistry and chemists and an awareness of their contribution to our society?

There are three necessary factors in communication; the person or group communicating, the information that forms the communication and the person or group receiving it. Each of these factors has its difficulties. The person who communicates must sincerely want to communicate and must consider the difficulties of the next two steps in order to communicate effectively. Any attempt at communication invariably produces a reaction from the receiver like that of the TV cup of tea—what's in it for me? Is it interesting, or useful to me or even necessary to my well-being? If it is none of these why should I take any notice? So the information must be in a form suitable to answer these questions. Also, the person on the receiving end must be able to receive the communication and to understand it. If he cannot understand the language or the concepts the message is lost. The communication must be adapted to suit his particular requirements.

The action involved in communicating is like that of an enzyme or drug reaction . . . if the molecule is not the right size and shape for a good fit, the reaction will not take place. So, if the communication is not shaped according to the receiver, the message will not be got across.

CATALYSIS IN INDUSTRY*

by

T. F. M. BROWN

Christchurch Boys' High School

In 1835 J. J. Berzelius reviewed a number of apparently diverse observations made on various chemical systems during the previous forty years by scientists such as Davy, Dobereiner, Dulong, Thernard, and Faraday. These observations all had one factor in common; in every case the nature of the reaction was influenced by the presence of a substance which was itself unchanged in the reaction. The reactions reviewed were mainly heterogeneous, that is, they took place at the interface of different phases. Most of today's industrial catalysts are of this type, wih a solid assisting in the conversion of gaseous or liquid reactants to the required products.

Berzelius was of the opinion that some "force" was manifest which brought about the reaction. The force he named catalysis. This name had previously been used to mean a decomposition, and was derived from the Greek words meaning "entirely", and "loosening". The implication of the name is that a catalyst loosens the bonds of the reactants so as to greatly increase the rate of the reaction. It is now generally accepted that the forces involved are probably the same as those involved in ordinary chemical reactions.

All catalysed reactions, whether homogeneous or heterogeneous, have certain common characteristics:

1. The catalyst is chemically unchanged at the end of the reaction.
2. A small amount of catalyst is frequently sufficient to bring about a considerable effect.
3. A catalyst speeds reactants and products towards their normal chemical equilibrium, but does not alter the position of the equilibrium itself.

Although unchanged chemically, heterogeneous catalysts in particular frequently undergo physical modification, their power falling as their surface area is reduced. This fact accounts for the world consumption of 120,000 tons a year of substances which emerge "unchanged" at the end of a chemical reaction. Another extremely important characteristic of heterogeneous cata-

* Shell Essay Prize, 1966.

lysts is their high specificity. For example, iron catalysts formed by oxide reduction have been shown to be capable of hydrogenating ethylene at temperatures as low as —100°C, yet they are incapable of hydrogenating benzene, even at 200°C. On the other hand nickel can carry out both reactions at room temperatures.

Heterogeneous catalysts may consist of elements, compounds or mixtures of compounds and elements. Among the elements, metals are particularly useful, whilst metal oxides and sulphides are outstanding among compounds. Alumina-silica mixtures which are used extensively in the hydrocarbon cracking beds are examples of mixed catalysts.

Evidence strongly suggests that the activity of such catalysts is centred on only a small fraction of catalyst surface. The nature of the active points or regions is very much a matter for dispute. In some cases they can be created by the addition of impurities, known as promotors. Promotors may constitute as much as ten percent of the catalyst but in some instances much smaller quantities not only increase the power of a catalyst, but also retard deterioration of the surface. Catalyst surfaces are very sensitive to impurities, some of which, the promotors, are beneficial whereas others are detrimental. The latter, known as poisons, are deposited in such a way as to deactivate the active regions of the catalyst. Traces of hydrogen sulphide will usually cause a rapid decrease in the activity of a metallic hydrogenation catalyst.

The ability of a catalyst to be specific is considered, amongst other factors, to be dependant upon the size and distribution of pores on the catalyst's surface. Catalysts for partial oxidation reactions should presumably have a pore size sufficiently large to allow the oxidized fraction to pass freely from the catalyst and reduce the chance of further oxidation. Exact details of the nature of a catalyst's surface cannot be specified, although recent trends emphasise the electronic structure of a catalyst. It is also believed that the active regions of a catalyst are associated with lattice defects caused by the addition of impurities, or by the removal of atoms from the original structure to form non-stoichiometric compounds, or by the preparation of a catalyst in such a way as to create many lattice iregularities.

The manner in which catalysts work is at present obscure, but it is generally agreed that solid catalysts invariably combine chemically at the surface with one or more of the reactants. According to what might be called the classical theory of catalysis, atoms at the surface of any solid are in a special environment,

for they are not completely surrounded by other, similar atoms. The surface therefore has very different properties from the bulk solid. In order to react, molecules must come within a certain distance of each other, and must possess an energy that exceeds a critical value for that particular reaction. A catalyst lowers this activation energy by providing an easier reaction path, the reaction taking place in steps each of which involves an activation energy lower than that of the uncatalysed reaction. Many elegant experiments have demonstrated conclusively that absorption of one or all of the reactants is an integral part of heterogeneous catalysis. The modern theories which consider the electronic structure of a catalyst do not basically conflict with the classical ideas of active centres and surface geometry. Rather do they attempt to explain their assumptions. There is undobtedly some relationship between catalytic activity and a substance's electronic properties. The availability of electrons at the surface, or the ability of the surface to receive electrons, clearly must affect catalytic activity because of the involvement of absorption in catalysis. Electrical conductivity is influenced similarly by the same availability of electrons, and it is found that catalysts can be classified very broadly by their conductivity. The catalytic metals (such as nickel, iron, and platinum) which are modest conductors of electricity are found to catalyse reactions involving hydrogen. Some oxides and sulphides (of nickel, copper and zinc) are semi-conductors and catalyse reactions involving oxygen; other oxides such as silica, alumina, and magnesia are electrical insulators and catalyse reactions involving water.

One of the first large scale applications of catalysis to industry was in the oxidation of sulphur dioxide for the manufacture of sulphuric acid, an extremely important "raw material" for many manufacturing processes. The old lead chamber process is one of the rare cases of homogeneous catalysis in the gas phase used commercially, and although superceded to some extent by the contact process for oxidation of sulphur dioxide over a platinum surface, has managed to compete in the production of lower grade acid. The contact process, originally patented in 1831, was first conducted on a commercial scale in 1875 and was limited to sulphur dioxide from specially purified sources, because of the susceptibility of platinum to poisoning. It was shown in 1900 that the substances responsible for the poisoning of platinum were arsenic and similar impurities. About 1928 the use of vanadium pentoxide instead of platinum was proposed, and at the present time many plants using this are being successfully operated. It is

claimed that, while giving a conversion equal to that obtained with platinum, vanadium pentoxide is not only cheaper but is also less sensitive to poisoning.

In 1908, a process for the catalytic oxidation of ammonia for the production of nitric acid was brought into use. The process was suggested in 1839 but was not used on a large scale until just before the 1914-18 war. The catalyst chamber, containing a platinum rhodium gauge is the smallest unit in the ammonia-nitric acid plant because of the exceedingly rapid and complete production of nitric oxide; the conversion of nitric oxide into nitric acid requires much more space. The gases from the catalytic converters are cooled, mixed with air and passed through scrubbing towers. The oxidation of oxide to dioxide is a relatively slow process; moreover one-third of the nitrogen dioxide is reconverted into nitric oxide when it reacts with water

$$3NO_2 + H_2O = 2HNO_3 + NO$$

The process is usually controlled so that a fifty percent solution of nitric acid is finally obtained.

The next milestone for catalysis in industry was laid in 1913 when the high pressure synthesis of ammonia was introduced. It was the first process to be evolved by the proper application of thermodynamic principles, and the catalyst was one which first demonstrated the value of promoters. The catalyst is virtually unchanged to this day—iron containing several promoters such as potassium, alumina, magnesia and other oxides, each having its own job to do, one increasing the specific surface area, another enhancing the activity of the iron surface, and others protecting it from gaseous impurities. In the process, nitrogen and hydrogen in the correct proportion are circulated over the catalyst at about 600°C and 200 atmospheres pressure. About 8% of the gases are converted to ammonia at each passage. A much higher conversion can be obtained by the use of pressures as high as one thousand atmospheres, whereby a reduction in plant size can be achieved.

The high pressure synthesis of methanol from hydrogen and carbon monoxide developed in 1923 used a catalyst of pelleted zinc oxide with chromium oxide; the latter helped to preserve the surface area of the catalyst. The same two reactants can be made to form hydrocarbons by the use of a different catalyst such as cobalt with other oxide promoters. This process, the Fischer-Tropsch process, came into use in the 1930's.

At much the same time, the first plants were installed to react methane with steam to produce hydrogen. Heat has to be

supplied, and the catalyst is used at 700 to 800°C in heated tubes. The catalyst here is nickel supported on a carrier of oxides such as alumina and magnesia, commonly made in the form of rings to keep the resistance to flow of the reactants to a minimum. This process has recently been utilized for the commercial production of hydrogen from waste gases rich in methane and ethane (which undergo a similar reaction) as in the natural gas from petroleum deposits, and the permanent gases produced during the cracking of petroleum.

The year 1935 saw the first catalytic process for petroleum refining with the introduction of catalytic "cracking" for the production of petroleum hydrocarbons from crude oils. The catalysts are alumina-silica mixtures, synthetic versions of the natural clays which were used in the earliest processes. A further advance came in the 1940's with the addition of platinum to the catalysts, which resulted in the production of higher grade petrols.

The shape and size of a catalytic reactor can vary enormously in practice depending on such considerations as whether the reaction is fast or slow, or whether it evolves heat or absorbs it. The catalysts may be used in the form of wide thin layers, deep beds or of solid suspensions in liquid reactants. The catalysts too, vary widely in shape and size, from large irregular lumps, or shaped pellets, pieces, granules, or fine powders, to scraps of metal and woven wire gauges.

In the development of a new chemical process all the properties and limitations of effective catalysts have to be borne in mind. In the search for new catalysts, the scientist is guided both by experience and by the theories which have been mentioned here. Many laboratory and large scale tests are made to determine the most suitable catalyst, to establish the rate of reaction and the yield that may be expected, so that the amount of catalyst, the size of reactor, the process conditions and so on, may be determined.

I have mentioned only a few of the catalysts which are now employed by chemical industry. The average cost of these catalysts is about £350 per ton, a comparatively high figure, more than the actual cost of materials, which reflects the value of the knowledge and attention to detail which goes into their manufacture. The amount of these expensive catalysts which are used annually, 120,000 tons, may seem considerable, but the amount is very small in comparison with the millions of tons of valuable chemicals for the manufacture of which they are indispensible.

PRESIDENT 1966-67

Mr. M. CARRIE (Canterbury)

Max Carrie was born in Wanganui in 1910, attended Wanganui Technical High School and Napier Boys' High School. He graduated from Otago University M.Sc. (First Class Honours in Chemistry) in 1931. After spending two years on postgraduate research at Otago, he joined N.Z. Co-op. Rennett Co. Ltd., Eltham in 1934. He went into camp with the N.Z. Engineers in 1939, sailed with the First Echelon, January 1940, and attained the rank of Major. He returned in 1943 and went to the Vegetable Processing Plant, Pukekohe, as Works Manager, then transferred to Hawke's Bay Farmers' Meat Co. Ltd. in 1947. He joined Canterbury Frozen Meat Co. Ltd. in 1952, where he is now Chief Chemist.

BRANCH CHAIRMEN AND OFFICERS 1966-67

Mr. K. E. SEAL (Auckland)

Kenneth Edmund Seal was elected Chairman of the Auckland Branch in February 1966 when Dr. G. A. Nicholls left for overseas. Mr. Seal was born in London in 1923 and educated at Kilburn Grammar School. He studied part-time at Birkbeck College of the University of London, graduating B.Sc. in 1945 and M.Sc. in 1950. He was employed in the British General Electric Research Laboratories, 1940-1948, and at the London Brick Company, 1948-1952. In 1952 he came to New Zealand and joined the staff of Amalgamated Brick and Pipe Company Ltd. where he is now Chief Technical Officer. In 1960 he was appointed to the Council of the D.S.I.R. (now National Research Advisory Council) and in 1962 to the Mineral Resources Committee of which he has been Chairman since 1964. He was elected an Associate of the Institute in 1952 and a Fellow in 1963. He has served the Institute previously on the Auckland Branch Committee. He is married with a son and a daughter.

Auckland Branch Officers

Chairman: Mr. K. E. Seal. Secretary: Mr. K. M. Gawne. Treasurer: Dr. D. J. Spedding. Committee: Mr. J. H. Goodey, Mr. J. K. Johannesson, Mr. A. S. Morton, Mr. G. R. White. Editor: Dr. D. F. Nelson. Delegate to Council: Mr. G R. White. Auditor: Mr. L. S. Spackman.

Dr. R. H. LOCKER (Waikato)

Dr. Locker was educated at Auckland Grammar School and Auckland University. Working under Professor Briggs he graduated Ph.D. in 1950. He joined the embryonic Meat Section of Dominion Laboratory which became the Meat Industry Research Institute in 1957. Awarded a National Research Fellowship he spent 1952-53 in Cambridge at the Low Temperature Research Station, where he began work on what is his main interest, the structural proteins of muscle. In 1955 he spent a summer at M.I.T. and last year at Johns Hopkins University. Elected an Associate in 1950 he has been for several years a member of the Waikato committee, and was Conference Secretary in 1964.

Waikato Branch Officers

Chairman: Dr. R. H. Locker. Secretary-Treasurer: Mr. F. S. Pickering. Branch Editor: Mr. F. D. Dorafaeff. Committee: Mr. W. Rolt, Dr. E. Pawson, Mr. E. A. Allan, Dr. D. E. Wright.

Dr. G. B. PETERSEN (Manawatu)

Dr. G. B. Petersen was educated at the Palmerston North Boys' High School. He graduated B.Sc. in chemistry and biochemistry in 1955 and M.Sc. with Second Class Honours in Chemistry in 1956 from the University of Otago. From 1956-1959 he was a student in the biochemistry department of Oxford University, from which he graduated D.Phil. in 1959. He was admitted to the degree of M.A. (Oxon.) by decree in 1962.

In 1959, Dr. Petersen joined the staff of the D.S.I.R. Plant Chemistry Division at Palmerston North. He returned to Oxford in 1962 and was for two years Departmental Demonstrator in the department of biochemistry. In 1964, he returned to the Plant Chemistry Division via the United States, where he spent a short time as Research Fellow in Medicine at Harvard University followed by a period of three months of observational travel on a travel grant awarded by the Carnegie Corporation of New York. Dr. Petersen's research interests are in the broad field of nucleic acid structure and function, and particularly in the arrangement of nucleotide sequences in deoxyribonucleic acid. He is an honorary lecturer in the faculty of biological sciences of Massey University.

Manawatu Branch Officers

Chairman: Dr. G. Petersen. Secretary: Dr. P. Peterson. Council Delegate: Dr. W. A. McGillivray. Branch Editor: Dr. M. R. Grimmett. Auditor: Mr. A. J. Weir. Committee: Dr. M. R. Grimmett, Mr. G. Wallace, Dr. J. W. Lyttelton, Dr. R. C. Lawrence.

Dr. P. K. FOSTER (Wellington)

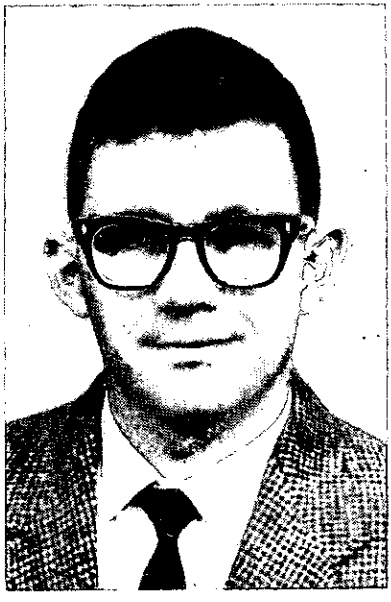
Dr. P. K. Foster graduated M.Sc. with First Class Honours in physical chemistry from Canterbury University College in 1949. After a year at BALM Paints he went to Imperial College of Science and Technology, London, where he studied the identification of solid solutions at high temperatures using gas-solid equilibria, for his Ph.D. and D.I.C. After a few years investigating problems in the welding industry, he was appointed to Chemistry Division, D.S.I.R., in 1957 where he worked on corrosion problems and the diffusion of hydrogen in steel associated with the development of the Wairakei geothermal power project.

In 1963 he was appointed Director of the Pottery and Ceramics Research Association. His current interests are in solid state chemistry and he maintains a close association in this field with Victoria University where he is an honorary lecturer.

Wellington Branch Officers

Chairman: Dr. P. K. Foster. Secretary: Dr. A. G. Freeman. Treasurer: Mr. R. J. Furkert. Delegate to Council: Dr. P. K. Foster. Branch Editor: Dr. J. F. Young. Branch Auditor: Mr. F. J. T. Grigg. Committee: Prof. J. F. Duncan (Immediate Past Chairman), Dr. A. M. Borren, Mr. I. R. C. McDonald, Dr. Dora Suuring, Dr. J. F. Young.

Professor L. PHILLIPS (Canterbury)

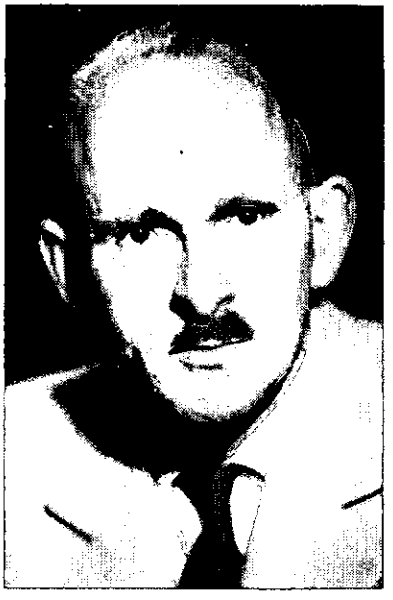


Leon Phillips, age 31, was educated at Westport Technical College and Christchurch Boys' High School. He graduated M.Sc. (First Class Honours in Chemistry) 1957, and went to Cambridge University on a Shell Commonwealth Scholarship in 1958. He completed a Ph.D. in 1960, spent a year in Canada on a postdoctoral fellowship, and then returned to Canterbury University as a lecturer in Chemistry. He was appointed to a personal chair in chemistry at the beginning of 1966.

Canterbury Branch Officers

Chairman: Professor L. F. Phillips. Secretary: Mr. W. R. McKeegan. Treasurer: Mr. G. M. Keeley. Auditor: Dr. G. B. Battersby. Branch Editor: Mr. D. J. Hogan. Committee: Professors B. H. Howard and A. M. Kennedy, Dr. D. A. R. Happer and Mr. T. R. Hitchings.

Mr. C. W. THOMSON (Otago)



The Chairman of the Otago Branch for 1966-67 is Mr. C. W. Thomson, Production Manager for the Linseed Oil Division of Fletcher Industries Ltd., in Dunedin. In 1952 he graduated B.Sc. in Chemistry in the University of Otago, and then worked in the Department for a further year with Dr. W. S. Fyfe. During this period he was elected President of the Science Students' Association. In 1954 he was appointed science master at John McGlashan College. He joined Fletcher Industries Linseed Oil Division as Chemist in 1957, and has since been promoted, first to Chief Chemist and then to Production Manager. His main interests there have been in improving the methods of analysis of oils and fats, and in the development of adhesives and sealants. He was elected an Associate of the Institute in 1960, and has been on the branch committee since 1962.

Otago Branch Officers

Chairman: Mr. C. W. Thomson. Secretary: Dr. R. M. Carr. Treasurer: Mr. G. W. Emerson. Committee: Dr. J. C. Dacre, Mr. R. H. McKeown, Mr. R. L. McNaught, Professor M. H. Panckhurst, Dr. C. G. Pope, Dr. R. F. Smith. Delegate to Council: Dr. J. C. Dacre. Branch Editor: Dr. C. G. Pope.

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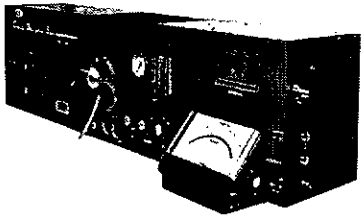

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INSTITUTE PRIZES

Members are reminded that the closing date for entries for the three prizes is April 15.

THE CHEMICAL ESSAY PRIZE

Offered for an essay or review paper of not more than 5,000 words, on any aspect of chemical science. The prize is open to all members and local members. The value of the prize in recent years has been £25.

THE I.C.I. PRIZE

This prize of £50 and a medallion has been donated by Imperial Chemical Industries (N.Z.) Ltd. It is awarded for "some major contribution to some branch of chemical science, this contribution to be judged by research work published or accepted for publication during the five years immediately preceding April 15 in the year of the award". Members may apply for the award or they may be nominated by Branch Committees or by individual members.

THE MORCAM GREEN, EDWARDS PRIZE

This is of the value of £25 and is donated by Messrs. H. H. Edwards and Morcam Green. It is offered "for the encouragement of original work by young chemists in pure and applied chemistry, with emphasis on applied chemistry". Applicants must be below the age of 35 years on June 1 in the year of the award. The candidate is assessed on published work or on a process he has designed or developed, or the product he produces.

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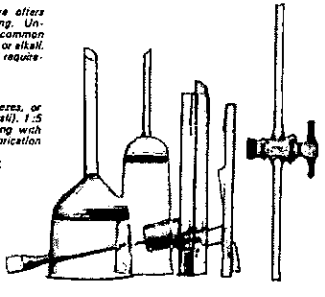

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New Appointment

Dr. M. Fieldes has been appointed Director of Soil Bureau, D.S.I.R., in succession to the late Dr. J. K. Dixon.

Dr. Fieldes graduated M.Sc. with Honours from Canterbury University College in 1935, and after a short period with the Post Office joined Dominion Laboratory in 1937. Here he worked on the development of instrumental methods of analysis, particularly with spectrographic and electrochemical methods. In 1945 he won the Institute's Industrial Chemistry Prize with an essay on electroplating in New Zealand. During 1947 and 1948 he was with Watson Victor Ltd. before being appointed to Soil Bureau as Officer-in-Charge of Physical Chemistry.

During his association with Soil Bureau Dr. Fieldes has developed instrumental techniques for the measurement of soil properties, but his major contributions have been in clay mineralogy and in the study of amorphous constituents of soils, particularly allophane. The University of New Zealand awarded him a D.Sc. in 1957 for his work in these fields. The award of an Underwood Fellowship by the British Agricultural Research Council enabled him to spend a year at the University of Oxford with Dr. R. K. Scofield working on soil colloids.

Dr. Fieldes has been an Honorary Lecturer in Chemistry at Victoria University of Wellington for some years and is currently a member of the Council of the N.Z. Society of Soil Scientists. He has recently been appointed a consulting editor for "Geoderma", a new international journal of soil science.

PAPERS READ BEFORE BRANCHES

Auckland

"Some Recent Advances in Atomic Absorption Spectroscopy", Dr. A. Walsh.
"Leather and Its Use in Ladies' Footwear", Mr. B. Marler and Mr. John Astley.
"Some Chemical By-products Associated with Kraft Pulping", Dr. G. A. Nicholls.
"The Training of Science Technicians", Mr. R. A. Keir, Associate Professor A. Odell, Mr. J. K. Johannesson.
"A Public Relations Programme for the Institute", Mr. K. Gawne.
"The Future of the N.Z.I.C. Annual Conference", Mr. G. White.
"A Chemist in Agriculture", Dr. A. T. Johns.
"Active Nitrogen", Professor L. F. Phillips.
"The Theory of Valency and Some Peculiar Small Molecules" Professor R. D. Brown.
"Applications of Raman Spectroscopy", Dr. L. A. Woodward.

Waikato

"Biological Control of Industrial Wastes", Dr. P. M. Nottingham.
"Applications of Nuclear Science in N.Z.", Mr. T. A. Rafter.
"The Place of Isotopes such as Cobalt 60 in the Treatment of Cancer", Dr. L. A. Lomas (combined meeting with the Royal Society).
"A Chemist in Agriculture", Dr. A. T. Johns.
"Planning a New University", Dr. D. R. Llewellyn.
"Science Teaching at the Massachusetts Institute of Technology". Professor F. A. Cotton.
"Current Studies of the Electronic Structure of 'Pye' Electron Systems", Professor R. D. Brown.
"The Pursuit of Science", Dr. L. A. Woodward.
"Classification and Chemistry of Soils", Dr. W. M. H. Saunders.
In addition there was a visit to the N.Z. Products Pulp and Paper Mill at Kinleith.

Manawatu

"Gas-liquid Chromatography", Dr. J. C. Hawke.
"X-ray Crystallography in a Chemical Research Laboratory", Dr. B. R. Penfold.
"Unusual Aminoacids in Plants", Professor L. Fowden.

Wellington

"Atomic Absorption Spectroscopy", Dr. A. Walsh.
"Non-existent Compounds", Mr. W. E. Dasent.
"Solids", Professor J. F. Duncan.
"Development of Smelting Processes of Titaniferous Ores", Mr. T. Marshall.
"The Pursuit, Promotion and Profit of Research", Professor J. S. Anderson (Mellor Lecture held jointly with the Royal Society).
"Minerals in Industry", Mr. T. J. McKee.
"Ring Whizzers", Professor F. A. Cotton.
"Chasing Rainbows", Dr. L. A. Woodward.
Additional Functions: "Developments in Technician Training", an Open Night at Wellington Polytechnic.
A series of postgraduate lectures on "Modern Analytical Techniques", given by Drs. Carr, Ellis, Matheson, Millar and Sullivan.

BRANCH NEWS

Auckland

As the Annual General Meetings of the Auckland Branch have been poorly attended in the past few years, the Committee decided to experiment this year by combining the Annual Meeting with a social function in the form of the First Annual Dinner to which members were asked to bring their wives.

The combined function was held at the White Heron Lodge on Thursday, October 27, with programme as follows: 7 p.m., Annual General Meeting; 8-8.30 p.m., Drinks; 8.30 p.m., Dinner.

The Annual Meeting was somewhat better attended than last year and the usual business went through in an hour as planned. No controversial matters were raised.

At the dinner, 48 were present. The guest speaker was Professor D. R. Llewellyn, Vice-Chancellor of the University of Waikato. While we cannot predict whether this will become an annual function, those present enjoyed the evening and made favourable comments.

Waikato

Dr. D. C. Wright has returned from Davis University California and rejoined the Ruakura Agricultural Centre.

The Waikato Branch was well represented at a recent Electronics Course held at Victoria University of Wellington. Both Mr. S. Pickering and Mr. O. C. Clinton attended and felt all chemists could benefit from such a course.

Mr. K. I. McNaught after spending four months obroad on both accumulated and anticipated leave returned to occupy a place in the "Tower Block" at Ruakura.

After a construction period of over two years and at a cost of up to £300,000 the new "Tower Block" at Ruakura is now an accepted reality. Many have been pessimistic over the move from old haunts made familiar through the years. The old has, however, given way to the new and some fifty scientists of many disciplines have found working space over seven floors. A more concentrated research establishment in New Zealand would be hard to find.

Manawatu

Dr. R. C. Lawrence has recently returned from study leave at the National Institute for Research in Dairying, Reading, where he worked on the metabolism of fat in Cheddar cheese.

Mr. J. G. Clarke has accepted a managerial position with Geo. W. Wilton and Co., Wellington.

Dr. W. Sanderson has returned to the D.R.I. from Wisconsin where he had been studying for a Ph.D.

Dr. M. R. Grimmett attended the R.A.C.I. Divisional Symposia in Alicyclic and Heterocyclic Chemistry held in Canberra during August. He later visited university and research institutions in Melbourne and Adelaide.

Dr. R. Hodges and Dr. J. C. Hawke have been appointed Readers in the Department of Chemistry and Biochemistry, Massey University.

Dr. C. R. Boswell will be leaving in January to take up a post-doctoral fellowship in Canada.

The new building of the Dairy Research Institute was opened officially on November 2 by the Minister of Science.

Wellington

The Chancellor's Lectures at Victoria University were this year given by Professor R. E. Blackett from Imperial College of Science and Technology, London. Prof. Blackett, who is a scientific advisor to the British Government, spoke on science and government.

Mr. M. Coleman has been awarded a Post-doctoral Fellowship at Victoria University. Mr. Coleman is at present finishing a Ph.D. at Melbourne.

Returned recently to Chemistry Division are:: Dr. D. F. S. Natusch, formerly a Rhodes Scholar at Balliol College, Oxford; and Dr. H. P. Rothbaum who has spent two years at the National Chemical Laboratories at Teddington, London, as a Senior Research Fellow for the British Ministry of Technology.

Dr. A. D. Rae has been appointed to Chemistry Division to work on X-ray crystallography. Dr. Rae, a former graduate of the University of Auckland has been at the University of Cambridge on a Shell Scholarship.

Dr. H. J. Whitfield has been appointed temporary lecturer at the University of Newcastle-upon-Tyne for the 1966-67 academic year.

Dr. P. P. Williams has been awarded a Nuffield Fellowship to work with Dr. H. F. W. Taylor at the University of Aberdeen for twelve months on solid state chemistry.

Mr. J. H. Watkinson recently attended the First International Symposium on Selenium in Biomedicine held at Oregon State University to read a paper on analytical methods for selenium in biological materials. After the conference he visited the Departments of Soil Science at the University of California and at Berkeley University.

The Third Wellington Science Fair, organized by the Science Teachers' Association, was very successful. Entries received were 50 per cent more than in previous years and the standard was high.

Victoria University held a two-week post-graduate course on electronics for chemists in October. Thirty-seven people enrolled for the course.

Mr. W. G. Hughson left on October 10 to attend the World Power Conference in Tokyo and to participate in technical and study tours of fuel research. He will also spend a few days with C.S.I.R.O., Sydney, on coal research work.

In Wellington from October 17-21 the International Conference on Electron Nuclear Hyperfine Interactions in Spectroscopy was held under the auspices of the Royal Society of New Zealand. The Conference was attended by nearly 60 delegates, 28 of them representing Australia, Brazil, Britain, Democratic Republic of the Congo, Germany, Israel, Japan, U.S.A., and U.S.S.R. The scientific programme covered many fields of spectroscopy including e.s.r., infrared, Mössbauer, n.m.r., and optical spectroscopy.

At the September meeting of the Wellington Branch of the N.Z.I.C., chaired by the Branch Chairman, Professor J. F. Duncan, Mr. J. E. Cornish, Technical Director of I.C.I. (N.Z.) Ltd., presented the I.C.I. prize for 1965 to Dr. I. K. Walker.

Dr. Walker, who is Director of Chemistry Division, D.S.I.R., was awarded this prize for his work on the longstanding problem of the causes of spontaneous fires in the New Zealand wool export trade.

Presentation of the 1965 I.C.I. Prize for Outstanding Achievement in Chemical Research. Left to right: Dr. I. K. Walker, Professor J. F. Duncan, Mr. J. E. Cornish.

In Nelson,

Mr. Peter Fenemore of the Entomology Division, D.S.I.R., Nelson, has recently returned from attending a joint F.A.O./I.A.E.A. sponsored course on the "Uses of Radio-isotopes and Radiation in Entomology" at the University of Florida. His section has just installed a Philips counter unit to further their work on insecticide problems such as the behaviour and biology of insects in relation to different insecticide treatments. One proposed experimental use will be to study the rates of soil ingestion by grass grub larvae.

The Australian seismic survey ship "Saori", owned by Geosurveys of Australia Ltd., is currently making a seismic survey for natural gas in Tasman Bay and Golden Bay.

Canterbury

Dr. A. Fischer has been awarded a Nuffield Fellowship and has left to spend a year at the University of Sussex with Professor C. Eaborn.

Dr. M. P. Hartshorn has left to spend a year at Cornell University as a Visiting Assistant Professor. He is to undertake graduate course teaching and research with Professor J. Meinwald.

Dr. J. E. Fergusson will spend 1967 on refresher leave at the University of Sussex. Dr. J. M. Austin will spend 1967 at the University of California (Berkeley), University of Minnesota, and Imperial College, London.

Dr. R. H. Earle, from The Hercules Powder Company in the U.S.A., and Dr. M. Viney from the University of East Anglia, have taken up postdoctoral fellowships in organic chemistry at Canterbury University.

Dr. R. F. C. Claridge has taken up a senior lectureship in physical chemistry, Dr. D. A. House a lectureship in inorganic chemistry, and Dr. A. G. Williamson a senior lectureship in chemical engineering. Dr. J. M. Coxon has been appointed to a lectureship in chemistry.

Professor J. T. Davis, head of chemical engineering at the University of Birmingham and a graduate of Canterbury University (1945), gave a special lecture entitled "Chemical and Physiological Origins of Smell", to an overflow audience of Institute and Royal Society members on October 31.

A practical exercise was held by the Canterbury Junior Chemical Society on the morning of Saturday, April 30, 1966. Upper Sixth Form chemistry pupils were previously invited to prepare the compound $[Co(NH_3)_3(NO_2)_3]$ by a prescribed method, carry out a number of chemical reactions with it and then submit a report to be examined. Twenty-two students entered, representing nine schools. Of these, fourteen were selected to attend at the Chemistry Department, University of Canterbury on the Saturday morning to study their compound further. Using their own preparations the students measured the conductivity of the compound, its infrared and visible spectrum. They found from a paper chromatographic separation that their preparation was in fact not a single compound, but at least two. The pupils were interested to find that their preparation was only 80 per cent pure, the other species being

$$[Co(NH_3)_2(NO_2)_4]^-[Co(NH_3)_4(NO_2)_2]^+$$

This fact has only been discovered in the last few years, and other preparative methods for $[Co(NH_3)_3(NO_2)_3]$ give an even lower yield of the required compound.

Otago

Professor H. N. Parton returns in December 1966 after a year's refresher leave at the University of Exeter where a former student of his, Professor M. L. McGlashan, is now Professor of Physical Chemistry.

The Chemistry Department of the University of Otago is pleased to be able to welcome:

Dr. D. J. Brasch a former Group Leader with the Chemistry Division of D.S.I.R. in the field of Pulp and Paper Chemistry, as senior lecturer in Applied Chemistry; Dr. B. H. Robinson, who has just completed two years post doctoral research at the University of Newcastle on Tyne, and at the University of Manchester, as a lecturer in Inorganic Chemistry.

Dr. A. G. Williamson has been apointed Senior Lecturer in Chemical Engineering at the University of Canterbury.

Dr. L. S. Deady has been appointed Lecturer in Chemistry at La Trobe University, Melbourne.

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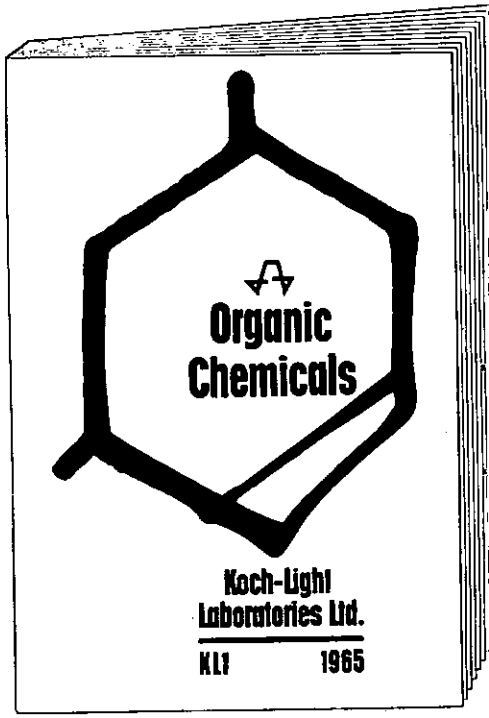

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BOOK REVIEWS

Photochemistry, by JACK G. CALVERT and JAMES N. PITTS, JR. John Wiley and Sons Inc., New York, 1966. 899 pages, $A19.50

This book, claimed to be the first work of its kind in two decades, is best described as a comprehensive textbook of photochemistry. Despite the recent appearance of the series *Advances in Photochemistry* the general development of the subject which has occurred of recent years is such that the young researcher who plans to enter the field and the established worker who wishes to have a quick source of reference ready to hand were virtually restricted to the abundant original literature for their information, until the appearance of this volume. Hence it is a must for all libraries which claim to have up-to-date chemical holdings and a text which all photochemists and many spectroscopists and theoretical, physical and organic chemists will want to purchase for themselves. The size of the volume and the wealth of material in it show how inadequate is the coverage of photochemistry in modern textbooks of physical chemistry.

There are seven main sections. A short introductory chapter is followed by a treatment of the interaction of light with atoms, including the important class of atom-photosensitised reactions, and the interaction of light with simple molecules (mostly diatomic molecules). The primary photophysical processes in polyatomic molecules are then treated, followed by the photochemistry of polyatomic molecules. Thus the book covers the field known usually as "organic photochemistry" to which organic chemists interested in synthesis and the less fundamental aspects of photochemistry have been the main contributors. Chemists with these interests will also find Chapter 6 on the determination of the mechanism of photochemical reactions of great interest. A final chapter of 100 pages is on experimental methods in photochemistry, a really first class summary of important information that is virtually unobtainable elsewhere. The authors are to be greatly praised for including this chapter and it would be a great boon if more authors of comprehensive texts would follow their example in this respect. The book ends with a number of appendices and the usual indexes.

This is a really excellent book which fills admirably an unfortunate gap in modern chemical literature.

B. D. ENGLAND

Advanced Practical Inorganic Chemistry, by D. M. ADAMS and J. B. RAYNOR. Published by John Wiley and Sons Ltd., London, New York and Sydney, 1965. 182 pp.

This text by Adams and Raynor fills a void created by the major changes which have occurred in the content of inorganic chemistry courses over the last decade and as such it can be unreservedly recommended for use in undergraduate courses.

There are two main sections in the book. The first is intended for a preparative two-year course and covers solid state chemistry, volumetric analysis, flame photometry, solvent extraction, ion exchange, paper chromatography, the measurement of ionisation potentials of the rare gases and the reactions and preparations of compounds of s- and p- block elements and transition elements. The second section is for third-year students and it deals with infrared, ultra-violet and visible spectroscopy, high-temperature preparations, vacuum-line preparations, inert-atmosphere techniques, non-aqueous solvents, organometallic chemistry, electrolytic preparations, inorganic polymers, high-pressure techniques, magnetochemistry, X-ray powder photography, electrical conductivity and optical isomerism.

The authors keep the amount of theory to a minimum, giving instead sensible exercises and literature references after each experiment so that overall they achieve a nicely balanced book which endeavours to make the student teach himself as much again as can be gained directly from the text.

To anyone interested in the teaching of inorganic chemistry this book should prove a welcome, low cost addition to their libraries.

G. R. BURNS

Quantum Organic Chemistry, by K. HIGASI, H. BABA and A. REMBAUM. Published by Interscience (a division of John Wiley and Sons Inc.), New York, London and Sydney, 1965. 358 pp.

This book treats quantum organic chemistry in a less rigorous way than Streitwieser has done in his text and concentrates in the main on the Huckel pi electron approximation and the Slater-Pauling valence bond method. Each chapter first gives an outline of the information to be gained and then gives the simplest possible mathematical development necessary for an understanding of how the information is obtained.

The authors excuse the appearance of another book on molecular orbital theory for organic chemists—although the book did

first appear in Japanese in 1956—on the grounds that it is simpler than the others. That the approach of this book is simpler cannot be disputed, but I am not convinced that a simpler approach than of Streitwieser's is either necessary or beneficial. This is a highly readable book and the latter chapters on dipole moments, electronic absorption spectra, electron spin resonance spectra of aromatic free radicals, chemical reactivity and polymerisation reactions are well written and give a clearer picture of where quantum mechanics fits into the organic chemist's repertoire than other texts in this field.

One minor fault is that there are a number of loose statements, such as ". . . the theoretical value exceeds the experimental value. This is often the case in this kind of calculation and we usually introduce a correction factor of 0.25 to 0.40; and when this is done f theor. appears to agree with f exp. . . ." These do little to foster the cause of applying quantum mechanics to organic chemistry.

As light reading the book is good value, particularly in the way it outlines the chemical information that can be gained from a quantum mechanical approach to problems, but for anyone requiring a clear picture of the uses and limitations of quantum mechanics in organic chemistry there are probably better texts available.

G. R. BURNS

R.I.C. Laboratory Handbook of Toxic Agents, Second Edition, by C. H. GRAY, Editor in Chief. The Royal Institute of Chemistry, London, 1966. 190 pp. Price 24s., R.I.C. members 18s.

Format and presentation are as before, with five sections: (i) Introduction and General Principles, (ii) Precautions and Preventions, (iii) First Aid in the Laboratory, (iv) Poisonous and Corrosive Gases, Reagents and Solvents, (v) Precautions against Radiations; and Glossary.

Major changes are complete rewriting on artificial respiration (now mouth-to-mouth recommended primarily, the Silvester method secondarily), and the whole of Section V.

The alphabetical list of over two hundred chemical items in Section IV has expanded—forty-one added, one (cellosolve) omitted. The additions include two inorganic substances ($AlBr_3$ and ICl), the remainder are organic. Prominent in these are halogenated substances (substituent or acid chlorides), amines and amides. The previous M.A.C. (maximum allowable concentra-

tion of dust or vapour) rating throughout this section has been replaced by T.L.V. (threshold limiting values), and a few marked differences can be noted, though most figures remain the same.

Proof reading has been thorough, but under "Chloroacetamide" the remark on "Effects" needs either correction or clarification.

As is stated in the preface, the compactness is achieved by selection of the more hazardous and more common chemicals, deliberately avoiding the encyclopaedic comprehensions of works such as that of Sax.

This selective economy results in a basic reference manual well within the reach of personal possession by every chemist—an aspect which cannot be too strongly recommended. Moreover, the omission of so many chemical materials is more apparent than real, for except in a few specialised fields, toxicity and treatments are very much conjecture for the vast majority of substances, which still await their "guinea-pigs" (human and others).

The demonstrated ability of the R.I.C. to condense and select information of this kind lends hope to suggesting, for future inclusion, three short features either absent or too briefly touched on in the present edition. These are: first, a very short classified beginner's guide to the bibliography on the broader and narrower fields of toxicology etc. in research, industry and agriculture; second, practical advice on predicting hazardous character from chemical constitution; third, carcinogenicity, in relation to the last point, and also to a quantitative perspective on the exposure risks, an aspect which at present tends to be either emotionally over-emphasised or discounted.

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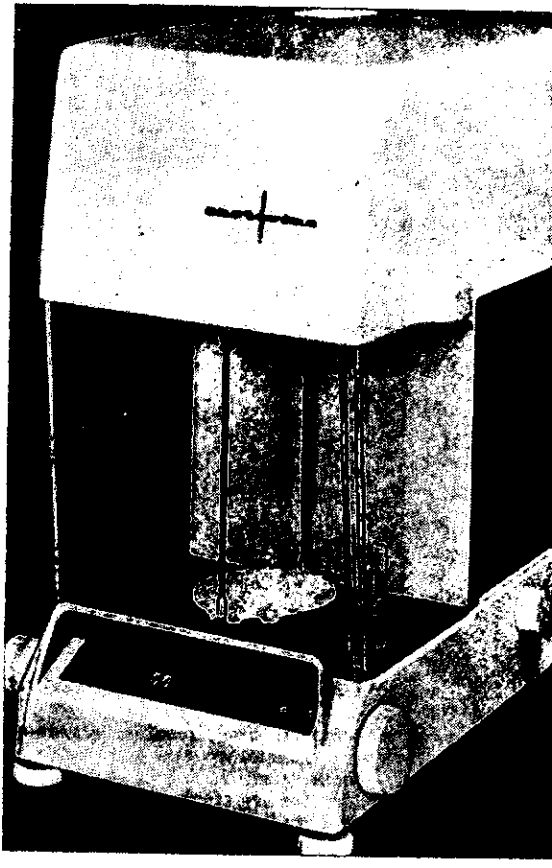

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