CHEMISTRY IN NEW ZEALAND

JOURNAL OF
THE NEW ZEALAND
INSTITUTE
OF CHEMISTRY

Vol. 33, No. 6, December, 1969

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Journal of The New Zealand Institute of Chemistry

Vol. 33, No. 6, December, 1969

Published bi-monthly by the New Zealand Institute of Chemistry Inc. (P.O. Box 250, Wellington)

Contents

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Printed by David F. Jones Ltd., 108 Tory Street, Wellington.

COVER PHOTO: Professor D. Barton (left), joint winner of the 1969 Nobel Prize for Chemistry, with his team in the Organic Chemistry Department, Imperial College of Science, London.
(Photo by courtesy of the British Information Services.)

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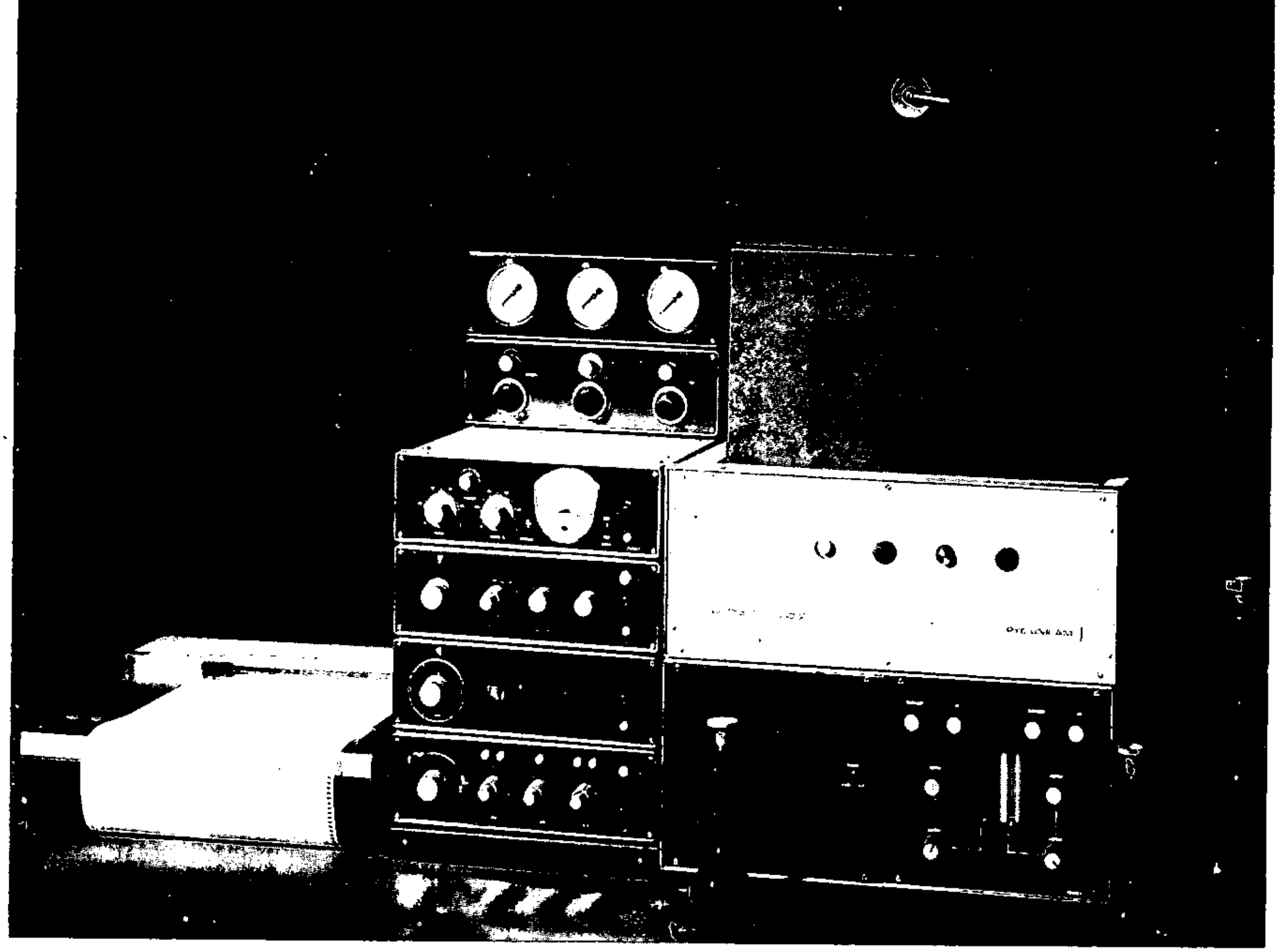
The Journal of the N.Z. Institute of Chemistry has an audit circulation Certificate of New Zealand Advertisers. Latest audited circulation (March 1969) 1150.

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IMPORTANT NOTICE

IUPAC have requested a list of all New Zealand manufacturers of chemical reagents (a chemical reagent in this context means, basically, any chemical sold in pure form). It is believed that some English chemical companies have recently produced and sold large quantities of reagents with an unusual isotope content (mainly compounds of barium, uranium and lithium). This, it is considered, could produce a minute amount of radioactivity in products incorporating these reagents and could conceivably affect analytical results.

IUPAC wish to advise New Zealand manufacturers of this problem and any individual or firm concerned is asked to contact

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so that any further information or action deemed desirable can be initiated.

PLEASE BRING THIS NOTICE TO THE ATTENTION OF ANYONE LIKELY TO BE AFFECTED.

CORRECTIONS TO THE 1969 LIST OF MEMBERS

Now that the List is at last published, the Chairman is dismayed to find his most glaring error blazoned over the beginning of the Alphabetical Section.

Firstly he has confused Honorary Fellows and Life Members.

Secondly he has lost one Fellow between the manuscript and the galley proof.

Since the closing date there has been time to elect a new Honorary Fellow. In view of all this we print herewith a correct and updated list of Honorary Fellows to be pasted over the erroneous version. With apologies,

JOHN POLLARD,
Chairman, List of Members Committee.

HONORARY FELLOWS

Dr. H. E. Annett, O.B.E.
Dr. C. R. Barnicoat
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CORRECTION TO LIST OF MEMBERS

WILKINSON, Barry Ralph, M.Agr.Sc. (Lincoln), Ph.D. (Lond.), Wool Research Organisation of N.Z. (Inc.), Private Bag, Christchurch. (*Research Biochemist*). A'69.

CHEMISTRY IN THE FIRST CENTURY O.U.

Lecture in Honour of J. W. Mellor, F.R.S. (1869 - 1938)

H. N. Parton

Mellor Professor of Chemistry, University of Otago

The year 1869, in which the Otago Provincial Council agreed to found a university not only in the interest of its province but in the interest of Her Majesty Queen Victoria's colony of New Zealand, ended a decade which was in a number of ways a watershed in the development of physical science. Mendelyeev announced his periodic law, chemistry's major generalisation, at a meeting of the newly formed Russian Chemical Society in March 1869, and his paper was published in the first volume of its Journal in the same year. A decade earlier Cannizzaro had taken the decisive step toward establishing a uniform and consistent system of chemistry. It is difficult to describe the confusion then current in the subject. Prior to his work (1858) there was no universal system of atomic weights, and different formulae were used by different schools for the same compounds. Dalton's atomic theory was fifty years old, but was not completely accepted because of the confusion and doubt brought about by several different systems of numbers, all called "atomic weights". There was no clear distinction between ultimate particles, especially the terms *atom* and *molecule*. The atom was in fact essentially a chemical concept in the science of the day and a very old metaphysical one. James Clerk Maxwell in a famous article on the atom in the Encyclopaedia Britannica began with the definition "The atom is indivisible" and justified it by reference to its etymological origin in Greek, and by the remark that although space and time appear to be infinitely divisible, the same is not true of the elementary units of matter. There is no scientific basis for these strictly speculative ideas. J. J. Waterston, who was a keen billiards player, had introduced the idea of a hard or "billiards ball" atom, and it had played a large part in the development of the theory of gases. It was in the sixties that Maxwell first postulated that the particles of a gas, instead of maintaining the same uniform speed as Clausius and others seem to have assumed, move with a distribution of speeds, an idea of immense fertility in physical science, not least in the understanding of the rates of chemical reaction.

At the end of this decade then, with its promise of fundamental scientific progress, the University of Otago was born. And in th same year, was born Joseph William Mellor, in Huddersfield, Yorkshire.

It is most proper that the memory of J. W. Mellor should be honoured in his own, and his University's, centennial year. It is equally proper that reference should be made to his wife, Emma Mellor, who survived him by 24 years and in her will added her husband's name and her own to the benefactors of Otago University. In Mrs. Mellor's will the University was bequeathed the royalties payable in respect of two of her husband's works — the *Comprehensive Treatise on Inorganic and Theoretical Chemistry* and *Modern Inorganic Chemistry.* The stated purpose was "the furtherance of research in pure chemistry". The University Council agreed to set aside from the first year's income a sum to be invested to establish a Joseph and Emma Mellor Prize for the best student in Part III chemistry, that is the fourth year course in which research training is started. A Mellor Fellowship was also established, and we have so far had two Visiting Professors under it — Professor M. L. McGlashan of the University of Exeter (1968) and Professor R. L. Scott of the University of California at Los Angeles (1968-9), the latter being partly supported by the Fulbright scheme. Grants are also made to research students and sometimes to staff members (mainly for travel in connection with research work), and equipment not otherwise available has been bought from the Mellor Fund. Overall, Joseph Mellor's posthumous and continuing influence on research in his first University should be a source of great satisfaction to all who know his history. And it is with some pride that I say that the University Council accepted a recommendation that the senior professor in the Department of Chemistry should be designated Mellor Professor, in memory of this distinguished son of the University, and that I have the honour of being the first bearer of this title.

Mellor's early years in Dunedin have been described by Mr. A. H. Reed in a memoir which is available as *Dunedin Public Library Publication No. 2 (1957)*. It is very good to be able to recall from Mr. Reed's memoir that the city has given Mellor's name to a street in the Kaikorai Valley. I do not propose to discuss this period beyond noting that the material we have available in the University library, incomplete as it is, reveals something of his astonishing industry. The library has, for example, a volume labelled Book XVII and dated March 8th, 1888. Mellor was then 18 and he did not enter the university for another six years. Book XVII contains 564 closely written pages of 65 lines each, averaging some 18 words a line. Allowing for the space taken by diagrams, there must be about 500,000 words. About three-quarters of it is chemistry, abstracted from Roscoe and Schorlemmer's *Treatise on Chemistry*. Mellor, the great encyclopaedist of inorganic chemistry in the English language, is clearly foreshadowed here. The remainder of the volume deals with electricity, magnetism and electrodynamics from the writings of Elihu Thomson, J. Ambrose Fleming (inventor of the diode) and J. A. Ewing. What Books I to XVI and any subsequent volumes of his handwritten notes contained, there is no means of knowing. It hardly seems credible they could be comparable.

Another interesting relic is his *Omnium Gatherum* (1895). This is a hard covered book of over 600 blank pages—blank, that is, when bought. It contains a receipt for 2s. 6d., being the annual subscription of Mr. J. W. Mellor to the Everett Shorthand Society of Belfast. 492 of the pages are filled with shorthand reproductions of articles on all kinds of topics; Liberty, Technical Education, Orthodoxy in Science, Psycho-Physiology, Origin of Diseases (from the *Lancet*), Supernormal Foresight, the Soul (from the *Agnostic Annual of 1897*) and Mathematics and the other Sciences.

Mellor passed the University Entrance examination in 1892 and entered the University of Otago in 1894. At this time physical chemistry, to which he gravitated when he went to England five years later, was in its infancy, if it can be regarded as beginning with the publication of the *Zeitschrift fur Physikalisches Chemie* in 1887. So it is of some interest to see what was presumably being taught in the New Zealand university chemistry departments. This was determined by overseas (i.e. United Kingdom) examiners, as the University Senate, a body of laymen essentially, had an abiding faith both in examinations and in particular in external examiners, then regarded as necessary (here but not in Australia) to "maintain the standards". The examination papers of the 1890's were at Pass (1st year) level ,then B.A. or B.Sc. for Honours; Senior Scholarships were competed for by separate papers. The chemistry examiners of the period were T. E. Thorpe (1890-94) and Vernon Harcourt (1895-99). Most of the questions were in inorganic and organic chemistry. Thorpe's papers however included the Periodic Law, explosions, chemical affinity, valence, and one which for the period is particularly interesting. It said "Give an account of the peculiar properties of carbon which render possible the formation of so many compounds of this element". It is difficult to see what the "peculiar properties", as known in 1893, would be. With Harcourt physical chemistry began to emerge; initially experimental work, vapour density, freezing point and molecular weight, osmotic pressure, measurement of high temperatures, classification of substances by their optical properties. Then new *ideas* were introduced; the bearing on chemical theory of the freezing points of dilute solutions; the distinction, if any, between chemical combination and the process of solution (something of an obsession of Harcourt's); the grounds for the existence of "ions" in solution; rates of reaction. All these indicate the growing influence of Arrhenius, Ostwald and van't Hoff, the three musketeers of physical chemistry. The 1897 papers were lost in the S.S. *Mataura* in the Strait of Magellan. Mellor gained the Senior Scholarship in Chemistry in that year, first class Honours in 1898 and was awarded the 1851 Exhibition Scholarship in 1899, five years after Ernest Rutherford. He taught for a few months at Lincoln College, married Miss Emma Bakes and they left for the United Kingdom in July 1899. At Owens College, in the University of Manchester, Mellor began by studying ,at the suggestion of W. H. Perkin Jr. the α-alkyl derivatives of some dibasic acids. Then at the suggestion of H. B. Dixon he took up the photochemical reaction of hydrogen and chlorine. He checked long standing results of J. W. Draper, of Bunsen and Roscoe and of Pringsheim and showed the presence of oxygen in the H_2-Cl_2 mixtures made by electrolysis (this played a large role in later work on the reaction). With E. J. Russell (later distinguished in soil chemistry) he confirmed the result that very dry H_2 and Cl_2 react slowly even in sunlight, found by H. B. Baker who later made a stir in the chemical world by his claims for the results of "intensive drying" of gases and liquids.

At this point Mellor was clearly establishing himself as a physical chemist. Instead of going on to become a leader in this field, he became instead the man of whom it was said (by J. F. Thorpe) that "probably no one since Josiah Wedgewood has had a more profound influence on the science of ceramics than J. W. Mellor". How did this come about? Primarily I think because the opportunities open to a man even of Mellor's quality were few. However, Professor W. E. S. Turner in the first Mellor Memorial Lecture of the Institute of Ceramics explains that Mellor was asked by the New Zealand Government to write a report on secondary education and decided that the best way to get an understanding of the subject was to get a teaching post in a secondary school. Moreover, Professor Turner states that he was offered, and declined, a Chair of Chemistry in Sydney in 1908, to the pleasure and relief of his associates at Stoke. In 1902, having obtained his D.Sc. (New Zealand), he accepted a post as science master at the High School, Newcastle-under-Lyme, in the potteries district. His own account of it is as follows: "I remember that I first came to the district through carelessly mistaking Newcastle-under-Lyme for Newcastle-upon-Tyne. Except for the mistake I should certainly not have been here. . . . While at the High School I was attraced to the industry by the queer chemistry I instinctively saw behind many of the operations associated with clays, etc." Two years later he became lecturer in ceramics at the Pottery School, Stoke-on-Trent. "I found in the pottery classes", he wrote later, "and in the Ceramic Society a lot of serious workers after my own heart. . . . We quickly got busy together." Rutherford in Canada and Mellor in Staffordshire were both men who "quickly got busy" on the problems in hand. Thus began his great work for the ceramic industry and his twenty years (1914-1934) as Principal of the Pottery School at Stoke Technical College, the latter being held along with his Directorship of the British Refractories Research Association (1920-37). It is not my purpose to discuss this side of Mellor's life work, not for lack of concern with applied chemistry, but because my interest in him has a different orientation.

Mellor the Author

I will turn instead to Mellor the author. His first book, published in 1902, was his *Higher Mathematics for Students of Chemistry and Physics* which ran to four editions in 10 years. One view of its genesis is that of the late Professor J. F. Thorpe, who held the Chair of Organic Chemistry at Imperial College, London, from 1914 to 1938. Thorpe met Mellor in Manchester in 1899 shortly after his arrival from New Zealand. He wrote "Mellor stayed for some years in Manchester and during that time wrote a book on mathematics for chemists. Mathematics is a subject which either appeals to chemists or does not appeal to them. They either worship it or they hate it. A large number hate it with an abiding hate, and it is the cause of many failures in examinations. Mellor was, in its best sense, a physical chemist and a sound mathematician to boot, so that when his book appeared it was welcomed by all the organic chemists—who hold mathematics under a deep suspicion and regard it as a clever form of juggling especially designed to affect the net of formulation into which they have wound themselves. But Mellor's book seemed to take one gently by the hand up the high hill, beguiling us by the way by examples which the organic chemist could readily understand, and many an organic chemist began for the first time to realise how much he had missed by not acquiring a knowledge of that profound science".

Mellor himself records that he was encouraged by Professor Dixon to "write a book explaining the inwardness of mathematical operations as applied to chemical results", remarking that "we chemists, as a tribe, fight shy of any symbols but our own". This was, in fact, the period when Ostwald formulated chemical reaction rates in the symbolism of the differential calculus, for example $\frac{dc}{dt} = kc$ for a first order reaction, some chemists enquired why he didn't cancel the d's. It is interesting to compare the contents of Mellor's book in its final (1912) edition with that of another written for physicists and chemists 30 years later—Margenau and Murphy's *The Mathematics of Physics and Chemistry*. Mellor covered differential and integral calculus, co-ordinate geometry, series (including Fourier series), differential equations, probability in relation to error theory, calculus of variations and determinants. His successors found it necessary to add a variety of special functions (Bessel's, Laguerre's, Hermite's, etc.) vector analysis, curvilinear co-ordinates, eigenfunctions, Hamiltonians, matrix algebra, quantum mechanics, statistical mechanics, linear integral equations and group theory. No one will claim that it is not possible to be a very good chemist without this mathematical equipment, but some knowlege of a good deal of it is required to understand current theoretical chemistry, and a good knowledge for anyone wanting to contribute to it.

Another of Mellor's early books was *Chemical Statics and Dynamics*. An interesting reference to this book is quoted in R. W. Clark's biography of Sir Henry Tizard. Tizard recorded that at this first interview in 1905 with his tutor in chemistry at Oxford, N. V. Sidgwick, the latter "turned to his shelves and picked out a new looking book entitled *Chemical Statics and Dynamics* by Mellor. 'This is an important subject' he said 'but the book is rather too mathematical for me. I wish you'd take it away and see how many mistakes you can find in it'."

Tizard continued "I believe that this was the first time . . . that anyone had suggested to me that there might be mistakes in a printed book of science. I took it away; an early discovery of a mistake in the first chapter aroused a detective spirit and led me to consult works of reference: and I returned in October with a list the length of which surprised my tutor as well as the author (who wrote a charming letter of acknowledgment) and I learnt a lot of chemistry in the process."

The mathematics in *Chemical Statics and Dynamics* is in fact elementary. Tizard's surprise at learning that there "might be mistakes in a printed book of science" is possibly indicative of the high tide of belief in scientific infallibility, characteristic of the period just coming to its end. Or perhaps Tizard at the age of 20 was somewhat naive. But that Mellor would write a "charming letter of acknowledgment" of the corrections is fully in character. He knew, as a distinguished philosopher of science has put it "nobody is exempt from making mistakes; the great thing is to learn from them".

The period in which Mellor returned to the Old World from his upbringing in New Zealand saw the spectacular series of discoveries which laid the foundations of atomic physics. It is largely forgotten today that some scientists, Kelvin for example, believed that physics was almost complete. Most chemists have heard the story of Baeyer who, when reporting to his students that Emil Fischer had synthesised glucose, announced "all we have to do is clean up the terpenes, and organic chemistry will be complete". It is also largely forgotten that most European physicists, under the influence of Ernst Mach, had rejected the atomic theory and that Ostwald, one of the founders of physical chemistry, gave a lecture to the Chemical Society in which he tried to explain the laws of chemical combination without the concept of atoms. Into all this dogma came the discoveries of the electron as a common constituent of all atoms (J. J. Thomson), X-rays (Roentgen) and radioactivity (Becquerel and the Curies). Very quickly Ernest Rutherford, born and educated in New Zealand, was analysing the radiations produced in radioactive decomposition and turning the α particle into a probe to study the structure of atoms in which Nernst, Ostwald, Mach and others did not even believe. Moreover, Max Planck was solving the riddle of the distribution of energy in black-body radiation by his quantum theory; and in 1905 Albert Einstein, in his "annus mirabilis", formulated, among other principles, his law of photochemical equivalence without which no further progress on the hydrogen-chlorine photochemical reaction which Mellor had studied would have been possible. It was, in fact, the discovery that a quantum of radiation instead of producing one reactive chlorine molecule, and hence two HCl molecules as Einstein's law required, produces up to one million, which led Bodenstein to the idea of a "chain reaction", of great significance in later years. But Mellor had turned to teaching and to ceramics and played no part in these developments.

It was also about this time, the turn of the century, that through Van't Hoff and most notably Willard Gibbs the thermodynamics of macroscopic systems (classical thermodynamics) began to make its impact on chemistry. It has three characteristics: (1) it is derived from a small number of axioms, (2) is applicable to many different types of system and (3) its principles are independent of physical models of material systems. At the same time the foundation had been laid, notably by Maxwell, Boltzmann and Willard Gibbs, of another discipline whose power was to be seen in chemistry when molecular models of material systems of an increasingly refined nature were developed during the ensuing decades of this century. This discipline, now often called statistical thermodynamics, also involves a relatively small number of axioms but in addition the methods of probability theory and the laws of mechanics. It can be applied either to (a) a model of a system involving large numbers of identical microscopic particles or (b) ensembles of large numbers of identical models of the system. The purpose in either case is to predict macroscopic (large scale) behaviour from molecular properties, for example, the heat capacity of a gas from the properties of its molecules deduced from, say, spectroscopic measurements.

The first method, associated mainly with Maxwell and Boltzmann, suffices only for dealing with a very restricted class of physical systems—virtually only with gases. The second method, introduced by Boltzmann but mainly developed by Willard Gibbs, is applicable quite generally to every physical system. The "large number of identical models of the system" are mental copies of the one system under consideration—of the one macroscopic system which we can actually set up on a laboratory bench. I do not propose to pursue this beyond the remark that this work is just as fundamental to modern theoretical chemistry as the rather better publicised quantum theory of Planck and its subsequent development, quantum mechanics. Moreover, I think Willard Gibbs should have endeared himself to chemists with his modest claim "If I have had any success in mathematical physics it is I think because I have been able to dodge mathematical difficulties."

None of this work, so seminal in modern physical science, appeared in the books of Mellor to which I have referred. He had turned to the application of chemistry to ceramics. I had it on the authority of the late Mr. Herbert Chapman, Registrar of Otago University from 1911 to 1948, that Mellor was a candidate for the Chair of Chemistry when J. G. Black retired in 1911. It is interesting to speculate what he would have done if his candidacy had ben successful. He had by this time published nearly 40 papers in the *Transactions of the British Ceramic Society,* and had been the Society's secretary since 1905. Would he have returned to physical chemistry in the pure sense, or would New Zealand have had a Pottery and Ceramics Research Institute arising within a university years before the Department of Scientific and Industrial Research was established? Or would the problem of being a professor in New Zealand with the minimal assistance regarded as proper in those times have overwhelmed him? It is impossible to imagine anything overwhelming Mellor. A brief examination of what the successful candidate for the chair, J. K. H. Inglis, was able to publish from Otago University reveals the situation. Inglis was appointed to the Chair of Chemistry when occupying a similar post at Reading University, where he was both the first Lecturer-Head-of-Department of Chemistry and then the first Professor of Chemistry. His published work had been in various fields including electrolytic chlorination of salts, conductivity of fatty acids, Grignard reagents, loss of nitre in the lead chamber process. World War I followed closely on his taking up his new Chair and he was involved in the manufacture of chloramine T. After the war there appeared papers on ethyl acetoacetate (with K. C. Roberts) and ethyl cyanoacetate. In addition, however, the work of the M.Sc. students whom he supervised was published under their names alone, with an acknowledgement only to him. This was characteristic of the man. His department was an active one—this is what he wanted.

Mellor then, remained in England. Much great work lay ahead. Of his tremendous effort over 15 years (1922-37) when he compiled the *Comprehensive Treatise* of which the Otago Chemistry Department is the beneficiary, one can only say what an incredible feat it was. Samuel Johnson in his famous dictionary did for the English language what the French Academy employed a large team to do for the French language.

Chemistry too has encyclopaedic works created by joint authorship, and it has Mellor—one man's personal achievement. There are 16 volumes, some 15,000 pages and some ten million words. A decade ago some 78,000 individual volumes of the Treatise had been published, out of some 325,000 copies of all his books. Perhaps the best short statement of Mellor's achievement is contained in the Preface to the first of the supplementary volumes (1959) which are now being produced under an Editorial Board.

"Mellor's *Comprehensive Treatise* has long been regarded by chemists the world over as one of their most valuable sources of information. That this is still true, even though the original work was completed twenty years ago, is very clearly shown by the continuing steady demand for the book. Nevertheless the publishers decided that, with the vast growth of chemical knowledge, the time has now arrived when Mellor should be brought up to date. Consideration showed that to re-write the whole work would be so vast a labour as to be inordinately costly in money and in time; moreover no such reconstruction could hope to retain or recapture that personal and individual flavour, so delightfully characteristic of the author".

I have outlined something of Mellor the chemist and the writer of scientific works. He was no mere scientist—he was a human person of a most admirable kind. *Uncle Joe's Nonsense* for Young and Old Children, reveals both his humour and the breadth of his reading. Written, or rather compiled, from his letters and other sources at the urging of his friends of the Ceramic Society, the "Random Ravings", as he called them are dedicated "to my nieces and nephews in New Zealand and to my friends of the Ceramic Society". In the preface he suggests that Shakespeare might have written

"The nonsense that men do lives after them
The good is oft interred with their bones".

The range of wit and wisdom is remarkable. Those of us who spend much of our time on committees will appreciate the comment "I am in sympathy with the man who always had the bad luck to be on a jury with eleven obstinate men". I like his example of a logical syllogism

All normal men are corkscrews
All corkscrews can reason
Therefore all men can reason.

As a chemist he recalls to one of his young readers that blue litmus paper will *always* turn red in contact with vinegar and goes on with some good advice; "I think I once told you of a man who suggested a novel use for litmus paper, since he advised his son who was courting a girl to be sure to test her mother with blue litmus paper before 'popping the great question'." Finally he holds forth On Kissing. Noting the absence of any record that Adam ever kissed Eve he goes on "It is inconceivable that Adam in the Garden of Eden with the most beautiful girl on earth could ever have called 'no bid' with such a hand. Two females kissing is quite another matter . . . it can be justified only by their instinctive . . . desire to keep the tackle in working order".

Here then we have a man who could clearly have contributed substantially and significantly to physical chemistry, but who was turned by circumstance to the applied field and made perhaps an even greater mark there; an author of many scientific papers, a monumental treatise, textbooks of chemistry—and *Uncle Joe's Nonsense.* When Harrod's listed his collected material for sale in 1937 there were 30,000 reprints and pamphlets in 1,000 box files, which the owner hoped might find a permanent home in a university or industrial library. What did he think about education, he who was a great practitioner of it? In 1916 he spoke on the Mission of Science in education. "For a long time" he said "it has been accepted . . . that the cultivation of science is necessary for the success of the nation, and the educational system has been modified . . . by the introduction of science subjects. . . . More science . . . is advocated, as if science is the elixir of national life. Some social and educational reformers are intoxicated with the extravagant hope that the introduction of still more science . . . will regenerate the nation, and leave us an easy first in the *post bellum* struggle for industrial supremacy."

He went on to stress the value of competition. "Nature has ordained that man shall toil and labour, that he shall be tested by the stress of competition, and prove his right to live. If competition be abolished, human progress, responsibility and self reliance will perish. There is a legend in the Talmud that the Rabbis once caught and imprisoned the Devil, and so the world came to a standstill, everyone went to sleep".

Then he spoke about teaching, criticising the "pernicious teaching of facts", and distinguishing between "technical" and "scientific" instruction. The latter he saw as creating "the scientific habit of mind", which will remain when the facts are forgotten. Mellor was principal of a Technical College, and the author of a Treatise the permanence of which rests on the essentially factual character of its content. But he was under no illusion that scientific education and technical training are identical, or that science consists merely of factual knowledge.

I have been, at least in some slight measure, trying to look at Mellor against the background of chemistry in his lifetime. He died in the decade in which the great advances in theoretical physics made in the first quarter of the 20th century began to have a major influence on his science. Pauli's Exclusion Principle was seen to provide the fundamental clue to chemical periodicity; the wave equation and its quantum conditions offered an understanding of the problem of chemical bonding—valence theory; moreover with Polanyi, Eyring and others, quantum mechanics also explained how atoms could exchange partners, that is undergo chemical reaction, bonds being broken under the influence of the formation of new bonds, with activation energy less than the bond energy. Statistical thermodynamics offered a link between the macroscopic behaviour of bulk matter and the microscopic behaviour of its particles.

Developments in Otago University

I have been involved in teaching chemistry, in particular physical chemistry, in New Zealand over the years when these things, and many others, were achieved. So I have been made aware of what Einstein meant when he said "The trouble with Chemistry is that it is too difficult for chemists". He was thinking of course of theoretical chemistry—the explanatory theories we seek to make sense of the manifold and diverse nature of chemical fact.

Here in Otago this period was marked by the premature death of Professor Inglis, and the opening of what I think is properly to be regarded as the modern era under his successor, F. G. Soper. The new professor brought a research field—the mechanisms of a certain class of reactions—in which he was a well established investigator, and as student numbers rose in the science faculty proper (as distinct from its service functions in providing basic science for professional schools), research activity developed in that field, in addition to the investigations on New Zealand natural products which Inglis had encouraged. At this time C. L. Carter with Professor Soper's support, established the micro chemical laboratory which has been a feature of the department ever since. World War II intervened, followed by the flush of students in the immediate post-war years. Examining became internal to New Zealand, and in consequence the standards rose. Recognisable research schools became possible as staff numbers increased and it became reasonable at last for even the best students to remain in the country for graduate study and research, and then to take their overseas tour at the post-doctoral level.

So the University's second century opens with its chemistry department transformed in terms of staff, and about to be transformed in accommodation; with a staff of sufficient size to offer a good variety of research fields and to cover in its teaching an adequate fraction of modern chemistry, including applied chemistry, with special strength in several of the important subdivisions of the major branches into which chemistry is traditionally classified; multiple professorships have replaced the single chair; the eras of Black, Inglis and Soper have been succeeded by a condominium. That, at any rate is how it looks to me from a point, the position of which can only be determined by a combination of atom-like orbitals, one labelled chemistry and the other administration. No doubt there are other, very different views.

And what is happening in the science we are engaged in teaching, and what is going to happen. I don't think we are out of the dilemma Einstein pointed up — chemical theory is difficult. It is, in fact, difficult physics. As Hinshelwood put it, "Electrons pass from one energy level to another and light quanta appear; mass dissolves and energy traverses space; particles follow statistical laws and are said to be like waves; they are found on the wrong side of barriers too high for them to surmount; space-time is curved in the neighbourhood of gravitating bodies." Hinshelwood called these "concomitances". All that we know is that one set of observations will in such cases be relatable to another set of a different kind. In these circumstances some philosophers of science claim that to ask for anything more than "concomitance" is to invent illusory difficulties; others that it is to set human intelligence a task beyond its capacity. I prefer a third view that reasonable solutions, but without final certainty, can be found. The last word is not to be said, nor can scientific enquiry predict its own future.

I would, however, like to think that some problems in which I have been interested will be significantly advanced in the not-too-distant future. It is distressing, for example, to an electrolyte chemist that the current status of the theory is essentially Debye and Huckel (1923) with subsequent minor amendments. It is 20 years since Joseph Mayer seemed to show how Debye and Huckel's *tour de force* could be superseded by a treatment based more firmly on the general theory of statistical mechanics. But beyond "slightly polluted water", electrolyte solutions remain singularly intractable. The same appears true of reaction kinetics. Some beautiful experimental methods have been developed, especially for very fast reactions which seemed quite inaccessible forty years ago. A great amount of theoretical work has also been published, some of it promising real advance beyond the simple collision theories and the pseudo equilibrium theories which still dominate the text books. But overall one is left with Einstein's opinion—theoretical chemistry is very difficult.

Finally, we must remind ourselves that science is one of mankind's major achievements. It is something done by people, and its major advances come from a few unusually gifted people. So it is important that it should continue to excite the interest of gifted people. It would be foolish to ignore the fact that, in this era of great scientific and technological achievement, young people show many signs of disenchantment with science and technology. We may, if we think it wise, ignore the student activists, to whom the university appears as a "mental slum" (to quote one point of view) instead of a real place of learning where enquiry should lead to openness of mind and a feeling of the urgency of the human problem. The activist seems to see the university rather as a machine producing a regular output for a social system he finds deplorable. Quite apart from that rather extreme view reports such as that of the Dainton Committee in the United Kingdom indicate that an increasing fraction of the ablest young people, at least in more highly industrialised countries than ours, are turning away from the scientific disciplines. They see the study of man and his manifold activities, in arts, letters and the social sciences as more worthwhile—in fact, in human as distinct from purely material terms, in the long run the most useful as well, to the kind of society they wish to help in creating. I find this view easy to understand. Two world wars separated by a major economic depression and followed by the struggles of former colonial territories to achieve stable nationhood are a poor advertisement for a civilisation as competent technologically as ours. I was disappointed to see that our own National Development Conference appeared to conceive development in purely material terms. Certainly the phrase "standard of living" as used in New Zealand always means material standard of living, and has little to do with the quality of living. But I see no necessary incompatibility between an effort to "raise living standards" in the popular sense, and one to introduce a real sense of purpose into human life. If science is harnessed entirely, or even mainly, to material prosperity in New Zealand's next century, the universities in my opinion will have failed. I believe Joseph Mellor would have agreed, and I end with some wise observations he made (on the value of visits to foreign countries). "It is obvious that visits of this nature must be mutually beneficial. We shall be brought closer and closer together as we realise that our objectives are the same. We lose . . . that stupid contempt for everything outside the walls of our celestial empire which is only the consequence of our unbounded ignorance. . . . We doubt where we formerly dogmatised and we tolerate where we formerly execrated. We learn not to confound that which is local and temporary with that which is general and universal". It is this last error which we are in danger of making. Mellor was an optimist. In the long run, perhaps a very long run, we can only hope that his optimism will be justified.

ELECTROCHEMISTRY GROUP

Meeting on Interfacial Electrochemistry

A one-day meeting on *Interfacial Electrochemistry* will be held at the University of Auckland on Wednesday, 4th February, 1970. The meeting will cover electrode behaviour, electrolysis and the electrochemistry of surfaces. Papers will be presented in the fields of electro-analytical chemistry, industrial electrolytic processes, biological electrochemistry and the kinetics of electrode processes.

Members of N.Z.I.C. and any other interested persons are invited to attend. Those wishing to present a paper should contact the Secretary as soon as possible. The Auckland Branch will hold an evening meeting on an electrochemical topic which will be related to the day's activities. Further details are available from the Secretary: Dr G. A. Wright, Department of Chemistry, University of Auckland, Private Bag, Auckland, Telephone 74-740, Ext. 9305.

1969 SALARY SURVEY (Part I)

P. K. Foster and J. H. Darwin

In approaching the task of summarising the data collected in the survey the authors have followed the advice to young playwrights attributed to Noel Coward: "Write to please yourself, and if it doesn't please the public, get out of the business fast". However, in addition to this, all the relevant information is supplied in tabular form for those who wish to study combinative factors of their own interets.

A summary of the nature of the questionnaire and the response received will be followed by the description and presentation of the data, together with words of warning concerning the caution necessary to prevent chance differences between numbers being taken to represent real differences. An analysis of variance study of the data which constitutes Part II of the report (to be published in February 1970) leads to interesting conclusions concerning the value of qualification, the relative liberality of different types of employers, etc.

The Questionnaire

A questionnaire was despatched to members resident in New Zealand asking them to specify:

Actual salary as at May 1969
One of 10 age groups
One of 5 primary qualification groups
Whether or not a doctorate was held
One of 8 employment groups
One of 9 major functions.

593 out of 829 members replied as shown in Table 1. It remains a mystery as to why over one quarter of our members did not reply. 39 forms were incorrectly completed in one or more respects. For ease of computing and analysis these were rejected and only the 554 correct forms have been examined further.

Record of data studied

Tables 2, 3 and 4 contain various subgroups of the membership, and give the sample number, mean salary and sample standard deviation for each. Table 5 comprises the breakdown of major function by employment group; the main purpose of this was to give the frequency distribution among major functions for the industry employment group, and accordingly standard deviations were not computed.

Tables 2, 3 and 4 represent a reasonable compromise between cost and reproduction of the data in all possible combinations, and comprise all the information necessary for comparison with Miller's tables 3, 4, 6 and 7, and with some other items in the text of his report.[1] The authors do not propose to comment at length on the content of Tables 2-5, nor to draw up analyses such as those presented in tabular form by Miller.

In the first place there is such a variety of comparisons which might be of interest that all cannot be attempted, and it has been left to the reader to extract the particular information he seeks. What is much more important is the strong likelihood of misleading the reader by a presentation of data which might, in fact, contain only chance differences and no real differences. In the present survey the authors have had the advantage over Miller of access to computing facilities. This has made possible the calculation of the standard deviations as an indication of the spread of the data from which the mean was calculated. Tables 2, 3 and 4 demonstrate both large standard deviations and, in many cases, small sample populations. Under these conditions quite large differences between sample means could arise *by chance* for samples taken from the *same* population, that is, it is dangerous to attribute reality to any differences between means in Tables 2-5 without carrying out standard statistical tests. In giving sample numbers and standard deviations the authors have provided the information necessary for such tests, but draw the line at carrying out tests for all possible combinations!

It should be pointed out that, because the difference that is significant statistically depends on the particular combination of sample numbers and standard deviations appropriate to the means being compared, no overall figure can be laid down as a least significant difference for any row or column of Tables 2-5.

Finally, the reader must decide for himself what level of significance he is prepared to adopt. Is he prepared to risk a 1, 5, 10 or 50 percent chance of misleading himself? There appears to be no particular reason for the levels of 1 and 5 percent, commonly used for discriminating between experimental data, to be necessarily applicable here. (It also may depend on which side of the wage claim you happen to be on.)

Errors are of two possible types. The authors can do nothing about erroneeously completed forms. Some errors will have occurred in transferring data. It has been assumed that both are at a negligibly low level.

While it is disappointing not to be able to reach firm conclusions on most of the figures reported here (that is, differences are often not statistically significant) some consideration shows that this is reasonable. It will be shown in Part II of this survey that each of the five items of information requested other than salary bore a significant relation to salary. This explains the large standard deviations shown in Tables 2, 3 and 4. For example, each mean in Table 2 can include people with all possible qualifications, and each mean in Table 4 can include people from up to every age group. Hence the spread of data can be explained even without considering margins for skill and ability. However in Tables 2, 3 and 4 the sample numbers are not large, and to break them down further by taking out another significant factor and so reduce the standard deviation reduces the sample numbers to such low levels that again, only large differences between means are significant.

Reference: 1. Miller, R. B.; 1966 "Salary Survey —July 1965". *J. N.Z. Inst. Chem. 30,* 41-50.

Table 1 — QUESTIONNAIRE RETURNS

	Members	*Returns*	*Percent*
Industry	280	196	70
Government	160	136	85
University	170	128	75
School Teaching	67	43	64
Research Assns.	55	45	82
Tech. Inst. / Self-employed / Other	97	45	46
Total	829	593	72

Table 2 — AGE GROUP - EMPLOYMENT GROUP COMBINATIONS

Age Group	*School Teaching*	*Industry*	*Government*	*University*	*Res. Assns.*	*Self-employed*	*Tech. Institutes*	*Others*
<25								
No.	—	7	7	9	5	—	—	1
Mean	—	3,854	3,031	3,866	2,800	—	—	6,600
S.D.	—	621	818	552	284	—	—	—
26 - 30								
No.	8	31	14	18	13	—	4	4
Mean	3,418	4,077	3,417	3,613	3,832	—	3,922	3,239
S.D.	547	580	720	689	559	—	496	1,427
31 - 35								
No.	7	24	14	25	5	1	6	1
Mean	4,468	4,857	4,344	4,959	4,159	10,000	4,827	5,000
S.D.	357	1,203	599	972	389	—	514	—
36 - 40								
No.	10	33	11	20	6	1	1	4
Mean	4,543	5,742	5,371	5,769	6,325	6,000	4,000	4,633
S.D.	612	2,078	1,134	1,008	896	—	—	926
41 - 45								
No.	5	34	30	18	5	4	3	2
Mean	5,254	5,695	5,572	6,676	6,568	5,925	4,607	4,575
S.D.	788	1,927	1,279	1,393	939	1,927	549	1,777
46 - 50								
No.	3	20	24	14	2	1	—	1
Mean	4,867	6,204	5,675	7,028	5,890	40,000	—	4,244
S.D.	702	1,555	949	2,203	693	—	—	—
51 - 55								
No.	5	16	17	7	1	1	3	2
Mean	4,901	7,271	6,054	8,171	3,765	7,500	5,393	5,771
S.D.	390	4,336	1,821	1,650	—	—	95	2,162
56 - 60								
No.	—	9	13	3	3	—	—	2
Mean	—	5,476	5,916	8,267	5,537	—	—	6,250
S.D.	—	851	867	1,940	984	—	—	1,909
61 - 65								
No.	4	4	2	1	1	—	—	—
Mean	5,490	10,500	4,865	7,000	6,650	—	—	—
S.D.	1,814	4,378	544	—	—	—	—	—
>65								
No.	—	1	1	—	1	—	—	1
Mean	—	14,000	2,080	—	2,400	—	—	4,970
S.D.	—	—	—	—	—	—	—	—

Table 3 — AGE GROUP - PRIMARY QUALIFICATION AND AGE GROUP - DOCTORAL QUALIFICATION COMBINATIONS

Age Group	*Primary Qualification*					*Doctoral Qualification*	
	3 yr. B.Sc. or ANZIC	*Pass*	*4 yr. B.Sc. or M.Sc. 3rd Class*	*2nd Class*	*1st Class*	*Without*	*With*
<25							
No.	5	3	2	12	6	25	4
Mean	3,953	3,469	3,560	2,872	3,422	3,270	3,659
S.D.	1,616	509	226	798	467	988	380
26 - 30							
No.	16	22	3	34	17	65	27
Mean	3,767	3,786	3,827	3,574	4,030	3,646	4,002
S.D.	539	779	507	747	637	729	572
31 - 35							
No.	18	13	2	31	18	49	34
Mean	4,640	4,588	3,645	4,692	4,858	4,510	4,923
S.D.	1,115	1,184	290	1,143	408	1,084	839
36 - 40							
No.	24	10	5	24	23	54	32
Mean	5,073	5,635	5,916	5,468	5,954	5,191	6,111
S.D.	2,063	1,760	1,106	1,377	908	1,693	1,041
41 - 45							
No.	39	10	14	23	14	72	29
Mean	5,465	5,179	5,611	6,327	6,499	5,450	6,701
S.D.	1,864	974	1,288	1,423	1,199	1,591	1,137
46 - 50							
No.	18	8	10	20	9	48	17
Mean	5,476	5,933	5,391	8,143	7,390	6,423	7,109
S.D.	1,495	792	941	7,623	2,234	5,153	1,476
51 - 55							
No.	13	6	5	15	13	40	12
Mean	5,752	4,972	5,733	5,877	9,117	6,107	7,971
S.D.	1,215	596	1,178	1,472	4,479	2,980	1,825
56 - 60							
No.	7	7	2	9	5	23	7
Mean	5,046	5,697	5,800	6,216	7,470	5,762	6,798
S.D.	813	960	283	882	1,770	927	1,915
60 - 65							
No.	3	2	—	5	2	8	4
Mean	5,043	3,950	—	9,752	6,975	5,449	10,537
S.D.	1,738	495	—	4,144	460	1,582	4,332
>65							
No.	2	1	—	—	1	4	—
Mean	9,485	2,400	—	—	2,080	5,862	—
S.D.	6,385	—	—	—	—	5,577	—

Table 4 — PRIMARY QUALIFICATION - EMPLOYMENT GROUP COMBINATIONS

	School Teaching	*Industry*	*Government*	*University*	*Res. Assns.*	*Self-employed*	*Tech. Institutes*	*Others*
3 yr. B.Sc. or ANZIC								
No.	8	74	31	7	9	2	5	9
Mean	4,436	5,348	4,649	6,157	4,433	7,250	4,820	4,921
S.D.	922	2,154	1,097	1,693	1,362	354	496	1,278
4 yr. B.Sc. 4 yr. M.Sc. Pass								
No.	16	39	15	3	3	1	3	2
Mean.	4,450	4,984	4,804	3,656	4,117	4,950	4,673	4,509
S.D.	722	1,470	1,366	991	2,240	—	765	701
4 yr. B.Sc. 4 yr. M.Sc. 3rd Class								
No.	5	17	14	3	1	2	—	1
Mean	4,956	5,064	5,543	5,333	7,750	5,875	—	4,244
S.D.	470	1,096	1,166	1,815	—	3,005	—	—
4 yr. B.Sc. 4 yr. M.Sc. 2nd Class								
No.	11	37	43	50	17	2	8	5
Mean	4,298	6,173	5,105	5,302	4,309	25,000	4,605	4,512
S.D.	1,131	2,564	1,488	1,811	1,321	22,200	742	2,334
4 yr. B.Sc. 4 yr. M.Sc. 1st Class								
No.	2	10	30	51	12	1	1	1
Mean	6,317	8,240	5,635	5,888	5,279	6,000	3,700	5,384
S.D.	1,390	5,158	1,813	2,097	1,406	—	—	—

Table 5 — MAJOR FUNCTION - EMPLOYMENT GROUP COMBINATIONS

Major Function Group	*School Teaching*	*Industry*	*Government*	*University*	*Res. Assns.*	*Self-employed*	*Tech. Institutes*	*Others*
Research								
No.	1	4	72	21	31	—	—	2
Mean	4,684	4,240	5,233	4,486	4,362	—	—	2,980
Teaching								
No.	36	—	—	79	—	—	17	2
Mean	4,367	—	—	5,466	—	—	4,627	4,471
Development								
No.	1	24	7	1	2	—	—	—
Mean	5,384	4,425	5,114	10,500	5,700	—	—	—
Admin./Mgt. —Laboratory								
No.	—	42	18	2	3	—	—	5
Mean	—	5,395	5,395	9,750	6,310	—	—	5,181
Admin./Mgt. —Other								
No.	4	75	8	9	3	2	—	4
Mean	6,028	6,627	6,416	7,756	7,233	6,500	—	6,218
Sales and Service								
No.	—	6	—	1	—	1	—	—
Mean	—	5,184	—	7,600	—	10,000	—	—
Analysis and Testing								
No.	—	6	27	2	2	2	—	4
Mean	—	4,432	4,337	3,049	3,465	4,350	—	3,995
Process/Quality Control								
No.	—	22	—	—	—	—	—	1
Mean	—	4,287	—	—	—	—	—	3,840
Consulting								
No.	—	—	1	—	1	3	—	—
Mean	—	—	4,200	—	2,400	18,500	—	—

THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.)

THIRTY-NINTH ANNUAL REPORT

for the year ending 31 July 1969

Officers

President: Professor J. Vaughan.
First Vice-president: Dr. T. A. Rafter.
Second Vice-president: Dr. W. A. McGillivray.
Delegates—
Auckland: Dr. D. F. Nelson
Waikato: Dr. D. E. Wright
Manawatu: Dr. R. R. Brooks
Wellington: Dr. P. K. Foster
Canterbury: Dr. J. M. Coxon
Otago: Dr. J. C. Dacre.
Immediate Past President: Dr. D. R. Llewellyn.
Editor: Miss J. Mattingley.
Hon. Librarian: Mr. S. G. Brooker.
Registrar: Mr. D. J. Hogan.
General Secretary: Dr. W. E. Harvey.

Membership

During the past year the membership of the Institute has changed as follows:

Associates elected to the Fellowship	9
New Associates	43
Resignations	10
Deaths	5
Deletions	3

Consolidated membership figures for the last four years are as follows:

	1966	1967	1968	1969
Auckland	182	199	211	220
Waikato	47	49	53	55
Manawatu	100	98	95	105
Wellington	229	246	244	231
Canterbury	120	128	133	129
Otago	91	89	93	90
Overseas	91	92	91	114
	860	901	920	944

Obituary

It is with regret that we record the deaths of the following members: Dr. M. T. Christensen, Mr. R. B. Cole, Mr. W. L. M. Dearsley, Mr. E. Leese and Mr. F. W. Jawarski.

Institute Prizes

Prizes for 1968 were awarded as follows:
I.C.I. Prize: Dr. R. C. Lawrence.
Morcom Green-Edwards Prize: Mr. D. A. Hills.
Chemical Essay Prize: No award.

Conference

The 1968 Conference held in Auckland was well attended and was devoted largely to Industrial Chemistry and Biochemistry. Professor Lloyde Smythe, University of New South Wales was the guest lecturer.

For the first time the Council offered a prize for the best student paper—an innovation which proved successful and will be continued at later conferences.

Publications

The Journal has continued to flourish under the Editorship of Miss Joan Mattingley. Miss Wendy Jeune resigned as Advertising Manager following her change of employment and Mr. D. G. Howard has assumed these responsibilities.

During the year the Institute published "Careers in Chemistry", an attractive booklet aimed at final year school pupils, outlining career opportunities, methods of training and qualifying, salaries, etc., in the profession. This was the culmination of a project initially undertaken by members of the Auckland Branch.

In Christchurch, discussions with representatives of the Department of Education have resulted in an arrangement whereby special articles written by members of the Institute will be distributed to secondary schools. This project, which will involve the Institute in very little expenditure, typifies the continuing interest in sixth form school pupils which has in the last few years developed at both Branch level and under the auspices of the central organisation.

Qualifications

During the year Council has resolved to increase the qualifying period of practical experience following completion of a Degree before entry to the Associateship. It is also proposed to introduce a new lower grade of corporate membership—Graduate Membership—and if these changes are accepted, as it is expected they will be, entry qualifications to the various grades of membership of the Institute will be closer to those required by similar organisations overseas and in particular the R.I.C. and the R.A.C.I.

Overseas Visitors

During the year Professor H. F. W. Taylor and Dr. B. S. Hartley both visited New Zealand under the auspices of the Institute. Professor Taylor from the University of Aberden travelled throughout the country visiting universities and research associations and industries in the general field of pottery and ceramics.

Dr. Hartley, whose visit was cut short by a family bereavement, came to this country on the way to Australia on a visit sponsored by the Biochemical Society. It is likely that a similar visit will be arranged annually with assistance from the Royal Society and kindred bodies.

Also during the year Professor R. A. Raphael spent a few days here as a Chemical Society lecturer. His visit was arranged by the local representative of the Society (Professor S. N. Slater) and financially assisted by the Institute. The Chemical Society arranged a one-day symposium on organic chemistry, held at Massey University, to mark Professor Raphael's visit.

Royal Society Matters

Two members of the Institute, Drs. A. J. Ellis and R. W. Bailey were elected as Fellows of the Royal Society of New Zealand during the year.

The Institute is well represented on committees of the R.S.N.Z. and continues to be one of the strongest and most active member bodies of the R.S.N.Z. The National Committee for Chemistry of the R.S.N.Z. has continued under the Chairmanship of Professor Packer, and Mr. S. G. Brooker attended the I.U.P.A.C. Conference in Italy in July.

During the year Council decided to transfer its library from the Auckland Institute and Museum to the R.S.N.Z. when the latter Society's new building is completed.

Professional Workers' Association

Mr. M. S. Carrie was instrumental in bringing to the notice of members the possible merit of establishing in New Zealand a professional workers' association similar to those in existence in the Scandinavian countries. Council has resolved to pursue this matter if support is forthcoming from other professional groups in New Zealand.

Specialist Groups Within the Institute

During the year Council laid down guidelines which it is expected will lead to the formation of a number of specialist groups within the Institute organisation. Such groups, whose membership would not be limited to Institute members, would receive secretarial and other assistance from the Institute, and may well in due course accept responsibility for major areas of the Institute's activities such as the organisation of symposia and sections of Conference programmes.

Finance

The Balance Sheet for the year ended 30 April 1969 shows an excess of income over expenditure of \$153. This is much less than the corresponding figure for the previous year (\$2,292), in large part because of the cost of publishing "Careers in Chemistry" and the new list of members at a total cost of \$1,557. The net cost of publishing the Journal showed little change from the previous year.

The auditors comment that the Institute continues to be in a sound financial position.

Thanks

It is a pleasure to record thanks to the many individuals, committees, and organisations who have assisted the Institute throughout the year.

For and on behalf of the Council:

J. VAUGHAN, *President.*
W. E. HARVEY, *General Secretary.*

BRANCH NOTES

Auckland

Monthly meetings of the Branch have been addressed by Professor F. G. A. Stone (Bristol University) on "Some Recent Developments in Metal Carbonyl Chemistry" and by Dr. H. J. Barber (May and Baker, U.K.) on "The Search for New Drugs—Retrospect and Prospect".

The Annual General Meeting was held on 30 October at the Berkeley Lounge, Mission Bay, and was followed by a buffet dinner for members and their wives.

The Annual Report of the Branch records that 9 meetings were held, with an average attendance of 42. Membership has risen to 254, including 29 local members. The breakdown of membership according to employment is Industry (food, agricultural, etc.) 15.6 percent, other Industry 31.2 percent, University 19.3 percent, Secondary Schools 8.2 percent, Government 8.7 percent, Hospitals 5.5 percent, Technical Institute 2.3 percent, Local Bodies 1.4 percent, other employment 7.8 percent. Since 1966 there has been a decrease in the proportion of members in the industrial sector, and a corresponding increase in the proportion in other occupations.

Auckland Technical Institute

Recent appointments raise to 6 the number of fellows and associates who are on the staff in the Applied Science Department. They are Messrs. L. H. Boulton, J. G. Fletcher, R. M. Fourie, M. G. C. Gibson, J. K. Johannesson and R. B. Page.

D.S.I.R.

The Government Analyst, Mr. O. H. Keys, is President of the Australasian Corrosion Association. He will attend the Annual Conference and Federal Council meeting in Perth.

Dr. J. M. Thorp of the Auckland Industrial Development Division of the D.S.I.R., recently addressed the Auckland Branch of the Australasian Corrosion Association on the subject of "Tribology", the scientific study of lubrication, friction and wear. Dr. Thorp, formerly Senior Lecturer at the University of Auckland, is a specialist on surface chemistry and has recently returned from overseas.

N.Z. Fertiliser Manufacturers' Research Association

Mr. G. McSweeney recently took part in the international conference of I.U.P.A.C. at Sydney. He also visited Australian fertiliser manufacturers, universities and C.S.I.R.O. research laboratories in fields of mutual interest.

The N.Z. Fertiliser Manufacturers Conference was held at Otara on 27-28 November.

University of Auckland

Professor A. L. Odell and Professor T. N. M. Waters have been appointed to Personal Chairs in the Department of Chemistry. The University Council has made these appointments in recognition of their personal achievements in research and teaching of chemistry. Professor Odell, who is at present on leave at the University of Wisconsin, has worked in the fields of inorganic and radiochemical laboratory for teaching and research. Professor Waters is active in the fields of X-ray crystallography, in organic chemistry and enzyme chemistry.

Industry

Mr. J. H. Goodey leaves in January on a world tour for 12 months. He will be accompanied by Mrs. Goodey and will visit laboratories and firms in his two fields of interest: the chemistry of cosmetics. His position as Chief Chemist at Sonata Laboratories will be taken over by Mr. R. Denyer.

Wellington

Chemistry Division

The main event of interest was the visit of Professor F. G. A. Stone of Bristol University on 22 September. He lectured on some aspects of organometallic chemistry of d^8 and d^{10} transition metal ions. The talk included an entertaining description of the Chemistry Department at Bristol and its environs.

Members of the staff who embarked on overseas visits were Dr. A. J. Ellis who was called to Turkey by the United Nations to advise on geothermal power projects in that country, and Dr. H. P. Rothbaum who visited Australia during September to study aspects of the fertilizer industry. He also visited the Textile Division of C.S.I.R.O. to discuss the purification of wool grease.

The new cement laboratory at Chemistry Division has now been opened, and all the section now works under one roof.

Victoria University

Dr. R. W. Hay has recently returned from a year's sabbatical leave in the United Kingdom. He spent some months with Dr. R. D. Gillard at the University of Kent at Canterbury and six months with Professor R. P. Bell at the new University of Stirling in Scotland. In Stirling he undertook a certain amount of undergraduate teaching, and was also involved in studies of fast reactions by stopped flow techniques.

Visitors to the Chemistry Department in October included Dr. D. Natusch of the Chemistry Division and Professor A. Fry of the University of Arkansas.

Canterbury

Mr. J. R. Sharman has transferred from the Taeri Agricultural Centre, Dunedin, to the Pathology Department, Public Hospital, Christchurch.

Miss P. C. R. Mason who has resigned from the Wool Research Organisation, Lincoln, is overseas on an extended visit and is at present working in London.

Dr. B. R. Mann, Factory Manager and a Director of G. L. Bowron & Co. Ltd., Christchurch, recently returned from a visit to the United States, Europe and India. He studied machinery and technical developments in the tanning industry.

University

Dr. G. A. Rodley has left to spend a year's sabbatical leave with Professor Harry B. Gray at the University of California.

Professor B. R. Penfold, who recently returned from a period of study leave, has been appointed Dean of the Science Faculty at the University of Canterbury.

Drs. D. A. R. Happer, S. A. House and K. R. Richards, have been promoted to Senior Lecturer.

MEMBERS INCOMMUNICADO

Mail addressed to the following members has been returned. If any one knows their present address would they please inform the Registrar.

- Mr. P. J. L. Dawson, Kodak Processing Laboratory, Wellington.
- Mr. R. C. Gibbons, 16 Troon Crescent, Lower Hutt.
- Mr. A. D. Collins, 108 Hillsborough Road, Auckland 4.
- Mr. R. I. Mouncey, 116 Pakuranga Road, Auckland.
- Mr. J. E. Haywood, Colonial Ammunition Co. Ltd., Auckland.

NEW ZEALAND METRIC ADVISORY BOARD

The Minister of Industries and Commerce, the Rt. Hon. J .R. Marshall, has announced the appointment of members of the Metric Advisory Board. The Board is to encourage, assist and advise on the progressive voluntary adoption of the metric system in New Zealand. One further appointment has still to be announced.

The following Board members have been appointed for an initial period of three years:

Chairman: Mr. I. D. Stevenson (formerly Superintending Engineer, Signals and Communications, N.Z. Government Railways).

Deputy Chairman: Mr. H. C. Holden (Assistant Secretary, Department of Industries and Commerce).

Members: Mr. N. W. Allardice (Director, Kingston, Reynolds, Thom and Allardice, Auckland).

Mr. W. B. Beaven (Director, Andrews and Beaven Ltd., Christchurch).

Mr. P. W. Boag (General Secretary, Post Primary Teachers' Association).

Mr. J. N. Cocks (Curriculum Officer, Mathematics, Department of Education).

Mr. J. R. Cocks (Provincial President of Federated Farmers' Mid-Canterbury Province).

Prof. Patricia Coleman (Dean of the Faculty of Home Science, University of Otago).

Mr. J. C. Corbishley (Assistant Secretary, Department of Labour).

Mr. G. H. Edwards (Director, Standards Association of New Zealand).

Mr. L. E. Patchett (Headmaster, Raumati School).

Mr. I. O. Stace (Director, General Motors N.Z. Ltd.)

Dr. R. W. Willett (Assistant Director-General, Department of Scientific and Industrial Research).

Dr. R. M. Williams (Vice-Chancellor, University of Otago).

Mr. B. E. Woodhams (Director, George Court Ltd., Hamilton).

The Board will have a vital role in planning the general guidelines for the changeover. It will establish various sector planning groups that will be responsible for the drawing up of plans for the change in each sector of industry, commerce and the community, in consultation with the individuals, companies and other groups involved. It will supervise and co-ordinate the work of these sector planning groups.

It is interesting to note that although members have been appointed as individuals and not as representatives of particular organisations, in the Board of 16 members eight are closely associated with the work of the Standards Association of New Zealand. Mr. Holden, Mr. Stace and Dr. Willett are currently members of the Standards Council; Professor Coleman, Mr. Allardice, Mr. Corbishley, and Mr. Stevenson are (or have recently been) members of Standards Committees; and Mr. G. H. Edwards is the Director of SANZ.

Notices of Prizes

PRIZES

The closing date for the I.C.I., Morcom Green-Edwards, and Essay Prizes is 30 April 1970.

IUPAC NOTICE

Roussel Prize

Nominations are invited for this Prize to be awarded for research in the field of steroids published between 1st January 1968 and 31st December, 1969.

Nominations should be submitted to Professor D. H. R. Barton, Imperial College of Science and Technology, London, before 1st March, 1970.

Further information can be obtained from

Professor C. J. Wilkins, Secretary,

N.Z. National Committe for Chemistry,

Chemistry Department,

University of Canterbury.

INTERNATIONAL SOLVENT EXTRACTION CONFERENCE

1971

The Hague, The Netherlands
19 - 23 April, 1971

Sponsored by The Society of Chemical Industry; in association with Koninklijk Institut van Ingenieurs, The Institution of Chemical Engineers and Koninklijk Nederlandse Chemische Vereniging.

The decision to hold an International Solvent Extraction Conference in The Hague was taken after a canvass showed considerable support for a meeting designed to explore the science, technology and engineering of solvent extraction in its widest aspects. It is hoped the Conference will also help to establish stronger links between academic and industrial workers in the field. The International Conference on Solvent Extraction Chemistry at Harwell in 1965, Gothenburg in 1966 and Jerusalem in 1968 played an important part in helping to identify those many areas in which solvent extraction theory and practice still required elucidation.

The choice of title for the 1971 Conference is deliberate and indicates a wider scope than that covered by the earlier meetings.

The Conference Committee is pleased to announce that ISEC'71 is sponsored by the Society of Chemical Industry with the active support of the Koninklijk Instituut van Ingenieurs, the Institution of Chemical Engineers and the Koninklijk Nederlandse Chemische Vereniging.

Papers and contributions to the discussion are invited which further the understanding or chemical engineering of solvent extraction or have an important bearing on process design, operation or control of plant. Papers are also invited on economic aspects of solvent extraction processes.

It is hoped to include visits to plants using solvent extraction and an active social programme for participants and their ladies is under consideration by the Netherlands Working Group under the leadership of Mr. N. G. W. Luitsz, Chairman of the Benelux Section of the Society of Chemical Industry.

The Conference Committee is confident that the growing interest in solvent extraction technology in the chemical and allied industries will be evidenced by wide support for ISEC'71.

Conference Committee: *Chairman,* B. F. Warner, U.K.A.E.A., Windscale Works, Seascale, Cumberland, U.K. *Secretary,* C. Hanson, University of Bradford, Bradford 7, Yorkshire, U.K.

For application forms apply to Conference Secretariat, 14 Belgrave Square, London, S.W.1.

NEW ZEALAND WATER CONFERENCE

University of Auckland, 12 - 14 May 1970

The New Zealand Institution of Engineers and the Royal Society of New Zealand have planned the New Zealand Water Conference 1970 to provide an opportunity for a general and comprehensive discussion of national problems of water resources management and development. The Conference is a part of the continuing efforts being made by the two organisations to make New Zealanders aware of the importance of water and to advance our readiness for planning the future use and control of this vital national resource. It will be an open forum for discussing key problems of water use and development, appraising the operations of the Water and Soil Conservation Act 1967, and considering technological, economic and administrative needs for the planning of a national water policy.

The formal Conference programme will be based on contributions from invited speakers and a number of background papers giving a comprehensive summary of the existing situation in regard to basic data, technology and policy relating to the water resources field. All papers will be circulated prior to the Conference and the full programme has been arranged to allow ample opportunity for participation by all delegates.

General promotion and details of the programme have been arranged by the two organisations through the combined Engineering and Scientific

Committee on Water Resources. The Conference is being presented by the Auckland Branch of the New Zealand Institution of Engineers.

The Conference is believed to be timely because of the growing interest in national development and the many problems of water policy which arise out of the implementation of the Water and Soil Conservation Act. It is not intended as a specialist conference for hydrologists or water engineers but as a general forum for all New Zealanders concerned with water use and water policy.

Topics will include: Water resources of New Zealand, Biology and chemistry of water in New Zealand, Water use in New Zealand, Socio-economic aspects of water development in New Zealand.

The role of scientific and economic research in water resources development (Mathematical models, Fresh water biology, Hydraulic research, Economic research).

Technological needs for efficient utilisation and management of water resources (Hydro-electric development, Municipal and industrial water supply, Agricultural water usage, Drainage, Water quality control, Groundwater, River control and erosion).

Emphasis will be placed on the integrated, basin-wide approach and the use of modern techniques such as systems analysis.

National Water Policy and Planning (Consideration of draft five-year plans for desirable development in relation to the separate requirements of major interests such as industry, agriculture, power and water authorities; Discussion on planning and policy; General recommendation of Conference; Setting up of working groups for conference follow-up).

For further information write to Conference Secretary, P.O. Box 1017, Auckland 1.

EXCHANGE JOURNAL REVIEW

Secondary School Chemistry in East Germany

From the beginning of this year we have received *Chemie in dur Schule* (School Chemistry) in exchange for our journal. This monthly, published by Volk und Wissen Volkseigener Verlag, Berlin, turns out to be a semi-official East German publication.

It is interesting to note the difference in emphasis in their teaching of chemistry. Theory is only a means to an end . . . economics and productivity loom large in all the articles; the advantages of large, preferably state-owned factories rather than small concerns is stressed repeatedly, as is the important role played by East Germany and Russia in modern manufacturing methods. The role of other countries is played down.

Manufacturing processes are published often in great detail, not only in their chemical aspects but also as far as equipment and cost are concerned. Because of this interest in cost rather than in science, quantitative analysis and stoichiometric calculations are apparently a greater part of the East German school syllabus than here.

The making of their own apparatus by students is suggested as a good way to further group activity and to integrate chemistry, physics and technical education—more a 'polytech' slant.

An article on the setting-up of class experiments stresses that in East Germany all pupils must have equal opportunity to see the experiment that the teacher is doing or to take part in experiments—that this can be helped by not clamping apparatus just when the reaction takes place, by using coloured substances or background etc.—all very normal and not worthwhile mentioning. Teachers are then admonished to further group activity by appropriate experiments. Many exercises are suggested. Often these consist of interpretation of graphs or the working out of problems which show the enormous improvements in East Germany since 1948, with historical reasons. Chemistry books should stress the 'right' philosophical and political attitudes and use chemistry as a means to acquire these attitudes. It is therefore dangerous to give pupils the lives of great scientists who do not conform to these ideals. This can be difficult for the teacher, so several ways out of such difficulties are suggested.

Book reviews seem to be only of Russian and East German publications, although processes which were originated in other countries, e.g. gas production by the CRG process developed by the British Gas Council, may be given in detail. Usually, however, an East German or Russian process is given as well. On the whole the emphasis is political and technical rather than chemical.

D.S.

BOOK REVIEW

Reserach in the Chemical Industry, by A. Baines, F. R. Bradbury and C. W. Suckling. Published by Elsevier Publishing Co. 1969. 298 pp. 124 references.

This book, or something very like it, should be obligatory study for all university teachers, and for final year degree students who have to decide on the type of career they should attempt. All three authors have held research management positions in I.C.I. and their reasons and aims are well described on the first page:

> "The effectiveness of research in industry has been and still is, restricted by a lack of understanding of its aims and methods which is not confined to academics but is shared by many people in industry both within and without research departments".

"Our basic aim in writing this book is to set out what industrial research is for, to indicate its objectives and also to describe its methods".

The authors then proceed to cover the field in nine chapters. The first three set the scene by discussing the industrial environment as it effects the chemist, the various functions in which an industrial chemist can expect to find himself involved, and research economics—a discussion of research in terms of the business goal of continued profitabiilty. These three chapters stand on their own as a thoughtful and comprehensive discussion on what industry is about, what graduates should be able to expect of it, and have expected of them, and the differences between the goals of academic and industrial science.

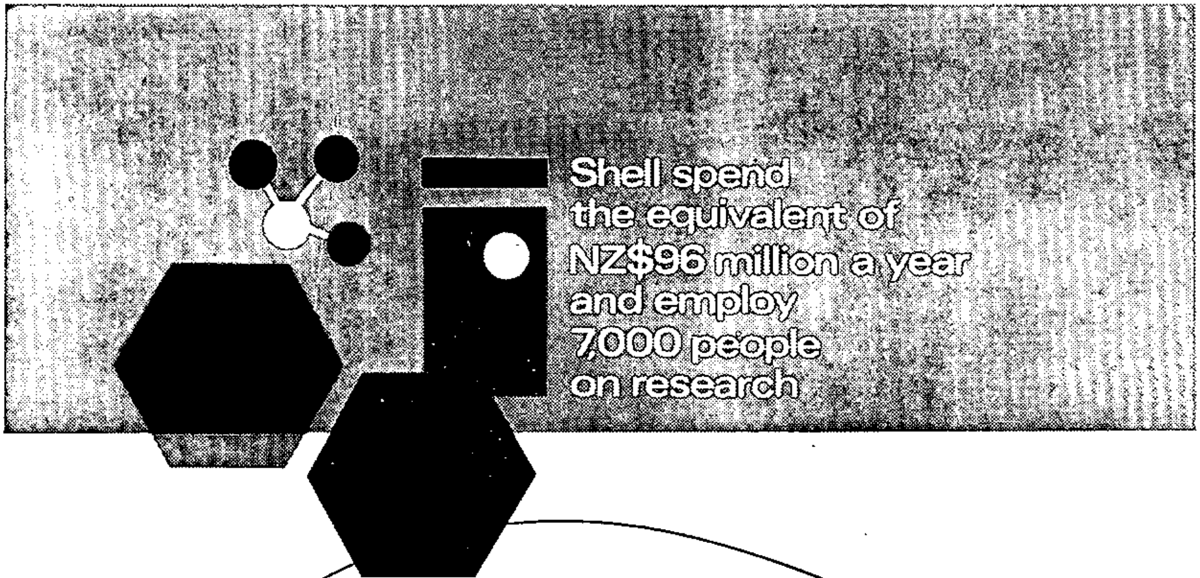
The authors then describe in the remaining six chapters the approaches made in the various steps which culminate in the profitable production of a new chemical, or the profitable operation of a new process. In sequence they analyse the tactics of searching and screening (with case histories), the devising of appropriate processes for a new compound, the selection of the most economical process, the problems of the pilot plant stage and full scale plant development and finally the types of scientific support the new plant is likely to require.

This is obviously an extremely wide field to cover, and the authors' success is due firstly to considerable care in planning the book. One measure of this is that the "Contents" extends over 6½ pages and comprises approximately 250 subdivisions. Thus each section can readily be related to its place in the whole story. The reviewer found this comprehensive "Contents" treatment far more useful for subsequent checking on detail than the "Index", which contains only a few more entries.

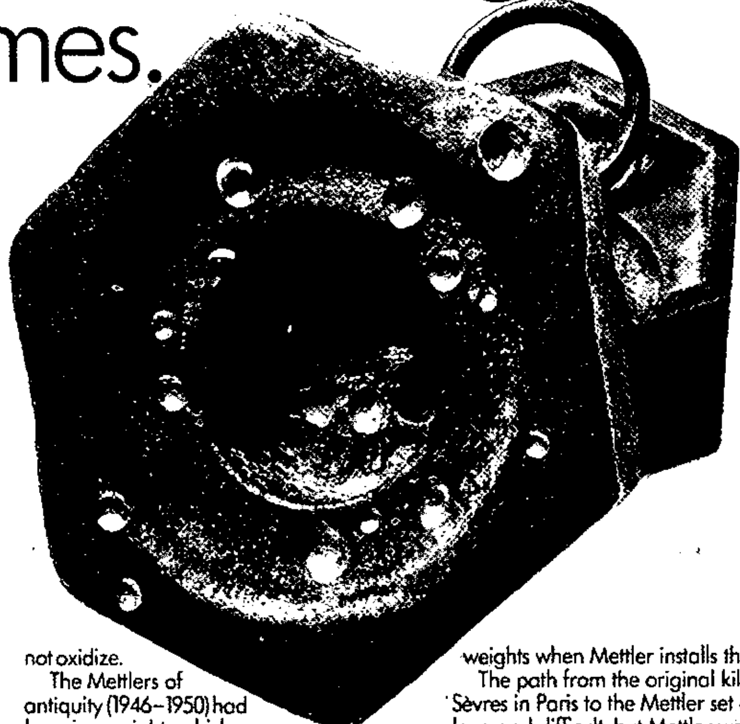
Secondly, the authors have studiously resisted the opportunities (and there must have been many) to give detailed prescriptions and instructions on specialist techniques. Rather than "This is how you should do it" we are told "There is a technique for this, it is called 'so-and-so', it works on the following principle, and textbooks (references given) are available if you want the whole story". Examples and case-histories are similarly well chosen and treated to illustrate important generalisations, not as individual cases important only for themselves.

The net result is that the book has a considerably wider audience than those interested only in the manufacture of chemicals. The authors' treatment provides a comprehensive description of industrial science. In this description the emphasis and illustrations are certainly drawn from that branch of industry concerned with the manufacture of chemicals, but to the scientist outside these fields (such as your reviewer) they do not detract from or hide the generalisations that apply to all industries.

P. FOSTER.


Shell spend
the equivalent of
NZ$96 million a year
and employ
7,000 people
on research

Before 1946 a kilogram may actually have been a kilogram sometimes.



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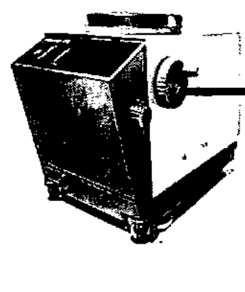

Mettler