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Editor: Miss J. Mattingley, M.Sc., A.N.Z.I.C.
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D. Howard, M.Sc., A.N.Z.I.C.
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D. J. Hogan, B.Sc., A.N.Z.I.C.
P.O. Box 1926, Christchurch.

Honorary General Secretary:
Prof. W. E. Harvey, M.Sc., Ph.D., F.N.Z.I.C.
P.O. Box 250, Wellington.

Employment Officer:
E. S. Borthwick, M.Sc., A.R.I.C., A.N.Z.I.C.
P.O. Box 2091, Wellington.

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CLASSICAL CHEMISTRY

Have We Reached the End of the Road*

by L. F. Phillips
Chemistry Department, University of Canterbury

When provided with a lecture title such as this, presumably the first thing one should do is to try to answer the question it contains. If the answer can by made to occupy forty-five minutes, that takes care of the problem of writing the lecture. When I tried this procedure with the present title I found the question could be answered rather neatly by defining *classical* as the adjective applying to any field in which the end of the road has been reached. This brought me to the end of my talk rather quickly, so obviously a different approach was needed.

Taking another look at the title, I decided that perhaps I was supposed to say something about the differences between "classical" chemistry and whatever it is that we do now, and whether these differences amount to a complete revolution. This seemed to fit in very well with the titles of other talks in this session—Instrumentation, The Computer and Chemistry, Modern Trends—so that I have continued on that basis.

Possibly the most conspicious feature of modern chemistry is the bulk of its subject matter. A simple indication of bulk is provided by L, the number of inches of library shelf occupied by the Chemical Abstracts for one year. The experimental data for the years since 1948 are shown in Fig. 1. Before 1948 the quantity L was relatively constant, e.g. Volume 1, for 1907, has a shelf length of seven inches, albeit with somewhat smaller pages. (To show how classical this is we may note that the

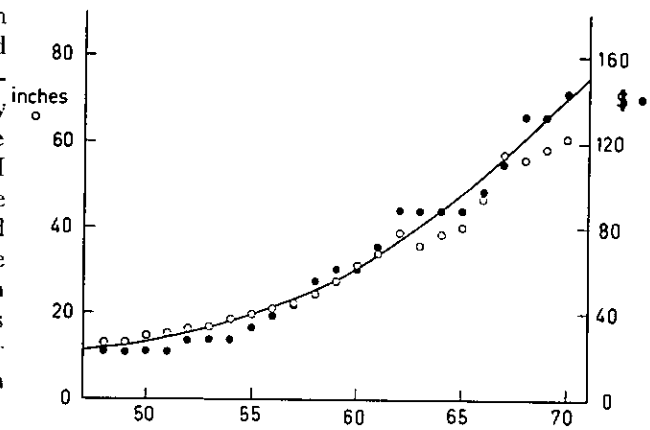


Fig 1.

first few pages of Volume 1 contain the abstracts of a paper on fluorescence of iodine vapour by R. W. Wood, one by G. N. Lewis on equilibria involved in the oxidation of HCl to chlorine, and one by E. Rutherford establishing that α-particles are helium nuclei.) Also shown in Fig. 1 is the cost of binding Chemical Abstracts (henceforth abbreviated to C.A.) in 1972 dollars, which increases at the same rate as shelf length, with a proportionality factor of about $2 per inch. The cost of buying C.A., as opposed to binding it, has also gone up; we return to this point shortly.

Taking the integrated shelf length of C.A. as a measure of the size of the subject of chemistry, we find that the whole of chemistry prior to 1950 occupies 32 feet of shelf, the second 32 feet was completed at the beginning of 1965, and a third 32 feet was completed towards the end of the 1971 volumes. Although a considerable amount of important and still definitive work

* Paper given at the 12th Science Congress, Royal Society of N.Z., Massey University, January 31st 1972.

was done before 1907, it is probably not too great a simplification to say that the subject of chemistry in 1950 is fairly represented by the first 32 feet of C.A., and for the purpose of my talk I will define this as classical chemistry. Thus the subject matter of chemistry is now three times as large as it was at the end of the classical era, and is growing fast. The effect of this growth on one's efforts to keep up with the literature in any given field needs no elaboration.

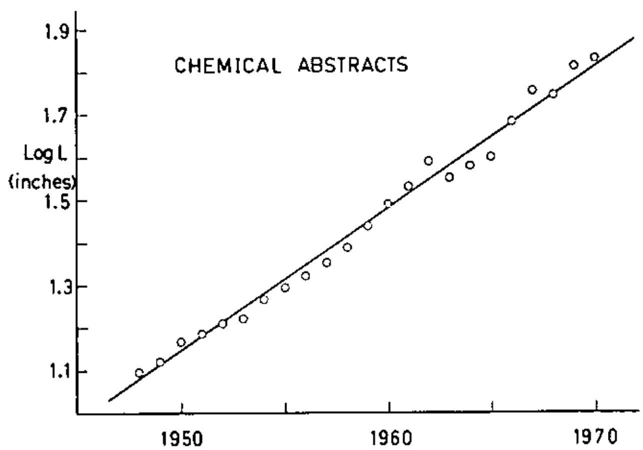


Fig. 2.

The kinetics of the growth of C.A. is illustrated in Fig. 2, where the ordinate is the logarithm of *L*. At its present growth rate *L* doubles in about nine years, and from the line shown we can predict *L* values of 12 feet in 1980 (compared with 5.5 feet in 1970), 26 feet in 1990, and about 55 feet in 2000. At present the cost of binding 55 feet of C.A. would be around $1500, and at roughly 25 lbs a foot the 250-odd volumes for the year would weigh nearly three quarters of a ton.

The cumulative indexes of C.A. are not included in the values of *L* that I have plotted. These also have grown; the 47-56 index occupies 31 in., the 57-61 index 33½ in., and the 62-66 index 58½ in. It appears that for each 100 feet of C.A. there will be about 25 feet of cumulative indexs. However, long-term predictions about cumulative indexes may be unsafe, because there is always considerable delay in the production of a cumulative index; if as seems likely the delay is a steep function of *L*, it may not take long to reach the point when the accumulated delay is sufficient to ensure that an index never does get published.

If just the abstracts of one year's articles in chemical journals are to occupy 26 feet of shelf space by the year 1990, it will no longer be a practical proposition for individual libraries to try to hold a large proportion of the journals in which the original articles appeared. Therefore, if anything has reached the end of the road, it would appear to be the present system for publishing and disseminating research results. In the short term the problem could be alleviated by a system of publishing only abstracts and tables of data, with full, refered manuscripts available on request from publishers, and with frequent reviews to correlate published material. However, in the long term, we seem to be obliged to develop a solution involving computer storage, editing, correlation, and retrieval of research results.[1]

One advantage of a computerised system would be the elimination of much of the redundancy which, according to librarians at least, is largely responsible for the current paper explosion (not necessarily an information explosion). The practice of stringing out a single piece of work through a preliminary communication, a full-length paper (with subsequent erratum), a review article and possibly several lots of conference proceedings, might persist but it should be fairly easy to programme a machine to store the whole lot at one location.

Another obvious way in which chemistry has changed since the pre-1950 "classical" era is in the matter of cost. Here again

1. For the American Institute of Physics approach to a solution for this problem see Physics Today, November 1971, p.23.

we can find food for thought by looking at Chemical Abstracts. In 1947 the annual cost of C.A. was $5-6 for ACS members, and $12 for non-members, and it had remained constant since prior to World War Two. In 1948 there was an ominous increase to $7 for ACS members, $15 for others, and by 1952 the price had risen to $15 and $60. In 1960 the price was $32 for ACS members, $150 for universities, and $570 for others; the 1965 price was $700 for universities, and also for ACS members if any were left who could afford it, and $1200 for others. Volumes 74 and 75, covering 1971, are listed at $1950, with educational institutions being eligible for a $500 reduction. Thus a chemistry department which paid $12 for C.A. in 1947, paid $1450 for C.A. in 1971. The cost per inch has risen from about $1 in 1947 to $27 in 1971. In the unlikely event that the price per inch subsequently remains constant at its present value, the price of C.A. in 1980 will be about $3500, and in 1990 about $7400. C.A. is only one item in a library's budget, which is only one item in a university budget, which is only one item in the education budget, and son on. This therefore appears to be another road whose end is uncomfortably close.

Of course the major cost of doing chemistry is not the cost of buying chemical abstracts. If we fasten onto one of the most expensive aspects of university chemistry, we find that it is fairly difficult to estimate the true cost of chemical *research* in New Zealand because many of the expenses are hidden in overheads, fellowships, facilities provided partly for teaching, and so on. It is not hard to work out that the capital cost of the major items in a moderately up-to-date department can easily exceed a quarter of a million dollars (nmr 60,000, esr 50,000, mass spectrometer 100,000, infrareds 25,000, ORD 20,000, uv-visible 20,000, gas chromatographs 20,000) but this gives no indication of running costs.

In the U.S.A. the system is different—research grants are meant to include provision for overheads, summer salaries of faculty members, consumable materials and so on, and both the total amounts of money spent and the return in terms of literature publications are published more-or-less openly. Therefore to obtain an idea of what it actually costs to produce the papers which are causing the observed enlargement of C.A., I have looked at figures given in the Fiscal 1970 Chemistry Programme Review of the U.S.A.F. Office of Scientific Research. These figures include virtually everything except the cost to A.F.O.S.R. of administering the grants. The cost per publication varies considerably between grantees: the best value for money appears to have been given by N. J. Turro of Columbia University who (with his 25 co-workers) produced 70 papers and articles between 1966 and 1970, at an average cost of just under $3000 per publication. Another man with a big group, M.J.S. Dewar of the University of Texas, spent $564,000 during the same years, and produced 60 publications at an average cost of a little over $9000 each. G. S. Hammond of Caltech. spent $375,000 during 1965-69 for 30 publications, at an average cost of $12,500 each. The last two averages would be fairly typical. As a slightly more expensive example we may consider W. F. Libby of U.C.L.A. who spent $330,000 during this period and produced 18 papers and articles at an average cost of about $18,000 per article. These are all well-established people who had relatively large grants, but the cost per publication generally remans around $10,000 even when one looks at persons who had as little as $50,000 to spend. This may reasonably be taken as an average cost per publication for work done in the U.S.A. in the years just prior to 1970. According to Derek Price of Yale the cost of scientific research in the U.S. is doubled every six years, the output of scientific papers is doubling every ten years, and the output of important and durable work doubles every thirty years. (Curiously the output of material in arts fields also doubles every thirty years.)

As I mentioned before, the average cost per publication for work done in New Zealand is less easy to determine, but on the basis of my own experience and observations I would say that in 1972 we could not get below Turro's pre-1970 figure of $3000, and that the average might even be closer to $5000. The days of string and sealing wax are gone forever! When I was at Berkeley in 1968 I learned that several of the experiments in the beam-switching yard of the Bevatron cost around a million dollars each, so we chemists have a long way to go before we catch up to the high-energy physicists. Nevertheless it is clear that costs are now so high, and the self-defeating effect of the flood of papers so marked, that the role of research and publication, and in particular the usefulness of research output as a major criterion for promotion in universities, is overdue for reconsideration in New Zealand and elsewhere. The most apt slogan for the latter part of this century may turn out to be "Publish *and* Perish".

A third aspect of chemistry which is beginning to show a marked change, possibly not an irreversible one, is its immediate usefulness as vocational training. Until a year or two ago it was quite rare to find a person trained as a chemist who did not continue doing chemistry after graduation. Of course many chemists progressed to senior positions in management or administration and most of us took pride in the thought that a training in chemistry could be relied upon to foster the versatility and tough-mindedness shown by these individuals. We now have a chance to find out if this is really true. Serious reductions in job opportunities for scientists and teachers, beginning with physicists in the U.S. about five years ago, but now covering most fields of science in most of the developed countries, have made it necessary for us to start thinking of chemistry as a cultural subject. So far, our graduates have not felt the pinch very strongly, and the predictable over-supply of scientists in New Zealand will not be very obvious for a few years yet. Nevertheless, one of the best chemistry Ph.D. graduates from Canterbury for some years recently went into the diplomatic service; at least three of our Ph.D.'s have become full-time computer programmers; several of our best honours graduates in recent years have continued with a Master of Commerce degree rather than a Ph.D. in chemistry, and one of these has just taken a job with the Monetary and Economic Council. This is in spite of the fact that at Canterbury we are second to none in terms of the number of our chemistry Ph.D.'s who occupy positions in New Zealand industry.

The current teaching of chemistry is based on a conception of the subject as being firstly an independent academic discipline having important areas of overlap with certain other disciplines such as physics and biology, and being secondly a vocational training for persons who are going to practise chemistry as a profession. Virtually nowhere is chemistry treated as a cultural subject in such a way as to point out, for example, its undeniable influences on the forms of civilisation in the past and at present, from the discovery of metal smelting to the present era of plastics and antibiotics. Chemistry deals with the constitution, transformations, and properties of matter, and in a real sense, since everything is made of matter, everythng is chemistry. But how many arts graduates know that? It might even be news to some science graduates. At the present time, because there is a tendency among academics to regard every recent discovery in their own field as sufficiently important to deserve a mention in lectures, there is hardly any room in our courses to devote to fitting chemistry into a broader context; we have come to rely on the student's ability to do this for himself in the years following graduation—the process seems to be basically one of forgetting the details of most that we have taught him. The idea of scientific method, and of what constitutes proof (or rather dis-proof) in the scientific sense, is generally assumed to enter by osmosis. If science students were given formal instruction in these matters to the point where they could expound them in plain English, it would do a great between arts and science graduates. If arts deal to overcome the communication barrier students were given such instruction there would be no barrier to overcome. We have begun to make changes along these lines at Canterbury but it is a painful process! The growth of the subject of chemistry ensures that we cannot go on indefinitely teaching all the fine details; since a change is inevitable we had better begin anticipating the form it will take. I think it was a World Chess Champion, Alexander Alekhine, who said that to foresee is to control. This is as true in science as it is in chess.

ACKNOWLEDGEMENT

Much of the material in this lecture had its origin, and the rest its inspiration, in discussions with Professor J. Vaughan in the Chemistry Department of the University of Conterbury.

STUDIES IN THE COORDINATION CHEMISTRY OF THE TRANSITION METALS

by J. E. Fergusson

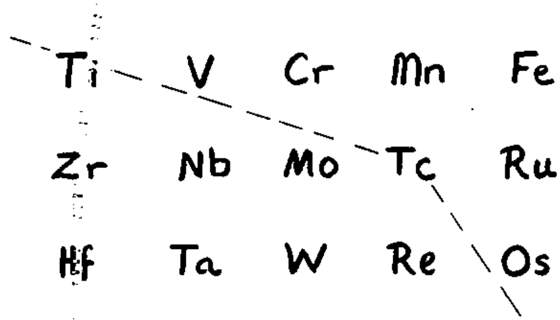
Chemistry Department, University of Canterbury, Christchurch.

During the period 1966 to 1971 research has been pursued on the coordination of chemistry of metal ions. The work has been in three areas, all of which overlap to some extent. The areas are: (a) the chemistry of metal halide complexes, [1,2,3] in particular the halide chemistry of technetium and rhenium; (b) studies in the stereochemistry of, and bonding in transition metal complexes; and (c) the chemistry of molecular nitrogen complexes.[4]

The study of the metal-ligand bond, and in particular the bonding between metal ions and the halogens Cl, Br and I has been a unifying theme in all of the work. The following summary is given from this point of view.

The Metal-Halogen Bond

The metal-metal bonded halide cluster chemistry of molybdenum and rhenium is an area of halogen chemistry that has been extensively investigated over the last 10 years. The clusters are composed of metal atoms bonded together and bridged with a number of halogens. The resulting units; Re_3Cl_9 in

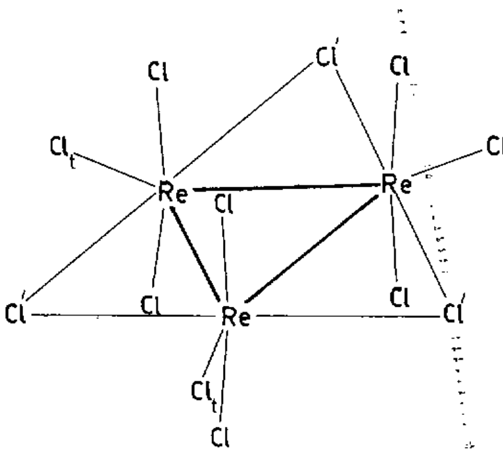


Form metal-metal bonded halide clusters.

$[Re_3Cl_{12}]^{3-}$ (A) and Mo_6Cl_8 in $[(Mo_6Cl_8)Cl_6]^{2-}$ have their own coordination chemistry and can attach further halogens or other ligands. The metal atoms that form metal-halide clusters are almost entirely limited to the elements on the left of the transition metal series (B). One element of interest in this respect is technetium, which is on the border of those elements that form halide clusters and those that do not. This gives technetium a distinctive halide chemistry compared with its congener rhenium.

The structural and reaction chemistry of the chloro-ligands marked Cl_t in $[Re_3Cl_{12}]^{3-}$

(A) are influenced by both their inter- and intra- molecular environment. Due to the steric pressure present within a cluster the Re-Cl_t bonds respond by lengthening, and one chlorine can be removed entirely when a large cation is used to isolate the anion. This type of investigation, viz. placing certain M-X bonds under steric strain, has been extended to other systems, for example, in the solid solutions formed between K_2PtCl_6 and K_2IrCl_6.



π—Bonding

The halogens Cl, Br and I may participate $M_{d\pi} \leftarrow X_{p\pi}$ and/or $M_{d\pi} \rightarrow X_{d\pi}$ π-bonding.

Investigations of this type of bonding have been undertaken by studying the metal-halogen bond in different systems, such as in the complexes and complex ions $MX_3(R_2S)_3$, $MX_2(R_2S)_2$, $[M(bipyridyl)_2X_2]^{+1,0}$ and $[MX_6]^{n-}$ where X stands for the halogen. Variations in the ligands, for example R in R_2S, different substituents on the bipyridyl, and changes in the metal M are reflected in the physico-chemical properties of the metal-halogen bond. The bonding has been probed by studying the proton nmr spectra of the R_2S ligands, uv-visible charge-transfer spectra of the bipyridyl complexes, and infrared and nuclear quadrupole resonance spectra of the hexahalogeno-complexes, as well X-ray structural studies. The ability of the metal-halogen π-bonds to form, and their strength, appear to increase in the order Cl<Br<I and 1st row < 3rd row < 2nd row transition metal (i.e. Fe<Os<Ru).

Interest in π-bonding has led to investigations of molecular nitrogen (dinitrogen) complexes of the transition metals. The remarkable stability of the complex ion $[Ru(NH_3)_5N_2]^{2+}$ can be accounted for by a strong Ru → N_2 π-bond. The electron donation is such that the metal ion has the physical properties characteristic of trivalent ruthenium. However, the transfer of charge is not sufficient to render the coordinated N_2 reactive so that the N≡N bond can be readily cleaved. The Ru-N_2 π-bond is affected by the crystal environment, and if the complex $[Ru(NH_3)_5N_2]Cl_2$ is co-crystallised with $[Ru(NH_3)_5Cl]Cl_2$ which has a smaller unit cell, the Ru-N_2 bond is strengthened to a small extent due to reduction of the bond distance by forcing the Ru and N_2 closer together.

The influence of steric factors on bonding has also been demonstrated from an investigation of the interplay of metal ions and the planar π-conjugated dipyrromethene ligands (C). With certain metals, such as Co, Ni and Cu, the ligand dominates in determining the tetrahedral or distorted tetrahedral stereochemistry for compounds ML_2, while for palladium the metal dominates in forming a square planar PdN_4 environment around itself. In this case, the planar ligand buckles at three places in order to accommodate the metal.

The author acknowledges the collaboration and assistance of colleagues and the work of a number of B.Sc. Hons. and Ph.D. students in the research described above.

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TRENDS IN MODERN CHEMISTRY IN NEW ZEALAND

by A. J. Ellis, Director, Chemistry Division, D.S.I.R. Lower Hutt

An Address to the 12th Science Congress, January, 1972.

Background

The beginnings of chemistry in New Zealand were associated with the mining industry. This affected both government, university and private chemists. 1865 was a key year with the establishment of the Colonial Laboratory with William Skey as Colonial Analyst, and with the arrival of the first analytical chemist to practice privately, J. A. Pond of Auckland. In 1870 the first professor of chemistry in New Zealand, J. G. Black was appointed to a Chair covering chemistry, mineralogy, geology and metallurgy at Otago University.

In the 1880s and 1890s further centres of chemical activity appeared with the establishment of Schools of Mines, and the fertiliser and animal products industries. A traditional New Zealand chemical interest in the extractives from plants also dates from these early years, and strong schools of research were built up at Otago and Auckland Universities. At the turn of the century a separate chemical laboratory was set up in the Department of Agriculture under B. C. Aston.

In the first half of this century chemistry became firmly established in industries concerned with fertilisers, dairy products, meat works, soap, food manufacture, the coal and gas industry, paint manufacturing, and in the forestry products industries.

In traditional fields of activity detailed chemistry went into improving fertilisers, into understanding the chemical metabolisms of sheep and cattle, into optimising the composition of cements for major structures, and into producing paints suited to New Zealand's climatic conditions. The detailed organic chemistry of New Zealand's plant materials, animal fats and dairy products was examined both in university and government research laboratories. The tremendous growth in the forest products industries provided creative opportunities for many chemists and chemical engineers.

The Colonial Laboratory, later the Dominion Laboratory, later Chemistry Division DSIR, has been the stock from which many other chemical research organisations have grown more or less directly, including laboratories now handling research in ceramics, leather, isotope chemistry, coal, meat, wool and some aspects of agricultural chemistry.

In the last decade, following successes in the mineral industry in Canada and Australia, there has been a rapid upsurge in interest of chemists in mineral exploration and product development. Although research on production of iron from New Zealand titaniferous ores goes back to the 1800s, it is only recently that following investigations at Victoria University and Chemistry Division and with the rise of new reduction techniques overseas, an iron and steel industry has become established in New Zealand.

More recently the New Zealand public, as in other parts of the world, are taking a greater interest in the maintenance of the quality of their surroundings, and chemists are increasingly involved in limiting the pollution from industrial processes and in monitoring the contamination of water, atmosphere and plants.

Chemistry has changed in its first hundred or so years from being almost an invisible part of the community, to a science that is required for the efficient operation of a high proportion of industrial, farming and community activities. Correspondingly, the professional membership of the New Zealand Institute of Chemistry has increased dramatically during the post-war years, rising exponentially from about 300 in 1945 to over 1000 in 1972.

Trends in Organisation

The obvious change is in the size of laboratories. University, government and industrial chemists are usually not the broadly-based scientists of the species of Black or Skey. There is a continuing trend towards increased specialisation.

Modern specialisation has increased the need and desire of scientists to work in common interest groups. There are exceptions, but there appears to be a minimum size if a group is to be successful and reasonably stable. This size is becoming larger as time goes by, because of the need for certain specialist instruments and services to keep the group as a whole operational. For example, in organic chemistry certain members of a group may for efficiency be almost entirely involved with the operation and theory of infra-red, n.m.r., or mass spectrometry instruments. In a geochemistry section, specialist operation of emission spectrography, atomic absorption or solid source mass spectrometry may be required. It is not just the need to exchange ideas, but the complexity of modern chemical operations that requires a sizeable group for efficiency. In Chemistry Division we feel the minimum effective size for a section of activity is about six professional staff.

Using modern instrumentation, output is vastly greater than that of isolated chemists working with traditional procedures. However, the expense of complex chemical instruments is such that only large research laboratories have sufficient work to justify their purchase, or for that matter sufficent financial flexibility to afford them. The trend towards more and more sophisticated instrumentation has been rapid. The exceptional instrument purchase for a laboratory was of the order of £1000 in 1950 (for example a high-quality ultra-violet or an infra-red spectrophotometer). This changed to the order of £10,000-£20,000 in 1960 (n.m.r. spectrophotometer or mass spectrometer), and it is now approaching the vicinity of $100,000-$200,000 in the 1970s with complex integrated instrumentation such as gas chromatography—mass spectrometry with computer controlled comparison and print-out. With trends of this type, centralisation of chemical work must occur. It will not be possible for New Zealand to afford expenditure on more than a few centres of high-performance chemical instrumentation.

An interesting recent trend has been in the availability of chemists for certain types of work. As recently as five years ago there were many fields, at least of government science, that it was difficult to staff, partly because there was a general world-wide shortage of chemists, and partly because the New Zealand universities were not training people in the specific fields. Also, graduates had a rather inflexible attitude, wanting to continue in the specialisation in which they had been indoctrinated. The growth of specialist research schools in the New Zealand universities, together with a retrenchment in many countries in industry and government science spending, has changed this. It is now not necessary to recruit a person who could be right if retrained; but to recruit from the world of chemists to obtain an appropriate specialist. It is important in this new situation that New Zealand graduates have the training that will enable them to compete with overseas chemists for specialist jobs in New Zealand.

The very size and importance of modern science in the community can produce rather a paradox in the organisation of science. Scientists in the mass require facilities and produce papers and reports, all of which take a vast amount of money. Because of this expenditure, direction of research by advisory committees is considered advisable for efficiency. Yet if not done carefully, guided or "white paper" science can produce a nine to five breed of scientists and may discourage the most useful member of the scientific community, the innovator, from participating, with the loss of the efficiency aimed for. The innovative scientist must be left at least with a feeling that he is in control of his work.

Some direction of scientific aims is necessary, but without arranging that a top rank scientist with imagination should lead the way it can be only too easy to direct the setting up of a research group, expend vast sums of money, and produce only imitations of overseas research, or a "science factory".

In several countries there has been a re-assessing of the importance of government sponsored science. Both in Australia and Canada there has been a very liberal attitude towards "pure" science, or undirected research, in the hope that discoveries of practical importance would in due course result. After a decade of funding, the governments are now looking carefully at the achievements from the programme; many groups from which the pay-off has been minor have been terminated or combined with groups having a more outward-looking programme.

Educating the Chemist

The rapidly expanding knowledge in chemistry has now resulted in a total university training period of 8-9 years being necessary to bring the final graduate up to the level where he is a more or less self-contained research operator. This represents a very large investment of what is usually public money, and it is important that the years be spent in the right environment.

An article in the Economist a year or so back pointed out that the majority of the world's recent major technological innovations took place in the United States not because of a higher proportion of scientists than in the European countries, but because U.S. scientists were trained in an atmosphere where no great distinction was made between fundamental and applied research. It is important that our young chemists in the universities and in their early years in government or industrial laboratories, get a training which presents chemistry as a whole—both the best modern theories and techniques and the industrial implications of chemical knowledge.

I have noticed an interesting trend very recently which seems to have developed spontaneously in young graduates from the different universities here and overseas. Whereas the average Ph.D. graduate of ten years ago was largely concerned with increasing his specialisation or expertise within a narrow field, many young chemist graduates of today are searching for social or industrial relevance as well as interesting chemistry in their post-university activities. This is an encouraging trend.

With the rapid changes in science that are occurring, the old concept that education ends in the early or mid-twenties must be changed. In recognition of the rapid changes, it must be accepted that formal education continue at intervals throughout the scientist's lifetime. Sabbatical leave to review progress in one's own field may not be all that is necessary. It could be that every six or seven years it will be necessary for a chemist to radically change his field of activities or upgrade his ideas with re-education.

Science graduates should appreciate the position of science in the community. Science is threatened both from within the body of science itself, and also from without. The threats from within include the information explosion with its unsolved problems of communication between sciences, the failure to understand the importance and moral effects of scientific ideas, and the corrupting influence of scientists promoting science as a pursuit of power. The latter is seen at its worst in large American laboratories devoted to current politically-sensitive topics. In the present less disciplined and permissive society at large there is a strong anti-science lobby. Scientific facts are not permissive, and careful science requires strong personal discipline.

The Changing Nature of Chemistry

The most obvious change is in the smaller proportion of time spent by chemists at the bench or in the work-shop. More time is spent in tending equipment, in puting results, or in paper work associated with more complex theoretical interpretations. The result has been an extraordinary increased output of results, calculation and testing of more complex theories, more rapid production of new materials. For all of this, chemistry has lost some of its human and observational interest. We have come along way from the time that Becher, in his *Physica Subterranae* (1681), described chemists as "a strange class of mortals impelled by an almost insane impulse to seek their pleasure among smoke and vapour, soot and flame, poison and poverty".

Where modern techniques have freed time for more extensive and new thinking they are indeed worthwhile, but where they have led to science factories (more results, more papers, minimum thought) it is a sad situation. This has not yet happened in New Zealand to any great extent, but that it is happening overseas is obvious from perusing a cross-section of the 30,000 major science journals produced in the western world. This number is increasing by about 1500 annually, and much of what they contain could with advantage be not printed. So many of the papers represent not new thoughts but one more turn of the handle of the new machine.

In the next few decades it is likely that the structure or environment of average molecules and crystals will become so simple to obtain as a routine, that chasing structures or mechanisms for the sake of the exercise will become rather uninteresting. The ability of chemistry to enable the understanding of biological, geological and industrial processes is where I believe the future excitement in chemistry lies. There is a trend for highly useful and interesting careers to be created by fusing chemistry with other subjects. There may be other sciences, producing hybrids such as biochemists, geochemists, chemical physicists, or with subjects such as economics or business management. The splintering of chemistry into specialist groups with few crosslinking interests, has however, created a problem for the chemical profession.

With the rapid changes in science, the only scientists to escape obsolescence will be the innovators, and the proper placement of these within the scientific community is more critical to programmes of research than any other single factor. I have seen estimates that only one person in one hundred thousand is capable of producing truly original ideas, or on the population size of New Zealand, about thirty people. With luck, some of these may be scientists, and with even more luck some of these may be scientists who are still in a position within their organisation to work at science.

Many chemists have achieved high co-ordinating positions in administration of universities, business and government organisations. In thinking why chemists should produce this type of person I was interested in remarks made by Dr D. S. Davies of I.C.I. in a lecture some time ago. He pointed out tests that have been done to check the balance between literacy and numeracy in various professions. It turns out that chemistry is one of only a few trades or professions which is equal in numeracy and literacy ability. In other words, chemists are either totally ignorant or totally well-balanced, if both features are considered important. Chemistry is enriched and improved by mathematics, but chemistry is also described in careful literature. In achieving practical results both words and numbers are important, but both are therapeutic at one dose level and toxic at a higher level. The balance of a good chemist in matter of words and number is of considerable importance to him when working on team projects involving other scientific disciplines. There is very often a tendency to labour what are essentially simple truths, or conceal dubious arguments in a smoke-screen of mathematics.

Choice of Topics

We are now in the middle of a period in which chemistry has become the dominant science in its effect on everyday life. We have only to think of everyday materials such as plastics, paints, synthetic fertilisers, antibiotics, insecticides, new alloys, new building materials, pharmaceuticals, adhesives and fabrics. Chemistry will have an important part in shaping New Zealand's future and it is our responsibility to see that it is directed along useful lines.

Three important facts should be pointed out. American experience has shown that new science-based industries are able to get off the ground only if there is a good collaboration between research worker and technologist. Secondly, there is a tendency for chemical industries to economise on production costs by operating at a larger and larger scale; there will be fewer and larger plants built at optimum positions in the world for raw materials, processing costs and transport. Thirdly, comparison of European and American experience has shown that success in new science-based industries occurs only when sufficient money is concentrated on particular projects. A year or so ago a report put to a meeting of Science Ministers of European countries of the Organisation for Economic Co-operation and Development pointed out that there were certain minimum threshold levels below which innovative efforts were likely to be unsuccessful.

New Zealand chemists must decide carefully in which specific areas we can make a success. In making this choice, the research schools, government departments and industry must decide which local advantages give them the edge on the rest of the world for being exceptionally successful in the field chosen. The local advantage may be due to one or a combination of several factors; a local raw material, a new concept, a particular man, availability of finance, cheap energy, or even the climate. But we should be certain both in pure or applied chemistry, that we have related our activity to the local scene and not to an overseas bandwaggon. If we are following a bandwaggon we can be almost certain we will be near the rear of the procession. Many successes can be related to advantages taken of local situations or challenges. Some of the chemical fields in which New Zealand has made its mark and has not just been a capable imitator include for example; gold extraction, natural product chemistry, ironsands processing, soil chemistry, geothermal chemistry, and brewing chemistry (the local advantage here is perhaps one of consumer challenge).

I have no intention of crystal ball-gazing far into the future, but a few obvious pointers can be given:

Of all the countries in the world, New Zealand has the highest ratio of protein supply to protein requirements. We at present concentrate on the production of high-quality proteins such as beef and mutton, but over 70 percent of the world population resides in poor, diet-deficient areas. The world needs food protein urgently and the need is intensifying. New Zealand is in an excellent position to be able to supply this, but diet supplements must be low in cost. Even our skim milk powder protein is twice the cost of soya bean flour protein. There is considerable research on synthesising or chemically extracting plant proteins, but they must be done efficiently, and the product made palatable.

If we decide to remain high-quality protein suppliers for the world's affluent countries, we must tailor our products to their tastes. In seeking new markets for mutton and lamb we must overcome the distaste that many potential buyers have for sheep meat because of its flavour. A D.S.I.R. project at Massey is looking at the chemistry of mutton flavour constitutents with the view to possibly being able to control their production through factors such as diet, breed of sheep, or methods of meat handling. This is highly complex chemical research heading in a positive direction.

Although wool has many advantages as a textile fibre, it has also many drawbacks, including instability towards heat, light, alkalis, reaction with dye-stuffs, and affinity for water. Research, at present at the Wool Research Organisation, on changing the natural characteristics of wool to a more desirable form is another example of advaned chemical research with very positive implications for New Zealand's economy.

The general aim of adding additional value to New Zealand raw materials before export, remains as a continuing challenge to chemists. New Zealand has some very vast mineral resources, often with associations which give natural advantages. For example, the association of pure quartz deposits with vast coal reserves in Southland, and the possibility of cheap electricity production, point to research on ferrosilicon and silicon metal production. Local specialised knowledge may give us an edge in producing synthetic rutile from our ilmenite deposits on the West Coast.

Building materials are still the most primitive of modern mass-production materials. The production of new substitutes to hold down building costs is a worthwhile challenge to chemists.

As cropping and animal husbandry practices change there will be a continuing requirement for specialised fertiliser materials keyed to New Zealand soil, climatic and nutritional needs, preferably produced from New Zealand-owned raw materials.

The pulp and paper industry has become a major export income-earner for New Zealand. In the chemical pulping process about half the material produced is lignin and hemi-cellulose which at present is burned as an energy source. It has more potential value as a chemical raw material than as energy produced by burning. Most of the expensive pulp bleaching stages of papermaking are necessary only because of the discolouration that accompanies industrial delignification. There is a singular lack of success in man's efforts to utilise lignin as an isolated product, or to utilise it in paper; this is related to his lack of understanding of the material. Unravelling of the organic complexities of lignin and hemicelluloses could potentially lead to new high-yield pulping processes producing strong, light-fast, lignified papers—a challenge well worthy of the most sophisticated research.

Food is presented to the community in a more refined and bacterially more acceptable condition than hitherto. Unfortunately, it is also lower in nutritional value and may have been contaminated by various artificial aids to production or processing. In U.S.A. there is already a strong action group protesting against highly processed and synthetic foodstuffs, and food in its natural form has an enhanced sales value. The relative purity and simplicity of food production in New Zealand should be kept in mind as a strong sales point in affluent markets, and one that chemists should carefully work to preserve.

The maintenance of the pure New Zealand environment may therefore have financial as well as aesthetic advantages, and is itself worthy of intensive chemical efforts.

These are but a few examples, but each could absorb several million dollars of research effort if we are really to be leaders in the fields. Success in chemistry will come through the creation of highly-qualified teams centred around selected problems. If chemists are not efficient in selecting relevant problems, we may have less palatable ones inflicted on us by administrative or political pressures.

Postscript This lecture was not written with publication in view, but was intended to stimulate discussion at the Congress session. Notes were not kept of the sources from which some of the material was obtained. The writer asks the forbearance of any authors who find that material of theirs has been abstracted without specific reference.

METRIC ADVISORY BOARD
TIMETABLE FOR THE INTRODUCTION OF THE METRIC SYSTEM INTO EDUCATION INSTITUTIONS

This is a general guide to the timing of conversion in the educational system. Anyone teaching or studying a particular course should be guided by the prescription relevant to it. Individual prescriptions and syllabuses of examining bodies or teaching institutions should also be consulted before textbooks and equipment are ordered for particular courses.

	1970	1971	1972	1973	1974	1975	1976
1. PRIMARY SCHOOLS AND TEACHERS' COLLEGES							
a. Gradually phase out imperial units and introduce common metric units.	╺━	━	━╸				
b. Teach only the metric system to all pupils and student teachers.			╺━	━	━	━	━
2. SECONDARY SCHOOLS							
a. Increasingly use metric units in practical work and computations.	━	━	━				
b. Relate changeover in some technical courses to the change in trades and industries.	━	━	━	━	━	━	━
c. Science courses in metric units.	━	━	━	━	━	━	━
d. All courses in metric units.				━	━	━	━
e. School Certificate questions may use imperial or metric units. (Imperial units are unlikely in mathematics and science in 1972).	━	━	━				
f. For School Certificate, mathematics and science questions will be in metric units. Alternative papers (metric and non-metric) will be offered in some applied subjects such as technical drawing, woodwork and home economics.				━			
g. For School Certificate, metric units only.					━	━	━
h. University Entrance, Bursary and Scholarship science papers will use metric units only. Some non-metric units in mathematics papers (mainly in U.E. applied mathematics which will be abolished after 1972).	━	━	━				
i. University Entrance, Bursary and Scholarship : metric only.				━	━	━	━
3. TECHNICAL INSTITUTES							
a. Technicians Certification Authority and Trades Certification Board examinations: Alternative forms of questions set.			━	━			
b. T.C.A. and T.C.B. examinations: metric only. (The teaching in technical institutes will be geared to examinations under (a) and (b)).					━	━	━
4. UNIVERSITIES							
a. Changeover at discretion of universities.	━	━	━				
b. Metric units in all university teaching and examinations.				━	━	━	━

FORTY YEARS IN STANDARDS

by G. A. Lawrence, O.B.E., J.P., B.Sc., F.R.I.C.

A major factor in the establishment of the New Zealand Standards Institution was undoubtedly the Napier earthquake. It was quite evident that something would have to be done about the building by-laws to insure that future building structures would be more resistant to shakes of this magnitude. In addition, there was a growing opinion that there were many avenues in our economy where standards would be desirable.

The orginal N.Z. Standards Institution was established under the aegis of the then N.Z. Society of Civil Engineers (now N.Z. Institute of Engineers). Mr. J. Pearce Luke was the first Chairman of a Council consisting of about 15 members. I was appointed to represent the New Zealand Institute of Chemistry.

The Council held its meetings in the office of the N.Z. Society of Engineers in a building opposite Parliament House in Molesworth Street. I shall always remember at the first meeting the clutter of electric wire and equipment about the floor, because at that time consideration was being given to equipment for the recently introduced hydro-electric power which replacd the old D.C. power.

My interest in standards had been stimulated by years of laboratory work, my experience as a consultant and by my service on several local bodies. It became quite evident to me that standards were a necessity if New Zealand was going to improve its own economy, and also to be in a position to comply with the requirements of its overseas customers.

While the government of the day professed sympathy towards the newly established Standards Institution, it was not prepared to make any substantial monetary grants towards the work. Industry at this time was more or less blind to the benefits that would be derived, and financial support from this source was negligible. It was not surprising, therefore, that little progress was made for the first two years, and Council was forced to make a more urgent approach to Government.

During these negotiations (1936) a change of government took place and a new Minister, the Hon. D. G. Sullivan established the standards organisation within the orbit of government. While this insured a continuation of the work it was not universally popular, especially in certain business circles, and this opposition continued until the present autonomous body was established a few years ago. The name of the body set up under the aegis of the government was New Zealand Standards Institute.

Apart from engineers, architects and other professional people, it was evident that there was considerable ignorance about standards and their value in modern society. Many manufacturers and businessmen felt that the imposition of standards would hamper their activities and result in some sort of dull uniformity. It was clear that a lot of preliminary work would have to be done in education before any real progress would be made.

In my small way I tried to do something about this lack of understanding of standards by writing articles for some trade and other journals and by giving short addresses to Rotary Clubs, etc. In many instances the public press was not too helpful and was always ready to pounce on what they thought were mistakes in the promotion of standards. I remember on one occasion during my term as Chairman of the Council seeking an interview with the editor of one of our newspaper. I told him we did not mind fair criticism but resented ridicule by, in most cases, people who did not understand Standardisation. He expressed surprise when I reminded him that his own organisation could grind to a halt were it not for the fact that his staff had periodical access to experts capable of adjusting his printing metal to standard alloy proportions.

During the earlier years of the Institute there was even opposition from within the organisation. Some members of the Council tended to "drag their feet", either because they really did not understand standards or because they resented the fact that the government retained control. There was an unwarranted feeling that the imposition of standards could interfere with their liberties as manufacturers and businessmen. Over more recent years thes older, more conservative members have been replaced by more enlightened younger men, and this opposition has happily disappeared.

The late Mr L. J. McDonald, first Director appointed by Government, was on many occasions a controversial figure. We had many arguments and differences of opinions about proposed standards and I remember on one occasion reminding him that integrity will always play an important part. One could send man with a grease gun under a motor vehicle to lubricate the bearings, but whether the job was done faithfully or not depends on the man's integrity.

Looking back on Mr McDonald's term as Director, I consider that it was a fortunate choice. As far as I know he was never a Civil Servant and there were no inhibitions. He was a great enthusiast for standards and was a most capable and forceful debater, and a crusader who would fight to the last ditch for what he thought was right. Had a Civil Servant been taken from the ranks for the job, the Standards Institute may not have got off the ground.

Almost from the beginning there were murmurs to the effect that private enterprise should have more say. Thes people overlooked the fact that private enterprise had already had it chance, but was not yet ready either in its knowledge of the value of standards nor in it willingness to make any worthwhile financial contribution to the project. It was hardly likely that the government would favour an autonomous body unless it had some financial support from industry.

During my term of office as Chairman of the Council I was instructed to interview the Minister of Industries and Commerce (the late Hon. Jack Watt) to ascertain whether the government would favour the setting up of an autonomous body with government support. The request was unsuccessful and we had to wait a number of years before this came about.

Looking back I feel certain that at the time I made the approach it will still too early. Acceptance of the standards project had come a long way, but industry had still not reached the stage when it would be prepared to make significant contributions.

The climate some five year ago, when the proposition was finally accepted by government, was much more favourable. We had those extra years of experience, many new and more progressive members in Council; we had an excellent Chairman in the person of Mr J. I. King, and above all we were dealing with the Rt. Hon. J. R. Marshall, then Minister of Industries and Commerce.

The strength and efficiency of a Standards organisation is dependent on the calibre of its committees. I think we have been very fortunate in the quality of the Committee Members and their willingness to serve. The general public have not the slightest idea of the vast amount of voluntary work by these people, highly qualified in their own spheres, and the hundreds of people engaged in this committee working. It is also not generally realised that every man, woman and child derives some benefits from standards. In an article of this length it would be invidious to try to pick out those standards which are of most importance to our economy. From a "needle to an anchor" is a common saying but to apply this to the scope of standards would be quite inadequate.

What of the future! The standard Association of New Zealand, under its present constitution, is well founded and it is to be hoped that there will be increasing financial support from private enterprise. To many firms, especially the smaller ones, the question arises as to what benefit are we going to get out of this if we become a subscribing member'? As I have said earlier, every man, woman and child derives benefits from standardisation. The push chair that carries the baby and the ambulance stretcher that is used to carry the patient to the hospital have been subject to the deliberations of the Standards Institution, and specifications prepared for the best possible design and construction.

The minimal fee for membership for a small organisation is only ten dollars a year,not much out of an annual budget.

As to the value of standards in overseas trade there can be no doubt; the more we link our standards with those of other countries the better. In particular, our association with the International Sandards Organisation is most valuable. If a New Zealand trade representative can say to a prospective overseas buyer 'our product complies with your country's Standard Specifications', he has established a major sales factor.

The late Mr G. A. Lawrence served as N.Z.I.C. representative and Foundation Member of the Standards Council since its inception forty years ago.

This article was written just a few weeks before his death.

OBITUARY

GILBERT ALEXANDER LAWRENCE

June 1893 — April 1972

Gilbert Alexander Lawrence was one of the pioneers of industrial chemistry in New Zealand. With his death on 17th April 1972 another of the links in the chain of early development of industrial chemistry was broken.

Gilbert Lawrence's main contribution to chemistry arose from his part in building up the consulting services of H. W. Lawrence and Son, Johnsonville. This service was started by Gilbert's father, H. W. Lawrence in 1908. It was the first industrial consulting and advisory service in chemistry set up in New Zealand. The initiation of the practice arose from H. W. Lawrence's earlier academic and practical experience. H. W. Lawrence was a graduate of London University, having also attended the College of Preceptors and the Royal School of Mines, London. He worked for eight years in the Royal Agricultural Society Laboratory and later became assistant to Sir Henry Gilbert, the first Director of Rothamstead Agricultural Experimental Station. This connection was commemorated in "Gilbert", his son's name.

When the family migrated to New Zealand in 1901 and after a period connected with farming, it seems natural that H. W. Lawrence's background should lead him into consulting practice, especially when the first client was Thomas Borthwick and Sons and the early work was quality testing of tallows and fertilisers for export.

When the 1914-18 war broke out Gilbert Lawrence was engaged in farming. At the outbreak of war he immediately enlisted, was drafted to Western Samoa and then to Gallipoli, where he was wounded and evacuated to England.

On returning to New Zealand he joined the Health Department and then his father's practice. During this time he qualified for his B.Sc. under Professor Thomas Easterfield. Later he took the examination for membership of what is now the Royal Institute of Chemistry and was the first New Zealander to gain admittance to this Institute by examination. These were outstanding accomplishments for a man who had no secondary school education. This background of free development by inclination and opportunities to follow wide interests are perhaps the foundation for Lawrence's outstanding subsequent career in professional and community affairs.

In the professional field, Gilbert Lawrence was a foundation member of the New Zealand Institute of Chemistry and was President of the Institute in 1938-39. He was elected a fellow in 1935 and an honorary fellow in 1963, and contributed to the earlier organisation and development of the Wellington branch. He was also a past president of the New Zealand section of the Royal Institute of Chemistry.

The consulting practice of H. W. Lawrence and Son in its early years gave many companies their first connection with the contribution that could be made through the service of chemists. These companies included practically all freezing companies, the brewing industry, fertilizer industry, refrigeration industry and many others. This service, in many cases, proved to the commercial world the value of chemical control and research and development and, mainly during the 1920's led to the beginning of the increase in numbers of appointments of chemists in industry.

The consulting work led to Gilbert Lawrence being called upon in many important court cases. Notable of these were the Grant v. Cooper McDougall classic sheep dip case in 1945 and the Maeder hair-waving patent infringement case in the late 1940s.

In later years his appointment as official analyst to the Racing Conference in connection with assay work relating to race horse doping was another exacting service.

After his retirement in 1963, the name of the service, H. W. Lawrence & Son, was changed to Chemical Service Laboratories Limited, and is carried on by Gilbert Lawrence's co-workers John H. Futter and Edgar Cone.

Lawrence's community contribution is shown by the following bodies, nearly all of which he at sometime held the highest office in:

- Hutt Valley Electric Power Board
- Wellington Suburban Highways Board
- Wellington Free Ambulance
- Member of Committee promoting electrification of the Wellington-Johnsonville Railway
- Councillor of thhe Johnsonville Town Board
- Member of the Council of the New Zealand Standards Institute
- New Zealand Institute of Refrigeration

He was also a Justice of the Peace, a member of the Rotary Club and a very active Freemason attaining to high office in the Order.

Lawrence was awarded an O.B.E. in 1964 for his contribution to scientific and local body affairs.

In the earlier years since his retirement Lawrence devoted much time to community affairs and took up pottery, producing some creditable work through the application of his basic knowledge and creative ability.

Few scientists with such a background as Lawrence have made as wide a contribution to their chosen scope of professional work and, at the same time, engaged in so many diverse and exacting community service activities.

Lawrence made a worthy contribution to an era which laid the foundation for the application of science to New Zealand industrial development.

Gilbert Lawrence's life work could not have been so valuable without the support of his wife Lillian. He also leaves a daughter, Mrs. Jean Prins (Auckland) and a son, Bill (Palmerston North).

C.G.W.M.

PUBLICATION OF

IUPAC PROPOSALS

ORGANIC CHEMISTRY RESEARCH:

After extensive discussion the Organic Chemistry Division Committee made the following observations and recommendations to the Council of IUPAC at Washington, DC, July 1971:

(i) The Organic Chemistry Division regrets to see an unnecessary proliferation of journals devoted to publication of the organic chemical literature.

(ii) The Organic Chemistry Division recommends that titles and summaries should be written in such a way as to facilitate information retrieval by including all the important keywords.

(iii) The Organic Chemistry Division Proposes for consideration by the appropriate authorities that when a *preliminary communication* is submitted, it should be accompanied by a fully detailed experimental section which would be available to the referees, but which would not be published. In addition, a copy of this experimental section would be available on payment of an appropriate sum to the publishing journal or to the author.

CONFERENCE 1972

Victoria University: Wellington

August 21-25

An attempt is being made to make this year's conference one that presents a broad spectrum of current work to interest workers in all fields. Among overseas scientists addressing the conference will be Professors E. N. Lightfoot and J. O'M. Bockris.

In 1952 the University of London awarded Dr Brockris the D.Sc. for "Authoritative contributions in electrochemistry". He became professor at the University of Pennsylvania in 1956—a chair he held until this year when he moved to Flinders University, Adelaide.

He is a founder member of the International Society of Electrochemistry and has been co-editor of Electrochemica Acta and the Journal of Electroanalytical Chemistry since the inception of these two journals.

He views electrochemistry as a central future field of interest in the development of a viable post-industrial society in which a clean environment must be associated with an electrically based industry. In his own words he sees his work as "seeding the changes in technology which most follow the gradual giving up of our fossil fuels as our source of energy, and the emergence of a new and entirely electrical technology"..

Professor Lightfoot is head of the Chemical Engineering department at the University of Wisconsin and is this year an Erskine Visiting Fellow at Canterbury University.

His present research interests include fundamental aspects and the application of transport phenomena concepts to fields as divergent as the disposal of organic wastes and the development of improved procedures for prolonged heart-lung bypass operations.

IUPAC CONFERENCE AND CONGRESS

The National Committee for Chemistry wishes to point out that the next (XXVII) IUPAC conference will be held in Hamburg in late August 1973, and will be followed by the XXIV IUPAC Congress in the same city from 3-8 September 1973. Themes in this congress will include High Polymers, Natural Products, Solid State Chemistry, Non-metal Compounds, Applied Electro chemistry, Radiochemistry, and Future Aspects of Chemical Documentation. The committee would like to know of New Zealand scientists who expect to be in Europe at this time, and who might be interested in atending part of the conference or congress. Any such scientists are requested to contact Dr. H. C. Sutton (Secretary to the committee) at the Institute of Nuclear Sciences, D.S.I.R., Private Bag, Lower Hutt.

FORTHCOMING INTERNATIONAL CHEMISTRY SYMPOSIA

1. IUPAC-EUCEPA Symposium on Man-made Polymers in Papermaking — Helsinki, Finland—5-8 June 1972.
2. Microsymposium on Photochemical Processess in Polymer Chemistry — Louvain, Belgium — 12-15 June 1972.
3. VIIIth International Congress on Clinical Chemistry — Copenhagen, Denmark — 18-23 June 1972.
4. IInd Discussion Conference on Macromo ecules: Molecular Matrices and Carriers of Biological Functions — Prague, Czechoslovakia — 21-24 August 1972.
5. Ist IUPAC Conference on Physical Organic Chemistry — Crans sur Sierrs, Switzerland — 4-8 September 1972.

Further information on any of these gatherings can be obtained through the Royal Society of New Zealand.

BRANCH NEWS

Auckland

It has been customary for this Branch to donate a prize to the top student completing an N.Z.C.S. at the Auckland Technical Institute. The 1971-1972 prize will be awarded to Mr. J. Maynard.

The Branch Committee had decided that a similar prize be awarded to a student completing B.Sc. in Chemistry at the Auckland University. The 1972 prize winner will be announced by Professor P. de la Mare later this year.

The April meeting was held at 5.45 in the Chemistry Department, Auckland University after a social half hour. A panel of speakers led by Mr R. Hopgood spoke on the role of contemporary chemists. The whole arrangement was well received by the 45 present—a significant increase on previous technical evening meetings. The new meeting time (refreshments 5.14-5.45 p.m., meeting 5.45-7.15) is proving most popular.

Dr Trevor P. Cheeseman, a graduate in Chemistry from Auckland University (Ph.D. in Chemical crystallography in 1964), gave a most interesting address entitled 'Evolution and the Future' to a joint meeting with the Student Society on Tuesday, 2nd May. This is the first joint meeting for some time and question time provided an excellent occasion for students to 'get involved'.

Auckland Branch Chairman, Dr G. A. Wright organised a well attended and much needed Symposium on 'SI Units in Chemistry' on Wednesday, 10th May.

Dr J. Rogers is preparing drafts of a Safety Booklet and/or broadsheets. He would welcome suggestions and practical aid on this large undertaking.

Associate Professor B. R. Davis received his D.Sc. at the May Auckland University Capping Ceremony.

Dr A. Herd has been appointed to the staff of the N.Z. Fertilizers Manufacturers Research Association, Otara.

Manawatu

Dr G. W. Butler delivered an address to the branch recently on the "Non-Medical Use of Drugs", with particular emphasis on marijuana.

Dr L. R. B. Mann (Biochemistry Dept., University of Auckland) delivered an address in May entitled "Environmental Health Hazards and the Social Responsibility of Scientists". A lively discussion followed at this well-attended meeting.

Applied Biochemistry Division, D.S.I.R.

Professor A. van Hare (originally from the University of Couvain, Belgium) who has spent some years in the Congo, is now on sabbatical leave at this Division of the D.S.I.R. His interests are physiology and biochemistry of nitrogen fixation by leguminous plants.

New Zealand Dairy Research Institute

Dr F. G. Martley has recently been awarded a Ph.D. from Massey University for a thesis on the influence of Streptococci on Cheddar cheese flavour. He has been granted two years leave of absence to work at the Animal and Dairy Science Research Institute, Irene, Transvaal, South Africa.

Mr C. G. Bloore, a chemical engineering graduate from Canterbury University has been appointed to the Milk Powder section of the Institute.

Wellington

Chemistry Department, V.U.W.:

Professor J. F. Duncan has accepted the invitation of the University of New South Wales to present the 1972 F. P. Dwyer Memorial Lecture in May. Professor Dwyer, at the time of his death in 1962, held a Personal Chair in Biological Inorganic Chemistry at the Institute of Advanced Studies of the Australian National University. Professor Duncan's lecture is entitled "From Atoms to Macromolecules".

Dr A. F. M. Barton will be on leave from V.U.W. from August 1972 to January 1973, and will spend this period in the Chemistry Department, Imperial College, London, with the research group of Dr M. Spiro. Professor R. J. Ferrier of the same Department will act as Wellington Branch Editor for the remainder of the year.

Following discussions with the Head of the Chemistry Department, Professor J. F. Duncan, Mt Isa Mining Holdings has arranged to finance a research student in the Chemistry Department for 2 years to study titanium extraction chemistry.

A short film has been made by Mr J. Burgess of the Chemistry Department to introduce the proposal to establish a Permanent Science Exhibition in Wellington. Mr Burgess has shown the film at several meetings in Wellington and would be pleased to receive enquiries from other interested individuals or societies.

Chemistry Division, D.S.I.R.

An A.E.I. MS 30 Double Beam—G.L.C. Mass Spectrometer is expected at Gracefield in early June.

Dr L. J. Porter spent ten days in Australia in May in order to attend an Organic Chemistry Symposium in Adelaide and also to visit laboratories concerned with bark utilization.

Mr R. M. Sinclair will depart in early June for two months on a world trip. He will visit Building Research Centres and Government testing establishments in the U.S.A., U.K., South Africa and Australia.

Mr G. J. Down, until now a Chemistry Division student bursar, has joined the Organic Chemistry Section. He recently completed his B.Sc. (Hons) at Canterbury University. He will be associated with the running of the new mass spectrometer at Gracefield.

Mr N. B. Milestone has returned to Chemistry Division after studying for his Ph.D. under the supervision of Professor Wilson at Waikato University. At Waikato he examined the amorphous constituents of some New Zealand soils. At Gracefield he will be a member of the Cement Section and will study the properties of admixtures.

Mr K. W. Dalzell, a student bursar who recently completed his M.Sc. at Canterbury, has joined the Paint Section of Chemistry Division.

Soil Bureau, D.S.I.R.

Miss R. E. Symes, who recently graduated M.Sc. with First Class Honours in Chemistry from Victoria University, has joined the Soil Physical Chemistry Section. During her course at Victoria University Miss Symes studied the kinetics in neutral solution of the classical analytical reaction between iodate and iodide.

Wellington Hospital

Miss J. Mattingley, Senior Hospital Scientific Officer of the Pathology Department, Wellington Hospital, who is on leave until October, will present a paper on "Normal Amino Acid Excretion" at the 8th International Congress of Clinical Chemistry at Copenhagen in June. Miss Mattingley will also study radiochemical urine assay techniques, and in connection with her position as Editor of "Chemistry in New Zealand" she will look into scientific editorial matters with the Chemical Society, London, and the Royal Society. During her absence from New Zealand this journal is being edited by Mr C. L. H. Stonyer of Tasman Vaccine Laboratory Ltd.

Canterbury

Mr J. R. McGimpsey has been appointed General Manager of Davis Gelatine Ltd.

Dr J. E. Fergusson attended the conference of the Division of Metal Organic and Inorganic Chemistry of the Royal Australian Chemical Institute in Sydney in May.

Dr G. J. Wright is spending the winter term as Visiting Lecturer in the Chemistry Dept, Monash University, Melbourne.

The 1972 Chemistry in Action lecture for sixth forms was given recently by Professor G. B. Peterson, Medical School, University of Otago. His topic was "You Are a Chemical Factory".

The Canterbury Junior Chemical Society's 1972 programme opened with a lecture from Professor James Collman of Stanford University, California, Erskine Visiting Fellow in the Chemistry Dept, University of Canterbury. He spoke on "An Interdisciplinary Approach to High Temperature Superconductivity". He outlined the theory of superconductivity and described the researches of an interdisciplinary group at Stanford attempting to produce synthetic materials which are superconducting at normal temperatures. He emphasised the staggering economic consequences of success in this field.

Dr W. S. Simpson returned to the Wool Research Organisation, Lincoln, in February after 18 months abroad, most of which was spent at the International Wool Secretariat's Technical Centre at Ilkley, Yorkshire. During his stay there he developed a process for incorporating polymers in wool to the level of industrial evaluation. In December, Dr A. S. McKinnon (also of W.R.O.) went to Ilkley to continue this work.

Mr J. S. Pollard has been appointed to the Council of the New Zealand Institution of Engineers for a two-year period. This is the first time that a member of the Institute of Chemistry has held such a post. Another "first" was his election as chairman of the Canterbury Branch of the N.Z.I.E. for 1971.

In 1960 he was chairman of the Canterbury branch of the Institute and for ten years after chaired the List of Members Committee. In 1969 he became convener of the committee that united New Zealand's chemical engineers as a Technical Group of the N.Z.I.E.

Mr Pollard has always considered one of the functions of a chemical engineer is to serve as a link between chemistry and engineering, and he continues his interest in the Institute as a member of the Membership Committee.

Professor B. H. Howard, Head of the Biochemistry Department at Lincoln College is spending 10 months study leave in the Microbiology Department of the Rowett Research Institute, Aberdeen, Scotland.

Mr D. C. Reanney (Biochemistry Dept) has recently completed his Ph.D. on soil virology.

Otago

Computing Facilities

Of interest to chemists is the new Burroughs B6700 Computer to be installed in the Computing Centre of the University of Otago in May, 1973, replacing the existing IBM 360/30.

The new machine will have the equivalent of 384,000 bytes of 1.5 micro second core and will run at least five times faster than the existing machine.

The B 6700 comes with a data-communications processer which will allow the use of remote terminals such as teletypewriters, card readers, line printers, etc. Initially, however, only one teletype terminal will be supplied.

Main languages available will be ALGOL 60, FORTRAN IV, ANSI COBOL and PL/I.

Chemistry Department, Otago University

Visitors to the Chemistry Department have included Professor J. P. Collman of Stanford University, California, who is at present the Erskine Fellow at the University of Canterbury. Professor Collman lectured on "The Iron-Tetracarbonyl Dianion—a new Grignard reaction".

Dr A. G. Williamson of the Chemical Engineering Department of Canterbury University also visited the Chemistry Department last month and gave a seminar entitled "The Principles of Congruence".

New University Staff

Dr B. R. Hajratwala has taken up a lectureship in pharmaceutics within the Department of Pharmacy. Dr Hajratwala comes from an industrial position in San Francisco.

Dr I. T. Forrester has taken up his appointment as lecturer in Biochemistry. Dr Forrester studied for his Ph.D. degree at Canterbury University, and comes to Otago from Monash University where he spent three years as a teaching fellow.

Overseas

Professor F. N. Fastier has left for Manilla where he will spend May and June working under the auspices of the World Health Organisation.

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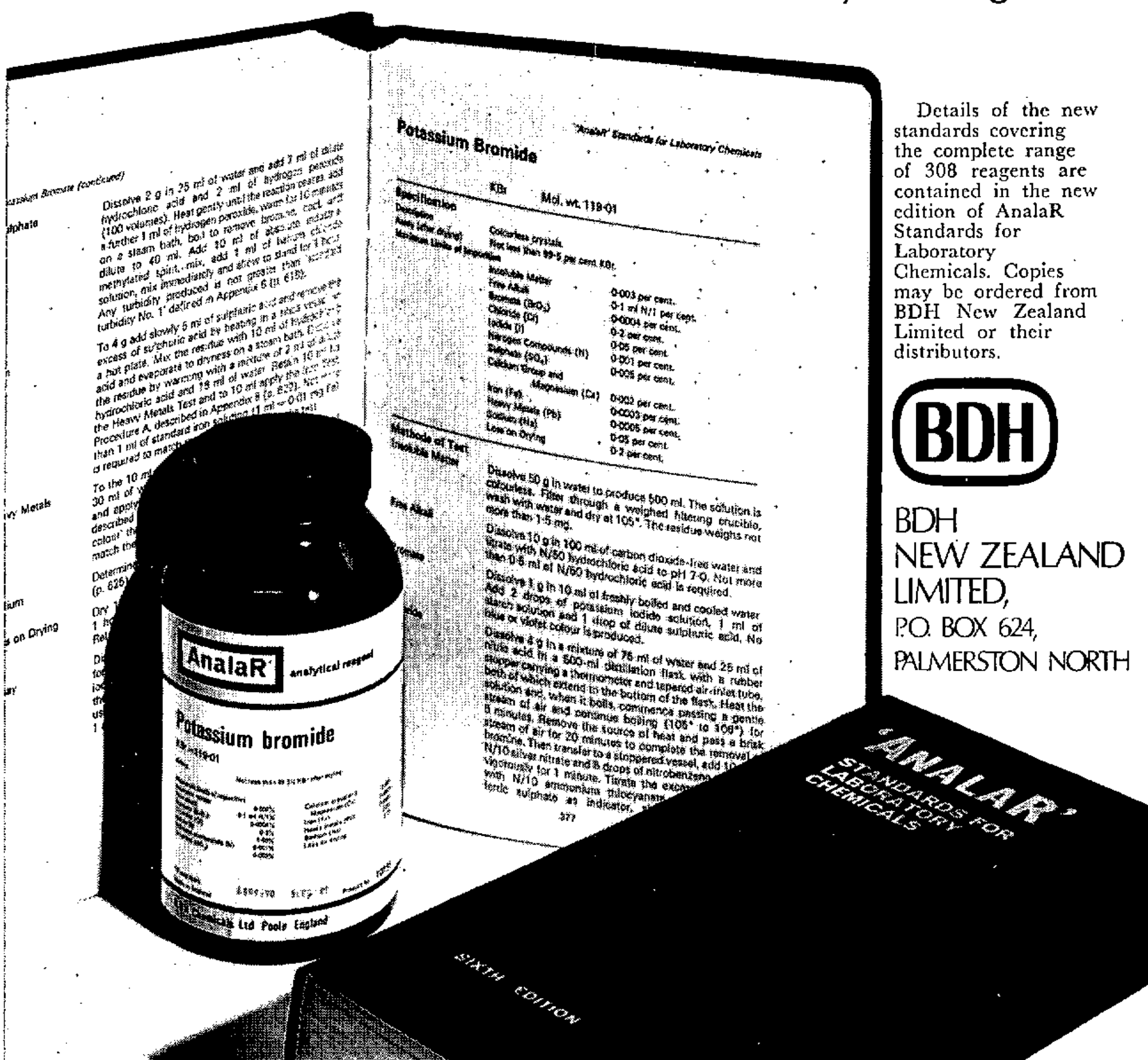

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