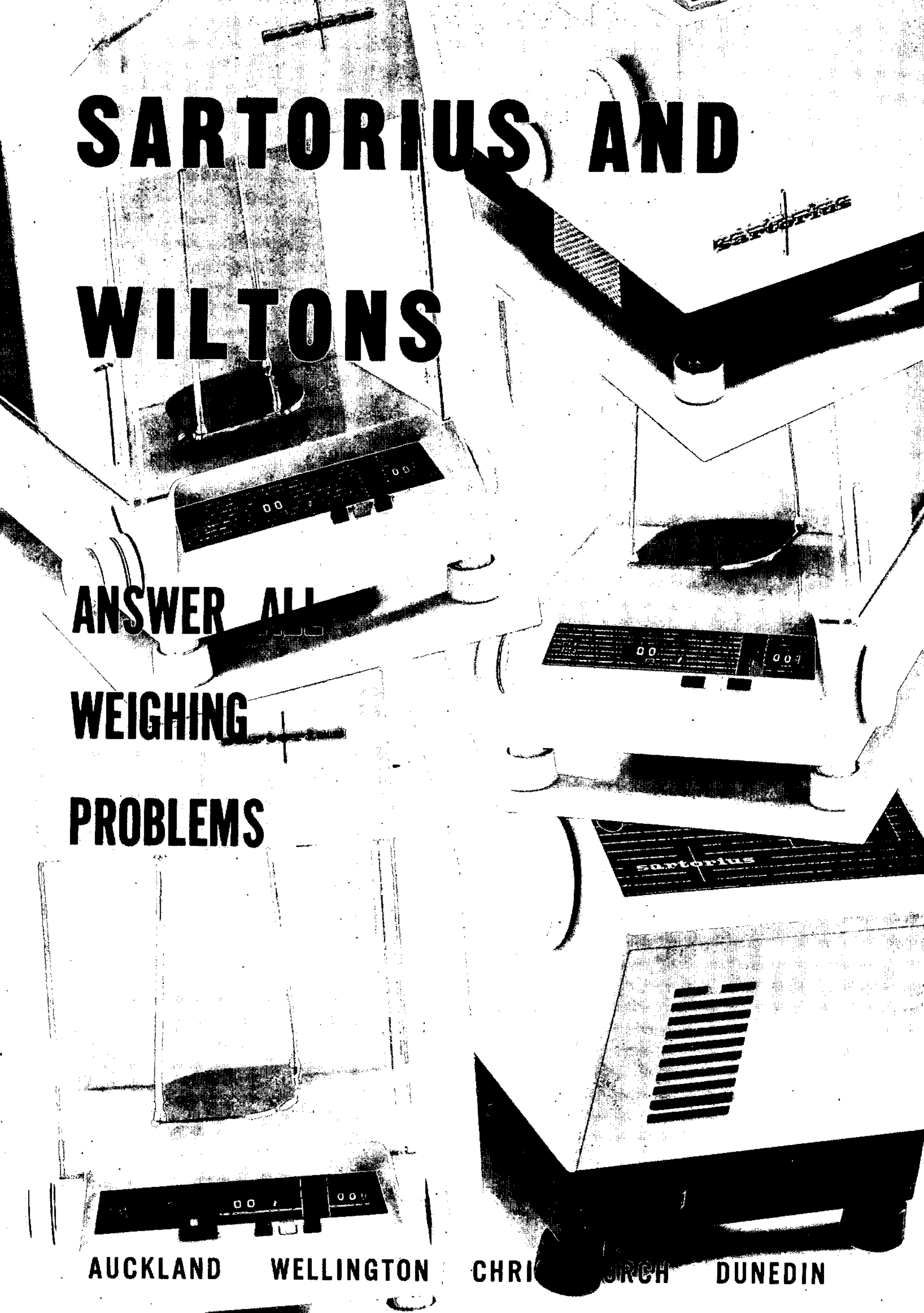
chemistry

in new zealand

december 1973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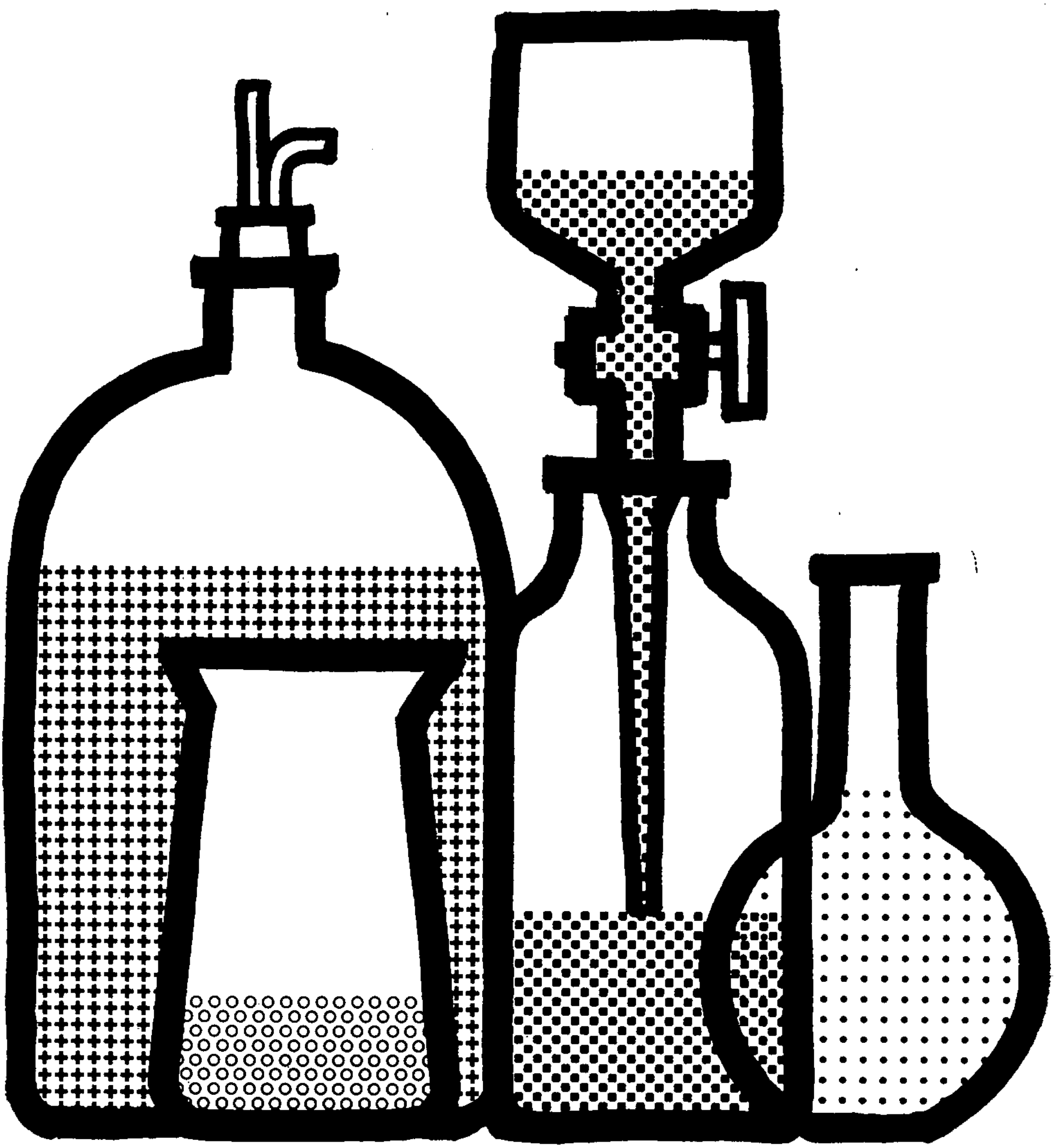
The new university library, University of the South Pacific.



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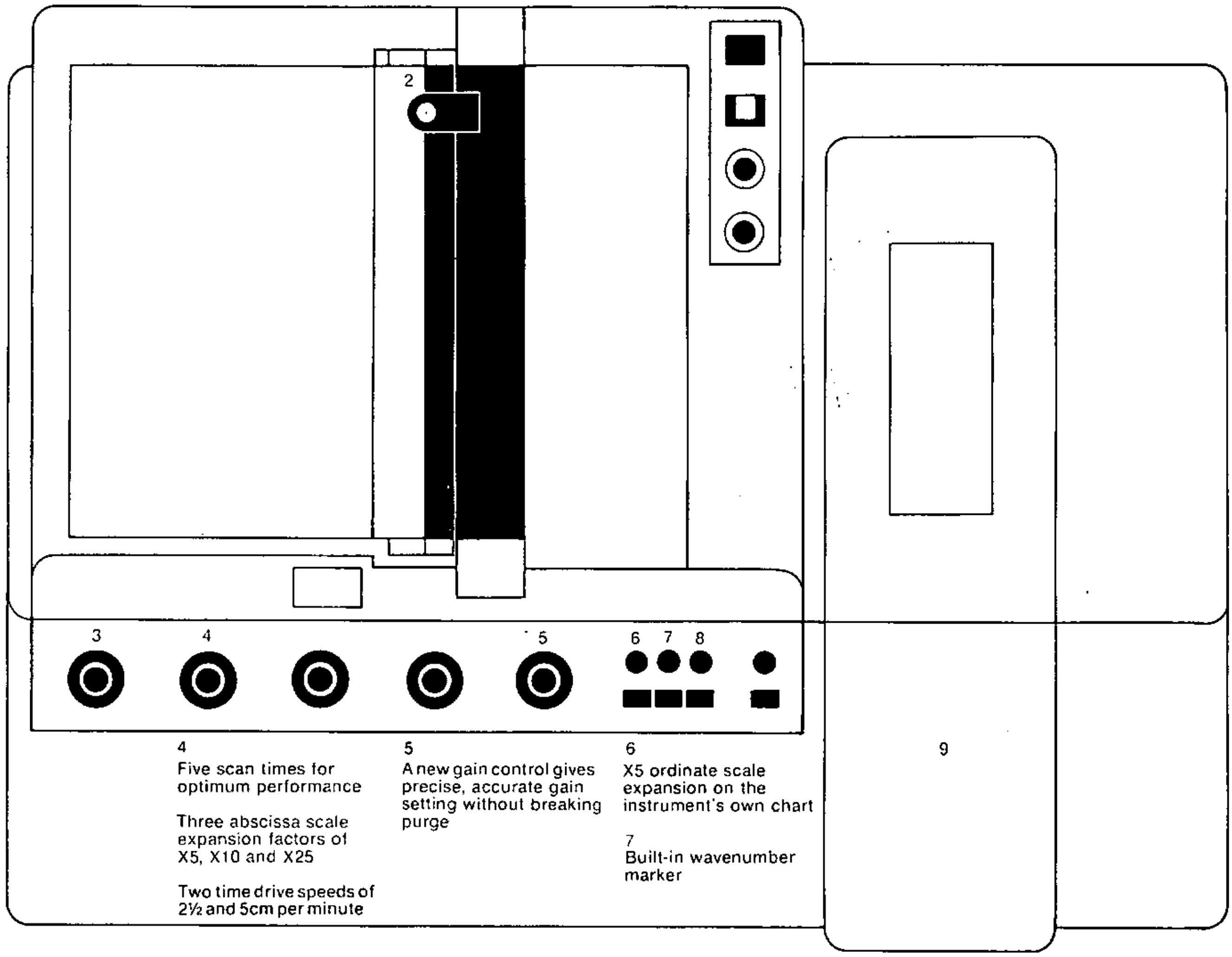

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The Packer Memorial Lecture

by J. Vaughan

After Professor Packer's death in February, 1971, Hugh Parton, Cuth Wilkins and I were asked by different journals to write obituaries. I have just re-read all three and from a distance of two years it seems to me that the note of personal loss is sounded with an unusual clarity in each of these pieces. But in my opinion, today is not the time for another obituary, and although memories and sentiment will certainly play their part in the early section of this address, I would not wilfully contribute any solemnity to the occasion—and I am quite certain that Packer, who was always a stickler for the proprieties, would have shared this view. It is partly for this reason that this talk will not be devoted to Packer's life and career; I will deal with neither aspect in any detail even though I appreciate that this decision brings with it a problem.

The problem arises partly because ours is a wide-ranging discipline, but mainly because of the unfortunate but inevitable effect of time. Some of you will have known Packer well and over a much longer period than I can claim. Others will have had only fleeting contact with him, and it is to be expected that, not only will many know Packer mainly by name, but a number of the younger members will be without even this acquaintance. Nevertheless I do not wish to repeat what I and others have said before, and, for a short while at least, I want to enjoy myself by drawing on a few personal memories of Jack Packer. It will be a distorted portrait, but it might convey to those who did not know him some of the characteristics which drew respect and affection from his colleagues; it is to be hoped, also, that the picture will not appear too grotesque to those who knew him well.

I should like to follow up these reminiscences with an attempt to outline some features of the academic chemistry scene of the nineteen-twenties, as it was when Packer began his university teaching career in 1923—exactly fifty years ago.

Script of an address given at the N.Z.I.C. Annual Conference, August, 1973.

Finally, it seemed appropriate to re-cross that 50-year gap and, for comparison, to comment on academic chemical activities of the present day.

I first met Packer under the clock in the old Christchurch Railway Station. It was about 8 a.m. on Tuesday 7th June, 1949. My wife and I had disembarked in Auckland, taken the Limited to Wellington, the overnight ferry to Lyttelton and the early morning connection to Christchurch where he and Mrs. Packer were waiting. The immediate impression was of a quiet courteous man with few words and an unusual concern that people, baggage and belongings were all accounted for and stowed away neatly in his well-kept green Vauxhall. I remember being shown over the Chemistry Department, being introduced to every member of the departmental staff and finally being asked whether I would be ready to give the first lecture of my Honours course at 9 o'clock on the following morning. The impression I gained of Packer on that day was confirmed as time passed—the picture of a serious man, conscious of his duty to staff, his discipline and his university.

When I met him, he had been at Canterbury for about 25 years, having come here as a 24-year old Australian in 1923 when he and Professor H. G. Denham were both new and constituted the entire academic staff of the Chemistry Department. In those early years of his service, prior to the Second World War, New Zealand university science departments must have ranked with the under-privileged and Packer, a versatile, all-round chemist with an old-fashioned belief in the virtue of hard work, would have been good value to both his professor and his university. This period must have been a frustrating one with staff tied to an agreed examination syllabus and to the inhibiting respectability of overseas examiners. These very features however, irritating though they were, would have facilitated internal communication, and university chemists must have appreciated this required contact, working as it did against the development of parochiality.

Research, too, would not have been easy at a time when communication was slow and both apparatus and study leave were hard to come by. But the invaluable New Zealand M.Sc. degree flourished; there were no prestige institutions to absorb outstanding students before graduation; and the impressive output of New Zealand Chemistry departments in the 1930s must have done much to lighten the equally impressive load carried by the three- and four-man departments of those years.

They say that Packer in his early forties was a very purposeful and slightly forbidding figure who liked efficiency in his own work and in that of his students, to whom he was essentially a conscientious, kindly but deliberate man with whom no liberties were to be taken. I do not know whether this is a true picture of him at that age, but at 55 he certainly showed these characteristics, and when he could occasionally be persuaded to patrol the organic undergraduate laboratory for an hour or so, the students learned at least two things. One was that the old man was far from being over the hill and the other was that, by comparison, Fred Fischer and I were rather easy-going demonstrators.

Jack Packer was methodical in many ways and he could often be understood by this mental tidiness which was so characteristic of him. It was perfectly natural for him in 1949 to refuse my invitation to check the lecture notes I proposed to use for my Honours course; he considered that at that level I could readily make adjustments as I discovered more about student background and reaction. However, in Stage I marking at the end of the year, he independently re-marked half my scripts; as he said, he had to safeguard the interests of his students! Having found our judgments to be closely similar, he never again queried any mark of mine but, had he found a discrepancy, I suspect he would have regularly checked on me until his retirement.

His respect for people and his patience with both colleagues and students were always impressive. There was the occasion when he received in his office a student who had been failed terms. This man, who was quite bright, had simply ignored his laboratory obligations in spite of warnings. Being rightly sure of his ability to pass the end-of-year written examinations, he could hardly believe that he was now not in a position to sit them. At the end of that interview the student asked Packer what could be done about the matter, and Packer replied that he did not think there was anything that could be done. There was then silence for a good five minutes, which, I can assure you, is an agonisingly long period to sit through, but I remember the student finally saying "I suppose that's it, then". To which Packer replied "I'm afraid so", and the student left. As Packer explained afterwards, he had made a decision and without reason he would not change it—but he was prepared to give the student every chance to find one.

This courteous consideration for people never left him, even in unexpected situations. A favourite story was given to me, hot off the press, by two research men who had been working quietly in one of the small basement rooms of the old department when they heard Packer showing a prospective member of the technical staff around the store and workshop area. Their attention was caught when the applicant began to tell J. P., slightly awkwardly, that he was a devout man and in fact considered it his duty always to obey God's orders, to which J. P. is said to have replied, equally awkwardly, that that was all right with him provided that in working hours his orders and God's coincided.

Jack Packer was, as I have often said in the past, a memorable head of department. He kept his finger, very gently of course, on everything that happened, but he did so discreetly and his unassuming manner often led outsiders to underestimate the firmness he could display. But the word "display", too, is not a word that should be used about Packer; he left that to the more extroverted members of his department. On the same theme, while he enjoyed preparing and giving his chemistry lectures, which were put together with painstaking care and remarkable thoroughness, he was never happy with lay audiences and was not seen at his best in public speaking.

To many of his colleagues he was characterised by gentleness and reserve and in conversation he was, as in other fields, conservative in the topics on which he would comment freely. But the humour, too, was there, and he had a pleasingly simple sense of fun which never ran to an appreciation of lengthy, sophisticated or malicious jokes. The first time I heard a really spontaneous burst of laughter from him was some months after I got here. He and I had a 2-berth cabin on the Lyttelton-Wellington ferry and, while getting into pyjamas, I tossed my underclothes into the projecting rack at the head of the upper berth by the door, a rack obviously (to my mind) intended for such purposes. It was after J.P. had had his laugh that I learned that this was the air-vent into the public corridor.

Jack Packer was for many years an administrator in great demand by local and national academic bodies. Perhaps because of this prominent service it is easy to forget the part he played earlier in the fights for independence of university colleges and for the recognition of research needs in the university departments. The changes wrought over the last 20 to 30 years are more readily seen when it is recalled that N. V. Sidgwick, during his 1938 New Zealand visit, made a public plea for New Zealand university teachers to be given a real chance, with proper support, to do research. We who now work in well-appointed post-war buildings and well-equipped research laboratories owe a great deal to Packer and men like him who fought, not for themselves, but quite consciously for a succeeding generation.

Their own achievements in research under difficult conditions should, however, receive due acknowledgement, and it is enlightening to read, for example, Packer's own work on tautomerism over a decade from the mid-twenties. On page 2823 of Chemical Abstracts for 1926, two papers are abstracted, one after the other. In the first, C. K. Ingold discusses the effect of substituents on the tautomeric system.

$$X{-}C{-}C{=}C \rightleftharpoons X{-}C{=}C{-}C$$

He virtually lays the foundation for our present understanding of substituent effects on the acidity of active methylene protons, such as those in malonic and aceto-acetic esters. In the course of the paper, he also gives strong experimental support to the electronic theory of aromatic substitution which, by that time, was beginning to resemble a working tool.

In the second paper John Packer and Jocelyn Thorpe, from Imperial College, discuss the effect of tautomeric equilibria in 3-carbon systems with an optically active centre. The paper has no experimental section, a privilege rare even in 1926, but it does set out the experimental consequences which they would expect in such a system as the *cis* and *trans* trimethylglutaconic acids

$$HO_2C - \underset{CH_3}{\underset{|}{C}} = \underset{CH_3}{\underset{|}{C}} - \underset{CH_3}{\underset{|}{CH}} - CO_2H$$

and in their paper the authors use 3-dimensional models with rare understanding and clarity.

The Packer-Thorpe paper was published at a time when electronic theory was beginning to be applied to systems other than aromatic, when pieces of the 30-year-old tautomerism puzzle were finally beginning to lock together, and when there was fairly rapid progress in the understanding of acid and base catalysis. For further progress in tautomeric equilibria, plenty of good experimental data were required and Packer went on to use the new ideas of acid and base catalysis to provide such data. In a 1931 paper, he and Terence McCombs, now our High Commissioner in London, reported racemisation rates of dimethylglutaconic esters with a clear appreciation of the errors in the method and the reliability of the results. Two years later he published one of the earliest thorough studies of the effect of acidity on tautomeric mobility and, following this, came a paper covering an examination of the same system under basic conditions.

What stands out from a reading of this series of papers is that Packer was in touch with, and could exploit, the latest ideas and developments in electronic theory, tautomerism, catalysis and optical activity. Those of us who worked with him in subsequent years were aware that this ability, to sift important ideas from an expanding literature and to incorporate them in his own understanding and presentation of organic chemistry, never left him.

Packer was remarkably fortunate in at least one respect. He moved into academic chemistry and into organic chemistry in a spectacular decade and was in fact present at the notable British Association meeting of 1926 which saw what would now be called a confrontation between Ingold and Robert Robinson over the authorship of ideas. The impact on Packer of his year at Imperial College was unquestionable and for any prospective physical-organic chemist the only country to be in during the 1920s was Britain. There was so much happening, and even in 1923 Robinson had remarked on "a transition state of knowledge fully comparable with that which obtained in the 1840s and 1850s". In organic theory, there was an acceptance that reactions were electrical and electronic in nature and the early 1920s saw a preoccupation with the manner in which charge is transferred between atoms.

Indeed, so much work was going on that an attempt to pick out single threads from the pattern of development would do injustice to many chemists, but two approaches require comment. First, G. N. Lewis, who did much to help chemical understanding of the energetics of reaction, recognised in 1923 unequal bond-electron distribution between unlike atoms and offered organic chemists, in clear terms, the idea of what has since been known as the inductive effect. Using it, Lewis could explain why chloroacetic acid was stronger than acetic and why alpha-chloro-acids should be stronger than beta-chloro-acids.

At around the same time, Lapworth, whose earlier work stands as an impressive backdrop to all later physical-organic work, envisaged bond polarity induced during reaction, and polarity extending through a chain of alternating single and double bonds. Lowry also, in 1923, put forward the concept of temporary polarisation in such systems and these ideas helped to shape the concept of what was to be variously known as the mesomeric, resonance, or conjugative effect. Inductive and conjugative effects were both used in 1924 by Howard Lucas well away from the main action, to account for relative reactivities of alkenes, but the triumph of a final synthesis of these qualitative ideas belonged to Robinson and to Ingold who could each exploit the fertile field of aromatic substitution to illustrate the power of the new theories of organic reactivity.

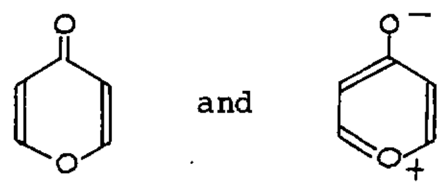
These developments, on their own, were enough to mark a spectacular decade, even though chemists had to wait until the early 1930s to feel the major effects of the quantum theory. Influence, however, is rarely a one-way process; Hinshelwood made a bootstrap announcement in 1932 that organic chemistry had "solved its problems by the aid of its own conceptions" and he went on to point out that the success of organic chemists had already "stimulated theoretical physicists to attempt the translation of these conceptions into the language of quantum physics". But so much else had been happening in chemistry that I can only pick out some features of personal interest and some probably of interest to Packer himself. Organic stereochemistry was a flourishing business and the glamour spot probably belonged to the discovery by Kenner in 1922 of optical activity in the biphenyl series and the final explanation of it by the inimitable W. H. Mills four years later. The Thorpe-Ingold tautomeric studies of the early twenties were of impressively wide interest. Lowry's related interpretation of the behaviour of sugars during mutarotation may be linked to the beautiful work of Haworth on sugar lactones, which in turn gave rise to the satisfying re-ordering of sugar chemistry—a subject which, incidentally, seems to have overshadowed other developments in natural products chemistry in the 1920s.

Of the methods and the techniques backing organic chemistry, it goes almost without saying that chemical analysis at that time was a very large branch of the subject and was described in 1924 as the means by which the ends of other branches were attained. There were few of the modern physical techniques, although the position was changing. Greater use was being made of optical properties, radiochemistry and spectroscopy, although infrared spectroscopy and mass spectrometry were still in the hands of physicists. One should perhaps recall, for the sake of my own generation, that the parachor was developed in the 1920s—where perhaps it should have remained. But there were two landmarks in what was to become a definitive technique of chemistry—X-ray crystallography. In 1923 (a good year, you will notice) Dickinson and Raymond reported the first organic crystal structure to be completely and accurately determined. It was that of the highly symmetrical hexamethylenetetramine, but a much more important structure determination was that of hexamethylbenzene—reported by Kathleen Lonsdale in 1928, and by all succeeding generations of reviewers and textbook writers.

Of other chemical fields, thermodynamics took a secure position in chemical teaching as Lewis and Randall's book came off the press into the academic bookshelves in 1923, a year which also unveiled the Debye-Hückel theory. Thermodynamics also recorded major achievements in the mid-twenties through the work of five men: the statistics of Bose and Einstein and the later work of Fermi and Dirac, with these two developments being linked by the Pauli principle of 1926. If, to these five men, I throw in another three—De Broglie, Heisenberg and Schrödinger—for their contemporary work in wave mechanics, I offer you an awe-inspiring forward pack whose playing methods, I regret to say, are almost a complete mystery to me.

For inorganic chemistry the 1920s, and particularly the early twenties, would be regarded by many as a quiet period. There was good preparative work by Stock on boron hydrides and by Gilbert Morgan, who was opening up the field of chelate complexes. Crystal structures of simple inorganic compounds and minerals were regularly being determined. Hein in Germany discovered the chromium-phenyl compounds which turned out, thirty years later, to be the first representatives of the π-bond aromatic complexes, but the big continuous influence of the twenties was that of Sidgwick, whose telling contribution was the ordering of inorganic chemistry within the new framework provided by the electronic theory. It has been pointed out to me, however, that in an almost paradoxical way the greater order that Langmuir and Sidgwick brought to inorganic chemistry almost impeded the interpretation of the non-classical compounds of men like Hein and Stock. It was molecular orbital theory, the origins of which also date back to the 1920s, which was to provide an understanding of these structures.

In looking over the literature of 1923 and thereabouts one can strike some unusual features. Just one example may be seen in a paper from the German chemist, Arndt, who had been examining anomalous properties of gamma-pyrones. He realised that the two classical formulae



were both required and he suggested what was effectively a resonance hybrid, pointing out that an intermediate state required merely a re-distribution of electrons. It turned out later that he wanted at this time to take up the wide implication of this idea but, at a time of furious organic publication, editors of German journals disapproved of theoretical contributions and refused to allow Arndt's submitted discussion on resonance.

Most fascinating of all was a frail connection, hitherto unknown to me, between New Zealand and a colourful moment of that decade. On January 20th 1923, a letter appeared in "Nature" entitled "On the missing element of atomic number 72". Coster and Hevesy, using X-ray emission spectroscopy—in our days highly instrumented for industrial analysis—had obtained evidence of the wide-spread occurrence of the element they called hafnium in zirconium minerals. Within a month, a short paper appeared in the J. Chem. Soc. by Mr. Alexander Scott, writing from Upper Hamilton Terrace, London. Scott reported that he had built up, over the years from 1913, a stock of about a gram of an insoluble oxide residue left after treatment of titaniferous iron sand from Maketu, Bay of Plenty. The properties of this oxide and its somewhat impure double flouride were those related to an element of the titanium-zirconium group and could only be element 72. Scott offered to send a sample to Coster and Hevesy, saying that he "awaited their report with breathless interest". There appears, however, to be no further literature comment on the matter. Neither was the new element named in accordance with the wishes of Alexander Scott who suggested Oceanium, a name which would recall, as he said, that the element is to be found "on the seashore of New Zealand, one of the components of Oceania."

Now, if John Packer were entering academic life in 1973, rather than 1923, how would the chemical scene differ? Above all, surely in sheer instrumentation and techniques. We were recently presented with an album of photographs of our old chemistry department taken prior to 1920. The laboratories and ancillary apparatus, apart from the gas mantles, looked very like those of my student days and not too different from the Canterbury laboratories of 1950. But all chemistry departments of New Zealand universities are now housed in laboratories built in the last twenty years and it is a fair bet that, with all but one of them, the planning for instrumental facilities has been inadequate.

Among the new tools, computer facilities are as impressive in their influence on techniques and even the direction of research as they are in total cost. While the computer is still only on the fringe of serious use, one can pick up well-ordered applications in two or three directions. On the one hand, it allows the handling of large amounts of information, the retrieval of this information, and the control of experiments linked to on-line analysis of complex data, as in X-ray structure determination and in autoanalysers. It can also cope with enormous numbers of calculations, and this capability allows us, for example, to reduce the simplifying assumptions which previously had to be made if we wanted topological information on molecules of practical size.

I guess that for simple organic chemists, however, what would have caught our eye a year or two ago was E. J. Corey's work on computer-assisted synthesis. In this development the chemist plays with a display screen and a computer which is packed with information on synthetic methods. When the operator puts up on the screen a picture of the structure he wishes to synthesise, the computer begins to offer immediate precursors to the compound. The chemist selects favoured possibilities and the computer draws on its stored information to offer possibilities for earlier links in the chain of synthesis. As Corey and others have clearly indicated, this device is something of a spectacular *aide memoire* and helps a chemist better to cope with the surfeit of reaction information which his own memory cannot usually handle. And we need some encouragement, I suppose, in the face of Leon Phillips's frightening estimate of three-quarters of a ton as the weight of Chemical Abstracts for the year 2000, or after reading J. D. Roberts's comment that the 1962-66 Chemical Abstracts index contains nearly a million entries.

But the young Ph.D. in organic chemistry, if he is fortunate enough to have at his disposal the range of equipment which, in New Zealand, I'm afraid, is associated mainly with Government, semi-government and university laboratories, will take all this in his stride. After all he has so much going for him. For instance, in a single generation, progress in techniques and instrumentation has given him a whole new approach to an unidentified compound—which, of course, he'll have isolated painlessly and probably with the use of one of a roomful of chromatographic variations.

He can then resort to a large number of instruments coming under the spectroscopic umbrella. If he's lucky right along the line, U.V. spectroscopy will say something about centres of unsaturation; infrared will give him information about functional groups; the mass spectrometer will yield the molecular weight and will place some of his functional groups for him, and nuclear magnetic resonance will take a roll call of hydrogen atoms and distinguish between their different environments. NMR spectroscopy has been with chemists for about twenty years and this technique is now just as indispensable to the organic (or inorganic) man as a car is to a commercial traveller, especially in its GT form, which allows him to both simplify and improve his spectra with lanthanide-chelate additives and to detect radicals through a sweetlv simple but clumsily named modification.

I have never ceased to be impressed by this technique, which allows us to examine, and classify, individual hydrogen atoms according to their chemical environment in a molecule. After that, I can accept its extension to phosphorus and fluorine, but the feeling comes back again with the rapid development of carbon-NMR, which helps the organic chemist to realise a dream and to look at his essential carbon atoms as he already looks at hydrogens. As a sensitive probe "for detecting structural and electronic perturbations around a carbon atom", ^{13}C chemical shifts, also, make an impact not only on analysis, but on organic theory. An appropriate example comes from work, reported earlier this year, in which ^{13}C-NMR was used to distinguish between two possible ways in which the old sigma-inductive effect is transmitted down a carbon chain. At present, carbon-NMR may be at the stage reached by hydrogen-NMR fifteen years ago but, in the opinion of many, it is going to prove to be at least as valuable.

Other spectroscopic or structure-determining techniques come readily to mind but laser incorporation perhaps calls for specific comment. It may well be that the laser is more spectacular than useful at present, but laser-Raman spectroscopy is an important development, and I understand that the ability to excite individual atomic and electronic energy levels with a tunable laser promises to revolutionise photochemistry.

I am conscious, incidentally, that some of the wide range of modern instrumentation is out of the reach of many chemists, and that contact with new, developing, and often expensive techniques is a privilege. But such contact and the exploitation of these techniques are also a necessity and the consequential move from special to general use is a continuous one. After all, application of infrared and atomic absorption techniques is widespread and even expensive installations sometimes must be viewed in perspective. For example, spark emission spectroscopy with computerised monitoring can run to $100,000. But in a large metallurgical plant, such as N.Z. Aluminium Smelters which might have a total capital investment of over $100 million, this analytical facility is a proportionately small investment, and it pays off—in fact it is essential to the running of such a plant.

If we examine present-day chemistry for new, basic theories and new concepts, we do not sense the ferment and fundamental controversy of the 1920s. It is hard to think of anything more recent and with greater impact than conformational analysis, and modern molecular-orbital and ligand-field theory are of about the same vintage. The Woodward-Hoffmann rules are more recent and they continue to bring a satisfying order to all concerted reactions. They were certainly brilliant in concept, not the least in their original simplicity, and this very simplicity added to the tremendous stimulus they have given to organic chemistry. But perhaps the jigsaw puzzle to which the Woodward-Hoffman principle gave the key is now revealing a picture which quite soon will become an integral, but relatively minor part of the chemical scene, without in any way transforming it.

Among the characteristic features of current chemistry we should not, I suppose, include the blatant search for novelty which is too widespread to be regarded as a characteristic of any specific present-day activity. But we should note the almost incredible efficiency in some directions. The synthetic chemist—if I can call him that—has a remarkable record of elegant and precise achievements; though modern X-ray diffraction equipment, complete structure determinations may now be a matter of days; quite unlikely organic reactions can be induced and kinetically followed on just a few thousand molecules which live for less than a millionth of a second; and the physical chemist can study molecular processes which last for 10^{-12} second—a picosecond, I should now say.

The crossing of branches is today quite noticeable, and is a healthy sign to the future. Metal-organic chemistry (and, in particular, transition metal catalysis) attracts a lot of attention, and model studies aimed at nitrogen-fixation and oxygen-transportation just help to reinforce the many indications of current development at the traditional edges of our discipline. Chemistry in 1973 sees unmatched and growing activity by unprecedented numbers of chemists. It is a gigantic repository of knowledge, techniques and enthusiasm and, unless there is a discipline-wide revolution which would restore introspection, the exploitation of what we have might best occur across inter-disciplinary boundaries—in harness with the mathematician and the biologist, the engineer and the psychologist. Perhaps we might say that we are too good at our game to be wasted by ourselves, our colleagues, or our community—and as we see more inter-disciplinary teams, and more individuals like R. L. Wain, the more profit there will be for all.

One other point comes to the mind of an academic. I believe that the New Zealand chemistry graduate is a good, well-prepared product. But as our discipline becomes more intricate and sophisticated, the greater becomes the obligation on teachers to resist the temptation to mould in their image. The virtue of the paradigm is a fragile peg to carry an enthusiastic plugging of our specialty to students who, in overwhelming numbers, will practise their chemistry outside our walls. Somehow, we have to keep wrestling with a problem well known to us but now more acute than ever before—that of teaching esential chemistry while meeting the need of most of our students for versatility and for some contact with the real world before they get hit by it.

Chemistry for the South Pacific

by Roger M. Smith M.Sc., Ph.D.

"Responsive to the well being and needs of the communities of the South Pacific . . ."

Thus reads the Royal Charter incorporating the University of the South Pacific founded to satisfy the educational needs of the peoples of the islands —unique in that the University serves not just one country but ten nations of widely different sizes and political structures. These are the newly independent Dominion of Fiji, the British Solomon Islands Protectorate, the Gilbert and Ellice Island Colony, the Kingdom of Tonga, the Republic of Nauru, the Cook Islands, Western Samoa, the New Hebrides Condominium, Niue and the Tokelau Islands, encompassing a total population of the University region of nearly 1 million spread over many thousands of square miles.

Foundation

The first step in the foundation of the University occurred when the New Zealand Government decided to withdraw from the RNZAF Flying Boat Base at Laucala Bay on the outskirts of Suva, the capital of Fiji. In May 1966 a committee under the chairmanship of Lord Morris recommended that the facilities be used to establish a fully autonomous University to serve the needs of the English speaking territories of the South Pacific. A subsequent report by Sir Norman Alexander provided detailed proposals for the setting up of the University.

The first students were enrolled on 5 February 1968 in pre-degree courses and on 5 March 1970, Her Majesty the Queen visited the University and presented a Royal Charter, formally inaugurating the University. The first Chancellor, His Majesty King Taufa'ahau IV G.C.V.O.,, K.C.M.G., B.A., L.L.B. of Tonga presented the first graduates with their degrees and certificates on 2 December 1971 at a ceremony in the former main hangar.

School of Natural Resources, University of the South Pacific, P.O. Box 1168, Suva, Fiji.

Academic Structure

The report of Sir Norman Alexander contained three important proposals, emphasising the need for the University to have a regional character, to create a relationship with existing tertiary institutions in the South Pacific, and the need for pre-degree or perliminary studies as well as degree studies. He also recommended the formation of Schools of Study as the academic structure best fitted to the needs of the South Pacific. Those chosen were the School of Education, the School of Social and Economic Development and the School of Natural Resources.

The School of Education comprises the disciplines of education, English and mathematics and its primary function is to prepare teachers for the South Pacific. It does this principally by means of Diplomas in Education and by the Graduate Certificate of Education which is taken in conjunction with degree studies in all three schools. In addition, in-service courses and educational workshops aid those teachers already in the schools.

To further its work an associated body, the Curriculum Development Unit (supported by the UNDP and UNESCO), has been set up, which is devoted to the important role of making the teaching methods, curriculum and examination systems relevant to the needs, experiences and environments of the pupils of the region, thus freeing them from the present often inappropriate and frequently irrelevant systems inherited from more technologically developed countries in temperate regions.

The School of Social and Economic Development includes the disciplines of economics, history (including Pacific history), social studies, politics and public administration and geography; its graduates are trained to have an understanding of the various social sciences and their relevance to the social and economic development of the region. The graduates are expected to be employed as teachers and in administration and managerial positions in government, commerce and industry or other positions requiring a general liberal education.

The School of Natural Resources provides studies in chemistry, biology and physics in order to provide the scientifically trained manpower needed in the region. A large proportion of the graduates will be required for school teaching but many others will go into areas such as agricultures, fisheries, mineral resources and industry. They will be filling positions from which they will play an important role in the planned usage of the natural resources of the region, and will carry out the vital fundamental and applied research that will lead to further economic expansion. The courses have an important ecological bias so that the graduates will be aware of the dangers inherent in the introduction of technological processes and in the exploitation of natural systems.

A fourth unit within the University is that of Extension Services whose primary responsibility is for correspondence courses taught in an increasing number of subjects to students throughout the region. To aid this work University centres have been established in Tonga, the British Solomon Islands Protectorate and the Gilbert and Ellice Islands Colony, which act as links between the University and the external student. The centres are linked by satellite communication to the University using the Peacesat system in a unique educational experiment, which also enables direct contact to be made with Hawaii, the Papua New Guinea Institute of Technology, and Wellington Polytechnic. Both the Centres and the Extension Service in Suva also spread the influence of the University by a number of non-credit courses and by public lectures on such diverse topics as Watergate and the Pill.

Course Structure

Courses at the University are at three levels, Preliminary, Diploma and Degree. This wide range is needed to adequately serve the region because of varying education levels in the different territories. Most students enter the University at the Preliminary and Diploma in Education level with the equivalent of New Zealand University Entrance qualifications; a few students enter with School Certificate and these begin at the Preliminary I level, which also includes students being trained for admission to the Fiji School of Agriculture.

The Diploma in Education is a three year course aimed at providing teachers for junior levels in secondary schools and is offered in Arts, Commercial Studies, Science, Home Economics and Industrial Art.

The Preliminary II programme is the normal prerequisite for degree studies but also provides the training that students require for entry to the Fiji School of Medicine, or to overseas universities where students would take degree courses unavailable at USP, such as law or engineering.

The normal three year programme leads either to a B.A. or B.Sc. degree, or it can be incorporated into a four year course with studies in education to give a Bachelors degree with a concurrent Graduate Certificate in Education, in either Arts or Science.

The degree courses are taught on a semester basis, the student normally taking 3 courses at one time (4 in their first year) in a two semester year. The grading of each course is based on continuous assessment and on a terminal examination. The system is designed to avoid the "Final" examination system used in many English-type universities, where all 3 years work are assessed simultaneously at the end of the course.

The major problem of the "Finals" system is that it requires the students to try to memorise all their facts at one time and this cramming can often result in short term retention rather than understanding. In a continuous assessment system the student's understanding can be continually checked, and coupled with a tutorial system, as at USP, ensures that the student cannot fall behind the course unnoticed. This can be particularly important at USP as almost all our students are first generation university students, and they and their families often lack an understanding of university work requirements and study habits.

The semester course system at USP cannot offer the full flexibility available in larger universities, but means that students failing part of a year have to repeat only that course and not the complete year's work. Often while repeating a course in one discipline they can continue to higher level courses in other disciplines. A system of prerequisites ensures that students have sufficient background to handle the more advanced courses.

At present because of the limited facilities there are very few post-graduate students. Although there is a commitment to provide advanced training, its high cost in time and facilities means that there will be little increase in the future.

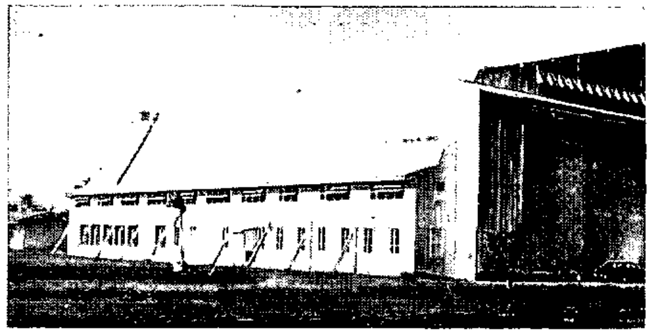
In 1973 there were about 800 students enrolled at the university, of whom about 500 were in pre-degree studies. This year about 60 students should graduate with Bachelors degrees at the university's third degree-conferring ceremony.

All the countries of the region are represented among the student body, Fiji as the largest country being the predominant group.

Buildings

The university inherited over two hundred buildings from the RNZAF, spread over a 194 acre site. Almost all, from the largest to the smallest, have been used at some time by the university, and as well as providing teaching areas they have also enabled the housing of 300 students and 45 staff members. Generous aid from the New Zealand

The general chemistry laboratory.



The chemistry offices in the main hangar on the lower base.

Government has provided further housing for students, and a large grant from Britain has been used to start to provide permanent facilities. Although the original buildings enabled the initial setting up of the university to be very rapid, they are widely dispersed and often not really suitable for teaching use; they will eventually require replacement by more integrated facilities.

The first permanent buildings to be completed included a student dormitory, the School of Ednucation, and Phase I of the library, which provides facilities for 70,000 volumes and 200 readers, and enabled them to move out of the formers officers' mess. Planning is in progress to provide a permanent building on the main campus for the School of Natural Resources. However this cannot be started until further capital aid is available. At present the School of Natural Resources is on the lower base or former operational area and ¾ of a mile from the main campus. Its most outstanding feature is the flying boat hangar which was for many years the largest structure in the South Pacific. The hangar is used for office space and is shared with the Fiji Government, who currently use the floor space for vehicle testing and the storage of hurricane relief supplies.

The surrounding buildings have been converted into lecture rooms, offices, and laboratories for physics, chemistry and biology. The old flight operations room has become a chemistry store and preparations room, and the armoury (after a period as an instrument laboratory) is now a dark room. At present there are three chemistry laboratories, one used by preliminary studies and the others by both degree studies and for limited faculty research.

The Philosophy of the School of Natural Resources

The aim of the courses in the School of Natural Resources is to give the student a broadly based and integrated approach to natural systems, and to produce a graduate who is aware of the potential for science in the Pacific. It is also aimed not so much at teaching the student a compendium of facts, but to enable the student to view problems from a logical and scientific aspect. In particular, because of the relatively small numbers in the school no attempt is made to give specialised training in a particular discipline or area. That approach would in any case be undesirable for the potential teachers who will usually be expected to be proficient in more than one subject. It is intended that those graduates who will require more specialised training to an Honours or postgraduate level will go overseas, basing any further studies on their broad inter-disciplinary background from USP.

This attempt to prevent the blinkering of students which can occur with single subject degrees is because of the need for graduates in the South Pacific to be able to relate their work to their environment and to other natural sciences. Generally the graduates of USP will find they are much more on their own, with heavy decision-making responsibilities (often unaided by fellow scientists), than would be a comparable recent graduate in a more developed country. The latter would usually be a member of a team of people of diverse viewpoints who could jointly examine each feature of a possible project from a range of disciplines.

Consequently, there is an emphasis on environmental studies, ecology, natural products and analytical chemistry, with examples (such as the effects of agricultural chemicals and of pollution) being drawn from the interaction of chemical, technical and biological systems.

The degree chemistry course is an integrated laboratory/lecture programme covering, in the first year, physical chemistry (including thermodynamics) bonding and kinetics, and the organic chemistry of functional groups. The emphasis is on general principles and an understanding of the basis of each topic.

In the following year the organic chemistry topics include aromatic and heterocyclic systems and biochemistry, and the physical chemistry course considers inorganic compounds, colloids, membranes and analytical methods.

In these two years the student also takes courses in physics, biology and mathematics to form a basic science platform.

Final year B.Sc. students can take a choice of subjects from chemistry and biology so that they can develop a bias towards one discipline or another and can develop their interests more deeply in a particular area. Potential teachers continue to take topics in both disciplines, but can use these courses to study particular areas of a subject in greater depth than they might need in their teaching. This enables them to see the uses to which the basic principles can be put and to learn more of the reality of the science as opposed to the theory. The chemistry options include analytical chemistry, natural products and biosynthesis, reaction mechanisms of organic and inorganic systems, and synthetic organic chemistry. In many cases the courses include short projects to introduce the student to the investigational aspects of chemistry and to promote independence. Throughout the courses examples in lectures and laboratories are taken from the region, and attempts are constantly made to relate the subject to the South Pacific.

Any suggestion that many scientifically important topics should be omitted as they currently have no use in the South Pacific, such as n.m.r. spectroscopy or radiochemistry, is refuted, because an important role of the courses is to show the student the potential methods available and to enable him to be an innovator of new techniques within the region.

Teaching Chemistry

There is a wide range of staff at USP, to provide the teaching at the different levels. The predegree courses are generally taught by regional staff or by school teachers recruited from New Zealand under the Scheme of Co-operation. Degree faculty are more widely based and come from the university region, Australia, New Zealand, Britain and other countries. At both levels considerable aid is given by Peace Corp Volunteers from the U.S.A. as lecturers and demonstrators. In addition personnel have come from Canada and Denmark under aid programmes and have added to the broad international outlook of the faculty.

At all levels attempts are made to attract suitably qualified regional staff whose insight into the student's viewpoint is especially valuable, as well as their familiarity with the particular needs of the region. The present chemistry degree faculty of five comprises two lecturers whose interests are in physical chemistry, one in inorganic and environmntal chemistry and three in organic chemistry including natural products and physical organic chemistry.

Physically, the temporary buildings cause considerable problems in the teaching of chemistry. The tropical climate of Fiji, with a rainfall of 100 inches and a humidity frequently between 95-100 percent coupled with high temperatures of 28-33°, means that care must always be taken in designing experiments to eliminate problems due to moisture. In many cases the evaporation of an organic solvent from a beaker causes condensation to form. Because of this, few "dry" experiments such as Grignard reactions or reactions with alkali metals have been carried out, partly because of the probability of failure, but also because of the safety risk. The high temperatures by themselves do not cause much interference and on the rare dry days there are few problems.

A further difficulty is the detrimental effect of these conditions on metal surfaces and electronics. At present, limited areas are air-conditioned but not de-humidified. However, the present piecemeal system is expensive to operate, and the proximity of the sea causes severe erosion of the air-conditioning units by salt spray with consequent costly maintenance and replacement. Hopefully many of these problems will be eliminated when the permanent building is completed. Specific examples of the problems faced include mould growing on analytical balances, the rapid deterioration of photocells, and the need to frequently replace windows and cells on the infrared instrument.

In all areas the need for ventilation in the sultry summer, coupled with sudden thunderstorms and squalls, have resulted in spray being suddenly blown into laboratories through open louvres or doors. These sudden changes also often catch staff and students at some distance from shelter or the next lecture room because of the wide dispersal of the buildings.

Chemistry in the Region

Most people's image of the South Pacific is of palm trees, white beaches and grass huts, but this would be very misleading. Technology is apparent throughout the South Pacific and on it rests the future development of the territories of the region. Today's modern world even at village level is frequently based on technology. Chemistry plays its part in many areas and the need for more knowledge is ever present. Obvious examples are the two main Fijian export industries, sugar and gold. The latter has recently been expanded to include tellurium. Other examples are the bauxite deposits in Fiji, phosphate in Nauru and copra and cocnut oil throughout the Pacific. At present many of these industries have to either employ expatriate technologists or to bring in consultants from overseas.

Less immediately obvious examples of introduced technology, includes pesticides, herbicides, fertilisers, plastic foam and bottle making, brewing, paint mixing, fruit processing and canning, as well as the Government services of hospitals, geology and mineral resources, the Government chemist, agriculture, fisheries, civil aviation, and telecommunications, including radio services and electricity production and distribution. In all these cases the workers need some degree of technical or scientific expertise, frequently chemistry based, not just at managerial level but also on the shop floor. This is why the university has such an emphasis on teacher production at all levels, so that these graduates can introduce an awareness of science from an elementary school level. Eventually this approach will result in more capable university entrants and thus better graduates. The alternative tertiary training at technical schools and agriculture colleges will also be improved, and in all cases the locally trained personnel will be more capable of accepting further overseas specialist training.

Finally, but not least, the introduction of scientifically trained people into administration, government, and politics will produce an understanding of the importance of technology and its implication in areas such as welfare, social services, economics and planning.

In all these areas the school's inter-disciplinary approach is important, because frequently the problems are not of pure science but of involved interaction of the new technology with the original environment.

Research and Consultancy

One important clause in the Charter refers to the role of the university in the dissemination and advancement of knowledge by research and consultancy and it is in this way that the university can make an immediate direct impact on the communities.

In many cases faculty at USP have assisted local hospitals, industrial companies and government departments by giving advice or by carrying out analysis of such compounds as pesticides, essential oils, or urine. In a number of cases collaborative projects have been undertaken, including an investigation into the operation of a sewage works.

Generally the philosophy of the School of Natural Resources is to concentrate on the more basic aspects of problems in the region, and to leave the applied areas to commercial concerns and government. In this way it is hoped that important background information can be obtained which can be used locally and which problem-oriented establishments would not have the time, facilities or expertise to investigate. In all cases the research problems chosen have been derived from the region and its natural resources.

The South Pacific is a paradise for natural products chemists, many plants are indigenous and have never before been studied. In many cases they are used in folk medicine, and a major research programme involving biologists, chemists and microbiologists is under way to collect folklore, carry out bio-assays and to isolate the active constituents. Over 200 plants have been examined in a primary screen and the more promising are being studied in greater detail. This is an obvious example of the advantage of an integrated interdisciplinary approach.

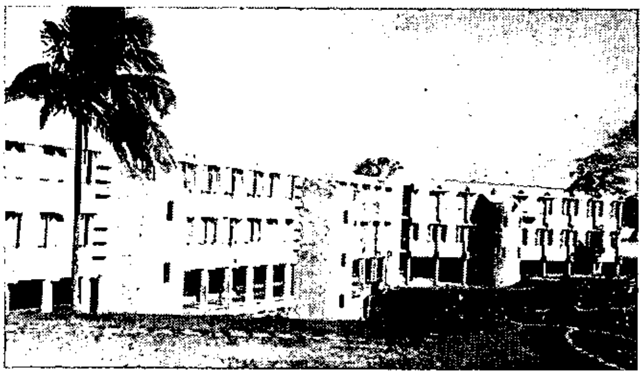
In other projects a chemist and an entomologist are studying the life cycle of the rhinoceros beetle, an important pest of coconut palms. Other studies are being carried out on the chemotaxonomy of potentially commercial fruit crops by collaboration between a chemist and a botanist. Further areas of potential interests in which work could be usefully carried out include soil science, the chemistry of marine systems, and methods of pollution control. Constantly there is a consciousness for the need for projects to be relevant and not become solely esoteric research studies.

The chemistry third year and research laboratory.

Of course in a new emergent university the facilities for research are limited, as the first priority is the undergraduate programme. Specially built research laboratories are very expensive, and instead small and not wholly satisfactory areas must often be used. The commitment to teaching also leaves little time for research, and in the absence of postgraduate students the work is largely carried out solely by the faculty members. At present the school has an ultraviolet spectrometer, an infrared spectrometer and two gas liquid chromatographs. The instruments are also used for teaching and despite the small number of faculty a considerable number of measurements have been carried out. The gas-liquid chromatograph in particular is very important for the chemistry projects and also operates as a service for workers in other fields. For more advanced measurements such as n.m.r. and mass spectra, help is obtained from colleagues overseas.

The other primary research requirements, that of a widely equipped store is also lacking, but it is hoped that the range of chemicals can be increased over the years. Supporting library facilities are improving rapidly as the result of an excellent response to an appeal for back issues of journals. Research texts are unfortunately very expensive and of limited use in teaching but a basic stock of reference books has been acquired. The undergraduates are very well supplied, partly as a consequence of large donations of texts by the New Zealand Students Association, who have also helped with processing the books at the library, and further gifts from the U.K. Government.

The biggest long term problem in research is not so much the facilities but the small size of the university and its isolation. The problem is particularly acute among the less experienced faculty who have come straight to USP from obtaining a Ph.D. degree. The requirement of the under-graduate teaching is for staff with widely based but separated interests in order to fully cover the various lecture topics. Consequently, this lack of a research group with closely related interests means that often in a new area no help can be gained by discussions;

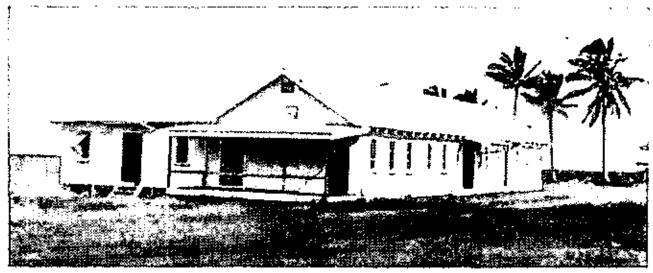


The lecture room block in the School of Natural Resources.

instead lengthy studies of the literature are needed. We are therefore always pleased, when scientists travelling via Fiji are able to spend a day or so with us and give a lecture, or to simply discuss current problems and recent scientific advances.

Conclusion

The philosophy of the University School of Natural Resources is to promote the understanding of science in the South Pacific by making the work, both under-graduate and research, relevant to the needs and the way of life of the communities of the South Pacific, and to enable the countries of the region to make the best use of the natural resources available to them by providing scientifically trained manpower.



The new School of Education building.

BOOK REVIEWS

"Principles of Photochemistry", by P. Suppan, The Chemical Society, London. Monographs for Teachers No. 22, 1973. 73 pages. stg £1.00.

The latest in the well established series of Monographs for Teachers this present volume contains a concise but readable account of the physics and the chemistry involved in light-induced chemical processes.

In the first two chapters the author introduces the basic principles and terminology of photochemistry and discusses energy states of molecules within the framework of a simple quantum-mechanical background. There is particular emphasis on the fact that photochemical reactions involve electronically excited molecules and the need to consider these as chemically different from the corresponding ground state species.

Chapters 3, 4 and 5 examine some examples of the principal types of photochemical processes found in organic, inorganic and biological chemistry. The majority of the examples chosen concern organic reactions, which is probably a fair reflection of the main areas of current research effort in photochemistry.

Chapter 6 is concerned with laboratory techniques commonly used in photochemistry and includes mention of the application of flash photolysis to the detection of short-lived intermediates and the study of the kinetics of fast reactions.

The final chapter considers the practical and industrial importance of photochemistry but would seem unfortunately to be of insufficient length to do this particular topic justice.

The treatment in the book is of necessity rather brief but the author has presented the subject clearly and confined his attention to examples which should be easily comprehensible to the non-specialist. The pages are well illustrated and there are sufficient references to further reading to satisfy the curiosity of even the most inquiring reader. The monograph is recommended to teachers at all levels of chemistry.

C. G. Freeman.

"Chemical Aspects of the Atomic Nucleus", by J. G. Cuninghame. The Chemical Society, Monographs for Teachers, No. 23, 1972; 118 pp.

This little book falls within the series published originally by the Royal Institute of Chemistry and now The Chemical Society to provide background information for teachers. It represents a brief but very readable survey of the ways in which chemical properties and behaviour are influenced by the atomic nucleus. The first part of the book deals at a fairly descriptive level with the properties, stabilities and interconversions of atomic nuclei. The second part treats methods of structure determination based on nuclear properties, radiochemical methods of analysis, and in a final chapter such themes as stellar nucleosynthesis and nuclear abundance.

The presentation of the topics within this broad coverage provides primarily for the needs of the general reader requiring basic information. The chemist having a deeper interest in the analytical or structural methods would of course have to turn elsewhere, but the author does cater for more specialised requirements by providing a list of suggestions for further reading at the end of each chapter. In all, the book should be of value in meeting the needs of a wider range of readers than the "sixth form science teachers" in the United Kingdom, for whom it was written.

The British price of £1.20 (0.90p to Chemical Society members) seems reasonable by current standards.

C.J.W.

Address to Symposioum,
HEAVY METALS IN THE ENVIRONMENT,
held at the School of Science, Auckland Technical Institute, 17th October 1972

Lead Emission from Exhaust Fumes

by E. S. Borthwick

In the present climate of increasing awareness of the many factors which may contribute to the overall pollution of the environment, reference is frequently being made to emissions from motor vehicles. The average person has at least some general understanding of the nature of the main constituents of the exhaust gases from motor vehicles—carbon dioxide, carbon monoxide, oxides of sulphur, soot and smoke, because these substances are also commonly produced from the combustion of non-automotive type fuels—coal, coke, wood etc. However, the additional presence of compounds of lead in the exhaust gases from gasoline-engined vehicles is much less well understood, and as a result one sees published from time to time articles, and even rightly alarmist statements, drawing attention to possible health hazards which may result.

The obvious first question in any discussion of lead in gasoline is —Why is lead added? The answer is—to make a better, less costly gasoline, using less crude petroleum, that will power modern piston engines better, with less wear and tear, to give maximum miles per gallon.

It is very relevant therefore that in a symposium of this kind, a factual review be included of the relationship of lead in gasoline with lead in the environment.

I propose to discuss the subject under three main headings:-

The technology and use of lead-containing additives in gasoline.

Lead in gasoline versus lead in the environment.

Trends and limitations in the future use of lead-containing additives.

Technology and Use

Although the phenomenon of detonation or 'knocking' in gasoline engines had been recognised some years earlier, it was only in 1921 that systematic research into the problem was begun by two General Motors scientists, Midgeley and Boyd. They set out to discover ways and means of eliminating the problem, and as a result of experimenting with very many candidate materials eventually showed that tetra-ethyl lead was by far the most effective. At that stage TEL was largely a chemical curiosity and had not been made outside of the laboratory. ,From about 1923 commercial production of TEL began and the additive soon became increasingly used in motor gasolines. In New Zealand the first leaded grade was marketed early in the 1930's, and although there were lead-free brands available until the beginning of World War II, from then on the use of TEL became essential, as it did elsewhere in the world, to raise the anti-knock rating of base gasoline to the required marketing level by the most economical means. Latterly, an allied compound of lower boiling point, tetra-methyl lead, has been introduced either as a partial or full replacement for TEL. Both compounds are known generically as lead alkyls.

In performing its function as an anti-knock agent (and time will not permit digressing to explain the mechanism of this action), TEL combines with oxygen in the combustion chamber, and the lead is converted to mixed lead oxides, which being solids, would tend to produce a rapid accumulation of deposits within the cylinder and exhaust system if allowed to do so. To overcome this problem, which would otherwise be very serious, substances known as scavengers are added with the TEL. These are the halogen compounds ethylene dibromide and ethylene dichloride, which combine with the lead oxides almost instantaneously, changing them to the volatile lead bromides and lead chlorides, so that the lead is then discharged from the engine partly in a gaseous form and partly as fine particulate matter.

However, not all of the lead originally contained in the gasoline is exhausted from the vehicle. It is not generally appreciated that quite a significant proportion, sometimes upwards of 50 percent under

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Technical Manager, Shell Oil N.Z. Ltd.
M.Sc.(N.Z.), A.R.I.C., M.N.Z.I.C.; now retired.

some conditions, becomes absorbed by the film of lubricating oil on the cylinder walls and progressively contaminates the crankcase oil. If the amount becomes excessive, visible sludges are formed which, although not harmful in the sense of being abrasive, can contribute to blocking of filters and oilways if the oil is not changed at the recommended frequencies.

This absorption is an important factor in reducing the amount of lead compounds which would otherwise be discharged into the air.

It should also be noted that driving conditions have a substantial influence on the amount of lead being emitted at any one time. This can vary from about 25 percent to above 75 percent of the lead intake in the fuel. At low speeds the lead tends to be retained in the exhaust system, to be discharged at some later period when the engine is used at greater speeds.

Lead in Gasoline versus Lead in Environment

Lead is a natural constituent of the earth's crust; all soil contains traces, even virgin soil far removed from human habitation. Greater amounts are found in rural and urban soils due to contamination over very many years from such agencies as ash from combustion of coal and refuse, industrial wastes, old lead-based paint, lead-based pesticides used in agriculture, and more recently deposition from motor vehicle exhaust gases. Inevitably all foods, beverages, drinking water etc. contain minute quantities of lead which are continually being ingested. Just how much is ingested depends upon where we live, the type of foods we prefer and so on, but will obviously be greater in the heavily industrialised and motorised areas of the world.

The influence of lead on vegetable and forage crops grown alongside busy highways has been studied by a number of research workers. They have found that, as would be expected, lead contents tend to increase with traffic volume and to decrease with distance from the highway. For instance, in one study grass collected at the intersection of two heavily travelled highways contained 3,000 ppm of lead in the ash; in another allied study grasses at a distance of 5 feet from a highway contained 100-700 ppm, and at distances of 500-100 feet only 5-50 ppm.

Lead is also suspended in the air. In urban areas we find lead from a variety of sources—dust from weathering lead paint, industrial fumes, the burning of coal and refuse and motor vehicle exhaust gases. However, lead is only a minor constituent of all particulate matter in the air; U.S. studies have indicated that lead particles may range on the average from about 1.5 to 2.5 percent of all city particulate matter.

Since there is no reliable information on community air concentrations of lead before TEL was introduced (primarily because sufficiently sensitive analytical techniques were not then available), comparisons of the effect of the use of lead alkyls on air lead concentrations must remain largely speculative. It must not be overlooked that lead has been present in the atmosphere from coal smoke and dust particles for a long time. According to one estimate the global contribution in the atmosphere from combustion of gasoline and coal would be of the same order. However some idea of recent typical lead levels in various parts of the world's atmosphere can be gained from table I.

Monitoring of levels of lead concentration in air is now being carried out regularly in many countries. In the U.S. this is being particularly well co-ordinated under the U.S. National Air Sampling network. It is interesting to note that in some areas there is evidence of a downward trend; for instance one programme in Cincinatti showed that the average in 1964 was only one third that of 1946, although the number of cars had risen nearly 200 percent. Amongst other factors, the authors attributed the decrease to the great reduction of coal as a heating fuel, and the construction of motorways which alter the traffic patterns and the emission of lead from exhausts. However, where populations are increasing some rise in lead emissions is expected. Another comprehensive survey, known as the Seven City Study of Air and Population Lead Levels, which commenced in 1968 and is still proceeding, would appear to confirm this trend.

Lead absorption in man results from a combination of inhaling lead particles in the air and ingesting lead in food and drink. In the case of inhaled lead, it is widely agreed by experts throughtout Europe and America that it is safe for workers in industry to be exposed to lead-in-air concentrations of up to 200 micrograms per cubic metre for a 40 hour week. This level, the so-called Threshold Limit Value, is based on an enormous amount of research and clinical experience with adult human males over the past 40 years. In busy city streets mean levels of lead-in-air from motor car exhausts reach no more than 3-4 micrograms/cu.m., a concentration some 40 times less than the industrial TLV. Clearly this level does not constitute a health hazard from inhalation, and to keep these figures in perspective, Table 2 shows the results of published work comparing the lead ingestion and absorption by man from food, water, air and tobacco smoke.

The most commonly used yardsticks of the total environmental exposure to lead are the concentrations in blood and urine. In a study by the World Health Organisation it was considered that normal lead levels in blood range from 15-40 micrograms/100 ml, with the average around 17. The study showed that only 2 percent of the world population has values above 50. However the U.S. Public Health Authorities still consider a level less than 80 micrograms/100 ml to be normal. By comparison, the average blood concentration of New Guinea natives living away from industrialisation and motorisation was 22 micrograms/100 ml, as was also that of Mexican Indians and people living in rural England. An article in the Journal of Occupational

Medicine in 1968 summarised information on blood and urine concentrations of lead of normal populations for 1931 to 1965 and concluded that there was little change during this period.

Trends and Limitations in the Future Use of Lead-Containing Additives

Although the potential hazards of lead as an anti-knock additive have been under continuing study for nearly fifty years both by private industry and public health organisations, it is still accepted by responsible medical and scientific opinion that at the prevailing levels of lead pollution in the atmosphere there is no valid evidence of a hazardous effect. A report from the Council of Europe in 1964 said "On various occasions and in different countries the question of the harmful effects of these emissions has been brought up, but the charges brought against them have always proved to be groundless".

A British White Paper in 1970 included the statement "Lead is a well-known poison, but the amount that is emitted from motor vehicle exhausts is, in this country, trivial. There is no evidence that cars add significantly to the lead which occurs naturally in the soil or in the vegetable food we eat".

Nevertheless, concern still exists in some quarters over possible chronic effects, and a great many research projects are under way to obtain more information on the long-term effects of atmospheric lead exposure. Consequently, it is now regarded as only reasonable that positive steps be taken to halt, and if possible reverse, any likely future tendency for lead levels to rise with rising car populations and gasoline consumption. Within the dictates of economy and practicability, steps are now being taken in a number of countries to reduce progressively, with or without legislation, the maximum allowable amounts of lead in gasolines. The present situation is summarised in Table 3.

Additionally, the amount of lead used in gasoline may well decrease for reasons other than associated health considerations. Present strategy in the U.S., for example, is based on reducing pollution from vehicle exhausts (primarily carbon monoxide, unburned hydrocarbons, nitrogen oxides and particulate matter) by improving combustion in the engine and eventually cleaning up the exhaust with catalytic devices or after-burners. The efficiency of these devices is on present knowledge reduced by the presence of lead in the exhaust. Therefore the U.S. plan is to produce by 1975 or 1976 lower compression, less economical engines which will run on unleaded or low-leaded fuel, thus permitting the use of catalytic devices in the exhaust system—though inevitably with some loss in power and with overall increased cost to the user.

Changing patterns in the future use of leaded fuels are now well recognised by both the motor and the petroleum industries, but it is important to realise that each country must decide upon its own course of action by using the straightforward basis of balancing cost and economic disadvantage against the known degree of genuine hazard arising from possible environmental and health effects. In New Zealand today we can confidently expect that lead exposure is well below that existing in many areas overseas, and that consequently we are not faced with any need for urgent or precipitate action.

At the same time, the New Zealand oil industry is well aware of, and is keeping itself very fully informed upon, overseas trends and developments. It is regularly reviewing the local situation, not only by interchanging information among the different marketing companies, but by active participation on relevant Government sponsored committees which have been set up to study all aspects of air pollution. The aim of the industry is therefore to be prepared to meet changing requirements in lead alkyl concentration in this country, as and when clear and factual evidence emerges for a need to do so. That stage, however, has yet to be reached.

TABLE 1

RECENT ATMOSPHERIC LEVELS OF LEAD IN EUROPE AND U.S.A.

Place	Sampling Location	Average Lead: Micrograms/ Cubic Metre
Berlin	Busy Streets	3.8
Berlin	Quiet Streets	0.5
Paris	Central Streets	4.8
London	Busy Streets	3.2
Californian Mountain Area	—	0.1
Los Angeles	Freeway	13.2
Los Angeles	Central Streets	6.6
New York	Central Streets	4.1
Composite — U.S. Cities:		
Below 1 Million	Central Streets	1.5
1-2 Million	Central Streets	1.6
Above 2 Million	Central Streets	2.5

TABLE 2

INGESTION AND ABSORPTION OF LEAD BY MAN

Substance	Intake/Day	Lead Absorbed: Micrograms/Day
Food	2 KG	25
Water	1 KG	1
Urban Air	20 M³	10
Tobacco Smoke	30 CIGS	10
		46

TABLE 3

WORLDWIDE GASOLINE LEAD LIMITS (AS KNOWN AT OCT. 1972)

Country	Present Limit: Grams/ Litre	Future Limits
U.K.	0.84	0.64 (1973), 0.55 (1974), 0.45 (1976)
West Germany	0.40	0.15 (1976)
France	0.64	0.55 (1974), 0.45 (1976)
Italy	0.64	—
Sweden	0.70	0.40 (1973)
Holland	0.84	—
Switzerland	0.57	0.15 (1976)
USA—Federal	1.1	0.53 (1974), 0.45 (1975), 0.33 (1977)
USA—New York City	0.27	0.13 (1973), NIL (1974)
Japan	0.29	NIL (1974)
Australia	0.84	—
N.Z.	0.84	—

REPORT ON THE SYMPOSIUM ON GAS CHROMATOGRAPHY HELD ON 16 OCTOBER 1973

The Symposium was organised jointly by the Auckland Branch and the Chromatography Group of the NZIC, and was held at Danish House in Parnell, Auckland.

The use of gas chromatography for analysis of a wide variety of compounds has been increasing rapidly in New Zealand over the last few years and this Symposium was organized with the aim of reviewing topics of interest to those using gas chromatography and to allow people with common interests to get to know each other.

The symposium was attended by 68 people, some from as far away as Wellington, Napier and Whangarei. A number of firms put on displays and some interesting new equipment was exhibited.

The morning session was chaired by Dr P. G. Robinson, Department of Paediatrics, Medical School, Auckland and began with a welcome by Mr R. H. Hopgood, Chairman of the Auckland Branch, NZIC.

This was followed by an introduction to gas chromatography given by Dr P. E. Nelson, Chemistry Division, DSIR, Auckland. Dr Nelson discussed the basic units which make up a gas chromatograph and spoke briefly about some theoretical aspects of separation and column efficiencies.

After morning tea Dr J. A. Zabkiewicz, Forest Research Institute, Rotorua, spoke at greater depth about column theory and its application to capillary columns. He drew particular attention to comparisons between packed and capillary columns and between the two types of capillary columns—wall coated (WCOT) and surface coated (SCOT)—and to the practical difficulties involved in the making of good capillary columns. That the very high efficiency of capillary columns is not always the answer was dramatically illustrated by his final example of the use of a short (2m) packed column containing one of the lesser known stationary phases to achieve as good a separation as that on a 50m SCOT capillary. The advantages of this where preparative work was needed were pointed out.

The next speaker was Mr G. Dick of Chemistry Division, D.S.I.R., Gracefield, who spoke on the theory and application of some specific detectors. Among the detectors which he discussed were: electron capture, both pulsed and d.c. types, including comparisons of conventional tritium and nickel-63 sources and a mention of the new scandium tritide source; flame photometric, which allows very sensitive and specific detection of either sulphur or phosphorus; nitrogen and phosphorus sensitive flame ionisation detectors, where selectivity is obtained by using a crystal of a particular alkali-halogen salt. Two different types of coulometric cell detectors were also mentioned.

The afternoon session was chaired by Dr Nelson and began with a tape recording which formed part of an audiovisual set on gas chromatography. The recording was narrated by Mr Walter Supina, President of Supelco Inc., a chromatographer of international repute, and the set was kindly donated for the symposium by Townson & Mercer (N.Z.) Ltd. The recording described some of the basic theory of gas chromatography and reviewed the various abstracting services available.

The next speaker was Dr P. Holland from Ruakura Agricultural Research Centre who spoke on the combination of gas chromatography and mass spectrometry.

In particular he reviewed the instrumentation involved in some detail, stressing the importance of the interface and pumping systems used. He also discussed the choice of stationary phases and gave some examples of applications of GC-MS with which he had been involved.

The final speaker was Dr P. G. Robinson who spoke on the derivation of compounds for gas chromatographic analysis. Among the reactions which he discussed were esterification (acid catalysed, base catalysed, use of diazomethane, dimethylformide-dialkylacetals and trimethylphenylamonium hydroxide), silylation, derivatives for use with electron capture detectors, derivation of keto groups, use of alkylboronic acids and derivation of carbohydrates to their aditol acetates.

The symposium concluded with a panel answering questions from the audience.

It is anticipated that the Chromatography Group will hold another symposium in March next year in Rotorua. The topic will be "Automation and Data Handling in Gas Chromatography".

IUPAC INFORMATION

IUPAC 1971—73
REPORT OF PRESIDENT
ON STATE OF THE UNION
IUPAC Council Meeting, Munich
August 29 and 31, 1973

In the binennial report on the state of the Union which I have the honour to present to Council, I do not propose to analyse at length the results of scientific work carried out in our various specialist Commissions, although this work is, of course, the sole reason for the existence of our Union. The Division Presidents and Chairmen of IUPAC bodies attached directly to the Bureau will shortly present their reports with a skill I shall not attempt to emulate. On the contrary and following the examples of most of my predecessors, I shall place before you a number of general questions on which I have been concentrating during the last two years. In my opinion some of them involve the very future of our Union. My reflections are based mostly on exchange of views I have had with some of you and they will recognise their own ideas in due course. I must mention here the particular debt of gratitude I owe to Members of the Executive Committee, who have never been stinting in their support, and also to the Bureau. However, the conclusions I have arrived at in some cases are entirely personal and involve nobody else.

My first subject concerns the establishment of nomenclature rules in our various Divisions. As everyone knows, this task was felt to be of paramount importance by our founders. For many years two Commissions have shared this task, one in organic chemistry and the other in inorganic chemistry. Their recommendations have been adopted universally by the chemical community. Due to the evolution of chemical science on the one hand and changes in methods and documentation techniques on the other, more difficulties have arisen in recent years. In chemical science, enormous families of compounds have been developed to which it is difficult to apply traditional nomenclature but on which our different bodies, because of their special expertise, have been able to make recommendations, e.g., co-ordination compounds, boron and silicon compounds, stoicheiometric phases, and macromolecules with biological activity. Simultaneously, Commissions on nomenclature have been created in other Divisions which are, of course, entirely justified, but whose activities need to be co-ordinated with existing Commissions. Experience has shown that the exchange of observers between these various Commissions has been very useful. However, it has become obvious that certain fundamental disagreements cannot be resolved in this way because perfect harmony in frontier areas of nomenclature, between inorganic and organic chemistry for example, would require a complete revision of the general system adopted by at least one of the partners, and this cannot possibly be envisaged. Another problem of standardisation of nomenclature is to persuade authors of reports and works published under our name to use rules of nomenclature that we have officially adopted.

Alongside those aspects I have mentioned is that of our relationship with powerful organisations which in some countries publish original scientific work and abstracts. Although our methods of work are and must be distinct, in my opinion we should collaborate with them because the common aim is to work for the benefit of the scientific community. The presence of representatives from these organisations in some of our Commissions offers us an opportunity to collaborate, providing that good will exists on both sides and this is obviously the case. The activities of our Interdivisional Committee on Machine Documentation must also be included in this policy.

It was in this context that Council approved several years ago the creation of an Interdivisional Committee on Nomenclature and Symbols, which has been chaired in turn by Profs. K. A. Jensen and M. L. McGlashan with a skill I am pleased to acknowledge. Experience seems to have shown, however, that deprived of sufficient powers, this Committee has not beein in a position to achieve a proper co-ordination of nomenclature activities which are presently divided amongst several Divisions. This is why the Executive Committee has approved the creation of an ad hoc Committee, chaired by Prof. N. Lozac'h to study ways and means of improving the present situation. The report of the ad hoc Committee is not to hand as I write this report, but without wishing to prejudge its conclusion, I think it might be useful to examine carefully the possibility of regrouping all our nomenclature activities and possibly symbols in a common Division.

My second subject is the place applied chemistry occupies throughout our organisation, not only in our Applied Chemistry Division. This is not a new subject and you will recall that most of my predecessors, some of them eminent in industry, have been involved with it.

The fact that this problem arises at all our meetings shows that an easy solution is not within reach. The Bureau and Executive Committee have spent the last two years trying to increase the interest of its Members in applied chemistry. In a moment, Dr. R. W. Cairns, President of the Applied Chemistry Division, will tell you about achievements in his Division and I do not wish to antcipate hs report. However, it should be mentioned once again that well before public opinion and, under pressure from this, governments began to take note of the dangers of pollution, IUPAC had already taken initiatives in devoting the work of several of its Commissions to study environmental problems. The decision some years ago to concentrate the efforts of the Applied Chemistry Division in this direction has proved an excellent one and we have maintained this policy. However, we must not forget the fact that IUPAC's applied work is not limited to the activities of the Sections attached to that Division. Of equal relevance surely is the work carried out by the Macromolecular and Analytical Chemistry Divisions and by the Sections on Medicinal and Clinical Chemistry.

One of the interesting aspects of IUPAC work in the appied field is the existence of Company Associates. This year we have been pleased to see companies from new countries joining the scheme and the total number of Company Associates has now risen to nearly 150. However, we must guard against undue optimism because even amongst those companies who have willingly subscribed, following friendly requests from several of us, there are some who are not convinced of the usefulness of our activities. Further, the financial climate in the world at the moment has led many chemical companies to reduce their budgets in respect of expenditures they consider merely philanthropic. This is why we decided to organise an Open Meeting during this Conference and invited participation by representatives of Company Associates and Members of our Commission who work mainly in industry. Following a tentative step in this direction at Cortina d'Ampezzo in 1969, we hope that as a result of this meeting the voice of industry will be heard and it will tell us what it expects from the Union. I take this opportunity of placing myself firmly against the interpretation which would wish to limit this action to its financial aspects. Applied chemistry, as well as pure chemistry, is written into the title of the Union and it is natural that both spheres co-operate in its work. It could be suggested that an opportunity should be offered to Company Associates as soon as possible to have a statutory voice at a high level in the affairs of our organisation.

The question has often been asked whether the difficulties of applied chemistry in IUPAC are due to the structure itself. It is obvious that a largely arbitrary grouping of Sections and Commissions on applied chemistry in one Division does not really favour contacts with pure chemistry Commissions. The remedy of bringing in large numbers of industrial Members to our Commissions may not be the best, because if one sets apart Sections and Commissions which relate to the Applied Chemistry Division and some others which relate to the Analytical and Macromolecular Divisions, I see little in them to attract true representatives from industry.

A more realistic approach would undoubtedly be to adapt our present very rigid structure in the fields where evolution is fast and often proceeds in an unexpected way. This could be achieved by superimposing, and eventually substituting, the present system of Sections and Commissions by a more flexible system of operation based on precise objectives whose term as well as resources will be strictly specified. It will be for our successors to explore this possibility which I am sure will enable our organisation to follow more closely all the variations of outlook in applied chemistry, at the same time ensuring a better utilisation of our limited finances.

The third subject I would like to bring to your attention concerns the development and rationalisation of the Union's external relationships. This development has become considerable in recent years and has constituted an important part of our preoccupations in the last two years. We must, however, take into account the fact that in spite of the foresight of the Union's founders, our organisation remained for many years an association of scientists who placed the development of the science to which they had devoted their lives at the very head of their preoccupations. Also, the division of the scientific disciplines rarely necessitated interdisciplinary liaison. Recently, however, the system of values on whch this structure reposed has received attacks from several sides. On one side, the man in the street demands the benefits of science with an ever-increasing energy, and the scientist is considered responsible for the extremely rapid evolution of society for better or worse. Therefore, it would be unreasonable for an organisation such as ours to dissociate itself from the implications of its activities in such fields as pollution, food, health, and education, to name only a few. From this arises the absolute necessity of co-operation with numerous organisations which deal primarily with these problems. You will know from reading the reports of our expert Commissions the exact contacts at their level with many outside organisations. But it is necessary that in certain cases the foundations of this co-operation should be laid down officially. Some contacts have been in existence for some time, but others have either recently been established or renewed by us. In this respect, we send delegates to various ICSU specialist committees, such as the Abstracting Board, CODATA, COSPAR, COWAR, SCOPE, and your President is, of course, on the General Committee of ICSU. We also maintain irregular contact with IUB, IUPAB, IUPAP, and IUCr. I am pleased to tell you that useful contacts have recently been established between IUB and IUPAC on the occasion of a meeting attended in particular by the IUB President, Prof. H. Theorell, and by Sir Harold Tohmpson, Prof. Lozac'h, and myself.

Relations are also maintained with international governmental organisations, in particular, WHO, FAO, and UNESCO. Our collaboration with UNESCO, mainly in the field of teaching of science, will be cemented this year by the organisation of an international congress on teaching of chemistry under the joint sponssorship of UNESCO and IUPAC. Our Committee on Teaching of Chemistry will, of course, be in attendance led by its Chairman, Prof. R. W. Parry. Also in this category of organisation is CEE with whom we have had a fruitful collaboration over many years in the field of analytical chemistry, thanks to the notable activity of the Co-ordinating Committee under the Chairmanship of Prof. R. Truhaut.

Another aspect of relationship IUPAC has with outside organisations which should not be forgotten is that of our contacts with scientific and technological societies devoted to chemistry. These are involved with us thanks to the Statute concerning Associated Organisations. This very flexible form of association only involves societies whose international nature is evident and whose scientific level is beyond reproach. This follows a recent decision of the Bureau which would avoid our falling into the error of ignoring the development of organisations whose aims are complementary to ours as well as the opposite, and any endeavour by the Union to assume exclusive control of all international chemical activity which would be completely beyond our means. We hope, however, that IUPAC will continue to be privileged to meet all those organisations who in various capacities devote themselves to these activities. It is in this spirit that we are proposing to Council the admission of several new Associated Organisations, including International Association for Advancement of High Pressure Science and Technology, International Committee for Rheology, International Conferences on Co-ordination Chemistry, International Society for Heterocyclic Chemistry. I take this opportunity of welcoming Delegates from the existing Associated Organisations here to follow our work during the Conference.

It would be unfair not to mention here the relationships which IUPAC has externally in the important role of sponsorships given each year to a carefully chosen number of symposia and congresses. This label is becoming more and more coveted, quite independently of any financial assistance which is sometimes also given, by organisers of some of the most reputed meetings and we can only be happy that this situation reflects moral credit on our Union. This gives our official representatives an opportunity to speak in front of huge audiences about our aims and activities. The granting of sponsorship is only given, as you all know, after certain conditions concerning the publication of plenary lectures in the IUPAC journal *Pure and Applied Chemistry* have been fulfilled. I must note here that more flexibility has been exercised by the Union recently in this respect. Sir Harold Thompson will no doubt inform us about this in his report on behalf of the Committee on Publications.

At the end of this quick review of our relationships with outside organisations I think I can confirm that we have established contacts wherever they appear to be necessary and that nobody can accuse us of living in an ivory tower. The, in general, very positive results of our collaborations constitute an important part of the balance sheet of our activities and this is why I draw your attention to them. I am pleased to record my thanks here to all our delegates who throughout the world have presented us and brought knowledge of IUPAC to those who were not previously aware of their activities.

We must now make a big effort to better disseminate information on our activities, not only in industry but also in academics and universities. It was with this aim that the Executive Committee asked Sir Harold Thompson to prepare an article containing general information about IUPAC. This received a wide circulation. Also, a more specialised brochure was prepared by Mr. P. M. Arnold for industrial use and was distributed widely. Finally, information on IUPAC activities is sent at regular intervals to the principal national chemistry news journals with a request for publication.

Council must now be informed about our actions in respect of revision of the 1965 IUPAC Statutes in light of our current requirements. You are aware that over the years, the evolution of our organisation has inevitably necessitated revision of particular aspects of our Statutes and Bylaws. It is enough to recall that these Statutes ignore completely the existence of both Standing Committees and Company Associates; that directives for Sections and Sub-Commissions are too vague; that there is no legal basis for the existence of Working Parties and other bodies created as various circumstances arose.

For this very good reason my predecessor asked Council to create a Committee which would prepare such modifications to the Statutes and Bylaws as were thought necessary. A consultation was organised amongst the Bureau, Division Presidents and Secretaries, and Officers and Standing Committees of IUPAC to establish a list of suggested modifications and these are currently being studied by the Committee under the Chairmanship of Sir David Martin and by the Executive Committee. For statutory reasons new proposals cannot be submitted to Council before 1975. Without wishing to anticipate the conclusions of these studies, I think it might be useful to make a distinction between modifications of detail which seem necessary and could be approved fairly readily, and those which concern the future policy of the Union and therefore require deeper study.

In this context we were asked to undertake a specific task. It was to codify the terms of reference of Standing Committees attached to the Bureau whose functioning has been on a de facto basis for many years. This work, which was first completed for the Finance Committee, has been followed for the Committee on Teaching of Chemistry, Committee on Publications, and Committee on Statutes and Bylaws. Terms of reference have been drafted for the Liaison Committee on SCOPE and Interdivisional Committee on Machine Documentation, and they are in preparation for the Co-ordinating Committee for CEE. In my opinion they have the great advantage of avoiding the possibility that these Committees may gradually deviate from the objectives laid down at the time of their creation. They also ensure, by fixing terms for length of service, that the composition of the Committees is renewed regularly. This corresponds to a great principle to which I am very attached, namely that no appointment is made without a time limit. That is why I have asked the Executive Committee to approve a rule that our official representatives on other organisations appointed by the President shall not exceed that President's term of office. This leaves the new President entirely free to reconsider, if he so wishes, the appointments made by his predecessor.

Nobody will wish me to ignore the subjects of finance and publications during my biennial report. I have not discussed these matters as priorities, not because I think them of less importance, but because they are the responsibility of two people far more expert than me. You will shortly be hearing the reports of Prof. O. Horn and Sir Harold Thompson and I will, therefore, make only a few general remarks on these subjects.

Concerning finance, I shall confine myself to referring to two basic principles: the first is the fact that expenditure must be related to income, and the second is that sufficient reserves are necessary to ensure effective administration. I must say that IUPAC gives me complete satisfaction on both these points although, of course, this result has not always been achieved easily. Our good position arises thanks to the skill and untiring activity of our Treasurer, Prof. Horn, to whom I would like to extend our appreciation. The advice of the Finance Committee under the excellent Chairmanship of Dr. J. W. Barrett must also be recognised. It is unnecessary to remind you of how thankless a task it is to run the finances of an organisation like ours, because objections to certain expenditures are not always easily understood or admitted by those who propose them. No less thankless is the task of the President, who sometimes has to arbitrate in disagreements which anyway should remain amicable. I must strongly reiterate here that financial problems cannot be dissociated from the idea that we ourselves provide the objectives for our organisation and that any position taken up in this must be justified by reference to these objectives.

On the subject of publications, I shall content myself with a request to Council to listen carefully to the report from Sir Harold Thompson on behalf of the Committee on Publications. Although this report is traditional, this year it is something special because Sir Harold does not feel it possible for him to continue as Chairman when he succeeds to the Presidency of the Union. We are all aware of his very real achievements over the many years he has led this Committee and it is no exaggeration to say that the IUPAC publications we know today are for the most part the product of his own work. I invite you to show your appreciation of this, including at the same time, of course, the other Members of the Committee. Prof. B. C. L. Weedon will take over as Chairman of this Committee, the Membership of which has also recently been augmented.

At the risk of taking advantage of your patience, I would now like to mention a few matters of a very general nature inspired by my observation of the functioning of the Union. In view of their generality it is unlikely that they can be used as the basis for immediate action, but they may be of use to our successors in the longterm development of IUPAC.

The first thing I noticed particularly during my two years is the fact that the Union's present structure does not seem to be adapted to the present situation of chemical science and its applications. The best way to make us realise this is to imagine for a moment that IUPAC does not exist and we have to create it ourselves. No doubt it would turn out very differently from our existing structure. IUPAC was originally designed along the lines of the clear distinctions when they existed in our discipline, particularly into inorganic, organic and physical chemistry. This was, of course, with very good reason. Since that time, however, these fields have developed to such an extent that the problems occupying us now are often less within the Divisions themselves than between neighbouring Divisions. Also, it is evident that the various nomenclature Commissions; those which establish standards, and those involved in documentation often have far more affinity with each other than with other Commissions in their own Divisions. It is obvious from the reports of our Commissions over the last twenty years that we have to counter this situation by exchanging representatives between groups which need to co-ordinate their actions or by setting up liaison committees. However, extending these procedures is not always efficient and can be both unwieldy and costly.

I appreciate that these remarks will seem to some of you to renege on the habits of half a century. However, I feel it necessary to broach the matter following discussions I had on interdisciplinary matters when I was Chairman of the ad hoc Committee on this subject set up by President A. L. G. Rees during his term of office.

Another aspect of the life of our organisation on which I have often meditated during my term of office and with which I would like to conclude is that of the faculty of IUPAC to adapt to evolution and growth. Everyone knows that in an organisation like ours, it is easy to obtain general approval for creation of new bodies, but that it is very difficult to decide to abandon existing ones. The result of this is that it takes far more courage to say 'no' than 'yes', particularly when the consequences involve our friends. Obviously, IUPAC's volume of activities has to be governed by financial considerations as in any other body. The adaptation of our organisation to the evolution of science, both technological and social, involving us in adopting new objectives, must be accompanied by the relinquishing of others. I am not, of course, saying that whenever we decide to create a new body we must do away with another one of comparable importance, but I do hope that at all levels in our organisation people will be aware of this necessity. An institution which does not have the strength to renew itself is an institution condemned to sterility. I hope that particularly in the field of applied chemistry a more flexible system will be progressively substituted for the much too rigid structure we have at present.

These are the reflections I wished to tell you about as my term of office as President draws to an end. They should not be interpreted as pessimistic, but on the contrary the expression of a wish to prepare our Union to meet the future as successfully as possible.

Finally, I would like to express my thanks to all those who have worked beside me during these two years, especially the Members of the Executive Committee and Bureau. I wish to mention particularly Dr. W. Gallay, Secretary-General, and Prof. O. Horn, Treasurer, with whom it has been a pleasure to collaborate. I also wish to mention our Executive Secretary, Dr. M. Williams, whose remarkable efficiency and devotion, as well as that of his staff at Oxford, is well known to all of us.

The shadow on all this is, however, the departure of Dr. Rees, who after being a skilful and efficient President, has been at my side as Past-President. His advice has always been most welcome. I am sure his wide knowledge of international scientific affairs will often be put to good use in other places. I reiterate the thanks I made to him in Washington for the contribution he has made to our Union in past years.

I now return to Sir Harold Thompson who will assume the Presidency at the end of this Council meeting. I express my best wishes for his success and the prosperity of IUPAC. It is a rare thing amongst us to find someone who has been active in so many areas of our organisation. There are very few of us who have such a deep knowledge and experience of the problems facing the scientific Unions in the world today. I feel therefore that I am placing IUPAC in good hands. It is up to you all, Members of Council, to facilitate his work by your full co-operation during his term of office.

J. BENARD,

President.

CORRECTION

Chemistry in New Zealand

October 1973 page 169, the heading Retirements, for Mr Spackman and Mr Hullett should have been, Honorary Fellows.

BRANCH NEWS

Canterbury

University of Canterbury

Dr Colin Freeman has been promoted to Senior Lecturer.

Dr W. Metcalfe who has received an Erskine grant is on study leave and will attend the 5th Asia and Oceania Congress of Endocrinology in Shandigahr, India, before returning in February.

The 3rd New Zealand Science of Materials Conference will be held on December 10-14 at the University.

Christchurch Boys' High School

Mr Alan Wooff, Head of the Science Department, has been awarded a Wolf-Fisher Travelling Fellowship and will attend the University of New South Wales Summer School of Chemistry.

Mr David Howarth at present lecturer in chemistry at Lincoln College is returning to a position at Boys' High.

DSIR

The Dunedin branch of the Chemistry Division Laboratories has now transferred to Christchurch. Also making the move are Mr E. Sutcliffe and Miss E. Peart.

Mr Scott is now Government Analyst for both Canterbury and Otago.

Christchurch Clinical School

The New Zealand Society of Endocrinology held the Second Scientific Meeting of 1973 at the new Medical Centre on October 16-17.

At the same site the Christchurch Hospitals Post Graduate Society Course in Clinical Endocrinology was held on October 18-19. Both meetings were attended by Dr J. D. N. Nabarro of Middlesex Hospital, London, and Dr L. Lazarus of St. Vincents Hospital, Sydney.

Otago

I.U.P.A.C. Symposium, Dunedin, 1976

The greatest gathering of scientists ever to visit New Zealand will attend the Tenth Symposium of Natural Products in Dunedin in August 1976. Delegates will include six Nobel Prize winners. The symposium will be held under the auspices of the Royal Society of New Zealand and the chairman of the organising committee is Professor R. E. Corbett, Chairman of the Department of Chemistry, University of Otago.

Professor Corbett reports that his invitation to chair the Symposium has been acepted by Sir Derek Barton, Hoffman Professor of Organic Chemistry at Imperial College of Science and Technology. Sir Derek is a Nobel Laureate.

It is expected that some 800 overseas scientists will attend as well as a large New Zealand contingent. A wide range of both chemical and biochemical topics will be covered.

The choice of Dunedin is attributed to several reasons, including the quality of facilities. There are also historical reasons as the Department of Chemistry has played an important role in natural products research for something like 60 years. In addition, the University of Otago was the first New Zealand university to teach Biochemistry.

Chemistry Department, O.U.

Associate Professor R. A. Matheson left in early November for a year's leave at the University of Newcastle-on-Tyne, England. He will be working on aspects of the physical chemistry of electrolyte solutions, in conjunction with Dr A. K. Covington.

Dr D. Fenby is to leave shortly for a brief visit to France.

Environmental Studies

Of interest to chemists is the report of the University of Otago's Chancellor, Mr T. K. S. Sidey, on seminars on the environment which he attended during the Congress of the Association of Commonwealth Universities in Edinburgh. Consideration is at present being given to the establishment of a course in environmental studies at the University.

Promotions

Congratulations are extended to Dr D. E. G. Jones (Chemistry Department) and Dr M. G. Shepherd (Biochemistry Department) whose promotions to Senior Lecturer were recently announced.

October Branch Meeting

The October meeting of the Otago Branch was held in the Pharmacology Department of Otago University. After the lecture by Mr A. G. Fricker members were invited to inspect the facilities of the Pharmacology Department in the new multi-storey Medical Sciences Building. Professor Fastier and staff organised guided tours.

CONFERENCE ON LABORATORY INSTRUCTION IN CHEMISTRY

TROY, N.Y.—Rensselaer Polytechnic Institute, under the sponsorship of the International Union of Pure and Applied Chemistry, will host a three-day conference on Laboratory Instruction in Chemistry, to be held in Troy, New York, on June 10-12, 1974. Five major areas, each keynoted by a plenary lecturer and supported by panel discussions and contributed papers are planned in the following areas:

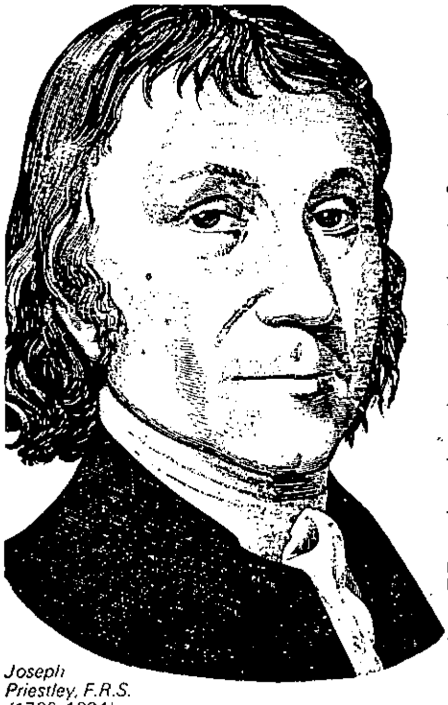
- The Integrated Laboratory in Chemistry
- The General Chemistry Laboratory
- The Computer in Laboratory Instruction
- Instructional Aids and Equipment
- Laboratory Organization.

The objectives of this conference are to examine critically the role of direct student experimentation and the format of the laboratory organization in view of the demands of sophisticated equipment, student time, space, etc., and the relation of the laboratory to the overall trends in Chemical education. The format of the conference will be informal, and will provide opportunity for participants to evaluate past, present and future aspects of laboratory instruction, to exchange views and experiences, and to explore direction and innovation.

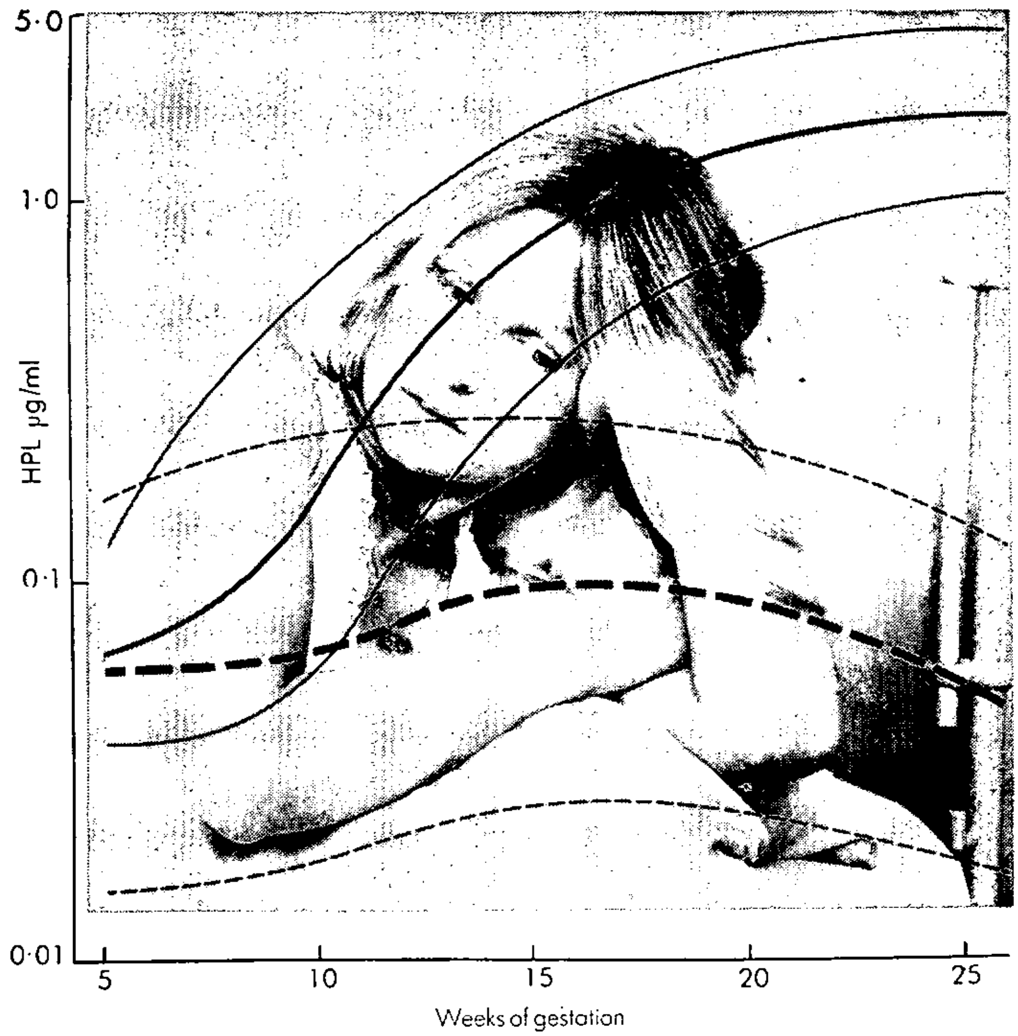
The conference will be part of the 150th anniversary activities of Rensselaer Polytechnic Institute. Founded in 1824, Rensselaer initiated the incorporation of field work and laboratory studies in a regular course of science in the United States.

Further information may be obtained by writing to the Chairman of the Organizing Committee, Dr Robert L. Strong, Department of Chemistry, Rensselaer Polytechnic Institute, Troy, New York, 12181.

Gerald H. Edwards, Director of the Standards Association of New Zealand, who led the New Zealand delegation at the Triennial General Assembly of the International Organization for Standardization (ISO) in Washington in September. He will also represent New Zealand at meetings of the Pacific Area Standards Congress which are being held concurrently.



Early warning or false alarm?



In cases of vaginal bleeding in early pregnancy it is frequently impossible on clinical grounds alone to distinguish between those patients who will abort and those who will proceed to term.
It has been shown that the assay of human placental lactogen (HPL) in maternal serum can often make this distinction.[1] Patients with lower than normal levels usually went on to abort during their first admission, whereas those with normal levels were likely to continue successfully to term. Thus, the HPL assay "can indicate those women in whom abortion is inevitable and could be used to reduce substantially the length of hospital stay in this common complication of early pregnancy."[1]

Reference Brit Med J, 3, 799-801, 1972.

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