JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. 29 No. 5
October 1965

JOURNAL OF THE NEW ZEALAND
INSTITUTE OF CHEMISTRY

Vol. 29, No. 5 OCTOBER, 1965

CONTENTS

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

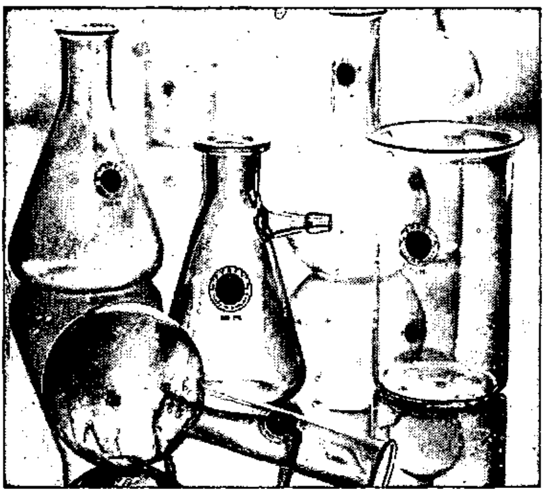
Edited by Joan M. Mattingley
P.O. Box 250, Wellington

Advertising Manager
Miss A. Dollimore, P.O. Box 260, Wellington

Registrar, N.Z. Institute of Chemistry (Inc.)
D. J. Hogan, P.O. Box 1926, Christchurch, N.Z.

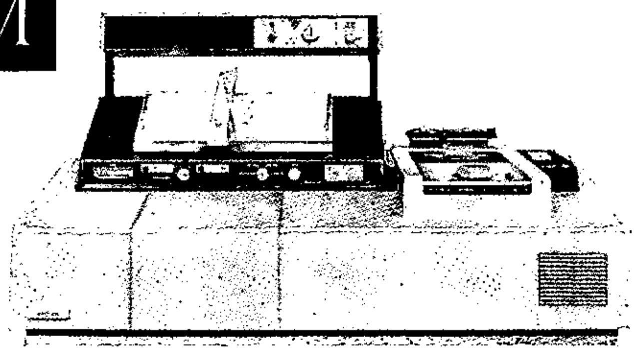
Employment Officer
E. S. Borthwick, Shell Oil N.Z. Ltd.,
Box 2091, Wellington

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



UNICAM

SP.800



for routine U.V. analysis and Complete Automation

Spectrophotometer

For faster and even more efficient operation Unicam offer a set of automation accessories.

SP.820 Constant Wavelength Scanner
SP.825 Programme Controller
SP.830 Automatic Cell Changer
SP.850 Scale Expansion Accessory

Facilities are provided for the automatic interchange of up to 4 sample and 4 reference cells, automatic re-cycling over any preselected wavelength range and automatic recording at predetermined time intervals.

Many time consuming operations become simple with Unicam automation, particularly

ENZYME REACTION RATES
MONITORING LIQUID COLUMNS
ALL ROUTINE SPECTROSCOPY

Specification

SP.800A—Double beam recording ultraviolet and visible spectrophotometer with linear wavelength scale 190-700 mμ. Complete with tungsten and deuterium lamps, automatic lamp interchange, fused silica prism in thermostatted monochromator, automatic slit programme, attenuator combs giving linear absorbance scale 0-2A, photomultiplier detector and automatic gain control, integral flat bed recorder, holders for standard cells in both normal and second sample position with two 10 mm. stoppered silica cells with case, instruction manual, 300 sheets chart paper, ring binder for completed spectra, test filters for wavelength and stray light, two absorbance scale attenuators, set of fuses and one spare pen.

SP800B—As SP.800A but with linear wavelength scale 190-850 mμ and special red sensitive photomultiplier.

SP800C—As SP.800A but with linear wavelength scale 52,500 cm^{-1} to 14,000 cm^{-1}.

SP.800D—As SP.800A but with linear wavenumber scale 52,500 cm^{-1} to 11.500 cm^{-1} and special red sensitive photomultiplier.

This elegantly styled instrument automatically records absorbance against wavelength or wave number throughout the ultraviolet and visible region of the spectrum. One of four different models may be selected to suit the applications in hand.

Performance

Wavelength (SP.800A, SP.800B)

Accuracy ± 0.4 mμ at 200 and 250 mμ, ± 2 mμ at 500 mμ.

Reproducibility ± 0.1 mμ at 200 and 250 mμ, ± 1 mμ at 500 mμ.

Wavenumber (SP.800C, SP.800D)

Accuracy ± 40 cm^{-1} at 50,000 cm^{-1}, ± 80 cm^{-1} at 20,000 cm^{-1}.

Reproducibility ± 15 cm^{-1} throughout range.

Photometric

Accuracy ± 0.02A

Reproducibility ± 0.005A

Absorbance Zero Flatness

± 0.01A (adjustable)

Resolution

190-370 mμ, 0.1-0.4 mμ; 370-700 mμ, 0.4-2.0 mμ.

Stray Light Less than 1 % at 200 mμ.

Sample Compartment

9.4 × 4.9 × 4.8 inches high.
24.0 × 11.0 × 12.5 cm high.

Overall Instrument Dimensions

37 × 23 × 15¾ inches, 211 lb weight.
94 × 59 × 40 cm, 96 kg weight.

REPRESENTED EXCLUSIVELY IN NEW ZEALAND BY

GEO. W. WILTON & CO. LTD.

Box 367, WELLINGTON **Box 1980, AUCKLAND**

JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. 29, No. 5 OCTOBER, 1965

Presidential Address: Conference 1965

LOOKING AHEAD

PROFESSOR S. SIEMON

Previous presidential addresses have varied from scholarly papers and reviews to comments about the organization and work of the Institute. During the twenty years I have had the privilege of membership I recall in the first group a magnificent address by the late Dr. R. O. Page, who not only told us about protein chemistry but in passing let us know his own contribution with all that modesty and delightful humour that make him live vividly in the memory of so many of us. I recall others—Dr. F. G. Soper on Wool, Dr. J. Melville on Photosynthesis, Professor J. Packer on Organic Reactions, with no attempt to be exhaustive. Other notable addresses have dealt with professional matters and aspects of New Zealand's industrial development, always with an eloquence and humour which amply refute claims that scientists cannot express themselves. I cannot hope to match Parton's philosophy or Brooker's humour, but it seems to me that the best addresses were about the subjects which engaged the enthusiasm of the President of the time. So these shall be my subject, or subjects, for as you all know well, I can never confine myself to one narrow line fo activity.

Recently I left the relatively homogenous and egalitarian community of New Zealand for the more cosmopolitan environment of Australia, an experience always stimulating to thought on social questions. So my address concerns the status of chemists in the community—concerns professional status. Presumably the community measures the status of our profession by the income it allows our members. If so, among the accepted professions which are about twenty in number, ours does not stand as high as some in terms of median salary, or the fraction of qualified members obtaining more than a salary which is regarded as barely adequate. At age fifty, for example, our members can reasonably expect to receive only about two-thirds of the income received by members of two more favoured professions offering personal services. And whereas fifty to seventy per cent of some professions receive what might be described as a generous income, for us it is only twenty per cent. For some of these occupations the training period is no longer, and I venture to say makes fewer intellectual demands as assessed by the usual intelligence probes applied to students. Yet in this age everyone is more dependent on our activities than he realizes. Without chemical insecticides and fertilizers we could not produce the food to feed our evergrowing population. Indeed the production per acre in New Zealand has probably trebled in the last two decades largely as a result of these agencies and could soon treble again. The human population growth itself is at present directly affected by the products of chemical industry, not merely restricted by starvation and disease. Health is not only improved by use of chemical products, but some polymers may soon replace bones, arteries, and other vital organs like the heart. Chemical products are essential to primary, secondary and tertiary industry and to modern transport. Fuel industries are now chemical factories, metallurgy is a chemical process and synthetic materials are normal constituents of clothing, building and machinery.

Man's first concerns are for food, clothing and shelter. If chemical products are essential to all of these, it is surprising that chemists do not receive more recognition for their part in producing these. I suspect that this is because the connection is not obvious. Until very recently man was responsible for providing for his own basic needs by his own efforts, and he does not yet really appreciate the contribution of others to them. Hence professions offering personal services can establish their claims for remuneration more readily. Also, the profession of chemistry tends to be confused in the public image with science on the one hand and technology on the other, e.g. in picture strip features in the daily press. To the general public science tends to mean space shots, atom bombs and artificial kidneys. Significant as they are, they hardly affect the lives of men to the same extent as equally spectacular events concerning farm production or water recovery or fuel production. Unfortunately, scientists have at times attached to themselves an appearance of arrogance which is quite unbecoming in an occupation alleged to be based upon absolute honesty of mind and a love of truth for its own sake. A kind of religious enthusiasm can be accompanied by an obvious pharisaism that is as prejudicial, intolerant and over-confident as that of the original Pharisees long ago. Sometimes "Science is a Sacred Cow" as Anthony Standen called it in 1950 and this creates a very bad impression outside the profession. We have no right to feel that inevitable progress as we see it will solve all problems. Improved means are not inevitably applied to better ends. There is no better illustration of this than atomic energy, but it demonstrates just a repetition of the experience of Nobel half a century before.

In retrospect there have been many fine chemists whose work, often brilliant, pioneering, and demanding has brought to them too little public recognition and to their profession too little reward. The names of many of these you can find in the Institute publication "Twenty-five Years of Chemistry in New Zealand". All those chemists were such that to them a job well done was sufficient reward. But all were very strongly conscious of the importance of their profession and the significance of the contribution chemists can make to New Zealand society.

It has never been the policy of professional associations to lobby for salary or canvass professional status. These are regarded properly as the reward accorded by society for the job we do. Our responsibilities are to do the work well and to see that what we do is known to society. How we go about these will decide whether we really merit the epithet "profession".

In his attitude to his work a professional man defines himself. He deals in service to society. This is recognized in law. For example, it is assumed that when a professional chemist invents some process, even if the idea is born in the weekend, the rights belong to his employer, because it is believed that a professional man gives his undivided loyalty to his employer's interests. The professional man finds his profession meaningful in that he makes not money but good health, good law, good products. This implies that he is a student all his life. He attempts to broaden his learning and extend his interests. He seeks new techniques and better materials. No matter how much progress is made he is restless in seeking even better, more reliable methods. This process depends heavily upon communication from one to another and the meetings of the Institute of Chemistry provide an important forum for this process. The universities have their part to play and so we have arranged from time to time post-graduate courses in association with the universities. I think we should do much more of this last activity. There seems much more real demand today for the specialist conference and the concentrated course than for the ordinary meeting and the conference of general interest.

So I recommend to the Council of the Institute and to the Branch Committees that they further develop the series of evening post-graduate lectures and vacation courses that have already been exemplified, and encourage the universities to co-operate in this. If necessary the subscription might be increased to provide for this. As far as I can find out our subscription is the lowest in the world and quite out of proportion to today's incomes. The courses should not be limited to lectures because they are easy to arrange and pay for. Courses in new analytical and research tools should be of a practical type. Perhaps research laboratories in D.S.I.R. and other agencies could help with this as they usually are exceptionally well equipped with plant and techniques. The increasing numbers of teachers among our membership should not be forgotten in this connection. They are responsible for the quality of our future members. The Institute could organize colloquia on the teaching of chemistry at schools for university, industry, research staff and secondary school teachers. Broadening courses in physics, numerical mathematics, analogue and digital computers are also called for.

Communication has become so important between technical men, and between them and the general public, that we should be trying to improve our communication techniques. It would be useful to give regular opportunities to members to improve their ability to communicate by means of debates and colloquia on technical subjects. It might be considered that each member has some responsibility to take part in these in order to improve his performance in this respect.

This would result also in better informed members who naturally would take a bigger part in forming plans and policies of the Institute. During the first twenty-five years the percentage attendance at meetings was very high, but since 1955 there has been a falling off in percentage attendance, no doubt due to other attractions. I do not believe that real interest is less but that present day needs are different and demand different methods. A more vocal membership might help committees to plan programmes.

At the beginning of this talk I mentioned the importance of communication between the profession and the general public. The value of "Chemistry in Action" lectures to school pupils has been appreciated for some time and has made quite a contribution to recruiting to the profession and to relations with the schools and parents of pupils. But the much larger aspect of public relations, with the vast public to whom chemistry is a form of black magic, is hardly touched. This demands of members of the Institute skills in three areas, speaking, writing and human relations.

Something has been said of speaking already and I shall consider technical writing later. On the matter of human relations the Institute could make a contribution through its post-graduate lectures. I notice a wide variety of people taking an interest these days in industrial management but there are few chemists among them. If we let this go by default we have no one to blame but ourselves if the salary plums go elsewhere, and we find ourselves being supervised by members of other professions, or worse. The Institute could profitably encourage members to attend courses in management or even arrange such courses itself. The latter would have the advantage of being pitched at a level suited to members. Some of our members have been singularly successful in this function already, but many must be passed over, classified as "back room boys" probably because of no expressed interest or proved preparation. I suppose most of us enter chemistry with a view to practising chemistry, but the hard facts are that the rewards are in the area of manipulating people, not reagents, and most of us finish up doing this anyway, whether we wish it or not. Even if management is not our aim, a better understanding of how the manager thinks will help us immensely in our relations with him and in our presentation of both verbal and written reports.

In all of science a great deal of communication is done by writing, not only papers for other chemists to read but also documents for management, and occasionally for the general public. It is here that our public relations are weakest. Our papers and reports are written badly. We fly from appearing in public and when we do we insist on the disguise of the "expert" and confine ourselves to giving "facts" wherever possible.

On the subject of the technique of writing we must lean on our secondary school and university teacher members for help. Indeed they should also take seriously comments about public speaking. The subject of English for matriculation should be taken more seriously than it is by and for students intending to major in science. Perhaps a separate course is needed, directed more to communication than to literature, and containing more practice (liberally criticised) in writing and speaking. The same detailed criticism is needed in dealing with laboratory reports in universities. It is granted that this demands more teachers and lecturers, but the results may be rewarding.

However, our writings should not be confined to technical papers in learned journals. Our speaking should be extended to include a wider audience than that at Institute meetings. We should seize opportunities to explain to those not expert in our subject what our objectives are and how we go about our work. We should take part in matters of decision where there are connections with our concerns, even if we seem to be running the risk of getting on the territory of the economist, for example. As I said before, we need to see to it that our education is broadened so we can better understand general problems. Actually, we have the advantage there, because it is much more difficult for others to learn about our speciality than it is for us to learn something about activities of wider interest which have less specialized language. We may learn by taking some risks in having opinions based on the best of our knowledge, even if other experts appear to prove us wrong. Actually they will most likely want to co-operate.

As an instance of the value of such writing and speaking I may point out the efforts of my former colleague, Dr. T. Hagyard, which are directed to audiences of Progress Leagues, Chambers of Commerce and so on. Those efforts have undoubtedly got people thinking seriously about the best use of our electricity resources. How valuable they are I did not really realize until I suffered the charges for electricity elsewhere.

I should like to take this opportunity to support Dr. Hagyard's case for a chemical industry in New Zealand on a much larger scale than at present. Both American and Australian experiences find that it pays to establish chemical industry even if tariff protection is needed until the advantages of increased scale outweigh the setting-up problems and the high initial costs.

Over the period 1945-46 to 1963-64 the output of the chemical industry in Australia (not including fuels, metallurgy, building materials) has increased from ten millions pounds to eighty million pounds, with a total capital investment of one hundred and ten million pounds, and an import saving of sixty million pounds, per annum. Eighty per cent of raw materials are local and twenty per cent are imported. In Australia the economy has grown four or five per cent per year, but the chemical industry has grown fifteen per cent, and allied products like fuels and building materials six to eight per cent. So it can be seen at once that chemical industry is a vital factor in a growing economy. Roughly, chemical industry in New Zealand occupies the same position as it did in Australia before the second world war, so the situation seems ripe for the same sort of relative development.

A characteristic of the chemical industry is that it tends to make valuable products from raw materials which would be otherwise wasted or not used. E.g. chlorine from salt (not otherwise separated from sea water), alcohol from molasses (spread on farms or burnt), plastics from petroleum naphtha (now in surplus supply in Europe because of the great demand for fuel oil, and able to be purchased at prices below or about equal to that of crude oil—£9/10/- per ton landed in Australia in big quantities. cf. £8/10/- to £10 for crude oil), sulphuric acid and superphosphate from the hydrogen sulphide which contaminates petroleum fractions (otherwise burnt, creating a nuisance in the area). In Australia eighty per cent of local raw materials are used. In Japan a much lower proportion of local raw materials are used, and success is still achieved.

Chemical industry fulfils a vital technological role in the community in building up technological skills, both within it and in subsidiary industries around it, such as in plant manufacture, plant maintenance, supplies etc., and provides a vital component in defence. Indeed the vast DuPont company was largely begun in response to a defence need in the newly independent U.S.A. Related are the aid and stimulus that chemical industry gives to the construction industry (of seventeen million pounds of capital development in Australia, fifteen million is spent on local labour and materials) and to services (three million four hundred thousand pounds p.a. for electricity, of which one million four hundred thousand are for the strictly electro-chemical industries). Incidentally the rate of investment in this industry in Australia is ten times what it was at the end of the second world war.

The prices of locally produced chemicals have been falling faster than those produced overseas (fourteen per cent, compared with ten per cent in Japan and five per cent in West Germany, over 10 years). They have been stationary or rising in U.K., Canada and U.S.A. And they are falling where costs of local production have been generally rising (eleven per cent). Hence chemical prices tend to stabilize the inflationary process. This is of course, a reflection of the continuous improvement in productivity. (The added value per factory employee for chemicals is two and a half times the average for all manufacturing, and twice that for iron and steel. As in New Zealand, pulp and paper comes in between). With regard to tariff protection it has been estimated that the industry returns a net gain over the cost of tariff protection of 1.7 : 1, and in addition of course, pays taxes at the rate of about fifty per cent of its profits. As the plant capacity has increased by ten times, the total fixed investment has increased by only four times, so that the capital charges are correspondingly lower. Incidentally, plants in U.S.A. tend to be five to six times larger again, which would further halve the capital charges. Japanese success in the international market is based on putting in oversize plants and working them hard.

For New Zealand with its excessive demand for labour, the development of large scale continuous processes as in the chemical industry, with low labour requirement, is attractive. Plant utilization in the Australian chemical industry is about seventy-two per cent compared with eighty per cent in U.S.A. and thirty per cent in New Zealand industry generally.

Other attractions are the wide variety of products produced, many of which can be raw materials for other processes (Australia makes 520 products from 11 basic raw materials), the wide substitutability of chemicals and processes, the rapid and persistent introduction of new products and processes, the quick growth of the market and the extensive use of research and development. In U.S.A. for example, only in the aircraft and electrical equipment industries is more money spent on research and development, than in the chemical industry. Most of this money is from government sources, whereas the chemical industry spends from its own resources the greatest absolute amount and the greatest proportion of all industry (around one thousand million dollars). In Australia, the chemical companies are spending each year about four million pounds, of which one company spends one million seven hundred thousand pounds on research and development. This is increasing at a rate of seventeen per cent compared with fifteen per cent per year for production of chemicals. The comparison between this figure and the total production of eighty million pounds per year, and profit after tax of six and a half million pounds is rather startling. The effect on employment of chemists is obvious.

To return to the main theme—status implies leadership among men. Our professional status will only be earned by accepting the responsibilities of leadership; being prepared to exercise informed judgment and to express opinion in public wherever it seems called for. It involves the unending task of increasing knowledge, and of applying it to the service of the community. It involves adherence to a code of behaviour that brings credit to the profession.

I hope I shall see more chemists taking a part in activities not strictly chemical in nature. Those chemists who have done so have left a valuable and lasting impression on New Zealand. If we have something to contribute, and I think we have, then let us make our contribution. Our profession can only gain thereby and our country will, I am sure, be the better for our efforts. New Zealand possesses the climate, the food supplies and, I believe, the social tradition to become the best country in the world to live in. I should like to see the chemists make their fullest contribution to its economic and social development.

NEW ZEALAND GEOCHEMICAL GROUP

At the University of Otago on 18th August 1965, during the Annual Conference of the New Zealand Institute of Chemistry, a meeting attended by twenty-one interested persons unanimously approved a motion by Professor D. S. Coombs, seconded by Mr. A. H. Horn, to form a New Zealand Geochemical Group. Officers elected were Dr. J. Rogers, Chairman, Mr. S. H. Wilson, Secretary, and Dr. A. Ewart, with power to co-opt. This motion crystallised a recommendation from a meeting chaired by Dr. A. J. Ellis at Lower Hutt during the centenary of the New Zealand Geological Survey.

The New Zealand Geochemical Group plans to promote discussion and co-operation in geochemical problems between scientists of different disciplines and backgrounds by newsletters, and symposia at conferences. Liaison is also proposed with Geochemical Societies overseas.

It is hoped to arrange a meeting of the group during the International Symposium on Volcanology in New Zealand between 21st November and 3rd December 1965. A considerable number of geochemists from overseas will be attending the Symposium. Anyone interested in joining the group is invited to register with Mr. S. H. Wilson, Institute of Nuclear Sciences, Private Bag, Lower Hutt.

MINERAL CHEMISTRY — LOST ART OR NEGLECTED SCIENCE

(Text of address given to Conference, 1965)

I. E. NEWNHAM
Division of Mineral Chemistry, C.S.I.R.O.

The twenty-five year period from 1885 to 1910 was an exciting time for mineral chemists in Australia and New Zealand. An industry which had been controlled by miners suddenly sensed the tremendous contribution which could be made by chemists and metallurgists, and a new era commenced.

In both countries the move towards mineral chemistry originated in the gold mines. As early as 1868 the quartz rock of Victoria presented recovery problems and the 20-year-old chlorination technique of Plattner was tested by the Port Phillip Company at Clunes. In 1885 the process was further studied at Mt. Morgan where a fine-grained ore, assaying ten ounces to the ton, was yielding little better than two ounces after conventional amalgamation treatment. Three successive plants failed to solve the problem and it was finally left to "Captain" Richard to show that the dead-roasted ore would, after leaching in open vats with chlorine-water, yield a solution from which the gold could be precipitated on charcoal.

Australia's first venture into mineral chemistry was soon over-shadowed by events on the other side of the Tasman. In 1887 a Scottish chemist, J. S. MacArthur, had shown that a weak solution of potassium cyanide would dissolve gold, and two years later J. McConnell erected the first commercial cyanidation plant at the Crown Mine, Karangahake. Within a year the new process had spread to the Rand and thence to Australia and North America.

An American Immigrant

The excitement of this period has been portrayed in the recent writings of the Melbourne historian, Geoffrey Blainey. In "The Peaks of Lyell" and "The Rush That Never Ended" he tells the story of Robert Sticht, a young American who, after graduating from Clausthal, returned to his own country convinced that pyritic smelting should be an economic proposition for the Rocky Mountain copper ores. At that time sulphide ores were usually roasted, prior to smelting in a blast furnace, and fuel consumption was high. Sticht contended that the oxidation of iron sulphide should alone provide sufficient heat to smelt a copper ore, and he designed a smelter based on this principle. His first attempt in Montana failed but he continued his experiments until in 1893 he encountered a sample of ore from Mt. Lyell, Tasmania. Convinced that this was at last the ideal ore for pyritic smelting, he accepted an invitation to build the Mt. Lyell smelters and arrived in Tasmania in 1895. Within eighteen months he had erected two 150-ton blast furnaces which he planned to operate on unroasted ore. The drama of his first run is described by Blainey:

> In a nervous, hushed atmosphere, broken only by rain drumming on the iron roof, he lit the furnace and supervised the charging of coke, ore and white silica into the roaring inferno. Shortly after midnight he tapped the furnace, and a stream of molten orange slag glided into the waiting slag pots. The furnace was working so quickly that six men, constantly wheeling away the glowing pots, could barely cope with the work. In the early hours of the morning the front gate of the furnace was knocked open, releasing the copper matte which hissed into firebrick-lined trucks. Assays revealed that little copper was lost in the smelting. But for singed beards and burnt arms, the smelters were a brilliant success."

Thus encouraged, Sticht continued his experimenting although his youthful failure in Montana seems to have left its permanent mark; we read that in his early days at Lyell he refused employment to R. M. Murray (later to succeed him as General Manager of the Company) because the "mine risked its efficiency by employing inexperienced graduates"!

Concurrent with Sticht's success runs a strange record of failure by the adjacent North Lyell Mining Company. Although endowed with skilled overseas directors, with adequate financial resources, with the metallurgical experience of MacArthur (of cyanidation fame), and with a richer ore-body than its competitor, this company slipped from one set-back to another. There is pathos in the account of MacArthur's attempt to cope with the problems of his antipodean mine.

"At one smelter", writes Blainey, "Robert Sticht was winning world renown. At the other smelters, nine miles away, J. S. MacArthur, whose skill had won millions of ounces of gold from mines and tailing dumps, was ruining a world-wide reputation. MacArthur, it seems, was a brilliant water metallurgist, but a poor fire metallurgist. Scotland's capital in the North Lyell Company was gathered through his prestige and lost through his folly."

It is ironical that MacArthur should have concerned himself unsuccessfully with pyrometallurgy in Tasmania when there was a cyanidation problem awaiting solution in Western Australia. The telluride ore-bodies were proving recalcitrant and a team of German chemists moved into Kalgoorlie to study new methods of cyanidation. They developed the bromosyanide reagent by treating their ore with an horrific mixture of cyanide, bromide and acid. It is regrettable that their leader, Ludwig Dhiel, is today remembered more for his introduction of the tube-mill than for his daring in the field of mineral chemistry!

Mineral Chemistry

But the real saga was yet to come. The problems of Lyell and Kalgoorlie had their counterpart at Broken Hill. As the rich carbonates and chlorides gave way to sulphides the specific gravity of the zinc ore approached that of the worthless gangue. At the close of the 19th century the mines were recovering 70 per cent of the lead, 50 per cent of the silver and none of the zinc—by 1903 the value of the metals in tailings dumps amounted to £30 million.

One of the most enterprising companies of the period was The Sulphide Corporation, which was formed in 1895 to produce zinc by an electrolytic process from the Central Mine orebody. The pilot plant at Cockle Creek did not support the claims of its English inventors but, undaunted by this failure, the company turned its attention to the German proposal of magnetic separation. This technique, though successful, was extremely hazardous to human health and in 1904 the company experimented with the Cattermole process, in which agitation of the ore with oleic acid in the presence of alkali produced sulphide granules which sank to the bottom of the container.

In the meantime Vincent Potter, a Melbourne brewer, had used the principle of a 100-year-old Welsh discovery to show that, in the presence of sulphuric acid, sulphide particles could be floated away from the tailings residue. While Potter worked on the developmental stages of his process, G. D. Delprat, the general manager of the Broken Hill Proprietary Company, approached the same discovery by another route. Searching for a method of forming sulphates in the tailings, he boiled samples from the dump with salt-cake and produced a sulphide scum which floated away from the barren gangue. In less than two years the mine staff of B.H.P. converted this laboratory discovery into a machine which operated successfully for the next twenty-one years.

During this period Potter had continued his tests in the plant of a neighbouring company. Litigation with Delprat inevitably ensued, and one of the witnesses called by Delprat was Auguste de Bavay, head brewer at Foster's in Melbourne. De Bavay's imagination triggered off yet another ore-floating process in which the sulphide particles were coated with oil; after six years' development, the de Bavay cone saw service for a further seven years.

A further significant contribution came from the Sulphide Corporation where a basic principle of modern flotation practice was discovered when the Cattermole process was accidentally operated with a deficiency of oleic acid; a froth resulted and the mineral particles floated instead of forming granules. Working in conjunction with Minerals Separation Ltd., an English company, the Sulphide Corporation developed froth flotation as a substitute for the magnetic process, and launched a new technique on the ore-dressing world.

The rapid development of the Delprat process and the slow evolution of the Sulphide Corporation froth process were soon to be matched by yet another success story at Broken Hill. Following the spate of rumours concerning new separation processes, the American Herbert Hoover gathered together a syndicate whose purpose was to buy tailings dumps and extract the zinc. In 1905 the Zinc Corporation was floated and Potter, whose lengthy lawsuit with B.H.P. was still in progress, was elated to have his process selected for development. Within a year Hoover switched to the froth process from the Central Mine and subsequently to the Elmore process—a novel English vacuum technique. After treating more than 700,000 tons of tailings in three years the Zinc Corporation reverted to the Minerals Separation cell in 1910. A succession of four plants in five years bore tribute to the financial reserves rather than the metallurgical acumen of the company, but it was the rising tide of mineral chemistry which finally started to earn dividends for the Corporation in 1912.

Blainey states that "in innovation and adaptation no mining country matched Australia in this triumphant era of world metallurgy".

A Lost Art

You will all be aware that a major theme of this Dunedin Conference is "the part chemistry is playing, and will play, in New Zealand's economy"; that your guest speakers are to concern themselves with the present and the future; and that I have spent more than half of this lecture discussing Australian history! It is even possible that some of you believe that mineral chemistry left Otago a century ago with William Skey, and that it is a subject no longer of interest to this South Island. If such is the case it is because we differ in our definition of mineral chemistry. The story of 1900 is not a record of chemical discoveries made by a group of academics working in a protected environment. It is an account of scientists and engineers who developed new processes under the close and pressing scrutiny of groups of company directors. This to me is the true role of mineral chemistry—the conversion of scientific novelty into economic viability. If you accept this definition you will find the message of 1900 is of vital significance to the chemist who seeks to play some part in the moulding of his country's economy.

In the pages of Blainey's books I see four characteristics which are relevant to our position today. If you look again at the story of Sticht you will be impressed by his *perseverance.* He was forty-five years old when he perfected pyritic smelting, and we might note that Delprat was the same age when he discovered his flotation process. Between the Montana failure and the Lyell success lay twenty years of single-minded devotion to an ideal. The chemist who seeks to serve industry must first establish a background of experience—MacArthur is a salutary reminder that the expert in one field cannot automatically transfer his credentials to another.

As you read the life of Delprat you will find yourself attracted by his *personality.* This man, who established a steel industry at the age of sixty, won co-operation from all sections of the Broken Hill community. The transition from a laboratory idea to an industrial process in less than two years is a feat almost unknown to the technologist in 1965, and it bespeaks an outstanding talent for organisation and co-ordination, coupled with an ability to convince others of the significance of scientific data. It is pertinent to note at this point that Delprat was an engineer by training. No matter how brilliant his discovery, the chemist will always be dependent on the man of vision and enthusiasm who can project the message of his new process into the Board Room.

But the Directors can be deluded and the early days of the Sulphide Corporation illustrate the good fortune of any chemist whose company shows a true sense of *perspective.* Undaunted by the failure of its electrolytic experiments, this stripling corporation installed a German magnetic plant while waiting for its chemists to develop a satisfactory flotation process! If today's chemists are to make significant contributions to the nation's economy they must collaborate with those companies which are convinced that the scientific successes of tomorrow are not necessarily circumscribed by the failure of yesterday.

Finally I detect in the story of the Zinc Corporation the over-riding significance of financial *perspicacity*. In my opinion the most exciting aspect of mineral chemistry today is the willingness of large mining companies to support research by Australians in Australia! The Australian Mineral Industries Research Association encourages adventurous academic research in a most practical manner, and I know of no better stimulus to creative thinking than the assurance that industry is interested.

A Neglected Science

For fifty years the concept of collaboration between chemistry and industry has received scant attention in Australia and New Zealand. The chemist has shown little concern for the needs of industry and the industrialist has relied on overseas chemistry for his ideas and processes. When I joined the C.S.I.R. Division of Industrial Chemistry in 1947 I found myself in an atmosphere where the traditional opposition to things Australian was being challenged; and as I watched the uranium project develop under R. G. Thomas, the first Chief of the Division of Mineral Chemistry, I subconsciously noted the four characteristics of a successful research programme.

I learnt first of all that the *perseverance* of T. R. Scott and P. Dixon had established a background knowledge of uranium chemistry; and that it was Dixon who had made the basic discovery that Radium Hill ore could be treated with dilute acid. Then I was privileged to work alongside J. N. Almond and to note the impact of his *personality* on the project. I sensed the vital need for close collaboration between the chemist and the chemical engineer during the early development stages of a process. Almond was destined to manage the plant which was erected at Port Pirie, but before he left the Division I became aware of the skilful planning of the South Australian Department of Mines. Behind the success story of Radium Hill lay the sense of *perspective* of men like S. B. Dickinson, who could pass on to the chemist an appreciation of the politics of uranium oxide production.

For a time the security barrier prevented me from recognising the significance of the final step in the process, and it was only in later years that I heard of the role of the Joint Purchasing Commission with its financial *perspicacity*. Here again the "feed-back" of information from the economist to the chemist was to ensure that the Pirie plant would prove a commercial success.

Are we still neglecting these lessons of 1900 and 1950? I believe that close attention to the four fundamentals of perseverance, personality, perspective and perspicacity will ensure that Mineral Chemistry plays its true role in the development of our respective economies.

CHEMISTRY IN THE UPPER ATMOSPHERE

by

B. P. SANDFORD

Physics and Engineering Laboratory, Department of Scientific and Industrial Research, Lower Hutt.

It may perhaps seem odd that many people think of the study of the upper atmosphere, a mixture of gaseous atoms and molecules in dynamic equilibrium, as solely a topic of physics. Should not this equally be a field of chemistry?

The term upper atmosphere is a rather loose one. It is commonly applied to the region which lies between an altitude of 17 km. (11 miles) and several hundred kilometres (hundreds of miles). The reason why it has in the past been the concern of physicists rather than of chemists becomes clear when we consider the history of the subject. The achievement of long distance radio communication and the resulting discovery of the ionosphere gave man his greatest single urge to discover more about the upper atmosphere. The radio waves themselves have been used by physicists to discover a great wealth of information. Other sources of information, again predominantly used by physicists, have been studies of absorption of sunlight and starlight in the ultra-violet, visible and infra-red regions of the spectrum, the absorption of cosmic rays and the emission of aurora and airglow. All these ground-based methods were frustrating, because by themselves they could not provide sufficient details of the composition, temperature and motions of the gases which are essential for a full understanding of the atmosphere.

The balloon was the first vehicle that was able to enter this region but unfortunately it has a maximum ceiling of 45 km. With a useful payload the ceiling is not much above 30 km. Although the balloon can only enter the lower part of the upper atmosphere, it nevertheless has been used extensively because of its relatively low cost and its long flight time lasting days at constant altitude. The development of the rocket, and its off-spring the artificial satellite, has been the significant factor in opening up high altitude research to other disciplines. The rocket and satellite can carry miniaturised versions of ordinary laboratory equipment allowing direct in situ measurements of parameters like pressure, density, composition and wind velocity which previously had been inferred indirectly from the ground-based data. In the last twenty years, these more accurate data have turned upper atmosphere research from a relatively speculative science into a more exact science. As this is the minimum of information needed for a critical study of the chemistry of the region the rocket and satellite have really opened this field to the chemist. The reaction rates of chemical processes are very fundamental to the understanding of the atmospheric equilibrium. Physicists are now demanding information and are looking to laboratory chemists to provide detail on reaction rates, particularly for systems involving oxygen and nitrogen. In cases where pressures are so low that mean free paths are impossibly long in the laboratory, there is a big demand for scientists to devise experiments that can be sent by rockets into the atmosphere where there are no walls to interfere with the reactions. Chemistry and physics are thus becoming closely interwoven in this field which is now commonly called "atmospheric sciences". In this paper some aspects of the relevant chemistry are briefly considered.

The upper atmosphere is mainly a mixture of N_2 and O_2 at very low pressure (10^{-4}mm. Hg. at 100 km., 10^{-6}mm. at 200 km.) under the influence of strong solar ultra-violet radiation during daylight hours. The ultra-violet is absorbed predominantly by photo-excitation, photo-dissociation and photo-ionization processes. Molecular oxygen is almost completely photo-dissociated above an altitude of 200 km. where atomic oxygen becomes the most abundant species. At night time when the ultra-violet is cut off atomic oxygen remains the most abundant species because its half-life is of the order of years. Atomic nitrogen does not become a major constituent because N_2 is not directly dissociated by ultra-violet. However, it is produced indirectly from photo-ionization processes.

Photo-ionization plays an important role because the free electrons produced, by acting as efficient reflectors of radio waves, make long distance radio communication possible. The region where the ions and electrons are produced is called the ionosphere whose height is controlled by the photo-ionization cross-sections of atmospheric gases. Because there is a mixture of gases the maximum production rates occur in three regions known as the D, E and F regions of the ionosphere, shown in Fig. 1. As N_2, O_2 and O are the main neutral constituents at ionospheric heights it might at first be suspected that the ions of these three species would be the most abundant ones. However, this is not the case. As ions are chemically very active they interact with the neutral gases to produce new species. An example of the multitude of reactions in systems containing ions of oxygen and nitrogen species is illustrated in Fig. 2 which gives what are considered to be the main ionic reactions in the ionosphere (from Nicolet and Swider). The left side of Fig. 2 shows the photo-ionization reactions giving rise to the ions whilst the right hand side gives the neutral species resulting from the ionic reactions. Some of the gross features of the ionosphere can be explained by these reactions.

It can be seen that the nitric oxide ion is the end product of many reactions but that this ion can only be lost by dissociative recombination. In the E-region of the ionosphere the ion reactions with the neutral gases predominate so that the E-layer is composed almost entirely of NO^+, in spite of the fact that nitric oxide is only a minor constituent of the neutral gas. Since NO^+ dissociates when it recombines with an electron, the ions of NO are not a source of neutral NO. In the F-region of the ionosphere the pressure is so low that the reactions with the neutral gases are relatively slow, therefore the ion of atomic oxygen, the most abundant neutral gas, is the most abundant ion.

The molecular ions all ultimately recombine with electrons by the dissociative recombination reaction giving rise to atomic oxygen and atomic nitrogen as shown in Fig. 2. These atomic species are chemically very active, giving rise to another host of reactions between neutral species which must be considered before it would be possible to predict the composition of the neutral atmosphere. Because the ultra-violet emission from the sun varies from instant to instant, in a seasonal manner and in an eleven-year cycle due to the solar sunspot cycle, the rates of photo-reactions vary all the time and the composition is therefore not constant. There are other factors which alter the equilibrium. Since many of the reactions are temperature dependent, the relative importance of the reactions will change with temperature. Diffusion and mass transport both horizontally and vertically are also important in considering the equilibrium, just as they are in the weather at the earth's surface.

At night time the solar ultra-violet is cut off and the left hand series of reactions in Fig. 2 ceases but the remainder of the reactions continue. The E-region then virtually disappears due to recombination. Fortunately for users of short-wave radio the recombination processes are much slower in the F-region due to lower density and the F-region does not disappear at night. In the auroral zones and polar regions, energetic electrons and protons originating from interactions between particles from the

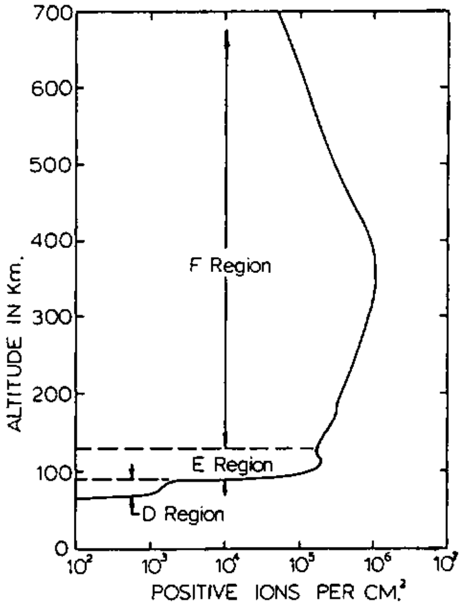


FIG. 1

The number density of positive ions as a function of altitude on a typical day at noon.

FIG 2

A schematic diagram of the main ionic reactions in the upper atmosphere illustrating the complex behaviour of this system composed of only two atomic species.

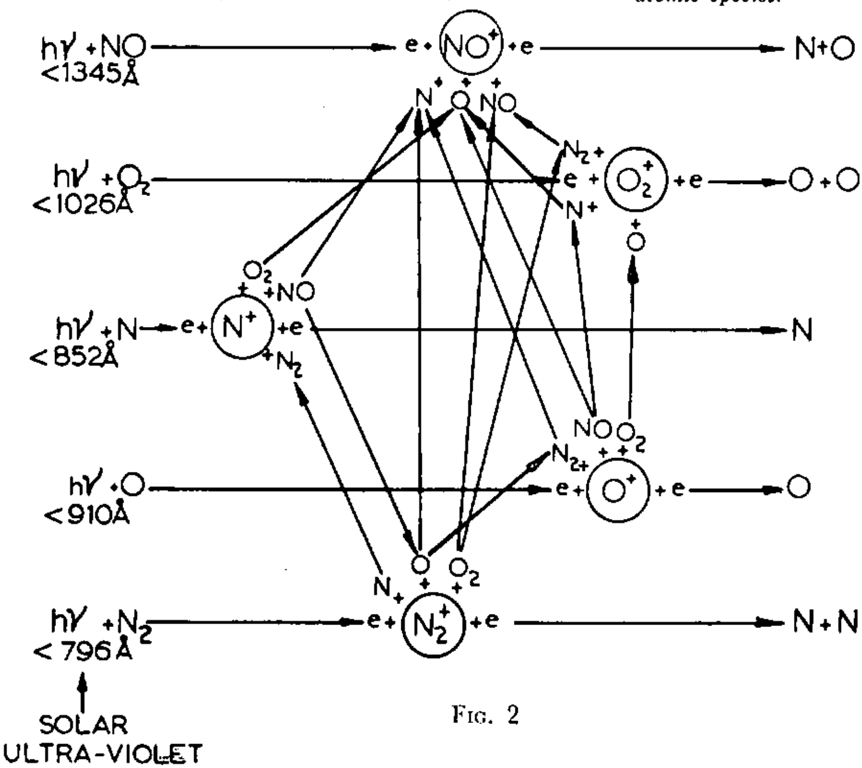


FIG. 2

sun and the earth's magnetic field continue to produce ions by collision processes, so that ion production is not completely stopped at night.

During the recent total eclipse of the sun in North Auckland, a series of rockets was fired into the shadow of the moon to investigate ion-recombination in the D-region. When the sun sets at dusk the geometry of the situation, refraction of light and non-uniformities of the atmosphere, make it difficult to know accurately just how much sunlight is still illuminating the high altitudes. On the other hand, during a total eclipse of the sun, the moon suddenly cuts off the solar ultra-violet as if a switch had been thrown. Scientists find this situation a far easier one to examine theoretically and experimentally. The North Auckland rockets were used to measure the change of ion concentration in the D-region before, during and after the moon had cut off the ultra-violet radiation. In this way information was obtained on the rates of the recombination and ionization reactions in Fig. 2. This is an example of one way in which the reaction rates can be measured.

A model of the daytime composition of the atmosphere under conditions of moderate solar activity is shown in Fig. 3. This is an assembly of details, some theoretical and some actual measurements, from many recent papers, and consequently should be taken only as a guide. Large fluctuations will in any case occur from day to night and over the period of a sunspot cycle. The only parts of this figure that are reasonably reliable are the amounts of O_2, N_2, O and n(+), the quantity n(+) being the number of positive ions.

It might be asked why we want to know the composition in such detail. Even though the proportion of nitric oxide is less than one part in 100 million at an altitude of 80 km. it is the first significant constituent, as one descends through the atmosphere, which absorbs the intense Lyman-α radiation from the sun. It so happens that O_2, N_2, and O all have holes in their absorption spectra and the Lyman-α radiation penetrates these major constituents with negligible absorption. The NO absorbs the Lyman-α radiation by photo-ionization, giving rise to the D-region of the ionosphere. In the D-region the collision frequency of the atmospheric particles is so high that radio waves tend to be absorbed rather than reflected. It is because of this that Australian broadcasting stations cannot be heard in New Zealand in the daytime. After sunset the Lyman-α flux is cut off, the D-region rapidly disappears by recombination, and the

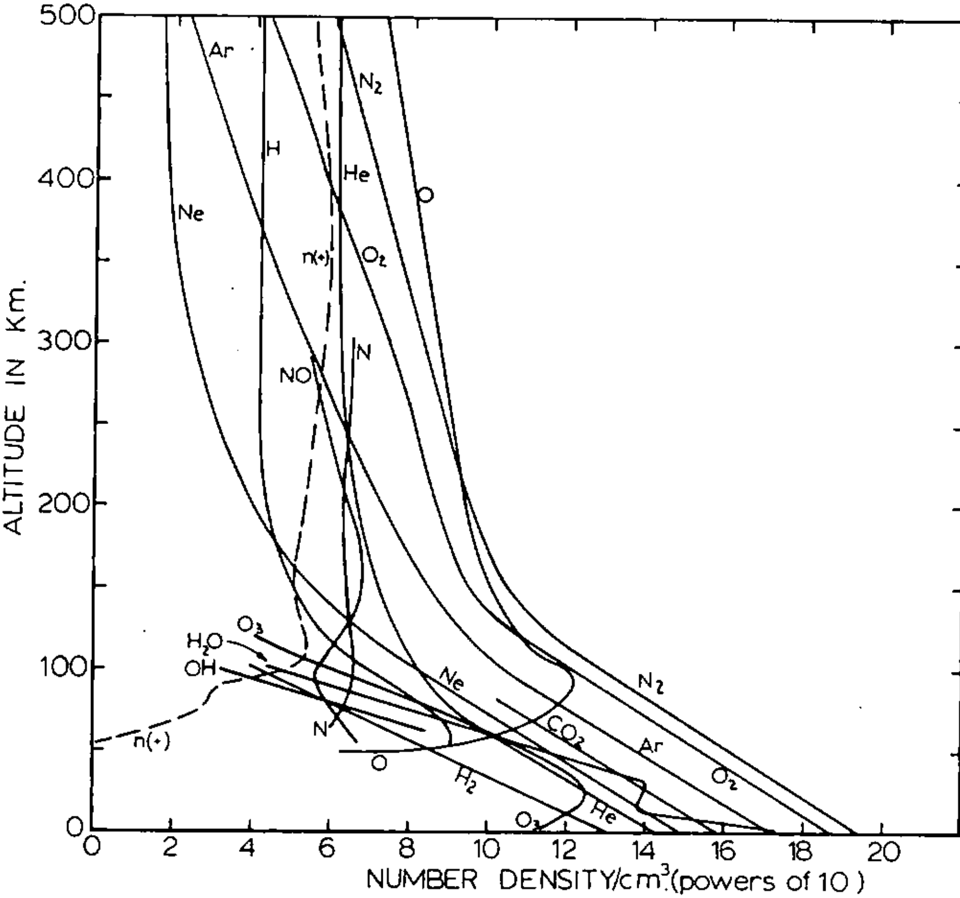


FIG. 3

A model of atmospheric composition showing variations of composition with height.

Australian stations start to come in on our broadcast sets. At altitudes around 20 to 40 km. the trace constituent ozone absorbs a major part of the sun's near and far ultra-violet radiation which would otherwise cause sunburn that the human body could not tolerate.

It is then quite clear that chemical reactions play an important part in the equilibrium of the constituents. With rocket and satellite-borne mass spectrometers and allied instruments we are on the verge of being able to measure the composition, including trace species at particular instants. If we knew the reaction rates of all interactions between the atmospheric components it would be possible to make much more accurate estimates of solar ultra-violet flux and particle influx, which are the main sources of the important but unstable ions and excited species. Although less than 2 per cent of the sun's electro-magnetic radiation is absorbed in this region, this includes all the solar radiation at wavelengths less than 3,000 Angstroms (the far and extreme ultra-violet). Recent investigations indicate that this energy could well have an appreciable influence on the weather of the world. A full understanding of upper atmosphere chemistry could possibly play an important role in long-range weather forecasting.

As we are still very far from the ideal situation of knowing all the required reaction rates there is a demand for scientists to devise experiments both in the laboratory and in the upper atmosphere to determine these quantities. Reactions of excited and ionic species will also figure more in the future chemical industry. With the advent of the plasma jet it is possible to efficiently heat gases to temperatures of up to 30,000°C. In these conditions all material in the jet is highly ionized and excited. Already acetylene can be efficiently produced by injecting powdered coal into a hydrogen plasma jet. The new research into electric power production by magneto-hydro-dynamic generation and from high temperature nuclear reactors may give us large volumes of high temperature gases which may be used for fixation of nitrogen and other useful chemical processes as by-products of power generation.

It seems quite clear that gas reactions, particularly those involving excited and ionic species, are going to play a more important role in the chemistry of the future. The upper atmosphere provides a large laboratory free of wall effects in which such reactions may be profitably studied.

References and further reading

Massey, H. S., & Boyd, R. L., "The Upper Atmosphere", Hutchinson, 1960.

Nawrocki, P. J. & Papa, R., "Atmospheric Processes", Prentice-Hall, 1963.

Nicolet, M. & Swider, W., Planetary and Space Sci. 11, 1459, 1963.

Ratcliffe, J. A., "Physics of the Upper Atmosphere", Academic Press, 1960.

THE COMPUTER AND THE CHEMIST

Text of an address given to the Auckland Branch by

D. HALL

Chemistry Department, University of Auckland

When F. J. Llewellyn came to Auckland in 1948 and established the X-ray crystallography group, he discussed before this Institute the objects and methods of the work, and *inter alia* emphasised the long and tedious nature of the calculations involved. Indeed, for many years, both the quality and quantity of the work accomplished by all crystallographers was directly controlled by their ability, or perhaps willingness, to cope with the long hours required on calculation, and not only their talking but their very thinking was dominated by this factor. Crystallographers have then, perhaps more than any other type of chemist, been keenly interested in the development of computers, have been prime movers for many of the computing centres now established all over the world, and have been the principal users in not a few of them.

The University of Auckland was very late in its decision to establish a computing centre, but we have certainly adhered to the above pattern. The sheer necessity for the X-ray crystallography group to have its own facilities was one of the foremost reasons for the acquisition of the computer, and we have consistently been the major user. Much of my own effort in recent years has been concerned with the development of the computer laboratory, and it is this aspect of our work which I wish to discuss tonight.

I find interest is shown in the computer by fellow chemists almost without exception. There are very few fields in chemistry, in science, in life in general where computers have not found application, and articles concerning them abound in every type of publication. In spite of this I find very few who have any notion of what a computer really is, of what it does or how it works. The popular articles make little attempt to explain this, and tend to surround the computer with a mystique, giving the impression that it is quite beyond the comprehension of the normal mortal. This is simply not true. I do not doubt that many who are aware of possible applications in their own field are deterred by this erroneous concept of difficulty, and it is with the hope of lowering this barrier that I give this lecture on the computer for the chemist.

The lecture will be oriented towards a particular computer, the I.B.M. 1620, as this is the machine we possess, but the principles to be discussed are perfectly general. To keep it in perspective I will attempt to place the 1620 in the hierarchy. Firstly it is about as small as a scientific computer can meaningfully be, and the ancillary equipment to be seen in our laboratory is absolutely minimal. The computer is fully transistorised, and when developed some four or five years ago incorporated many of the most up-to-date developments in the field. Developments in microcircuitry which have followed from the U.S. space programme have, however, led to major advances within the last year or two, and by today's standards the 1620 is not only small but very slow. It is nonetheless a very useful and useable machine, but it should be remembered that it represents a minimum of attainment in 1965.

What is a computer? In essence it is a highly developed version of an adding machine, such as many of you may have on your desks. It can add numbers together. Sometimes this is done using an accumulator, an adding device similar in principle to the mileage gauge on a car. Sometimes this is done by referring to a built-in addition table. The latter type of computer can usually multiply as a distinct process (i.e. it also has a multiplication table) but commonly a computer will multiply by repeated addition—37 × 5 is effected as 37 + 37 + 37 + 37 + 37. It can add algebraically, i.e: it can handle negative numbers, and thus subtraction is essentially the same process. Division, as with all digital calculating machines, is a laborious process of repeated subtraction. The problem 7 ÷ 2 is effected thus:

2) 7	
−2	
—	
5	check—is this negative—if not add 1 to quotient—i.e. quotient = 1
−2	
—	
3	not negative—quotient = 2
−2	
—	
1	not negative—quotient = 3
−2	
—	
−1	negative!—ignore the last subtraction—final quotient—3, remainder 1

These basic operations represent the total of the computer's abilities in the mathematical, or rather arithmetical sense, and it can be seen that they are not necessarily accomplished very elegantly. What is remarkable about the computer is the speed at which the operations can be performed electronically. On the 1620, two 10-digit numbers can be added in $\frac{1}{1000}$ of a second, two 5-digit numbers can be multiplied in $\frac{5}{1000}$ of a second, and even the inefficient division of a 10-digit number by a 2-digit number requires only $\frac{15}{1000}$ of a second. And here it must be remembered that on present day standards the 1620 is rather slow.

An essential feature of any computer is its memory unit. This is essentially a device on which certain numbers can be recorded such that they can be referred to when required. The mileage gauge of a car is a familiar example of a small numerical memory. A gramophone record is another type of memory—the information is stored permanently and when required can be produced by means of a suitable device. The magnetic tape of a tape-recorder is another and many computers use tapes as auxiliary memory devices. But to match the above operating speeds a memory unit is required which gives near-instant access to the stored numbers, and today this is done using magnetic core assemblies. A core is a tiny ring of ferromagnetic material, which can be magnetically polarised in either of two senses, by passing a current in the appropriate direction through the wires which thread the cores. The polarisation is permanent until it is reversed, i.e. the core can remember the direction of the last current to pass. A digit is represented by the polarisation pattern of four such cores, thus:

0 is	represented	by	↑	↑	↑	↑
1 „	„	„	↑	↑	↑	↓
2 „	„	„	↑	↑	↓	↑
3 „	„	„	↑	↑	↓	↓
4 „	„	„	↑	↓	↑	↑
5 „	„	„	↑	↓	↑	↓
6 „	„	„	↑	↓	↓	↑
7 „	„	„	↑	↓	↓	↓
8 „	„	„	↓	↑	↑	↑
9 „	„	„	↓	↑	↑	↓

(This is the binary-decimal number representation. A fifth core is used to represent the sign, positive or negative. The polarisation can be set in times of the order of microseconds and can be read by means of sensing pulses equally rapidly, i.e. a number can be read into the memory, or read from it, in such very short time. The 1620 has a memory capacity of 20,000 digits.

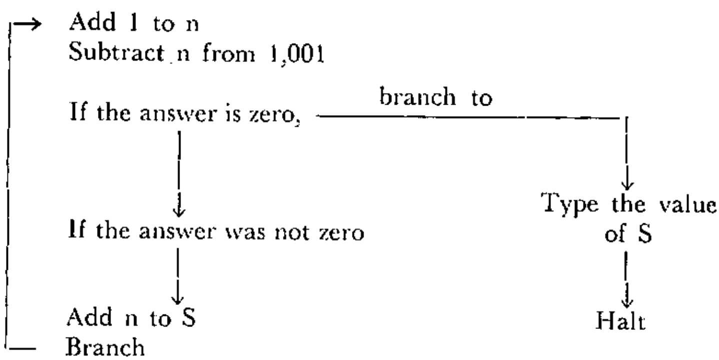
Operating speeds such as have been mentioned would have little value if it were not possible to eliminate human intervention between steps. It may take a competent operator only seconds to decide on the next step and to press the necessary buttons, but a second is a very long time to the computer. One of the main functions of this memory is to hold the programme or the sequence of instructions for the particular calculation. Any calculation, no matter how complex, can be broken down into basic arithmetic steps, and this must first be done. Each operation is specified by an instruction, which is expressed in a code form as a 12-digit number. For example, 21 12845 07382 means "Add the number which is stored at memory location 7382 to the number stored at memory location 12845". The programme is the full set of such instructions which will accomplish the required result, and this is stored in the memory. Once started, the computer works its way through the full set of instructions without intervention from the operator.

The power and economy of such a procedure is not apparent until one appreciates that most lengthy calculations involve considerable repetition, the same steps being required over and over again. Much of this repetition can be avoided in the programme by the use of a "branch" instruction which tells the computer to go back to an earlier point in the sequence of operations and start again. As an example, a programme for the sum $1 + 2 + 3 + 4 + \ldots$ could be written as follows. Two working numbers, S and n, must first be defined and these would be held in some specified location in the memory. These should both be zero at the beginning. The programme would read:

```
|→  Add  1 to n
|   Add  n to S
|—  Branch
```

As n and S were initially zero, n firstly goes to 1, and S also to 1. Then branch back to the beginning, where a further 1 is added to n, and n becomes 2, S becomes $1 + 2$. Next cycle n becomes 3, S becomes $1 + 2 + 3$, and so on. This continuous cycle is known as a loop, and will perform the summation indefinitely. Most actual programmes contain many such loops.

It is obvious, however, that it would be necessary to stop the summation at some point, i.e. at some specified value of n, and that the programme would not do this. Now we come to one of the most interesting features of the computer, its ability to make decisions and hence to simulate thought. In fact, a computer can only think retrospectively. It can know what it has just done, and can make decisions if they are made dependent on past events. One form of this awareness is that indicators are set after every arithmetic operation (addition, multiplication, etc.) denoting whether the answer was positive, negative or zero. The computer can then remember the state of the last arithmetic result and a "branch" operation can be made to be conditional upon it. In our example, let us assume that the summation is to stop when n reaches 1,000. Then the programme could read:



For the first 1,000 cycles the answer to the subtraction would not be zero and the programme would continue as before. But at the beginning of the next cycle n would assume the value 1001, the subtraction would give zero difference, and the calculation would cease, with S at the value of 1 + 2 + 3 + . . . + 999 + 1000. This may be considered a fairly crude thought process, involving as it does a wasted subtraction on every cycle. It is true that the amount of arithmetic in a calculation is substantially increased in this way, but this is a triviality as against the power now available—the ability to make a controlled decision. Actual calculations may involve very many and very complex situations in which decisions are required, but provided that these can be expressed arithmetically they can be handled in a similar way.

Computers are frequently used not for actual calculation but for processing large quantities of data. For example, the Auckland Hospital Board proposes to record on magnetic tape the case histories of all patients that pass through their hospitals. When a new patient is admitted his name and identifying characteristics will be fed to the computer, which will scan all of the records, extract the information pertinent to this patient, and thus compile his medical history. Magnetic tape can be scanned very rapidly, but how does the computer recognise the name, etc. of a particular patient? Firstly the computer can handle alphabetical information by means of a code, wherein two numerical digits are used to represent each alphabetical character. The letter A in the 1620 code is 41, B is 42, C is 43 and so on up to Z which is 69. Special characters such as a full stop, comma etc. can also be represented, and even a blank space has its equivalent. The name of our secretary, for instance, would appear as:

G R A H A M   W H I T E

47594148415400664849634 5

If the name were fed to the computer it would be held in the memory as that number; if it were to scan records looking for one headed by that name, it would in fact look for one headed by the same number. And how does it know if two numbers are the same? By subtracting one from the other, and then checking to see if the answer is zero. Once again, the problem is formulated as if it were arithmetic, and then it is within the computer's power.

It is hoped that these somewhat simplified examples have illustrated the manner in which a computer does operate, and that more of you may thus be emboldened to use this tool which is now available to us.

Members Incommunicando

Would members knowing the present whereabouts of D. A. Morrison or Dr. J. D. Saunders please advise the Registrar.

Instrument Survey

The instrument survey by A. H. Horn has been completed. It covers an extensive array of instruments which are used in New Zealand laboratories. The collection is tabulated under types and makes of instruments, and the laboratories which have them. An enormous amount of work has gone into producing this reference list.

Copies will be sent to all laboratories which contributed to the survey, and to Branch Secretaries for distribution to members who require them.

CONFERENCE RETROSPECT: A PERSONAL IMPRESSION

If it is possible to say that a theme developed at the 1965 Conference (apart from the themes formally imposed by the Conference Committee) then that theme was publicity and public relations. The Minister of Science, The Hon. B. E. Talboys, started it with his plea in his opening address that chemists make the results of their researches more widely known to industry and more intelligible to the layman. Both points were referred to a number of times during the Conference and were discussed at the Annual General Meeting. This theme was also widely publicised in the newspapers and by the N.Z.B.C., on both television and radio.

Guest speaker Ivan Newnham in his lecture said that publicity was often the last thing that industry wanted. He gave examples to show that collaboration between a research organisation, such as his, and industry was a delicate matter to be handled with the utmost care. The Editor, Miss J. M. Mattingley, was asked in an interview for the N.Z.B.C. (parts of which were used in three separate broadcasts, including News Review) how chemistry could be made more intelligible to the layman. Her reply, in part, was that communication was a two-way process and that if the public was to be better informed it would need to learn some of the language of Chemistry. The lack of communication is not entirely the fault of the chemists.

Professor Duncan raised the question of public relations at the Annual General Meeting, while at the same time seeking publicity for the Mössbauer Conference to be held next year. In fact, as the Conference Chairman, Dr. J. Rogers, pointed out, the Press coverage of the1965 Conference was very extensive. This was no doubt a result of the good relations existing between the Conference Committee and local reporters—newspaper, radio and television.

The Conference was very well served by the principal speakers, in particular by Mr. I. E. Newnham. His lecture, "Mineral Chemistry: Lost Art or Neglected Science", developed around the themes Perplexity, Personality, Perseverance and Purse, showed him to have a lively personality as well as a lively appreciation of what could be done for industry, or, in some cases, what industry could be lead into doing for itself. Both Mr. Newnham and the President, Professor S. R. Siemon, discussed the development of New Zealand industry and mentioned a point which has been made a number of times at Conferences over the last few years. This is that New Zealand problems must be solved within New Zealand; it is a myth that overseas experience and research can be directly applied, without modification, to the New Zealand situation. It would be a worthwhile public relations job to dispel this myth.

In sessions devoted to research papers it was again apparent that, in many cases, too little attention had been given to presentation. Some slides were illegible and it was a fortunate chairman who did not have to contend with speakers running over time. In some cases the papers presented bore little relation to the published abstract. Could it be that some papers are not compiled until long after the abstract has been written? If more use were made of abstracts more time would be available for discussion, provided of course that the audience had read the abstract. However, despite defects in presentation, there were many lively papers and, so far as the writer could judge, there was a lot of good chemistry to discuss.

There were two programme innovations at the Conference, both of which seem to have been favourably received. The first was leaving Wednesday evening free. This enabled various groups, both formal and informal, to meet. The second was the spreading of visits over a number of days and having these at the same times as research papers. This seemed to give delegates more choice so that visits could be made to coincide with those sessions which were not of great interest to a particular delegate.

There can be little doubt that the Conference Programme was well arranged, finishing with the encounter at Carisbrook. The standard of accommodation provided by the Halls of Residence and of catering arranged by the University Union were both favourably commented on. However, the arranging of a Conference is now a major undertaking in both time and money and it may soon be necessary for the Institute to consider streamlining Conference by choosing, say, two sites and alternating Conferences between them. These sites should be such that facilities are of a high standard and accommodation is of the fully residential type. It is probable that the thought of the work involved in arranging a Conference was responsible for the somewhat less than enthusiastic reception, by Otago delegates, of the suggestion by Professor H. N. Parton that the 1969 Conference should be held in Dunedin, 1969 being the Centennial year of the University of Otago.

M.H.P.

The New Zealand Institute of Chemistry (Inc.)

THIRTY-FIFTH ANNUAL REPORT
for the Year Ending 31 July, 1965

Officers

President: Professor S. R. Siemon. First Vice-President: Dr. A. T. Johns. Second Vice-President: Mr. M. S. Carrie. Delegates: Auckland, Dr. G. A. Nicholls; Waikato, Dr. E. B. Davies; Manawatu, Mr. D. W. King; Wellington, Dr. P. P. Williams; Canterbury, Mr. A. T. Mitchell; Otago, Dr. J. C. Dacre. Immediate Past President: Mr. S. G. Brooker. Editor: Miss J. M. Mattingley. Registrar: Mr. D. J. Hogan. Hon. Librarian: Mr. S. G. Brooker. General Secretary: Dr. W. E. Harvey.

This is the first year during which, following changes to the Rules, the Institute has had two Vice-Presidents as members of the Council. Professor Siemon although overseas since the end of 1964, has continued to serve as President, with the First Vice-President chairing Council meetings in his absence.

Membership

Membership of the Institute has, during the past year, changed as follows:

Associates elected to Fellowship	10
New Fellows	5
New Associates	78
Resignations	9
Died	1

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

	1963	1964	1965
Auckland	134	155	170
Waikato	35	38	44
Manawatu	61	73	87
Wellington	185	197	215
Canterbury	103	105	109
Otago	74	83	94
Overseas	67	70	78
	659	721	797

Sub-committees of Council

1. *Standing Committee*

The Standing Committee of Council has met only infrequently during the year and the business transacted at these meetings has been mainly of a semi-formal nature.

2. *Journal*

Miss Joan Mattingley was appointed Editor when Mr. N. T. Clare resigned to proceed overseas. During the year the Council resolved to terminate the arrangement with Editorial Services Ltd. whereby that company printed and published the Journal in addition to providing other services. The Journal will continue to be printed in Wellington but certain services such as addressographing and duplicating will be carried out in Christchurch. It is believed that the cost of the Journal will not be materially altered by the new arrangements which are just beginning to operate.

3. *Examinations Committee*

The Examinations Committee based in Auckland has completed re-drafting the Regulation covering admission to Associateship by examination, and the new Regulation has been approved by Council. This has brought to a conclusion a project which has extended over several years, during which time there has been a great deal of discussion and thought devoted to this method of entry to Associateship status.

4. *Membership Committee*

Dr. J. C. Andrews, Professor R. D. Batt and Dr. W. A. McGillivray have dealt with a large number of applications during the year. Although the new Rules may have simplified in some ways the task of assessing the qualifications of applicants there continues to be a considerable number of applications which do not fall into a common pattern and which may require considerable time for scrutiny.

Institute Prizes

Prizes for 1964 were awarded as follows:

I.C.I. Prize—Professor R. C. Cambie.
Morcom Green Edwards Prize—Dr. D. J. Brasch.
Chemical Essay Prize—No award.

Conference 1964

The Annual Conference was held at Hamilton in the newly completed buildings of the University of Waikato. One hundred and seventy registered for the Conference, making it one of the biggest conferences in recent years. The financial surplus of approximately £80 was credited, as is usual, to the Overseas Visitors' Travelling Fund.

Royal Society of New Zealand

The Institute has been represented on the Council of the Royal Society of New Zealand by Miss J. M. Mattingley. During the year the changes to be made in the Royal Society Act and Regulations appear to have been finalised. This will bring about a considerable reorganisation of control of the Society but should not significantly affect the relationship which has developed between the Institute and the Society. The changes should improve both the power and the prestige of the Society and this can only be of benefit to member bodies.

The National Committee on Chemistry, on which the Institute is represented, has taken over the duties of the Sectional Committee, thus effecting a streamlining which the Institute supported from the beginning.

Overseas Visitors

Dr. J. S. Shannon from the C.S.I.R.O., Sydney, the guest lecturer at the Conference, subsequently toured New Zealand. No other overseas visitors have been supported by the Institute during the year under review although a number of distinguished scientists have visited this country with assistance from other organisations, and have delivered lectures in the main centres.

Programmes for School Children

Lectures for school children, mainly in the sixth forms, largely pioneered by the Canterbury Branch, are rapidly becoming a regular activity of most Branches. Although not organised by the Institute (as distinct from the Branches) these activities have always been welcomed by the Council and the publication "Chemistry in Action" has been financially supported for a number of years.

Financial

The Balance Sheet for the year ending 30 April 1965 shows an excess of income over expenditure of approximately £190, a decrease of approximately £120 when compared with the previous year. However, the overall financial position of the Institute has further strengthened during the period under review.

A. T. JOHNS, Vice-President.
W. E. HARVEY, General Secretary.

ADMISSION TO THE NEW ZEALAND INSTITUTE OF CHEMISTRY BY EXAMINATION

Regulation 1 has been redrafted by the Examinations Committee and has been approved by Council. It is now as follows:

Regulation 1.

1.1. To satisfy the requirements of Rule 8.2.4. a candidate seeking admission to the Institute by examination must comply with the whole of this Regulation.

1.2. The candidate shall reach the required examination standards in both written and practical chemistry as follows:

1.2.1. The requirement in written Chemistry shall be a pass in the written papers of a Stage III Chemistry unit of a New Zealand University, or, with the approval of Council, an equivalent examination of another University.

1.2.2. The requirement in Practical Chemistry shall be a pass in an examination conducted by the Institute and the standard of this examination shall be not less than that of a Stage III Chemistry unit of a New Zealand University and shall include Inorganic, Organic, Physical, and Analytical Chemistry and may at the candidate's option include a section in a particular branch of Chemistry nominated by the candidate and subject to the approval of Council.

1.2.3. In addition the candidate may be required to pass any further oral or practical test that the examiners may apply to ascertain the extent of the candidate's knowledge.

1.3. The Examination in Practical Chemistry shall be conducted in terms of the following:

1.3.1. The examination shall be of the equivalent of four days duration during which the candidate shall be at liberty to consult books of reference, provided however, that the examiners may require the candidate to carry out certain exercises without such aid.

1.3.2. There shall be not less than two examiners, at least one of whom shall be a member of the teaching staff of the Chemistry Department at a New Zealand University.

1.3.3. The examination shall be held at such times and places as the Council may determine. Normally the examinations shall be held in November of any year.

1.4. The candidate shall apply to the Registrar to be examined in Practical Chemistry and shall forward with his application:

(a) Satisfactory evidence of date and place of birth.

(b) An examination fee of fifteen pounds.

(c) Satisfactory evidence that the candidate has passed the written papers of a Stage III Chemistry Unit of a New Zealand University or an equivalent examination from another University.

This application to be examined shall be made not later than the 30th day of June of the year in which the candidate presents himself for examination provided however, that where the candidate—

(i) chooses to include a section in a particular branch of Chemistry of his nomination, or

(ii) offers in fulfilment of the pre-requisite of 1.4 (c) a qualification other than a New Zealand University qualification, the application to be examined shall be made not later than the first day of February of the year in which the candidate presents himself for examination.

1.5. No candidate shall be admitted to the Associateship by examination unless he has been engaged in the study and practice of chemistry for at least five years in a laboratory in which the standard of work is satisfactory to the Council.

(Note:—

1. Candidates may present themselves for examination in any year.

2. Candidates are advised to apply to the Registrar at an early stage for a decision as to the suitability of the laboratory in which they are working for the purposes of this Regulation.)

1.6. On completing the requirements of this Regulation 1 the Candidate shall become eligible to apply for election as an Associate in terms of Rules 5 and 8.

1.7. In cases of hardships Council shall have power to relax any of these Regulations and if necessary prescribe a special examination which shall be of a standard equivalent to that described in this Regulation.

BRANCH NOTES

CANTERBURY

Dr. A. M. Kennedy, formerly Senior Lecturer in Applied Chemistry at the University of Otago, has succeeded Professor S. R. Siemon as Professor of Chemical Engineering at the University of Canterbury. Professor Kennedy was a visiting lecturer in Chemical Engineering at the University of Canterbury from 1960 to 1963, before taking up the senior lectureship at Otago University. Prior to this he worked in the Chemical Engineering section of the Dominion Laboratory of D.S.I.R., and in the control and factory laboratories of J. Lyon & Co., London. He gained his Ph.D. from Cambridge University in 1954.

Professor Siemon has transferred to the University of Melbourne, where he will be head of the Chemical Engineering Department. During his twenty years in New Zealand he has become the first Professor of Chemical Engineering at the University of Canterbury, was Dean of the Faculty of Engineering from 1960 to 1963, was President of N.Z.I.C. in 1964, and has served on many national committees, including the National Research Advisory Council.

The Reverend Father K. A. O'Connor has transferred from St. Bede's College to take up a senior chemistry teaching position at St. Patrick's College, Silverstream.

Mr. P. Fitzgerald has transferred from Burnside High School, Christchurch, to become head of the Science Department at Southland Boys' High School, Invercargill.

Two new lecturers have taken up appointments in the Chemistry Department of the University of Canterbury. They are Dr. G. O. Osborne, who was formerly with Shell Research at Woodstock, England, and Dr. K. R. Ryan, who has been working at the Aerospace Research Laboratory, Dayton, Ohio. Dr. Osborne's main interest is the synthesis of insecticides containing phosphorus and sulphur. Dr. Ryan's work has been concerned with gaseous ion-molecule reactions, as studied by mass spectrometry. Earlier in the year Mr. H. K. J. Powell, formerly of Victoria University, was appointed as Lecturer in Inorganic Chemistry.

The Junior Chemical Society has been active, with a lecture from Professor A. T. Wilson, "Chemistry of Everyday Life", in March; a field trip to the Biochemistry Department of Lincoln College in April; also in April, a highly successful and well-enjoyed practical project whereby 14 selected students from eight schools spent a morning carrying out experiments and using various instruments in the University Chemistry Department; and a lecture from Dr. L. F. Phillips, "Reactions of Atoms", in June. The membership of the Junior Chemical Society is at present approximately 180 upper sixth form students from Christchurch

Mr. E. W. Hullett, Director of the Wheat Research Institute, a foundation member of the Canterbury Branch and a past President of N.Z.I.C., retired on June 30. He was farewelled by the Branch at a function chaired by Professor Packer, after the branch meeting on June 21. During his retirement he is to do consulting work in Auckland in relation to the baking industry.

Mr. R. W. Cawley, formerly Assistant Director of the Wheat Research Institute, has been appointed Director of the Institute on Mr. Hullett's retirement. He was Chairman of the Canterbury Branch in 1964. His own special interest is in the biochemistry of bread making, but he has also taken part in a wide range of the Institute's activities. He is a graduate of Auckland University, and, in addition to his experience at the Wheat Research Institute, he has been an Assistant Lecturer in Agricultural Biochemistry at Massey College, Assistant Factory Manager with T. J. Edmonds Ltd., and the holder of a C.S.I.R.O. Fellowship at the Bread Research Institute in Australia. In 1959-60 he led a New Zealand Alpine Club expedition which carried out exploration and survey work in the Beardmore Glacier region of Antarctica.

Dame Kathleen Lonsdale, F.R.S., who visited the university for six days at the end of July, gave a number of seminars on her crystallographic research at University College, London, and a public lecture entitled "Scientific Serendipities". During her visit she was staying with Dr. W. S. Metcalf of the University Chemistry Department.

Mr. B. H. Kerr has transferred from Thames High School to become Head of Chemistry at Burnside High School, Christchurch.

Dr. R. M. Golding of the Chemistry Division, D.S.I.R., Gracefield, visited the Chemistry Department for the week beginning Monday, July 19. He gave a series of five lectures on aspects of quantum chemistry, dealing especially with nuclear magnetic resonance, electron spin resonance, Mössbauer spectroscopy and the magnetic properties of transition metal ions.

MANAWATU

Massey University of Manawatu Building Projects

After over two years of planning by Ministry of Works surveying and architectural staff and private architectural firms, and after many hours of meetings and painstaking research by Massey staff, work has commenced on the University's building programme. During the next few years the sounds of heavy earth-moving equipment, concrete mixers and the contractor's hammer will become familiar. It is estimated that the cost of approved buildings totals two and a half million pounds, and that another one million pounds are involved in providing services. A further fixe to six million pounds worth are at the drawing board stage.

Preliminary contracts which precede major building activity are well in hand. Site preparation for the Veterinary block is virtually complete. Earthmoving equipment has been employed extensively on the first section of a new ring road (to be named University Road) which will eventually encircle the entire campus and provide vehicular access to new buildings. This is part of a plan to convert the central part of the campus into courtyards and lawns for pedestrians only. Traffic through the centre of the campus is already becoming a problem. The new road is on a curved alignment so as to blend aesthetically with the existing landscape and to open up interesting vistas on the campus. Great care has been taken both in planning and in construction to preserve as many trees as possible. Landscaping of the newer portions has been given great prominence by the architects.

All services (power, water, telephones, etc.) to existing and new buildings are underground in a large service tunnel, which will solve many problems of subsequent location of faults and maintenance. Building the duct is a major undertaking because it measures seven feet by five feet six inches internally, and is large enough for a person to walk through. When completed it will be about thirty chains long. Construction on the first twenty chains has begun and is expected to be completed in October.

Tenders have been called for the three-storey, 53,000 sq. ft. Library and Arts building which was designed by Kingston, Reynolds and Thom of Auckland. It will house all the library resources of Massey plus the Faculties of Humanities and Social Sciences which are now at Hokowhitu. Future plans are for these faculties to move into their own buildings by late 1967.

Working drawings prepared by the Government Architect for the Science Block are at an advanced stage and it is hoped that a start can be made shortly in conjunction with other buildings. The building is of four storeys and has an area of 101,000 sq. ft. This will provide badly needed space for the science departments which are at present cramped in the main building and in other quarters around the campus.

Drawings for the Veterinary Science block, sited to the west of the Veterinary Clinic, are almost complete. Construction will be in two stages—the first, of one storey, will cater for the most immediate needs of the Veterinary Faculty; the second, a multi-storeyed "tower block" is to be built later to cater for expansion in the faculty. Extra staff accommodation has been provided in a new wing erected at the Veterinary Clinic. A further block recently completed at the Clinic is temporarily housing the diagnostic centre and hospital, but it will be used from next year for the fourth and fifth professional years of the veterinary degree course. Eventually this block will become the small-animal house.

The Riddet Building for the faculty of Food Science and Biotechnology is nearing completion. Equipment and fittings are now being installed and the faculty should be well settled in its new home for the start of the next academic year.

Construction has commenced on a 28,000 sq. ft. Central Stores and Maintenance Building. Initially it will be equipped to teach Botany and Zoology until the Science Block is completed, thus relieving pressure on space in the present main building. The new building is of simple design (portal frame and single storey) and should be completed by the start of the 1966 academic year. The progressive transfer, over the next six months, of the Dairy Research Institute from the main building to their new building opposite the dairy factory will also help to ease the space problem.

Several other buildings are at the preliminary design stage. These include a building to house the Agricultural and Horticultural Science Faculty, an Administration Block and the Central Boiler House.

Student Centre and Hostels

With the successful conclusion in June of the University's £30,000 appeal and subsequent negotiations on the question of Government subsidy, it now seems clear that sufficient finance will be forthcoming for the Student Centre. Architects are Messrs. Warren and Mahoney of Christchurch who are preparing working drawings. The facilities in the building are urgently required for resident students (e.g. cafeteria and some common room space) as well as for non-residents and staff. The building is to be a two-storey structure having a cafeteria, common rooms, Students' Association, administrative offices and an auditorium-gymnasium with associated cloakroom and changing facilities.

Because of Massey's location in a relatively small urban area and its national responsibilities which mean an intake of students from all over the country, hostels are essential to its future growth and development. At present only 450 places are available on the campus for 1,200 students. By 1972 when the internal roll will probably be 3,000, about 2,000 of these students will require accommodation.

A number of organisations are actively participating in a drive to meet these demands. The University Council has authorised drawings to be completed for a 100-bed hostel which it hopes to have open for 1967. Money which qualifies for a £4 to £1 Government subsidy is being provided by Council largely from a weekly capital levy (10/-) which is included in each student's boarding fees, plus monies raised by allowing the use of hostel facilities by other organisations during vacations. This is a continuing scheme and consequently further amounts from these sources will become available each year.

The Palmerston North City Council proposes to raise a loan for £90,000, to provide hostel accommodation at the University. The total amount which will be available with subsidy will provide about 300 places. It is expected that at least some of these places will be available by 1968. This very significant and public-spirited action is unique in local body affairs in New Zealand and is deserving of considerable praise.

A combined committee of the Presbyterian and Anglican Churches in Palmerston North have underway a fund-raising programme for student hostels. The committee is appealing for funds in a wide area and has a 500-bed project in mind. Thus while perhaps 1,200 beds are in sight by 1972, this will be still short of the estimated requirements mentioned previously.

Science Degree

The biological sciences will receive greatest emphasis as far as science degree training at Massey is concerned. Regulations for a B.Sc. and B.Sc.(Hons.) have been approved, and it is hoped that the first students will enrol for the advanced course in 1966. Use of established departments is to be made and the range of subjects planned include Chemistry, Zoology, Botany, Pure and Applied Mathematics, Biochemistry, Microbiology, Physiology, Geography, and Psychology. The B.Sc. will be a three-year, nine-unit degree and selected students may take a B.Sc.(Hons.) course in specialist fields after their second year. Advanced training will also become available. It is hoped that Massey B.Sc. graduates will fill an increasing demand in New Zealand for personnel qualified in the biological sciences.

A feature of science teaching at Massey next year will be the introduction of two new subjects which will replace the traditional teaching of first-year botany and zoology, in all courses. To be known as Cell Biology and Multicellular Biology, the former will deal with the individual cell as the building block of living matter, while the latter will cover the aggregation of cells into multicellular organisms.

WAIKATO

Dr. R. Hodges a past Secretary-Treasurer of the Waikato Branch has resigned from the Ruakura Agricultural Centre. He has taken up an appointment with the University of Manawatu where he will specialize in Mass-spectroscopy. At present he is working with Dr. Shannon (Leader of the Organic Chemistry Group of the Division of Coal Research, C.S.I.R.O., at North Ryde, Sydney) for a six-month period before being stationed at Palmerston North.

Dr. D. E. Wright has an American Health bursary and has left for twelve months' research at the University of California, Davis.

Mr. K. R. Middleton, A.R.I.C., has joined the staff of the Ruakura Agricultural Research Centre (Soil Research Section). Ken Middleton for the last seven years has been on the staff of the Rubber Research Institute of Malaya, Kuala Lumpur. At the Research Centre he will work in the Plant Nutritional Section on problems relating to plant nutrition and fertilizer applications.

Work is well under way on the new laboratory to house the Soil Research Section of the Ruakura Agricultural Research Centre. The new building will house what was the Rukuhia Soil Research Station and provide extra space for the Animal Research Section, as well as allowing up-to-date facilities for a combined library. The building is expected to be finished and occupied within twelve months.

WELLINGTON

The 1965 Mellor Lecture was presented by Mr. T. A. Rafter, Director of the Institute of Nuclear Sciences. This was the second Mellor Lecture to be given by Mr. Rafter and it covered recent work by the Institute in the field of isotopic geochemistry.

Junior members of the Wellington Branch were addressed by Dr. M. D. Carr on "The Transition From School to University". The meeting was well attended and the students' discussion following the lecture was most stimulating.

Wellington Branch members have been fortunate to learn more of the industrial or money-making side of chemistry from two prominent industrial chemists. Mr. I. E. Newnham, who will be remembered as an entertaining after-dinner speaker by delegates to the 1965 Conference, emphasised mineral chemistry, while recent developments in organic chemistry were discussed by Mr. J. E. Cornish, Technical Manager, I.C.I. (N.Z.) Ltd.

The second Science Fair was held in Wellington from September 6 to 10. Among the many impressive displays by secondary school pupils from most colleges in the Wellington area were studies of factors affecting crystal growth, isolation of the constituents of the geranium plant and a model of a crude oil distillation plant.

THE REGISTRY

Fellow:

Rogers, John, M.Sc., Ph.D., Geochemistry Laboratory, Geological Survey, D.S.I.R., c/o Chemistry Dept., Otago University. (Officer in Charge.)

Associates:

Beatson, Ian David, M.Sc., Watkins Gardinol Chemicals Ltd., New Plymouth. (Production Manager.)

Dennison, Donald James, B.Sc., Wellington Meat Export Co. Ltd., Wellington. (Chief Chemist.)

Freeman, Colin George, B.Sc.(Hons.)(Cant.), Chemistry Dept., University of Canterbury. (Ph.D. Student.)

Galbraith, Walter Douglas, B.Sc., Unilever (N.Z.) Ltd., Hastings. (Quality Control Manager.)

Grigor, Bruce Anthony, M.Sc., Ph.D (Leicester), Chemistry Dept., Auckland University. (Lecturer.)

Leary, Gordon James, M.Sc., Ph.D.(Cant.), Chemistry Division, D.S.I.R., Gracefield. (Scientific Officer.)

McKeown, Robert Henry, M.Sc., Dept. of Pharmacy and Pharmacology, Medical School, Dunedin. (Lecturer.)

Myers, Donald Burton, Ph.D. (California), Wellcome Research Institute, Medical School, Dunedin. (Research Officer.)

Pybus, John, B.Sc., Central Laboratory, Auckland Hospital. (Biochemist.)

Peterson, Peter John, M.Sc., Ph.D., Plant Chemistry Division, D.S.I.R., Palmerston North. (Scientific Officer.)

Pickering, Frank Sydney, A.R.I.C., Ruakura Agricultural Research Centre, Hamilton. (Scientific Officer.)

Pritchard, Colin William, M.Sc., Philips Electrical Industries, Lower Hutt. (Production Manager.)

Ryan, Keith Ronald, B.Sc.(Hons.), Ph.D.(N.S.W.), Chemistry Dept., University of Canterbury. (Lecturer.)

Sullivan, Patrick Alexander, M.Sc., Biochemistry Dept., Medical School, Dunedin. (Ph.D. Student.)

van der Hooft, Johannes Theodorus, Kempthorne Prosser Ltd., Wanganui. (Production Superintendent.)

Thomas, Terence David, M.Sc., Dairy Research Institute, Palmerston North. (Biochemist.)

Winterbourn, Mrs. Christine Coe, M.Sc., Biochemistry Dept., Massey University, Palmerston North. (Research Assistant.)

COURSES ON SPECTROSCOPIC METHODS OF ANALYSIS

To be held at Victoria University of Wellington, October 19-29. Forms for enrolment are available from the Council of Adult Education, V.U.W.

COURSE 1: LECTURE COURSE (fee £4)

Tuesday, October 19

Spectroscopic methods of analysis—Dr. E. Sullivan (V.U.W.).
Errors in spectroscopic measurements—Prof. J. F. Duncan (V.U.W.).
Spectrometers and their uses—Prof. A. T. Wilson (V.U.W.).
Emission spectroscopy—Dr. R. Brooks (University of Manawatu).
Infra-red as an analytical tool—Dr. N. F. Curtis (V.U.W.).

Wednesday, October 20

X-ray fluorescence and diffraction—Dr. A. Freeman (V.U.W.).
Flame absorption methods—Dr. A. Walsh (Chemical Physics Div., C.S.I.R.O., Melbourne, Australia).
Ultraviolet techniques in organic chemistry—Dr. R. Hay (V.U.W.).
Nuclear spectroscopy I, Activation Analysis—Mr. W. J. McCabe (Nuclear Science Inst., D.S.I.R.).
Some films on Chemical Spectroscopy.

Thursday, October 21

Nuclear Spectroscopy II, Nuclear magnetic resonance—Prof. J. F. Duncan (V.U.W.), Dr. P. Williams (Chemistry Div., D.S.I.R.).
Nuclear Spectroscopy III, Mössbauer effect—Prof. J. F. Duncan (V.U.W.).
Electron spin resonance—Dr. M. Probine and Miss J. de Lisle (Physics & Engineering Lab., D.S.I.R.).

COURSE 2: PRACTICAL COURSE (fee £20)

Each day a class will be held in which worked exercises will be discussed. Otherwise the entire course will be devoted to practical work, and will last from 26-29 October.

1. **Worked Exercises**

Activation analysis and related topics—Prof. A. T. Wilson.
Infra-red/Raman—Prof. B. D. England.

Visible-UV—Dr. N. F. Curtis.
Emission—Dr. E. Sullivan.
X-ray—Dr. A. Freeman.

2. **Practical work**

Radioactive methods of analysis—Prof. A. T. Wilson.
Infra-red—Dr. N. F. Curtis.
Visible-UV—Dr. N. F. Curtis.
Emission—Dr. E. Sullivan.
Raman—Dr. E. Sullivan.
Fluorescence—Dr. E. Sullivan.
X-ray diffraction—Dr. A. Freeman.

It is hoped that a visit to D.S.I.R. at Gracefield can be arranged for Wednesday, October 27.

University Appointments

INTERNATIONAL CONFERENCE IN NEW ZEALAND
ELECTRON NUCLEAR HYPERFINE INTERACTIONS IN SPECTROSCOPY

to be held in Wellington, New Zealand, October 17-21 1966

This conference will be concerned with the theory and applications of all forms of spectroscopy. Those aspects which have developed as a result of recent theoretical and experimental advances will be emphasised. Instrumental methods, especially those involving new applications of nuclear techniques (e.g. Mössbauer and nuclear magnetic resonance spectroscopy) will be included.

Provisional suggestions for contributions for suitable papers are invited in the fields specified below. They should be sent to Dr. R. M. Golding, Conference Secretary, Royal Society of New Zealand, c/o Chemistry Division, D.S.I.R., Private Bag, Petone, Wellington, New Zealand. The closing date for final submission of papers is April 1 1966, but indication of intention to submit a contribution is requested by December 1965. When papers are accepted by the organising committee, authors will be requested to prepare a 400-word abstract before June 31 1966 for publication in the records of the Conference. These abstracts will be made available as preprints and after the Conference will be published by the Royal Society of New Zealand. The Conference fee (not including Conference Dinner) will be £2.

Papers are invited in the following fields:

1. **Theoretical aspects**

   Interpretation of spectra in various fields of spectroscopy.

2. **Scientific developments**

   Recent developments in the understanding of electron-nuclear interactions in molecules and ions in solid, liquid or gaseous state related to Mössbauer, nuclear magnetic resonance, electron spin resonance spectroscopy, ultra-violet, visible, infra-red, microwave, etc.

3. **Experimental techniques**

   New developments in experimental techniques in the above fields for using spectroscopy in analytical instruments in Physics, Chemistry, Geology, Medicine, Engineering and other fields.

4. **Applications**

   New applications of spectroscopy in Physics, Chemistry, Biology, Geology, Engineering, Medicine and other Applied Sciences.

NEW TOOLS FOR THE CHEMIST

DRUMMOND "MICROCAPS"

Disposable micro pipettes—calibrated lengths of precision-made capillary glass tubing designed for general microchemical applications.

ACCURACY — Within 1 %.

ECONOMY — So low in cost they can be discarded after use.

CONVENIENCE — Sizes available ex stock, 1, 2, 3, 4, 5, 10, 15, 20, 25, 30, 40, 50, 75 and 100 lambda capacity.

SAFETY — Invaluable for handling dangerous material.

RAPID ELECTROPHORESIS WITH "CELLOGEL"

Gelatinized cellulose acetate strips manufactured by Chemetron Chimica Ltd. offer these advantages:

TRANSPARENCY — Superb transparency readily obtained by gentle warming for a few minutes after staining strips.

FAST SEPARATION — Usually completed within two hours at approximately 125V.

SHARP SEPARATION — Alpha and beta globulins are split with clear separation. Pre- and post-albumin bands can be shown by using various buffers.

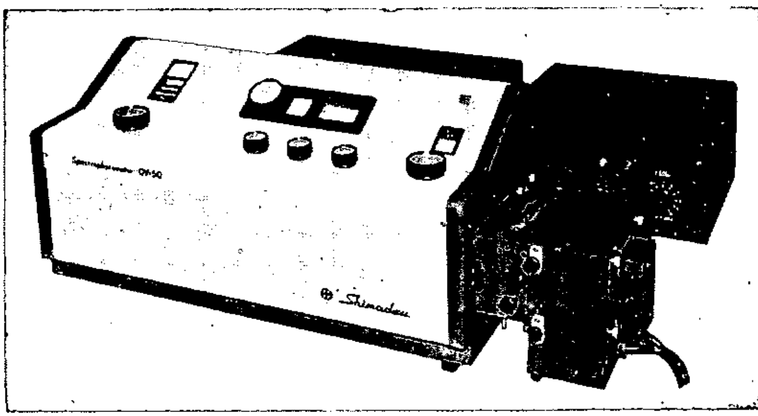
SIMPLE, REPRODUCIBLE RESULTS — The "gel" strips do not dry while handling, need not be cleared with oils, do not give any internal precipitation when wetted and are highly pliable.

Sole New Zealand Agent:

SCIENTIFIC & LABORATORY EQUIPMENT (N.Z.) LTD.

P.O. BOX 619, AUCKLAND **TELEPHONE 546-235**

NEW **SHIMADZU SPECTROPHOTOMETER** *QV-50*



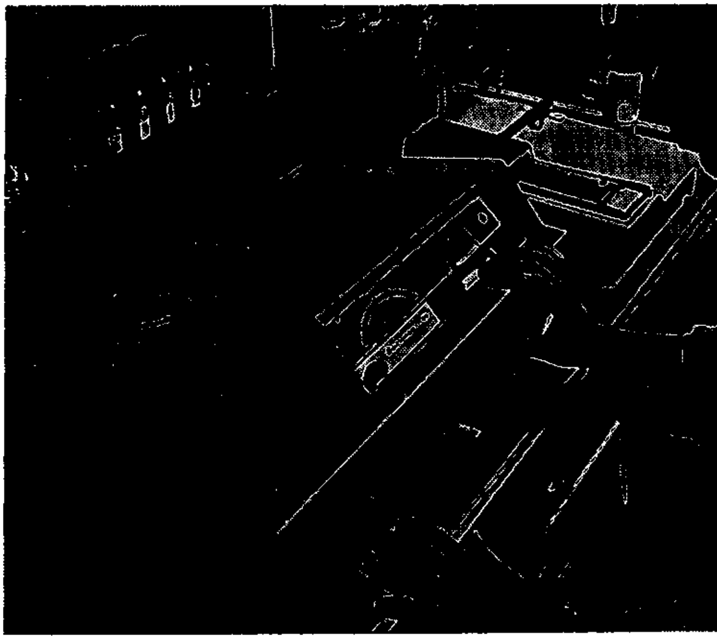
- RANGE 182 - 1200mu.
- MONOCHROMATOR SEALED FOR N PURGE
- TRANSISTORISED POWER SUPPLY.
- COMPACT — VERSATILE — STABLE.

RECORDING ACCESSORY UNIT NOW AVAILABLE

ALL Shimadzu Spectrophotometers are quoted inclusive of necessary accessories and installed in your laboratory.

TOWNSON & MERCER (N.Z.) LIMITED

AUCKLAND . . . WELLINGTON . . . CHRISTCHURCH



The BECKMAN DB SPECTROPHOTOMETER

is a compact, direct-reading, easy-to-operate *double-beam* instrument for making transmittance and absorbance measurements in the 205 to 770 mμ wavelength range. It is a low-cost instrument that can be installed in your laboratory for less than £1,150. The DB provides both the accuracy and the versatility usually found only in much higher priced spectrophotometers. Over five years user experience in New Zealand has proved the reliability of this instrument. The DB may be used as a direct reading instrument, or it may be made a double-beam ratio-recording spectrophotometer by connecting it to a recorder such as the Beckman Potentiometric Recorder or the Beckman Linear and Log Recorder, Combined with a Beckman Linear and Log Recorder and a Beckman Scale Expansion Accessory, the DB offers the versatility of double-beam ratio-recording spectrophotometers costing twice as much. The wide range of accessories available to increase the versatility of this instrument includes Sequential Sampler, Flow and Micro Cells, Programmed Scanning, Atomic Absorption, and Reflectance Attachment.

Full servicing and maintenance available from . . .

WATSON VICTOR LTD

16 THE TERRACE, WELLINGTON

Also at Auckland, Christchurch, Dunedin.

"Serving Science and Medicine since 1888"

Printed by David F. Jones Ltd.