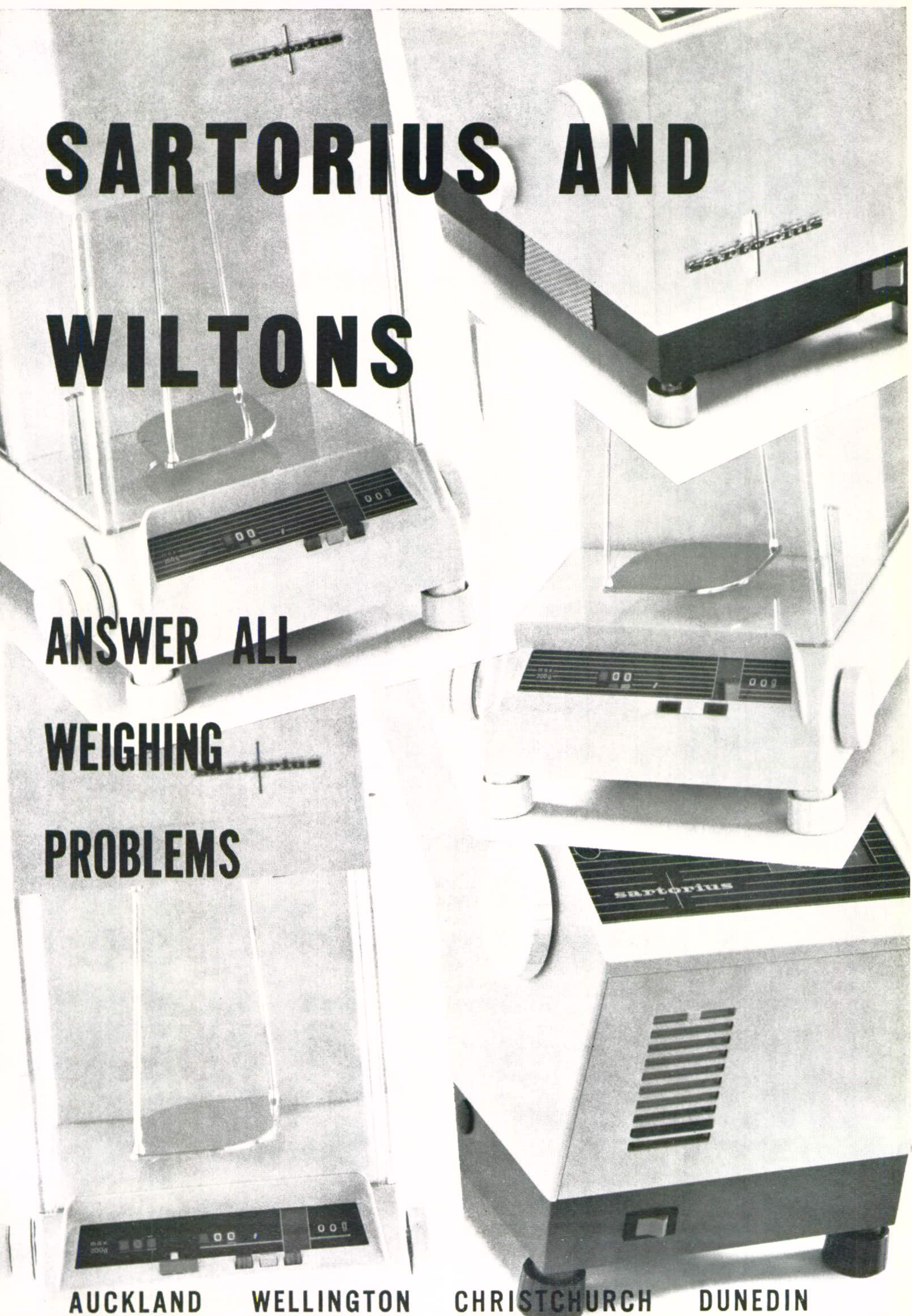
chemistry
in new zealand

april 1974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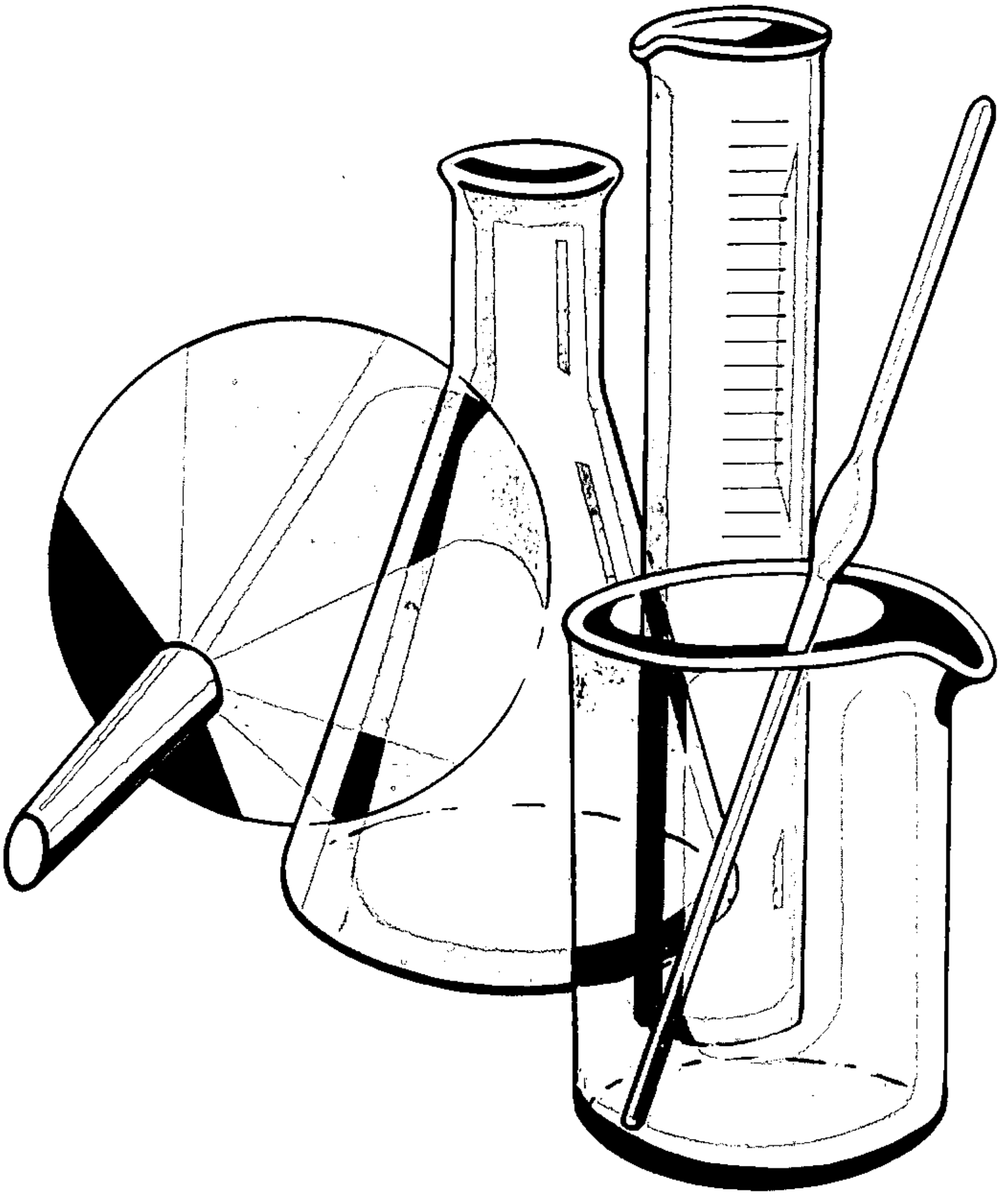

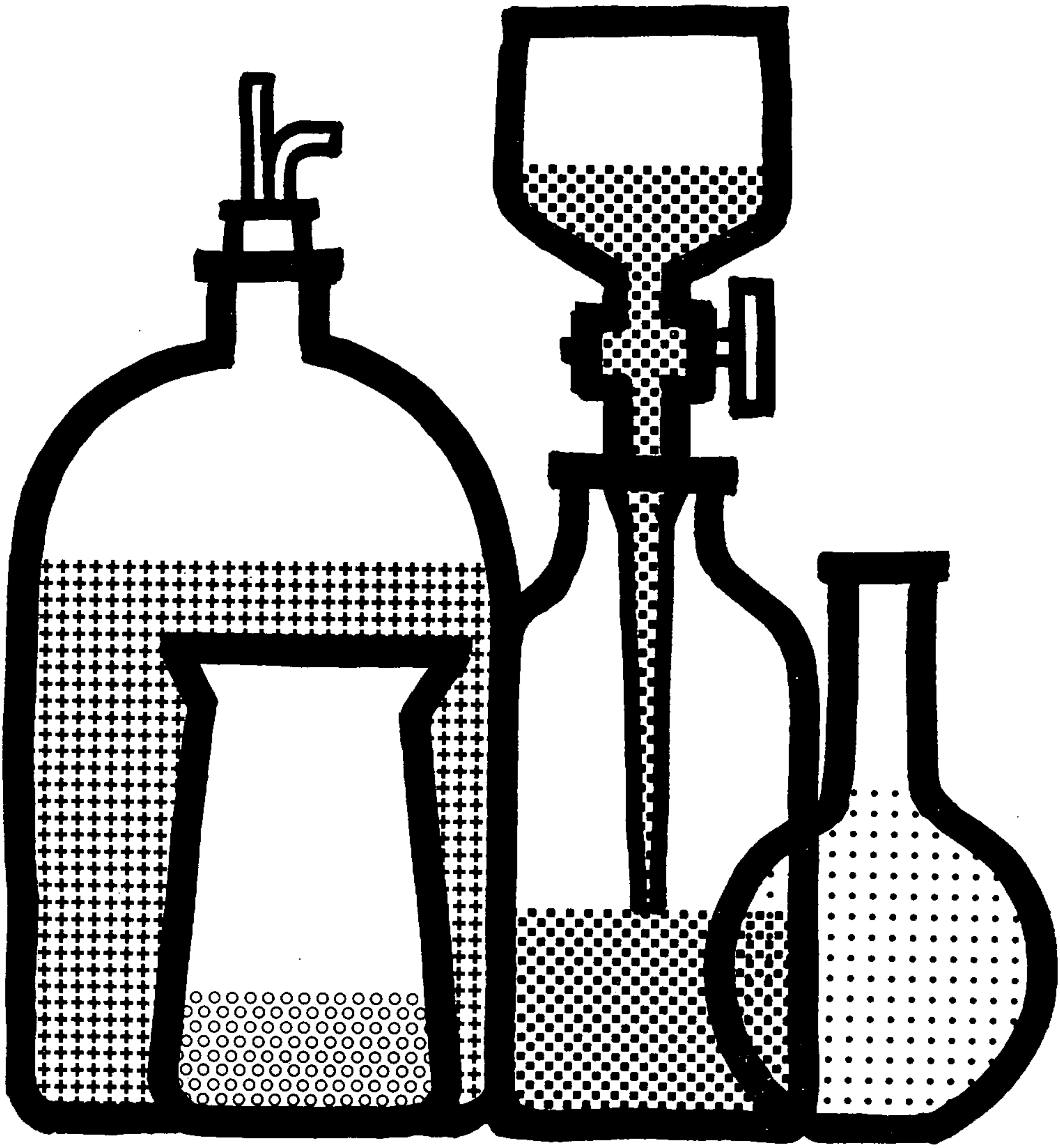

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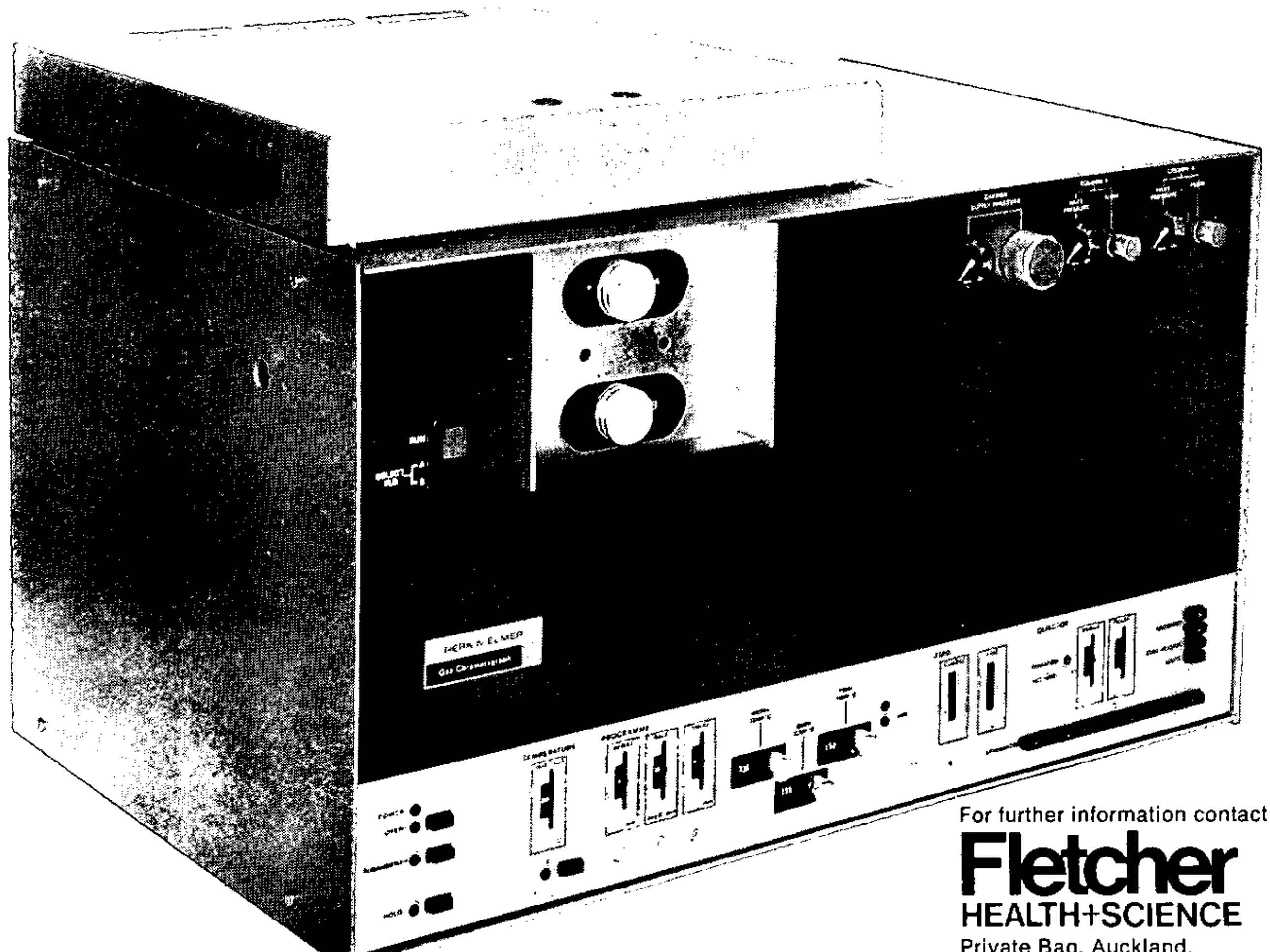

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EDITORIAL

Are we as chemists aware of the discussions on educational development which the present government is sponsoring? To what extent, either as an Institute or as individuals, are we making known our views on the future basic education of young scientists? We have been active in the tertiary education field; have we any views on primary and secondary education?

Is what is called 'general science' providing the right basic raw material for chemists? Perhaps more important, does it provide the right basis for the non-scientist members of our community to live in a world of technology created by the efforts of chemists?

How many of us have read the three working party reports which are to provide the basis for community discussion? These reports will shape the future education of New Zealanders for the next 25 to 50 years. Overseas experts currently visiting and advising are non-scientists. Should such experts have included one concerned with education in science?

RULES ERRATA

A slip is enclosed with this journal to correct minor errors in the latest issue of the Rules. The errors are associated with the "Associateship by examination" which is being phased out in December this year.

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Introducing Organic Chemistry at Secondary Level

by Richard O. C. Norman

It is essential, in thinking about how we may best approach the teaching of organic chemistry at secondary level, first to answer two fundamental questions. Whom are we teaching? What qualities of mind do we wish to develop in those pupils?

There is sometimes a temptation to aim sixth-form teaching at those who are likely to go on to read chemistry at the university, and who will probably become professional chemists. It is wrong to do so, for this group is a minority—in Britain, less than 10 percent of those taking 'A' level chemistry go on to read chemistry—and there are two other groups who must be given at least equal consideration: those who will go on to study other sciences, with chemistry as a subsidiary; and those who will have a career—perhaps as economists, or in accountancy or local government—in which the methods of science are not of prime importance and for whom this is a terminal course. For these groups, a crucial need is to put organic chemistry into perspective not only amongst the other natural sciences, but also in the wider context of its relationship with industrial production, national economics, and the social problems to which it can give rise, and can also help to solve. Moreover, for the pupil who is likely to become a professional chemist, this emphasis on perspective can be only for the good, in broadening his outlook.

I can best illustrate what I mean by looking at the changes that have occurred in and around organic chemistry in the last decade. For example, the ways in which organic compounds and their reactions play their crucial roles in living organisms are beginning to be understood; DNA, which underlies the transmission of inherited characteristics, is after all an organic compound, and when animals need energy they obtain it by the controlled oxidation of another organic compound, glucose. These are but two examples of the ways in which organic chemistry impinges on the work of the biologist.

Professor of Chemistry, University of York; Erskine Fellow, University of Canterbury, 1973.

(Substance of a talk given at the N.Z.I.C. Conference on 20th August 1973)

We have also witnessed the increasingly important part played by the techniques of the physicist in the study of the structures of organic compounds, especially the spectroscopic methods such as infrared and mass spectrometry.

As well as these changes, organic chemistry has been undergoing an internal revolution: we are concerned now with answering not only the question 'What product is formed when A reacts with B?' but also the question 'How does A react with B?'—the field of mechanistic organic chemistry.

Finally, the importance of organic compounds in our economy has been rising steadily for many years and will continue to do so. New plastics are being invented; new medicines are being tailor-made for specific requirements; there is a new awareness of the problems of pollution which has meant that the organic chemist is concerned with the discovery of new fuels, detergents and pesticides which have more desirable environmental properties; and we are perhaps now on the threshold of manufacturing proteins for animal feedstocks which could revolutionise the economies of developing countries.

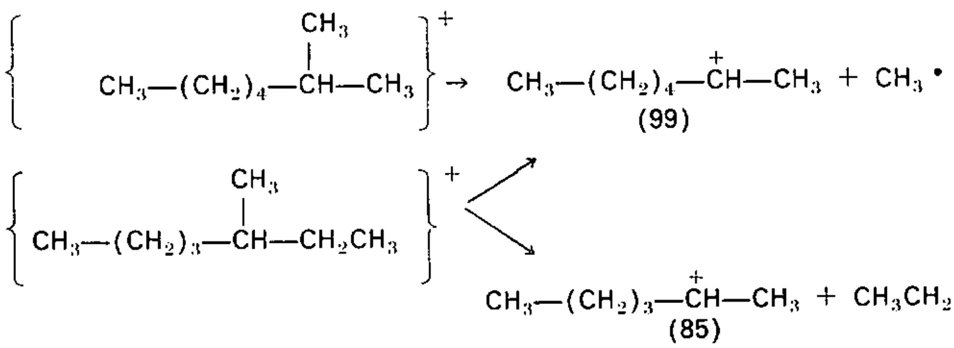
Let me turn to my second question: what qualities do we wish to bring out in our pupils? First, we want to inculcate an understanding of the subject and of its method. I must emphasise at once that I am not advocating this at the expense of the building up of the facts of the subject, but rather that I don't believe there is value in aiming at a facility for the mere regurgitation of factual material. Let me add, too, that our enthusiasm for imparting understanding has in the past carried some of us away, to the point where fact and explanation become distorted. I remember one student I examined who, asked to describe and discuss the differences between amines and amides, ended an entirely theoretical exposition with the sentence: "Thus, I *predict* that amines will be more basic than amides" (my italics). Clearly, 'describe' must always precede 'discuss', and it is our job to get the balance right. We must remember that observation and the assembly of facts provides the essential basis for our speculations about the behaviour of chemical compounds; but also that a scientific education is valueless when it is concerned only with the short-lived remembering of information.

I don't wish to pretend that it is easy to develop in a pupil the ability to reason scientifically. For example, I have often asked my students why it is that the addition of hydrogen chloride to propylene gives mainly 2-chloropropane, not 1-chloropropane; the typical answer is "Because of Markovnikov's rule". Markovnikov's rule, of course, is simply a summation of experimental observations including the one above; it is not an explanation. Teaching the appropriate use of the word 'because' is one of our most difficult tasks.

Secondly, we should involve our pupils all the time in a dialogue. Given an observation, can they suggest an explanation for it? Then can they suggest an experiment to test their hypothesis? Not only is this the method of chemistry, but also it leads naturally to another important feature: the open-endedness of the subject. Quite soon we reach a question to which the answer is not known; an explanation could be suggested but it has yet to be tested. In my experience this is a most stimulating facet of chemistry. I shall always remember the sense of excitement I felt when my school chemistry teacher explained that it wasn't clear whether the bonding in the sulphate ion was best described as S=O or S→O; for the first time I felt a sense of enquiry into the subject.

We have then a framework in which organic chemistry is to be related to other sciences and other disciplines, and we have a group of qualities which we wish to develop within that framework. Let me illustrate these two sets of ideas with examples.

The importance of physics in providing tools for organic chemistry can be effectively illustrated at quite an early stage by mass spectrometry. Not only is this a technique which now occupies a central position for the practising organic chemist, but also the students will have the necessary background for it from their physics. They will know that charged particles are deflected in magnetic and electrostatic fields and that, for a given amount of charge, the deflection decreases as the mass of the particle increases. It remains to show that, quite reasonably, when an organic compound is bombarded with electrons, it is 'damaged' by losing an electron; the resulting positive ion is subjected to magnetic and electrostatic fields and, from the amount by which it is deflected, its mass can be determined. Not only is the molecular weight thereby measured, but also, because of the accuracy of the measurement, the molecular formula can be determined unambiguously. For example, a molecular weight of 103.0382 represents $C_2H_5N_3O_2$, and cannot represent $C_6H_3N_2$ (103.0296), $C_3H_5NO_3$ (103.0269), and so on (masses based on $^{12}C = 12.0000$). With a group of bright students one can take the technique a stage further: the initial organic ion tends to fragment to small particles in a way which varies regularly with structural features, so that by measuring the masses of these fragments the detailed structure can often be obtained. For instance, an ion from a branched-chain alkane tends to fragment at the branch, so that 2-methylheptane gives a fragment of mass 99 whereas the isometric 3-methylheptane also gives one of mass 85:



The close relationship between physical chemistry and organic chemistry should also be effectively stressed; the principles of one can be illustrated by examples from the other, and vice-versa, so that each is reinforced by the other. (I think it is a pity that university lecturers on thermodynamics tend often to use as illustrations such things as the expansion of gas into a vacuum—which chemists are not much prone to do—at the expense of applying the principles to organic and inorganic reactions.) As an example we need look no further than the (mono) chlorination of methane, which will inevitably be a reaction which is met early on in the organic course:

$$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$$

First, we can use bond-energy tables to find whether the reaction is exo- or endo-thermic; a C-H and a Cl-Cl bond are destroyed during the reaction and C-Cl and H-Cl are formed, and tables will indicate, by summation, that the process is exothermic (ΔH = -100 kJ mol^{-1}). At this point I believe it is helpful to introduce an approximation: that for reactions of the type A + B = C + D equilibrium will lie to the right if the process is exothermic and to the left if it is endothermic. (This is, I know, to neglect the entropy change, but it is small in such processes and I don't think it profitable to try to introduce the Second Law at this stage. Certainly we should say that it is an approximation, and to a lively and enquiring student we must go further and comment on the situation in a reaction of the type A + B = C where, even if the process is exothermic, equilibrium may lie to the left because there is more 'randomness' in the independent movement of two molecules, A and B, than in one, C.)

The chlorination of methane, then, is exothermic, and equilibrium lies to the right; we cannot expect to obtain methane from chloromethane and hydrogen chloride. But despite its exothermic nature, reaction does not occur unless some source of energy is applied in the form of light or heat. So the idea of activation is introduced. Let us consider the light-initiated reaction. Methane is transparent to the wavelength used (about 300 mm) but chlorine is not, so that a reasonable suggestion for the first step is

$$Cl_2 \xrightarrow{\text{light}} 2Cl\cdot$$

and this is consistent with the fact that the amount of energy available from light of wavelength 300 nm, calculated from $E = h\nu$, is 400 kJ mol^{-1}, which is more than the bond energy of chlorine (242 kJ mol^{-1}). Then it is reasonable to suggest the reactions

$$Cl\cdot + CH_4 \rightarrow HCl + CH_3\cdot$$
$$CH_3\cdot + Cl_2 \rightarrow CH_3Cl + Cl\cdot$$

The key feature here is that the formation of a molecule of chloromethane is accompanied by that of a new chlorine atom to keep the process going—that is, is propagate a chain reaction. Therefore if this mechanism is sound, one photon should bring about the formation of more than one molecule of chloromethane, and experiment shows this to be so. Indeed, the yield per photon would be infinite but for the occasional collisions of say, two methyl radicals ($2CH_3\cdot \rightarrow C_2H_6$) or a methyl radical and a chlorine atom ($CH_3\cdot + Cl\cdot \rightarrow CH_3Cl$) which bring the chains to an end. Thus in this one example it is possible to introduce thermodynamic data and the idea of activation, as well as the essentials of a substitution reaction which is also a photochemical, chain reaction.

Perhaps the most useful early example of an organic reaction with ionic intermediates is the addition of bromine to ethylene. It is worth pointing out that if this reaction is carried out in solution in the presence of sodium chloride, $CH_2Br\text{-}CH_2Cl$ is formed as well as $CH_2Br\text{-}CH_2Br$; and then asking for a possible explanation. Eventually someone will suggest that the dibromide is formed first, as usual, and then some of it reacts with sodium chloride by halogen exchange. Further discussion should bring out a test for this hypothesis—to find whether, by starting with the dibromide and sodium chloride, the bromo-chloro compound is formed. In practice it is not (though the suggestion was an eminently sensible one), so that further speculation is needed. Someone may well suggest that, since sodium chloride provides chloride ions in solution, a likely intermediate is $CH_2Br\text{-}CH_2^+$, which could take up either Br^- (formed in the initial step) or Cl^- to give the observed products. So the argument can proceed, as far as time and inclination allow.

Elementary organic chemistry can be both properly and interestingly 'flavoured' throughout by reference to its industrial importance. If one deals first with the alkanes, then clearly it is appropriate to discuss their occurrence in natural gas (methane, ethane, propane) and petroleum (higher members). Many of the important processes in the petrochemical industry are closely related to operations students are familiar with in the laboratory; for example, fractional distillation to obtain cuts of different average molecular weight; 'cracking' of the naphtha fraction (C_4 - C_{10}) by heating at 700-900°C to yield, e.g. ethylene and propylene as well as high-grade petrol; and the conversion of ethylene into vinyl chloride (for PVC manufacture):

$$CH_2{=}CH_2 + Cl_2 \rightarrow CH_2Cl{-}CH_2Cl$$
$$CH_2Cl{-}CH_2Cl \xrightarrow{600°C} CH_2{=}CHCl + HCl$$

The cracking of oil lends itself, incidentally, to a simple and effective lab experiment. A sample of paraffin oil in the bottom of a test-tube is soaked up in asbestos wool, some porous pot chips are added on top, and the chips are heated with a bunsen. The mixture of alkenes which is formed is led through a glass tube in the stopper and collected in another test-tube by displacement of water. That alkenes have been formed can be readily shown by adding alkaline potassium permanganate or bromine in carbon tetrachloride; and if a gas chromatography apparatus is available a detailed picture of the composition of the gaseous mixture can be obtained.

A more thorough study of a particular industrial product can readily be made. My own choice is the polymerisation of vinyl chloride in the manufacture of PVC. We have already looked at the production of vinyl chloride; and we have introduced the idea of a radical reaction. In this case, the radical chain is initiated by the addition of a compound such as a peroxide which readily forms radicals (R.); and the other difference from the chlorination of methane is that the propagating process involves addition to a double bond rather than abstraction from a saturated compound:

$$\text{Initation:} \quad R\cdot + CH_2{=}CHCl \rightarrow RCH_2{-}\dot{C}HCl$$

$$\text{Propagation:} \quad RCH_2{-}\dot{C}HCl \xrightarrow{CH_2=CHCl} RCH_2{-}\underset{|}{\overset{Cl}{C}}H{-}CH_2{-}\dot{C}HCl$$

$$\xrightarrow{(CH_2=CHCl)n} RCH_2{-}\overset{Cl}{\overset{|}{C}}H{-}(CH_2{-}\overset{Cl}{\overset{|}{C}}H)n{-}CH_2{-}\dot{C}HCl$$

The chain is ended when, for example, one polymer radical abstracts a hydrogen atom from another, so that PVC consists of chains of varying values of *n*.

The interface between organic chemistry and biology is perhaps most easily illustrated by reference to proteins. I don't suggest that a detailed treatment of α-amino-acids is necessary, but only that attention is focused on their bifunctional character. The first two steps in the discussion—that the amino group of one molecule and the carboxyl group of another can react under suitable conditions to form the peptide link ($—CO_2H + H_2N- \rightarrow -CO-NH- + H_2O$), and that, because of the bifunctionality, similar condensations can lead to a polymeric chain (-CO-CH(R)-NH-CO-CH(R)-NH-) —are readily understood. The third step, that a particular RNA determines the order in which different amino-acids are incorporated into the growing chain in living organisms, is a more difficult one; nevertheless, even in broad outline, an account of how a specific DNA controls the synthesis of a particular RNA and this in turn codes for specific proteins represents one of the most elegant scientific stories that we have yet learned to tell, and the stimulus of hearing it is considerable.

Man has, of course, got as far as duplicating proteins in only a rough and ready way. Even so, a study of e.g. the formation of nylon-6.10 is instructive and can be simply demonstrated. Sebacoyl chloride ($ClCO—(CH_2)_8-COCl$) is dissolved in carbon tetrachloride and a solution of 1,6-diaminohexane and sodium carbonate in water is added gently so that there is minimum mixing of the two layers. The nylon forms at the interface and can be drawn off as a thread with a wire loop; this allows further reaction to occur so that a long, continuous thread can be extracted.

Finally, I believe it right to draw attention to some of the social problems that have been raised by organic chemistry. For example, a student who reads that the spraying of a Canadian forest with DDT, ($(p\text{-}Cl\text{-}C_6H_4)_2CH\text{-}CCl_3$), to control spruce budworm, caused the loss of the entire season of salmon in an adjacent river into which the DDT was washed, can be rightly indignant; but I don't doubt that, on balance, the enormous number of lives saved by the use of DDT to reduce insect-borne diseases has far outweighed its harmful effects This is not to say that we should rest content, but rather than the student who will soon have to make value judgments on such issues should begin to look at the facts from both sides; and that he should appreciate, too, that much remains to be done to improve the situation, and that organic chemistry is a field of study which will make such improvements possible.

Primary Products Symposia Review

by Bruce J. Ross

The four symposia which I was asked to review, on wool, pastoral food products, forest products, and minerals, all covered subjects of tremendous economic importance to New Zealand, and you didn't need an economist to tell you that. Exports of primary products earned about 92 percent of all export exchange receipts in 1972, an amount equal to 77 percent of New Zealand's total current overseas receipts. In addition, these primary industries satisfy a wide variety of local demands for food, timber, and the like, and also provide the raw materials for a fair proportion of our manufactured exports, such as carpets and crockery. Anything which affects the earnings and physical productive capacity of any of our major primary activities is therefore of profound significance to every citizen of this trade-oriented nation; and it is appropriate that your Institute should periodically take time off to review the roles its members can play in promoting these industries.

In a society as developed and organised as ours there is a very high level of interdependence between the many workers involved in the long chain of production for each product. The productive chains are so long, in fact, that it is hard to say where exactly they start, but the chain which links phosphate miners on Christmas Island, with slaughtermen in a New Zealand freezing works, for example, is obviously very long and complex indeed.

In such a chain it is impossible to say who plays the most important part, but the role played by chemists in ensuring the continued successful operation of our major industries is certainly one of the more important. I think the relative contribution of chemists is probably even greater in regard to developments for the future, and a majority of the papers presented dealt with this aspect of chemists' work. New developments are inevitably more glamorous than routine analysis, but before looking at the future we should acknowledge the contribution to production made by those who spent the bulk of their time engaged in routine activities.

If there is a common thread linking the majority of the papers presented, I think it can be summed up under the joint heading of "New Products, New Methods, New Uses," and I intend to discuss most of the papers in the light of the feeling of change that such a heading invokes. As an economist concerned with the New Zealand economy in general, and agriculture in particular, I can see a number of areas where the involvement of chemists may be critical in the future.

Wool

The wool symposium began with a general review by Dr Simpson which fitted perfectly under my general heading. Among other things, he discussed work aimed at giving wool new properties, to enable it to be used for a range of new products which can command a premium price, and he listed an impressive range of new uses to which wool is being put. Papers on the flame-proofing of wool, colouration and bleaching, and polymer modification of wool, all reinforced this theme of new products and new uses. For more than twenty years wool has been under severe and growing pressure from various types of synthetic fibres, some of which can perform certain specific functions better than wool, and some of which compete strongly on price for many uses. The strongest way in which the woollen industry can fight back is in developing new products from wool and in increasing the ability of the wool fibre to compete with its synthetic competitors, and this is obviously being done. Wool's share of the wool-type fibre market has declined dramatically over the year, and Dr Simpson drew attention to this fact as a long-term danger. Virgin wool's share of the wool-type fibre market, which was 60 percent in 1962, had declined to 44 percent by 1972; it can be expected to fall even further, but as long as the total market goes on expanding sufficiently rapidly, this need cause us no great problem. When the present world-wide economic boom subsides, however, giving a reduced demand for fibres in total, possibly just when more

Lincoln College, Canterbury
Review paper delivered at NZIC Conference, Christchurch, 1973.

synthetic capacity is coming on stream, we have to ensure that we have carved out a sufficiently secure section for wool to enable the industry to survive without a repetition of the traumas and price fluctuations of the last six years.

New methods were the theme of the papers on woolscouring, wool wax and sheepskin technology and sliping. The increased processing of products which were previously exported in a raw state has always been regarded as one of the most promising ways of increasing our export income, but for a variety of technical, economic and institutional reasons this increased processing has taken longer to eventuate than might have been expected. In recent years however there has been a marked upswing in woolscouring and in the tanning of pelts in New Zealand; there is certainly still a lot of potential in those industries. Increased export income from these industries will be of little real value to us, however, if we ruin sections of our environment in producing it, and it was good to hear the emphasis Mr Stewart placed on the problems of effluent control, and the extraction of useful by-products during effluent treatment. The paper on wool wax formed part of the total picture related to scouring; we must wish the Wool Research Organisation well in their efforts to extract by-products which will help to pay for effluent treatment, and enable New Zealand scourers to perform their task at a price which is attractive to overseas customers whilst having the minimum impact on our environment. I understand that much of the increase in scouring which we have already seen is in fact attributable to the work of the Wool Research Organisation.

Forest Products

Compared with the embattled wool industry, the forest products industry has been confidently riding high for years. Demand for forest-based products of all sorts has been rising steadily and rapidly, with the result that we have been selling greater volumes of products at higher prices. The long term outlook appears to be good, giving considerable confidence in the future; this was reflected in Mr Conway's paper on the future of the forest products industry, and in comments made by some of the other speakers. Confidence has to be high to justify the increased levels of plantings being undertaken, because a real act of faith is involved in investing vast sums of money in enterprises which will not produce a return for 20-30 years. As Dr Wilson commented at the beginning, the Forestry papers were largely concerned with processing, and I am obviously not competent to review them except to say that they come under my headings of methods and products. Lowering the costs of any of the processing stages improves the international competitiveness of our industry, as does any process which increases the yield of usable product from trees. We must ensure that we do lower costs at least as fast as our major competitors; effective effluent disposal makes the whole industry more socially acceptable, and it is my guess that an increasingly aware society is going to demand further progress on the problem of effluent control.

While I share the general optimism about the future of the industry, and I emphasise this, I want to sound a note of caution by pointing out some of the dangers of competition I can foresee for forestry, since I believe that chemists will have a big part in saving the industry from any major long term setback.

The present booming world demand for forestry products and the associated high prices will stimulate a search for alternatives, or for ways of economising on the use of timber-based products. I think the competition to timber based commodities comes in two varieties—products which replace the use of paper or other timber derivatives; and new ways of making paper from materials other than trees.

(1) Products replacing the use of timber derivatives:

(a) Television newspapers. To the extent that consumers buy newspapers to get the latest news, newspapers could face stiff competition in the 1980s from the new electronic newspaper demonstrated last year by the BBC as part of their 50th anniversary celebrations.

BBC engineers have for some time been studying the possibility of increasing the utilisation of the existing broadcasting bands and the receivers. They have now devised a system for the transmission and display of up-to-the-minute information which will appear as typescript "pages" displayed on the television receiver screen whenever the viewer touches a button to select a subject of interest. Any one of up to 30 different pages may be instantly available, covering the latest news, weather reports, sports results, market trends and other topics.

This new system, called Ceefax, will require an extra unit, housed in a separate box bearing a series of numbered pushbuttons, which will be coupled to the existing receiver by a wire. It will be not necessary to buy a new receiver to be able to use the service although, no doubt, manufacturers will eventually incorporate the Ceefax unit within new receiver designs.

The number of impulses transmitted per second and hence the writing speed of the "television typewriter" will be such that all 30 pages, each containing about 640 characters, can be rewritten every 24 seconds and the information they carry will, therefore, be quite literally up-to-the-minute. The transmitted impulses must be noted by the Ceefax units as they arrive and be memorised so they are ready for use whenever the viewer wishes to read the information. The Ceefax unit thus contains a store which receives the trickle of impulses and stores them in readiness for the moment when, at the press of a button, they are used to write a message on the television screen. Every time new information is received the old is discarded automatically.*

**Trade Topics from Britain*, May 1973.

(b) Increased storage of records on micro-film, possibly doing away with the need for so many copies of records, and freeing existing records for recycling.

(c) Electronic data storage, retrieval and transmittal systems, also doing away with the need for multiple copies of the same data sheets in different offices.

(d) The development of industrialised building systems, possibly based on laminated sandwiches of insulating plastic foam with rigid facings. The development of metal and plastic furniture is an example of this sort of substitution; the walls of caravans give some clue as to what can be accomplished in structures.

(2) New sources of paper:

(a) There have been suggestions for years that the Japanese were about to start using all sorts of new materials other than conventional timber pulp in the making of paper, and the oft repeated cry of wolf has made us rather sceptical of any new claims in this area. You will remember, however, that in the folk story the wolf did eventually come, and because of the degree of scepticism among those who heard the cry, he had a free rein. The latest suggestion I have heard concerns the use of sugar cane fibre. This may be another non-starter, but we can be sure that there will be a starter one day.

(b) Synthetic paper:

There has been considerable work in recent years on the development of synthetic papers of various kinds, mostly based on petroleum. The early forms were rather plastic in appearance and as Mr Conway pointed out, the fact that they were not biodegradable made them unattractive to public authorities and unlikely to gain acceptance. Let me remind you again of the time-scale involved, however. Who is to say that biodegradable forms of synthetic paper will not be produced within 15-20 years? I have already heard one report of such paper being available commercially now, but that has not been confirmed publicly. Right at this moment synthetic paper does not appear to be competitive in price—as one British paper-maker is reported to have said, "Synthetics aren't competitive, except as jotter pads for undersea divers," but again, who is to say what changes may come?

The great task for chemists in the forestry industry is to seek out and develop new uses for timber derivatives as fast as old ones are taken over by new materials. The best local example of this process that I can think of concerns the development of timber preservatives which vastly extended the range of uses for soft woods, but there are many other examples, such as the range of products made available by new adhesives and finishes. In other words, chemists have extended the range of timber products in the past, and they must continue to do so in the future.

Pastoral Food Products

The pastoral food products fall naturally into two main groups—dairy and meat.

The dairy industry is, to me, the model of a flexible, adaptive industry which has been able to react rapidly to the changing circumstances it faces overseas. Dr Robertson's paper illustrated this point very well, with his discussion of the tailor-making of products to customer requirements, and the fact that the industry now produces milk powders to some 60 different specifications is an outstanding example of this.

The papers on milk proteins, rennet manufacture and the like, all related to this theme of dynamic development. Chemists have played an indispensibe, and recognised, part in the profitable survival of this industry, and their role is obviously a continuing one. Dairy industry chemists are involved in all my categories — new products, new methods and new uses—and the fact that I want to look rather more closely at the meat industry is simply a tribute to the universal recognition of the chemists' role in the future of the industry.

As far as the meat industry is concerned, the situation is rather different. Despite the considerable amount that has been accomplished, it is my impression that the contribution of chemists has been insufficiently recognised and utilised in the past in the meat industry, and I am not sure that the role they are going to have in the future has yet been fully and widely recognised.

Wool and dairy products have already had to face the fires of competition from synthetics; meat is about to meet this competition, and I don't think the implications have been fully recognised.

Mr Moyle mentioned the coming threat from textured vegetable protein products in his opening address, and Dr Hove presented a paper on the extraction of grass protein for use in human food in some way. With the development going on in TVP so rapidly in Japan and U.S.A., I think it is essential that work be accelerated here, and the Applied Biochemistry Division should be encouraged to push on with both the processes now being investigated.

If a proportion of our meat market is likely to be lost to TVP, then at least we should try to ensure that it is our vegetable protein which is used, rather than soyabeans from the U.S., or some other product based on petroleum.

Make no mistake, of our three major meat exports, lamb, mutton and beef, two could easily come under attack in the near future. Our mutton is mostly shipped to Japan for incorporation in processed meat products, and a high proportion of our beef exported to the United States of America is ground up for use in hamburgers. Manufacturing grades of meat such as these will be the first to suffer the full force of competition from meat substitutes, and the present high prices for meat will certainly stimulate research in the whole field of meat substitutes.

Mr Law discussed the future of meat as a universal food—on the whole I am optimistic on behalf of consumers, but I am worried about the proportion of meat which we will supply. The relative economies of producing meat here, or in the northern hemisphere may change greatly over the next decade or so, and the meat industry may have to take some dancing lessons from the dairy industry if it is to save itself from being trampled on a few times.

Let me quote an item from the **Economist** of 4th August.

"Within three years Imperial Chemical Industries should be churning out 100,000 tons of protein animal feed a year, grown not from soil but from North Sea gas. ICI announced plans this week for the leap from making synthetic foods in a pilot plant to make them in a £15m commercial installations. It will be the second such plant to be built: British Petroleum is already going ahead with a similar-sized project that grows protein yeasts from paraffin. The ICI plant could replace about 8 percent of Britain's protein imports. The common market's protein shortfall of 4m tons a year could be entirely met by chemical plants within a decade.

"The development poses the same threat to farmers that synthetic fibres did to cotton and wool growers 10 years ago. Scientists have long realised that farming, no matter how modernised, is primitive. And the sudden world shortage of vegetable and fish oils last season (which drove the soyabean price up by 300 percent) showed what a haphazard business farming is. If the new developments work, it is possible to see the bulk of animal (if not necessarily human) protein produced not on the farm but in a process plant within a generation.

"ICI uses a methanol base derived from natural gas as the feed for its protein-rich bacteria. These are grown under pressure, and are tapped off in a continual process. The final product has an 88 percent protein content, far richer than anything that nature can produce. Soyabeans, for example, contain only 44 percent protein. The present price of soyabeans is £220 a ton and ICI reckons that it will be able to sell its protein at a profit at £160 a ton. Because the ICI product is so much richer in protein, this is the equivalent of soyabeans selling at a mere £75 a ton. So there is no problem of the synthetic product being uncompetitive. It has been calculated that just 1 percent of the world's gas and petrol consumption could produce all its protein needs; so the conversion is clearly more economic than fuelling motor cars.

"The synthetic protein is a better food for calves, pigs and poultry than any natural product. It is too rich for beef and dairy herds, for which it has to be diluted. The protein, of course, would be acceptable, and could be made palatable, as a human food, but that is a long way off. More important, cheap synthetic proteins will drive down meat prices and push up Europe's standard of diet. The Japanese are also rapidly developing their own synthetic protein plants, although the two British firms hold a definite lead."

If this sort of thing really catches on the biggest threat in the future may come, not from TVP, but from real meat from animals raised in the Northern Hemisphere, fed on synthetic feeds.

The chemists' role in the future will be to keep meat competitive by lowering costs, an example of which is the accelerated ageing discussed by Mr Chrystall, and the development of alternative uses for our pastures, such as TVP. Eventually I think the battle with petroleum-fed cattle will have to be fought on grounds of cost alone.

Minerals

The Minerals Symposium seemed to differ slightly in tone from the other three. The symposia on Wool, Forestry and Pastoral Food Products dealt with commodities in which this country has a comparative advantage, and which provide the bulk of our foreign exchange. Those commodities are vital to the country's economic welfare; the people involved in their production know this, and the symposia on those commodities exuded a feeling of self-confidence which seemed to be lacking in the minerals papers. This difference in attitude probably stems from a variety of things, but with the exception of the burst of enthusiasm which followed the Maui gas discoveries, the minerals industry in New Zealand seems to lack glamour. Gravel extraction is an important mining activity, but adds nothing directly to exports and there are no new exciting discoveries or developments; coal mining is popularly regarded as a declining unprofitable industry; many people have expressed doubts about the wisdom of establishing an iron and steel industry in New Zealand; publicity concerning the ceramics industry in recent months has concentrated not on its export performance but on requests for the almost complete exclusion of imports from the local market. Despite the lack of glamour, however, I think the minerals industry will play an increasingly important role in our economy, and chemists will be deeply involved in many of the developments.

Dr Foster described the ways in which the Pottery and Ceramics Research Association has helped the development of several industries, with the tableware industry standing out in my mind. The development of the export trade in tableware has undoubtedly provided one of the major success stories in the field of manufactured exports. This industry is one of our more competitive manufacturing activities; the effective rate of protection has been estimated to be about 25 percent, which is less than half the average for manufacturing as a whole, and the export performance also points to production at internationally competitive prices. This being the case, I feel it is a great pity that in straining for the last 10 percent or so of its local market to be guaranteed to it by import restrictions, the industry should have alienated so many of its domestic consumers.

Several aspects of the question of protection of local industry were touched on by Dr Foster, and I would like to comment on one or two points. The first is that, whilst I believe that protection can be justified on a number of grounds, I do not think the system of protection we have operated in New Zealand can be expected to ensure that the best allocation of resources is encouraged. Various studies have shown that effective rates of protection (i.e. protection for the value added to a product in New Zealand, as distinct from the protection granted to the finished product including imported components or raw materials), vary enormously from product to product in New Zealand, with the result that we have encouraged some industries we would have been better off without, and we have discriminated against others which could have made greater contributions to the nation's welfare. One aspect of protection which is not always appreciated is that by encouraging manufacturers to supply the whole range of products in a certain field, we may have caused them to dissipate their resources, with the result that they are not as competitive internationally as they might have been with greater specialisation on a more limited range of products. For example, G. C. Billing has shown that the woollen industry had almost driven imports of rugs and blankets from the local market by 1930, but thereafter resources were spread over a much wider range of goods which protection had made profitable. When protection was later relaxed somewhat, the imports of rugs and blankets grew to twice the volume of local production. (There may be a lesson here for the tableware industry.)

Mention was made of the fact that protection of industry can be used as an aid towards achieving certain social objectives. This is true, but I would suggest that the attainment of one such objective, regional development, has been hindered rather than aided by the systems of protection we have adopted in this country.

By concentrating as much as we have on the development of import-substitution industries, which are almost exclusively devoted to supplying the local market, we have fostered the growth of manufacturing industries adjacent to our largest centre of population. The greater the proportion of an industry's output that is exported, the less important internal transport costs become in determining where the industry should be located.

The building industry has always been important in New Zealand, and I learnt a gread deal about the contribution of chemical research to this industry from the paper by Dr Kennerley on recent advances in concrete technology. Technical advances in such fields as this are not always apparent to a layman, and I was intrigued to discover just how much progress has been made in recent years.

Fertiliser is obviously crucial to our whole agricultural output, and it was pleasing to hear of the way in which the Fertiliser Manufacturers' Research Association has been tackling the problems of increasing the efficiency with which fertiliser is produced and utilised. The change in the source of supply of phosphate, the fact that the raw material may be harder to get in the future, and the increasing level of public concern over the nutrient enrichment of waterways, possibly associated with greater fertiliser use, all indicate that there are plenty of problems still to be tackled in this area.

I was somewhat surprised not to hear some comments on the chemical possibilities of Maui gas. Perhaps this lack is related to the point made by Dr Walker that we do not have enough people looking after potential new industries, but natural gas has proved to be such a rich source of raw materials for industries overseas, that I would have expected at least to hear some comments on why it has been decided to burn all our gas as fuel.

For the future, the mineral industry is likely to become more important, especially if imported minerals become more expensive. One of the major roles of chemists in this field will be to lower the cost of extraction from a given ore, as is in fact exemplified by the work of Mr Evans with iron. Like Mr Dick, I have been impressed by the quality of the work done at New Zealand Steel, but, harking back to the discussion on protection, I am not fully convinced that the same effort could not have produced a better return elsewhere. Lowering the costs of extraction is bound up with Dr Walker's quote that "minerals are made, not found." This will become increasingly true in the future, as the richest ores are used up. The Commodities Research Unit London, has estimated that the total natural occurrence of most metals in the top mile of the earth's crust is about a million times as great as present known reserves. The world is not about to run out of minerals, but they are going to become increasingly difficult to extract, and chemists will have a crucial part in the development of new extraction technology.

Conclusion

To conclude, I come back to my omnibus heading of "New Product, New Methods, New Uses."

The future of the industries covered by our four symposia will depend on their ability to innovate —in the sort of products they make, in the ways they make them and the uses they find for them. This has always been the case from the days when mutton was a waste product to be rejected after sheep had been boiled down for tallow. Much of the past innovation has come from chemists, and their role will be at least as important in the future.

The need to actively seek worthwhile innovation has been well recognised in the dairy industry, and to a lesser extent in wool. The meat industry may have to become more innovative than ever before in the near future, whilst I am convinced that there will be an ever growing need for chemical research in all aspects of the forestry and mineral industries.

Statistical Examination of Parameters in Atomic Absorption Spectrophotometry

by H. Green and C. Nixon

Synopsis and Introduction

In the last few years the use of statistics has greatly increased in the assessment of the degree of confidence which can be placed in an analytical result.[1,2,3] As analysis is a composite of individual processes such as weighing, diluting, aliquoting and calibration, each process carries its own degree of accuracy or error, positive or negative. The sum of these individual errors appears as the total error. To improve a method of analysis it is necessary to identify the main sources of error and to try to eliminate or reduce them as much as possible. After finding the overall standard deviation of the method, the proportion of this due to the chemical processing and the proportion due to fluctuations in instrument response can be found. At the same time it is possible to assess whether significant reduction in read-out error occurs when using a recorder instead of a meter.

If the instrumental variables only are changed the effect upon the response can be examined by carrying out an analysis of variance on the instrument and recorder readings.

In this paper are presented statistical investigations into a method for the determination of copper in cast iron and steel employing atomic absorption. These assess (1) the errors arising from the analytical method and from the spectrophotometer with and without recorder, (2) the relative importance of the instrumental variables: lamp current, slit width, burner height and acetylene flow rate.

Analytical Procedure

The method investigated was as follows:-

Weigh 1.0g of sample, cast iron or steel, into a 250 ml squat beaker and dissolve in 15 ml of concentrated hydrochloric acid. When dissolution is complete oxidise the iron by dropwise addition of concentrated nitric acid. Add 15 ml of perchloric acid sp.gr 1.7, and evaporate to fumes. Continue fuming, with the beaker covered, for five minutes. Remove from the source of heat and dilute with 50 ml of cold water. Swirl the solution until the salts have dissolved and only silica and graphite remain. Transfer the solution to a 200 ml volumetric flask, cool to room temperature, dilute to the mark and mix well. Filter the solution through a dry Whatman No. 1 filter paper or similar grade, using a dry funnel and collecting the filtrate in a dry beaker. Transfer a 15 ml aliquot to a 100 ml volumetric flask, dilute to the mark and mix well. Aspirate the solution into the flame of the spectrophotometer.

First Investigation

Eleven separate one gram samples of the BCS Steel 251/1, average copper content of 0.55 percent were processed as described above and measured on the Techtron AA5 atomic absorption spectrophotometer employing the following instrumental conditions.

Wavelength	—	324.8 nm
Lamp Current	—	4.0 mA
Slit Width	—	50 (17nm Spectral Bandwidth)
Burner Height	—	8 mm
Acetylene Flow	—	2.5 l/min at 100 KN/m^2
Air Flow	—	5.75 l/min at 170 KN/m^2

Tables 1 and 2 give the certified analysis figures provided by the Bureau of Analysed Samples Ltd.

The solutions were aspirated alternately with water and the zero was re-set as necessary. The optical density readings were taken from both the meter and a 10 mV full scale recorder with 250 mm chart width. Lamp current, slit width to monochromator, burner height and acetylene flow rate were then upset and the entire setting up process was repeated. The solutions were re-aspirated and a second set of eleven readings was obtained. This procedure was repeated and a third set of readings taken.

An "average" solution was prepared by mixing together equal volumes of each of the eleven separate solutions and this new solution was aspirated eleven times, alternating with water, the zero being re-set as necessary. This gave one set of eleven readings for both meter and recorder. By upsetting the same four instrumental conditions and re-setting twice more, with intermediate aspirations, a second and third set of readings was obtained.

The six sets of figures obtained are given in Tables A and B in the appendix. Each set of eleven results was treated separately for calculation purposes and the standard deviation was calculated.

The results of these calculations are shown in Tables 3 and 4.

The major property of standard deviation is that can be used to estimate the confidence limits which can be placed on any individual result taken at random from an infinite population. With a normal distribution of errors, equally likely to be + or —, 68 out of every 100 results obtained will lie within $\bar{x} \pm$ one S.D. (the 68% confidence limits) and 95 results out of every 100 can be expected to lie within $\bar{x} \pm$ 2 S.D. (95% confidence limits). It is generally accepted that the 95% confidence limits are the most realistic to apply.

Examination of Table 3 shows that the third series of readings gives a much higher S.D. than the first two series.

One reading is appreciably different from the others in this third series. The value for $\bar{x}$ on the meter readings for this series is 52.1 and with 95% confidence limits a range between 48.58 to 55.62. The fact that the one result of 48.5 is both obviously out of line with the others and in excess of 2 S.D., indicates that this is one of the remaining 5% excluded by employing 95% confidence limits. Although it most certainly is a result which belongs to this population it is reasonable to remove it from the calculation and to recalculate the S.D. on this third series using the 10 remaining results. A revised table of standard deviations can then be drawn up (see Table 5).

The value for the third series is now more in line with the other two. When an average is taken of the three S.D. values for both meter and recorder there is virtually no difference, and no improvement in reproducibility is to be gained by employing a recorder. It should be noted that copper is a good element to determine by atomic absorption spectrophotometry and gives stable readings on a meter without high damping. For other elements meter readings may be less stable and therefore subject to the operator's judgement, and it is quite possible that a significant improvement would arise from employing a recorder.

To ascertain how much of the total error of the analytical method is due to the chemical processing and how much is due to fluctuations in instrument response the concept is employed that variance is additive. Using the S.D. figures for both meter and recorder obtained in Tables 4 and 5, we find 35.8% of the total difference which can arise between the "true" and "observed" results is due to the instrument response, and 64.2% to the processing.

Second Investigation

It was decided at this stage to carry out an investigation into four of the major instrumental variables, in an effort to discover the reason for such a large proportion of the total error arising from the final step in the process—aspirating into the flame and measuring the absorption due to the cloud of atoms produced.

The four instrumental variables selected for investigation were the slit width (S) for the light beam as it entered the monochromator, the lamp current (L), the burner height (B) from the centre of the light beam to the top of the burner, and the acetylene flow rate (A). All other parameters were kept constant. A standard solution of copper containing 2.75 ppm in an iron matrix was prepared as previously described, and used for all the conditions investigated. The values for S, L, B and A, are shown in Table 6.

Table 1.—Certified Analysis of B.C.S. 251/1

	Si %	Mn %	Ni %	Cr %	Mo %	V %	Cu %	C %	S %	P %
Avge.	0.41	1.54	1.24	0.51	1.51	0.65	0.55	0.38	0.029	0.026

Table 2.—Certified Individual Results for Copper on B.C.S. 251/1

Analyst No.	1	2	3	5	6	7	8	9	Av.
% Copper	0.54	0.55	0.57	0.55	0.57	0.56	0.56	0.53	0.55

Table 3.—Standard Deviation Results for Eleven Separate Samples

	Standard Deviation	
Series	Meter Readings	Recorder Readings
1	0.78	0.98
2	1.07	1.15
3	1.73	1.57

Table 4.—Standard Deviation Results; One Sample, Eleven Separate Readings

	Standard Deviation	
Series	Meter Readings	Recorder Readings
1	0.78	0.91
2	0.23	0.39
3	0.69	0.84
Average	0.57	0.71

Table 5.—Revised Standard Deviation Results for Table 3

	Standard Deviation	
Series	Meter Readings	Graph Readings
1	0.78	0.98
2	1.07	1.15
3	1.32	1.10
Average	1.06	1.08

Table 6.—Fixed and Variable Parameters Employed

S—Slit Width in microns	—S1=25, S2=50, S3=100
L—Lamp Current, in mA	—L1=3, L2=5, L3=7
B—Burner Height, in mm	—B1=7, B2=9, B3=12, B4=15
A—Acetylene Flow, in 1/min	—A1=2, A2=2.5, A3=3, A4=3.5
Air Flow—5.75 l/min	—Fixed.
Wavelength—324.8 nm	—Fixed.
Standard Copper Solution—2.75 ppm—Fixed.	

Three of the variables in turn were held at one of their fixed values, the fourth variable was changed over the range of values shown in Table 6. A series of results were obtained which included every possible combination of the 4 variables, i.e. 144 results in all. These results are given in Table C in the appendix.

These results were then subjected to an "analysis of variance" in order to obtain the magnitude of the effect each variable had on the instrumental response. Analysis of variance techniques may be found in most standard works on statistics — the attention of the reader is particularly directed to reference 2, page 400 onwards, for a detailed description suitable for these particular circumstances.

After the statistical work was completed, the information was gathered together in an analysis of variance table—Table 7.

It will be seen from Table 7 that for the factors B, S, L, A x B and L x S the figures are so large that these are of over-riding importance and the estimate of the variance for the other factors would be completely distorted. In such a case, it is the usual practice to regard these as part of the residual variance and by pooling them with the first residual and recalculating the value for this an improved variance estimate is obtained—Table 8. The factors themselves are removed from the new table.

In order to assess how significant each factor was statistically, the "F ratio" for each was obtained—by dividing the variance of the factor under consideration by the residual variance. The result of these calculations may be seen in Table 9.

These figures for the F ratios are now referred to the appropriate "Tables of F Values" using the degree of freedom from the last column for the values of N1 and N2.

From the tables with 3 and 123 degrees of freedom, the 99 percent significant level is 4.0. Since 941.02 greatly exceeds this figure, the effect of factor B is at least 99% significant. In other words, there is a better than 99% probability that this result is not by chance and it must therefore be considered that this factor is having a significant effect. In fact, because of the very high figure it is undoubtedly a major source of variation in the meter readings. A similar result is obtained for the other factors in Table 9. However, the effects of factors B and L are such that they completely swamp the effects of S, A x B and L x S and it would be necessary to carry out another planned experiment with the values being changed at much smaller intervals to assess whether these other factors are highly significant.

Conclusions

It was found that the standard deviation of the analytical method for copper, using the Techtron AA5, was one meter division (=0.01 on the optical density scale) and statistically for 95 analyses in every 100, a figure within ± 0.02 units of the true optical density should be obtained. For copper no difficulty arose in reading the optical density directly from the meter so the use of a recorder offered no advantage. Between 35 and 40 percent of the total error arising during a copper determination has been shown to be due to fluctuations in the instrumental response.

In the second experiment, two of the four major instrumental variables examined proved to be of considerable importance. These were the current applied to the hollow cathode lamp and the height of the light path above the burner slot. There was indication that the slit width was having some effect the magnitude of which could only be ascertained by a more detailed experiment. All the other factors involved lacked significance. There was no evidence that changes in the acetylene flow rate had a measurable effect. This would seem to indicate that the lowest flame temperature in the experiment was high enough to convert the major portion of the copper present in the solution to ground state atoms in the flame. The highest temperature did not cause the atoms to move to the first energy level or to ionize to any noticeable extent.

Table 7.—Analysis of Variance Table

Factor	Sum of Squares	Degrees of Freedom	Variance Estimate
A	3.56	3	1.19
B	1213.91	3	404.64
S	38.86	2	19.43
L	716.88	2	358.44
A x B	36.52	9	4.06
A x S	3.07	6	0.51
A x L	3.35	6	0.56
B x S	3.56	6	0.59
B x L	10.12	6	1.69
L x S	38.58	4	9.65
A x B x L	4.99	18	0.28
A x B x S	3.68	18	0.20
A x L x S	5.23	12	0.44
B x L x S	5.88	12	0.49
Residual	9.97	36	0.28
Total	2098.16	143	

Table 8.—Revised Analysis of Variance Table

Factor	Sum of Squares	Degrees of Freedom	Variance Estimate
B	1213.91	3	404.64
S	38.86	2	19.43
L	716.88	2	358.44
A x B	36.52	9	4.06
L x S	38.58	4	9.65
Residual	53.41	123	0.43
Total	2098.16	143	

Table 9.—F-Ratios for the Important Factors

Factor	F Ratio	Degrees of Freedom (N1/N2)
B	404.64/.43 = 941.02	3/123
S	19.43/.43 = 45.19	2/123
L	358.44/.43 = 833.58	2/123
A x B	4.06/.43 = 9.44	9/123
L x S	9.65/.43 = 22.44	4/123

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APPENDIX

TABLE A.—Results for Eleven Separate Samples

Meter Readings 1st	2nd	3rd	Recorder Readings 1st	2nd	3rd
48.0	51.0	54.0	49.0	51.0	55.0
48.0	51.5	53.5	48.0	52.5	55.0
47.0	52.0	53.0	47.5	53.0	55.0
46.5	51.0	53.0	47.0	52.5	54.5
46.0	50.0	50.5	46.0	51.0	52.5
46.0	50.0	50.5	46.5	50.0	52,5
47.0	48.5	48.5	48.5	49.5	50.0
47.5	49.5	53.5	48.5	51.0	55.0
48.0	50.5	53.5	49.0	51.0	53.5
48.0	51.0	51.5	48.0	52.5	53.0
47.0	49.0	51.5	47.5	50.5	53.0

Table B.—Results on One Sample, Eleven Individual Readings

Meter Readings 1st	2nd	3rd	Recorder Readings 1st	2nd	3rd
51.0	50.5	51.5	52.5	52.0	52.5
50.0	50.5	51.0	53.0	52.0	51.5
50.5	50.5	51.0	53.0	51.5	51.5
51.0	50.5	50.0	52.5	51.5	50.0
50.5	50.5	50.0	51.5	51.5	50.0
50.5	50.5	50.5	51.5	51.0	51.0
50.0	50.5	50.0	51.0	51.5	50.5
52.0	50.5	50.0	52.5	51.0	51.0
52.5	50.0	49.0	54.0	51.0	50.0
50.5	50.0	50.0	51.5	51.0	51.0
50.5	50.0	50.0	51.5	51.0	52.0

Table C.—Copper Results for Analysis of Variance

		A1 B1	A1 B2	A1 B3	A1 B4	A2 B1	A2 B2	A2 B3	A2 B4	A3 B1	A3 B2	A3 B3	A3 B4	A4 B1	A4 B2	A4 B3	A4 B4
	S1	45.0	42.5	38.0	33.5	43.0	41.5	37.0	34.0	43.5	41.5	38.0	34.5	42.0	42.0	38.0	35.5
L1	S2	40.5	38.0	34.5	32.0	40.5	37.5	34.0	32.0	40.5	39.0	35.0	32.5	39.0	39.5	35.0	33.0
	S3	41.0	40.0	35.5	33.0	41.0	38.5	35.5	32.5	41.0	40.0	36.0	33.0	39.0	40.0	36.0	32.5
	S1	39.0	37.0	32.5	29.5	39.0	37.0	33.0	29.5	39.0	37.5	33.5	31.0	36.5	37.0	35.0	31.5
L2	S2	39.5	37.0	33.5	30.0	37.5	36.0	33.0	30.0	38.0	36.0	33.0	30.5	37.5	37.0	34.0	31.5
	S3	37.5	35.0	33.0	30.5	39.0	36.5	33.5	31.5	38.5	35.0	33.5	31.0	35.5	37.0	33.5	32.0
	S1	36.5	34.5	31.0	28.5	35.5	34.0	30.5	28.5	34.5	34.5	32.0	29.0	34.5	35.0	31.5	29.5
L3	S2	36.5	35.0	30.0	28.0	34.0	34.0	30.0	28.5	35.0	34.0	30.0	28.0	34.5	34.5	32.0	29.0
	S3	37.0	34.5	30.5	28.0	35.0	33.0	30.5	28.0	34.5	34.5	30.5	28.5	33.5	34.0	31.5	28.5

THE TESTING LABORATORY REGISTRATION COUNCIL OF NEW ZEALAND

by J. A. Gilmour

Talk given to Auckland Branch NZIC, 20 February, 1974

The Testing Laboratory Registration Council of New Zealand was incorporated by Act of Parliament in October 1972. The Act came into force on 1 January 1973. From this you can see that the Council is just over one year old and up to now the work has been behind the scenes, laying the groundwork for what is to come.

The Council is charged with the responsibility of promoting the development and maintenance of good laboratory practice, and to establish and maintain a scheme for the registration of testing laboratories.

The Council consists of 9 members all appointed by the Minister of Science. Two members are appointed personally by the Minister, one of whom must be the Chairman. Three members are nominated by the New Zealand Manufacturers' Federation, and one member appointed on the nomination of the Standards Council. There are three ex-officio members. These are the Director General of DSIR, the Secretary of Industries and Commerce and the Secretary of the Government Stores Board.

The definition of its aims may be extended to include involvement in any matter related to testing, so that we can expect the Council to become involved with organisations interested in standards, promotion of quality control and quality assurance, scientific and technical bodies generally including the professional institutes, and also in the dissemination of information related to testing.

Essentially, the work of Council will be initially to provide a network of recognised competent laboratories throughout New Zealand. This will be followed by promotion of the need for good testing, for good laboratory management and for intelligent quality control concepts generally.

I have used the idea of recognised competent laboratories and it is important to realise that the intention is that this recognition will apply in both New Zealand and abroad.

The Council has had to establish a framework within which all this could take place, and the framework adopted is based on a system used in Australia; there the organisation is known as the National Association of Testing Authorities.

Firstly, Council is establishing criteria which will define a competent laboratory. The next task is to convince organisation and company managers and laboratory managements that these criteria are correct, reasonable and worth achieving. We must also establish the formal steps for recognition, then publish and advertise the availability of these recognised testing facilities. After that there is the problem of educating the marketplace as to the value of competent testing, then convincing them that the registered laboratories do, in fact, provide the service required.

Criteria

It is fairly easy to establish the basic criteria for a competent laboratory. The essential ingredient for any laboratory is, of course, the people who work in it. They all must be competent to do their appointed tasks, and the management must be qualified, experience and sensible.

The equipment used in a laboratory must be the right equipment for the job, and it must be shown to be the correct equipment in good working order. The essential ingredients for adequate equipment management include correct installation, regular calibration, careful useage and maintenance. TELARC's basic philosophy on equipment is that all measurements that are made in a laboratory must be traceable to the National Standards of measurement, so that the calibration of equipment (such as balances, viscometers, thermometers and the like) must be traceable, not necessarily directly, but nevertheless traceable to PEL or any of the recognised overseas national standardising authorities.

TELARC uses the term "laboratory practice" to describe such things as sampling procedures, methodology, recording and reporting of test results. To meet the criteria, a laboratory must be able to demonstrate that its practices in these areas are satisfactory. The object of any test report is to communicate to someone outside the laboratory what the findings of the laboratory are. Reports, therefore, should be clear, unambiguous and factual. They should naturally describe what has been tested, how it was tested and what the findings in the test were.

Generally speaking, provided that the standard of housekeeping is satisfactory, accommodation will be regarded as being satisfactory. This will, of course, depend very murh on which tests are being conducted and whether or not the accommodation will interfere with the performance of the tests.

These general requirements apply to any sort of laboratory doing any sort of testing. There is nothing in them that anyone can object to, provided they are interpreted in relation to the individual laboratory itself.

The Council has assembled a series of expert committees, one for each arbitrarily defined field of testing and has given to each of these committees a brief statement of its criteria and asked them to prepare detailed statements applicable to each field of testing.

The Council has divided all testing into 6 fields:

Biological Testing
Chemical Testing
Electrical Testing
Mechanical Testing
Metrology
and
Miscellaneous Physical Testing

The Chemical Testing Committee Chairman is Professor Arthur Campbell from Dunedin.

These committees are called Registration Advisory Committees; the members of these committees are appointed for their personal expertise, not as representatives of any organisation. Their responsibility is to give advice to Council. They do not have any executive power of their own.

The Chemical Testing RAC has drafted a booklet detailing its requirements for registration and this will be published and be freely available to anyone who is interested. It should be ready shortly.

Having published the details of its requirements, the Council will invite formal applications for registration. Applications will be accompanied by a fee which has been set at $250. Following application, there will be contact between staff of the Council and the laboratory, followed by a formal assessment by a panel of specialised honorary assessors. The assessors will report to the RAC who will then make recommendation to Council.

Correction of major problems in the laboratory will be necessary before registration, but advice on minor ones and even advice on such things as general efficiency will be offered to the laboratory.

Thus there will be two levels of advice to laboratories—one being mandatory requirement for action, and the other being guidance and suggestions. The final step in the process is formal registration by the Council. Registered laboratories will be subject to re-assessment at the Council's pleasure but generally speaking, an interval between successive re-assessments will be approximately two years.

At all stages any informal advice will be available through the staff and assessors. Assessors will be people selected by the RAC for their own personal abilities and not as representatives of organisations; they will be specialised in the testing being undertaken by the applicant laboratory.

Obviously, for commercial reasons, testing laboratories will not be subject to assessment from people from opposition organisations without their prior consent. What will happen is that the Council staff will contact the laboratory and suggest some possibilities and the laboratory will have the right of veto. Australian experience has shown that assessment by people from competitive organisations often has distinct advantages for both parties. A feeling of trust develops over a period of time without any pushing at all from NATA in the Australian context and TELARC in New Zealand. This is something that will be allowed to happen.

This system which I have described will, therefore, provide a network of recognised competent laboratories. Obviously, to be of optimum value to the laboratory, the organisation or to the country, the value of this recognition must be apparent to managements and to the marketplace, both locally and overseas. The Council has a lot of work to do to convince organisations and individuals that it is to their advantage to patronise the services of the registered laboratories, and also to convince the manufacturing industries generally that quality testing is one of the cornerstones on which quality products are made.

Request

The School of Natural Resources, University of the South Pacific (see *Chmistry in New Zealand* Vol. 37, No. 6 December 1973) would appreciate assistance in expanding their use of visual aids. They would be interested in cassette players, casette tapes (such as those of the Open University or American Chemical Society), films or a slide projector.

Contact Dr M. Smith,
School of Natural Resources,
University of the South Pacific,
Box 1168, Suva FIJI.

Monsanto

"In conformity with Monsanto world-wide policy, Monsanto Company will establish its own New Zealand sales organisation effective 1st July, 1974.

Sales of a range of Monsanto products have been handled by Gollin (N.Z.) Limited on an agency basis for many years. The Monsanto New Zealand sales organisation will handle the full range of Monsanto world-wide chemical and plastic products.

IUPAC INFORMATION

IUPAC PHYSICAL CHEMISTRY DIVISION

The activities of the International Union of Pure and Applied Chemistry (IUPAC) are reported in detail in the *Comptes Rendus* of the Union which are published after each of its biennial Conferences. The last Conference was held at Munich, B.R.D., August 1973. The *Comptes Rendus* are supplemented by a series of *IUPAC Information Bulletins.* Provisional recommendations relating to units, symbols, chemical nomenclature, and like matters are issued by the IUPAC Secretariat as *Appendices to the Information Bulletins.* After a minimal period of eight months such provisional recommendations are republished, subject to any necessary revision and with the approval of the Bureau and Council of IUPAC, in the official journal of the Union, *Pure and Applied Chemistry.* In this journal the Union also publishes the plenary lectures and a selection of other scientific papers presented at the Union's biennial Congresses and at other conferences and symposia organised under IUPAC sponsorship. Information about these publications can be obtained from the Executive Secretary of the Union.[1]

The Physical Chemistry Division comprises six Commissions which, together with their Sub-Commissions, cover most fields of physical chemistry. The current structure and membership of these Commissions and Sub-Commissions will be published in the Comptes Rendus of the XXVIIth Conference (1). Information about them and about their programmes may also be obtained on application to the Executive Secretary of IUPAC[1] or to the President[2] or Secretary[3] of the Division.

Commission I.1—Physicochemical Symbols, Terminology and Units.

The work of this Commission led to the inclusion of the "amount" of a substance as a seventh base unit of the Systeme International d'Unites at the XIVth General Conference of Weights and Measures in 1971. This unit is the mole (symbol mol) and is defined as "the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilograms of carbon-12." Recognition of this base unit permits the inclusion within the SI of such derived units as molar mass, molar entropy etc.

This Commission is now revising its *"Manual of Symbols and Terminology for Physicochemical Quantities and Units"* (2) to conform with a new edition of *Le Systeme International d'Unites* (3-5) published by the International Bureau of Weights and Measures in 1973.

In co-operation with other Commissions of the Division, and with the IUPAC Section on Clinical Chemistry, this Commission is also working on more detailed sets of units, symbols and nomenclature recommendations of special relevance in more limited fields of chemistry. These will appear as independent appendices to the Manual. Such appendices dealing with colloid and surface chemistry (6) and with electrochemistry have already appeared: the latter as yet in a provisional version only (7).

This Commission is also giving consideration to the formalization of a recommended terminology and symbolism for quantum chemistry.

Commission I.2—Thermodynamics and Thermochemistry

In 1972 this Commission produced a *"Guide to Procedures for the Publication of Thermodynamic Data"* (8). This has since been republished widely elsewhere including French, Japanese, and Russian language versions; a German version is in preparation. Publications on experimental thermochemistry (9,10) and experimental thermodynamics (11, 12) are either completed or in progress. Under the auspices of this Commission an annual *Bulletin of Thermodynamics and Thermochemistry* (13) is published; this provides an index of current publications and on-going projects. Commission I.2 is organizing the IVth. International Conference on Chemical Thermodynamics which wil be held in southern France in late August 1975*.

Sub-Commission I.2.1 which deals with plasma chemistry organised a symposium at Kiel B.R.D. last September and is preparing an extensive bibliography of the plasma chemistry field. It will hold a second symposium in Vienna in August or September 1975* and a smaller meeting on energy transfer between a thermal plasma and a condensed phase at Odeillo, France, also in August 1975*.

Sub-Commission I.2.2 is concerned with the preparation of thermodynamic tables and has actively supported the Thermodynamics Tables Project at Imperial College, London. The first volume of the series *"International Thermodynamic Tables of the Fluid State"* entitled *"Argon 1972"* appeared in April 1972 (14) and a second volume *"Ethylene 1972"* (15) is in press. Additional volumes dealing with carbon dioxide and helium are scheduled to appear soon.

Commission I.3—Electrochemistry

This Commission has been mainly occupied during the past year with the production of *"Electrochemical Definitions and Symbols"* (7), as an appendix to the Manual of Symbols and Terminology for Physicochemical Quantities and Units. It is also assembling electrode kinetic data and electrode potential data and these are now being organized for publication. Associated with this is a separate project on electrode potential data on fused salts.

Commission I.4—Physicochemical Measurements and Standards

A major activity of Commission I.4 has been the preparation of a *"Catalog of Physicochemical Standard Substances"* (16). This listed reference materials available from national laboratories for a large number of physicochemical measurements of interest to science and industry. Only reference materials certified or otherwise guaranteed by national laboratories were included in this catalog. These do not suffice for all needs and a new *Sub-Commission on Calibration and Test Materials* is compiling a more comprehensive list to appear as *"IUPAC Recommended Calibration and Test Materials for the Realisation of Physicochemical Properties."* Chapters and Sections under consideration deal with calorimetry, density, dielectric constant, distillation column performance, molecular weight, optical properties, potentiometric ion activities, PVT properties, surface tension, temperature test materials, thermal conductivity, viscosity. International panels of experts in these fields are being assembled, and a series of recommendations will be forthcoming.

1 Dr M. Williams, Executive Secretary, IUPAC Secretariat, Bank Court Chambers, 2-3 Pound Way, Cowley Centre, Oxford OX4, 3YF ,U.K.

2 Dr R. N. Jones, Division of Chemistry, National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario K1A OR6, Canada.

3 Professor M. Fayarde, Ecole nationale superieure de Chimie, Universite de Paris, 11 rue Pierre et Marie Curie, F-75, Paris 5e, France.

* Information about these three conferences can be obtained from their respective Chairman (a) Prof. M. Laffitte, Centre de Recherches de Microcalorimetrie et de Thermochimie 26 Rue du 141e R.I.A., 13 Marseille (3e), France; (b) Dr A. T. Bell, Dept. of Chem. Engineering, University of California, Berkeley, California 94720, U.S.A.; (c) Dr C. Bonet, Laboratoire des Ultra Refractaires, B.P. 5, Odeilo, 66120 Font Romeu, France.

This Commission is also planning to prepare new comprehensive tables of the vapor pressure of water based on the work of Wexler and Greenspan (17) and of Ambrose and Lawrenson (18); there is still some uncertainty about the triple-point pressure but new measurements are in progress to resolve this uncertainty. Evaluation of the density of water over the range 0 deg. C to 40 deg. C is in hand and it is planned to propose that national standards laboratories throughout the world undertake a new co-operative programme in this field.

Commission I.5—Molecular Structure and Spectroscopy

In colaboration with Commission 1.1 this Commission has revised the section of the Manual of Symbols and Terminology for Physicochemical Quantities and Units dealing with light and electromagnetic radiation. The revision was published in provisional form in 1972 (19) and will be incorporated into the new edition of the Manual. In the area of spectrophometry these recommendations will offer an alternative to the disparate terminologies that have long existed in Europe and North America.

Commission I.5 has produced a series of publications to help unify the documentation of spectral data in both tabulated and graphical forms. Recommendations concerning Raman spectra (20) and nuclear magnetic resonance of protons (21) have reached the "approved" stage while recommendations on non-proton nuclear magnetic resonance spectra (22), Mossbauer spectra (23) and photo electron spectra (24) are in process of publication in tentative form. Consideration of infrared spectroscopy has been slowed by the need to take account of newer interferometric techniques of infrared spectrophotometry but work on this is proceeding; also under consideration are the symbols and terminology for molecular force constants.

Commission I.5 has recently published Parts III and IV of *"Tables of Wavenumbers for the Calibration of Infrared Spectrometers"* (25). These cover the range 1-600 cm^{-1} and supplement Parts I and II (600-4000 cm^{-1}) (26).

A Sub-Commission on Mass Spectroscopy has recently been established.

Commission I.6—Coloids and Surface Chemistry

Commission 1.6 has completed Part I of a *"Manual of Definitions, Terminology and Symbols in Colloid and Surface Chemistry"* (6). Part II of this publication, which deals with heterogenous catalysis, has also been completed and will appear as a provisional set of recommendations in the near future (27). Light scattering terminology and rheological properties of importance to the colloid and surface chemist are also under consideration; a set of provisional recommendations *"Nomenclature of Zeolites and Molecular Sievas"* is in an advanced stage of preparation.

In association with the Society for Chemical Industry and the National Physical Laboratory in the United Kingdom this Commission has been instrumental in providing certified surface area standards covering the range 10-300 m^2g^{-1}. Information about these can be obtained from Dr. R. Wilson, Division of Inorganic and Metallic Structure, National Physical Laboratory, Teddington, Middlesex, U.K.

Conclusion

The Physical Chemistry Division of IUPAC is primarily involved with basic chemistry rather than with specific applications to industrial, commercial or environmental problems. The later aspects are however always kept in mind to give as wide an applicability and usefulness as possible to our recommendations with respect to nomenclature, to standard materials, and to collections of numerical data. The link is especially close with analytical chemistry; today's advances in physical chemistry pave the way for future developments in analytical chemistry and the time lag is ever diminishing.

By itself—and through its contacts—the Physical Chemistry Division of IUPAC represents a reservoir of expertise in physical chemistry. The Division is always willing and interested to offer its services through the well established channels that have been formulated within IUPAC over the years.

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XXVth INTERNATIONAL CONGRESS OF PURE AND APPLIED CHEMISTRY

Jerusalem, Israel, 6 to 11 July, 1975

At the invitation of the Israel Chemical Society, the 25th IUPAC Congress will be held in Jerusalem under the auspices of His Excellency, The President of the State of Israel, Professor Ephraim Katzir, and under the sponsorship of:
The Israel Academy of Sciences and Humanities
The National Council for Research and Development
The Hebrew University of Jerusalem

Organising Committee for 25th IUPAC Congress

Professor E. D. Bergmann, President; Professor Y. Marcus, Chairman; Professor C. Amiel; Professor E. Bergmann; Professor M. R. Bloch; Professor J. Jortner; Professor S. Lifson; Professor R. Mechoulam; Professor A. Patchornik; Mr. Z. Zurr.

Plenary lectures

The following distinguished scientists have already agreed to deliver plenary lectures at the Congress:

Herbert C. Brown; Egbert Havinga; Dudley Herschbach; Ephraim (Katchalsky) Katzir; E. Bright Wilson.

TENTATIVE SCIENTIFIC PROGRAMME

Main Topics

A. ORGANIC CHEMISTRY

New theoretical insights into organic molecules.
Chemistry of excited states.
Novel instrumental methods of structure determination.
Computers in organic synthesis and structure determination.
Novel synthetic applications of organometallic compounds.
Ylid chemistry.
Prebiotic chemistry and organic geochemistry.
Approaches to the structure of biological receptors.
Stereochemical aspects of biogenesis.

B. PHYSICAL CHEMISTRY

Condensed phases
Lasers in chemistry.
Molecular spectroscopy.
Molecular dynamics.
Interfacial Electrochemistry.
Molecular structure.
Molecular conformations.
Symposium: 50 years of quantum chemistry.

C. MEDICINAL CHEMISTRY

Prostaglandins.
Chemistry and biochemistry of ageing.
Chemistry of memory.
Chemistry of pain relief.
Chemotherapy of tropical diseases.
Molecular pharmacology.
Drugs and toxins from marine sources.
Histochemistry.
Immunosuppression.

D. APPLIED CHEMISTRY

Processes for future chemical industries.
Chemical aspects of future energy sources.
Food resources through chemistry.
Surface chemistry and surface activity.
Chemical processes for water desalination.
Industrial use of water.
Recycling and re-use of wastes.
Chemical means for reduction of environmental pollution.

In conjunction with the 25th IUPAC Congress, the following symposium will be held jointly with the Division of Macromolecular Chemistry of IUPAC, in the week following the IUPAC Congress.

E. MACROMOLECULAR CHEMISTRY

—The Tihlrd Aharon Katzir-Katchalsky Conference.
Developments in polymer theory.
Surface and electrochemistry of macromolecules.
Specialized polymeric systems in structural materials.
Polymers in pollution abatement.

Advice has been received from IUPAC of the following—

1. Conference on Laboratory Instruction in Chemistry — Troy, New York, U.S. — 10-12 June, 1974.
2. VII International Symposium on Carbohydrate Chemistry — Bratislavia, Czechoslovakia — 5-9 August, 1974.
3. I International Conference on Organic Synthesis — Louvain-la-Neuve, Belgium — 26-30 August, 1974.
4. IV Polish Conference on Analytical Chemistry — Warsaw, Poland — 26-31 August, 1974.
5. XIV Microsymposium on Macromolecules — Prague, Czechoslovakia — 26-29 August, 1974.
6. IV International Symposium on Medicinal Chemistry — Noordwijkerhout, Netherlands — 9-13 September, 1974.
7. II Symposium on Inorganic Phosphorus Compounds — Prague, Czechoslovakia — 10-14 September 1974.
8. II International Symposium on Chemistry of Nonbenzenoid Aromatic Compounds — 23-27 September 1974.
9. XXV IUPAC Congress — Jerusalem, Israel — 6-11 July, 1975.

Appendices on Tentative Nomenclature, Symbols, Units, and Standards —

No. 30—Classification and Nomenclature of Electro-analytical Techniques.

No. 31—Nomenclature of Organic Chemistry: Section D.

No. 32—Nomenclature of Iron-Sulfur Proteins.

No. 33—Nomenclature and Conventions for Reporting Mossbauer Spectroscopic Data.

Technical Reports—

No. 7—A Survey of Some Recommended Methods for the Identification and Determination of the Phenol Group.

No. 8—Recommended Method for Aflatoxins in Cocoe Beans.

SOLUBILITY DATA PROJECT

The Analytical Chemistry Division of IUPAC intends to form at the XXVII IUPAC Conference a Sub Commission on Solubility Data.

This Sub Commission in co-operation with the Committee on Data for Science and Technology (CODATA) of the International Council of Scientific Unions (ICSU) and the Gmelin-Institut of the Max-Planck-Gesellschaft zur Forderung der Wissenschaften, is undertaking a project on compilation, tabulation, critical evaluation and publication of solubility data in all physical systems. The data generated by the programme will serve not only chemists but scientists and engineers in all branches of science, medicine and technology.

The Sub Commission is now recruiting compilers and evaluators, motivated experts who wish to contribute to the success of the Project by doing scientific work in their specific field of interest.

For further information please contact Prof. A. S. Kertes, Institute of Chemistry, The Hebrew University, Jerusalem, Israel.

LOCAL SYMPOSIA

PERSPECTIVES IN PROTEIN CHEMISTRY

A symposium to be presented by the Manawatu Branch of the New Zealand Biochemical Society

at the

Department of Chemistry, Biochemistry and Biophysics, Massey University, Palmerston North

Friday, 12th July, 1974

The symposium aims to give a perspective of the various aspects of protein chemistry being carried out in research laboratories in the Palmerston North area.

Outline of Programme

The programme will be divided into the following broad sections:

1. Chemistry: protein structure; physical studies; sequencing and chemical synthesis; fractionation and purification of enzymes.
2. Biochemical aspects: biosynthesis and protein function.
3. Nutritional aspects: proteins as suppliers of amino acids for animals; protein quality; interaction and imbalance of amino acids; amino acid metabolism.
4. Protein engineering: large scale fractionating and purification; chemical modification; all aspects involving the production of proteins and protein food stuffs.

The day's programme will end with a buffet dinner followed by open lecture by Dr E. Hove, Applied Biochemistry Division, D.S.I.R., entitled

The International Protein Balance Problem

ONE DAY SYMPOSIUM ON TOXICOLOGY

The Auckland Branch is sponsoring a one day symposium on Toxicology.

Date: Monday, May 13, 1974.
Place: Danish House, 289 Parnell Rd., Auckland.
Time: 8.30 a.m.-5.00 p.m.
Registration: $8.00 (includes tea, lunch and copy of proceedings).
Car Parking: Holy Trinity Cathedral Car Park.
Details from:
J. G. Fletcher,
Box 25037,
Auckland, 5.

RECENT APPOINTMENT

Dr G. W. Butler, F.N.Z.I.C., was recently appointed Assistant Director-General of the DSIR. He has for many years been an important figure in New Zealand nutritional and biochemical research.

As Director of the Applied Biochemistry Division, he has controlled work on many aspects of plant, animal and human nutrition, and some of the studies being conducted by the division are among the most advanced in the world.

Dr Butler was born in Auckland in 1928. He joined the then Plant Chemistry Laboratory of the DSIR in 1949 after graduating M.Sc. with honours in chemistry at Auckland University. Later, on leave from the laboratory, he studied biochemistry at the University of Otago, and went on to Lund University, in Sweden, where he completed his doctorate of philosophy in 1953.

Dr Butler is a member of the Cawthron Institute Trust Board, an executive member of the Medical Research Council, and convenor of the MRC's standing committee on non-medical use of drugs. He is a Fellow of the Royal Society of New Zealand, and a Fellow of the New Zealand Institute of Agricultural Science.

His own researches contributed substantialy to understanding the interaction of various substances in plants and soils, and their relationship to animal nutrition and health. His special interests have included aspects of nitrogen metabolism in plants, and mineral nutrition of plants and animals.

CORRESPONDENCE

To the Editor

The tone of Dr MacKay's letter (Chemistry in New Zealand, October 1973) is such that I feel some further comment is required. My so-called "sermon" was not intended as supercilious criticism, but was an attempt to initiate discussion on an import aspect of modern science.

I regret that Dr MacKay misconstrued the article as a specific attack on his University, which is what his letter would suggest. It was certainly not my intention to single out Waikato; my remarks being addressed to the Universities in general. I apologise if the wrong impression was created. However, to dismiss the whole article on the basis of disagreements with the first paragraph, which Dr Mackay would have us do, is hardly the objective approach of a professional scientist.

Unfortunately I do not have a copy of the advertisement in question before me at this time of writing. I assume that Dr MacKay's corrections are accurate, but I fail to see that they alter the tenor of the advertisement that I inferred in my opening paragraphs. Dr MacKay appears more concerned with intradisciplinary interests across the whole spectrum of chemistry itself, whereas I was primarily discussing the interaction between chemistry and other disciplines; for example medicine, geology, engineering, ceramics, etc. The University of Waikato may well be as enlightened as Dr MacKay suggests, but this is not emphasised in their international advertisements, and therefore they will not be attracting the interdisciplinary chemist. This is also true for most positions advertised by New Zealand Universities.

I am aware that generalisations are dangerous and I hope that my original remarks are not as widely applicable as I believe they are. It would be interesting to learn in more detail about interdisciplinary programmes in the Universities, including those at the University of Waikato, through the pages of "Chemistry in New Zealand."

But please, let us have reasoned arguments in place of emotional reactions.

J. FRANCIS YOUNG,
Assistant Professor of Civil Engineering,
University of Illinois, U.S.A.

1974 CONFERENCE, AUCKLAND

Monday, 26 August to Thursday, 29 August

The Conference is being held in Auckland at the University and the Technical Institute. This year, the theme is "CHEMISTRY SERVES SOCIETY", with two symposia focussing on the varied roles and responsibilities accepted by Chemists today. A third symposium will deal with aspects of the Science and Technology of Fats.

The Chairmen and Plenary Lecturers will be:

Science and Technology of Fats

Chairman: Dr F. B. Shorland (Victoria University)

Plenary Lecturers: Mr S. G. Brooker (Abels Ltd.)
Prof. J. C. Hawke (Massey University).

Professionalism

Chairman: Dr D. R. Llewellyn (Waikato University).

Plenary Lecturers: Dr A. T. Johns (Department of Agriculture).
Prof. A. M. Kennedy (Canterbury University).

Social Responsibility

Chairman: Prof. J. Vaughan (Canterbury University).

Plenary Lecturers: Prof. A. T. Wilson (Waikato University).
Dr R. B. Mann (Auckland University).

In addition there will be Chemistry and Biochemistry Guest Lecturers, the Easterfield and Presidential Addresses, a Vice-Chancellor's Buffet, a visit to the Mercury Theatre, Social Hours, and the Conference Dinner. A comprehensive Ladies programme and visits to local points of interest have been arranged. A teachers' refresher course to be held on August 29 and 30 will be run in conjunction with the Chemical Education Group.

Specialist Groups will meet throughout the Conference, and the traditional student papers will be included in these. Guest speakers from overseas will feature in some of the Specialist Group meetings. An innovation will be the inclusion of an Industrial Chemistry Group to cater for speakers in this area.

Participants in the Conference are invited to present reports of research and development work or brief reviews of special fields in these Specialist Sessions. Offers of papers must reach the appropriate Specialist Group organiser by May 25, 1974. It is not necessary to be a member of a Specialist Group in order to submit a paper. If there is any doubt as to which Session is appropriate for your paper, submit your offer directly to the Conference Secretary.

Each offer of a paper must be accompanied by the full title; names of authors (place an asterisk beside the person who will present the paper); affiliation; and an abstract not exceeding 200 words. To facilitate typesetting no diagrams or structural formulae should be used. Please make the title and abstract as informative and detailed as possible to help delegates to properly select the papers they wish to hear. Thirty minutes will be allowed for each paper including questions and discussions. Slide and overhead projectors will be available. The abstracts will be published in the August issue of *Chemistry in New Zealand*.

Organising Secretary:

Dr P. S. Rutledge,
Department of Chemistry,
University of Auckland,
Private Bag,
AUCKLAND, N.Z.

PROGRAMME 1974 N.Z.I.C. CONFERENCE, AUCKLAND
CHEMISTRY SERVES SOCIETY

Monday, 26 August	Tuesday, 27 August	Wednesday, 28 August	Thursday, 29 August
Registration, 9.00-10.30 a.m.	Easterfield Address, 9.00-10.30 a.m.	Biochemistry Guest Lecturer, Dr W. H. Elliott, University of Adelaide, 9.00-10.30 a.m.	Visiting Lecturer, Dr H. J. Moore, Hannah Research Institute, Scotland, 9.00-10.30 a.m.
TEA 10.30-11.00 a.m.			
Registration, 11.00-12.30 p.m.	Symposium Plenaries, Science and Technology of Fats, 11.00-12.30 p.m.	Symposium Plenaries, Professionalism in Chemistry, 11.00-12.30 p.m.	Symposium Plenaries, The Socially Responsible Chemist, 11.00-12.30 p.m.
LUNCH 12.30-2.00 p.m.			
Opening Ceremony, 2.00 p.m.	Fats Symposium and Specialist Groups, 2.00-3.30 p.m.	Professionalism Symposium and Specialist Groups, 2.00-3.30 p.m.	Social Responsibility Symposium and Specialist Groups, 2.00-3.30 p.m.
TEA 3.00-3.30 p.m.	TEA 3.30-4.00 p.m.		
Specialist Groups, 3.30-5.30 p.m.	Fats Symposium and Specialist Groups, 4.00-5.00 p.m.	Professionalism Symposium and Specialist Groups, 4.00-5.00 p.m.	Social Responsibility Symposium and Specialist Groups, 4.00-5.00 p.m. Repeat of Winning Student Paper 5.00 p.m.
Social Hour, 5.30-6.30 p.m.	Vice-Chancellor's Buffet, 5.45 p.m.	Social Hour, 5.00-6.00 p.m.	Social Hour, 6.00-7.30 p.m.
Guest Lecturer, Dr A. Walsh, C.S.I.R.O., 8.00 p.m.	Mercury Theatre, 8.00 p.m.	N.Z.I.C. Annual General Meeting, 7.00 p.m., Presidential Address, Dr P. K. Foster	Conference Dinner, 7.30 p.m.

BRANCH NEWS

Auckland

Luncheon Meeting, 20 February, 1974

Mr J. A. Gilmour, the Director of TELARC, addressed the branch at this meeting. A report of this address is included in this journal.

Personal

Mr K. Boyer has been appointed to the temporary staff of the Chemistry Department of the Auckland Technical Institute.

Mr J. K. Johannesson of the Auckland Technical Institute will be visiting overseas laboratories and conferences in the course of a world trip later this year.

Mr M. S. McR. Greig has recently been appointed research chemist at Winstone Ltd., Auckland.

Dr R. Kay, Research Director of Formica, U.K. Ltd., recently visited New Zealand.

Dr M. J. Taylor of the Auckland University will spend eight month's leave at Lester University later this year.

Dr D. E. Williams, University of Auckland, will take up a Junior Research Fellowship in physical chemistry at Braesenose College, Oxford, in April.

Dr R. J. Wong has recently completed the requirements for a Ph.D. and has been appointed to the staff of Chemistry Division, D.S.I.R. in Auckland.

Miss Judy Strange has been appointed development manager for Con-Stan Industries (N.Z.) Ltd. She will be responsible for the research, development and quality control of the Con-Stan skin care and beauty aid range for New Zealand, Australia and the Pacific. Previously research chemist for Mill Valley International Ltd, Miss Strange is one of the few women members of the Australian Society of Cosmetic Chemists.

Manawatu

The Manawatu Branch has appointed Dr P. S. Robertson to the recently established Council of the Palmerston North Technical Institute. Dr Robertson is Assistant Director of the New Zealand Dairy Research Institute and is a Fellow of the Institute of Chemistry.

The Institute of Chemistry Prizes for the best students in third year chemistry and biochemistry at Massey University have been awarded to R. W. Parker and A. J. R. Kriechbaum respectively.

The March meeting of the branch was addressed by Professor G. N. Malcolm on "Configuration and Behaviour in Macromolecular Systems."

Massey University

The University was the venue for the Senior Chemistry Teachers Refresher Course. About one hundred chemistry teachers attended the course which was chaired by Mr J. B. Collett, Head of Science, Otaki College.

Dr E. W. Ainscough and Dr A. M. Brodie attended the Fifth Conference of the Division of Coordination and Metal Organic Chemistry (Royal Australian Chemical Institute) at Broadbeach, Queensland.

Dr J. S. Ayers has recently returned from a trip to Europe where he visited research laboratories working on the chemistry of viscose. This was in conjunction with the Massey and TVL joint programme on the development of new ion-exchange resins for the isolation and purification of proteins. Dr Ayers also attended a symposium on affinity chromatography organised by the A.C.S. in Charleston, S. Carolina, U.S.A.

Dr T. M. Kitson has been appointed to the position of lecturer in the Department of Chemistry, Biochemistry and Biophysics.

Dr Kitson who has obtained his D.Phil. from the University of Oxford, has been a post-doctoral fellow in the Department working on alcohol and acetaldehyde metabolism in mammals.

Dr G. R. Hedwig has arrived to take up a post-doctoral fellowship in the Department of Chemistry, Biochemistry and Biophysics. He is to work with Professor G. N. Malcolm on microcolorimetry of biological molecules. Dr Hedwig gained his Ph.D. degree from the University of Canterbury.

A co-operative programme has been arranged between the Food Technology Department of Massey University and the Department of Chemical Technology Chulalongkorn University, Bangkok. The aim of the programme is to help in the development of Food Technology teaching and research in the Thai University.

As part of this programme Professor E. L. Richards plans to visit Thailand in August to lecture in Food Chemistry, organise a practical course and to advise on a masterate programme.

N.Z. Dairy Research Institute

Mr Euan Cant has joined the flavour chemistry section. Previously he has been completing his Ph.D. degree at the University of Canterbury.

An amino acid analyser has been installed in the fundamental protein section.

A low resolution pulse n.m.r. spectrometer is being evaluated by the Butter and Milkfat section, work being concentrated on solid/liquid content measurements.

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

Dr C. J. Asher is on leave from the University of Queensland. He will be working on the mechanisms of arsenic uptake by plants and the mineral composition of plant cells.

Professor W. D. Loomas from the Department of Chemistry and Biophysics, University of Oregon is spending a year in the Division. He is on a NRAC Senior Research Fellowship and will be working on phenolic oxidation by enzymes.

Professor E. Epstein, Department of Soils and Nutrition, University of California, Davis, is coming to work on mineral nutrition of plants.

Dr R. T. Gallagher, Department of Chemistry, Biochemistry and Biophysics, Massey University has been appointed to the Organic Chemistry Section and will be working on aspects of plant-insect relationships.

Wellington

Chemistry Division, D.S.I.R.

Mr J. D. Whitehurst (B.Met., Sheffield) joined the Metallurgy Section in February. He was formerly a corrosion engineer for Caltex (U.K.) in London. At Chemistry Division he will study the problem of fatigue under geothermal conditions.

Soil Bureau

Drs K. S. Birrell, W. B. Healy and D. J. Ross, have been admitted to the Fellowship of the Institute.

Dr G. J. Churchman has recently joined the Physical Chemistry Section from the Department of Soil Science, University of Wisconsin, where he worked with Professor M. L. Jackson on reactions at mineral surfaces.

Mr A. J. Metson attended the recent "Sulphur in Australasian Agriculture" Symposium in Canberra.

Institute of Nuclear Sciences

Professor C. W. Ferguson joined the Institute for two months after the INQUA conference in Christchurch in December. Professor Ferguson comes from the laboratory of tree-ring research at the University of Arizona, and is a well known authority on this subject. While in New Zealand he is extending his studies to the kauri and giving lectures at various centres on his work.

Dr T. A. Rafter attended the INQUA conference in Christchurch and lectured on "Radiometric Dating—Achievements and Prospects in the Quaternary."

Dr B. W. Robinson visited laboratories in America and Europe in November and delivered lectures on his work at two conferences organised by the Geological Society of America. The first was a symposium on Stable Isotopes in Relation to Problems in Ore Deposition, held in Dallas, and the second was on the Geochemistry of Ore Dejosits at the G.S.A. Annual Meeting at Dallas.

Dr C. B. Taylor has left the Institute temporarily to take up a two-year appointment at the Vienna laboratories of the International Atomic Energy Agency. His work will continue to be associated with tritium as a hydrological tracer.

Chemistry Department, Victoria University of Wellington

Dr B. Halton attended the R.A.C.I. Organic Chemistry Division Conference held in February in Cowes, Philip Island Victoria, and presented a Paper entitled, "Some Recent Developments in the Chemistry of Arocyclopropenes."

Canterbury

The first meeting of the year was preceded by a buffet tea at the University Staff Club. Following this a visit was made to the School of Forestry which was opened in 1970. During the tour of the building it was learnt that the Forestry course consists of two intermediate years and two professional years. The School currently has 8 graduate students and a staff of 7. The subjects covered in the course include the economics, engineering and biology of forestry. In addition soil science, wood technology, silviculture and management are taught. Branch members were impressed by the laboratory facilities.

A meeting on April 1st was addressed by Dr M. J. McEwan on the subject of Extraterrestrial Chemistry. Dr McEwan of the Chemistry Department, University of Canterbury, has recently returned from leave taken at the Laboratory for Atmospheric and Space Physics in Boulder, Colorado, and his talk covered some of the recent chemical discoveries arising from experimental observations of the atmospheres of nearby planets.

The first 1974 meeting of the Christchurch Biochemical Society was held on March 18th in the Clinical School of Christchurch Hospital. Dr G. A. Rodley of the Chemistry Department, University of Canterbury, gaven an address on the chemistry and biological implications of the interaction of DNA with copper ions.

Lincoln College

On March 9th it was announced by the Minister of Forests, Mr Moyle, that Sir Malcolm Burns had been appointed a member of the South Island Beech Forest Management and Utilisation Council.

Professor T. W. Walker, of the Soil Science Department will be taking six months study leave in Moscow commencing at the end of April.

Mr D. G. Moore has resigned as Demonstrator in Biochemistry to take up a position as Tutor in Biochemistry at the Christchurch Technical Institute.

Princess Margaret Hospital

Dr Glen Metcalf of the Medical Unit has recently returned from study leave in the U.K. where she visited laboratories in connection with her work on Steroid Hormones. Dr Metcalf also attended the 5th Asia and Oceania Congress of Endrocinology at Shandigarh, India. Mr C. Irvine of Lincoln College and Dr R. A. Donald also attended the conference.

Christchurch Technical Institute

The number of students who have this year nominated the Chemistry option for their certificate of science has arisen to 49. For the first time the Chemistry IV class is to be split to cope with increased numbers. Last year all 7 students sitting Chemistry V successfully completed the course.

Mrs. Jill Sumich will be assisting with teaching in Chemistry. The other tutors in Chemistry are Mr D. Lewthwaite, Dr D. Cretney and Dr S. Maister.

Mr. Tom Crossen has resigned from the position of Senior Tutor in Biochemistry to take up a position as Reader in Horticulture in Adelaide.

University of Canterbury

Mr R. B. Jansen from Christchurch Boys' High School, and Dr. Herbert Beall from Worcester Polytech. in Massachusetts, have joined the Chemistry Department as Visiting Lecturers.

From Australia on study leave are Dr. Errol McCoy of Flinders University and Dr. Colton of the University of Melbourne.

Professor E. Slowinski, Dr J. Blunt, Dr. R. Maclagan and Mr. R. B. Jansen have arranged a practical course in inorganic and organic analysis for selected 7th Form students as part of the Junior Chemical Society programme. Prof. Slowinski recently spoke to the Society on the subject "The Nature of Energy or Why the Water Engine Won't Work." Professor J. W. Tomlinson gave this year's Chemistry in Action lecture to senior school pupils on the subject: Chemistry, Electricity and Energy.

From 8th-11th April several members of the staff of the Chemistry Department will assist with an in service teachers course in 7th Form Practical Chemistry to be held at the Department of Education's residential house, Hogben House.

D.S.I.R.

Mr. J. Bathurst, who is completing a Ph.D. in organic chemistry at the University of Canterbury, has joined the staff of Chemistry Division.

Dr Russell Allison reports that the Applied Biochemistry Division is placing increasing emphasis on the isolation of human food grade leaf protein concentrates. They are now able to prepare a cream undenatured fraction in good yield. Other items of note are the purchase of an automatic programmable G.C. sample injector, and the development of a new colourimetric determination for Solasidine from Solanum Aviculare.

ADDENDUM

List of Branch Officers 1973-74.

Canterbury Branch

Chairman: Dr G. J. Wright.
Secretary: Dr J. W. Blunt.
Treasurer: Dr C. G. Freeman.

Otago

Dr B. R. Hajratwala of the Pharmacy Department of the Medical School has been elected a Fellow of the Institute of Chemists (India).

UPJOHN PUBLISHES URETHANES SAFETY BOOKLET

A booklet on safe handlng, use and applications of isocyanates, isocyanate-based foams and chemicals, a publication of The Upjohn Company, is announced.

Upjohn's recommend that every person who specifies, stores, handles or supplies any urethane or isocyanurate chemical, system or finished product read this book in its entirety and become thoroughly familiar with its precautionary contents.

The booklet is intended to be a reference guide. As such, it should be readily available for consultation, as needed, both in the office and on the job site.

The 40-page booklet discusses in detail the hazards involved in manufacture, fabrication, storage and end-use applications of urethanes and isocyanurates and the chemicals that go to make them. Precautions, warnings and recommendations for minimizing these hazards are presented.

The completely indexed booklet begins with an overview of types, methods of manufacture, applications and uses of urethanes, isocyanurates and related chemicals. It contains a glossary of terms and a complete bibliography.

The Upjohn urethane safety booklet can be obtained free on application to the Chemical Marketing Services Department, The Upjohn Company, Polymer Chemical Division, Kalamazoo, Michigan 49001, U.S.A.

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Some important corrigenda on this standard will shortly be issued and will be distributed to those who have sent in the usual amendment request slips to the Standards Association, Wellington.

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