

CHEMISTRY IN NEW ZEALAND

JOURNAL OF
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OF CHEMISTRY

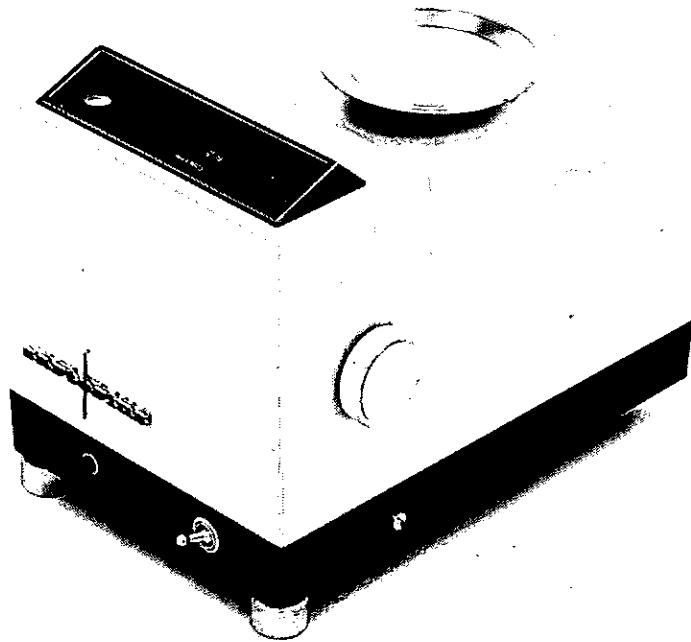


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Editor: Miss J. Mattingley, B.Sc., A.N.Z.I.C.
P.O. Box 250, Wellington.

Advertising Manager:
D. Howard, M.Sc., A.N.Z.I.C.
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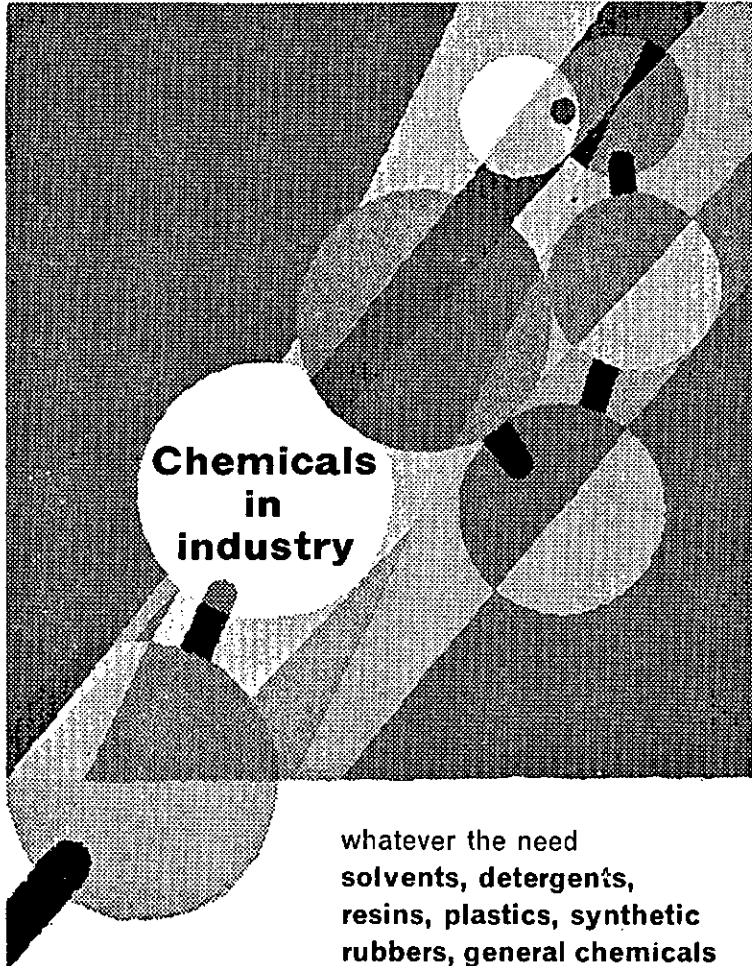
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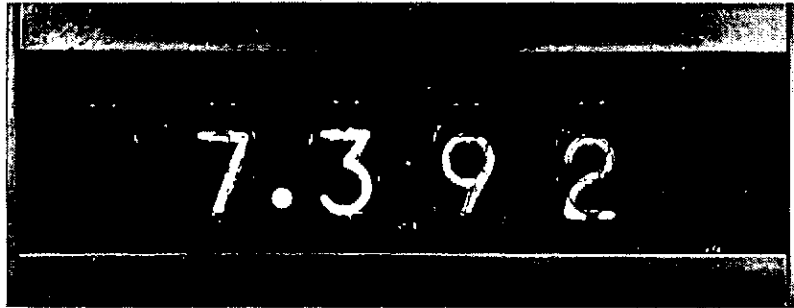
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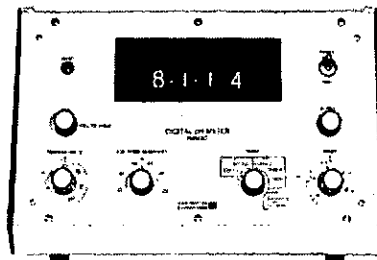
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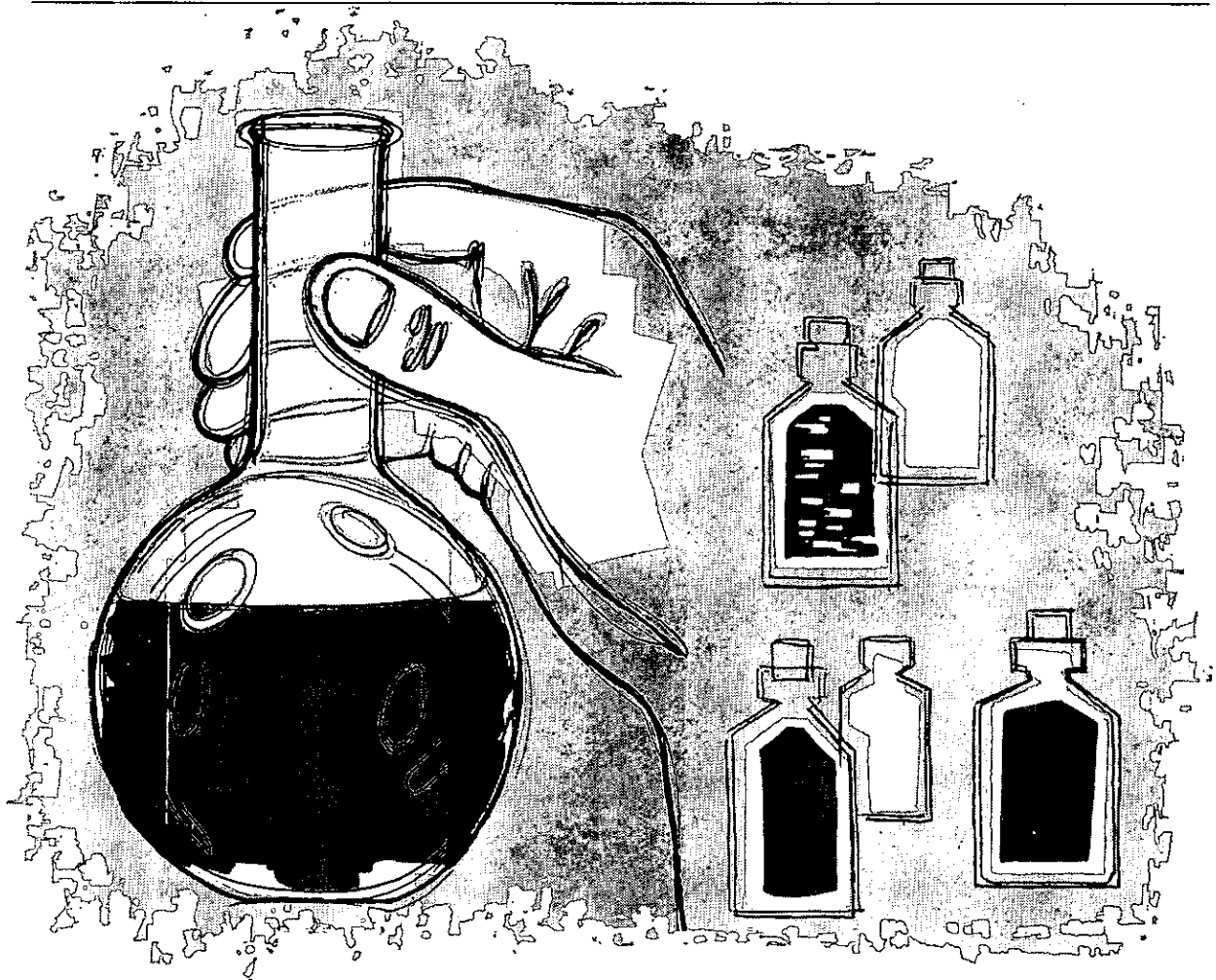
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THE ONLY SUBSTITUTE FOR PROFIT IS LOSS

P. K. Foster, M.Sc., Ph.D., D.I.C., F.N.Z.I.C.

N.Z. Pottery and Ceramics Research Association, Lower Hutt

By way of introduction* to a session on chemical-based industry I thought it appropriate to describe the context in which industrial science operates.

I want to start by making two points. The first arises from a talk I had with a man who has diverse commercial interests. He was telling me about an agricultural lime works in which he had just bought a controlling interest, and described at length the factors which had decided him to invest, for example, the value of new plant owned by the company was five times the amount he had to spend to get control of it; the company had large accumulated losses which could be set against future profits for tax purposes provided the shareholding was not changed by more than a certain amount; he had been careful to achieve control without exceeding this limiting change in shareholding; he added a lot of other details that I can't remember. Finally, after about 5 minutes he remembered who he was talking to and said, "Oh yes, and the stuff is high in carbonate—if it's carbonate it's supposed to have a lot of." My first point is that chemists and chemistry have no place in industry unless they contribute to profits.

My second point is covered by a quotation from Hansard:

"Sooner or later the Government will be forced to recognise that Government are the chief partners in industry. . . . The Government take up to one half of the earnings. No one is more vitally interested in the production of profit-making industry than the Government. It is a sleeping partner and it takes half the profits." (Hansard, U.K. 27/4/1938).

This statement was made in 1938 in the House of Commons by Harold MacMillan. My second point is that profit in industry is everybody's business, not just the shareholders'.

I must first talk about profit because it is impossible to consider science in relation to industry without considering the prime motivating force in industry. Industry does not exist to make bricks, or pipes, or fertilisers, but to make profits for shareholders. If you do not like this brutal attitude consider what happens if there are not any profits. The shareholders will pull out and invest their money somewhere where there *are* profits. All of us do the same, and consciously or unconsciously assess the profit to risk ratios in deciding between Post Office, the Public Service Investment Society, Government and local body loans, superannuation schemes and the stock market, as to where we will put our humble savings. Do you worry what they use your money for as long as the interest rate is all right?

The functions of Boards of Directors and managers and chemists in industry are therefore to maximise the profits for the shareholders. This is what they are paid for and loss of sight of this factor by an individual soon results in unemployment for that individual. Quality and efficiency affect both cost and sales and so are intimately connected with profitability, but to upgrade the quality or efficiency is not necessarily the most profitable thing to do, and therefore not necessarily the best way of a company fulfilling its obligations to its shareholders. Boards of Directors and managers have considerable choice within their company as to where they can invest their funds and a responsible scientist in industry has to recog-

* Text of paper given in Symposium on Chemical Based Industries at N.Z.I.C. Conference, 1969.

nise that the employment of more chemists with a consequent increase in quality and/or efficiency may well be an inferior investment to more advertising, more salesmen, more plant, better raw material, etc., etc.

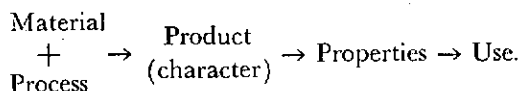
There are various ways of classifying scientific effort. There are all kinds of research such as fundamental, pure, applied, directed and undirected, and there is a variety of types of scientific organisations such as Universities, Government, Research Associations and industrial laboratories. These concepts do little, however, to clarify some of the issues involved in:

- (a) The relation between technology and research;
- (b) The distribution of scientific effort in regard to a particular industrial process or problem;
- (c) The different attitudes of research and technical workers;
- (d) The implications of these differences to a professional institute and to universities, the origin of our members.

There are two factors which if examined now will throw considerable light on later discussion. The first is the over-riding effect of time in determining profitability—the urgent necessity for the rapid application of any investment. This can most easily be stated in terms of the total return which will be obtained on an investment. The total return, calculated on a “present value” basis using discount rates, decays rapidly and approximately exponentially with respect to the delay which elapses before a given cash benefit begins. For rates of return of 20 to 60 percent, the “half-life” of the decay is 3 years to 18 months respectively. In other words if you have done some research which could return 40 percent on the investment, but are two years later getting it applied than you could have been, half the total profit you could have made is lost forever! Hence the extreme importance of speed in industry.

The second is the use of the terms “character” and “property”. In this paper the terms will be used in a special and relative sense. Broadly, a property of a material or product is an aspect of importance to its user, for example, the strength of sewer pipe is a property important to a drainage engineer. The character of a product comprises those aspects which determine and explain the properties. For example, the character of a sewer pipe comprises the phases present, their size distribution and shape, their stress states resulting from differential thermal contraction after firing, the presence of flaws. These factors interact to determine the property of macroscopic strength.

Relation between Technology and Research



This diagram obviously suggests not only a manufacturing sequence but also a research sequence—one first does research on materials and on the ways of treating them to produce a product. One then does research on the product to determine what character it has and what properties will result from that character. These properties can then be regarded as determining its use and the use will then determine the sales and the return on the research. This, I think, is an all-too-common view of the way in which research leads to technological advancement. It is a very comforting sequence for the research worker because he is able to convince himself that he is giving society rather more than in fact he is. Comforting it may be, but it is usually hopelessly wrong and is readily demolished by asking one question—to fulfil this long sequence of operations, where is all the money coming from? At any stage in such a sequence one could find that the system was not a profitable economic concern and that the money expended would therefore be wasted. Would you put your money into

such a system, or would you prefer to invest in a going concern with a record of at least some profitability? I suggest that this fallacious sequence has a very low profit to risk ratio.

Let us now consider what happens in practice. Almost invariably the demand for an industrial product is seen and a decision to invest in a system to produce that product is taken. *Existing* knowledge is then used to take *available* materials and processes as a first attempt to make the desired product. This has to be on the market producing a return *as soon as possible*, both to keep the shareholders' support of the project and to provide revenue which can be spent on further development. The urgency associated with industrial development is readily shown by the fact that *only 3 years' delay* in achieving a return on an investment will halve the return obtainable on that investment without such a delay. Thus in practice one jumps right across the diagram and fills in the gaps later as finance allows. This shows how technology cannot wait for research and shows the sort of way in which technology creates the demands for research. Research fills in the gaps and continually upgrades the process, gives more reliability to empirical relationships and leads to innovation. This ensures that the maximum return is obtained on the initial investment. I would emphasise that it is not until the technology is a viable commercial process however, that research can be afforded.

Let me give you some examples. Consider the motor car; Hollomon has said:

"All of the technology was essentially available for the development of the automobile 50 years before it was generally introduced. In 1850, there was a vehicle operating on four wheels and carrying five persons, propelled by a steam engine. I would have called it an automobile. It was outlawed on British roads. Entrepreneurs then attached cars to it, put it on rails, and called it a railroad train. People were not yet ready to buy individual trans-

portation. They weren't sufficiently wealthy. Demonstrate the point for yourself. Plot the number of automobiles per person, as a function of the income level per person. You will find that, in all the nations of the Free World, the curves are mostly the same."

—that is, nobody would invest in production until the market would ensure a profit.

Hollomon also refers to an analysis by the U.S. Department of Defence of the development of weapons systems since 1946. Of the significant inventions that were necessary in the development of every weapons system, 92 percent depended upon science that had been available for 30 years and only 8 percent depended upon science (mainly applied) that had been developed after World War II. In other words they could have been developed 30 years before if the market had existed for them. From 1945 to 1960 Japanese economic growth rate was the startling figure of 10 percent per year, yet until recently the support of basic science in Japan was negligible. Schmookler examined inventions in major industries in the United States over 30 to 40 years. He found that invariably the inventions in a given industry followed the decision to invest. This decision motivated the inventions.

To come closer to home, consider the development of geothermal power technology in New Zealand, in which field the Ministry of Works, N.Z.E.D., and D.S.I.R. are acknowledged to be world experts. Here again, the decision was to invest in geothermal steam as a source of power in New Zealand. As in other cases the research work is carrying on and leading to more efficient exploitation and use, but initially the engineers were producing steam largely independent of new research. You have only to ask how you can do research on steam or drilling cores that you haven't got!

Change in Scientific Effort with Time

We have covered the fallacious sequence of research and technology and also the real

sequence. Let us now consider how scientific effort should be distributed in relation to real problems of the type which can be reasonably accurately described by the diagram. The job of the technologist is to get the process working profitably and he does this by by-passing the middle of the chart, that is, he correlates the properties or use of the product with parameters of the materials and process. Then, as he learns more and more about his system he is moving further towards the centre of the chart, developing more and more understanding of his correlations, achieving better and better control or efficiency in his system, and able to come up with innovations because of his increased understanding.

I can best illustrate this by considering some of the research which PACRA has undertaken in the last twenty years. Twenty years ago when the Association was formed, work was commenced in two important fields; one was the development of miniature laboratory methods for determining the properties of fired clays cheaply in a way which related to the properties of the products produced commercially; thus the development of test methods at the right hand end of the diagram was one of the first points of attack. The other was to characterise materials as to their suitability or otherwise for producing ceramics, and establishing correlations between the material characteristics and the use already made of them. Twenty years later we are further refining the characterisation of materials and are also making a major step towards characterising an important part of the process, that is, towards determining what is most worth controlling in the process to achieve uniformity and efficiency of production.

The Association has done virtually no work on characterising the product, that is, on the microscopic factors which determine the properties which are important to the user. It is still too difficult and too expensive to work profitably in this area and much more profitable work can be done at either

end of the diagram. Even if it were not difficult and expensive, it would still be too soon; results would be produced which it would be impossible to use in the absence of knowledge of correlations across the diagram. Much published work on ceramic science is of this nature and parallels Carrie's comments concerning Nobel prize awards to those who determined the structure of haemoglobin.

The reason for stressing this is that there are considerable pressures on the research worker to do the opposite, to seek a full explanation or to establish the functional relationship too soon and therefore less profitably. It is worth examining these pressures.

- (a) To work on the character as opposed to the properties explains why. We like knowing why and have been expressly trained at considerable cost to develop this attribute. May I suggest it is an even greater attribute to ask oneself why one is asking why, and whether, at a particular stage in an investigation, it is in fact the most profitable question?
- (b) There is a lot of exotic equipment available to scientific research and this has two results; firstly the greater the novelty and complexity of the equipment, the greater the aura of social acceptability associated with those who use it. Secondly, if you are the one responsible for buying an expensive item you do not like seeing it idle. I am talking of equipment such as that used in X-ray diffraction, nuclear magnetic resonance, electron spin resonance, infra-red absorption, electron microscopy and electron probe microanalysis. The point about this type of equipment is that its use lies chiefly in determining the *character* of products and in explaining *why* things happen.
- (c) A large proportion of the total number of scientists receive significantly greater personal financial rewards if they can demonstrate their ability by scientific publications in recognised journals. Such

publications are usually concerned with explanations of why things happen, rather than describing what has been observed empirically.

These pressures are cumulative and considerable. They all act in the direction of reduced profitability.

Differences between Research Workers and Technologists

The earlier discussion and the use of the diagram have implicitly demonstrated that there are two types of chemist, that is two groups both using the same basic language and knowledge of chemistry but towards quite different ends. The basic differences can be described in many different ways:

- (a) The research scientist is endeavouring to understand some product or process to a sufficient depth to lead to more efficient processing and/or better products, when the results are applied by industry. It is essential that his work be soundly based, and that all conclusions from the work should be sound, not to the extent of giving complete answers, but certainly to the extent that the limitations and restrictions on their use are thoroughly understood. Industry then has a firm and reliable base from which to work. The pressure on the research worker is therefore to be right. His training and experience make him cautious; he must not mislead and he must have time to think. The only pressure of time on the research worker is that the greater the problems (in number and difficulty) he can solve *correctly* in a given time, the greater will be his remuneration. There is no quantitative measure of success or failure.

The technologist is in a completely different environment. He works in an atmosphere of urgency and is measured quantitatively in money

terms. The challenge is different, but no less, and often lies chiefly in having to make decisions on the basis of inadequate information. An excellent technologist will be right far more often than he is wrong and will make a large profit, a satisfactory technologist will be right often enough to make a satisfactory profit, and an unsatisfactory technologist will lose his job either through making too many wrong decisions, or worse still, making none, and either way making a loss.

- or (b) If you put a material, process or product in front of a research chemist his over-riding reaction will be "What makes this work the way it does, or have the properties it has?" The technologist's reaction will be "How do I make this work, or use it in a more profitable way?"
- or (c) The research worker is interested primarily in developing a full explanation and tying up as many loose ends as possible in accounting for observed behaviour. The technologist is interested in the cost-benefit break-even point—as soon as further investigation is no longer as profitable as some other investigation, he has no further interest.
- or (d) For the research worker, understanding is the aim in view (and so it should be); for the technologist, the aim is increased profits (and so it should be); understanding is only *one* of the means available to him.
- or (e) Research is for being pure at;
Technology is for being profitable at!

I have obviously taken extremes in each case, and in fact there is some of each in all of us. Because of this some people can be interested and good at both types of approach, and I find that the better they are in one field, the more able they are themselves in the other, and appreciative of it.

Generally however, one approach predominates strongly over the other and this validates the distinction I have made.

This difference in attitude is well illustrated by the matter of publication of scientific results. Research results and their interpretation have to be sound, free from ambiguity and have to make a significant contribution to scientific understanding. These can be established only by provision of opportunity for public criticism and debate. Publication is essential for research, not only for dissemination of knowledge but for the equally important opportunity for criticism. It is in this way that publications should provide an important measure of the research worker's ability and therefore constitute an important end of research in the research worker's eyes. It follows that research work is generally written in a form suitable for this end, not in a form explaining how the results can be used. The research worker is saying, "This is how I did it; these are my arguments—you prove me wrong."

The technologist on the other hand has largely completed his work as soon as it is profitably applied. He must look at the question of publication as a separate cost-benefit exercise. The costs include the time and effort involved in rounding off the work, writing, editing, etc., and the possible losses resulting from making the results available to competitors. The benefits comprise public demonstration that the process or product concerned is backed by competent scientists and by public demonstration of the scientific integrity of the company. Publication by a technologist in industry is justifiable only when the return on the exercise is superior to that in other avenues in which the same time and effort would otherwise be spent. In reporting to his management the technologist is saying, "Use my work in this way, and this is the return you will get."

Surely these two ways of looking at the same question could hardly be more different! It follows that criticism of each by the other, at least as so often expressed,

amounts to each saying the other is wrong to be good at his job! It is equally nonsensical to say that a good research worker cannot be a useful source of expert opinion for industry and to say that a good technologist does not perform work of equivalent difficulty because it is not taken to the stage of publication.

Implications of Differences between Research and Technology

(a) Institute of Chemistry

We have seen that technological advancement usually takes place by the application of "old" science, and that there is therefore apparently no great advantage for technologists to have close contact with new or current research.

I also regard as well established that there are two quite different basic attitudes towards the application of chemical knowledge—research and technology.

I submit that these two factors together provide a serious barrier to communication within the Institute which according to the 1968 membership list is split about 50-50—firstly we can get along pretty well in our respective jobs without much communication, and secondly when we do try to talk to each other there is too great a chance that our respective points of view and our motives will be misunderstood or regarded with suspicion. To be an effective professional body with the active participation of both groups, we must recognise these barriers and the complementary roles that the research worker and the technologist play in the profession. Attendance at each other's Branch Meetings and Conference Sessions is an obvious responsibility that must be fulfilled, and not ignored as many of us have so often done. You will note that I am refusing to ask how the Royal Society can adequately speak for the technological half of the Institute.

(b) Universities and Industry

There has been considerable discussion recently on how university research can better

serve the ends of industry. The sequence given earlier for the development of research into an industrial process requires the rapid application of available materials and techniques to make early profits. This type of science has to succeed within a time limit and is usually exceedingly demanding, and in these respects is appropriate to Ph.D. studies. However, it is unlikely to be publishable in accepted scientific journals, it is unlikely to have the type of scientific originality required, it is unlikely to be practical for one man only and it is unlikely to be practical remote from the factory. It is correspondingly unlikely to provide a satisfactory topic for Ph.D. research. On the other hand, it is comparatively easy to find Ph.D. topics in the centre area of the diagram. It follows that university research effort can be of practical benefit only to relatively "advanced" industries—advanced in the sense that the industry employs staff of its own to formulate the problem and apply the results, and advanced enough to have reached the stage for a problem related to the centre of the diagram to be a profitable study. The direct assistance which university research can give industry is therefore highly restricted. This must be recognised if the place of university research is to be properly assessed.

The second point concerns the education and training which universities provide at post-graduate level. There are three important factors:

- (1) Research courses are the only post-graduate courses available.
- (2) Encouragement of the best student to undertake post-graduate research is provided by the internal status of Ph.D. courses and the fact that the only financial reward available for undergraduate success within the university is support for post-graduate research.
- (3) Able staff rightly re-create in their own image, and students' only continuous personal contacts of importance are with university staff who have to be successful

and skilful at research to safeguard their own promotion.

These are three powerful and controlling influences in creating the present imbalance of university science graduates. The attitude of university graduates, particularly of the best ones, is predominantly oriented towards research—towards making understanding and away from making profits. If you are an industrial company requiring chemists as technologists these are three serious obstacles to your obtaining applications for positions from the best university graduates. I am well aware that many industry managements can be criticised for their management of graduates and their lack of understanding of how to get the best from them. However, this is the Institute of Chemistry not the Institute of Management, and I think we should ask ourselves here whether we are taking as much trouble over educating chemists for technology as we do over educating chemists for research. I have no doubts on the answer to this question.

I do not accept the answer that universities are educational bodies which must not become Vocational Training Institutes. I maintain they are inescapably both. If a Ph.D. course is not also first class vocational training for a career in research, I'd like to know what it is! Nor do I accept that technology is chemical engineering only and not chemistry. I believe that there is a place for both disciplines in technology and that we should be careful not to abdicate useful chemistry to the engineers in the way that physics and mathematics appear to be doing.

If the three factors I have mentioned are valid, the solutions are fairly obvious—alternative post-graduate courses, financial encouragement towards such courses, and most important of all, appointment to faculties of staff with industrial experience and recognition of the experience. I would stress that I suggest *alternative* not substitute courses. It is the present *balance* that is of concern, *not* the quality. Until we get a greater number of able technologists into

industry, we can't use our university research facilities to the greatest advantage, that is, by undertaking research for advanced industries without sacrificing the educational functions of university research. Whatever the causes and whatever the solutions, the imbalance exists and is an important part of the context of industrial chemistry.

In conclusion I have tried to show that

there are important differences between chemistry practised in research and chemistry practised in industry; that there is a progressive change in the emphasis of scientific effort as an industry develops; and that technological progress is largely independent of current research. There is a relationship of financial investment, technology, and *then* research.

PRIZES — REMINDER

Entries for the New Zealand Institute of Chemistry Prize should be in the hands of the Secretary, P.O. Box 250, Wellington, by 30 April.

The regulations governing the award were published in the December 1968 issue of *Chemistry in New Zealand*.

EASTERFIELD AWARD 1969

REMINDER

The Easterfield Medal will be awarded at the 1970 Conference of the New Zealand Institute of Chemistry.

This will be the eighth occasion on which the Award has been made and it is intended to maintain the high standards already established by the earlier recipients. The Medal, which will be supplemented by a cash grant of \$50, is considered to bring high honour to the successful applicant who will be expected in his application to indicate the quality and originality of his research work.

As this is the 1969 Award candidates should have been under the age of 35 years at 30 April 1969.

NOTE FOR CHEMISTS EMPLOYING TECHNICIANS

The New Zealand Institute of Science Technicians is a national organisation for all science technicians whether employed by industry, government, local bodies, universities, etc., provided they are normally employed full-time in technical aspects of scientific work. There are four grades of membership, progress through which will eventually depend upon qualification alone. At present, and until facilities for technical education are more uniform throughout the country, a combination of qualifications and experience entitles a technician to membership.

The Institute provides for technicians from all scientific disciplines opportunities to meet and exchange ideas and information at lectures, demonstrations, regional and national meetings. The publication 'Scope', although small at present, makes a significant contribution, and will in time expand to include larger technical articles.

Chemists could bring this Institute to the attention of their technicians. Its aim is 'to create a large, well qualified, enthusiastic membership from technicians working in science'.

National Secretary, P.O. Box 30-439, Lower Hutt.

PLANT PROTEIN AS HUMAN FOOD

J. W. Lyttleton, M.Sc., Ph.D., F.R.S.N.Z.

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

Whenever the question of the food supply for the rapidly increasing world population is considered, it is generally recognised that adequate supply of protein is probably the major problem, and a very common suggestion is that people will have to start eating plant protein as if this were a novelty. To many it may come as somewhat of a surprise to realise that of all the protein consumed by humans in the world today, rather more than two-thirds is of plant origin, with less than one-third coming from meat, fish, milk or eggs. In round figures the amounts quoted for protein consumption in the year 1960 are 22 million tons from animal sources and 48 million tons from plants, with a predicted rise to 34 million and 78 million tons respectively by the year 1975. Of course these gross figures are for the world as a whole and they conceal very marked differences in proportion between different countries. The so-called developing countries of Asia, Africa, Central and South America consume even more than two-thirds of their protein from plants. In these countries the average ratio plant:animal protein is about 5.3:1, while the more advanced countries of Europe, North America and Australasia average about 0.85:1. Even in these latter countries almost half the protein consumed comes from plants. Clearly plant protein as a human food is no novelty.

The reason why plant protein is commonly mentioned when increase in protein production is discussed is probably because it should be much easier to increase protein production from plants than from animals. Taking the mean of the yields of seed crops and leaf crops, an acre of land will produce about ten times as much plant protein as meat protein and about five times as much as

milk protein. Thus if some of the protein fed to animals were diverted to human consumption a rapid increase in the amount available should result. More efficient use of plant protein is certainly an important concept in meeting deficiencies in under-developed parts of the world.

There are in general two types of plant protein that are of importance—seed protein and leaf protein; i.e., storage protein which the plant lays down for use by the developing embryo, and metabolic protein which is made up from the active enzyme systems by use of which the plant grows and develops. To date, seed proteins have contributed by far the major part of the plant protein used for human nutrition.

Seed Proteins

Seed proteins were among the first proteins to be studied and classified, and a system of nomenclature based on their solubilities is still to some extent in use today (Table 1). Within the seed is normally found an embryo (a group of cells which on germination will give rise to a new plant), while the remainder of the tissue contains storage material including various amounts of protein. The protein of the embryo, small in amount, contributes practically all of the albumin and a part of the globulin found in the seed. The nature of the remainder of the

Table 1
CLASSIFICATION OF SEED PROTEINS

<i>Solubility</i>	<i>Type</i>
Water	Albumin
Dilute salts	Globulin
70% Ethanol	Prolamin
Dilute alkali	Glutelin

protein depends on the type of seed considered. Of the two most economically important types, the legumes and the cereals, the former contain mainly globulins, while the latter contain larger amounts of prolamins and glutelins. In all cases however, these storage proteins are shown to be complex mixtures when examined in solution by modern physico-chemical techniques. The globulins of legumes undergo reversible association-dissociation reactions when dissolved in salt solutions of different strengths; the cereal prolamins and glutelins when examined by gel electrophoresis reveal increasing numbers of components with breakage of -S-S- linkages by reduction and of hydrogen bonds by exposure to solvents such as 8M urea. In a sense this complexity might be considered to be an artefact, as the seed proteins probably never exist in solution at any stage *in vivo*, and only by doing violence to their natural state are the multitudinous "components" revealed.

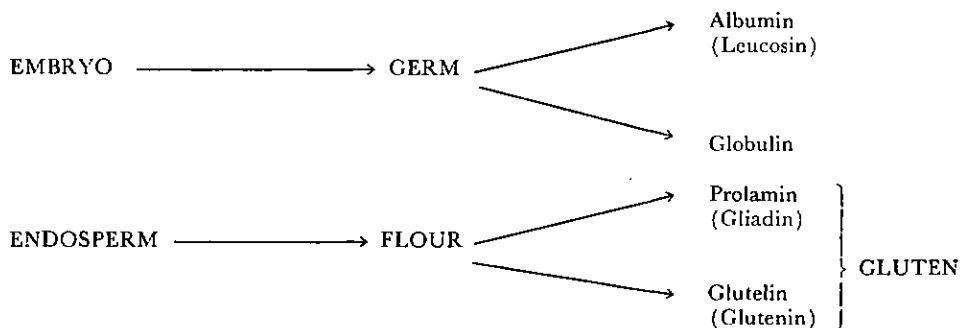
Cereals account for the larger part of protein intake by people in the developing countries, contributing some 24 million of the 35 million tons of plant protein consumed per annum. It is important to note that when starch sources are considered, the cereals have the advantage over root crops from the point of view of protein content. For each 100 calories intake cereals will con-

tribute 8-15 as protein, while root crops contribute only 2-5 in this form.

The proteins of wheat, a typical cereal, are set out in Table 2. The prolamins and glutelin fractions together make up gluten, the rubbery insoluble residue obtained by washing the starch away from ordinary flour. The nature of the gluten has a great deal to do with the baking quality of the flour, and it is in the study of the properties of this fraction that the multiple components revealed by gel electrophoresis in dissociating solvents can be of value in making detailed comparisons between the gluten of different strains of wheat.

From the nutritional point of view the main drawback of cereal protein in general is a low level of lysine, one of the amino acids essential for man. This lack can be dealt with in one of three ways—by mixing with the cereal diet a certain amount of legume seed protein which contains adequate lysine, by adding to the milled cereals free lysine (produced at a reasonable price by bulk microbial fermentation) or by using genetically improved cereals which contain a higher level of lysine. This last is probably the most satisfactory, but it seems that it is not easy to persuade farmers in developing countries to use new seed for their crops when there is no obvious improvement in yield to convince them that the new variety is better.

Table 2
WHEAT PROTEINS



The protein of cereals is not extracted to produce a concentrate but is eaten as part of the milled grain. This is in contrast to the oilseed legumes such as soya bean or ground nut (peanut), which are commonly processed to give a fraction rich in protein after the extraction of oil. The soya bean in particular is produced in great quantity, particularly in the U.S.A., where its oil is extracted on a very large scale. In the East, where it is consumed widely as a staple item of diet, domestic processing has been adapted to remove a toxic factor, now recognised to be a trypsin inhibitor, which is present in significant levels in the bean. Commonly the beans are ground and heated to give a type of flour which is then cooked in other dishes, in which case the inhibitor is destroyed by heat. Alternatively the ground beans are fermented by added moulds, giving protein-rich products such as Miso or Tempeh.

In the U.S.A. however, where almost two-thirds of the world's crop is grown, practically all is processed to yield vegetable oil, either by pressure or by solvent extraction. In either case the beans are first cracked to remove the hulls, ground to give flakes and progressively heated to remove moisture. The continuous pressure system involves passage of these flakes through an extrusion press with a tapered screw compressor in a slotted case through which the oil can escape. The grinding, shearing and compression in this system leads to rise in temperature more than adequate to inactivate the trypsin inhibitor—in fact, if the digestibility of the protein is not to be impaired by heat the press must be cooled by a water jacket. In the solvent extraction system the milled flakes are treated with a counter-current flow of hexane which is recovered by steam distillation. This method is economical only when 300-1000 tons of material per day are to be handled, when the higher recovery of oil pays for the more expensive processing.

The residue of either treatment is a soya bean meal containing 50-55% protein; practically all of it is used at present simply as

animal feed. If all the meal produced in the U.S.A. were diverted to human consumption, it has been calculated that it could give 750 million children 40 grams of protein per day—no small impact on world nutrition!

Such soya bean meal as is used for human consumption in the U.S.A. is mostly processed further by alkali extraction to give a concentrate of up to 90% protein which is then incorporated into other processed foods, or textured and flavoured to give simulated animal protein at much less cost than the authentic material.

One further product from soya beans should be mentioned—the so-called Full Fat Soya Flour. This is obtained by milling the beans in a way very similar to the pressure oil extrusion process, but the oil is reabsorbed into the meal rather than allowed to escape. The result is a bland, highly digestible, toxin-free powder of 45% protein and 20% fat content, costing only 5 to 6 cents per pound—potentially a very valuable foodstuff.

The second legume oilseed of importance, the ground nut, is not produced on a scale equal to that of the soya bean but it can be treated to give an oil and a protein meal in the same way. Because the level of trypsin inhibitor is much less groundnuts can be eaten without special pretreatment, although we recognise the fact that they are tastier when roasted with salt or coated with chocolate. In India however, they contribute significantly to the protein diet, mostly after being lightly roasted and ground to give a milky paste which is incorporated into other foods.

The final seed proteins to be mentioned are the pulses—legumes such as peas and beans. These are produced to about half the amount of the oilseed legumes, and differ from them in having low fat but relatively high carbohydrate content as well as 20-30% protein. Like the cereals they are consumed without any fractionation, mainly as a simple domestic food. It may be worth pointing out that the protein content does not rise to a reasonable value until the seed is mature,

so the tender green vegetables we prefer do not contribute much to our protein intake. (Pea soup or baked beans are much better.)

Leaf Proteins

The utilisation of leaf protein for human consumption presents many problems. In contrast to seeds, where nature has obligingly concentrated the protein into a form from which it is relatively easily extracted, in each leaf cell the protein is confined to a thin layer of cytoplasm surrounding a large vacuole full of watery, protein-free liquid, and contained within a cell wall built largely of cellulose impermeable to molecules as large as proteins. The extraction of protein from its dilute and inaccessible location is not easy. However, there are two factors at least which speak in favour of leaf proteins—they have a better balance of aminoacids than seed protein, so are capable of being better utilised as food, and the potential yield is much greater. The literature indicates that legume seeds can be expected to give a crop of up to 600 pounds of protein per acre per year, while a high production legume leaf such as lucerne can produce 2500 pounds. In peak conditions yields of 6000 pounds have been obtained. It is mainly this great potential harvest which makes it worthwhile investigating ways and means of making direct use of the protein locked up in leaves.

Grazing animals are provided with microbiological assistance at some point or other in their digestive systems, in the form of cellulase enzymes which dissolve the leaf cell walls, liberating protein which can then be utilised. Humans have no such help; they must content themselves with soft leaves such as spinach or lettuce, from which a great deal of protein may be liberated by chewing, or must enlist mechanical aid to break the cell walls.

This problem, the extraction of protein from leaves, is of course well known to plant biochemists who make extracts on a laboratory scale by blending, mincing or grinding

the leaves. This experience has shown that in order to get a good yield of soluble protein from broken tissue buffer must be added to prevent the vacuolar fluid (often of low pH) from causing isoelectric precipitation, and when tannins are present in the leaf some agent such as polyvinylpyrrolidone (PVP) must be added preferentially to absorb them, thus preventing the formation of an insoluble tannin-protein complex. Further, to prevent modification of the protein after isolation thiol compounds must be present to prevent atmospheric oxidation of protein -SH groups to -S-S- linkages; and when phenolic compounds commonly found in leaves are present polyphenoloxidase must be inhibited by a copper chelating agent to prevent the formation of quinones, which by combining with proteins will often change their properties quite markedly.

These precautions are undesirable complications when protein is to be extracted on a large scale, so it is wise to choose a plant which does not have low vacuolar pH, contains no tannins and has low phenoloxidase activity. Lucerne is such a plant; its proteins on extraction into water are not precipitated by low pH, at least not for several hours, nor by tannins and are not darkened by quinone formation. Possibly -S-S- linkages are formed but this is of no consequence from a nutritional point of view.

The mechanics of extracting the protein involves the breaking of leaf cells, removing the protein solution from the solid residue, collecting the protein in an insoluble form and finally purifying it. The most commonly used and probably most efficient system of bulk extraction is that of Pirie in which the wet leaf is torn apart in a horizontal cylinder containing a rotating axial shaft carrying rigid projecting bars which pass between fixed bars projecting inwards from the walls of the cylinder. This type of machine can handle about 1 ton per hour of fresh leaf and will break up to 70% of the cells. The resultant pulp is like a pile of wet blotting paper in that it will not give up its juice without being

squeezed, so the protein solution must be extracted from the pulp in a press of some sort. Neither the maceration nor the pressing are very efficient, and an extraction of 50-60% of the leaf protein is considered quite good. This inefficiency has its advantages; the residual pressed pulp should be a valuable feed for ruminants who derive a large part of their energy from cellulose, and for whom the remaining protein, 40-50% of the original high level in a legume leaf, should be adequate.

To obtain the protein from the press juice and to purify it further are processes which are interrelated, because the way in which the protein is precipitated will modify the treatments needed to remove the pervasive green of the chlorophyll and the rather persistent odour and bitterness often associated with leaf protein. Heat coagulation by steam is often used to harvest the protein, but it is probably fair to say that there is no universal agreement as to the best way of producing a generally acceptable protein preparation from leaf extract. While this remains the case, production of leaf protein on a large scale will be unlikely, but the potential yield of such protein is so great that the research at present being devoted to these aspects of

the problem will doubtless continue until a satisfactory method is developed.

Conclusion

What will be the role of New Zealand in the production of plant protein? It is not likely that there will be an internal demand for supplementary plant protein for our diet. A comparison of the different countries of the world on the basis of how much meat can be bought with the average wage shows us to be well ahead of all the rest; so while lamb chops continue to taste nicer than a lucerne omelette we shall probably continue to live very well on meat. But provided that an economic outlet for a protein concentrate can be found, it should ultimately be possible for us to produce a large amount very cheaply from legumes, feed the residue back to ruminants and hopefully raise almost as many animals on the legume-producing area as before. This would cut the cost of the protein to that of the processing alone, and although it would be rash to forecast this, operation on a suitably large scale should make the process efficient enough to keep the cost modest. The major problems in the future of leaf protein really rest with the economist more than with the chemist.*

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* Text based on an address to the N.Z.I.C. Conference 1969.

INSTITUTE OFFICERS 1969-70**PRESIDENT**

Mr. T. A. Rafter, O.B.E., M.Sc., F.R.S.N.Z., F.N.Z.I.C., Director of the Institute of Nuclear Sciences, Department of Scientific and Industrial Research, Gracefield.

He joined the Dominion Laboratory of D.S.I.R. in 1940 working for a time on coal chemistry then became interested in the chemistry of uranium and its extraction from uranium minerals. He worked on these and on the chemical analysis of rocks and minerals until 1947.

During 1948/1949 he studied the applications of both radioactive and stable isotope techniques at the Massachusetts Institute of Technology, Boston, and Columbia University, New York, and visited many Nuclear Centres in America, Canada and England.

The Isotope Section of the Dominion Laboratory was established under Mr. Rafter's direction and prior to his appointment as Director of the Institute of Nuclear Sciences in 1949 he was Divisional Head of the Isotope Division of the Dominion Physical Laboratory.

Mr. Rafter was a New Zealand delegate to the Atoms for Peace Conference at Geneva in 1958; has been invited to lecture on his scientific interests in America, Italy and Australia, and in 1967 was a member of the New Zealand and Australia Nuclear Power Mission to Canada.

He is D.S.I.R.'s representative to the New Zealand Radiological Advisory Council and attends all meetings of the New Zealand Atomic Energy Committee.



DR. T. A. RAFTER

In 1959 he was awarded the O.B.E. for his contribution to nuclear science in New Zealand and made a Fellow of the Royal Society of New Zealand in 1961. He is author of 45 scientific papers and meets many requests to lecture to scientific societies and colleges within New Zealand. He is a Fellow of the N.Z.I.C.

FIRST VICE-PRESIDENT

Dr. W. A. McGillivray, M.Sc., Ph.D.(N.Z.), D.S.Cc.(Massey), F.N.Z.I.C., Director of the N.Z. Dairy Research Institute.

SECOND VICE-PRESIDENT

Mr. K. E. Seal, M.Sc.(Lond.), M.Aust.I.M.M., F.N.Z.I.C., Chief Technical Officer, Amalgamated Brick and Pipe Co. Ltd., Auckland.

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Mr. J. C. Hawthorn Dr. D. F. Nelson
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Branch Editor: Dr. G. A. Wright.



DR. J. RODGERS

Dr. John Rodgers was educated at Christchurch Boys' High School and the University of Canterbury, where he graduated with first class honours in Chemistry. He then joined C.S.I.R.O. Division of Industrial Chemistry at Melbourne and worked on the separation of minerals by flotation. After a brief period with the Soil Bureau in Wellington, he was appointed to the staff of the School of Mines at Otago University in 1947. Dr. Rodgers moved to the Department of Colloid Science at Cambridge University

in 1955, and completed his Ph.D. on the flotation of soluble salts in 1957. This was followed by research on the flotation of sulphide ores with the International Nickel Company in Canada. In 1959 Dr. Rodgers joined the Geological Survey and carried out research in the Joint High Temperature and High Pressure Laboratory at Otago University. He was appointed Director of the N.Z. Fertiliser Manufacturers Research Association in 1966 and has developed an expanding research programme covering all aspects of the industry at the Otago laboratories near Auckland.

Dr. Rodgers is married with four children. He was elected a Fellow of the Institute in 1965. He served as Conference Chairman in Dunedin in 1965 and was the first Chairman of the Geochemical Group.

Waikato

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Mr. J. E. Allan Mr. D. F. Campbell
Delegate: Dr. D. E. Wright
Editor: Dr. W. P. Judd.



DR. W. H. M. SAUNDERS

Dr. W. M. H. Saunders graduated from Canterbury University College M.Sc.(Hons.) in 1947 and joined Soil Chemistry Section of Soil Bureau. He spent 1950-1953 at the Macaulay Institute for Soil Research and gained his Ph.D., then returned to Soil Bureau and worked mainly in the field of soil phosphorus with special reference to its relationship to soil classification in New Zealand. He is also interested in the soil-plant relationships of phosphorus and potassium. In 1965 he transferred to Ruakura Soil Research Station as head of the Soil Chemistry Section, and is now interested in problems of soil testing for fertiliser requirements, the effect of high stocking rates on chemical properties of soil and pastures and in soil chemistry of hill soils.

Manawatu

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Branch Editor: Dr. L. K. Creamer

Council Delegate: Dr. E. Wong.



DR. E. WONG

Dr. Edmon Wong was born in Hong Kong and has lived in New Zealand since 1940. In 1948 he was awarded the Victoria University College Institute of Chemistry Prize; in 1950 he received the Emily Lillas Johnston Scholarship. He graduated M.Sc. in 1952 and after completing a Ph.D. in Physical Organic Chemistry in 1957 he joined the staff of the Plant Chemistry Division of DSIR (now incorporated into the Applied Biochemistry Division) where he is now Head of the Natural Products Section. During 1962-3 he spent 15 months at University of California, Los Angeles, and later in 1963 he was awarded the Morcom Green Edwards Prize. In 1968 Dr. Wong was awarded a Senior Fellowship by the Alexander von Humboldt Foundation and spent a year studying in West Germany. His chemical and biochemical interests are centred about the phenolic constituents of plants and the biosynthesis of flavonoid and iso-flavonoid compounds. Dr. Wong has published some 30 papers and one review.

Wellington

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Secretary: Mr. C. L. H. Stonyer.

Treasurer: Dr. K. R. Tate.

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Branch Editor: Dr. A. F. M. Barton.

Delegate to Council: Dr. P. K. Foster.

Hon. Auditor: Mr. F. J. T. Grigg.

J. W. Tomlinson was born in Sheffield, England, and graduated in chemistry from the Royal College of Science (1947). He worked under J. O'M. Bockris for the Ph.D. degree (1949) and then spent two years at the Massachusetts Institute of Technology in the Department of Metallurgy as Research Associate to Professor John Chipman. In 1951 he returned to Imperial College and joined the Nuffield Research Group in Extraction Metallurgy with Professor F. D. Richardson in the Royal School of Mines where he remained until 1966 when he was appointed



PROFESSOR J. W. TOMLINSON

to the chair of physical chemistry at the Victoria University of Wellington.

His research work has been mainly in the field of high temperature physical chemistry with particular emphasis on the thermodynamic and transport properties of liquids. Prior to 1966 much of it was related to the extractive metallurgy of such salts as uranium, copper, lead and aluminium. Since 1966 he has concentrated on the study of ionic migration in concentrated electrolyte solutions and low melting organic electrolytes and has been active in establishing an inter-departmental laboratory for work under conditions of elevated temperature and pressure. He is currently chairman of the Electrochemistry Group of the N.Z.I.C.

He enjoys fly fishing for trout.

Christchurch

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Dr. M. P. Hartshorn graduated B.Sc. with First Class Honours in chemistry from the Imperial College, London, in 1957. Working under Sir Ewart Jones at University College, Oxford, he gained his D.Phil. in 1960. He was then appointed Lecturer in Chemistry at the University of Canterbury, where he is now Reader in Chemistry. During



DR. M. P. HARTSHORN

1967 he was a Visiting Professor at Cornell University while holding a Fulbright travel award. His research interests are in the reactions, particularly molecular rearrangements, of alicyclic compounds. He was elected an Associate of the Institute in 1961 and a Fellow in 1968.

Otago

Chairman: Dr. R. M. Carr.

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Branch Editor: Dr. M. R. Grimmett.

Delegate to Council: Professor G. B. Peterson.

Hon. Auditor: Mr. T. A. Thomson.

Historical Officer: Mr. J. Dennison.

Dr. R. M. Carr was educated at John McGlashan College and the University of Otago. He graduated M.Sc. with First Class Honours in Chemistry in 1957. After working for a year on the extraction of uranium ore in the Otago School of Mines he was awarded the I.C.I. Research Fellowship and commenced studies on silicate mineral equilibria. He was appointed to the staff of the Otago University Chemistry Department in 1959 and graduated Ph.D. in 1962. From 1962-64 he carried out research with molecular sieves at Imperial College, University of London, and investigated some geochemical problems at the Pennsylvania State University, U.S.A. Dr. Carr is now a Senior Lecturer in Chemistry and is responsible for the operation of the high-pressure geochemical laboratory.



DR. R. M. CARR

CONFERENCE 1970

Massey University, Palmerston North

MONDAY, 24 AUGUST to THURSDAY, 27 AUGUST

A cordial invitation is extended to all members of the Institute and their wives to attend the Annual Conference for 1970. The programme has been planned with due consideration to the themes of the two previous conferences and with regard to recent developments in the Institute. The last two conferences have been concerned with the general relationship of chemistry to N.Z. industry and to the national economy. Another general conference is to be held in three years' time. It is appropriate now to devote a conference to the presentation of specialist research reports, and it is opportune to do so in this first year after the establishment of a large number of specialist groups within the Institute.

Information given in the first circular should now be modified as follows:

- (a) More than two whole sessions will be available to those groups which would like more time. Arrangements about extended time are being made with the organisers of the different groups;
- (b) There will be no sessions on Geochemistry at this Conference as the Geochemistry Group held two full meetings in 1969;
- (c) Offers of papers should be made directly to the group organisers where these are known. Some names are given in the first circular and others will be made available as soon as possible.

Dr. R. D. Reeves,
Massey University,
Conference Secretary.

RETIREMENT

PROFESSOR L. H. BRIGGS

Many former students were among the members and former members of the Department of Chemistry of the University of Auckland who gathered at the University on 12 December 1969 for a dinner to honour Professor Lindsay H. Briggs on his retirement which became effective from 1 February 1970. Professor Briggs has been a member of the staff of the Department of Chemistry since 1933 and became a full Professor in 1958. He headed the Organic Section of the Department for a considerable period and has acted as Head of the Department on a number of occasions.

Professor Briggs has served New Zealand science and education in many capacities, including terms as President of both the Royal Society of New Zealand and the New Zealand Institute of Chemistry, and he has received many awards and honours.

Professor P. B. D. de la Mare, the Head of the Department of Chemistry of the University of Auckland, in presenting Professor Briggs with an engraved silver tray on behalf of all present, thanked him for his many contributions to various facets of the life of the Department. In particular, Professor de la Mare emphasised Professor Brigg's worldwide reputation as a research worker in the area of natural products organic chemistry, and praised the manner in which he had built up this area of the Department's work.

Professor R. C. Cambie, who has succeeded Professor Briggs as Head of Organic Chemistry at Auckland, spoke for his former research students and colleagues of the

Organic Chemistry section, and on their behalf he presented Professor Briggs with a bound volume containing copies of those one hundred and fifty-two research papers which he has had published to date. Professor de la Mare accepted a similar volume on behalf of the library of the Department of Chemistry.

In reply Professor Briggs said that in thirty-six years the University and the Chemistry Department had come to mean so much to him that this was a time of sadness. However it was also a time for pleasure, both because in Professor Cambie he was to be succeeded by a former student, and because he is to be able to continue his work in the Department. In expressing his thanks to all his former colleagues, students and associates whom he could not thank individually for their gifts and their co-operation over the years, Professor Briggs especially acknowledged his friendly and fruitful relationships with those who had been Heads of the Department, and noted with pleasure that three of these, Professor de la Mare, Dr. D. R. Llewellyn (Vice-Chancellor of the University of Waikato) and Professor D. Hall of the Auckland Chemistry Department, were present at the dinner.

Professor Briggs was also honoured at a number of other gatherings including the inaugural dinner of the Auckland Student Chemical Society and received a presentation from the Auckland University Staff Club. He has been elected an Emeritus Professor by the Council of the University of Auckland, and will continue as a research worker and specialist lecturer at the University.

OBITUARIES

C. L. CARTER, M.Sc., A.R.I.C., F.N.Z.I.C.

Mr. Charles Lyon Carter was a man who for nearly half a century devoted himself to chemistry. Although one of his major contributions may well prove to be his part in the research which led to the introduction of iodized salt in New Zealand, Mr. Carter will be remembered with respect and affection by the thousands of students who passed through his hands.

Mr. Carter was educated at Southland Boys' High School (where he was dux in 1913) and entered the University of Otago in 1914 with a senior national scholarship. His studies were interrupted by active service with the 1st NZEF when he served as a sergeant in France. When he resumed his studies in 1917 he took up a part-time demonstrating position under Professor J. K. H. Inglis. In 1919 he was Senior Scholar in chemistry for New Zealand, and the following year graduated M.Sc. with First Class Honours.

Continuing in research, Mr. Carter engaged in work on New Zealand natural products, including the study of muttonbird and fish oils in conjunction with Professor J. Malcolm. Later, in collaboration with Professors C. E. Hercus (later Sir Charles) and W. N. Benson, he investigated the subject of endemic goitre in this country, and as a result of this research iodized salt was introduced to New Zealand.

During his many years as a university teacher Mr. Carter often carried a very heavy burden and made a notable contribution to New Zealand education. At the same time he also pursued his research interests and his establishment of a microanalytical

laboratory with its special techniques was a tribute to his patience and persistence. This laboratory still serves the microanalytical requirements of most of New Zealand chemistry. Among his noteworthy research was his elucidation of the nature of hiptagenic acid and hence of the glucoside karakin, the first natural product to be shown to contain a nitro group.

Mr. Carter served as secretary to the Otago Chemical Society, and when this body was replaced in 1930 by the Otago Branch of the N.Z.I.C. he was secretary for ten years and chairman in 1939.

Rugby football was his main sporting interest although he took a keen interest in all the sporting activities of the University. He was president of the University Football Club for 15 years until his retirement in 1958.

Mr. Carter leaves a widow, a son, a daughter and three grandchildren.

KATHLEEN BROWN (nee Currie)

M.H.Sc., B.Sc., A.N.Z.I.C.

The death occurred in Nelson on 19 February 1970 of Mrs. Kathleen Brown following a short illness. Kathleen Brown graduated from the University of Otago and was on the staff of the Cawthron Institute from 1947-49. Following her return from an overseas trip she taught at the Nelson College for Girls and later at Waimea College. Mrs. Brown is survived by a husband and three children.

ELECTROCHEMISTRY GROUP REPORT

Electrochemistry at Interfaces

A one-day meeting of the Electrochemistry Group held at the University of Auckland on 4 February 1970 attracted nearly 50 people to hear 11 papers on a variety of electrochemical topics. Papers ranged from the application of micro-electrodes in muscle cells (Dr. D. S. Campion) to efficiency studies of gas-phase electrochemical reactors (Dr. P. L. Spedding). The general title *Interfacial Electrochemistry* was interpreted by some speakers as the study of electrode surfaces themselves, while other speakers clearly had in mind interfaces between electrochemistry and other fields of chemistry. Applied topics included the amperometric analysis of trace hydrogen sulphide (Mr. J. K. Johannesson); potentiometric determination of fluoride (Dr. J. B. Macaskill); the corrosion of copper in Auckland water (Mr. I. R. C. McDonald); corrosion of iron group metals (Mr. G. T. Burstein); the production of magnesium by electrolysis of molten magnesium chloride (Mr. I. P. Anich, Dr. E. G. Kelly and Mr. R. M. McDonald). More academic topics were the determina-

tion of thermodynamic data for bismuth fluorides from galvanic cells (Mr. J. C. M. Devereaux); mechanistic studies of the anodic dissolution of bismuth in perchloric acid and hydrochloric acid (Dr. G. A. Wright and Mr. D. E. Williams); investigation of oxide-film formation and growth on copper by cyclic voltammetry (Mr. P. C. A. Bailey).

The meeting was concluded with an address by Dr. T. Hagyard to an evening meeting of the Auckland branch of the Institute. Dr. Hagyard spoke on research work at the Department of Chemical Engineering, University of Canterbury, on the behaviour of reactive metal electrodes such as aluminium, magnesium and lithium, and the special techniques that have been developed to study the earliest phenomena exhibited by freshly formed metal surfaces.

N.B. The next meeting of the Electrochemistry Group will take place during the Institute Annual Conference at Palmerston North, 24-27 August 1970. There will be 3 specialist sessions on Electrochemistry: any member of the Institute wishing to present a paper should send the proposed title to the Secretary: Dr. G. A. Wright, Department of Chemistry, University of Auckland.

I.U.P.A.C. NEWS

Information has been received from I.U.P.A.C. on forthcoming international chemistry meetings as follows:

1. Conference on Relationship of Performance Characteristics to Basic Parameters of Polymers — Strasbourg, France — 5-6 March 1970.
2. VIIth International Symposium on Chemistry of Natural Products — Riga, U.S.S.R. — 21-27 June, 1970.
3. Symposium on Non-aqueous Electrochemistry — Paris, France — 8-10 July 1970.
4. IIIrd International Symposium on Photochemistry — St. Moritz, Switzerland — 12-18 July 1970.
5. Symposium on Cycloaddition Reactions — Munich, Germany — 7-10 September 1970.
6. IInd International Symposium on Organic Solid-state Chemistry — Rehovot, Israel — 14-18 September 1970.

C. J. Wilkins (Hon. Secretary, N.Z. National Committee for Chemistry), Chemistry Department, University of Canterbury.

BRANCH NOTES

Auckland

On 4 February 1970 the Auckland Branch sponsored a one-day meeting of the Electrochemistry Group. This was followed by an evening branch meeting addressed by Dr. T. Hagyard, Reader in Chemical Engineering, University of Canterbury, on "Research on the Behaviour of Metal Electrodes".

The immediate Past-President of the Institute, Professor J. Vaughan, addressed the branch on "The University, the Community and the Chemist" on 16 February.

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Mr. D. L. Parnell has joined the company as Development Chemist. Other chemists on the staff are Mr. J. C. Hawthorn (Works and Technical Manager), Mr. P. France (Works Chemist) and Mr. S. Jordan (Research and Development Chemist).

University of Auckland

Following his retirement, Professor L. H. Briggs has been appointed Professor Emeritus and part-time Teaching Fellow in the Department of Chemistry. Associate Professor B. R. Davis, Dr. J. E. Packer and Dr. C. E. F. Rickard have returned from study leave in England. Dr. P. D. Woodgate has been appointed Lecturer in Chemistry. Approximate enrolments this year are as follows: Chemistry I, 790; Chemistry II, 160; Chemistry III, 100; M.Sc., 29; Ph.D., 39; total University enrolment 9,250. The Chemistry I enrolment is about 100 less than was predicted from the growth rate in recent years. This may be explained by the commencement of science teaching at the University of Waikato which has 98 first-year chemistry students this year.

Auckland Technical Institute

This year has seen a further increase in student numbers in the courses in the Applied Science Department. Enrolments are as follows: Chemistry I (Sch. Cert.) 240; Chemis-

try II (U.E.) 27; Chemistry III 145; Chemistry IV 35; Chemistry V (final year N.Z. Cert. Sci.) 25; Chemistry VI (post-N.Z. Cert. Sci.) 6; Biochemistry I 42; Biochemistry II 18; Food Science (post-N.Z. Cert. Sci.) 8. Total enrolment at the Institute exceeds 12,000.

The post-N.Z. Certificate in Science courses are becoming more popular; in 1969 there were 2 passes and 2 partial passes in Chemistry VI. At present there is no diploma available to students who pass this course.

Waikato

Dr. R. B. Marsh of the Meat Research Institute recently returned from the United States after spending six months as Visiting Professor in the Department of Meat and Animal Science at the University of Wisconsin. During his visit, Dr. Marsh co-edited a volume of symposium papers entitled "Physiology and Biochemistry of Muscle as a Food."

At the March meeting of the Branch Professor A. T. Wilson of the University of Waikato gave a lecture on the chemistry of germination.

The Waikato Technical Institute has appointed Mr. John Amies to teach biochemistry and microbiology.

The first students in the School of Science at the University of Waikato began their courses in March. There are 102 students in the Stage 1 Chemistry class and 10 students enrolled for Doctorates in Philosophy. Chemistry laboratories for teaching and research will be completed by April.

Wellington

Chemistry Division

An event of interest was the visit of Professor F. G. A. Stone of Bristol University on 22 September 1969. He lectured on some aspects of organometallic chemistry of d^8 and d^{10} transition metal ions. The talk in-

cluded an entertaining description of the Chemistry Department at Bristol and its environs.

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

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

Dr. W. E. Strauss, of Department of Applied Chemistry, University of Melbourne, visited Chemistry Division on Tuesday, 17 February. Dr. Strauss, author of "Industrial Gas Cleaning" and editor of "Air Pollution Control" gave an informative lecture entitled "Air Pollution and the Environment".

In February Dr. L. J. Porter left for Australia where he will study for 1 year with Professor J. W. Clark-Lewis at the School of Physical Sciences, Flinders University, South Australia.

Mr. C. R. Henwood of the Toxicology Section has been granted extended leave to work at Victoria University.

Miss J. Ross has transferred to the Christchurch branch of Chemistry Division. She will continue her gas analysis work there.

Institute of Nuclear Sciences

Mr. A. E. Bainbridge, who is a former member of the Institute, returned as a visiting scientist in January with a research team from Scripps Institution of Oceanography at California University. His group will spend a year measuring the concentrations of trace gases (CO , CO_2 , CH_4 , H_2) in the atmosphere as part of a world-wide study.

Mr. C. J. D. Adams joined the Geochemistry section in November. He has studied isotopic dating methods at Oxford and Toronto and will use the potassium-argon technique in studies of New Zealand rocks.

Dr. D. C. Robinson returned to the Nuclear Physics Section of the Institute in December after several years at Harwell.

A recent graduate in physics from Victoria University joined the staff in February. He is Mr. D. C. Lowe, who is studying T, 180 and D concentrations in natural waters.

Mr. G. J. McCallum and Dr. M. R. Manning attended the Third Nuclear Physics Conference at Melbourne University in February, organised by the Australian Institute of Nuclear Science and Technology.

Dr. C. H. Hendy is attending a panel discussion, organised by the International Atomic Energy Agency, in Vienna in March on certain aspects of isotopic geochemistry. A symposium on isotopes in hydrology will precede this.

Soil Bureau

Dr. R. B. Miller has recently returned from Rome, where he has spent two years with FAO working on the world soil map.

Dr. M. Avrahami completed a 3-month term of temporary duty at Soil Bureau in December.

Mr. J. M. Bailey, B.Sc. (Hons.) (Bangor), Dip.Ag.Sc. (Cantab.), has joined the Chemistry Section after previous experience in agriculture, pedology and soil chemistry in Sarawak and the United Kingdom.

Soil Bureau has purchased an MS-702 Spark Source Mass Spectrometer which is currently being installed.

Victoria University

Dr. H. David Ellerton joined the staff of the Biochemistry Department in January. After completing his Ph.D. at the University of Adelaide Dr. Ellerton spent 3 years in the U.S.A., one year at the University of California at Berkeley and two years at Oregon State University. In Oregon he worked with Professor K. E. Van Holde studying the physical biochemistry of hemocyanins from the Dungeness Crab.

Dr. Ellerton's wife, Dr. Nerida F. Ellerton, has also recently joined V.U.W. in the Department of Chemistry. She also gradu-

ated from the University of Adelaide and spent 3 post-doctoral years in the U.S.A. At Oregon State University she worked with Professor Irvin Isenberg studying the interaction of acridine dyes with DNA, using fluorescence polarization measurements.

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

Popular Opening Meeting

The Wellington Branch programme opened with a Panel Discussion on Pollution. As was the case with the March 1969 Panel Discussion on Drugs this meeting was very popular and 300 people heard three aspects of the problem discussed by a zoologist, Professor J. T. Salmon (Victoria University), an engineer Mr. F. Lowe (Auckland), and a chemist Mr. L. Wilkinson (Chemistry Division, Christchurch).

Manawatu

Mr. David Ogilvie has resigned from his position of chemist to the Palmerston North City Council and has taken the position of Works Chemist at the Manukau Purification Plant, Auckland Regional Authority.

Massey University

Professor R. Hodges has been appointed to a Personal Chair in Mass Spectrometry. The University Council has made this appointment in recognition of the work done by Professor Hodges in maintaining the mass spectrometry unit as an active research unit, in addition to his normal university duties.

New Zealand Dairy Research Institute

Mr. B. C. Richardson has joined the Protein Section of the Chemistry Department of the New Zealand Dairy Research Insti-

tute. He will be working on problems associated with bitter compounds arising during the hydrolysis of milk proteins.

Mr. D. J. Woodhams has recently returned from the University of Wisconsin where he obtained a Ph.D. from the Department of Food Science.

Canterbury

Dr. J. W. Blunt has taken up an appointment as Lecturer in Chemistry at the University of Canterbury.

Miss J. B. Ross has transferred from Chemistry Division, D.S.I.R., Gracefield, to the Christchurch laboratory of Chemistry Division where she will carry on her work on gas analysis.

Mr. R. B. Withers has transferred to Canterbury branch from Otago.

Dr. A. C. Arcus, Biochemist in the Medical Unit, The Princess Margaret Hospital, has been granted a year's leave to study in the Chemistry Department, University of Canterbury, where he is working on large scale electrophoretic separation of proteins.

The February meeting took the form of an inspection of the Chemical Engineering Department, University of Canterbury, including the recently completed five-storey building. The inspection was preceded by a series of short lectures on current research projects in the department.

Overseas Visitors

Professor J. B. Hyne of the University of Calgary, Canada; Professor W. A. McBryde, Dean of Science, University of Waterloo, Ontario, Canada; and Dr. D. M. L. Goodgame of Imperial College, London, have been recent visitors to the Chemistry Department, University of Canterbury.

Otago

Industry

Mr. R. McNaught, a local branch committee member, has resigned from McLeod Ltd. to take up an appointment as chemist with Kempthorne Prosser's Fertilizer Works in Wanganui.

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University

Dr. G. Engel has accepted a position in the National Biological Standards Laboratory, Canberra. Other recent Ph.D. graduates, K. M. Taylor and C. E. Devine, are to take up two-year post-doctoral fellowships in the Department of Pharmacology, Johns Hopkin's University, Baltimore, and the Presbyterian University of Penn, Medical Centre, Philadelphia, respectively.

Dr. I. D. Watson, Senior Lecturer in Chemistry, is to take up a similar appointment in the Department of Chemistry and Biochemistry, Massey University, later in the year.

A recent visitor to the Chemistry Department from Ontario, Professor W. A. E. McBryde, gave an address describing "Spectrophotometric Methods for the Study of Equilibria in Solution".

Dr. D. Whyman, recently Senior Scientific Officer at the National Physical Laboratory, Teddington, has been appointed to the Chemistry Department, as Senior Lecturer in Applied Chemistry.

Overseas

W. G. Hughson is enjoying an extended tour overseas after his retirement from the Coal Research Association. He left New Zealand in 1968 to attend a World Energy Conference in Moscow in August, then a Natural Gas Conference in England in September. In between caravan tours of various parts of Europe and England he attended a number of meetings of the Institute of Fuel. He attended the Shetland Islands Historical Society celebrations of 500 years of sovereignty, for three months entering into the life of the community of the Isle of Yell (where his father came from to New Zealand in 1879), harvesting peat, rooing the sheep and reading outside at midnight, etc., etc. On a visit to the Orkneys he found "an astonishing number of ex-New Zealanders." He is spending the winter in Shropshire at Sir John Corbet's cottage, before spending the coming summer in more travel.

While in Stockholm he rang Brian Thomas (ex Dominion Laboratory, Petone) and visited the Wenner-Gren Center, a residen-

tial centre for visiting scientists and the administration centre for Swedish research organisations.

BOOK REVIEW

Methods in Zone Electrophoresis (2nd edition), by John R. Sargent. Published by B. D. H. Chemicals Ltd., Great Britain, 1969, 118 pages. Price 25/- U.K.

It is a pleasure to review the latest edition of Dr. Sargent's excellent monograph on electrophoretic techniques. This valuable little book offers simple, concise but practical details of most of the techniques of electrophoresis in current laboratory use although certain of the more specialised techniques such as curtain electrophoresis and isoelectric focussing are mentioned only briefly.

The new edition has been extensively revised and enlarged but still follows the same basic pattern of its predecessor. The opening chapter provides a brief but adequate discussion of the theoretical background to electrophoresis and the various factors that influence the movement of ions in an electric field. Succeeding chapters discuss in more detail the practical aspects of electrophoresis on paper (high and low voltage), cellulose acetate, starch gel, agar gel and poly-acrylamide gel. A new chapter on thin-layer electrophoresis has been included. Each chapter gives clear instructions for the experimental procedures involved in making the medium, applying the sample, location of components by selective staining, etc. The section on high-voltage electrophoresis (HVE) has been extended to include details of such techniques as two-dimensional "fingerprinting", the "sewing-in" technique and diagonal electrophoresis for studying the structure

of macro-molecules such as peptides and oligonucleotides.

Chapter 4 on Thin-Layer Electrophoresis (TLE) is a valuable addition to the book and discusses, with examples, the practical advantage of TLE over HVE, especially for the separation of peptides. Following chapters deal with starch and agar gel electrophoresis for the separation of proteins and immuno-electrophoresis.

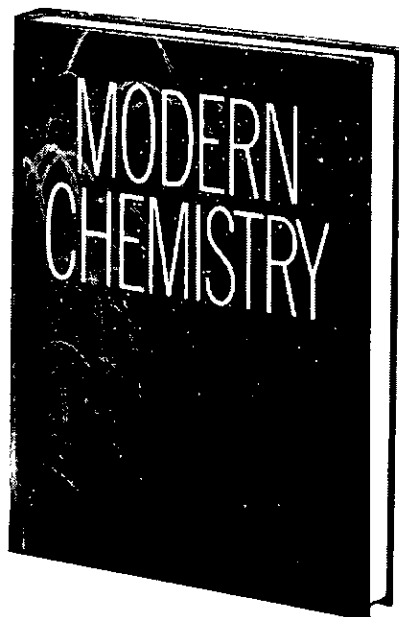
Another feature of the new edition is the major expansion and revision of the chapter on polyacrylamide gel electrophoresis (PGE). Full working instructions are given for both the methods of Raymond and Wang and the "disc" method of Davis and Ornstein together with a much simplified explanation of the theory involved. This chapter also deals with PGE on vertical slabs, preparative PGE and the assay of radioactive labelled fractions on gels. In conclusion the author reviews some of the many practical applications of PGE for the separation of proteins and nucleic acids. The final chapter (Chapt. 10) provides a useful discussion and guide to the choice of medium for a particular separation problem.

Taken all in all this book represents very good value for money. It is essentially a practical book and should be welcome on the work bench of anyone concerned with electrophoresis. It may be confidently recommended to those studying for the N.Z.C.S. or similar laboratory qualifications. The publishers are to be congratulated for having produced so useful a book at such a reasonable price.

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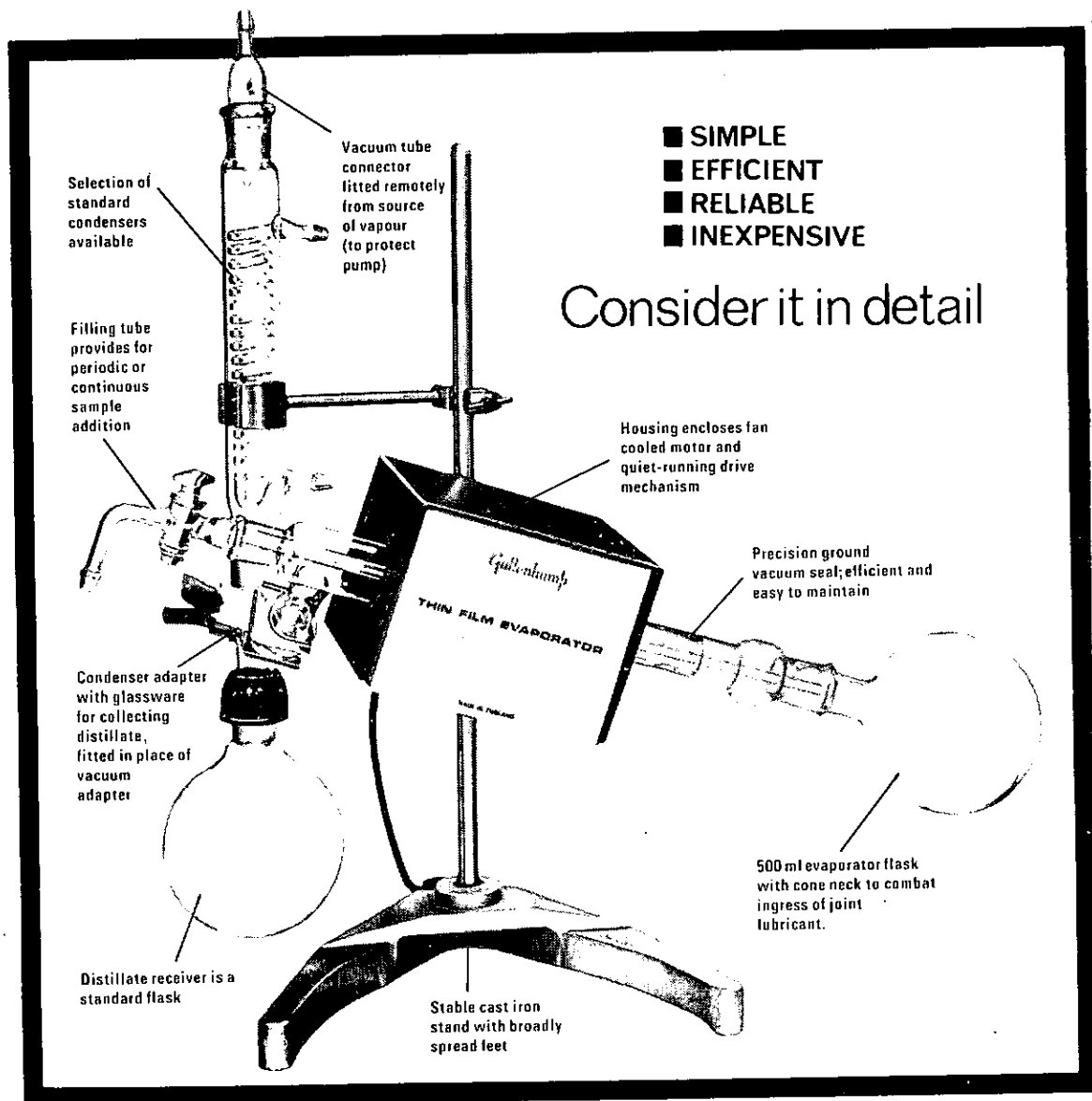


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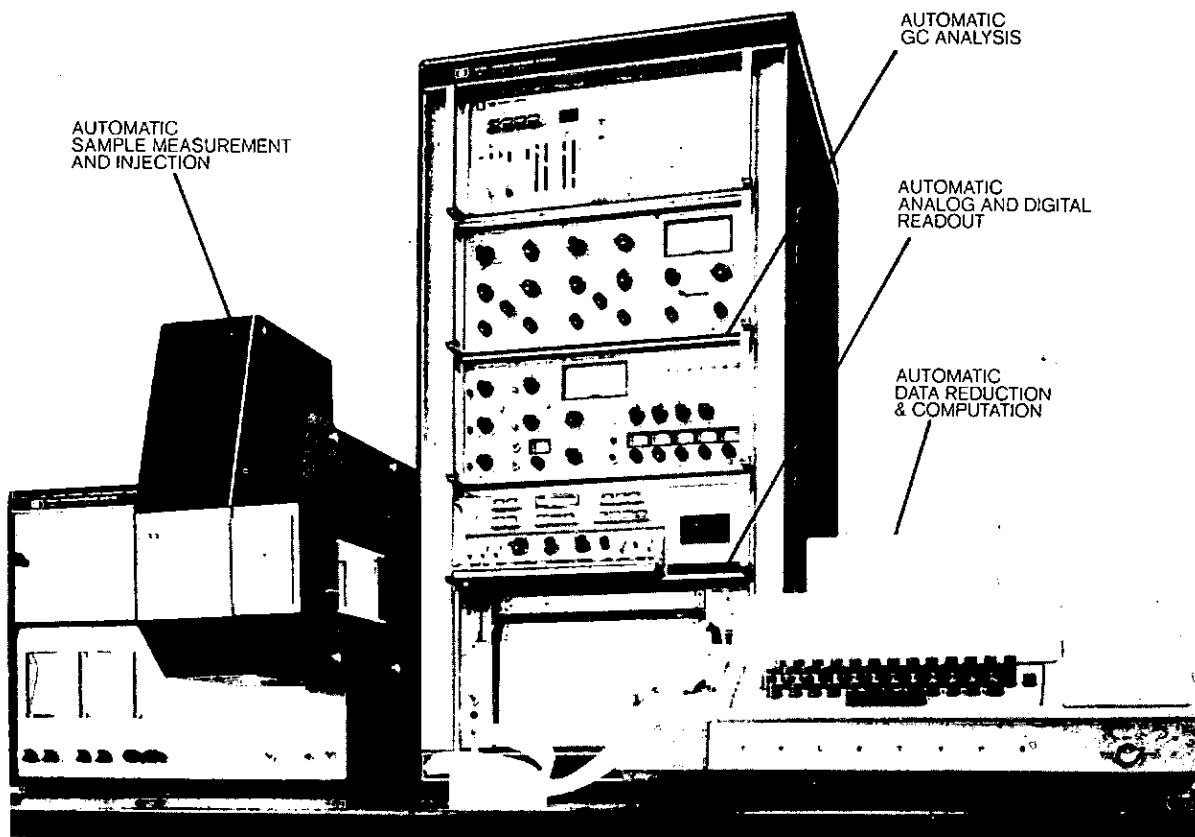
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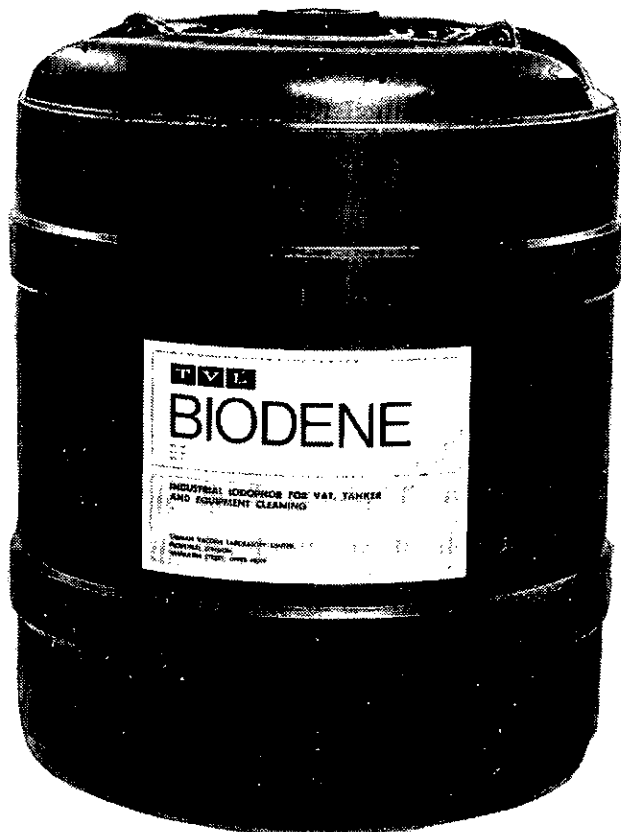
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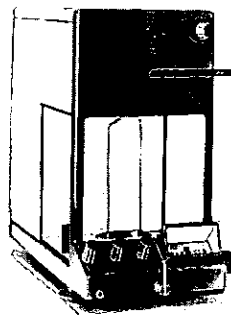
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