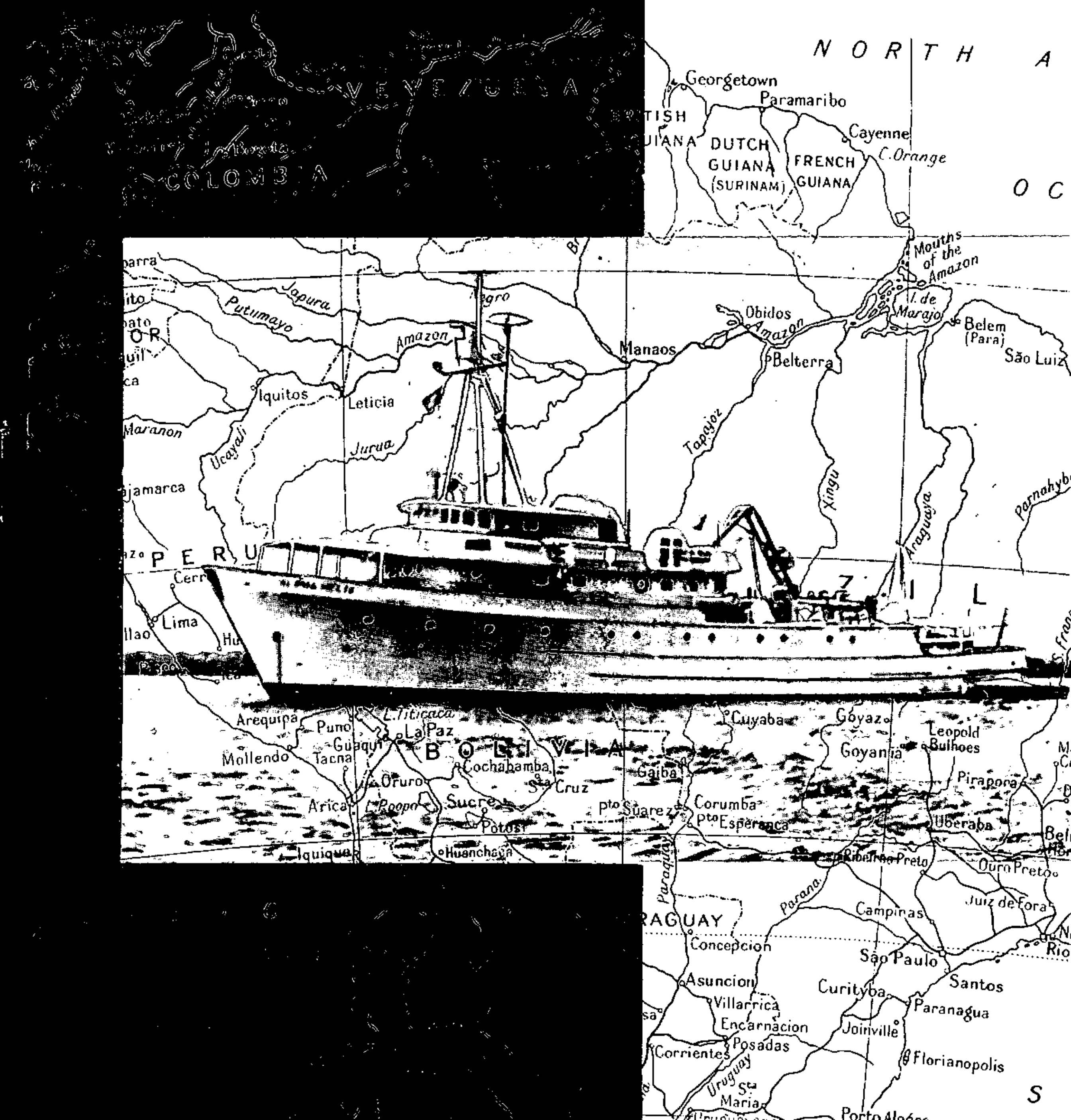
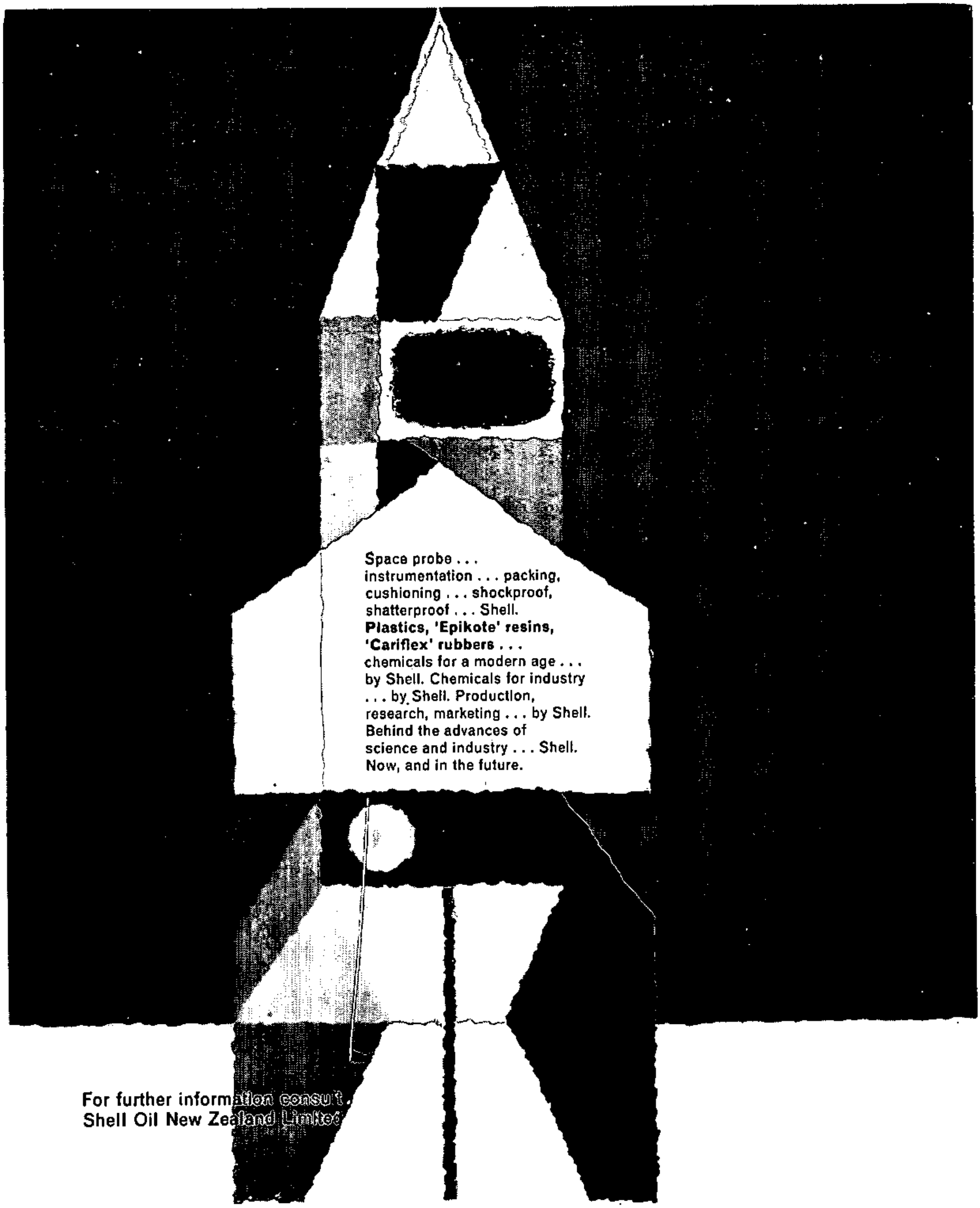
CHEMISTRY IN NEW ZEALAND

JOURNAL OF
THE NEW ZEALAND
INSTITUTE
OF CHEMISTRY

Vol. 32, No. 5, October, 1968





In New Zealand Industry Shell Chemicals

145.8

CHEMISTRY IN NEW ZEALAND
Journal of
The New Zealand
Institute of Chemistry

Vol. 32, No. 5, October 1968

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

Contents

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

Advertising Manager:
P.O. Box 250, Wellington.

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

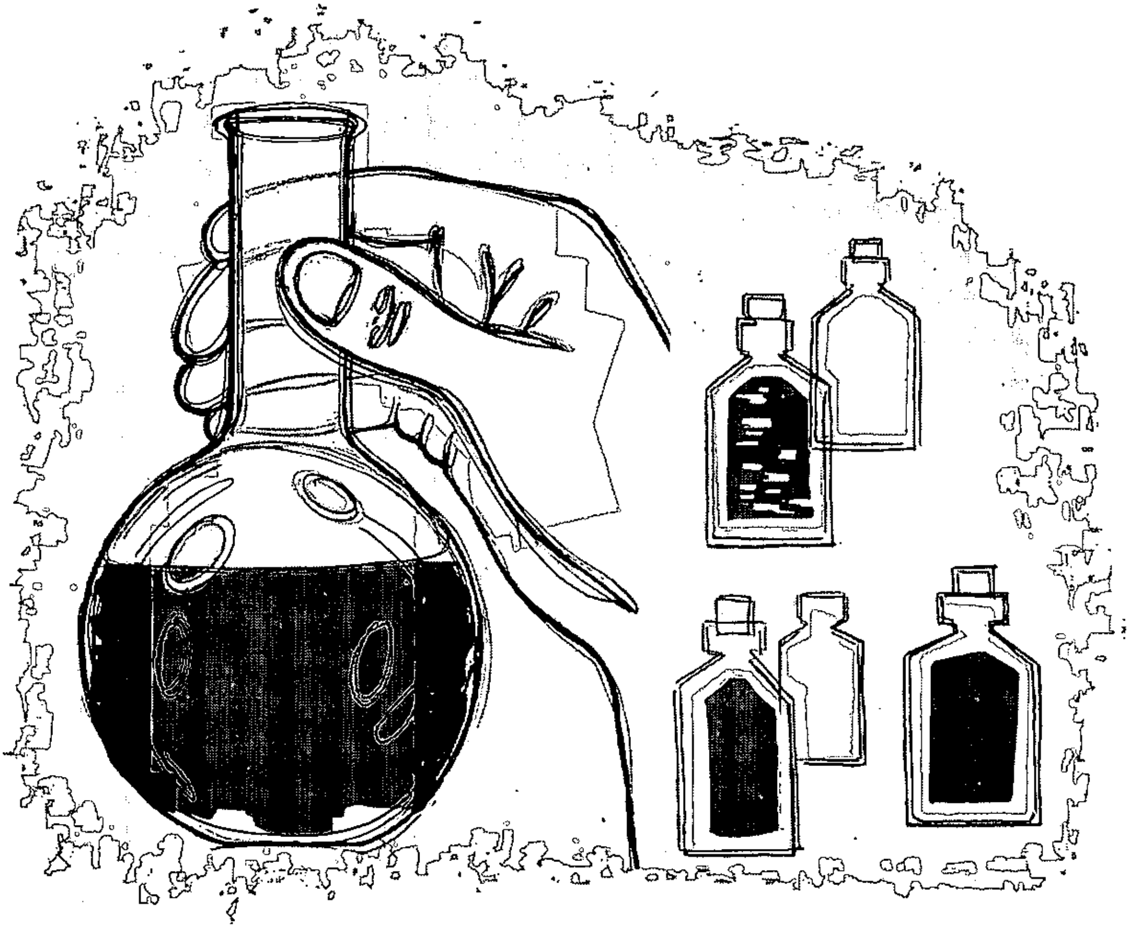
COVER PHOTO
Research Vessel Alpha-Helix Amazon Expedition.

Distribution. The Registrar:
D. J. Hogan, B.Sc., A.N.Z.I.C.
P.O. Box 1926, Christchurch.

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

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

The Journal of the N.Z. Institute of Chemistry has an audit circulation Certificate of New Zealand Advertisers.



ONE THOUSAND MILES UP THE AMAZON

P. J. Peterson, M.Sc., Ph.D.(Lond.)
Plant Chemistry Division, D.S.I.R., Palmerston North

Introduction

During August, September and part of October last year I was a member of the Research Vessel Alpha-Helix Amazon Expedition located principally on the Rio Negro tributary. This was the vessel's second expedition, the first, the Billabong Expedition, went to the Great Barrier Reef in 1966. The Alpha-Helix concept of research is a unique one; it is the taking of a sophisticated laboratory to the habitat of the organism. [In many laboratories the reverse of this is true—"conventional" organisms are experimented with, or organisms are brought into the laboratory and attempts made to simulate the habitat. Often however these may not be the most interesting organisms to study.] In addition, expedition members when living together for months are, in effect, participating in a twenty-four hour symposium with informal exchanges and interchanges of ideas with scientists from differing but related disciplines. During an expedition in an underdeveloped or developing area one becomes more keenly aware of the environment, the organisms dependent upon it and the potentialities of the area.

The Expedition was financed by the National Science Foundation (U.S.A.) with the Alpha-Helix being operated by the Scripps Institute of Oceanography through a National Advisory Board. I am grateful to the N.S.F. for providing return air fares and all expenses including food and lodgings for the duration of the Expedition. I was a member of Programme D, Plant Physiology and Biochemistry led by Professor J. B. Biale.

R/V Alpha Helix

The Alpha Helix, 512 tons and 133 feet long, was built at a cost of one million dollars and carries half a million dollars' worth of scientific apparatus. It has been ice-strengthened for high or low latitudes and air-conditioned for the tropics. The ship berths 10 scientists and a crew of 12 and is used as the main "camp". A shore-camp was established close by the vessel to accommodate a greater number of scientists. Two portable air-conditioned laboratories were also on shore for scientific use. The principal laboratory space on the vessel is a main laboratory, part of which can be cooled to 5°, a deep-freeze room at —20°, a small laboratory and attached dark-room and a machine shop. Equipment such as centrifuges, balances, a lyophilizer, spectrophotometers, gas chromatograph and radioactive counting gear are installed. Members also brought their own specialised equipment—for example I took a small portable H.V. electrophoresis unit and light-weight power supply specially made in our workshops and tropicalised for the Expedition; others took oxygen electrodes, gas analysers, particle counters, solar radiation meters, transpirometers and so on.

Location

The Amazon basin, about 1,000 miles north to south and 2,000 miles east to west in size, contains one of the largest areas of tropical forest in the world, much of it in an untouched state. In the Rio Negro area where we were stationed, temperatures just below 100°F and near-saturation humidity made life a contrast after a winter in New Zealand. Many fascinating animals, birds, fish and insects were seen and some contacts were made with the native inhabitants, especially as guides for the area.

The Expedition formed at Manaus, Amazonas, almost at the confluence of the Rio Negro and the Amazon and we then journeyed some 200 miles up the Rio Negro almost to the junction with the Rio Branco, about 80 miles from the Equator. Although our programme commenced in the dry season (the end of the wet season is around June) the river was still high. At Manaus the river rises maximally 50 feet during the wet season. As Manaus is only about 80 feet above sea level yet some 800 miles inland tremendous areas are flooded when the river rises. The Rio Negro and flooded areas drain an area about twice the size of New Zealand. Two main types of vegetation are recognised here, the flooded forest (Igapo) and the forest on dry land (terra firme). Nearer the mouth of the Amazon tidal movements of fresh water also give rise to flooding and another forest type is recognised (Várzea).

In the Rio Negro the water has an extraordinary high acidity, around pH 4, which inhibits bacterial decomposition of organic matter. As its name implies the water is black, or more correctly like the colour of "black" tea, caused by humic acids of molecular weight around 100,000. The river contains little undissolved minerals so no sedimentation takes place. Similarly little erosion takes place as the area is so flat, although leaching does occur. Dr H. Ungemach from the Hydrobiological Station, Max Planck Institute, Plön (now at Instituto Nacional de Pesquisas da Amazonia at Manaus) has been carrying out a hydrographical and chemical survey of the Rio Negro. Much useful discussion took place between the Alpha Helix personnel and Dr Ungemach on mineral movements in the area.

Research Programmes

Programme D consisted of 20 scientists, 14 from U.S.A., 5 from Brazil and myself from New Zealand. The research topics are outlined below.

Total mineral contents of the forest were studied by Dr N. Stark (Desert Research Institute, University of Nevada, Reno) with mineral cycling as the main aim of the work. The importance of mycorrhiza in these systems was investigated by Dr F. W. Went (Desert Research Institute). As anaerobic conditions could be expected throughout many areas of the Igapo forest, Professor R. S. Bandurski (Michigan State University, East Lansing) and A. L. Hargens (Scripps Institute of Oceanography, La Jolla) studied oxygen transport through stems of typical species using an oxygen electrode. Studies of the sap tensions in these trees compared with those on *terra firme* were carried out by Dr P. F. Scholander (Scripps Institute of Oceanography) and Dr M. de Oliveira Perez (Instituto de Pesquisas da Marinha). Using the same method Professor S. L. Miller (University of California at San Diego) and P. F. Scholander investigated the sap tension in mangroves in relation to the osmotic properties of the cells and the osmotic pressure of the water. Dr H. T. Hammel (Yale University, New Haven) and I did comparative work on turgor (hydrostatic pressure) of phloem tissue (just under the bark of trees) and the osmotic pressure and chemical composition of phloem exudates. I also did some comparative work on xylem tissue (wood) exudate composition. Negative pressure measurements in trees were extended by Dr Scholander and Mr Hargens to include the interstitial fluid pressure in several animal species under various conditions of hydration. Measurements were made of the light environments in the various forest communities by Professors R. S. Loomis and W. A. Williams (University of California, Davis) and on the degree of stomatal opening in relation to shade and moisture stress by Dr P. de T. Alvim (Centro de Pesquisas do Cacau, Itabuna, Bahia). Dr L. M. Coutinho and Dr A. Lamberti (Universidade de Sao Paulo) investigated relative transpiration rates and stomatal efficiencies and compared these values with microclimatological conditions alongside the plants. Studying the same plants these investigators also measured net photosynthesis and compensation points and were thus able to gain a measure of productivity for the vegetation type studied.

Dr F. W. Went, using gas chromatography, accumulated interesting data on the concentration and composition of volatile organic substances present in the forest air and measured the submicroscopic condensation nuclei which he believes to be the reaction products of such volatiles. The gas chromatograph was also used by Professor J. B. Biale and D. E. Barcus (University of California, Los Angeles) to study ethylene production by tropical fruits. They also studied respiration patterns in fruits and were able to isolate mitochondria from various fruits and study their activity with an oxygen electrode. Seeds from these and other fruits were germinated by Professor M. L. Ibanez (Louisiana State University, New Orleans) to investigate their sensitivity towards cold. Some were embedded for electron microscopic investigation of the cold-produced lesions.

I also looked at chromatographic and electrophoretic patterns of aminoacids from various toxic and non-toxic plants to see if unusual aminoacids could be the toxic agents. Various plant extracts were brought to Plant Chemistry Division for further aminoacid work. Dr A. A. Benson (Scripps Institute of Oceanography), using plants considered by the natives to be remedies for snake bites, studied red cell lysis. He was also studying phosphatide metabolism in the electric organ of the eel and the metabolism of long chain fatty ethers of glycerol in fresh water sharks.

The sulphonic group is a constituent of aliphatic compounds in plants. Bacteria isolated from various Amazonian waters and grown in enrichment cultures were used by Professor H. L. Martelli (Universidade do Brasil, Rio de Janeiro) to investigate the oxidative pathways for this group of compounds, using ^{35}S. Dr E. G. Trams (National Institute of Health, Bethesda) was concerned with the nature, origin and levels of serum chromophores of various birds in relation to carotenoid pigments derived from food sources.

This brief outline of the research topics in Programme D gives some indication of the wide variety of programmes undertaken. Perhaps the research of most interest to chemists was in the earlier Programme C. Professor R. F. Schultes (Harvard University) and Dr B. Holmstedt (Karolinska Institutet, Stockholm) studied the chemistry, toxicology and ethnobotany of the plant genus *Virola* which contains hallucinogenic compounds, while Professors C. M. Williams and F. C. Kafatos (Harvard University) investigated the insecticidal properties of the Rio Negro.

Conclusion at Belém

At the conclusion of the Expedition the Alpha Helix journed approximately 1,000 miles from the shore camp down to Belém, Para, at the mouth of the Amazon. A two-day conference was held at the Instituto de Pesquisas e Experimentaçao Agropecuárias do Norte to which many prominent Brazilian scientists were invited by the National Science Foundation (U.S.A.) and by the Academia de Ciencias and Counselho Nacional de Pesquisas (Brazil). Apart from the Brazilian Institutes already mentioned, scientists came from Instituto Evandro Chagas, Belém; Museu Goeldi de Historia Natural e Ethnografia, Belém; Instituto Oswaldo Cruz, Rio de Janeiro; Universidade de Campinas, Sao Paulo and Instituto de Pesquisas e Experimentaçao Agropecuárias do Centro-Sul, to mention only a few. Here we were able to make many worthwhile contacts with scientists from various fields and pave the way for greater international scientific collaboration in future years.

Undoubtedly the Amazon Expedition was a success irrespective of whether one considers the science programme carried out, the informal and formal contacts made between investigators, or the opportunities offered to the participants to work in one of the world's remotest areas on the most unique plant and animal communities. Indeed the successful combination of all three aspects made the Amazon Expedition a grand success and I am indebted to the National Science Foundation for providing me with the opportunity to be a member of that Expedition.

OBITUARY

Professor B. D. England

Victoria University lost a devoted member of its staff when Dr. B. D. England, Associate Professor of Chemistry, died suddenly a few weeks ago. Brian England went from Dannevirke High School to Otago University as an Entrance Scholar. He graduated from Otago after a distinguished career which culminated in 1945 with the award of 1st Class Honours in Chemistry, and a Post Graduate Scholarship in Science. Following a period as Assistant Lecturer at Canterbury University College he travelled to University College, London, where he joined the research school of the late Prof. E. D. Hughes and undertook research into the mechanisms of organic substitution reactions. His interest in this field of Physical Organic Chemistry was retained and developed in his subsequent career.

After graduating Ph.D. from London University in 1949, Dr. England joined the staff of the then newly established University College at Ibadan, Nigeria. He returned to New Zealand in 1955 as Senior Lecturer in Physical Chemistry at Victoria University College.

He joined the Victoria Chemistry Department at a time when it was facing rapid increases in student numbers for which it was ill prepared. Its staffing was, numerically speaking, meagre and its material resources very limited even by the rather modest standards of the day. It is therefore greatly to Prof. England's credit that a good standard of teaching and research in Physical Chemistry was maintained and developed during the years when he was in charge of that branch of the subject at Victoria. Perhaps the best tribute to his work during this period is the number of his former students who subsequently distinguished themselves in New Zealand and overseas.

Professor England took a keen interest in educational matters generally. He represented the teaching staff on the Victoria University Council for a period and at the time of his death was a member of the Wellington High School Board of Governors. He also took an active interest in Refresher Courses for Secondary School Chemistry teachers. His death is a considerable loss to colleagues and students. Striking evidence of the esteem in which he was held by students at Victoria was the spontaneous action by a group of senior students to set in motion a collection aimed at establishing an award to perpetuate Professor England's name at the University.

R.A.M.

PRELIMINARY NOTICE

CONFERENCE 1969

Dunedin — Monday, 25th August to Friday, 29th August

This is to be the first of the Special Conferences to be organised every third year.

Conference Chairman: Professor H. N. Parton.

Conference Secretary: Dr P. K. Grant.

Further information will be published in the December Journal.

1969 is Otago University's Centennial Year.

THE UNIVERSITY CHEMISTRY SYLLABUS

Objective Approaches to its Determination and Revision

B. D. England, M.Sc., Ph.D.
Chemistry Department, Victoria University of Wellington

Introduction:

The Need for an Objective Approach

One of the most difficult problems which faces the head of a university department of chemistry is that of dividing the fixed and unchanging teaching time among the various subdivisions of a large and rapidly expanding subject. The problem grows as more and more specialist teachers are appointed, each with a demand for time to impart some knowledge of his own specialised field to the undergraduate. Yet, if more is put into the syllabus it is emphatically necessary to reduce the time devoted to existing subdivisions. The process of re-thinking the presentation of these so that the essential principles may be presented in less time is a difficult one which university teachers are wont to resist with considerable vigour.

There has been no lack of recognition of these particular problems in recent literature. A. D. Walsh[1] discusses the widespread enthusiasm for changing syllabuses and the common criticism that chemistry teaching is out of date, but asks, "What principles are to guide additions to and removals from the syllabus?" He points out that until we have clear, guiding principles we shall never subtract at the same rate as we add and thus our syllabuses will become hopelessly congested. C. F. Sellers[2] makes a plea for official guidance about what is important to include in the school syllabus.

In any discussion of the undergraduate course structure in chemistry it is essential to start with facts. The purpose of this paper is to present quantitative evidence of various kinds which has a bearing on the training of chemists. The precise relevance of these facts to the question of the chemistry syllabus will, no doubt, be a matter of some debate. However, more evidence is available about the state of modern chemistry than most chemists realise and such evidence is most useful in any syllabus discussion. It is relatively easy to make out a case for teaching this or that aspect of chemistry to the undergraduate but far more difficult to arrange the various aspects in an order of priority. It is hoped that the data presented here will be a useful guide to those who finally have to decide what is to remain or be introduced and what is to be eliminated or modified.

The Chemical Literature

Most chemists read the literature and are only too well aware of its large and increasing volume. Few, however, are conversant with the relative volume of publication in different fields and even fewer with the trends in publication volume at the present time. Yet the volume of publication in a field is a valuable index of the significance of this field, especially when it is compared with similar data for other fields. The volume of publication by an individual chemist is frequently used as an index (some would say the only index!) of his competence, and the volume of publication in some particular field of pure chemistry is certainly a no less important criterion of its importance in the education of the undergraduate. Publication volume certainly reflects the intrinsic interest of a chemical topic and its economic importance, both excellent criteria, in the author's opinion, of the value of the topic in the undergraduate syllabus. It is also a good indication of the fields in which newly trained

TABLE 1

Main Divisions of the Literature of Chemistry as Classified by Chemical Abstracts in 1951 and 1961

Classification	*C.A. Vol. 45*, 1951 No. of Abstracts	% of Total	No. of Pages	% of Total	*C.A. Vol. 55*, 1961 No. of Abstracts	% of Total	No. of Pages	% of Total
Biological Chemistry	14,518	28.7	1,077	24.6	35,046	29.6	2,801	24.8
Organic Chemistry	5,206	10.3	1,024	23.4	12,663	10.7	2,662	23.6
General and Physical Chemistry	5,135	10.1	418	9.5	9,836	8.3	814	7.2
Electronic Phenomena and Spectra	2,231	4.4	185	4.2	7,607	6.4	627	5.5
Analytical Chemistry	1,886	3.7	148	3.4	4.407	3.7	373	3.3
Nuclear Phenomena	2,013	4.0	127	2.9	5,458	4.6	387	3.4
Metallurgy	2,038	4.0	155	3.5	7,539	6.4	697	6.2
Inorganic Chemistry	574	1.1	56	1.3	2,181	1.8	189	1.7
Totals	50,657		4,379		118,337		11,290	

Notes:

(a) Books, New Journals, cross references etc. are not included.

(b) Abstracts of Patents are not included; the number of Patents is about 20% of the Number of Papers abstracted.

(c) Inorganic Chemistry is included only for comparison; on a page basis it ranks 16th of the 33 subdivisions in 1951 and 11th in 1961.

chemists will make their careers. Undoubtedly though, the volume of publication also reflects other values which are less tangible and probably less relevant to the present discussion. The volume index could no doubt be improved upon as a criterion of importance if each contribution could be multiplied by a weighting factor proportional to its scientific merit. But this is surely an impossible task—as impossible as the weighting of votes in an election according to the worthiness or political insight of the individuals who cast them!

An important point is that the analyses of the literature presented here reflect, within the limitations already discussed, the present importance of various aspects of chemistry and the syllabus which takes account of them should also have a balance which is contemporary rather than historical. Furthermore, by considering the changes over a ten-year period it is possible to make predictions of the likely balance of the discipline in future and to modify the syllabus accordingly.

Survey Tables of the Recent Chemical Literature

Table 1 has been constructed from *Chemical Abstracts* in 1951 and 1961. This particular 10-year period was chosen because, in 1962, a major change in the format of *Chemical Abstracts* was introduced. The main reason for this change was, undoubtedly, the large volume of organic and biological chemistry. Before 1962 some 50% of *Chemical Abstracts* was classified under these 2 heads and the other 50% under the other 31 heads! There are now 73 subdivisions. However, it appears that other changes in the classification system were made at the same time with the result that the latest 10-year period for which comparable figures are available is that given in Table 1. For the sake of brevity the Table includes only the largest seven of the 33 subdivisions of *Chemical Abstracts*. These seven, however, do make up some 60% of the journal, and, together with Inorganic Chemistry, they do include all the material which a university department typically attempts to teach. In a technological university or department a wider selection of subdivisions might be more appropriate.

TABLE 2

The Literature of Pure Chemistry as Classified by Current Chemical Papers 1955 and 1965

Section	Classification	C.C.P. 1955 No. of Pages of Titles	C.C.P. 1955 % of Total	C.C.P. 1965 No. of Pages of Titles	C.C.P. 1965 % of Total
1	Sub-atomics (Chemical aspects)	10.9	1.6	11.4	0.8
2	Atomic and Molecular Structure	63.6	9.2	247.9	18.2
3	Phase structure and phase relations	50.1	7.2	103.4	7.6
4	Surface properties	21.7	3.1	60.2	4.4
5	Colloids and Macromolecules	35.2	5.1	102.7	7.5
6	Electrochemistry	34.4	5.0	52.9	3.9
7	Thermodynamics	16.2	2.3	24.4	1.8
8	Kinetics and Mechanism	51.7	7.5	151.0	11.0
9	Inorganic	32.3	4.6	30.9	2.2
10	Organometallic and Organometalloid	—	—	74.5	5.5
11	Organic	255.1	36.8	340.4	25.0
	Isotope Chemistry	4.3	0.6	—	—
12	Analysis	94.8	13.7	141.6	10.4
13	Apparatus and Techniques	22.7	3.3	22.7	1.7
		693.0	100.0	1,364.0	100.0

Notes:

(a) Section 10 was introduced as a separate section in 1961 and the corresopnding subdivision of Section 11 was deleted.

(b) Isotope chemistry was not classified after 1960.

(c) Sections 1-8 inclusive amount to 41.0% in 1955 and to 55.2% in 1965.

Table 2 relates to *Current Chemical Papers* which has used the same basic classification scheme since it started in 1954. Some minor changes which occurred in 1961 are recorded in the footnote. It is important to note that, whereas *Chemical Abstracts* is comprehensive, *Current Chemical Papers* describes itself as a "classified world list of new papers in pure chemistry" and lists only about one quarter of the papers included in *Chemical Abstracts.* As the university syllabus is properly concerned with basic chemistry it is to be expected that Table 2 will be a more valuable guide than Table 1. It is noteworthy, too, that much more change is observable in the makeup of *Current Chemical Papers* than of *Chemical Abstracts* and, over a ten-year period, the former shows some marked changes in the balance of the various sections.

Discussion of the Tables

From the point of view of the student and of the university teacher a surprising feature of Table 1 is the extremely large volume of publication in Biological and Organic Chemistry which together account for some 50% of *Chemical Abstracts* on a page basis. The importance of the Organic area is echoed in Table 2 where it is easily the largest subdivisional although the proportion is clearly diminishing. It might be worthwhile to examine this diminution in more detail. Clearly, part of it is due to the introduction of Section 10 in 1961.

Even more surprising is the comparatively minute volume of publication in Inorganic Chemistry recorded in both tables. It is clear that, according to this criterion, Inorganic Chemistry is no longer a major branch of the subject. Many chemists have difficulty in accepting this finding, contending that much inorganic research is classified under other heads. However, there seems to be almost complete agreement between the two distinct sets of classifiers, one in Britain and the other in the U.S.A., as to what is Inorganic Chemistry and what is not. It seems much more likely that chemists are conditioned by their education to regard Inorganic Chemistry as a major branch of the subject especially in British countries where the division of departments, staff, lecture and laboratory time and examinations into three approximately equal units of Inorganic, Organic and Physical Chemistry is almost universal. Another possible factor is the "renaissance" of inorganic chemistry which many claim to have occurred since the war, a claim that an examination of the literature does not substantiate.

Turning now to Physical Chemistry, the third traditional area, the subsections "General and Physical Chemistry" and "Electronic Phenomena and Spectra" account for some 12-14% of *Chemical Abstracts,* but Sections 1-8 of Table 2 make up 41% of *Current Chemical Papers* in 1955 and 55.2% in 1965. This difference is not surprising since papers originating from industrial organisations are typically concerned with chemical products or analytical procedures rather than with chemical principles. Such papers would have a large influence on the content of *Chemical Abstracts* but probably a negligible effect on "pure" chemistry as recorded by *Current Chemical Papers.* The large increase in the volume of publication in the physico-chemical area over the ten-year period covered by Table 2 is clearly due to an enormous growth (about 400%) in Section 2, the area of spectroscopy and structural theory, accompanied by a notable increase in Section 8 (Kinetics and Mechanism). These two sections now account for some 50% of physical chemistry while the more traditional areas of thermodynamics and electrochemistry are much smaller and have some tendency to show a decline in volume relative to other sections.

It appears that classical thermodynamics may be undergoing the same sort of transformation which has already taken place with atomic weight determinations where new work is almost non-existent. Before the war it was customary to spend much time at school and university on the methods and reasoning which led to the establishment of the atomic weight scale. This has now almost completely disappeared from the chemistry syllabus although it is still most important that students should be taught to use atomic weight data correctly. Correspondingly, the main aim in a general course of thermodynamics should be to teach the student to use thermodynamic data properly and leave the historical aspects to special courses for those students who have a particular interest in the foundations and fundamentals of the subject.

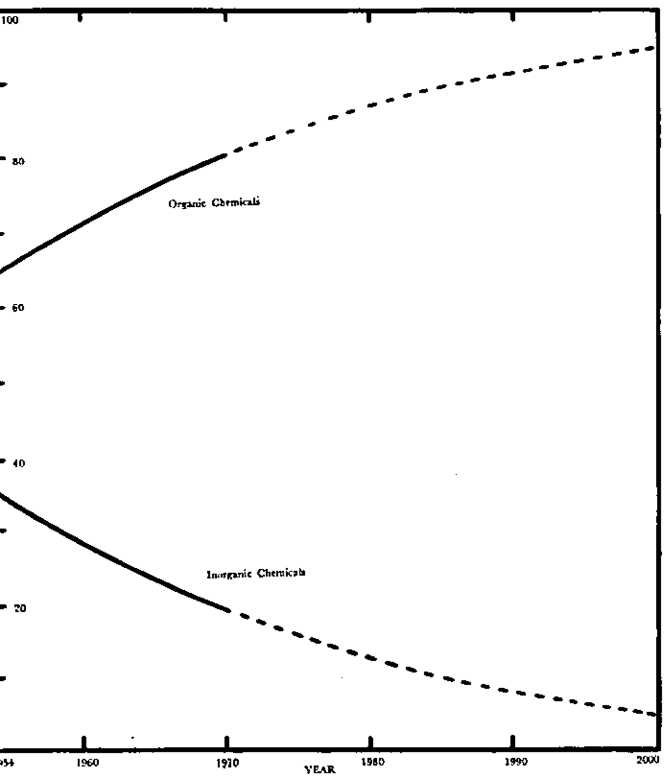
The chemical literature then, and especially that section of it which is classified and recorded by *Current Chemical Papers,* provides a convenient, contemporary and objective method of assessing where the areas of activity and growth in chemistry actually lie; most chemistry departments would do well to give full consideration to the kind of data presented here in any discussion of the balance of the undergraduate course. In the author's experience, emotion and tradition are often the main determinants of what the student should be taught.

The Patent Literature and Industrial Chemistry

A major difference between a degree in chemistry and a pure arts degree is that the former is partly vocational. It should combine training in objective reasoning with preparation for employment as a chemist. Consequently, provided a topic can be presented in a way that stimulates the imagination and challenges the intellect it will be the more worth while as a component of the undergraduate course if it is useful in an economic sense. It follows that an analysis of the products of the chemical industry and present trends in industrial production should have an important bearing on the balance of the undergraduate course. Since Physical Chemistry deals with principles rather than specific compounds, this sort of analysis is not expected to provide any comparison between Physical Chemistry and other branches. However, the data should be highly relevant in assessing the claims of the organic and inorganic areas relative to each other.

An analysis of the United Kingdom Chemical Industry into various types of products according to their value has been made by Mumford[3] and his conclusions have been discussed by Taylor[4] in a series of lectures on the modern chemical industry. It appears that in 1954 some 65% of the total value of the products was contributed by organic chemicals and 35% by inorganic chemicals. Mumford has also made a careful assessment of the changes in the balance of industrial production which are to be expected in

Figure 1
Organic and Inorganic Chemicals as a Percentage (by Value) of the Total Production of the U.K. Chemical Industry



the present decade. He concludes that the value of organic chemicals produced will rise at a rate over three times greater than that for inorganic chemicals.

The significance of these figures is easily appreciated from Figure 1 which has been prepared from them. The present growth rates have also been extrapolated to the end of the century. It is clear that at the present time the chemical industry is in the midst of a wholesale swing towards the production of organic chemicals at a rate which few chemists appear to appreciate. The manpower requirements of the chemical industry are probably not adequately reflected by the production figures since the organic developments include hosts of new products, while inorganic chemical production involves mainly the manufacture of increasing quantities of the same traditional compounds.

To many of the older generation whose education in Chemistry was dominated by industrial processes for the manufacture of the main inorganics—sulphuric acid, ammonia, caustic soda, sodium carbonate and chlorine—this trend may seem somewhat surprising. There is, however, much independent evidence of the reality of the phenomenon. Table 3, where the main sections of the Patent Literature have been analysed over a ten-year period, shows that invention in chemistry occurs very largely and increasingly in the realm of organic chemistry. The discovery of new organic chemicals proceeds at the remarkable rate of some 100,000 per annum.[5] A glance at the typical chemical products in the average home also yields significant information on the vast growth of industrial organic products which has occurred since the war. New synthetic fibres, plastics, paints, dyes, glues, drugs, aerosols, pesticides and plant growth products which would, for the most part, have been absent twenty years ago are all represented. By contrast, it is difficult to think of a single, new, inorganic compound which has made its appearance in the home in the same period: some such as Epsom Salts have virtually disappeared!

TABLE 3

Main Divisions of the Patent Literature as Classified by Chemical Abstracts in 1951 and 1961

Classification	C.A. Vol. 45, 1951 No. of Patents	% of Total	No. of Pages	% of Total	C.A. Vol. 55, 1961 No. of Patents	% of Total	No. of Pages	% of Total
Organic Chemistry ...	2,074	19.9	205	25.4	5,847	22.3	723	29.4
Synthetic Resins and Plastics ...	1,041	10.0	82	10.1	3,080	11.7	311	12.6
Dyes and Textile Chemistry ...	840	8.1	72	8.9	1,523	5.8	184	7.5
Petroleum Products ...	788	7.6	57	7.1	1,570	6.0	132	5.4
Metallurgy ...	666	6.4	39	4.8	2,092	8.0	159	6.5
Inorganic Industrial Chemicals ...	499	4.8	31	3.8	1,320	5.0	97	3.9
Pharmaceuticals, etc. ...	399	3.8	29	3.6	749	2.9	64	2.6
Totals ...	10,417		807		26,247		2,458	

Note:

Pharmaceutical etc. Patents seem to have fallen considerably in importance between 1951 and 1961. In 1961, Plant Equipment, apparatus etc. Patents were seventh in number and Pharmaceuticals were 10th.

All these facts have an immense influence upon the employment of chemists and therefore upon their education. Whatever special aspects of chemistry are stressed by Dr. X or Professor Y in their lectures, the eventual employment of chemists is going to be controlled largely by the needs of the economy for this is where the opportunities will lie. It is certain that a very large majority of tomorrow's chemists are going to spend their lives working with organic chemicals.

The Employment of Chemists in New Zealand Industry

The production figures and trends given for the chemical industry in Britain are probably typical of industrial countries in general. It would be useful to examine the employment of chemists in New Zealand itself to see if any general modification of the conclusions reached is necessary here. Data on this point have been provided by D. A. Watkins[6] who lists the distribution of chemists between various types of industry in the following approximate order of importance: foodstuffs, dairy industry, wood products, freezing works, fertilisers, petroleum products, textiles, paints, general industrial chemicals, tanneries, rubber processing, breweries, gas industry, ceramics, metallurgy, cement and soap. The largest employers are clearly those who produce or handle organic materials or animal and plant products and the importance of inorganic chemistry is once again much less.

Some General Conclusions

The main purpose of this article is to induce university teachers to think about the principles which should determine the balance of the basic undergraduate course at the university—the first three years and the common core of the fourth year—and to present some objective data which should have a strong influence on the decisions on course structure. Universities, in the author's experience, are notoriously conservative in their approach to what they should teach. One has only to consider, for example, that no Asian languages are taught in New Zealand Universities (with the exception of some Japanese at Massey) or the fact that there was only one Department of Biochemistry in this country until 1957, to realise the truth of this statement. Generally speaking, there is only one operation that is more difficult than introducing a new university course and that is deleting an existing one! Consequently, it is necessary that, in a world of rapid change, principles should be developed which will enable syllabuses to move smoothly with the times to the advantage of the student. Chemistry is such a large and expanding discipline that some method of deciding between the conflicting claims of lecturers for the students' time is particularly desirable.

The evidence here shows that the tripartite structure of Chemistry Departments that is typical of Commonwealth Universities is no longer appropriate to the times in which we live. It is this traditional administrative structure which is primarily responsible for the division of lectures, laboratory work and examinations into three approximately equal units of inorganic, organic and physical chemistry. This general structure also has a great deal of influence on new staff appointments and is markedly self-perpetuating.

The outstanding anachronism of the present system is that it leads to a quite unjustified emphasis on the teaching of Inorganic Chemistry and a corresponding failure to educate students sufficiently in the newer areas of Physical Chemistry and those areas of Organic Chemistry which find a particular application in biology and the chemical industry. Inorganic Chemistry forms such a small part of modern chemistry that, although it is traditional for universities to establish inorganic chairs in a department of average size, there is now a much better case for chairs such as chemical spectroscopy, chemical mechanisms, polymer chemistry or theoretical chemistry (to quote but a few of the possibilities).

Traditionally, the physical and inorganic areas have been closely associated, with Organic Chemistry as a separate and more empirical study. However, and at the risk of repetition, it is clear that most chemists now spend their lives working with organic chemicals and will do so to an increasing extent and, if Physical Chemistry courses are to serve the students' best interests, they must devote much more attention to the areas of growth such as spectroscopy, photochemistry, kinetic studies and polymer chemistry which tend to find their chief application to organic chemicals. It would certainly make sense in New Zealand, too, to impart to the chemistry student some knowledge of protein chemistry—a vast area which is currently ignored.

Finally, a general plea must be made to academics to realise their wider responsibility to society in the training of chemists. University lecturers have almost invariably spent their whole lives in universities and naturally tend to train students as if they too were to become members of the university staff. It would hardly be too severe to say that students who do not continue to the Ph.D. level are sometimes regarded as "drop-outs". But there are great differences between industrial and academic chemistry as Max Carrie[7] has shown very clearly in his recent Presidential Address. The unquestioned hypothesis that what is good for the academic chemist is good for everybody needs serious examination.

REFERENCES

[1] Walsh, A. D., *Education in Chemistry, 1*, 175, 1964.

[2] Sellers, C. F., *Education in Chemistry, 1*, 236, 1964.

[3] Mumford, L. S., Lecture on "The Future Pattern of the Chemical Industry" delivered to the Institution of Chemical Engineers in April 1960.

[4] Taylor, James, *Journal of the Royal Society of Arts, 109*, 339-81, 1961.

[5] "Chemistry, an Experimental Science", Chemical Education Material Study, W. H. Freeman and Co., San Francisco and London, 1963, p.322.

[6] Watkins, D. A., *J. New Zealand Inst. Chem., 27*, 80, 1963.

[7] Carrie Max, *J. New Zealand Inst. Chem., 31*, 123, 1967.

BOOK REVIEW

Physico-Chemical Quantities and Units (The Grammar and Spelling of Physical Chemistry) by M. L. McGlashin, M.Sc., Ph.D., D.Sc., F.R.I.C. Royal Institute of Chemistry Monograph for Teachers, No. 15. Price 86 cents.

One's first reaction on receiving a copy of this booklet is to give a huge gasp of relief. Here at last is an authoritative statement about the internationally recommended names and symbols for physical quantities and units, and about the way in which they should be used. Whether one is engaged in teaching science or in scientific writing such a statement has long since become essential, and the lack of it has caused frustration. A paragraph from the preface makes the purpose of the monograph plain:

"As the result of a great and continuing international effort there now exists an internationally agreed language of physical science. I have often tried to persuade fellow chemists to use that language correctly but almost as often have had to admit that neither a 'Fowler' nor a dictionary for that language is readily available to chemists. This monograph is an attempt to supply those needs."

The author's "attempt to supply those needs" has been outstandingly successful. Any dull catalogue of definitions, names and symbols could have served a useful purpose and would have been appreciated. But this booklet far exceeds that simple role. It is a book with a story, not just a dictionary. Despite its prosaic title it is readable, interesting, informative, satisfying; it even contains a joke!

After all, who are these demi-gods who from Olympian Heights decree that such familiar things as litres, dynes and calories should be replaced by cubic metres, newtons and joules? Who suggested that the unit of mass might be named the giorgi, and the unit of pressure the pascal? Where are the Olympian Heights anyway? It seems a pity that the answer to the last question is Copenhagen, but it is interesting and satisfying to have even such questions as these answered.

The book is not only satisfying but also convincing. The true basis of any agreement is understanding. The author's lucid explanation of the reasons for the various decisions and recommendations is most compelling. One cannot easily withhold one's consent to radical changes after reading the arguments which are presented here.

Thirdly, this book is helpful. Professor McGlashan writes not only as a man who knows exactly what he is talking about and can lay down the law, but he writes also with the true spirit of a teacher. On each topic he states the particular convention and then gives examples, both of its correct use and also of various forms of familiar yet incorrect usage. Many questions which come into one's mind on reading the main text have been skilfully anticipated and are answered in the examples or else in the numerous footnotes.

A list of a few of the twelve chapter headings will give an indication of the scope of the book: The International Authorities; Physical Quantities; Units; Numerical Values of Physical Quantities; Conventions related to Galvanic Cells; Definition of pH; Electrical and Magnetic Quantities and Units; and four appendices, including Recommended Names and Symbols for Selected Physical Quantities and Recommended Values of Physical Constants.

The book contains just sufficient a trace of controversial material to permit one the pleasurable experience of mildly disagreeing with the authorities on certain points. I am prepared to give up being a non-conformist on most of the points at issue, but I am inclined to think that I will always be a heretic about the "flow of positive electricity through a galvanic cell" (p. 42).

Professor McGlashan is to be congratulated on giving us such an authoritative, interesting and helpful account of what many of us would regard as a most unpromising subject to write about. I do not

(continued on page 170)

SINGLE ELECTRODE POTENTIALS

A. J. Easteal, M.Sc., Ph.D., A.R.A.C.I.
Department of Chemistry, University of Auckland

It has been my experience that undergraduate students sometimes have difficulty with the meaning of single electrode potentials, their definition and the fact that they are not experimentally measurable by ordinary (i.e. thermodynamic) techniques. A confusing factor is the two conventions in use concerning the signs of electrode potentials.

It seems worthwhile to summarise the basic facts and generally accepted conventions concerning electrode potentials so far as they are relevant to an understanding of galvanic cells.

The definition of the potential of a single electrode can be based on the concept of the potential at a point in a single phase. For a single, homogeneous, electrically conducting phase the work required to bring a unit positive charge from infinity to a point in the surface of the phase is the *outer potential* (or external potential), ψ, of the phase. The work required to bring a unit positive charge from infinity to a point in the interior of the phase is the *inner potential* (or internal potential), ϕ, of the phase. The relationship between ψ and ϕ is

$$\phi = \psi + \chi$$

where χ is the *surface potential* of the phase. ψ is a measurable quantity, but neither ϕ nor χ can be measured. Also, while the *Volta potential difference*, $\Delta\psi$, for two phases in contact is measurable, neither $\Delta\phi$ (the *Galvani potential difference* or *Galvanic* tension) nor $\Delta\chi$ can be measured.

The emf of a galvanic cell can be regarded as the algebraic difference of the electrode potentials of the two electrodes of the cell. Thus the Daniell cell represented by[1]

$$M_I \mid Zn \mid Zn^{2+} \,\vdots\vdots\, Cu^{2+} \mid Cu \mid M_I \qquad \ldots . A$$

has emf[2]

$$E_{cell} = E_{Cu/Cu^{2+}} - E_{Zn/Zn^{2+}} \qquad \ldots . 2$$

where $E_{Cu/Cu^{2+}}$ and $E_{Zn/Zn^{2+}}$ are the theoretical electrode potentials of the Cu/Cu^{2+} and Zn/Zn^{2+} electrodes respectively. E_{cell} is measured by measuring the externally applied electric potential difference required to just balance the cell emf. At balance, the emf (or *chemical tension (2)*) of the cell is exactly equal to the potential difference (or *electric tension (2)*) between the terminals. The cell is represented with the negative terminal on the left[3] and the positive terminal on the right side. The terminal phases M_I are identical (usually copper) and take no part in the electrode reactions. The standard emf of the Daniell cell, i.e., the emf of the cell represented by

$$M_I \mid Zn(a_{Zn=1}) \mid Zn^{2+}(a_{Zn^{2+}} = 1) \,\vdots\vdots\, Cu^{2+}(a_{Cu^{2+}} = 1) \mid Cu(a_{Cu} = 1) \mid M_I \qquad \ldots . B$$

is

$$E^\circ_{cell} = E^\circ_{Cu/Cu^{2+}} - E^\circ_{Zn/Zn^{2+}} \qquad \ldots . 3$$

---

[1] The symbol ⁞⁞ will be used to denote a boundary between two liquid or two solid electrolytes, or a bridge electrolyte; ⁞ to denote a boundary between a solid and a liquid electrolyte, and | a boundary between (a) two metallic conductors, (b) a metallic conductor and an electrolyte, (c) a metallic conductor and a gas, (d) a gas and an electrolyte.

[2] In cell A and all subsequent cells with junctions between two non-identical electrolytes the diffusion potential will be assumed to be negligibly small.

[3] The left hand electrode is understood to be connected to the negative terminal of a potentiometer.

$E^\circ_{Cu/Cu^{2+}}$ and $E^\circ_{Zn/Zn^{2+}}$ will be referred to as the *standard theoretical electrode potentials* (s.t.e.p.) of the two electrodes. Although neither $E^\circ_{Cu/Cu^{2+}}$ nor $E^\circ_{Zn/Zn^{2+}}$ can be evaluated by a thermodynamic method their difference is experimentally determinable.

The s.t.e.p., $E^\circ_{M/M^{z+}}$ of an M/M^{z+} electrode can be taken as a measure of the tendency for positive electricity to flow spontaneously from the metallic phase in its standard state to the electrolyte phase in its standard state. If ϕ°_m and ϕ°_e are the standard-state inner potentials of the metallic and electrolytic phases respectively then the s.t.e.p. of the electrode is defined by

$$E^\circ_{M/M^{z+}} = \phi^\circ_m - \phi^\circ_e \qquad \ldots . 4$$

$E^\circ_{M/M^{z+}}$ could alternatively be called the standard *Galvani electric potential difference* of the electrode. The definition of $E^\circ_{M/M^{z+}}$ expressed by eq. 4 is consistent with the "Gibbs-Stockholm" or "European" convention (*1*). On the basis of the so-called "American" convention, $E^\circ_{M/M^{z+}}$ would be defined by

$$E^\circ_{M/M^{z+}} = \phi^\circ_e - \phi^\circ_m \qquad \ldots . 5$$

The concept of single electrode potentials is particularly useful, because the magnitude of a theoretical electrode potential as defined above is an absolute measure of the extent to which an electrode reaction can take place and hence of the amount of electrical energy generated by the electrode reaction. Although non-thermodynamic methods for measuring theoretical single electrode potentials have been proposed (*3*), no measurements of s.t.e.p. have yet been successfully accomplished. The difficulty of non-measurability is circumvented—but not fully overcome—by defining a practical single electrode potential which is operationally meaningful and is a *relative* measure of the extent to which an electrode reaction can take place.

Practical electrode potentials are defined and measured with respect to a reference electrode whose potential is assigned an arbitrary value. The universally accepted reference electrode is the standard hydrogen electrode (s.h.e.) whose practical electrode potential has been assigned the value zero, at all temperatures. The requirement that the electrode potential of the s.h.e. be zero *at all temperatures* may no longer be necessary, since a method has been proposed (*4*) for measuring the absolute values of the temperature coefficients of theoretical single electrode potentials. One practical electrode potential is the *Gibbs-Stockholm standard electrode potential* (s.e.p.), $V^\circ_{M/M^{z+}}$, of the M/M^{z+} electrode. $V^\circ_{M/M^{z+}}$ is defined as the emf of the cell whose left hand electrode is the s.h.e. and whose right hand electrode is M/M^{z+} (with $a_M = a_{M^{z+}}$ or $a_{M^{z+}} = 1$ if M is pure metal). Thus, $V^\circ_{Zn/Zn^{2+}}$, for example, is equal in magnitude and sign to the emf of the cell

$$M_i \mid Pt \mid H_2(f_{H_2} = 1 \text{ atm.}) \mid H^+(a_{H^+} = 1) \,\|\, Zn^{2+}(a_{Zn^{2+}} = 1) \mid Zn \mid M_i \qquad \ldots . C$$

where f_{H_2} is the fugacity of hydrogen.

$$\begin{aligned} E^\circ_{cell} &= V^\circ_{Zn/Zn^{2+}} - V^\circ_{H_2H^+} \\ &= V^\circ_{Zn/Zn^{2+}} \\ &= -0.763 \text{ volt (at 25°C)} \end{aligned}$$

The *standard electric tension* (*2*) of the $_{Zn/Zn^{2+}}$ electrode is the electric tension $(\phi_{M_i'} - \phi_{M_i})$ of the cell

$$M_i \mid Zn \mid Zn^{2+}(a_{Zn^{2+}} = 1) \,\|\, H^+(a_{H^+} = 1) \mid H_2(f_{H_2} = 1 \text{ atm.}) \mid Pt \mid M_i' \qquad \ldots . D$$

(M_i and M_i' being identical), and similarly for other M/M^{z+} electrodes. The s.e.p. of the Cu/Cu^{2+} electrode is equal in sign and magnitude to the emf of the cell,

$$M_i \mid Pt \mid H_2(f_{H_2} = 1 \text{ atm.}) \mid H^+(1_{H^+} = 1) \,\|\, Cu^{2+}(a_{Cu^{2+}} = 1) \mid Cu \mid M_i \qquad \ldots . E$$

$$E^\circ_{cell} = V^\circ_{Cu/Cu^{2+}} - V^\circ_{H_2/H^+} = V^\circ_{Cu/Cu^{2+}} = 0.337 \text{ volt (at } 25^\circ C)$$

If cell C is set up in the conventional manner, with the positive terminal (connected to the s.h.e.) on the right and the negative terminal (connected to the Zn/Zn^{2+} electrode) on the left side, then

$$E^\circ_{cell} = -V^\circ_{Zn/Zn^{2+}} = 0.763 \text{ volt (at } 25^\circ C)$$

so that $V^\circ_{M/M^{z+}}$ is a sign-invariant quantity.

For practical purposes it is much more convenient to maintain the partial pressure rather than the fugacity of hydrogen at 1 atm., and to maintain unit concentration (molar or molal) rather than unit activity of hydrogen ions in the electrolyte. It is usually an acceptable approximation to assume that for this electrode, i.e.

$$M_I \mid Pt \mid H_2(f_{H_2} = 1 \text{ atm.}) \mid H^+(C_{H^+} = 1 \text{ molar or 1 molal}).$$
$$V^{\circ\prime}_{H_2/H^+} = V^\circ_{H_2/H^+} = 0$$

The emf of any cell, e.g. the standard-state Daniell cell, can be expressed as the difference of two Gibbs-Stockholm standard electrode potentials. Thus

$$E^\circ_{\substack{Daniell\\cell}} = V^\circ_{Cu/Cu^{2+}} - V^\circ_{Zn/Zn^{2+}} \quad \ldots\ldots 6$$

The electrode with the smaller algebraic value of V° (anode) is connected to the negative terminal of the galvanic cell. While $V^\circ_{Zn/Zn^{2+}}$ and $V^\circ_{Cu/Cu^{2+}}$ are not absolute quantities their difference is an absolute quantity and is an absolute measure of the extent to which Cu^{2+} is displaced by Zn^{2+} from a solution containing Cu^{2+} and Zn^{2+} ions in contact with Zn and Cu. Values of $V^\circ_{M/M^{z+}}$ for a large number of M/M^{z+} electrodes have been tabulated (*5*).

The M/M^{z+} electrode is of course a special case; there are many other types of electrodes. A more general type of single electrode may be represented by

$$M_I \mid RED, OX$$

where RED and OX are the reduced and oxidised forms of the species taking part in the electrode reaction. M_I is a metallic phase, as before, inert to RED and OX. At an M/M^{z+} boundary there is an exchange of ions as well as electrons; at a M_I/RED or M_I/OX boundary there is an exchange of electrons only. At a RED, OX "boundary" there may or may not be an exchange of ions and electrons. The symbol , is used here to indicate that the species RED and OX may be present either in the same phase or in different phases. There may, of course, be more than one OX and more than one RED species taking part in the electrode reaction.

Practical electrode potentials for $M_I \mid$ RED, OX electrodes can be defined in the same way as before. Thus, the s.e.p. of the $M_I/Cu^+,Cu^{2+}$ electrode is the emf of the cell

$$M_I \mid H_2(f_{H_2} = 1 \text{atm.}) \mid H^+(a_{H^+} = 1) \,\vdots\vdots\, Cu^+, Cu^{2+}(a_{Cu^+} = 1 = a_{Cu^{2+}}) \mid M_I \quad \ldots\ldots F$$
$$E^\circ_{cell} = V^\circ_{Cu^+, Cu^{2+}} = 0.153 \text{ volt (at } 25^\circ C).$$

LITERATURE CITED

(*1*) Light, T. S., and Bethune, A. J., J.Chem.Educ., *34*, 433 (1957).
(*2*) Milazzo, G., "Polarography 1964", editor G. J. Hills, MacMillan and Co. Ltd., London, 1966, Vol. 1, pp. 80, 81.
(*3*) (a) Oppenheim, I., J.Phys.Chem., *68*, 2959 (1964);
(b) Salomon, M., Enke, C. G., and Conway, B.E., J.Chem.Phys., *43*, 3989 (1965);
(c) Rabinovich, V. A., Nikerov, A. E., and Rotstein, V. P., Electrochim. Acta, *12*, 155 (1967).
(*4*) Milazzo, G., Z.physik.Chem. (Neue Folge), *54*, 27, (1967).
(*5*) Charlot, G., Bezier, D., and Courtot, J., "Selected Constants; Oxydo-Reduction Potentials", Pergamon Press, London, 1958.

News and Views

SCIENTISTS, POLITICS AND SOCIETY

RECENTLY Britain's Minister of Technology, Mr Anthony Wedgwood Benn, made a speech at the Welsh Council of Labour in Llandudno. His very penetrating remarks achieved some fame. In an interview with the Editor of the New Scientist he explained the thinking behind his speech ("Politics in a Technical Age", *New Scientist, 6,* 13th June 1968, pp. 506, 572).

His views on the influence of science on politics, communication between Government and governed, the new responsibilities of mass media, and the involvement of people in decision making, deserve a wide audience. He had a special word on the place of scientists and engineers in society.

QUESTION: Are you satisfied with the degree to which scientists and engineers are playing a part in the running of the nation's business?

Well, my general criticism of scientists and engineers is that they are far too limited in their interests. Too many of them (not all of them) regard themselves as being specialists, and they simply don't think of the broader consequences of their special activities. They sometimes grumble when they're not consulted—but then, who really wants to consult a man who is a self-condemned specialist? When you talk to a man who's invented a new process, you don't just want to hear about the process—you want to know what he thinks this will do to the shape of the industry and to the pattern of employment in the places where his process is likely to be used.

We should get an awful lot more out of the scientific community if its members learned to inter-relate their special understandings with the other aspects of the contemporary scene. Mind you, I don't believe that just because a man is a scientist or an engineer, he should automatically command a position of authority. He has to work to get his views accepted, just like anybody else. At the moment far too few scientists and technologists feel the need for any such effort. As a result the community is losing access to the thinking of a lot of people who are highly skilled in thinking but who just don't think broadly enough. I can't believe that it's more difficult for scientists to appreciate the political implications of their work, than it is for the politicians to attempt —as they must—an assessment of the impact science and technology are having on society.

QUESTION: Have you a message for the scientists and technologists of this country?

Yes. Have the courage, even the effrontery to think and talk about the wider questions that go beyond the field in which they are specialists. As a Minister of Technology without engineering or scientific training, I have had to try to do exactly this. The experiment has changed my view of society. Similarly, the engineeer and scientist broadening his vision to encompass the politics he is himself reshaping could well change his view, not least of his own role. That would be the best thing that could possibly happen for all of us.

RECOMMENDED READING

WE all have far too much to read and have become very selective. We have not got the time to unravel contorted sentences to discover what hidden treasure there might be within. If those who write want to be read they must take this situation into account.

A series of articles 'Communication and the Scientist' began in the July issue of *Chemistry and Industry in New Zealand.* This series by L. T. Brown, B.A., Dip.Ed., Consultant in Commercial English, is about how to write clearly.

Mr Brown's articles should be read by everyone.

NEW CAWTHRON INSTITUTE LABORATORIES

THE Cawthron Institute Trust Board has recently approved plans for a new $130,000 laboratory building to replace the present "Fellworth" building which has been "temporary" accommodation for the past 40 years.

The new building has been designed by J. W. Cantlon and Associates of Palmerston North and features a novel two-storey "H" shaped design which will give 11,000 sq. ft. of floor space. The exterior of the building will be of brickwork and open aggregate panels featuring local stones and minerals to enhance the landscaped courtyards between the two laboratory wings. The main wings of the new building will house the library, laboratories, workshops and stores, whilst specialist services such as instrument rooms, cold rooms and so on will be grouped in the centre block. The various laboratories will provide up-to-date facilities for biochemistry, microbiology, histochemistry, a chemical services section, and soil and mineral analysis. It is hoped that these new laboratories will enable a considerable expansion of the existing professional staff. As well as providing these new facilities the building will enable a greater expansion into consultant work. There is a large demand for this type of work which would contribute to the income of the Institute and thus release more money for application to basic research work.

The Cawthron Institute is a non-profit research organisation established in 1920 under the terms of the will of the late Thomas Cawthron. It is financed from this and other bequests and grants administered by the Cawthron Trust Board. Since its establishment the Institute has carried out a variety of services for individuals and organisations, usually without charge, but increasing costs and disruption to the research programme have reluctantly forced a revision of this policy. It has therefore been decided to establish a separate Chemical Services section of the Institute to handle this work and to offer these services more widely, with charges based on the recovery of costs. Support of this Section will thus aid the Institute's fundamental research programme in problems related to New Zealand's primary production.

LIST OF MEMBERS

It is proposed to publish the next list of Members before the end of 1969. Members are asked to give some thought to increasing the number of occupational categories. In particular, it has been suggested that further breakdown of the Industrial section would be of value.

In arranging the current list a few errors have occurred and one correction has come to hand. Dr Graham Osborne of Lincoln College was listed incorrectly as Research Fellow. He should have been listed as Research Chemist. In addition, his name was omitted from the category of Agricultural Chemist.

The Chairman would be grateful for any other such corrections to the current list. **Please note that only corrections to errors in the list are required.** Changes of listing since the 1968 issue will be made when preparing the 1969 issue.

Corrections should be sent to:

J. S. POLLARD,
76 Hackthorne Road,
Christchurch 2.

THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.)

Thirty-eighth Annual Report for Year Ending 31st July, 1968

Officers

President, Dr D. R. Llewellyn; First Vice-president, Professor J. Vaughan; Second Vice-president, Mr T. A. Rafter; Delegates: Mr G. R. White (Auckland), Dr R. E. Wright (Waikato), Dr R. C. Lawrence (Manawatu), Dr P. K. Foster (Wellington), Mr T. A. Mitchell (Canterbury), Dr J. C. Dacre (Otago); Immediate Past President, Mr M. S. Carrie; Editor, Miss J. M. Mattingley; Honorary Librarian, Mr S. G. Brooker; Registrar, Mr D. J. Hogan; General Secretary, Dr W. E. Harvey.

Membership

During the past year the membership of the Institute has changed as follows:

Associates elected to Fellowship ...	10
New Fellows	3
New Associates	50
Resignations	21
Deaths	7
Deletions from list	8

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

	1966	*1967*	*1968*
Auckland ...	182	199	211
Waikato ...	47	49	53
Manawatu ...	100	98	95
Wellington ...	229	246	244
Canterbury ...	120	128	133
Otago	91	89	93
Overseas ...	91	92	91
TOTAL	860	901	920

Honorary Fellows

Dr H. E. Annett, Dr C. R. Barnicoat, and Professor N. L. Edson, were elected to Honorary Fellowship.

Obituary

It is with regret that we record the deaths of the following members: Mr N. W. Vere-Jones, Mr T. A. Glendinning, Mr P. R. Parr, Professor B. D. England, Mr R. G. Pool, Mr A. J. Calder and Rev. Father K. A. O'Connor. Mr Parr (a Past President) and Mr Glendinning were both foundation members of the Institute.

Institute Prizes

Prizes for 1967 were awarded as follows:

I.C.I. Prize, Dr H. P. Rothbaum.

Morcom Green & Edwards Prize, Mr G. J. Schafer.

Chemical Essay Prize, Dr J. C. Dacre.

Conferences

The Institute did not hold a Conference during the year under review, but many members attended the A.N.Z.A.A.S. Conference held in Christchurch in January 1968, and indeed members of the Institute, and in particular those in Christchurch, were prominent in the organisation of the A.N.Z.A.A.S. Conference in general, and of Section B (Chemistry), the Section of greatest interest to most Institute members.

During the year, active preparations for the N.Z.I.C. Conference in August 1968, and preliminary planning for the 1969 Conference have proceeded.

Journal

The change to the new format of the Journal, made at the beginning of 1967, has been well received, and the Journal has continued to flourish under the Editorship of Miss Joan Mattingley. Advertising Manager, Miss Annette Dollimore, resigned following her change of employment and was succeeded by Miss Wendy Jeune. These three lady members have done an excellent job on the Journal, and thanks are also due to the printers, David Jones Ltd.

Qualifications

During the year one additional member qualified for the Associateship by examination. The Examinations Committee and the Membership Committee have been reviewing the qualifications required for the various grades of membership and considering what, if any, steps should be taken to enlarge the membership by the introduction of a grade below the Associateship, such as exist in the R.I.C. and the R.A.C.I. This is a difficult problem and it is unlikely that a final decision will be reached in the near future.

Liaison With Schools

Most of the Branches have well-developed programmes designed to interest school teachers and senior pupils in chemistry, and this phase of the Institute's activities appears to be assuming greater importance all the time. The publication "Chemistry in Action" is well established and additional publications for schools are in preparation. At an official level, members of the Institute have been closely associated with the revision of examination syllabuses, and on the Technician Certification Authority are closely involved with the development of courses for the National Certificate in Science.

Overseas Visitors

During the year Professor Sir Ronald Nyholm spent several weeks in New Zealand during which time he visited all the main centres. His visit was arranged by the Chemical Society representative, Professor S. N. Slater, and financial assistance was provided by the Institute as well as other interested bodies. It seems likely that visits such as this will become annual events.

Professor T. S. West visited New Zealand as Corday-Morgan Memorial Lecturer of the Chemical Society (London) to which Society the Institute extends its thanks.

A number of distinguished chemists attended the A.N.Z.A.A.S. Conference in Christchurch, but for the most part did not spend any time outside the Canterbury province.

Finance

The Balance Sheet for the year ended 30th April, 1968, reveals an excess of income over expenditure of $2281.71 compared with $208.00 in the previous year. The large increase reflects the increased subscription rates which became fully applicable during the financial year, but it is clear that the increased income was essential for the continuance of the Institute's activities since costs have edged up in most areas. The Journal however, despite increased production costs, costs the Institute very little more than in the previous year because of the most satisfactory increase in advertising revenue.

Thanks

It is a pleasure to record our thanks to the many individuals and organisations who have assisted the Institute in its activities during the year, and those members who have given freely of their time to serve on one or more of the considerable number of committees.

For and on behalf of the Council.

W. E. HARVEY, *General Secretary.*
D. R. LLEWELLYN, *President.*

CONFERENCE REPORT

ENROLMENTS at this year's Conference were 206, with 97 members representing industry, government laboratories 53, universities 40, and other occupations 16. Delegates from outside Auckland numbered 90. Theme addresses were delivered by Mr A. W. Mackney, Hon. R. D. Muldoon, Dr R. W. Willett and Dr Lloyd Smythe. The Easterfield Address was given by Dr R. M. Golding on aspects of theoretical chemistry.

Most sessions of Conference attracted considerable interest. The analytical workshop proved a deservedly popular feature, and the student papers competition was deemed a successful innovation. (The winning paper and summaries of the others will appear in the next issue of the Journal.)

On the eve of Conference the social side got under way with the help of the "Cambridge Three" group, and social events continued as a pleasant background to the more serious side of the Conference programme. Visits and local tours were quite well supported, 13 members making the pre-Conference trip to N.Z. Forest Products Ltd. Kinleith plant, and over 50 visiting the oil refinery at Marsden Point and the N.Z. Window Glass Co. works at Whangarei on the final Saturday.

(Copies of the Tables given in Dr Lloyd Smythe's address are available on request from Mr J. K. Johannesson, Auckland Technical Institute.)

INSTITUTE PRIZE WINNERS

The I.C.I. Prize was won by Dr R. C. Lawrence (Manawatu Branch).

The Morcom, Green Edwards Prize was won by Mr D. A. Hills (Christchurch Branch).

Chemical Essay Prize. No award made.

BRANCH NOTES

Overseas

At the recent Fifth International Symposium on the Chemistry of Natural Products Professor L. H. Briggs was Chairman of a Biosynthesis section meeting and Dr I. D. Morton, an NZIC member working at the Unilever Research Laboratory, Welwyn, Herts, was Vice-chairman.

Dr C. R. Boswell, until recently a Postdoctoral Fellow in the Applied Chemistry Division, National Research Council, Canada, has taken a position as Senior Scientific Officer in the Analytical Sciences Division, Atomic Energy Research Establishment, Harwell, England.

Auckland

Sixth Form Lectures: The Branch recently organised a short series of lectures for sixth form science students under the general heading "Chemistry in Action". Speaking on "Things in the Witness Box", Dr D. F. Nelson, D.S.I.R., showed how inanimate objects can give evidence in court as witnesses to a crime. Mr N. T. Clare, Ruakura Animal Research Station, explained the contribution of chemistry in applying scientific method to the biological problem of facial eczema—"Fact, Fallacy, Fantasy and Facial Eczema". "Can you Beta Gamma?" was given by Associate-Professor A. L. Odell to illustrate principles and some applications of the interaction of nuclear radiation with matter.

University News: Recent appointments include Dr G. A. Bowmaker from Sydney University, a physical chemist with special interests in valency theory. Dr Bowmaker took up a Lectureship at the beginning of September.

Dr G. R. Clark will return to the staff in February 1970, following postdoctorate work in crystallography at the University of Waterloo, Ontario.

Dr B. R. Davis has been promoted Associate-Professor and Drs W. R. Roper and M. J. Taylor, Senior Lecturers from February 1969.

Dr J. M. Thorp has resigned from the university staff to return to Britain. Dr M. A. Long will leave shortly to spend a few months at the University of Wisconsin after which he will take up an appointment in radiochemistry at the University of New South Wales.

Dr D. J. McLennan will take over Dr Long's work as Secretary to the Examinations subcommittee of the Institute Council.

Members of the Chemistry Department granted study leave for next year are Dr B. R. Davis (at Southampton University, U.K.), Dr J. E. Packer (Manchester, U.K.), and Dr A. J. Easteal (Purdue, Indiana). Staff returning from study leave include Dr C. J. O'Connor, who worked for some months with Professor G. Wilkinson at Imperial College, London, and Dr B. A. Grigor, who spent a year at Clarkson College of Technology, N.Y., working with Professor Vaska.

Auckland Technical Institute: Mr K. M. Gawne, Tutor in Chemistry since 1966, left in September to take up an appointment at the Gordon Institute of Technology, Geelong. As Branch Secretary and recently as secretary to Conference, Ken Gawne has done a great deal of work for the Institute in Auckland and his departure for Australia will mean a considerable loss for the Branch.

Manawatu

Plant Chemistry Division

Dr E. Moustaffa has recently returned to the Plant Chemistry Division, D.S.I.R., Palmerston North, after spending more than a year at Purdue University, Lafayette, Indiana, where he was studying the mechanism of nitrogen fixation in micro-organisms.

Mr G. B. Belling from the Division of Nutritional Biochemistry, C.S.I.R.O., Adelaide, who specialises in analytical methods, is visiting the Plant Chemistry Division, D.S.I.R., Palmerston North, for the next five months.

Massey University

Mrs C. Winterbourne has resigned from the Chemistry and Biochemistry Department, Massey University, prior to travelling to Vancouver with her husband.

An Organic Chemistry Symposium was arranged to coincide with Professor R. A. Raphael's visit to the area. A number of chemists from various parts of the country came to Palmerston North to attend the Symposium.

Dr R. M. Greenway has been promoted to Reader and Drs R. D. Reeves and G. G. Midwinter have been promoted to Senior Lecturers in the Chemistry and Biochemistry Department at Massey University.

Mr S. Oldfield of the Auckland Farmers Freezing Company has been appointed to the Biotechnology Department at Massey University. He will be involved with the new Meat Technology Diploma.

Miss M. Humphries, Lecturer in Food Technology at Massey University, who has interests in the sensory evaluation of foods will soon transfer to the New Products Section of the New Zealand Dairy Research Institute.

Dairy Research Institute

Dr N. J. Walker will shortly return to the New Zealand Dairy Research Institute after an absence of nearly four years. He travelled on a fellowship from the New Zealand Dairy Research Institute to Pennsylvania State University to take a Ph.D. in the Department of Dairy Science. He gained the degree at the end of last year and remained at the University to complete the project and has since travelled in England, Europe and Australia visiting many research establishments. He will be working in the Chemistry Department on flavour problems of special interest to the dairy industry.

Wellington

Soil Bureau

The 9th International Congress of Soil Science was held in Adelaide in August. Among the delegates from Soil Bureau were Dr M. Fieldes, Dr R. J. Furkert, Dr W. B. Healy, Mr A. J. Metson, Dr D. J. Ross, Mr P. L. Searle, all of whom presented papers. After the Congress Dr Furkert attended the 4th Conference of the Australian Clay Minerals Society, also held in Adelaide.

Mr R. Davies from the Department of Soil Science, University of Wales at Bangor, spent a month at the Biochemistry Section during September.

Dr. K. Tate has completed his Ph.D. and is now working full-time at Soil Bureau.

Chemistry Division

Dr W. F. Giggenbach has joined the Geochemistry section. Dr Giggenbach is a graduate of Munich and has recently been working at Michigan State University on titanium complexes under Professor Brubaker. He is particularly interested in the chemistry of sulphur and geochemical problems.

Mr E. Stevens is spending six months on an ANZAC Fellowship working with Dr Ellis. Mr Stevens is a geochemist with the New South Wales Department of Mines, Sydney.

Mr N. A. Miller has rejoined the Metallurgy Section after working at the University of Canterbury.

Dr A. D. Rae has been appointed Lecturer in Inorganic and Theoretical Chemistry at the University of New South Wales, Sydney.

Dr. R. M. Golding has been appointed to the Chair of Physical and Theoretical Chemistry at the University of New South Wales, Sydney. Dr. Golding will take up his new position in September.

Mr. W. J. McCabe recently spent 6 weeks at the Australian Atomic Energy Research Establishment at Lucas Heights. He was studying the use of isotopes for sediment and sewerage tracing and for water and gas flow measurements.

Mr. W. G. Hughson retired from Chemistry Division in May and is now spending a "busman's holiday" in Europe. He is presenting a paper at the 7th World Power Conference being held in Moscow in August, and in September will be in England to attend an international conference on the Utilisation of Natural Gas. Mr. Hughson will also attend a meeting of Directors of Commonwealth Fuel Research Stations.

Dr. T. D. R. Manning has joined the Organic Section and will undertake research in terpenoid chemistry. Dr. Manning recently graduated from Auckland where he studied oxidation of steroids under Professor Cambie.

Institute of Nuclear Sciences

We congratulate Dr. T. A. Rafter who recently had the D.Sc. degree conferred on him by Victoria University of Wellington. Dr. Rafter is at present spending 6 months at the U.S. Geological Survey's Branch of Isotope Geology at Denver, Colorado.

Dr. Mitzutani, Associate Professor at Nagoya University, Japan, will be spending 5 months at the Institute of Nuclear Sciences from early September, working on sulphur geochemistry.

Dr. I. Devereux has left the Institute of Nuclear Sciences to join T. J. Sprott and Associates, Public Analysts and Industrial Consultants, in Auckland.

N.Z. Coal Research Association

Early last year the N.Z. Coal Research Association was incorporated as the latest joint venture in research and development between Government and Industry. The new Association takes over the research and advisory activities of the former Coal Advisory Service Association, the advisory service of the Mines Department and the research effort of D.S.I.R. The C.R.A. has commenced its first research programmes using temporary premises at D.S.I.R., Gracefield.

Initially the emphasis will be on development work using existing basic knowledge. Projects under way include the testing of prototype coal-fired appliances to achieve the most efficient burning of N.Z. coals; the development of briquettes and pulverized coal fuels; investigations into improved handling and marketing of coal and the development of new uses for coal. In the long-term the Association intends to promote fundamental studies to support and extend its development work.

Mr. P. A. Toynbee is Director and there is a technical staff of 10. Mr. J. O. Elphick, Chief Chemist, was formerly on the staff of Chemistry Division.

Victoria University

Professor J. F. Duncan was one of the new Fellows elected by the Royal Society this year. It is gratifying to see more chemists being given due recognition by their fellow scientists and Professor Duncan through his achievements, both as chemist and teacher, is a worthy representative.

Professor M. Lister, Professor of Inorganic Chemistry at the University of Toronto, has been spending some time here on sabbatical leave.

Dr R. W. Hay left for Scotland in September to spend a year's sabbatical leave with Dr R. P. Bell at the University of Stirling.

Professor A. T. Wilson presented a paper at the 9th International Congress in Soil Science.

Canterbury

At the March meeting Mr. T. A. Mitchell delivered his chairman's address on Large Scale Laboratory Tests for the Baking Quality of Wheat.

The August meeting of the branch took the form of a buffet tea at the laboratories of the Wool Research Organisation of N.Z. (Inc.) at Lincoln followed by a guided tour of the laboratories. A good muster of members enjoyed a very successful evening.

Also during August members of the branch and local chemistry teachers were the guests of the Chemistry Department, University of Canterbury, at a meeting addressed by Professor Harry B. Gray of California Institute of Technology. He spoke about trends in curriculum revision in 6th form and undergraduate chemistry.

The branch prize for the best student in second-year chemistry at Canterbury University was presented at the March meeting to Mr. W. Lowry.

The branch prize for the best student in third-year chemistry at the Christchurch Technical Institute was won for 1967 by Miss Janette Wederall.

Mr. P. R. Richards has returned from two years' teaching experience in the United Kingdom and is now Head of Science Dept. at Southbridge District High School, Canterbury.

Mr. N. A. Miller of Chemistry Division, D.S.I.R., has completed work for a Ph.D. in the Dept. of Mechanical Engineering, School of Engineering, University of Canterbury, and has returned to the Metals and Corrosion Section of Chemistry Division, Gracefield.

Mr M. J. A. Fuller has transferred from Dominion Yeast Co. Ltd., Auckland, to their Christchurch branch.

Mr. M. Abernethy has left the Medical Unit, The Princess Margaret Hospital, Christchurch to take up an appointment in the Biochemistry Dept., The Royal Melbourne Hospital, Melbourne, Australia.

University

Dr. B. R. Penfold leaves in August to spend 10 months at the Chemistry Dept., University of British Columbia, Vancouver. On the way back he will spend two months in Great Britain, mainly at Oxford University.

Dr. D. Hurst, Visiting Lecturer in the chemistry department, left in July to return to Kingston College of Technology, England.

The Visiting Lecturer to the Chemistry Department for the next year will be Mr. R. Davis who has been completing a Ph.D. at University of Nottingham. His particular interest is in Rhenium chemistry.

Dr. John E. Douglas of East Washington State College, Cheny, Washington, arrived in July to spend a year's sabbatical leave in the chemistry department. He will work with Professor C. S. Wilkins on electron donor acceptor complexes.

Dr. Kenneth Emerson of Montana State University will arrive in September on a Fullbright Award to spend a year in the chemistry department. He is an inorganic and structural chemist with a particular interest in X-ray crystallography.

Dr. Alan Metcalfe leaves in August on a year's leave which he will spend at Queen's University, Kingston, Ontario, where he will be working with Professor R. McIntosh on microwave dielectric constants of physically adsorbed gases on solids.

Professor Harry Gray, Professor of Chemistry, California Institute of Technology, is spending two months in the chemistry department as a Visiting Erskine Fellow. His principal research interests are bonding and co-ordination chemistry and he also has an active interest in methods of presenting chemistry at first-year level.

Dr. I. T. Forrester has completed a Ph.D. at the Biochemistry Dept., Lincoln College, and is now at the Dept. of Chemical Microbiology, Cambridge University, England.

Canterbury Junior Chemical Society

The "Chemistry in Action" series was this year confined to a single lecture and this was given in April by Professor J. F. Duncan. His lecture on "Solids" was supported by a large number of very high standard demonstrations and was thoroughly enjoyed by a capacity audience.

On the following Saturday morning members of the Junior Chemical Society spent an instructive three hours learning of work in the departments of Soil Science, Biochemistry and Plant Science.

Professor Harry B. Gray addressed the society in July on "Iron Rust to Haemoglobin." The society's activities for the year concluded the following morning with a very successful conducted tour of the Chemistry Department, University of Canterbury.

Otago

Dr J. C. Dacre has been invited to serve as a member of the WHO Expert Advisory Panel on Food Additives.

THE REGISTRY

Fellows

The following were elected to Fellowship on 24 May 1968:

BRADWELL, Donald, F.R.I.C., Chemistry Division D.S.I.R., Auckland (Scientist).

BROOKS, Robert Richard, B.Sc. (Hons.) (Bristol), Ph.D. (Capetown), Massey University, Palmerston North (Reader in Chemistry).

DE LA MARE, Peter Bernard David, M.Sc.(N.Z.), Ph.D., D.Sc.(Lond.), Auckland University (Professor of Chemistry and Head of Department).

HARLAND, Charles William, M.Sc., A.M.I. Chem.E., Bay of Plenty Co-op. Fertiliser Co. (Production Manager).

Associates

The following were elected as Associates on 24 May 1968:

ALLEN, Robert Maurice, B.E.Chem.(Hons.) (Cantua), University of Canterbury, Christchurch (Lecturer in Chemical Engineering).

ASTON, David Arthur, M.Sc(Auck.), Ivon Watkins-Dow Ltd., New Plymouth (Chemist).

BUCHANAN, John Gordon St. Clair, M.Sc., Ph.D.(Auck.), Dyson Perrins Research Lab., Oxford University (Post Doctoral Fellow).

DAWSON, Peter John Leslie, B.Sc., Kodak Processing Lab., Auckland (Quality Control Officer).

FENBY, David Vernon, B.Sc. (Hons.) (Otago), Ph.D. (U.C.L.A.), Otago University (Lecturer in Chemistry).

FREW, Mrs. Maureen Doris, B.Sc. (Hons.) (Cantua.), Mathias St., Darfield.

HUNTRAKUL, Charus, B.Sc. (Hons.) (Otago), Chemistry Dept., Otago University (Ph.D. Student).

JARVIS, Brian Douglas Walton, B.Agr.Sc. (Dairy Tech.), Ph.D. (U.N.E.), Massey University, Palmerston North (Senior Lecturer in Microbiology).

McLENNAN, Duncan James, M.Sc., Ph.D.(Well.), Auckland University (Lecturer in Chemistry).

MOOYMAN, Cornelius, B.Sc., Unilever (N.Z.) Ltd., Motueka (Factory Chemist).

NATUSCH, David Frances Stewart, M.Sc.(Cantua.), D.Phil.(Oxon.), Chemistry Div., D.S.I.R., Gracefield (Scientist).

PRICE, Richard Thomas Clive, G. W. Wilton & Co. Ltd., Wellington (Technical Representative).

ROUSE, John Edward, N.Z. Fertiliser Manufacturers' Research Assn., Auckland (Chemist).

SALINGER, John David, B.Sc., Cadbury Fry Hudson Ltd., Dunedin (Chemist).

SHARMAN, Lionel Edward, M.Sc.(N.Z.), Chemistry Division D.S.I.R., Gracefield (Scientist).

SKIDMORE, Adrian Howard, B.E.Chem., Unilever N.Z. Ltd., Petone (Development Manager).

SUTTON, Harry Callender, M.Sc.(N.Z.), Ph.D. (Durham), F.R.S.E.(Edin.), Institute of Nuclear Science, Gracefield (Scientist).

TAYLOR, Kenneth Martin, M.Pharm.(Otago), Wellcome Medical Research Institute, Dunedin (Research Officer).

TRIBE, Robert Wayne, B.Pharm., Sterling Pharmaceuticals N.Z. Ltd., Auckland (Chief Chemist).

VALPY, Graeme Wilfred, M.Sc.(N.Z.), N.Z. School of Pharmacy, Petone (Tutor in Chemistry).

WEATHERALL, Ian Leslie, M.Sc.(Otago), Ph.D. (Otago), Wool Research Organisation, Lincoln (Research Scientist).

Deaths

The following deaths were noted with regret. Members stood in silence as a mark of respect.

PARR, P. R.
ENGLAND, B. D., Associate Professor.

Remission of Subscriptions

Payment of further subscriptions was remitted for the following members:

ADAMS, D. E., BRUCE, J. A., GAY, S. R., PITCAITHLY, N. P., SPACKMAN, L. S., WILLIAMS, W., WOOLMAN, H. G.

Leave

Leave with two years' remission of subscriptions was granted to:

FREEMAN, C. G., JAMESON, M. B.

Cancellation of Membership

For non-payment of subscriptions the following memberships were cancelled:

PERRY, K. D., WILLIAMS, Miss X. K.

FORTHCOMING INTERNATIONAL MEETINGS

1969

March 25-29: **Labex International (London)** will be the largest exhibition in Europe entirely devoted to instruments, apparatus and supplies for laboratories, produced in many countries.

An important feature will be the programme of lectures. Visitors will be able to hear experts in various fields discussing and reviewing current research which is relevant to the latest techniques and instrumentation. Subjects will include the biochemistry of bacterial cell walls, carbohydrate research techniques, organic chemistry of ancient rocks, ultra short laser pulses and low temperature survival of cells and tissues.

There will also be Discussion Meetings, a forum where research scientists can discuss their problems with newer techniques. As technical personnel of leading instrument manufacturers throughout the world will be present, the resulting co-operation between manufacturers and users should be of great value.

April 21-25: **International Symposium of Natural Products,** Mexico City.

July (early): **XXVth International Conference of Pure and Applied Chemistry,** Cortina d'Ampezzo.

July 14-20: **International Symposium on the Chemical Control of the Human Environment,** Johannesburg.

July 14-18: **IVth International Congress on Pharmacology,** Basle.

July 14-18: **International Conference on Atomic Absorption Spectroscopy,** Sheffield.

July 21-25: **International Symposium on Analytical Chemistry,** Birmingham.

July 27-August 1: **IVth International Symposium on Organometallic Chemistry,** Bristol.

August 20-27: **XXIInd International Congress of Pure and Applied Chemistry.**

XIIth International Conference on Coordination Chemistry, Sydney.

August 25-30: **Symposium on Kinetics and Mechanism of Polyreaction,** Budapest.

September 8-13: **VIIth International Congress of Clinical Chemistry,** Geneva.

September 9-12: **International Symposium on Conformational Analysis,** Brussels.

After the IUPAC Conference in Sydney next year (August 20-27, 1969) the Chemical Society (of Britain) will fly its officers and regalia to New Zealand to hold a meeting here.

BOOK REVIEW

Organometallic Compounds. Volume One: The Main Group Elements, Third Edition by G. E. Coates and K. Wade. Methuen, London, 1967 price 120s.

The first edition of *Organometallic Compounds* appeared in 1956 as a Methuen Monograph of some 197 pages. The second edition of 364 pages appeared in 1960. In this third edition the book has been subdivided into two volumes of which the first, dealing with organic compounds of the main group elements, occupies 573 pages. This growth in content reflects the enormous expansion which has occurred in the field of organometallic chemistry over this period. Obviously a book of this type which runs to three editions in a decade is outstandingly successful and fills a clear need. Certainly no one interested in the field could have afforded to be without the earlier editions nor can he afford to do without the fruits of this latest extensive revision.

Professor Coates and his co-authors consider organometallic compounds as those involving metal-carbon bonds. Thus compounds in which metals are bonded to organic systems through other elements are not discussed. Organoboron compounds are included, but not organosilicon compounds nor compounds of phosphorus or arsenic. Compounds of the transition elements are to be dealt with in Volume Two. In the present volume considerable attention has been directed to aspects of preparative and co-ordination chemistry of the compounds of the main group elements. Features of structural and valency interest are also dealt with. The compounds are first broadly discussed in terms of classification by period groups to which the metallic elements belong and then in detail in terms of the individual metals which appear in sequence down each group.

In a review of the first edition W. Conard Fernelius stated that 'the net result is near perfection'. The present reviewer is not qualified to make a similar comment but, clearly, this is an excellent book.

A. FISCHER.

NATIONAL COMMITTEE FOR CHEMISTRY NEWS

Members nominated Mr S. G. Brooker to be New Zealand delegate to the next IUPAC Conference at Cortina d'Ampezzo, Italy, early in July 1969. The Council of the Royal Society of N.Z. has approved their nomination.

(*continued from page 156*)

merely hope that many people will buy this booklet. I assert that everyone who is engaged in any aspect of scientific teaching or reporting ought either to possess a copy for himself or to ensure that he has access to one through his library.

G. N. MALCOLM.

Copies are available from the Registrar as are copies of all earlier Monographs for Teachers.

We're growing

60-61

62-63

64-65

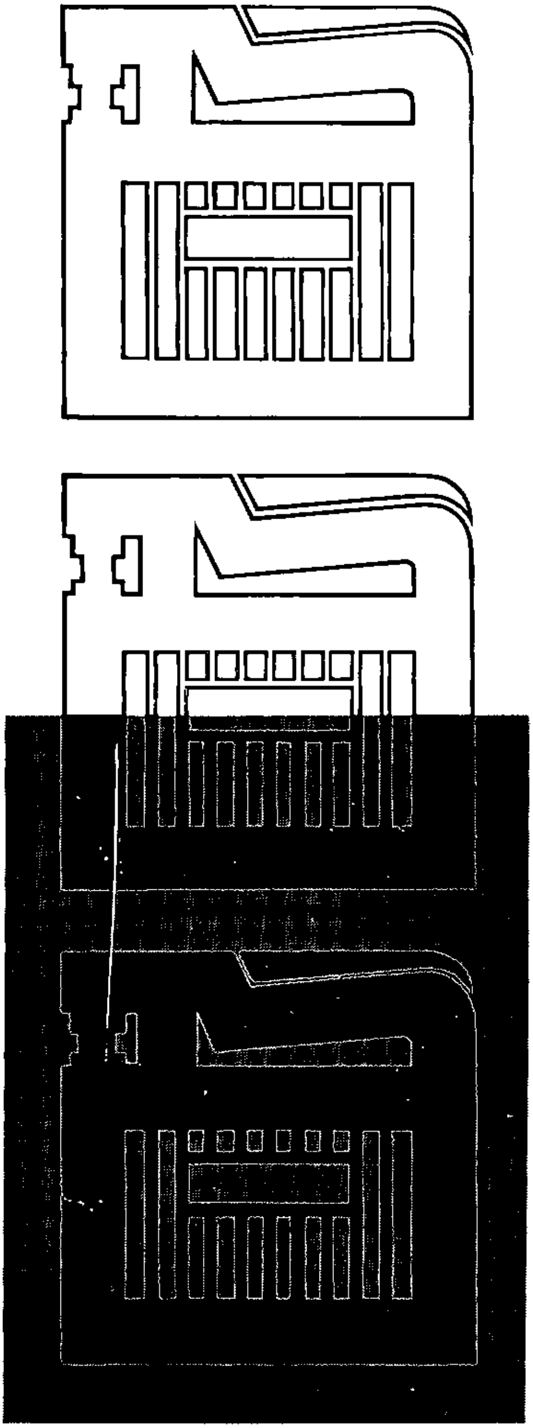
66-67

...grow with us

IWD'S growth over the past seven years has been tremendous—as a result we now have unparalleled need for qualified personnel. We have openings for graduates in research, quality control, development, process control, marketing, sales and advisory services. Programmes range from weed and pest control to veterinary products, from detergents to fumigants. If you're a science graduate this is what the IWD group of companies has to offer: * Employment in a position of status. * A position of satisfactory work content — on programmes where there are problems to solve and something to really get to grips with. * Work with distinguished colleagues * The opportunity to continue academic study. * Good prospects for the future. * A satisfactory remuneration during the induction period — as well as later. *If you're interested drop us a line. The address is The Secretary, Ivon Watkins-Dow Ltd., Box 144, New Plymouth.*

THE IVON WATKINS-DOW GROUP OF COMPANIES

W5621



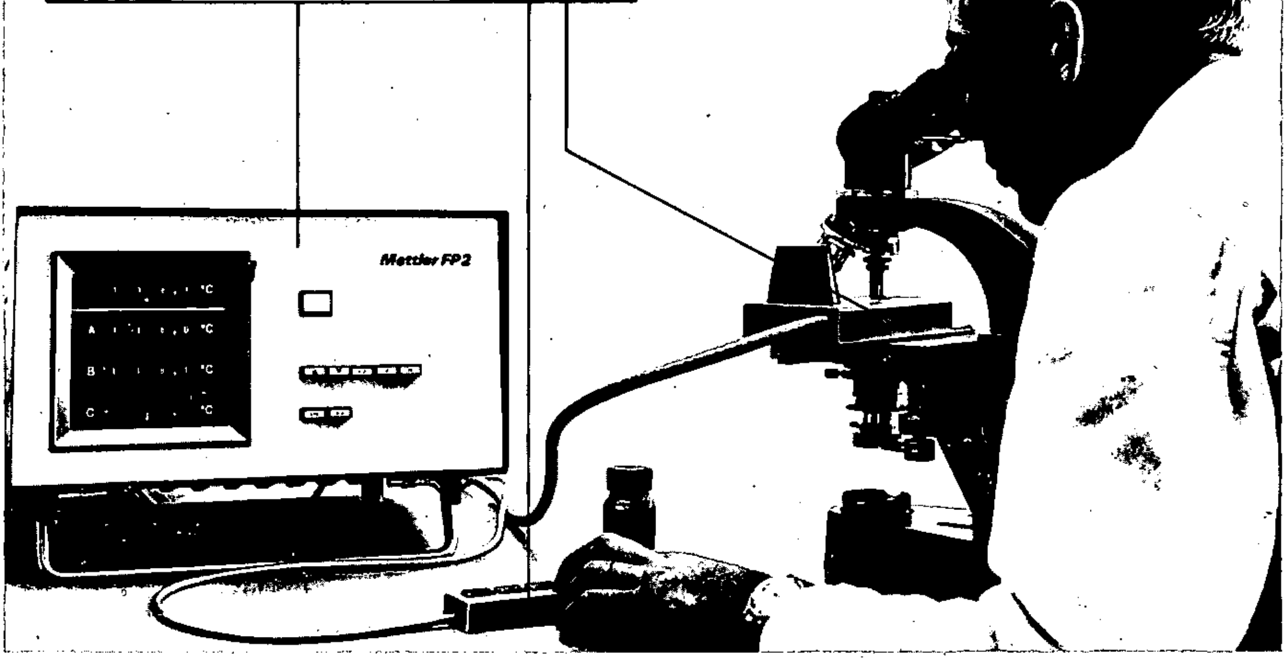
Mettler makes microthermal investigations without disturbance possible.

The researcher

retains first, by simply pressing a button, the temperature at the moment, where characteristic changes occur to the micro sample during the heating process. All routine manipulations, such as control of the temperature, thermometer reading and recording of the results are eliminated.

The Mettler FP2

consists of three elements: Micro hot stage, electronic control unit and push button station for the fixation of the temperature values. The following features guarantee that one can rely on the analytical data supplied by the METTLER FP2.



The temperature field of uniform pattern of the micro hot stage is heating up the sample regularly. Fully automatic temperature control allows three heating rates. The exact measuring of the sample temperature is guaranteed by a platinum resistance thermometer, embedded in the heating plate and in direct contact with the sample. Thanks to digital result storage, three independent temperature values can by stored with an accuracy of 0.1 °C.

WATSON VICTOR LTD.

WATVIC

Head Office: 4 Adelaide Road, Wellington.
Branches: Auckland, Christchurch and Dunedin.

Printed by David F. Jones Ltd.