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PRESIDENT, 1956.

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PRESIDENT.

President for 1956 is Dr. M. M. Burns, Principal of Lincoln College. Dr. Burns is already well known to members of the Institute. Elected an Associate in 1937 and a Fellow in 1943, he has served for a number of years on the Canterbury Branch Committee and was Chairman in 1943. From 1939 to 1943 he served as Canterbury delegate to Council.

Dr. Burns attended Rangiora High School and Canterbury College where he graduated with first-class honours in botany. He also studied advanced chemistry. He was Senior Scholar in botany and as a Post-Graduate Science Scholar proceeded to the Macaulay Institute for Soil Research where he graduated Ph.D. from the University of Aberdeen. In 1934 he was granted a Commonwealth Fund Fellowship in agriculture to Cornell University, New York, where he undertook two years' post-graduate work in the plant sciences and agronomy and conducted research on the exudation of nitrogenous compounds from legume nodules.

Returning to New Zealand he was appointed plant physiologist to the Soil Bureau D.S.I.R. where he was concerned particularly with surveys and reports on the citrus and tung oil industries in the United States and New Zealand. In 1937 he transferred to Lincoln College as senior lecturer and head of the soil science department. From 1948 until 1952 he was Director of the Fertiliser Manufacturers' Research Association and in 1953 took up his present position.

Dr. Burns was chairman of Section L. of the 8th Science Congress held in Auckland in 1954. He was also appointed a member of the D.S.I.R. Council in 1955.

Under his vigorous leadership we look forward to another successful year as we commence the second quarter century of our Institute's existence.

VICE-PRESIDENT.

The Vice-president this year is Mr. W. A. Joiner, Assistant Secretary and Departmental Secretary, D.S.I.R. Mr. Joiner has also been closely associated with the Institute and a biographical note on his career will appear later when he assumes the Presidency.

Due to shortage of space in this issue notes on Branch Chairmen together with some Council material have been held over until the April Journal.

THE TEACHING OF CHEMISTRY.

For many of us it is becoming longer than we care to remember since we completed our formal education. Many changes have taken place in the educational systems of this century since that time. Our Institute as a body and members individually are of course vitally interested in the teaching of chemistry in our schools and Universities. What changes then have taken place in post-primary school chemistry teaching? Why have they been made? What are the objectives of a University Chemistry Course? How are they now being achieved in practice? What provision is being made in New Zealand for the training of biochemists? These and other similar questions are discussed in the following series of articles on the teaching of chemistry. It is hoped they will provide a basis for further discussion on this very important subject.

THE TEACHING OF CHEMISTRY IN POST-PRIMARY SCHOOLS

BY E. J. SEARLE,

Lecturer, Post-Graduate Department, Auckland Teachers' College.

A number of major changes has taken place in post-primary education in this country since most of the older members of scientific staffs passed through the schools. These have inevitably affected the teaching of chemistry as they have that of other subjects. The most important general changes have been:—

(1) A very great increase in the post-primary school population has caused schools to grow rapidly and many new ones to be established. Where there were once a handful of secondary schools catering for academic pupils there are now scores.

(2) The raising of the school leaving age coupled with a high standard of living has resulted in a greater proportion of young folk of post-primary age coming to the schools and staying there longer.

(3) The abolition of the proficiency certificate at the end of the primary course has resulted in a greater number of the less able proceeding to post-primary schools. Changes in primary school curriculum means that pupils go to the post-primary school with lower standards of attainment in some academic subjects.

(4) Increased avenues of employment for science graduates have reduced the number of the more able who formerly took up teaching as a career.

(5) The introduction of the school certificate examination as the examination at fifth form level resulted in the consequent lifting of the university entrance examination to sixth form level and the university scholarship to a five-year course.

Coupled with the high failure rate in first year science subjects at the University this has forced pupils intending to read for a science degree to complete a five-year school course before proceeding to the University.

The cumulative effect of these changes has been very great indeed on the patterns of post-primary schooling. The rapid increase in numbers has caused, for example, acute accommodation problems. In many schools pupils are able to be in laboratories for only a portion of the time they are studying science. The old-fashioned, but ideal, science teaching unit of a laboratory with attached classroom, used only by one teacher, is very much a thing of the past. In most schools the pressure on laboratories and the shortage of science teachers mean that laboratories are seldom vacant and teachers seldom free from classes. In the few periods when they are free they cannot get access to their laboratories. No doubt this has been a powerful factor in the undeniable deterioration in practical work in chemistry in the schools. Proper maintenance of the laboratories and adequate preparation for a fully practical course is most difficult under the conditions that exist in the schools.

The increased attendance at post-primary schools has had other important effects. Prior to the thirties post-primary education was reserved for the more able (sifted by a qualifying entrance examination) and for the more privileged members of the community. Only those whose parents could afford to let them attend school, or who were prepared to make sacrifices so that they might do so, were able to secure a secondary education. On the whole they constituted the more intellectually able groups. Nowadays, of course, virtually the whole population of the appropriate age group attends a post-primary school and the ability range is correspondingly wider. The school certificate examination introduced by the Education Department makes provision for this wider spread in ability by providing a multiplicity of subjects and encouraging the establishment of a variety of courses—good pupils in a school become diffused through the courses and the average ability of even the top forms is lowered.

The school certificate also introduced changes which had more obvious or direct effects on the place of chemistry in school science. The study of at least some general science was demanded as part of a compulsory non-examinable core of studies. In effect all pupils must study general science for a minimum time during their first two years; they need do no other science. The old science teaching pattern was for pupils to begin a study of physical measurements and either chemistry or a branch of physics (later the physical measurements was dropped) and to follow this through to the fifth form. In current patterns the pupil must study general science during at least the greater part of the first two years of his post-primary education before he commences the study of a particular science. In addition the subject General Science may also be taken as an examination subject at school certificate stage and this is becoming increasingly popular at the expense of the particular sciences. Biology was introduced at fifth form level about 1935 and after a slow start has become soundly established. It had the reputation of being a relatively easy subject in which to score marks in examinations and has been adopted as the dominant fifth form science in many schools for the weaker, if not for all, pupils. General Science and biology now attract more candidates than does chemistry. To qualify for the old matriculation and its associated examinations (e.g. Medical Preliminary) it was necessary to include a science among the subjects in which a candidate offered himself for examination; this is no longer required. The result: a smaller proportion now study science at fifth form level than used to do.

The net result of these changes has been that whereas the bulk of students presenting themselves for examination at the end of their third year at post-primary school included chemistry as one of their subjects, they now no longer do so. Many schools now teach no chemistry, as such, in the 3rd, 4th and 5th forms, while others teach it only as a subsidiary subject for the better pupils. A few retain it as the main science subject for school certificate purposes but it is then little more than a one year's study and not a three-year course as it once was. Only in the Auckland Province has chemistry retained its place as the most important school science at fifth form level; elsewhere it has largely been abandoned. Several of even the large long-established boys' schools in the South now teach only general science as far as the fifth forms are concerned.

Table 1 and 2 show the number of students taking chemistry at different levels in 151 post-primary schools which together cater for approximately 5/7ths of the secondary school pupils in New Zealand. The schools of the sample have been chosen from schools of all types but as a representative sample it is slightly ill-balanced in order to give worthwhile figures for certain groups. Almost all the old established schools (mostly single sexed) have been included; the private schools are not well represented but include most of the well-known ones; the technical schools are only those that are dominantly technical in nature; others have been included with the mixed schools as also have the district high schools whose rolls are greater than 250. This classification gives a far better picture of types of schools than does the official one.

The figures show clearly the position to which chemistry has been relegated as a subject of study in the first three years of post-primary education. It will be noticed that 91 of the 151 schools of the sample have no chemistry course for fifth forms but it should be remembered that 46 of these are district high schools with rolls less than 250—often less than 50—where staffing difficulties are particularly felt. Technical colleges have for a long time played little part in the teaching of chemistry and only one of these in the sample provided courses. Fifty per cent. of the boys in fifth forms

TABLE 1: NUMBERS TAKING CHEMISTRY IN POST-PRIMARY SCHOOLS—FIFTH FORM LEVEL. (1953 FIGURES).

Class of School.	No. in Sample.	No. of Fifth Form Pupils	No. Taking Chemistry.	Schools with no Chemistry Fifth Form.
Boys (State)	14	2616	756	3
Boys (Private)	10	623	315	2* (1 No V)
Mixed (rolls over 250)	34	3849	762	15* (4 No V)
Girls (State	12	2384	204	7
Girls (Private)	16	2497	78	71
Technical Colleges	8	972	28	7
District High Schools	57	1004	84	46
TOTAL:	151	13,945	2,227	91

*In brackets is shown the number of schools with no Fifth Form included in these totals.

NOTE:—From the same schools:
8,858 study general science.
3,357 study biology for School Certificate examination.

TABLE 2: NUMBER OF PUPILS IN SIXTH FORMS OF THE SCHOOL OF THE SAMPLE WHO STUDY CHEMISTRY.

Schools.	University Entrance Level.		Post-University Entrance Level.	
	Roll.	Chemistry.	Roll.	Chemistry.
Boys (State)	971	553	370	215
Boys (Private)	276	163	105	51
Girls (State)	603	141	139	32
Girls (Private)	260	58	65	6
Mixed	709	375	221	99
Technical College	100	41	15	5
TOTAL:	2,919	1,700	924	408

at private schools still study chemistry and in no other group is the proportion comparable. In boys' (State) schools less than 29% now take chemistry in the fifth form and this is the next most secure stronghold of the subject—particularly in the North. Where other sciences are taught together with chemistry at this level it is generally chemistry that is chosen by the more able pupils—the weaker elect, or are directed, to take biology or general science.

Practically all post-primary schools excepting the technical colleges and, of course, the smaller district high schools provide courses in chemistry at sixth form level leading to University Entrance examination and, when numbers warrant it, for a fifth year of study at University Scholarship level. Where no chemistry as such is taken for the Certificate examination the jump to sixth form work is a big one and it is difficult to see how a well-founded course covering the syllabus can be operated except by sacrificing practical work. However, this is being attempted in many schools. Few teachers, I fancy, recognise the intrinsic difficulty of many chemical concepts and particularly in the senior courses pupils find the understanding of chemical concepts and chemical theories their main trouble. Usually the courses in the three main sciences are available at this level in post-primary schools and pupils are able to select more than one science for study; time-table arrangements often permit them to take them all. Where they do choose to study more than one science, chemistry is usually one of those chosen. In at least one large school organic chemistry is available as well as chemistry, physics and biology for students studying at post-University Entrance level but working towards bursaries rather than towards scholarships. It is in the sixth forms of such large schools that really solid science courses are available—they have the advantage of large sixth forms (in some cases more than two hundred pupils), well-equipped laboratories and stable qualified science staffs. It would be well for science if such schools could be open to pupils from wider areas and that they be given the right of some form of selection of pupils. Particularly in the lower forms the more able pupil is not receiving all the attention his talents demand and specialism within the schools would enable them to be given more meaty courses and better competition.

For the purposes of this discussion the chemistry of the compulsory general science (often called 'core science' may be ignored. It teaches few chemical concepts, shows little of the nature of chemistry as a science and gives very little knowledge of the facts of chemistry. From the point of view of the later development of chemistry as a subject of instruction in the school, it is of little importance. Its factual content is small and in most courses not integrated. I do not, however, wish these comments to be considered as a condemnation of the general science for I consider it capable of contributing in a very worthwhile manner to background knowledge and general atmosphere; but it gives no more than a bare introduction to chemistry. The chemistry of general science as an examination subject is also shallow and insufficient for those intending continuing the study of chemistry. For pupils completing their formal education at the end of the third year it is probably the best science subject. For others it is too superficial. I have little confidence in a science course which is not developed at depth in at least some portion, for otherwise it can teach few principles and becomes a 'useful knowledge' rather than a science course.

Chemistry for school certificate has one of the finest prescriptions of any school subject. It has been carefully and thoughtfully drawn; it is full; it is so arranged that teachers can understand why particular items are included and it is based on a few solid pillars of chemical philosophy. Its basic concepts are such fundamental ones as element and compound, acid, base and salt, metal and non-metal, valence and types of change. The electromotive series provides a basis for integration. Further, it is designed and presented in such a way as to encourage a practical approach. Material of interest is included as well as material of chemical importance. Some organic substances are included for study, so are a few named industrial processes. Under present conditions the syllabus is probably too long to be covered adequately in the one year in which many schools are attempting to use it.

Those responsible for the syllabus obviously had two things in mind: (a) to plan a prescription that would be wide enough to let pupils glimpse the importance of chemistry and to give to those who would make no further study of chemistry a satisfying complete study; and (b) to give a good solid basis of chemical facts, concepts and principles so that those going on with the study would have something to build on. I think they have succeeded. If anything, by making the syllabus so extensive they may have sacrificed a little in depth.

The jump from the school certificate to University Entrance level is a considerable one. For those who have taken chemistry it is not too big—they should be ready for precision work—but for others it must be steep going. The syllabus is a long one and appears to lack thoughtful planning. It is highly factual with depth of treatment not sufficiently indicated; it is presumably meant to be unified about periodic principles. Like so many syllabuses far more time seems to have been spent on arguing whether this or that substances would be included and far too little to deciding what concepts or principles should be expected of a pupil at the stage it is intended to test. As might be expected from the foregoing it is full of "preps. and props." with little indication of why the particular compounds were selected for study. As a syllabus it appears more likely to produce notebooks packed with chemical facts rather than a clear and lasting picture of the philosophy of chemistry; to lead to long and detailed notes rather than to experimentation; to the learning of properties rather than to the solving of problems; to swotting rather than thinking. The syllabus for university scholarship contains some new material but the bulk of it is the same as that of the entrance examination.

With respect to the teaching of chemistry in the school it is probably fair to claim that on the whole, and considering the difficulties it is good. Teachers claim that up to fifth form level, about half the time available or a little less, is devoted to practical

TABLE 3: SHOWING TYPICAL SCIENCE COURSE ORGANISATION OF SCHOOLS IN PRE-S.C.E. (SCHOOL CERTIFICATE EXAMINATION) TIMES AND A TYPICAL PATTERN POST-S.C.E.

Form.	Pre-S.C.E.	Exam.	Post - S.C.E. (Pattern A)	Exam.
VI (2nd Year)	(Very few. Same as below)		Physics Chem. Biol.	Schol. or Bursary
VI 1st Year)	Chem. Mag. & El.	Scholarship	Physics Chem. Biol.	University Entrance.
V IV III	Chemistry or Branch of Physics.	University Entrance P.S.E. (Higher Leaving Certificate)	General Science.	S.C.E.

TABLE 4: PATTERN B—SHOWING PLACE OF CHEMISTRY IN ONE OF THE ADMITTEDLY BEST SCIENCE SCHOOLS IN NEW ZEALAND.

Form.	Number in Form.	Science Subjects with Numbers Taking.			
Upper VI 2nd Year.	45	Organic Chemistry 16	Chem. 39	Physics 37	Biology 8
VI	151	No Science 21	Chem. 69	Physics 66	Biology 39
V	350	Core Only 103	Chem. 149	Physics 131	Biology 79
IV	298	Core Gen. Science Only 88	General Science 211		
III	302		General Science 302		

TABLE 5: ALLOCATION OF TIME TO CHEMISTRY IN A SIXTH FORM AT A MAJOR SCHOOL. The nominal time available over the year suffers loss by 20-25 per cent. through interruption, public holidays, school activities, public examinations, etc. The total school week is 35 periods.

Number of Periods	7
Length of Period	40min.
Approximate Number of Periods Devoted to Practical Work	2
Approximate Number of Periods Devoted to Theory	4
Approximate Number of Periods Devoted to Revision, Testing and Exams.	1

work and above that about one-third. Most ex-pupils—and some eleven hundred have been investigated by questionnaire—agree that practical work figures prominently though they would put note-giving and lecturing high on the list, which would agree, as suggested earlier, with the observer's impression that less practical work is being done than heretofore. Sixth form practical work is not easy to match with classwork and many teachers introduce a quite unrelated course. In some cases it has become a practice to follow the pattern of the Stage I practical course at the local university college. This is not a plan that appeals as fundamentally sound and would be avoidable if teachers would decide what it is desired that practical work should teach and develop courses directed to that end.

Lastly the product, and here I am considering only the smaller group who will continue study at the university. Others writing in this series will no doubt have something to say about the preparedness of university freshers beginning courses in chemistry. The writer would submit his opinion based on nearly twenty years' teaching experience in a good science school. He considers that there has never been a time when the good science school turned out a better prepared product than it does today. Factually, at any rate, they are far better chemically informed than ever before. A pupil with university entrance chemistry today has covered a far more extensive course than one with matriculation twenty years ago and in general if he is proceeding to a science degree he has a far wider and I think sounder science background than pupils of comparable status in the past. Of course as far as intellectual ability is concerned it must be realised that a much wider range of pupils now go through to the sixth form and with a scaling system applied to marks in examination it is possible that a lower rating are able to pass examinations than was the case when the group was more carefully selected. The main criticism that I would make of the secondary school product would be the same as I would apply to the university graduates in chemistry—of whom I see a large number of good second-class types—amazement at the amount they know and wonder at the little they understand.

Far more is demanded of teachers than in the past when they seldom taught more than one or at the most two sciences. Nowadays a science teacher, except in the largest schools and even frequently there, may reasonably be expected to teach one or more sciences up to sixth form level in addition to general science up to fifth form. On the whole the writer considers that science teachers in the schools do a good conscientious job and that they are performing adequately a service important to the whole structure of science in this country.

CHEMISTRY IN THE UNIVERSITY OF NEW ZEALAND.
FIRST YEAR CHEMISTRY

BY H. S. MASLEN,
Chemistry Department, Auckland University College.

The aim and object of any first year course must of necessity be related to those of the University as a whole. In its teaching activities the University of New Zealand appears to have two objectives: it endeavours to educate in the most general sense of the word and also offers highly specialised courses which can only be described as trade training. The former is its primary teaching aim and the latter is, and should be, a secondary purpose. There is a constant pressure from groups both within and without the University who desire to see the secondary purpose become pre-eminent and this must be resisted by all those who have the welfare of the University at heart.

The determination of the function of first year chemistry poses a problem which is similar in principle to that of the University as a whole. This course is obviously a preparation for more advanced study in the chemistry department, yet little more than 10% of the class eventually proceeds to such study. The greater part of the class is made up of students who intend majoring in the faculties of engineering, medicine, dentistry, agriculture, veterinary science or home science; or in one or more of the other science departments, to wit, physics, mathematics, zoology, botany, geography or geology. To cap this list it must be borne in mind that there is always a sprinkling of students who are taking courses in arts, law or commerce, and that a certain proportion of the students who take this course will leave the University without obtaining a degree and possibly enter industry or the teaching profession. Some knowledge of chemical matters is undoubtedly desirable and even necessary for each of these categories of students, but it would be well nigh impossible to frame a single course which would satisfy in toto the professional requirements of each, and not provide the others with factual material with which they may never be subsequently concerned. Yet such must be the aim if the University is to turn out men who are experts in their own fields. Being at heart chemists it is very easy for the teachers to become parochial and take the view that first year chemistry must be solely a preparation for advanced chemistry; but even if one takes such a narrow view, this solution immediately raises the very real problem of which, if any, of the major divisions of chemistry should predominate. Any such solution which relates the material of the course primarily to the needs of subsequent specialised vocations is, in fact, no solution at all. It fails on two points. Firstly, it should not be the function of an elementary course to feed specialised material to University students with the aim of developing a practising specialist, and secondly, the minor point, that to do so for each specialist division of the University is patently impossible.

The aim of a course in elementary chemistry must be in harmony with the general aim of the University. That is to say a course in chemistry must endeavour to produce a thinking man who has some knowledge of chemical matters. A man who besides having a sound knowledge of the facts is familiar with scientific methods and is able to use them consistently in his thinking and experimenting.

Evolving a course which will accomplish this is a much harder problem. The course must firstly instruct and above all encourage students to seek further information, secondly it must provide thought-provoking exercises with a view to giving the students' minds practice in logical deduction, and thirdly it must go some way at least in training the students' minds in the selection of relevant data from a mass of irrelevant information. To contrive this a foundation of factual knowledge which will serve as a basis for later generalisations and deductions must first be laid. The selection of material is in itself a difficult matter as the preparation of students entering the course varies from Junior scholarship level to no prior knowledge at all. The latter class of student is quite entitled to enter first year chemistry and must be catered for. Selection of material is probably the greatest problem to be faced by the teacher but it is essential that an answer be found. The University has a limited teaching year and in many cases great damage is caused by failure to cull material from courses. Such overcrowded courses merely drug the student's intellect and his critical faculty and encourage the blind learning of facts. The illiterate scientist is frequently the subject of comment, yet he is often the product of the stilted phraseology of dictated notes. The answer is not to be found in presenting the student with a series of digests and rules of thumb for predicting the properties of substances. While there is undoubtedly a place for such things, they should not entirely take the place of the detailed material on which they have been based, nor, if the detailed material is expected to be known, should they precede it. If they do the basic material may never be considered and this leads to a superficial knowledge and shallow intellect. One of the gravest dangers in the preparation of a course is the teacher's own desire to present a neatly connected series of lectures and this often leads to artificial links being fashioned. It is not always possible to deduce the next step from the preceding material and where this is so it should be clearly stated that a postulate is being made. Finally, the material presented should be as comprehensive as possible but it is not suggested that there is a "best" selection. Provided that the material is selected primarily for its intrinsic value some secondary consideration may be given to the subsequent requirements. At Auckland accommodation difficulties have necessitated the division of the class into two approximately equal groups. This has been accomplished by dividing the class into those more concerned with the physical sciences on the one hand and with the natural sciences on the other. About eighty per cent. of the subject matter of the courses presented to the two groups is common to both but the remainder is quite different. We consider these two selections to be equally effective.

The course in chemistry must not, however, just instill facts. If the University graduate is to be a man capable of independent thought he must be given some training in thinking for himself. Consequently the lecture course must contain material which can form a basis for problems of some sort. It matters little whether such problems are arithmetical, e.g., based on quantitative analysis or equilibria, factural, e.g., qualitative analytical, or logical, e.g., stereochemical; but they must be based primarily on chemistry and not be made difficult merely by the need to use complicated mathematics in their solution. These problems should require the maximum effort from the student and the provision of rules of thumb or formulae designed to aid the solution generally nullifies the value of the problems.

Chemistry is a practical science and a course of lectures is always accompanied by a course of laboratory work. Probably the best opportunities for developing the intellectual powers of students arise in the laboratory and yet it is often the most useless part of a first year course, existing in some cases almost as a benign tumour. If a practical course is to be worth while the selection of material must be given just as much attention as the selection of lecture material. It must of necessity involve some training in the handling of laboratory gear and in the performance of simple laboratory operations, but these matters should always remain a means and never become an end in themselves. In the laboratory the student should ideally be given the opportunity of formulating an hypothesis, devising an experiment or series of experiments to test this hypothesis and finally be required to analyse his results critically in order to determine their significance. Such an exercise should preferably precede the lectures on the topic under consideration. Experiments designed "to prove that . . . " or "to demonstrate that . . . " are not only ineffective, but may be even harmful in that they develop a false concept of the function of practical chemistry. In this connection it may be mentioned that although practical courses in quantitative and qualitative analysis are invariably included in laboratory work, they warrant a place only as examples of laboratory operations. They have little intrinsic value being in essence only a procedure. The student only needs to perform the required motions efficiently for the correct result to emerge. Their benefit lies only in developing manipulative skill and little mental effort is, in general, required.

Finally, the course will fail unless it arouses the student's enthusiasm and awakens in his mind the realisation that the pursuit of science is worthwhile in its own right and much more than a means of livelihood.

ADVANCED CHEMISTRY.

BY T. A. TURNEY,

Chemistry Department, Auckland University College.

I should like first to give my views on what I consider chemistry to be and then to state my views on the ideal and present functions of the New Zealand University. Lastly, I shall consider how chemistry should be presented within this framework.

I think the subject of chemistry is best dealt with under four classifications which I choose to call analysis, structure, equilibrium and rate. I use the first two terms in a philosophical sense and not in the conventional sense used in chemistry. This should be borne in mind in the discussion which follows.

The first classification, analysis, deals with the fundamental particles. Views on these have a long history, but were not established until the time of Dalton. As a result today we do not generally question the use of atoms as the primary particles with which we are concerned in chemistry. We do not doubt that water consists of hydrogen atoms and oxygen atoms in the ratio of two to one.

The second classification, structure, leads to a different set of ideas. If we accept the use of atoms, then matter is simply a combination of atoms. The possible combination of atoms is rather large. The theoretical problem has been, by making assumptions (based on experiments) about the nature of atoms, to explain the existence of all combinations of these atoms. Structurally water consists of one atom of oxygen and two atoms of hydrogen, each hydrogen atom at a definite distance from the oxygen, the two hydrogen-oxygen links being at a definite angle. Theoretically we try to correlate the structural properties of the substance water with the properties of hydrogen and oxygen atoms. To do this we make assumptions about the electronic nature of hydrogen and oxygen atoms and attempt to correlate a model based on these properties of the atoms with the existence and properties of the substance water.

The third classification arises in this way.

Granted the existence of atoms and of larger structural units formed by combination of atoms, what are the conditions for the formation of large stable structural units either from atoms or small structural units? That is, given hydrogen and oxygen, under what conditions is water formed from these, and in what state is it when formed? The pattern to questions such as these is given by classical thermodynamics. Its answer to such questions are given without the necessity of any postulate about the microscopic state of matter. The bridge between this and the second classification is provided by statistical thermodynamics, which builds up a model based on the structural properties of atoms and larger units and attempts to correlate this with the bulk thermodynamic properties.

Finally, assuming the conditions are favourable for the formation of water from hydrogen and oxygen, how in fact does this process take place? This is the fourth classification. The bridge to the previous set of ideas, if a bridge is necessary, is provided by the activated complex theory of reaction rates.

This is a very brief outline. Each section could be considerably amplified. I believe, however, it does not omit any major aspect of modern chemistry and gives a useful picture of the nature of the subject.

Next we must consider the ideal and present functions of the New Zealand University. I believe it is the function of all Universities including the New Zealand University to advance knowledge and that all University teachers should be actively engaged in this pursuit. I do not think it matters if it is the kind of knowledge that is sometimes called applied. To further knowledge University teachers are more liberally rewarded in free time than other members of the community. In exchange for this they are usually asked to perform a social function in training people for the professions. The New Zealand University is almost the sole avenue whereby students can be trained in many professions of which chemistry is one. The main criticism of the New Zealand University is that the advancement of knowledge is too often subordinated to professional training.

I wish now to consider how chemistry should be presented within this framework. I assume that most students entering a chemistry course at the University have had a minimum of two years of chemistry at secondary school before entering the University. There are things to be said on this but not in this context. I believe that Stage I should be an introductory course to the whole subject of chemistry; that in Stages II and III we lay the main basic foundations of the subject and that in Honours we pursue the subject to an advanced and more specialised level with a thesis taking the place of practical work at the lower stages: This assumes a four-year chemistry course to the Honours level. There are also things to be said on this but again not in this context.

In regard to subject matter I think the whole lecture course should be built around the divisions, analysis, structure, equilibria and rate, as I have outlined. I think we have outlived the classical division into physical, inorganic and organic Chemistry. Modern chemistry is the solution of chemical problems which can occur in any field or context. Primarily we want students who can solve chemical problems by bringing the appropriate techniques to the job in hand. We do not particularly want, I would suggest, physical, organic or inorganic chemists though with the complexity of the subject we may allow ultimate specialisation.

In practical work I think that students by the end of their Stage II course should be trained to have a good knowledge of preparative chemistry and qualitative and quantitative analysis of a wide variety of substances. I do not regard this as a *sine qua non* of the practical course to this stage but any course that does not produce students capable of performing these operations in a workmanlike manner can be looked at critically under present conditions. The Stage III practical course should be a year engaged in studying advanced techniques for the solution of problems. By this I mean techniques such as spectroscopy, use of radioisotopes and chromatography which I believe could be taught more extensively than they are at present.

Lastly I should say that perhaps in essence what is taught is not of supreme importance. More important probably is that the teacher be an investigator and a person of independent intellect who can convey these attitudes to the student. Unfortunately such individuals are too rare.

THE TEACHING OF BIOCHEMISTRY

BY N. L. EDSON,

Professor of Biochemistry, Otago University, Dunedin.

In the Nineteenth Century a tremendous expansion occurring within the fundamental disciplines of physics, chemistry and biology led to much fragmentation and regrouping of scientific knowledge. Amongst the new syntheses which have emerged are the "borderland" disciplines of biochemistry, microbiology and physiology. It is difficult or perhaps impossible to define the limits of biochemistry as a science because it traverses the artificial boundaries that are employed to divide chemistry from biology; but it is not difficult to proclaim the objective of biochemistry or to prescribe its limits as an academic discipline.

The ultimate object of biochemistry is a description of the "vital phenomena" in the language of chemistry and physics. These phenomena include the structure and morphogenesis of the *living* cell, the mechanism of chemical changes (metabolism) occurring in the cell, intra-cellular transformation of energy, cellular motion and excitability, reproduction and heredity. Contemporary biochemistry is able to offer hypotheses and facts concerning these fundamental questions in respect of animals, plants and microbes at levels of organization ranging from the soluble multi-enzyme system and the sub-cellular particle to the multi-cellular organism.

The techniques employed in the practice of biochemistry are predominantly chemical, but not exclusively, because the peculiar needs of the subject have compelled the invention of techniques that have no application in classical chemistry. On occasion the biochemist must also have recourse to the techniques of microbiology and of animal and plant physiology.

Since biochemistry utilizes the theory and methods of chemistry in a biological context, the subject is apt to be mistaken for a branch of chemistry, whereas in fact it is a biological science closely aligned with general physiology and microbiology. A similar error arises in equating the chemistry of natural products with biochemistry. The biochemist is deeply interested in the processes which are responsible for the synthesis of a natural product in a living organism, and in its functions and in the reason for its existence in Nature, but the study of the chemistry of natural products lies properly within the sphere of organic chemistry.

A division of knowledge is worthy of recognition as a science in its own right when it has developed a coherent body of theory peculiar to its province. Judged by this criterion, biochemistry has attained full stature. Today the course of biochemical investigation is set and maintained by broad hypotheses which have acquired the proportions of theories, namely, the theory of enzymes, the theory of metabolic cycles, the theory of the dynamic state, the theory of energy transference, and the biochemical theory of inheritance. These generalizations apply to all kinds of living cells; and, indeed, it was the gradual recognition of biochemical unity in life that led to the establishment of biochemistry as an independent discipline in the universities.

During the latter part of the Nineteenth Century the teaching of biochemistry (or "physiological chemistry") was fostered chiefly in the medical schools where it was located in a department of physiology. The teaching was directed towards mammalian physiology and, in the first quarter of this Century, towards diagnostic medicine as well. The devotees of the subject became dissatisfied with such narrow orientation of their work and demanded independence with freedom to extend their investigations to all forms of life. The revolt was led by Hoppe-Seyler and Hofmeister in Germany, by Hopkins in Great Britain and by Chittenden in the United States of America; and it was not surprising that these men were associated with the foundation of the major biochemical journals—Hoppe-Seyler's Zeitschrift fur Physiologische Chemie (1877), the Biochemische Zeitschrift (1908), the Biochemical Journal (1906) and the Journal of Biological Chemistry (1906). The faith which inspired the pioneers has been justified by the phenomenal growth of biochemistry that has taken place since 1920. Universities throughout the world have set about the task of creating independent departments of biochemistry often by releasing their biochemists from subservience to physiology or chemistry. The struggle for independence was finally won in 1952 when the biochemists were granted permission to form an International Union of Biochemistry.

The School of Biochemistry at Cambridge was a model institution conceived and founded by Sir Frederick Hopkins. Its remarkable success was due as much to the magic of his personality as to the greatness of his scientific genius. In a famous address delivered at Stockholm in 1925, Hopkins (1) had something to say about the teaching of biochemistry:

. . . "The greatest need of biochemistry at the moment in my opinion is equipment which shall make possible the study under one roof (of course, from its own special standpoint alone) of all living material. No full understanding of the dynamics of life as a whole, no broad and adequate views of metabolism, can be obtained save by studying with equal concentration the green plant and micro-organisms as well as the animal. . . . The Institute I have in mind would steal something from the activities (usually, however, minor activities) of various existing biological Institutes, but would justify the theft by a highly profitable combination and co-ordination of the stolen material. I am in fact only pleading for one of those reconstellations in intellectual pursuits which the progress of knowledge often makes desirable or necessary. I am sure that the one in question is now desirable."

He went on with characteristic modesty:

"Such Institutes of General Biochemistry would have to be equipped for teaching as well as for research. . . . I do not undervalue the difficulties of equipping and staffing an Institute of general biochemistry such as I am picturing but I must not stop to discuss them. I will only state that we have, in not too ambitious fashion, attempted the task in Cambridge. In addition to our ordinary medical teaching of chemical physiology in the older sense, my colleagues and I take a few advanced students each year over a much wider ground. Apart from hearing lectures on general biochemistry, they deal, in practical classes, with the chemical activities of bacteria, yeast and the green plant and do not neglect even the invertebrate animal. I think our experiment is a success, for our students undoubtedly acquire a scientific outlook which at present is somewhat unusual. . . ." More recently similar views were expressed by a Committee of the Royal Society (2) reporting on the post-war needs of biochemistry in the British Universities and by Fruton (3), who discussed the place of biochemistry in the American Universities.

The Royal Society's expert committee gave its opinion as follows:—

"C20. With this end in view all those universities which do not as yet possess departments of biochemistry in the Faculty of Science should be encouraged to create them as soon as possible after the war. The department of biochemistry should not be contained within or under the control of any other department, but to obtain effective collaboration in research it should be placed geographically in close proximity to the departments of organic and physical chemistry and of the fundamental biological sciences.

"C 21. All universities in which departments of biochemistry in the Faculty of Science are established should give courses leading to an honours degree in biochemistry. In his early years the student should be given the necessary grounding in both physical and organic chemistry, and in one, or preferably two of the subjects botany, zoology, biology and physiology. These courses should be given in, or in collaboration with, the departments concerned. The student's subsequent training in biochemistry will have to depend somewhat on the various degree regulations of his university; he might take (a) third and fourth year courses leading to the Honours B.Sc. degree, followed by two years' research for the Ph.D., or (b) a third year course leading to the Honours B.Sc. (or B.A.) degree, followed by three years for the Ph.D., in the first of which he should do approximately another year's course work. A curriculum extending over a full six years is considered to be the minimum required to train a competent biochemist."

In New Zealand facilities for teaching biochemistry developed slowly. With the coming of the late Professor Malcolm in 1905 the teaching of chemical physiology was initiated effectively at the Otago Medical School. When Professor Malcolm retired in 1944 the physiological department of the University of Otago was subdivided to create a department of biochemistry which became quite independent in 1949. Thus developments in New Zealand followed the usual pattern in Europe and America. An abortive effort to introduce biochemistry into the B.Sc. course occurred in 1938, but this was inadequate and full courses leading to an Honours degree carbohydrates, lipids, nucleic acids and porphyrins which are not treated adequately at any stage of the regular courses in chemistry; but the main emphasis is on enzymology and metabolism. The hormones are treated as regulators of metabolism and nutrition is considered from a comparative point of view, beginning with the autotrophic bacteria and proceeding to the most exacting forms of nutrition. Comparative and evolutionary aspects in animals (vertebrate and invertebrate), plants and microbes are kept in view throughout the course which does not neglect to point out that the phenomena analysed and studied must be related to their proper medium, the internal organization of a living cell.

The practical work illustrates the lecture course and is no more than an introduction to the practice of biochemistry. It includes the relevant qualitative and quantitative analysis, the use of absorptiometers and spectroscopes; manometry and paper chromatography; the preparation and handling of enzymes, some elementary enzyme kinetics, biochemical preparations (e.g., cytochrome *c*, haemin and its derivatives, chlorophylls, glucose-1-phosphate), yeast and bacterial fermentations, Thunberg tube technique, tissue slice technique, the methods of detecting metabolic intermediates and some elementary experiments with invertebrates.

Stage III provides a more detailed treatment of general biochemistry again with emphasis on enzymology and intermediate metabolism and elaborates topics such as virus, enzymic adaptation, biochemical genetics and the metabolism of moulds. In addition each student is required to select a broad topic for special study and subsequent presentation at the degree examination (essay paper). Thus a limited amount of specialization is permitted early in the student's biochemical career. The laboratory work involves some more difficult operations in the purification of enzymes, including crystallization, biochemical preparations (e.g., the conversion of glucose-1-P to glucose-6-P with phosphoglucomutase), the use of spectrophotometry, column chromatography and paper electrophoresis and an introduction to the use of radioactive isotopes.

The Honours student is expected to cover the whole subject at a more advanced level and to have special knowledge of the field of biochemistry with which his thesis is concerned. The Honours graduate has sufficient theoretical and technical equipment to enable him to complete a Ph.D. course in two years. Honours graduates in chemistry, even those who have included one or two stages of biochemistry in the B.Sc. course, are accepted as Ph.D. students only on the understanding that the production of a satisfactory thesis will probably take longer than the statutory minimum of two years. Hopkins (5) offered some advice in this connection:

"But I would urge upon any young chemist who thinks of occupying himself with biological problems, the necessity for submitting for a year or two to a second discipline. If he merely were begun in 1945. In this way the University of Otago anticipated the recommendations of the Consultative Committee on Scientific Man-Power Resources in New Zealand (4). Biochemistry has always had some place in the curricula of the Agricultural Colleges, but a department of Agricultural Biochemistry was not established at Massey College until 1940.

At the present time Otago University is the only institution offering biochemistry courses for the B.Sc. and M.Sc. degrees of the University of New Zealand. When the department was established the advice of the Royal Society Committee was followed closely, the courses being designed to meet the above-mentioned recommendations within the degree structure of the University of New Zealand. The main difference is the minimum time required to train the "competent biochemist". In New Zealand it is seven years because Stage I Chemistry includes much work that is completed in the post-primary schools of the United Kingdom.

The courses given to science students are quite separate from the professional courses given in the Faculties of Medicine, Dentistry and Home Science. They are courses in *general biochemistry* placing no stress on any particular applications of the subject. The aim is to create a good understanding of biochemical theory and to supplement this core with an account of chemical functions in animals, micro-organisms and plants. On the practical side the aim is to give an adequate illustration of biochemical techniques.

Biochemistry begins as a Stage II course because the prerequisites are Chemistry I, Physics I and Zoology I or Botany I together with prior or concurrent pursuance of Chemistry II if the student has not passed Intermediate Organic Chemistry in his first year. Experience has shown that it may be possible to reduce this formidable list by omitting the requirement for Chemistry II. Chemistry III (prior or concurrent) is demanded for Stage III Biochemistry. It is a distinct advantage to include Physiology II or Microbiology II in the programme. The Honours course is a compulsory two-year course. In the first year the student is required to pursue a specified course in organic and physical chemistry at the standard of Honours Chemistry to the satisfaction of the teacher of chemistry and to spend the rest of his time at biochemical studies, including research; the second year is devoted wholly to biochemistry. It is obvious that this exacting course which includes so much chemistry will attract none but the more able students.

Stage II Biochemistry is an introduction to general biochemistry suitable for students majoring in botany, chemistry, microbiology, physiology or zoology; indeed, it is a compulsory prerequisite for Stage III Microbiology and Stage III Physiology. The syllabus includes a substantial description of the proteins, migrates to a biological institute, prepared to determine the constitution of new products from the animal and study their reaction *in vitro,* he will be a very useful and acceptable person, but he will not become a biochemist. We want to learn how reactions run in the organism, and there is abundant evidence to show how little a mere knowledge of the constitution of substances, and a consideration of laboratory possibilities, can help on such knowledge. The animal body usually does the unexpected."

The Honours graduate who has proceeded to a Ph.D. degree will have a thorough understanding of the principles of biochemistry and will be capable of tackling any minor biochemical problem and of undertaking major fundamental problems in enzymology and metabolism. The converted chemist who has taken the Ph.D. degree will not possess the same broad background. The student whose biochemical education has ceased at Stage III will make a satisfactory research assistant in agricultural, medical or veterinary institutes or in an industrial laboratory (e.g., brewing, processing of food and drugs). Such students have been trained to consider problems although they have had no experience in attempting to solve them. The student who has not gone beyond Stage II Biochemistry will have a useful background of biochemical knowledge, and if he has taken Chemistry III or Honours Chemistry, he is likely to find a place in a hospital laboratory, in an industrial laboratory or in government routine service where biological material is handled. Practical considerations apart, the Stage II course offers something of general educational value to all science students including those whose vocation is destined to be school teaching.

It must be emphasized that the courses given at the University of Otago are deliberately designed to give an education in *general biochemistry without any specific applications.* It is too much to expect that a student can emerge from Stage III as an expert in any particular field or in any particular technique. Knowledge of applications and technical skill must be gained in subsequent practice. This raises an important question. Is there need for biochemical training in other centres or for biochemical training of a different kind? The one centre which possesses advantages, unique in this country, for the development of teaching in biochemistry is Palmerston North. The nucleus of a full-scale department of biochemistry exists already in Massey Agricultural College hard by the Dairy Research Institute and the Plant Chemistry Laboratory of the Grasslands Division, D.S.I.R. If the College department of agricultural biochemistry were strengthened and linked with the full resources of the other institutions, it would be possible for the College to give an excellent training in general theoretical biochemistry and to offer special instruction in applied biochemistry directly relevant to agriculture and the food industry.

The Royal Society Committee (2) was fully aware of the importance of biochemistry in agricultural research and included the following amongst its recommendations:

"C 24. Applied biochemistry will occupy—and does occupy indeed—as prominent a position in the industry of the mid-twentieth century as chemical engineering did in the early decade of this century. Applied biochemistry should accordingly be given as prominent a place in the Faculty of Engineering of certain selected universities as chemical engineering has found in the past. The subject of applied biochemistry should include the large-scale preparation of biological products.

"C 25. The expansion in agricultural research that will undoubtedly take place after the war will call for the services of biochemists with specialized training. In certain universities or university colleges, therefore, where the local conditions or associations are suitable, the orienting of the teaching and research in the department of biochemistry towards one or more of the branches, plant biochemistry, insect biochemistry, veterinary biochemistry, comparative biochemistry and microbiological chemistry, should be encouraged."

The next logical step to develop the teaching of biochemistry in New Zealand is the extension of educational facilities at Massey College, possibly in conjunction with similar expansion in microbiology and other subjects. The institution of undergraduate teaching for the B.Sc. degree is probably the best way of securing an effective school. Postgraduate teaching and research in branches of applied biochemistry related to the agricultural problems of New Zealand have been conducted in the College ever since its foundation; but it is likely that the full potential of the educational resources available in Palmerston North will not be utilized until Massey College possesses a department of general biochemistry.

REFERENCES.

1. Hopkins, F. G. (1926). Arch. physiol. scand. *49*, 33.

2. Report of the Committee of Post-War Needs in Biology. Section III. Post-War Needs of Biochemistry in the Universities, pp. 40-45. Royal Society of London. January, 1945.

3. Fruton, J. S. (1950-51). Yale J. Biol. Med. *23*, 305.

4. Report of the Consultative Committee on the Scientific Man-Power Resources of New Zealand. Government Printer, Wellington, 1948.

5. Hopkins, F. G. Rep. Brit. Ass., 1913, p. 652.

Note: The Council of Victoria University College has recently announced its intention of initiating the teaching of biochemistry in the department of chemistry, but the nature of the courses to be offered is not clear.

NEWS AND NOTES.

AUCKLAND BRANCH:

Our last year's activities closed with a lively Annual Meeting. The main bone of contention was the difficulty branch committees find themselves under, when dealing with local members who should, by qualification, be applying for admission as Associates of the Institute, but who refuse to do so. The rules do not cover this contingency, and we shall be bringing the matter before the Council for clarification.

Our last meeting of the year took the form of a ladies' night, when Mr. S. G. Brooker, Chief Chemist to Abels Ltd., Margarine Manufacturers, talked about "Fats in Cooking". We had a very large attendance of members and their wives, and Mr. Brooker in his inimitable style gave an interesting address, very liberally illustrated with slides, samples, and cakes, the latter consumed in vast quantities during the lecture and at supper.

We are pleased to wish Professor Llewellyn a pleasant and profitable time in his new appointment as Rector of Canterbury University College, and to welcome back amongst us, Mr. R. Hicks, Chief Chemist to the Auckland Metropolitan Drainage Board. We are looking forward to hearing about his world travels in search of materials and plant for our new drainage scheme.

WAIKATO BRANCH:

Mr. F. D. Dorofaeff, of the Soil Research Station, Hamilton, has left New Zealand on loan under the Colombo Plan. He is doing agricultural chemical work at the Chemical Institute, Bogor, Indonesia.

MANAWATU BRANCH:

Dr. H. R. Whitehead, Assistant Director and Chief Bacteriologist of the Dairy Research Institute, returned in January from a nine months' tour abroad. In the United States and Canada he visited Universities and Institutes where research work in dairying and on the more fundamental aspects of bacteriophage is being carried out ond on the more directly practical side he had a look at the attempts which are being made in the United States to wrap small amounts of cheese in attractive individual packages suitable for sale in the super-markets. In Europe, Dr. Whitehead spent most of his time in the United Kingdom with only short visits to Switzerland and Germany. He was particularly interested to visit places where work on the biochemical problems of cheese ripening was being carried out, but also visited dairy factories in England and Scotland to observe the latest methods used in mass production of cheese.

Another recently returned member of the Manawatu Branch is Dr. A. T. Johns, Chief Chemist, Grasslands Division, D.S.I.R. Dr. Johns, who has been abroad for 15 months, spent most of this time in the United States working at the University of California and visiting Universities and Research Institutes. He also spent three months in Britain and on his way back to New Zealand attended at Canberra, a C.S.I.R.O. Conference on Ruminant Digestion.

Mr. G. M. Wallace has joined the staff of Massey Agricultural College as Senior Lecturer in Biochemistry. Previously employed in the Government Analyst's Laboratory at Auckland where he was concerned in the bacteriology and chemistry of waters, foods and dairy products, his main interest at the College will be in dairy chemistry. Mr. Wallace has been associated with the Journal for a number of years and was Editor in 1954.

Dr. R. H. Jackman, previously of the Rukuhia Soil Research Station, has been appointed Soil Chemist at the Grasslands Division, D.S.I.R. In his new position, Dr. Jackman will be concerned with the significance of organic matter in soils under pasture.

WELLINGTON BRANCH:

Prof. W. P. Evans has been honoured for his services by the award of C.B.E. Formerly Professor of Chemistry at Canterbury College, Professor Evans was a foundation president of the New Zealand Institute of Chemistry.

Mr. M. Fieldes, of the Soil Bureau, leaves shortly to spend a year at Oxford University where he will hold the Underwood Fellowship. This is awarded by the British Agricultural Research Council to stimulate exchange of ideas and work and is tenable at Oxford University or at Agricultural Research Centres in the United Kingdom.

The Council of the New Zealand Pottery and Ceramics Research Association (Inc.) has announced that Mr. I. C. McDowall, Chief Executive Officer, has been appointed Director of the Association. A former member of the Dominion Laboratory, where he worked on clay mineralogy, Mr. McDowall has been associated with PACRA since its formation in 1946.

Mr. H. V. Brewerton, holder of a National Research Fellowship, has left for Cambridge University where he will work on fundamental organic chemistry under Sir Alexander Todd.

Under the Colombo Plan, Mr. H. J. Wood, chemist in charge of the food and drugs section of the Dominion Laboratory, has just left for Indonesia. At the request of the Indonesian Government, Mr. Wood has been posted to the large Chemistry Institute at Bogor to teach the staff new methods of analytical technique.

Dominion Laboratory recently celebrated its ninetieth anniversary by holding a series of 'open days'. Great interest was shown by the public, and the laboratory which was open for four days and three evenings was inspected by just under six thousand people. Displays showed the scope of the work covered by the different sections and by the library, and there was also an historical exhibit. Several broadcasts were made and it is hoped that the general public now has a clearer idea of what goes on in this department.

CANTERBURY BRANCH:

Mr. J. N. Sutherland has accepted a teaching appointment at King Edward Technical High School, Dunedin.

Mr. R. N. Woodward has taken up the position of Technical Director, Agricultural Research Laboratories Ltd., Christchurch.

OTAGO BRANCH:

Mr. H. M. D. Wilson has left for a six months' visit to the United Kingdom, where he will study the latest developments in paint technology.

Dr. G. A. Bottomley has been granted leave of absence from the University of Otago to accept an invitation by Imperial Chemical Industries Ltd., to work in their Akers Research Laboratories at Welwyn, London. He expects to return in March, 1957.

Mr. G. J. Halliburton has accepted a position as Chemist to Commercial Cleaners Ltd., at Christchurch.

Mr. A. R. Matheson, who has been studying for his Ph.D. at Otago University, leaves in February for the University of New England, Armadale, N.S.W.

Mr. J. K. Martin has now joined the staff of N.Z. Breweries Ltd., Wellington.

Mr. G. W. Broughton has been selected by the N.Z. Institute of Management to be its representative at H.R.H. the Duke of Edinburgh's Study Conference on the Human Problems in Industry to be held at Oxford in July. The Conference will be attended by 280 men and women from the British Commonwealth and Empire, including ten representatives from New Zealand.

N.Z.I.C. AND R.I.C.

Joint Conference — August, 1956.

Conference this year will be held in Auckland from Monday, 20th August to Thursday, 23rd August. A fully representative conference committee, comprising Dr. L. H. Briggs (Chairman), Mr. J. Ricketts (Deputy Chairman), Mr. H. S. Maslen (Secretary), Miss M. P. Bartrum, Messrs. S. G. Brooker, K. M. Griffin, G. S. Lambert, W. E. Russell, and T. H. Wilson has been meeting for some months and already has arrangements well in hand.

The most important part of the formal business of Conference is the presentation of papers and it is proposed to hold symposia on the following topics, provided that there is sufficient interest shown:—

Animal metabolism
Instrumentation
Meat and its products
Medical chemistry
Wood and its products
and also some topics of more academic interest.

All those who wish to present a paper at one or more of these symposia, or who wish to suggest other topics for symposia are asked to write to the Conference Secretary:—.

H. S. MASLEN,
P.O. Box 2818,
Auckland, C.1.,

not later than April 4th. It is essential that this deadline be observed as it will be necessary to finalise the Conference programme early in April. The Conference Committee is also hoping that it will be possible to arrange for one or more lectures to be delivered to the Conference by some person of note.

No Conference would be complete without excursions and Auckland is fortunate in that many industries of chemical interest are reasonably close to the city. Two afternoons have been set aside in the draft programme for visits to a selection of these industries. In view of the current interest in the works at Kinleith and Kawerau, a pair of post-sessional excursions are being considered. Both will leave Auckland on Thursday afternoon, stop overnight at Tokoroa and then on to Kinleith on Friday 24th. One party will then return to Hamilton in time for Friday night's train south and the other will proceed to Kawerau and then spend some time in the thermal regions and finally connect with the train south on Sunday night. Further details will be advised later, but both of these post-sessional excursions will be contingent on sufficient support being received.

A comprehensive exhibition is planned in conjunction with the Conference and an enthusiastic response from various firms has been received. At least one firm is importing a special display of equipment from overseas for the exhibition.

Accommodation will be available at leading hotels and also at O'Rourke Hall. O'Rourke Hall is the College Hostel situated about five minutes' walk from the College and it is hoped that "hostel life" will again be a feature of Conference.

Present indications augur well for the 1956 Joint Conference and the Conference Committee looks forward to receiving advance information from you on papers and also any suggestions.

A.N.Z.A.A.S. MEETING, JANUARY, 1957.

SECTION B (CHEMISTRY).

The next A.N.Z.A.A.S. Conference will be held in Dunedin from January 16th-23rd, 1957. The following topics have been suggested as possibilities for symposia, which the Organising Committee has decided will form the main part of the Section meetings.

(1) Reactions at High Pressure and Temperature (joint with Section C).
(2) Isotope Chemistry (joint with Section N).
(3) Electrolyte Solutions.
(4) Chromatography, including gas chromatography.
(5) Analytical Chemistry.
(6) Surface Chemistry.
(7) Natural Products.
(8) Medicinal Chemistry (possibly with Section O).
(9) Chemical Education.
(10) Agricultural Chemistry (with Section K).
(11) Pulp and Paper Chemistry (possibly with Section K).
(12) The Inorganic Raw Materials of Australia and New Zealand (possibly joint with Section C).
(13) Mechanisms of Chemical Reactions.

In addition to symposia, it may be possible to accept contributions in other fields.

Forms on which suggestions for Section B can be made are obtainable from the undersigned, Chemistry Department, University of Otago.

H. N. PARTON (Secretary).
W. S. FYFE (Asst. Secretary).

INSTITUTE PRIZES.

The attention of members is again drawn to the fact that the closing date for all Institute Prizes is now 30th April.

Applications will be received this year for the I.C.I. Prize, the Morcom Green and Edwards' Prize and the Chemical Essay Prize. In particular, it is hoped that this latter prize will attract more entries than in the past.

Reference is made to the Chemical Essay Prize and to an amendment to the Morcom Green and Edwards' Prize Regulations in the Council minutes published in this issue.

JUBILEE RECOGNITION

" . . . Our Institute has more than a responsibility to chemists. . . ."

During the 1955 Institute Conference held in Palmerston North, opportunity was taken at the Social Evening for appropriate recognition of the Jubilee of the Institute. The first Secretary, Mr. W. A. Joiner, proposed a toast to the Institute. After briefly outlining the formation of the Institute and referring to the foresight of the chemists of that day, Mr. Joiner went on to discuss the changes which have taken place in the intervening years and something of the future.

" . . . . In 1931 the membership was 93; it is now nearly 400 more! At the beginning we had four branches. Now there are six. These are sure signs of the vitality of our Institute and of the satisfaction that chemists derive from membership. I might mention many other activities and details of history and achievements, but that will be done elsewhere. The soundness of the structure which New Zealand chemists have conceived, planned and built is evident to all. There is no doubt that our Institute is continuing to fill an important place in the professional and scientific life of chemists in this country, but I think you will agree that if our Institute is to be the living organism which we all desire, we must ever be finding new ways of advancing not only the science of chemistry and the interests of chemists, but also the welfare of our country.

What then of the future? Is our Institute to become a kind of club for chemists or is it to become a living force in the community? This may be putting the alternatives too simply, but I do so to emphasise the point I wish to make, that is that our Institute has more than a responsibility to chemists; it has a responsibility to all our fellow citizens.

The Institute is celebrating the 25th Anniversary of its birth. It has grown to manhood and it must now assume the responsibilities that come with man's estate. We cannot here consider all that we might do to discharge these responsibilities, but first of all we must learn to be articulate. Science today enters the lives of all our fellow citizens. We have the responsibility of interpreting and informing. We have the supreme duty of seeing that those who have the responsibility of deciding to what ends science is to be used are informed and enlightened. We must make plain to all what chemistry can do in the development of our resources and in the service of our fellows. In doing these things we are not only helping others and discharging our obligations, we are advancing the interests of all our members."

In a characteristic reply the President, Mr. K. M. Griffin, dealt with many phases of the work of the Institute. From the start he left us in no doubt as to the place of origin of our best chemists. But on a more serious note he dealt particularly with the work of the individuals who, as officers of the Institute, were to so great an extent responsible for the success of the 25 years we were celebrating.

" . . . All the best chemists come from Nelson. . . . "

THE NEW ZEALAND INSTITUTE OF CHEMISTRY.

LIST OF OFFICERS.

FOR THE YEAR NOVEMBER 1st, 1955 — OCTOBER 31st, 1956.

President: Dr. M. M. Burns, Lincoln College, P.B. Christchurch.
Vice-President: W. A. Joiner, Department of S. & I.R., Box 8018, Wellington.
Hon. General Secretary: W. G. Hughson, Box 250, Wellington.
Auckland Delegate: W. E. Russell, 108 May's Road, Auckland, S.E.5.
Waikato Delegate: N. T. Clare, Ruakura Animal Res. Stn., P.B., Hamilton.
Manawatu Delegate: C. B. Radcliffe, Glaxo Laboratories, Box 624, Palmerston North.
Wellington Delegate: J. A. D. Nash, Department of S. & I.R., Box 8018, Wellington.
Canterbury Delegate: Dr. R. M. Allison, Crop Res. Div., Lincoln, P.B., Christchurch.
Otago Delegate: Prof. H. N. Parton, University of Otago, Dunedin.
Editor of Journal: Dr. W. A. McGillivray, Massey College, P.O., Palmerston North.
Past President: K. M. Griffin, Govt. Analyst, Durham Street West, Auckland.
Registrar: V. J. Wilson, Box 250, Wellington.
Assistant Secretary: Dr. W. E. Harvey, Victoria University College, Box 196, Wellington.

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Secretary: L. W. Jagger, 23 Princess Street, Auckland, C.1.
Treasurer: P. J. Gallaher, 110 May's Road, Te Papapa, S.E.5., Auckland.
Committee: S. G. Brooker, H. R. Gapper, Dr. G. S. Nicholls, T. H. Wilson.

WAIKATO BRANCH:

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Secretary/Treasurer: J. E. Allan, Rukuhia Soil Res. Stn., Box 490, Hamilton.
Committee: M. R. Coup, Dr. E. B. Davies, Mrs. D. R. Perrin, E. P. White.

MANAWATU BRANCH:

Chairman: C. B. Radcliffe, Glaxo Laboratories (N.Z.), Box 624, Palmerston North.
Secretary/Treasurer: Dr. J. L. Mangan, Grasslands Division, Box 623, Palmerston North.
Committee: Dr. G. W. Butler, C. V. Fife, Dr. W. A. McGillivray, P. S. Robertson.

WELLINGTON BRANCH:

Chairman: J. A. D. Nash, Department of S. & I.R., Box 8018, Wellington.
Secretary: Miss H. E. Barr, Dominion Laboratory, Box 8018, Wellington.
Treasurer: Dr. W. E. Harvey, Victoria College, P.O. Box 196, Wellington.
Committee: J. R. Beck, N. H. Law, Miss M. E. Malcolm, Dr. O. M. F. Nauen.

CANTERBURY BRANCH:

Chairman: Dr. B. R. Penfold, Canterbury University College, Christchurch.

Secretary/Treasurer: D. J. Hogan, Dominion Laboratory, Box 1290, Christchurch.

Committee: Dr. R. M. Allison, J. D. Austin, F. H. G. Johnstone, R. H. Shepherd.

OTAGO BRANCH:

Chairman: Dr F. N. Fastier, Medical School, King Street, Dunedin.

Secretary/Treasurer: Dr. D. M. Alexander, University of Otago, Dunedin.

Committee: Dr. R. D. Batt, G. W. Broughton, Dr. W. S. Fyfe, O. H. Keys, N. P. Lino, Prof. H. N. Parton.

SUB-COMMITTEES — 1/11/55—31/10/56.

CONFERENCE COMMITTEE, 1956:

Prof. L. H. Briggs, Chairman, J. Ricketts, Deputy Chairman and H. S. Maslen, Secretary-Treasurer.

EMPLOYMENT COMMITTEE:

E. S. Borthwick, C/o. Shell Co. of N.Z. Ltd., Box 2091, Wellington.

EXAMINATION COMMITTEE:

O. H. Keys (Chairman), Dominion Laboratory, Box 562, Dunedin.

C. R. Edmond (Secretary), C/o. Dr. R. Gardner, 41 Dowling Street, Dunedin.

Dr. A. D. Campbell, J. W. McChesney and H. G. Woolman.

JOURNAL EDITORIAL COMMITTEE:

Dr. W. A. McGillivray, Editor, Massey College P.O., Palmerston North.

D. G. Howard, Business Manager, Shell Co. of N.Z., Box 2091, Wellington.

Prof. C. R. Barnicoat, Dr. G. W. Butler, Dr. R. M. Dolby and C. V. Fife.

MEMBERSHIP COMMITTEE:

Prof. L. H. Briggs, 68 Brighton Road, Parnell, Auckland.

Dr. Gardner, 41 Dowling Street, Dunedin.

W. A. Joiner, Dept. of S. & I.R., Box 8018, Wellington.

PATENTS OFFICE:

No appointment as yet.

PROFESSIONAL STATUS COMMITTEE:

Dr. J. C. Andrews, 63 Onslow Avenue, Auckland, S.E.3.

J. Ricketts (Secretary), 113 Valley Road, Auckland, S.2.

F. H. V. Fielder, 29 Adam Street, Greenlane, Auckland, S.E.4.

D. Whillans, Pathological Lab., Public Hospital, Park Rd., Auckland.

K. M. Griffin, Government Analyst, Durham Street, Auckland.

STANDARDS INSTITUTE OF N.Z.

Representative on N.Z. Standards Institute Council:
G. A. Lawrence, Johnsonville.

Chief Representative for all Standards Institute Affairs:
L. H. Stonyer, 47 Mandalay Tce., Wellington, N.5.

Representatives on Special Standards Institute Committees:

(*a*) *Chemical, Insecticides, Domestic Refrigeration, etc.*—
L. H. Stonyer.

(*b*) *Roadmaking Materials and Methods, etc.*:
J. B. Hyatt, Dominion Laboratory, Wellington.

(*c*) *Electroplating and Electro Metal Finishes:*
Dr. R. Gardner, 41 Dowling Street, Dunedin, C.1.

(*d*) *Rodent Poisons, Refrigeration, Timber Preservatives, etc.*:
Mr. C. G. W. Mason, P.O. Box 632, Wellington.

(*e*) *Metal Containers, Paints, etc.*:
J. M. C. Tingey, 20 Cavendish Square, Wellington, E.5.

(*f*) *Textiles:*
Dr. L. F. Storey, Woollen Research Association, University of Otago, Dunedin.

U.N.E.S.C.O. REPRESENTATIVE:

J. A. D. Nash, Dept. Scientific and Industrial Research, Wellington.

SALARIES COMMITTEE:

Prof. H. N. Parton, C/o. University of Otago, Dunedin.
Dr. G. A. Bottomley, University of Otago, Dunedin.
J. L. Mandeno, 1 Pine Terrace, Wellington, W.3.

COUNCIL MINUTES.

ABRIDGED MINUTES OF A MEETING OF COUNCIL-IN-PERSON OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY (INC.) HELD IN D.S.I.R., WELLINGTON, ON FRIDAY, 18th NOVEMBER, 1955.

PRESENT:

K. M. Griffin, President, in the Chair; Dr. M. M. Burns, Vice-President; J. Ricketts, Auckland delegate; N. T. Clare, Waikato delegate; Dr. W. A. McGillivray, Manawatu proxy; J. A. D. Nash, Wellington proxy; F. H. G. Johnstone, Canterbury delegate; Prof. H. N. Parton, Otago proxy; W. G. Hughson, Hon. General Secretary; Dr. W. E. Harvey, Hon. Assistant General Secretary. Mr. V. J. Wilson, Registrar, was present for part of the meeting. Apologies were received from Dr. F. H. McDowall and T. A. Rafter.

CONFERENCE, 1955: The statement of receipts and expenses showed a net loss of £1 6s. 9d. This loss will be shared on a pro rata basis with the R.I.C.

Resolved: THAT the Manawatu Branch be thanked for their work in organising the Conference, and that a copy of the Conference Report be forwarded to Auckland for their consideration.

CONFERENCE, 1956: Mr. J. Ricketts outlined progress to date. A Conference Committee has been set up consisting of the following:—Prof. L. H. Briggs, Chairman (replacing Prof. Llewellyn, resigned), J. Ricketts, Deputy Chairman and H. S. Maslen, Secretary-Treasurer.

EXAMINATION COMMITTEE:

Institute of Science Technologists: The Examinations Committee will consider this matter and report to the next meeting of Council.

L. A. C. Regulations: After some discussion on the desirability of amending Rule 2 (b) it was *Resolved:* THAT in view of the fact that L.A.C. is under review, and because the proviso in Regulation 2 (b) is required by the Public Service Commission and effects the financial recognition of the L.A.C., the present Regulation be retained meanwhile. Mr. J. A. D. Nash undertook to provide the Examination Committee with information on the D.S.I.R.'s views of the L.A.C.

APPLICATION FOR MEMBERSHIP:

Resolved: THAT the principle of sponsorship be dropped and that applicants be asked to provide the names of suitable persons to act as Referees. The Hon. Assistant General Secretary was instructed to draft the required amendments to the Rules, and suggest suitable modification of the membership application forms.

JOURNAL:

The Editor, Dr. W. A. McGillivray, reported on the general situation at the end of the first year's operations since the Journal was transferred to Palmerston North. It appears that the change of printer has resulted in a saving of approximately £30, and the nett cost of the Journal this year, £147, compares most favourably with the corresponding figure for last year, £262. The newly introduced practice of issuing separate reprints of articles increases the cost of production by about £6 per copy, but the Council agreed that the practice is most desirable and should be continued.

Jubilee Issue: Dr. McGillivray reported on the progress of the Jubilee issue, which should be published in the near future. After some discussion as to the distribution of the Jubilee Issue it was *Resolved*: THAT 1500 copies of the Jubilee Issue be published and that copies be distributed to the main newspapers in New Zealand as soon as possible, and to secondary schools in the New Year. ***Resolved***: THAT in 1956 the Journal be continued along the lines of 1955. *Resolved*: THAT the Editor's suggestion that the Address of the President, R.I.C. be printed as a monograph be approved.

Travelling Expenses: ***Resolved***: THAT the Editor be invited to attend not less than two meetings of the Council each year and that on such occasion his expenses be paid if necessary. The Assistant Secretary was instructed to investigate the position regarding travelling expenses for other officers.

SALARY SURVEY:

A letter from the Minister in charge of the D.S.I.R. was received. The Hon. General Secretary was instructed to reply to the Minister, emphasising again the Institute's concern over the delay in Government action over scientific salaries, and pointing out that the Minister's attention had been drawn to this matter in February and again in May. It was agreed that copies of the Salary Survey should be distributed to Members of Cabinet, senior members of the Opposition and to the D.S.I.R. Council.

STANDARDS INSTITUTE:

The President reported that he had written to the Minister concerning membership of the Timber Preservation Authority. A reply from the Minister was received and it was ***Resolved***: THAT the Hon. General Secretary write to the Minister acknowledging his letter and indicating that the Institute regretted that chemists were not represented on the Timber Preservation Authority and trusted that they would be consulted when necessary.

ANNUAL REPORT:

Resolved: THAT the Annual Report be taken as read and adopted.

BALANCE SHEET:

The Registrar tabled a draft Income and Expenditure Account showing an estimated excess of income over expenditure of £280. ***Resolved***: THAT the sum of £150 be transferred to the Trust Account, and £25 to the Overseas Visitors' Fund. (The £150 covers two years. Last year no money was transferred to the Trust Account).

OFFICERS AND SUB-COMMITTEES:

Officers and Sub-Committee members, as listed separately in this Journal, were elected. Mr. F. H. G. Johnstone leaves the Council after a long service and it was *Resolved*: THAT a vote of thanks and appreciation be accorded to Mr. F. H. G. Johnstone for his services to the Canterbury Branch and the Council over many years.

Registrar: Mr. Wilson reported that the Board of Directors of Technical Publications Ltd. had asked him to inform the Council that the firm would not be able to continue to provide office facilities for the Institute, and thus it would be necessary to make some alternative arrangement. After considerable discussion as to the possibility of finding suitable people to undertake the duties for a reasonable fee it was *Resolved*: THAT Mr. W. A. Joiner, the Hon. General Secretary and the Hon. Assistant General Secretary be appointed as a sub-committee to investigate possible arrangements for getting the secretarial and office work done, with power to act up to a maximum of £350 per annum. The President thanked Mr. Wilson for his efforts on behalf of the Institute.

HONORARIA:

Resolved: THAT the honorarium for the Editor be 15 guineas, and THAT the honorarium for the General Secretary be 35 guineas.

INSTITUTE PRIZES:

The Chemical Essay Competition (Regulation 3.1.). *Resolved*: THAT the attention of Branches be drawn to the Chemical Essay Competition and that suitable publicity be given to it in the Journal. This prize is at present worth £25.

Morcom Green and Edwards Prize: *Resolved*: THAT Regulation 3.3.3. be amended as follows:—After 'applied chemistry' in line 2 the words 'with emphasis on applied chemistry' be inserted; and that Regulation 3.3.5. (ii) be amended to read '*A* candidate will be . . . ' It was further *Resolved*: THAT Regulation 3.3.4. be amended to read as follows:—'Applications by or on behalf of candidates for the award shall be sent to the Secretary of the candidate's Branch, not later than the 15th of April. The Branch Committee . . .'

A.N.Z.A.A.S.:

Prof. H. N. Parton as Secretary of Section B of the A.N.Z.A.A.S. Conference invited the Institute to co-operate with the A.N.Z.A.A.S. organisation as far as possible. With this in view he will communicate with Prof. Briggs, Chairman of the 1956 Conference Committee to avoid possible duplication of topics at the two Conferences. Prof. Parton made the suggestion that the Institute may like to make itself responsible for entertaining Section B members to dinner during the A.N.Z.A.A.S. Conference. Prof. Parton also briefly outlined the preliminary arrangements that have been made for the A.N.Z.A.A.S. meetings.

LOCAL MEMBERS:

The Rule relating to Local Members is not completely satisfactory in that it raises a problem if a Local Member wishes to continue in that capacity when his qualifications are such that he could apply for Associate Membership. Canterbury have suggested that the present Rule 21.7 be amended by the addition to the first sentence of the clause "provided that upon election to Local Membership the Local Member undertake to apply for Associate Membership when he attains the necessary qualifications." After some discussion on this suggestion it was *Resolved*: THAT the Professional Status Committee be asked to consider the question of Local and Student Membership, and to report in time for the Annual General Meeting, 1956. The President pointed out that in the new Rules no provision is made for the collection of local subscriptions from Fellows, Associates or Local Members. *Resolved*: THAT steps be taken to have Rule 21.8.6. of the 1947 Rules reinstated. (This relates to the payment of Branch subscriptions).

JUBILEE RECOGNITION:

Resolved: THAT the Wellington Branch be asked to investigate the possibility of the Institute acquiring some suitable object to mark the Jubilee. (It has been suggested that some insignia of office for the President would be desirable).

MEMBERSHIP:

The following were elected as Associates of the Institute:—

Anderson, Colin Macdonald, B.Sc., Department of Animal Husbandry, Lincoln College, P.B., Christchurch.

Hungerford, John Sealy, Wellington Gas Co., Miramar, Wellington.

Beachen, John Frederick, M.Sc., 2 Clouston Street, Auckland, E.1.

Davis, Brian Reeve, M.Sc., 8 Brett Ave., Auckland, N.2.

Gee, Roy, M.Sc., Glaxo Laboratories, Botanical Road, Palmerston North.

Jakobsson, Bjorn Frithiof Maths, Gill Road, Lowry Bay, Eastbourne.

Marshall, Thomas, B.E., A.O.S.M., 28 Bledisloe Cres., Wainui-o-mata.

Morgan, Bernard Ramon, B.Sc., Caltex Oil Co., Box 48, Petone.

Weston, Allette Louise, M.Sc., Flat D, 133 Tinakori Road, Wellington.

Resolved: THAT for the purpose of Rule 8.2.1. the Degrees B.E. (Chem.) and B.Sc. together be considered equivalent to the M.Sc. Degree.

Resignations: Resignations from the following members were accepted with regret: J. Benstead (Wellington), R. N. Carr (Wellington), S. W. Josland (Wellington), L. H. Bird (Canterbury).

CHEMISTRY IN SCHOOLS:

Resolved: THAT the letter from Mr. Mummery be received, and that it be referred to the Waikato Branch which is preparing a report on the teaching of chemistry in schools.

BOOK REVIEWS.

ELECTROLYTE SOLUTIONS by R. A. Robinson and R. H. Stokes, Butterworth Scientific Publications, 1955.

Twenty-three years ago, the senior author of this book came to Auckland University College as Lecturer in Physical Chemistry. D. A. Sinclair had just discovered how Bousfield's (1918) method of determining vapour-pressures of aqueous solutions by equilibration could be improved considerably in accuracy by proper attention to thermal contact between the solutions. Robinson, with recent experience of the outstanding work being done on the thermodynamics of electrolyte solutions in H. S. Harned's laboratory at Yale, immediately saw the significance of the improved isopiestic method for the accurate determination of activity coefficients. In the next fourteen years he produced an abundance of accurate and significant data on aqueous solutions, in collaboration with a number of able students, among whom his co-author of the book under review was especially prominent. Since then, separated geographically but still in close collaboration, they have maintained their position in the very forefront of physical chemists studying the properties of electrolytes in solution.

They have now presented in monograph form their mature views on the nature of electrolyte solutions, insofar as that nature has been explained by the interionic attraction theory of Debye and Huckel, as developed by Onsager, Fuoss and Falkenhagen. The success of the work need not detain us; it is as completely successful as any of the monographs in chemistry and physics (they number but a handful) which a

University teacher can give to his students with confidence in their clarity, critical capacity and, thought I dislike the word, authority. It contains the best discussion of the fundamental statistical theory I have read and an equally fine treatment of diffusion, both from the theoretical and experimental points of view. But the other chapters fall in no way short of the authors' standards of exposition. Why lecture on electrolytes when students can read Robinson and Stokes? The echo comes back, will they?

The book invites comparison with Harned and Owen's "Physical Chemistry of Electrolytic Solutions". On the theoretical side it is complementary to the earlier work, much easier to read and less demanding on the mathematical equipment of the reader; in fact the best introduction to the field available. Moreover three chapters are devoted to the experimental determination of the main properties considered (conductance, chemical-potentials and diffusion coefficients). To one of those, diffusions, Stokes has made contributions as important as those made by Robinson to the measurement of chemical-potentials through the vapour-pressures.

New Zealand chemists should be interested in this book. So much of its genesis took place here. If Malaya and Australia are now the addresses from which their publications derive, there are still many Auckland graduates about who learned their physical chemistry from Robinson, and many Institute members who have heard both authors on their chosen field of research. These and others will find "Electrolyte Solutions" of very special interest.

—H.N.P.

BOOKS RECEIVED.

The 23rd and final volume of *Grignard's "Trate de Chimie Organique"* has just been issued by Masson et Cie of Paris at a price of 8,000 francs. It contains a section on the condensed pyrimidines, including the purines, and an alphabetical index to the complete work. All concerned must be congratulated on the completion of a monumental task. The same publishers have also produced *"Les Gaz Inertes, l'Hydrogene, les Halogenes"* (396 pages, 3,600 francs) by P. Laffitte and H. Brusset. This book discusses in detail the physical and chemical properties of this rather curious assortment of elements and their principal compounds, and the kinetics of the chief reactions they undergo. For those who have to deal with any of them it will definitely be useful, but a volume of this type should be much more fully referenced.

Everyone who uses a balance will find something of value in the British National Physical Laboratory publication "Balances, Weights and Precise Laboratory Weighing" (46 pages: H.M.S.O. 2/-). This pamphlet covers both theory and practice and includes some rather abstruse as well as elementary points for the sake of completeness. The U.S. Bureau of Standards has also re-issued in a revised form, "Precision Laboratory Standards of Mass and Laboratory Weights" (Washington, 25 cents.).

The second volume of Klages' *"Lehrbuch der Organischen Chemie"* (Berlin: Walter de Gruyter; 603 pages, D.M. 68) deals with the theoretical aspects of the subject: to translate this book would be an excellent training in German and give a good grounding in this branch of chemistry.

In *"Verteilungsverfahren im Laboratorium"* (Berlin: Verlag Chemie; 229 pages: D.M. 19), Dr. Erich Hecker has given us a standard text on the important field of countercurrent separation and liquid-extraction. It discusses the principles and theory of the process, the apparatus used and deals with its application to the various classes or organic and inorganic compounds exhaustively. It is profusely supplied with illustrations of apparatus, tables and graphs and can definitely be recommended.