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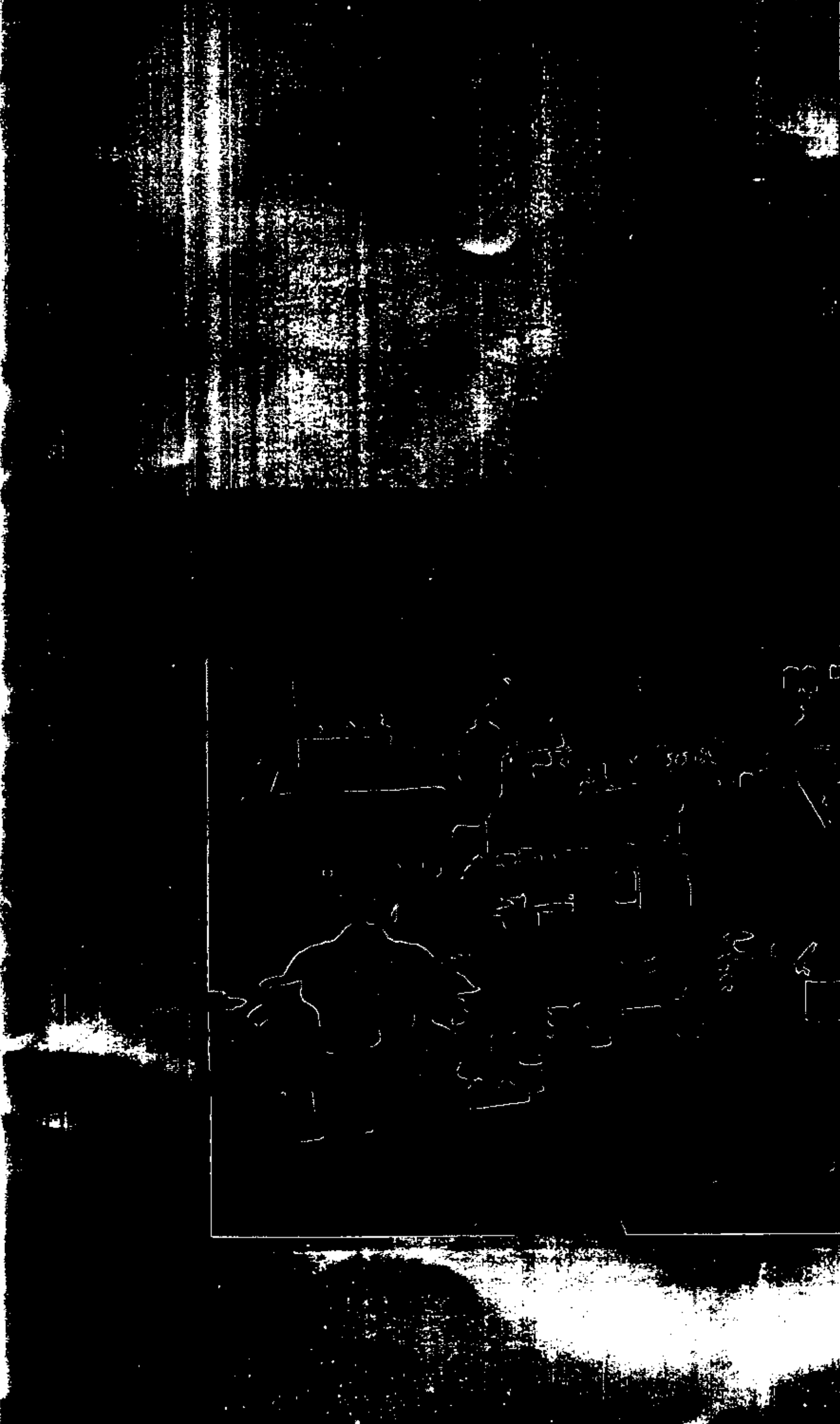

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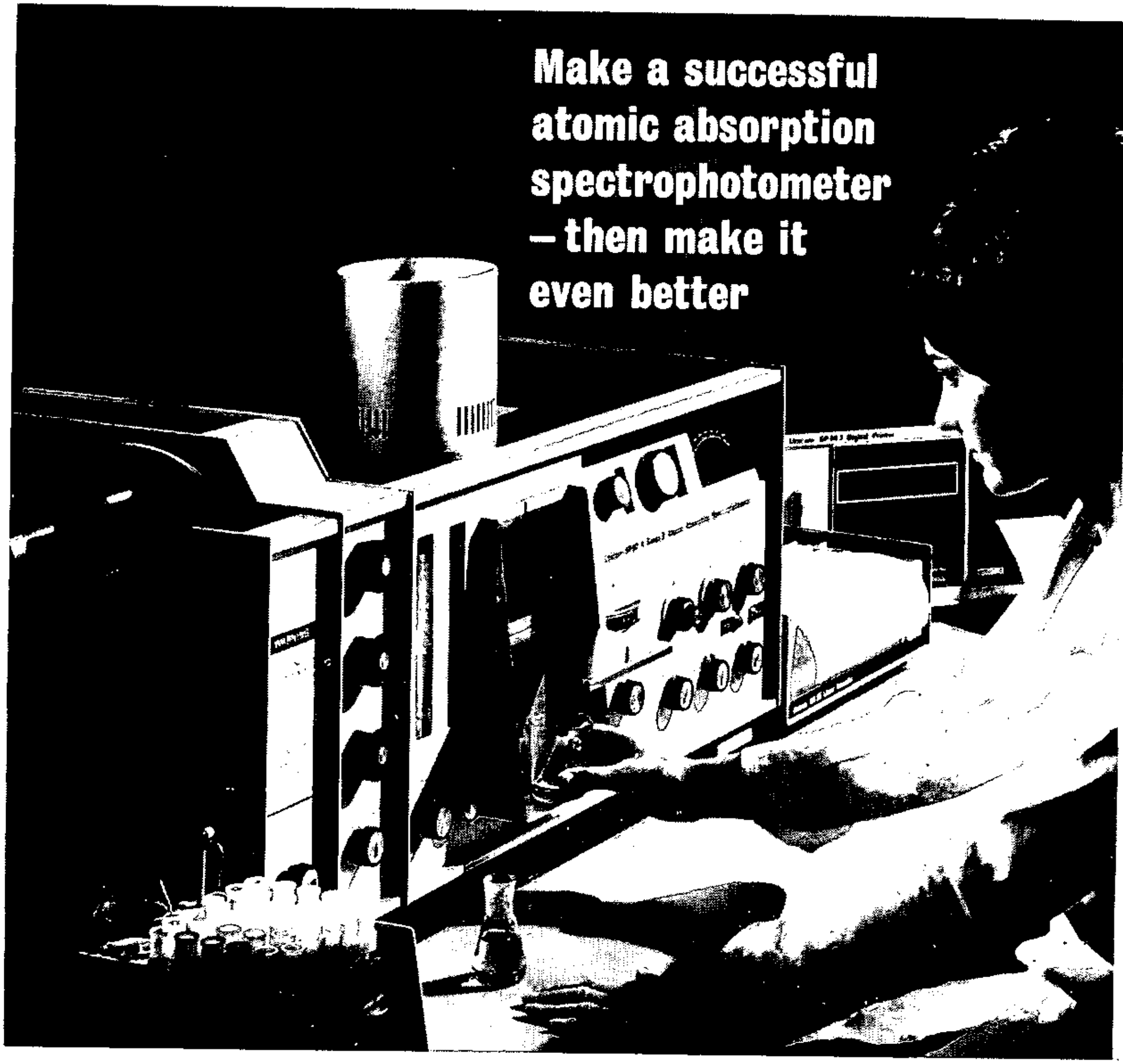

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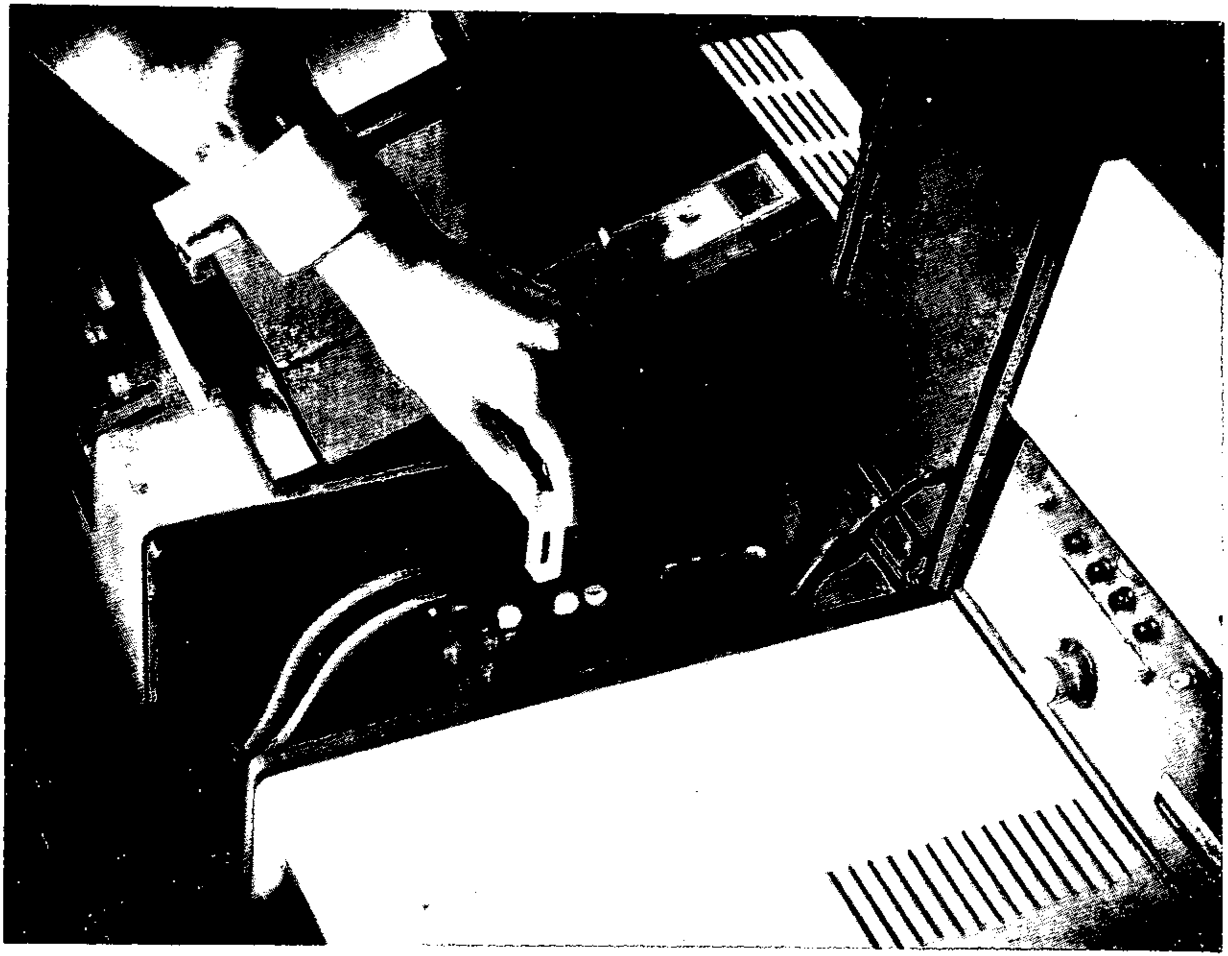

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THE UNIVERSITY, THE CHEMIST AND THE COMMUNITY

Professor J. Vaughan

Department of Chemistry, University of Canterbury

(Based on the Presidential Address to the NZIC Conference, Dunedin, 1969)

Introduction

For some time the university has been news, although it can be fairly said that on journalistic criteria the university student has been better news. Serious public and private concern about the University, its rights and obligations, its structure and functions, would however, have been expressed without evidence of student unrest and the accompanying publicity. What this publicity has done is to influence people's thinking rather than to initiate it; the concern would inevitably have been with us and would have grown over the last twenty years. This is because of a general awareness of rapid university expansion, proliferating demands for graduates, the spectacular increase in university expenditure, and the certainty that without some adjustment to the system this expenditure would undoubtedly continue in its auto-catalytic course.

At times like these most university men tread warily because they know the situation is a difficult and complex one. This may not always be apparent to others, partly because even within the university there are men who have found in the painful problems of our growth a fruitful and not unprofitable field for report and speculative interpretation. As to observers from outside the university, we have come to accept the fact that everyone is an expert on education, and certainly almost every graduate knows just what is wrong with the university and is only too anxious to put us on the right track. Within our own Institute of Chemistry there has been from time to time some spirited comment on our institutions of higher learning. But we are a professional body of graduates; the criticism has been constructive and well meant; and I believe it has been taken in the right spirit. Therefore, in choosing to discuss a few university problems and to express some highly personal views on university chemistry, I can do so without feeling either apologetic because of our imperfections or vulnerable because of my own apprehensions.

In ending this introductory note I should warn you that among the many topics that I am omitting are two which are major areas of controversy. One is student unrest and the other is what an Australian committee once called the academic mortality rate. To deal with either of these, even briefly, would lead to an over-shadowing of other points I wish to bring to your attention.

What is a University?

I wanted to begin with a summary of the functions and features of a modern university which stands some chance of general acceptance by my academic colleagues. It was not easy to do this and I settled, finally, for a comprehensive statement made by Mountford two or three years ago:

> 'Knowledge at the highest level is the domain of the universities; their function is to preserve it, hand it on and expand it. This is inherent in their nature and confirmed by their history. The relative emphasis of these three aspects of their work has necessarily varied from age to age; for universities are part of the society in which they function and they are viable only if

they respond to the implied influence and the positive demands of changing cultural, social, economic and political environments.'

Mountford amplified this statement in the following way:

> 'Wisdom they may foster but cannot teach; and, in the main, they regard character as a prior responsibility of home, church and school. The knowledge with which they are concerned is that which is ascertainable by human reason and observation. Their attitude is, of necessity, critical; they tend to be radical rather than conservative; they are seminaries for new ideas and a sanctuary for unpopular opinion. Freedom of thought and expression is essential to their existence.'

For completeness we should add a summary of comments made by the British University Grants Committee in 1964. The committee defined six areas in which it believed universities should have a wide measure of self-determination. The first three of these areas covered the selection of staff, the selection of students and the content of degree courses. As was quickly pointed out, the U.G.C. was affirming the right of a university to determine 'who should teach what to whom'. The last three areas covered the university's right to determine its own size, to decide its own teaching-research balance and to allocate its recurrent income in its own way. The U.G.C., therefore, left no doubts about its belief in the university's right very broadly to determine its own academic policy. With all these points most academics would agree. You will note, though, that none of these rights is absolute. What was spoken of was 'a wide measure of self-determination' and this important qualification is sometimes forgotten by those who regard the 'six freedoms' as their own academic Bill of Rights. Furthermore, if we use these arguments, we must accept the corresponding responsibilities that accompany the privileges and rights to which we are laying claim. In this we are vulnerable, because many of us—staff and students alike—come into the university without consciously embracing high ideals. We just bring in a rather naive belief that we understand the university and what it stands for. We can therefore count ourselves among the fortunate if the community we serve does not subject us to an acute personal catechism. However, we do a little soul-searching and we would be fools not to do so. If we did not, then somebody else would surely carry out the reappraisal for us.

Structure of the Bachelor's Degree

One area in which New Zealand universities have certainly been self-critical is that of degree structure, and there have been some interesting changes in the last decade. Here we might gain much useful information by noting modifications made to the British first degree. In Britain after World War II the Honours degree became virtually the only respectable academic target and today by far the greater number of pass degrees appear to be granted as compensation for narrow failure by Honours degree candidates. The Honours degree is a specialised degree and, with restricted entry into the university, it would be natural for departmental heads to want entrants with strong school records in their proposed majoring subjects. It has been said that this implied pressure has resulted in unwanted specialisation at a sixth form level and, so long as there is an unsatisfied demand for university places, the operation of such a system prompts the obvious question of whether the post-war dominance of the Honours degree truly reflected the British community's needs for such men.

Two other recent trends are relevant. First, at Keele about twenty years ago a four-year degree was introduced with compulsory 'foundation studies' in arts, sciences and social sciences; graduation was in at least two disciplines. This was a broadening course, but it could not be called a rousing success at the time. It seems to me that one reason for this was that while the Keele degree was a truly élitist degree, combining depth with breadth of study, Keele did not attract a significant proportion of the student élite. The more eye-catching, student-catching new universities of the 1960s often echoed Keele in their new courses. Most of them aimed at breadth, but somehow they were generally reluctant to give up the depth present in the normal Honours degree. These, then, were likely still to be élitist degrees, but they were being offered when Britain was preparing to move away from her highly selective university entrance policy. It will be interesting to see how wide the British universities can open their doors and still concentrate almost entirely on a specialist degree.

In this country we start in some ways from the other end of the spectrum. New Zealand universities in their Bachelor's degree have catered for the average undergraduate; they have given good basic courses and they have sent out adaptable products. Honours degrees of the British type, not geared to a unit system, are recent introductions. They are good degrees but they account for a small fraction of the student intake. We should indeed bear constantly in mind that they are courses for the few and not the many. We must beware also of transferring any surplus enthusiasm for specialisation to the corresponding Pass degree courses where there is an increasing tendency to intensify and extend subject material with the inevitable reduction in breadth. We must fight on all fronts against the natural temptation to turn more and more of our students into narrow specialists—without having good reason for doing so.

Problems of Growth

Rapid growth brings its own problems and North America provides some instructive lessons for us. Perhaps the most obvious difficulty has to do with organisation. Antony Jay has said that the university, like any enlarging institution, reaches a critical mass at which leadership tends to be replaced by administration.

Such an enlarging institution is likely to lose the kind of communication that, to me, is essential for the well-being of a university community — the personal communication that prevents individuals thinking in terms of 'we' and 'they', where 'they' invariably refers to the administration. As our own universities increase in size we must try to reduce the inevitable loss of personal contact which brings with it an accompanying loss of personal involvement and institutional loyalty on the part of both staff and students. In many ways a present-day New Zealand university runs along lines which suited the small colleges of the old federal New Zealand university and many of the changes made over the last decade or so have been *ad hoc* adjustments to a machine not necessarily suited to universities of 5,000 to 10,000 students. Fortunately, however, we are well aware of this problem; some real innovations are being made and others need to come within the next few years.

Again, in our situation of rapid university growth the balance between teaching and research becomes an acute academic worry. At the turn of the century William James was able to talk of the Ph.D. octopus in his own United States and, although effects of accelerated graduate school growth can be seen most clearly in that country, the signs can be read in many others. The Ph.D. is often assumed to be for the ambitious scientist his union card and for the humanist what Jacques Barzun calls 'the permit to lead the good academic life'; but in any field these days the Ph.D. is not enough for the intending academic. A university department tends to hire men who have one or two postdoctoral years behind them and who are often already specialists. They join the university staff on the strength of research achievement and potential (rather than on evidence of teaching promise) and the course of their research work within the university often governs their rate of progress up the academic ladder.

Some results of these practices can be seen in universities of even moderate size. For example, a decade ago, when the University of Toronto graduate schools were about our own present size, a Toronto publication could sound the following warning:

> 'There is a danger . . . that the emphasis on research and writing in a large university will overshadow the importance of good teaching. It is now often difficult to obtain faculty members who recognise that teaching and research are of equal importance. There is a tendency, because we employ men to teach and promote them for the research they do, for many professors to seek devices by which they can 'ease' their teaching responsibilities and find more time for research: they send assistants to the classrooms and laboratories, they set up easily marked objective questions for examinations, they have a 'second office' where they will not be interrupted by students. When this happens, a university is, indeed, open to the charge of 'mass-producing' students, and it has ceased to perform one of its two essential tasks.'

Trends of this sort are difficult to halt and the situation is aggravated by the intense competition for top men in any academic field. In the limit some remarkable things happen. Astonishing offers have been made for exceptional men by American universities and these sometimes include the right not to teach. Generous offers beget preposterous demands and Jacques Barzun has described the case of the sought-after scientist who was offered the job of reviving and rehousing a department in a major American university. Naturally, he asked for the maximum salary supplemented, of course, by the amount the Government would have added for summer work on a research project. He asked also for $6,000 additional salary for acting as department chairman, for a $6,000 consulting fee for supervising new building, for a travel allowance of $10,000 a year to allow him to recruit the men he wanted and, finally, for a $15,000 salary for his wife who possessed a degree in science. Barzun does not tell us whether the university concerned agreed to these conditions.

There are other serious effects that are felt at a student level. Some specialisation within the university is inevitable, but some comes with the interests of the specialists we recruit, and unless we are careful this can result in the production of student specialists. In New Zealand our graduate research activities are roughly similar to those of the Toronto of eight to ten years ago. But our universities have a very strong teaching tradition which, as Dr. D. R. Llewellyn told the universities' conference last May, has been overlooked in the last ten years in the lively discussions which have taken place on university research. We have, I am convinced, a higher proportion of conscientious teachers in our universities than in some other university systems which may well be held in higher regard by their own communities. We face quite a problem. We need our graduate work for which we have fought so hard and so successfully. We need it to provide training, to provide departmental and inter-departmental stimulus, and to help us to recruit well—something we certainly have been able to do in chemistry since our graduate schools became established. However, we must ensure, if we are still to produce adaptable graduates, that our students can be given the broad integrating treatment that was so noticeable to me when I first came to New Zealand. Yet to add to the problem, some of the best of our teaching comes from young research-minded enthusiasts. We must foster their initial enthusiasm for teaching while at the same time we must provide them with generous opportunities for research. Teaching and research must go together in any university worthy of the name, but a pre-occupation with the health of either can have a destructive effect on the other.

Graduate work and the profession

My comments on graduate work have clearly had as their focal point the health of the university, and I should like to look a little more closely at the link between the research student and the community into which we are sending him.

The Ph.D. is a training degree but it is sometimes worthwhile asking ourselves what we are training the man for. The usual answer is similar to one given recently by an Australian industrialist—that the Ph.D. gives 'training in problem-solving'; that it 'teaches them to define a problem, to think divergently and to think convergently'—in other words, to get a result. The speaker (Dr. Whitton of ICIANZ) added: 'Any post-graduate training that teaches a man all these things is preparing him for a very wide range of activities in modern industry.'

This view may be combined with the 'union card' argument—that the man has to have a Ph.D. degree in many overseas countries to give him a wide choice of posts and that even in New Zealand it will keep open all the possibilities. When the union card approach is mixed with the belief that graduate research is life-blood to staff and undergraduates alike (a mixture to which I was addicted for some years) a stage can easily be reached at which most eligible Honours men want to go on to Ph.D. work and are encouraged to do so unless they are notoriously inept at practical work.

Under present and foreseeable New Zealand conditions would such a situation suit many people other than academics? Even if we ignore the costs of training these students we should ask again what we are training them for. We might in some cases be training them for academic research without asking ourselves whether they are appointable. In less extreme cases we might be directing their ambitions towards research work without asking ourselves whether, in spite of the Ph.D. they chalk up, this is the kind of work for which they are best fitted. In talking like this I am not assuming any callous, selfish attitude on the part of the supervisor, but we know that it is natural for both supervisor and student to become engrossed in research projects and their progress. The danger of student-conditioning within the confines of a purely academic environment is undoubtedly there and does not go unremarked by either industry or government. Many academic engineers and technologists in the United Kingdom will have noted with concern at least two comments from industry reported in the recent Royal Society study of post-graduate training. First, it was the almost unanimous industrial view that the Ph.D. is not an essential qualification for top level industrial research and not even necessarily a preferable one. Second, while most firms anticipate an increase in the demand for Ph.D.s, it appears that the reason is that the best graduate students take Ph.D. work and that it is this talent and not the Ph.D. which will be in demand. In chemistry we may not get quite as violent a reaction on the first point, but the second would, I think, find loud echoes from our industrial colleagues. Dr. Hoggarth, of I.C.I., has some pungent comments on the Ph.D. system in a recent number of "Chemistry and Industry".

Having a past record of unrestrained enthusiasm for graduate research, I feel a little vulnerable in saying now that while we must still care about the health of our graduate schools, we are coming to the stage at which we must pay more attention to the conditions of their growth. Several things might be done. For example, we should look again, as Canada and Australia are doing, at the likely Ph.D. needs of the country and, after making a generous allowance for natural wastage and current under-use of Ph.D. holders, we could ensure that our requests from the University for graduate scholarships are reasonable and based more on needs than on ambitions. Our small figures will make initial conclusions quite uncertain, but if the exercise is continued for some years it must surely be profitable. As a starting point recent Canadian and Australian articles give us some lead on Ph.D. production and industrial needs as they affect those countries. It is worth noting, for example, that while the populations of New Zealand, Canada and the United States are in the ratio of 1:10:100, the Ph.D.s in chemistry produced in those countries are in the ratio of 1:25:100. The Canadian figure is very high, but it is in Canada that the over-production of Ph.D.s has been the subject of recent debate. Our position is of interest because we know that our chemical-based industries are as yet in their infancy. This assessment of the degree of sophistication of our industry is supported by recent figures which show that in Canada 30 percent of the country's Ph.D.s are engaged in industrial work as compared with the figure of 15 percent for Australia and a figure of below 7 percent for New Zealand.

We must, of course, encourage graduate work in order to stay healthy and we might do well to remember too that a first-class graduate who cannot do a Ph.D. in this country is not simply going to be absorbed into New Zealand's scientific manpower. He is going to go where he *can* do a Ph.D. and there is consequently less chance of his roots going deeper into the New Zealand soil. We could, though, look more closely at the N.D.C. (and earlier NRAC) recommendations for closer contact between university, government and industry. While the doctoral candidate is at the university we should, with outside encouragement, help him to see the opportunities for New Zealand employment and, where it is sensible and possible to do so, involve him in New Zealand problems and developments.* One of our difficulties in this respect is often the lack of lively communication with industry. In this area it seems to me that each university has to work on its own to increase the contact which will be profitable to industrial chemists, to university staff and, above all, to students.

Even if NZIC branches and individual chemists themselves could do more to help I have no doubt that it is in the university that the first moves should be made. I accept the argument that has been made by Mr. John Pollard that somebody must co-ordinate joint activities and that it should be the university —the institution that can provide common ground for all graduate chemists wherever they work. And in this business of gaining closer contact of mutual benefit there must be nothing contrived or artificial. We must see what the needs of professional chemists are and try to meet them. For example, more can certainly be done in the field of graduate re-training. It is often said, and some of us are fond of saying it, that there is a great need for frequent refresher courses for chemistry teachers because of rapidly advancing knowledge and techniques. This argument can be applied with equal validity to industrial and to other chemists, and in my limited experience such courses aimed at practising chemists meet with enthusiastic response. But every such course requires initiative and often we in the universities have to be pushed into action. One way of ensuring that such matters are not left in the academic 'pending' file is to arrange for a joint committee composed of local NZIC and university members to discuss and continually up-date ways in which chemical knowledge and expertise in the branch area (not only in the university) can be exploited for the benefit of other chemists.

An encouraging trend noticed in recent years is towards increased use of government and industrial chemists in seminars for senior students and university staff. This move can do nothing but good. Those inside the university become much more aware that theirs is but one part of the New Zealand chemical

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* Our loss of PhDs to other countries may not be as great as is sometimes assumed. A survey of 50 chemistry graduates with Ph.Ds from Canterbury shows that 60 percent are domiciled in New Zealand. Furthermore, if we omit graduates still holding short-term post-doctoral appointments the figure is 75 percent.

scene and those coming to speak will perhaps leave with a more balanced picture of our departmental activities. An important extension of these visits would bring in such visiting chemists for longer periods of several weeks or even a term, making it possible for these men to contribute materially to the teaching and research work within the department. We have experimented at Canterbury along these lines and hope in the coming year to have two or three outside chemists on our staff contributing to course work. We would like at least a proportion of these courses to be open to other interested NZIC members in the hope that local industrial men can occasionally attend and make their own contribution both to the lecture course and to the attendant seminars. This would then become a valuable programme of mutual aid. As Pollard again has pointed out, useful information comes from many directions; we, in the university, should have something to offer, but so also should every industrial chemist within our area. I should add perhaps that on our side, while students gain from these arrangements, they come and go even more rapidly than staff and it is university staff who should accumulate over the years a wealth of information and understanding about New Zealand industry. Coming back to a point made earlier, this is especially valuable these days when a young staff member's working experience outside the university is sometimes limited strictly to his vacation work as a student—and even that time might have been spent working as a research assistant in a university chemistry department.

Supplementary undergraduate courses

With increasing awareness on the part of New Zealand industry of the potential value of science graduates we could also do more to supplement academic teaching in order to reduce the jolt sometimes felt by our graduates when they take up an industrial post. I do not believe that we can afford to satisfy sectional interests of industrial firms, but there are general courses which can add to the useful equipment of our graduates. Otago has for some time run an Applied Chemistry course which has received far less publicity than it deserves; Victoria offers a valuable course on Instrumental Techniques and Canterbury expects to begin a course on Chemical Process Technology within a year. The introduction of our course has been made possible entirely by the generous cooperation of the Chemical Engineering Department at Canterbury, which offered to design the course and to staff the major portion of it. Some of the topics that will be covered will be stoichiometry, transport processes, design and operational problems, process development, optimisation methods, feasibility and profitability of new processes. It will rely also for its success on the cooperation of industrial and government concerns because the course will depend in part on the contributions of the chemists we hope to bring into the department on short-term visits. In academic level the course will be suitable for the upper half of our pass B.Sc. students and it will be offered as an optional course for the Honours B.Sc. students and for those carrying out graduate research.

University finance

Whenever there is talk of university science problems there is inevitably also talk of university finance and the ever-increasing demands that are the result not simply of rising student numbers but of rapidly accelerating running costs of all sciences and technologies. Derek Price at Yale offered the dubious but salutary assessment that research output in science doubles in twelve years, real contributions double in thirty years and the cost doubles every five years. Not only our Government but also others are deeply concerned with the problems of university expense. There could surely be few places now in which there is not serious discussion as to what level financial support to the universities can reach before there is some accompanying restriction on the university's traditional choice of research fields. Wherever it might be, the modern university is 'an expensive home of experts and an expensive source of techniques'. It would, admittedly, be the reasonable assumption of most people that both the university and the community should make best use of these experts and these techniques. I should like to think that 'most people' would want to see this done in ways that allow the university as much freedom and independence as possible.

In New Zealand the next few years will tell us what kind of compromise is to be reached and, in a way, the New Zealand academic has more reason to be apprehensive about the possible compromise than his counterparts in some other countries. Well-staffed, well-equipped university science departments with relatively strong graduate schools are fairly new to New Zealand, and I have the uncomfortable feeling that they still carry the taint of the 'nouveau riche'—those who somehow need to 'adjust' to a system that is otherwise smooth-running and respectable. Yet whatever is wrong with the assumptions and *mores* within the sometimes introspective university society, it is still an intellectual community that could, in my opinion, be consulted more and instructed less. About a year ago, I heard a man, for whom I have affection and respect, talk about 'harnessing the energies of the university.' I am not a man of the soil but to me the word 'harnessing' implies the guidance of a working force that cannot do much thinking for itself. The men who do the harnessing so often want to do the thinking.

Relations between individual scientists in University, Government and Industry are astonishingly good when one considers the often disparate employment conditions, the sporadic and sometimes unhelpful official contact, and the many opportunities for misunderstanding. It would seem essential for the health of the entire New Zealand scientific research effort that the mutual respect and co-operative spirit that we know to exist at an individual level be seen by all to exist at less personal, but more official and more responsible levels.

1969 SALARY SURVEY — PART II

P. K. Foster and J. H. Darwin

Part I of this survey did not give standard deviations in Table 5, which contained the major-function-employment group combination. In the analysis to be described here "major function" was found to be a more important factor than "employment" group, and Table 5 is repeated here as Table 5 (a) with the addition of standard deviations, so that the reader can test the significance of differences between means of particular groups.

Analysis of Variance

Tables 2-5 included the data from the 554 returns which were complete. It was noticed that the last three employment groups (self-employed, technical institute, other) and the last major function group (consulting) were small in sample size and/or included one or two unusually high salaries. It was also apparent that the last age group included some low salaries which probably would be retirement pensions. The 50 returns falling into these five groups were omitted from the present analysis which is thus concerned with a more homogeneous population in which subgroups are of a size sufficient to enable worthwhile conclusions to be drawn on the relationship between salary and the other recorded information. The analysis of variance was therefore carried out on the 504 returns remaining in the first nine age groups, the first five employment groups and the first eight major function groups.

In this analysis it was supposed as an approximation that

Salary = basic salary for a person of average age, qualification, etc.

+ age group correction

+ primary qualification group correction

+ employment group correction

+ major function group correction

+ "random" correction.

The "random" correction is only termed "random" here, because it depends on factors not recorded in the survey, or on interactions between factors that were recorded, but which were too complex for the analysis to cope with.

It was found that 52 percent of the variation of salaries was accounted for by this relationship (i.e. $R^2 = 0.52$). Estimates of the constants of the relationship are given in Table 6 and the statistical significance of differences between these constants is given in Tables 7, 8 and 9.

There are several comments to be made on the analysis.

(a) This form of analysis separates the effects of each factor from the effects of the other factors in so far as salary can be validly related to all the factors in this linear, additive manner. For instance, \$131 is an estimate of the correction to be made to the basic salary for a man with second-class honours, whatever his age, major function, etc.

(b) While Table 6 can be used to give a salary prediction for anyone whose age, qualification, etc., are known, the prediction is not likely to be very good since the residual standard deviation is estimated as \$1300. This implies that one can only estimate a salary with any certainty to within about ± \$2600. *Table 6 should not therefore be* *used for salary prediction.* It gives an *analysis* of salaries as at May 1969 and reflects some of the peculiarities of salaries at that time. For instance, it suggests a lower salary for the 56-60 age group than for either the 51-55 or 61-65 groups. This is a property of the sample analysed—no one would believe that chemists' salaries are decreased for a few years at age 56 and restored later! However, Table 6 shows interesting differences within groups and these will be considered.

(c) Tables 7, 8 and 9 give percentage probabilities for the comparison of constants within the qualification, employment and major function groups. They express the probability of the difference being due to chance and not to a real effect. Whenever the probability falls below 5 percent the symbol S is added. Because in these tables there are 48 comparisons one would expect about 2 S's by chance alone. Here there are 22 S's and therefore a number of well-established differences. For instance, Table 6 shows that ($568-$131) is an estimate of the salary difference between graduates with first and second class degrees when they are in the same age group, same doctorate group, same employment group and same major function group. Table 7 shows that such a difference is significant so that one can say that other things being equal, there *will* be a difference in salary, the difference being estimated as $437.

As was stated in Part I the probability level for "significance" is a personal choice made by the reader.

As might be expected, differences within the age group are very significant and have not been separately shown.

The difference of $1044 between "with" and "without" a doctorate is very highly significant.

(d) The employment group classification was found to be non-significant; i.e. its inclusion added nothing to the proportion of the salary variance explained. This group was found to be significant only when the major function was omitted from the analysis, and correlation between the two items readily explains this; e.g. Table 5 shows that teachers perform no industrial functions and that no industrial chemists are predominantly teachers. It is interesting and important that when both items are included in the analysis, function is what matters and not the nature of the employer. This suggests that employers, both public and private, have an efficient grapevine on current rates of pay in the different sectors.

The non-significance of the employment group is demonstrated by Table 8 which shows that there are only two out of ten differences which are anywhere near significance, and that the spread of probabilities is about what one would expect by chance alone.

(e) Because of the limitation of the computer memory the analysis does not incorporate interaction terms. This is a pity as it might be expected, for instance, that the rate of change of salary with age might be different for a man with a Ph.D. than for one without, and the analysis as done ascribes the same rate to each. Similarly, it is implicit in Table 6 that the correction to be made for primary qualification is the same whether the employer is Government, University or Industry etc., and whatever the major function. At first sight this assumption (that there is no significant interaction between the qualification and employment groups) could be tested by considering the within-group and between-group variations on selected pairs of columns of Table 4 (Part I). This would however be misleading and it has not been done. It has been shown that there is a significant age effect and Table 2 (Part I) shows quite different frequency distributions of age between employment groups. An analysis of Table 4 would therefore be expected to show a significant effect between employment groups, but such an analysis would not be able to distinguish whether the cause lay in employer differences or in the underlying age differences.

Table 5 (a) — MAJOR FUNCTION - EMPLOYMENT GROUP COMBINATIONS

Group	*Teaching*	*Industry*	*Government*	*University*	*Res. Assns.*	*Self-employed*	*Tech. Institutes*	*Others*
Research								
No.	1	4	72	21	31	—	—	2
Mean	4,684	4,240	5,233	4,486	4,362	—	—	2,980
S.D.	—	662	1,381	1,872	1,243	—	—	2,658
Teaching								
No.	36	—	—	79	—	—	17	2
Mean	4,367	—	—	5,466	—	—	4,627	4,471
S.D.	851	—	—	1,526	—	—	665	324
Development								
No.	1	24	7	1	2	—	—	—
Mean	5,384	4,425	5,114	10,500	5,700	—	—	—
S.D.	—	863	1,201	—	424	—	—	—
Admin./Mgt. —Laboratory								
No.	—	42	18	2	3	—	—	5
Mean	—	5,395	5,395	9,750	6,310	—	—	5,181
S.D.	—	2,140	1,602	1,060	1,391	—	—	939
Admin./Mgt. —Other								
No.	4	75	8	9	3	2	—	4
Mean	6,028	6,627	6,416	7,756	7,233	6,500	—	6,218
S.D.	690	2,904	2,300	2,032	553	707	—	1,428
Sales and Service								
No.	—	6	—	1	—	1	—	—
Mean	—	5,184	—	7,600	—	10,000	—	—
S.D.	—	1,329	—	—	—	—	—	—
Analysis and Testing								
No.	—	6	27	2	2	2	—	4
Mean	—	4,432	4,337	3,049	3,465	4,350	—	3,995
S.D.	—	544	1,058	351	425	848	—	508
Process/Quality Control								
No.	—	22	—	—	—	—	—	1
Mean	—	4,287	—	—	—	—	—	3,840
S.D.	—	837	—	—	—	—	—	—
Consulting								
No.	—	—	1	—	1	3	—	—
Mean	—	—	4,200	—	2,400	18,500	—	—
S.D.	—	—	—	—	—	18,621	—	—

Table 6 — CORRELATION FROM ANALYSIS OF VARIANCE STUDY OF RESTRICTED GROUPS (N = 504)

Basic Salary in Dollars	*Age Group Correction*		*Qualification Group Correction*		
	<25	−2004			
5644	26-30	−1464	3 yr. B.Sc. or ANZIC		−266
	31-35	− 830	4 yr. B.Sc. or M.Sc.	Pass	−284
	36-40	− 82	4 yr. B.Sc. or M.Sc.	3rd Class	−149
	41-45	+ 496	4 yr. B.Sc. or M.Sc.	2nd Class	+131
	46-50	+ 680	4 yr. B.Sc. or M.Sc.	1st Class	+568
	51-55	+1168			
	56-60	+ 559			
	61-65	+1482			
For significance levels of differences within group—			see Table 7		

Doctoral Qualification Group Correction		*Employment Group Correction*		*Major Function Group Correction*	
Without	−522	School Teaching	− 4	Research	− 502
With	+522	Industry	+ 88	Teaching	− 623
		Government	−176	Development	+ 50
		University	+145	Administration Management— Laboratory	+ 66
		Research Assns.	− 53	,, Other	+1291
				Sales and Service	+ 805
				Analysis and Testing	− 709
				Process or Quality Control	− 379
For significance levels of differences within group—		see Table 8		see Table 9	

Table 7

Mean Salary Correction (from Table 6)	*Qualification Group*	*Significance levels of differences between qualification groups*			
		3 yr. B.Sc. or ANZIC	4 yr. B.Sc. or M.Sc. Pass	3rd Class	2nd Class
—266	3 yr. B.Sc. or ANZIC				
—284	4 yr. B.Sc. or M.Sc. Pass	>90			
—149	4 yr. B.Sc. or M.Sc. 3rd Class	65	60		
+131	4 yr. B.Sc. or M.Sc. 2nd Class	5 (S)	5 (S)	30	
+568	4 yr. B.Sc. or M.Sc. 1st Class	<0.1 (S)	<0.1 (S)	1 (S)	2 (S)

Table 8

Mean Salary Correction (from Table 6)	*Employment Group*	*Significance levels of differences between employment groups*			
		School Teaching	Industry	Government	University
— 4	School Teaching				
+ 88	Industry	80			
—176	Government	60	20		
+145	University	60	85	20	
— 53	Research Assns.	90	60	60	50

Table 9

Correction Mean Salary (from Table 6)	*Major Function Group*	*Significance levels of difference between Major Function Groups*						
		Research	Teaching	Development	Admin./ Mgt.- Laboratory	Admin./ Mgt.- Other	Sales and Service	Anal. and Testing
− 502	Research							
− 623	Teaching	65						
+ 50	Development	5 (S)	5 (S)					
+ 66	Admin./Mgt. Laboratory	2 (S)	5 (S)	>90				
+1291	Admin./Mgt. Other	<0.1 (S)	<0.1 (S)	<0.1 (S)	<0.1 (S)			
+ 805	Sales and Service	2 (S)	2 (S)	20	20	35		
− 709	Analysis & Testing	45	80	2 (S)	1 (S)	<0.1 (S)	1 (S)	
− 379	Process/Quality Control	75	55	25	20	<0.1 (S)	5 (S)	40

(f) At the end of Part I it was pointed out that large standard deviations in Tables 2-5 arose from the large number of significant factors and from flexibility in the application of salary scales to allow margins for skill and responsibility. In Table 6 the former effect has been taken out, for example, the employment group correction shows the amount by which salary changes from employment group to employment group, for persons of the same age, the same primary and doctorate qualifications, and the same major function.

The error quoted above (± $2600) is thus due to factors not covered in this survey (or indeed not able to be quantified at all) and to the assumptions of linearity and independence of the factors necessarily implicit in Table 6. While this error militates against firm conclusions, it is the personal opinion of the authors that you cannot have it both ways. For the analysis to yield the same satisfaction and confidence as the scientific experiments to which we are more accustomed, at least 80 percent, say, of the salary variance would need to be explained by the factors considered (i.e. $R^2 \geqslant 0.8$). This would be a frightening situation—it would mean, in the present case, that your salary was virtually written for the future from the time you left University and selected a particular function for your career. Thus, the alternative to tantalisingly incomplete and uncertain conclusions to salary surveys appears to be a rigid and unimaginative system of employment with the minimum of margins for skill, personality and creativity.

CONTEMPORARY CRYSTAL STRUCTURE ANALYSIS

Ward T. Robinson, M.Sc., Ph.D.

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In 1965 the development of structural crystallography was reviewed[1] from Bragg's elucidation of the positions of atoms inside the unit cell of sodium chloride (1913), through organic compounds of increasing complexity (1930's), to vitamin B12. The intricate atomic arrangements of biologically important proteins have been derived with increasing precision during the past decade. The merit of these achievements has been recognised by the award of Nobel prizes in Chemistry, Medicine and Physiology to six[2] outstanding scientists whose discoveries have all depended, to varying extents, on one experimental technique. Widespread publicity has attended the recent publication[3] of James K. Watson's book "The Double Helix" which describes the science, and the scientists, involved in one of these undeniably glamorous projects.

During this same decade the number of people actively engaged in crystal structure analysis has grown from one to many thousands and is increasing rapidly every year. Very few of these scientists work on projects which receive much public attention. However, they have all contributed to an explosive increase in knowledge of the three dimensional geometry of compounds which are intermediate in structural complexity.

That New Zealand contains and trains scientists who contribute regularly to this field seems adequate reason for summarising the technical developments of the decade in non-technical language.[4,5,6] The clear implication of these developments overseas, and now in New Zealand, is that every chemist who ever isolates crystals of some substance of unknown structure should consider the worth of complete structure determination by available X-ray diffraction techniques.

Experimental Development

In a diffraction analysis the intensities of 1,000 to 10,000 Bragg reflections must be determined photographically or by using counting techniques. The former, parallel, data collection typically requires two months. This time has changed little in ten years though there has been a gradual transition from eyeball to photometric estimation of the degree of blackening of film caused by X-ray reflections.

During the same period automated counting equipment has been developed and is now in use all over the world. The sequential mode of collection is more than compensated for by round the clock operation and the extreme potential accuracy of these instruments. In two weeks a very much more precise data set can be obtained than would take two months by film. A comparable data set can be obtained in a few days.

In the past two years several manufacturers have offered these automatic diffractometers with small built-in computers to control the complete data collection process. This includes the accurate alignment of the crystal and scintillation counter to record the intensity of each Bragg reflection and its background.

Computing Development

The precise location of atoms in crystals, even for low molecular weight compounds, involves an astronomical number of complicated but highly repetitive calculations. Ten years ago digital computers were physically large, exceedingly expensive and unavailable to most scientists. Crystallographers patiently pushed buttons on desk calculators and reckoned in years the time required to extract from a typical data set the crude structure of a simple compound. Now they reckon in days. The implied phenomenal improvement in computing hardware and software will continue and will be welcomed by crystallographers whose calculations can expand to use the largest core storage capacities and the fastest data processing units[7] available. Categorical Parkinsonian statements such as this one should be explained, since they imply large expenditure on the adjunct computing facilities (which are normally shared with hundreds of other people).

Problems and Results

Many experiments in chemistry aim at the elucidation of one or two points of interest in molecular structure. For example U-V spectra may sometimes distinguish between *cis* and *trans* isomers, n.m.r. spectra between axial or equatorial conformers, I-R spectra between transition metal site symmetries, Mossbauer spectra between resonating atoms in non-equivalent environments and measurements of circular dichroism, and optical rotatory dispersion, between possible absolute configurations. Combinations of experiments may even lead to complete knowledge of "how a molecule looks". Although far from complete structure determination, such information has proved exceedingly valuable in both industrial and university research. Chemists always will want such information and want it quickly. For many of these problems X-ray diffraction is now the fastest technique.

X-ray diffraction has other advantages. If a problem can be solved at all the results are definitive within specified limits of accuracy. Complete structure determination implies the simultaneous elucidation of all stereochemical features including bond lengths, bond angles, non-bonded inter-atomic distances, angles between supposedly planar groups of atoms and deviations of atoms from assumed planes. Time and again chemists have required such quantitative information to explain kinetic data or spectral results (which is another way of saying the structure could not be determined with requisite certainty by other methods).

For the research chemist and physicist accurate (and more time consuming) analyses provide a means of probing the thermal motion of atoms in crystal lattices and, ultimately, the scattering power of electrons associated with the same atom in different chemical bonding situations.[8,9]

New Zealand

X-ray structure analyses, using photographic methods, have been carried out by research groups at the Universities of Auckland and Canterbury since 1948 and 1954 respectively. There are individuals active in the field at the Chemistry Division of the D.S.I.R. and in the other universities.

At the University of Canterbury there are two staff members, three Ph.D. students and three part-time research students currently involved in analyses. Molecules under investigation range in size from 10 to 64 atoms. Each analysis is expected to take about 10 hours of I.B.M. 360/44 computer time. Some of the best programs currently available in the world[10] have been cut down to the size of this machine. They are continually modified to include the latest ideas in sophisticated structure analysis calculations. There are, however, very desirable modifications which cannot be included until the storage capacity is doubled. Small core storage inhibits efficient analyses of molecules involving more than 50 atoms. So far this has not proved a severe restriction at Canterbury, but problems currently under investigation by the much larger research group in Auckland will be hampered by inadequate facilities.[11]

The past affords one outstanding example of crystallography aplied to a problem of national importance. This was the determination of the complicated crystal structure of sporidesmin[12] (the causative agent of facial eczema in sheep); work ably carried out by C.S.I.R.O. scientists in Melbourne. Other natural product structures of interest to New Zealand scientists have been solved at the University of Auckland. Still others have been tackled overseas (sometimes by expatriate New Zealanders). Current projects at the University of Canterbury include the determination of the structures of chemical initiators of the polymerization of acrylonitrile *in situ* in wool.[13] At Auckland and Canterbury support is being provided for investigations by organic and inorganic chemists throughout our university system. Other interesting problems have been presented by scientists outside New Zealand.

This country's overall capacity for rapid, accurate and obviously useful work in this field will improve enormously with the importation of two automatic single crystal diffractometers during 1969. We hope that suitable structural problems from industrial, government and university laboratories will always be offered for solution by New Zealand's crystallographers. Even now the investment in running costs and man hours is not great ($40 and 400 hours) for solving such a problem. We confidently expect to halve this by the end of the year.

REFERENCES

1. Hall, D., "Crystals and Chemistry", University of Auckland, (1966).
2. Chemistry (1962), J. C. Kendrew and M. F. Perutz for their work on the protein structure of myoglobin and hemoglobin.
   Medicine and physiology (1962), J. D. Watson, F. H. C. Crick and M. H. F. Wilkins for their work on DNA.
   Chemistry (1964), D. C. Hodgkin for her work on vitamin B12.
3. Watson, J. D., "The Double Helix", Atheneum, New York, (1968).
4. For easy reading and a compact history of this subject see Bragg, W. L., Scientific American, *219*, 58, (1968).
5. A more comprehensive description of these developments can be found in Ewald, P. P., "Fifty Years of X-ray Diffraction," International Union of Crystallography, Utrecht, The Netherlands (1962).
6. Harding, M. M., Chemistry in Britain, *4*, 548 (1968).
7. Ibers, J. A., Physics Today, *21*, 58 (1968).
8. Hamilton, W. C., J. Chem. Ed., *45*, 296 (1968).
9. Raymond, K., Meek, D. W., and Ibers, J. A., Inorg. Chem., *7*, 1111 (1968).
10. Derived from the outstanding programmes written by W. R. Busing, K. O. Martin, H. A. Levy and C. K. Johnson at the Oak Ridge National Laboratory during the last ten years.
11. Waters, N., University of Auckland, Private Communication.
12. Fridrichson, J., and Mathieson, A. McL., Acta Cryst., *18*, 1043 (1965).
13. Simpson, W. S., Chemistry in New Zealand, *2*, 15 (1968).

IUPAC INFORMATION

Report on XXVth Conference of the International Union of Pure & Applied Chemistry

Cortina d'Ampezzo, Italy — 30 June - 8 July 1969

The main event of the conference was the two-day Council meeting attended by 142 delegates representing 37 nations. Luxemburg has ceased to be a member of the Union through non-payment of dues, and Brazil was granted a lower status requiring a smaller payment. On the other hand Japan and Rumania offered to increase their payment and accordingly received a higher status.

It was stated at the Council meeting that the finance being received by I.U.P.A.C. is not sufficient to enable it to fulfill all the increasing work it has undertaken in the service of chemistry and a proposal that the suggested dues paid by each country be related to the "national chemical turnover" was put forward by Mr. P. M. Arnold (U.S.A.), Chairman of the Finance Committee. There was considerable discussion over what would be included in "chemical turnover"; one delegate asked if it would include food manufacture (which could have considerable effect on New Zealand's contribution). The motion was referred back to the Committee for a definition of "national chemical turnover" which means that no decision can be made until the Council meets again in Washington in 1971.

The Council voted to set up a section on Medicinal Chemistry within the Division of Organic Chemistry. It also received a number of reports from Committees and Commissions chiefly on nomenclature in various branches of chemistry. The preparation of these has involved a tremendous amount of work by the committees concerned and the reports are of great value in setting up internationally accepted nomenclature in chemistry. There were nine of these reports presented covering various aspects of inorganic, organic, physical and analytical chemistry. On the academic side the most important probably was the "Manual of Symbols and Terminology for Physicochemical Units and Quantities" while the "Tentative Definitions and Nomenclature for Polymer Science and Abbreviations for Polymeric Materials" should be of considerable significance in the applied field. These reports are all published in a tentative form in the I.U.P.A.C. Information Bulletin which goes to all member countries, and any interested chemists are invited to comment. So far we in New Zealand have made no contribution to this programme but the National Committee for Chemistry at its next meeting will consider means of making the reports more widely known and it was suggested at the Conference in Dunedin that the reports be listed in "Chemistry In New Zealand" as they become available.

The preparation and publication of these standards constitute one of the most important tasks of the Union; another is the holding of Congresses on various aspects of chemistry. An international congress of Pure and Applied Chemistry and a conference on Coordination Chemistry held in conjunction in Sydney in August and an international symposium on Chemical Control of Human Environment in Johannesburg in July may be taken as examples. A third important activity is the publication of authoritative review papers given at I.U.P.A.C. meetings in its journal "Pure and Applied Chemistry". The Council expressed some concern over publication delays in this connection, but the situation should improve with the establishment of a permanent secretariat under Dr. M. Williams at Oxford, England.

Since the Council meets only every other year, I.U.P.A.C. has a Bureau consisting of the officers and ten members elected by Council to carry out the work of the Union betwen Council meetings. Prof. L. H. Briggs, of Auckland, who was the New Zealand delegate to the Council meeting in Prague in 1967, was nominated for the Bureau and only narrowly failed to be elected.

While the Council meeting was naturally rather formal with few items creating discussion, the meetings of Divisional Committees, Sectional Subcommittees and Commissions were much more animated and involved a large number of chemists besides those on the Council. Attendance at such meetings is limited to those specifically named as members but with permission of the Chairman concerned, anyone interested can attend as an observer and this can be a most interesting part of the Conference. Up till now New Zealand has not been active on these committees but as a result of his attending the meeting of the Oils and Fats Section as an observer, the writer has now been appointed an Associate Member of that committee.

Cortina is a delightful spot in the Italian Dolomites and through a number of bus tours and social functions delegates were able to see something of the magnificent scenery in the area. The meeting was very well organised by the Secretary General, Dr. R. Morf, of Basle, and the Secretariat under Dr. Williams and Mr. Ratcliffe of Oxford. It has been a very revealing and rewarding experience to attend and it is hoped that New Zealand will play a more important role on the international chemical scene as a result.

As a general observation on the chemical scene abroad, one is impressed by the close liaison between university and industry in some countries. This is particularly true in certain parts of Europe, for example, in the Netherlands where many industrial scientists also hold professorships and it is probably no coincidence that the chemical industry in that country shows a growth rate of 205 percent over the last ten years, compared with 77 percent for the United Kingdom.

S. Brooker.

Forthcoming conferences

1. Joint Symposium on Accurate Methods of Analysis for Major Constituents—London (Imperial College), 3-4 April 1970.
2. IIIrd Conference on Industrial Carbons and Graphite—London, 14-16 April 1970.
3. International Symposium on Ylides—Leicester, U.K., 14-16 July 1970.
4. IInd International Conference of Non-Aqueous Solvents—Manchester, U.K., 28-30 July 1970.
5. IIIrd Conference on Analytical Chemistry—Budapest, 24-29 August 1970.
6. XIIIth International Conference on Coordination Chemistry — Krakow/Zakopane, Poland, 14-22 September 1970.
7. International Congress on Analytical Chemistry—Kyoto, 3-7 April 1972.

Further information can be obtained from Professor C. J. Wilkins (Secretary, N.Z. National Committee for Chemistry), Department of Chemistry, University of Canterbury, Christchurch 1.

Appointment

IUPAC has appointed *Mr. T. R. Hitchings*, Riccarton High School, Christchurch, to be New Zealand's Corresponding Member of the Union's Committee on Teaching of Chemistry. The activities of this Committee include: (i) a study of examinations, (ii) a survey of teacher training programmes, (iii) a study of enrolment trends in the chemical curriculum.

The committee, under the chairmanship of Professor R. W. Parry, University of Utah, hopes that through its Corresponding Members it will be able to collate information from the various member countries.

COUNCIL NOTES (August Meetings)

Change of Rules

It was resolved (President/Secretary) that the following changes be made to the Rules of the Institute, such changes to become effective from 1 January 1970.

1. Introduce a new Rule 8 as follows:

   Rule 8 — Graduate Membership

   8.1. No person shall be elected a Graduate Member unless he is connected with New Zealand by birth, education or domicile and has produced proof satisfactory to the Council of having reached the required standard of attainment.

   8.2. Any person shall be deemed to have complied with the required standard of attainment who:

   8.2.1. Has completed the requirements for a Bachelors Degree of a New Zealand university, such Degree having included a Chemistry III unit or its equivalent, or Biochemistry III or its equivalent, provided that the courses taken have included the pursuance of not less than three years' study of Chemistry and/or Biochemistry together with suitable practical work, or

   8.2.2. Holds such qualification as Council may approve as being equivalent to the requirements set out in 8.2.1.

   8.3. No Graduate Member may retain that status if his qualifications are such that he may become an Associate.

2. Re-number Rules 8-25 as appropriate.
3. In present Rule 8.2.1. last line replace "two" by "four".
4. In Rule 5 amend the first sentence to read "The Institute shall consist of three classes of members who shall be designated Fellows, Associates and Graduate Members respectively."
5. In Rule 6 amend the first sentence to read "The annual subscription for each Fellow, Associate, and Graduate Member shall be such a sum as Council may from time to time determine."
6. In present Rule 13.4 change "members" to "Fellows or Associates".
7. In present Rule 13.10 replace "any other member of the Institute" by the words "any other Fellow or Associate".
8. In present Rule 13.11.1 change the first phrase to read "To elect Graduate Members, Associates, Fellows . . ."
9. Amend present Rule 15.2 to read ". . . or the Associateship or Graduate Membership of the Institute . . ."
10. In present Rule 19 paragraph 2 add "or Graduate Members" after "Associates".
11. In present Rule 21.4.2 amend the second sentence to read "One member of the Committee, who must be a Fellow or Associate, shall be elected as Delegate to Council".
12. In present Rule 21.7 amend the last sentence to read ". . . he can become a Graduate Member or an Associate."

The annual subscription for Graduate Members was fixed at $2.00.

Overseas Visitors

Professor P. J. Randle, the Biochemical Society visiting lecturer, will visit New Zealand in May 1970 either prior to or immediately after touring Australia. It is expected that he will spend approximately two weeks in this country, during which time he will visit all the Branches.

Specialist Groups

Council approved the formation of an Electrochemistry Group and a Geochemistry Group within the Institute. Officers of the two groups are as follows: Electrochemistry Group: Chairman, Prof. J. W. Tomlinson; Secretary, Dr. G. A. Wright. Geochemistry Group: Secretary, Dr. A. J. Ellis.

Council received a deputation comprising Professor R. D. Batt, Professor J. O. T. Sneyd and Dr. G. W. Butler. The deputation discussed with Council matters of particular interest to biochemists with respect to the possible formation of a Biochemical Group within the Institute. The President and members of Council expressed the hope that biochemists would feel that, in the immediate future, their interests would best be served by the formation of a Biochemical Group within the Institute rather than by the formation of an independent Biochemical Society.

Chemical Society Joint Subscription Scheme

The Secretary reported that replies received from Branches had shown that the membership was divided almost equally over the merits of the suggested scheme. The officers had considered that the scheme was not appropriate in the New Zealand context but had taken the opportunity to discuss the proposed scheme and other matters with the General Secretary and the Treasurer of the Chemical Society during their recent visit. It was clear from the discussions that the joint subscription scheme had little appeal to either party but it was also clear that co-operation between the Institute and the Society was welcomed on both sides, and it is envisaged that a much closer relationship between the two bodies will develop, especially in the event of the proposed merger of the major chemical societies in Great Britain.

Prizes

Council, on receiving the reports of the assessors, resolved to award the I.C.I. Prize for 1969 to Dr. B. R. Davis, University of Auckland.

No entries were received for the Morcom Green & Edwards Prize, nor for the Chemical Essay Prize.

Member Bodies Committee of the Royal Society

Dr. P. K. Foster wished to resign as one of the Institute's representatives on the Committee. Council agreed that his place be taken by Dr. P. P. Williams.

T.C.A.

The Secretary reported that he had recently been elected to the Technicians Certification Authority, as one of the representatives of that body's Executive Committee for Science on which he sits as N.Z.I.C. representative.

CONFERENCE COMMITTEE 1970

(Manawatu)

Chairman: Prof. G. N. Malcolm

Committee:

Dr. R. D. Reeves

Dr. J. W. Lyttelton.

THE REGISTRY

Fellows

The following were elected to Fellowship 10.12.69:

FOSTER, Peter Kinnear, M.Sc.(N.Z.), Ph.D. (Lond.), N.Z. Pottery and Ceramics Research Assn., Lower Hutt (Director).

HITCHINGS, Terence Rich, M.Sc.(N.Z.), Dip. Ed., Riccarton High School, Christchurch (Principal).

ROY, Ronald Urwin, B.Sc., Dept. of Education, Christchurch (Senior Inspector of Secondary Schools).

WILL, Graham Melville, M.Sc.(N.Z.), D.Sc. (Well.), Forest Research Institute, Rotorua (Scientist).

WILLIAMSON, Arthur Gordon, M.Sc.(N.Z.), Ph.D.(Reading), Dept. of Chemical Engineering, University of Canterbury (Reader).

WILSON, Ashley Francis, M.Sc., Ph.D.(N.Z.), N.Z. Forest Products Ltd., Tokoroa (Technical Superintendent).

The following Fellows were erroneously listed as Associates in the October issue:

Elected 25.8.69:

GALLAHER, Philip James, B.Sc., N.Z. Fertiliser Manufacturers' Research Association. (Chief Chemist).

MOLLOY, James Joseph, M.Sc.(N.Z.), East Coast Farmers' Fertiliser Co. Ltd., Napier. (Works Manager).

THORP, John Martin, B.Sc.(Hons.), Ph.D. (Lond.), Auckland Industrial Development Division, D.S.I.R. (Scientist).

Associates

The following were elected to the Associateship 10.12.69:

BLACKETT, Barry Neville, B.Sc.(Hons.)(Cantua.), Chemistry Dept., University of Canterbury (Ph.D. Student).

CLARKE, David Graeme, M.Agr.Sc.(Massey), Biochemistry Dept., Lincoln College (Ph.D. Student).

CLARKSON, Thomas Stephen, M.Sc.(Well.), Chemistry Dept., Victoria University of Wellington (Junior Lecturer).

DAVIDSON, Robert, B.Sc., A.R.A.C.I., Dunlop (N.Z.) Ltd., Christchurch (Development Chemist, GRG Division).

EVANS, Leslie Poynton, B.Sc., Union Carbide Pty. Ltd., Auckland (Quality Control Chemist).

FERRY, Donald George, B.Sc., Toxicology Research Unit, Medical School, Dunedin (Research Officer).

GIBBS, John Barry, B.Sc., Hamilton Boys' High School (Teacher).

HICKFORD, Ronald Hames, M.Sc., Dip.Ed., Aranui High School, Christchurch (Head of Science Dept.).

HIGHLEY, Cedric James, B.Sc., Dunlop (N.Z.) Ltd., Christchurch (Chief Chemist).

JACKSON, Barry Lance, B.Sc., Shirley Boys' High School, Christchurch (Teacher).

McQUEEN, Russell George, B.Sc., M.Pharm. (Otago), Dept. of Pharmacy, Medical School, Dunedin (Ph.D. Student).

NEAL, Gwyneth Elizabeth, B.Sc.(Hons.)(Cantua), Chemistry Division, D.S.I.R., Christchurch (Scientist).

OPIE, Melville Charles Albert, B.Sc., Chemistry Dept., University of Canterbury, Christchurch (Research Assistant).

PEAKE, Barrie Michael, B.Sc.(Hons.)(Cantua.), Chemistry Dept., University of Canterbury (Ph.D. Student).

PEDDIE, William Stewart, B.Sc., Linwood High School, Christchurch (Chemistry Teacher).

SWEETMAN, Leslie John, M.Sc.(Auck.), Shell Oil (N.Z.) Ltd., Petone (Chemist).

VIRJI, Adi Sorab, B.Pharm., Ph.D.(Lond.), Dept. of Pharmacy, Medical School, Dunedin (Research Officer).

WETHEY, Peter Douglas, B.Sc.(Hons.)(Otago), N.Z. Forest Products Ltd., Auckland (Industrial Chemist).

WYATT, Gordon Neil, B.E.Chem., B.Sc., Central Institute of Technology, Petone (Chemistry Tutor).

Graduate Members

The following were elected as Graduate Members 10.12.69:

ERCEG, Ivan Joseph, M.Sc.(Auckland), A. C. Hattrick Ltd., Auckland (Industrial Chemist).

GARLAND, Richard Pelham, B.Sc.(Hons.) (Cantua.), Chemistry Dept., University of Canterbury (Ph.D. Student).

MITCHELL, James William, B.Sc.(Hons.) (Cantua.), Chemistry Dept., University of Canterbury (Ph.D. Student).

Resignations

J. M. CLIMO, Mrs. L. A. SALAMONSEN, B. R. THOMAS.

Remission of Subscription

J. D. SARGENT.

BRANCH NOTES

Auckland

N.Z. Fertiliser Association

The Annual Conference was held at Logan Park Hotel on 27-28 November. Professor K. B. Cumberland gave the opening address on the "Future of New Zealand Farming". A symposium was held on Research and Development in the industry, and the future prospects for nitrogen fertilisers were discussed. Other symposia were on Selenium in Fertiliser Mixtures, Sulphur, Industrial Effluents, and Computer Applications in the Industry. Dr. G. B. O'Malley of Melbourne described the Lake Rotokawa sulphur deposit being developed by the American Cyanamide Co. Other visitors were Dr. J. Keay, Division of Soils, C.S.I.R.O., Perth; Mr. R. B. Tennent, N.Z. Phosphate Commissioner; and Dr. B. W. Doak, British Phosphate Commission, Melbourne.

The Place of Practical Work in the Teaching of Chemistry

A symposium on this topic was held by the Auckland Branch on 9 December. Mr. G. R. White, Senior Lecturer, University of Auckland, defined the main objects of practical work as imparting information, mental attitudes and skills. He described the newer type of laboratory exercise: a student-centred investigation with few instructions, aimed at discovery rather than verification of lecture material. Mr. R. E. M. Hodge, Head of Science Department, Rutherford High School, outlined the technique of guided inquiry and the role of pupil-teacher interaction. Mr. J. K. Johannesson, Senior Tutor, Auckland Technical Institute, emphasised the importance of teaching basic skills, and showed the scope for teaching observation, deduction and problem solving in the laboratory. Professor Arthur Fry, University of Arkansas described the education of chemists in U.S.A. and spoke on the value of research work in graduate courses.

Mr. J. K. Johannesson and Mr. K. E. Seal have been invited to attend meetings of the Branch committee.

University of Auckland

Dr. A. J. Easteal, Dr. B. A. Grigor, and Dr. P. S. Rutledge have each been promoted to the position of Senior Lecturer. Associate-Professor B. R. Davis, who spent 1969 on leave in England, has been elected Dean of Science.

Canterbury

Mrs. L. A. Salamonsen has resigned from the Medical Unit, The Princess Margaret Hospital, to travel overseas.

Dr. D. E. G. Sheat has resigned from the Botany Department, University of Canterbury, to accept an appointment with Department of Agriculture, Hamilton, where he will be investigating problems associated with wine production.

Mr. G. D. Edwards has been appointed Technical Manager of Laminex Industries. He was formerly Chief Chemist.

Consequent upon the sale of the Christchurch company of A. C. Nottingham Ltd. to Johnsons Wax Ltd. the Canterbury branch will lose three of its industrial members. Mr. A. H. Swaney has joined J. B. L. Consolidated Ltd., Auckland, as Food Technologist. He will be working on fish processing. Mr. G. J. Cort and Dr. E. Dansted have joined Ivon Watkins-Dow Ltd. who have taken over the Pinene production side of Nottingham's business.

Dr. R. M. Allison has returned to Plant Chemistry Division, D.S.I.R., Lincoln, after spending six months in North America and United Kingdom where he made a special study of the extraction of protein from grass.

Manawatu

Dairy Research Institute

Mr. L. P. J. Chapman, Head of the New Products Section of the Chemistry Department of the New Zealand Dairy Research Institute, has resigned and has taken the position of Technical Director of the Fishing Industry Board in Wellington. Mr. Chapman is well-known for his work in developing the New Zealand Whole Milk Biscuit.

Mr. C. H. Towler, who graduated B.Sc. (Hons.) from Edinburgh University in 1966 has resigned his position at Manawatu College in Foxton to take up a position as an applied protein chemist, under the direction of Dr. R. M. Dolby at the New Zealand Dairy Research Institute.

Mr. J. W. Smith, a recent graduate of the Biochemistry Department of Victoria University of Wellington, has joined the New Zealand Dairy Research Institute and will be working in the Biochemistry Section of the Microbiology Department on the use of tracers.

Massey University

Dr. W. R. Bannatyne of the Food Technology Department of Massey University has resigned and has taken a two-year appointment to the Ministry of Overseas Development as a Technical Assistant. He will be involved in the setting up of a Food Technology Department at the University of the Aegean at Izmir in Turkey.

Mr. S. L. Oldfield of the Department of Biotechnology at Massey University has been promoted to the position of Senior Lecturer.

Dr. P. M. Greenway of the Department of Chemistry and Biochemistry has been awarded a grant of $2300 by the Medical Research Council of New Zealand for research on the metabolism of the newborn.

Waikato

At the final meeting for 1969, the Branch was addressed by the retiring chairman, Mr. J. E. Allan, on "Applications of Atomic Absorption Spectroscopy to Plant and Soil Analysis."

Mr. K. J. McNaught, F.N.Z.I.C., has received a D.Sc. from Victoria University, Wellington, for his research into animal and plant nutrition.

The University of Waikato has appointed Dr. K. M. MacKay (Reader) and Dr. P. J. Morris (Lecturer) to the School of Science. Professor A. T. Wilson, Dean of the School of Science, has spent the summer doing research in the Antarctic.

RIC REVIEWS

The Registrar has for sale ex-stock at $3.25 per set a few copies of R.I.C. Reviews Volume 2, 1969. The table of contents is:

No. 1 Chemistry and the Origin of Life by A. I. Oparin.
Inorganic Polymers by B. R. Currell and M. J. Frazer.
Chemicals and the World Economy by A. C. H. Cairns.
Some Chemical Applications of Ultrasonic Absorption Measurements in the Liquid State by E. Wyn-Jones.

No. 2 Organic Electrochemistry by M. Fleischmann and D. Pletcher.
The Chemistry & Physics of Enzyme Catalysis by S. Doonan.
Chemistry and Nutrition by Alastair Frazer.
Nuclear Fuels by B. R. T. Frost.

R.I.C. Monographs for Teachers, Numbers 1-4, 6-15, are also available ex-stock.