JOURNAL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY

Vol. XIX. APRIL, 1955. No. 2.

EDITORIAL

In this issue of the Journal we are publishing two major articles. This is the policy which we hope to follow in subsequent numbers provided sufficient material is forthcoming—one article as in the past, of a specialised chemical nature, and another article of general scientific, rather than specifically chemical, interest. The first article this month is based on the Easterfield address delivered at the Nelson Conference last year. In view of the administrative link between our two Institutes of Chemistry in the making of the Easterfield award, we are pleased to concur with the suggestion of the N.Z. Section of the Royal Institute of Chemistry that this address should be published in our Journal.

The second article requires perhaps some Editorial comment. Professor Kathleen Lonsdale, Professor of Chemistry and Head of the Department of Crystallography at University College, London, visited New Zealand recently and addressed a meeting in Wellington on The Right Use of Science. This meeting was arranged jointly by The Society of Friends, who sponsored her visit to New Zealand, and by Victoria University College and the Wellington Branches of the Royal Society, the Association of Scientists and the New Zealand Institute of Chemistry. It was chaired by Dr. E. Marsden, F.R.S. A tape recording was taken and after correction by Professor Lonsdale, the address is now published in this Journal in a slightly condensed form. Editing has been kept to a minimum to avoid altering her characteristic style.

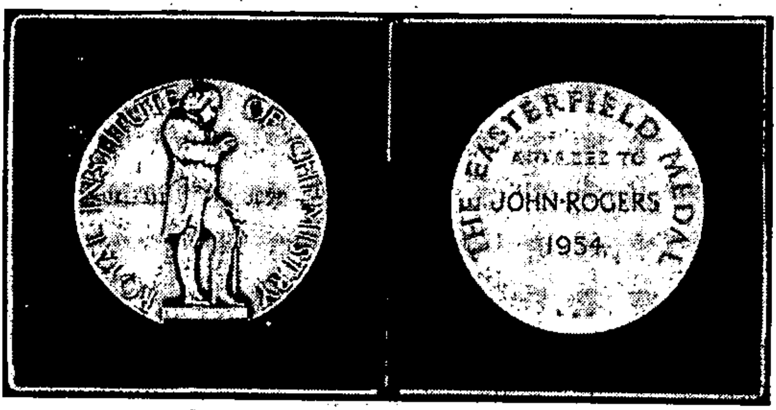
Professor Lonsdale is well known for her work in the field of crystallography. She may not be as well known to chemists as an exponent of the point of view expressed in this article. Laymen and scientists alike are concerned at the present trends in international politics and at the possible consequences of atomic warfare. Most scientists, because they are so directly concerned, have given serious consideration to the principles involved and have arrived at their own decisions regarding participation in work of possible military significance and have formulated their own ideas regarding the right use of their particular branch of science. However the article does represent a point of view which, although held and followed in practice by perhaps only a minority, is still worth recording particularly when it is expressed by a person of Professor Lonsdale's standing.

From time to time there is criticism of the standard of presentation of papers at scientific meetings. In this issue we are publishing two short articles which it is hoped may help to fulfil the general demand for some concrete assistance in this direction.

Published by the New Zealand Institute of Chemistry, G.P.O. Box 250, Wellington.
Edited by W. A. McGillivray, 178 Fitzherbert Avenue, Palmerston North.
Printed by Stylex Print Ltd., 98 Taonui Street, Palmerston North.

EASTERFIELD AWARD, 1954

The presentation of the first Easterfield Award took place at the Institute Conference in Nelson last August. In making the presentation, the Chairman of the New Zealand Section of the Royal Institute of Chemistry, Dr. J. K. Dixon, referred to the fact that the meeting was being held to honour the memory of Sir Thomas Easterfield, the first Professor of Chemistry at Victoria University College, the first Director of the Cawthron Institute, the first Chairman of the New Zealand Section, R.I.C., and an early President of the later-formed New Zealand Institute of Chemistry. For some time the Institutes had desired to perpetuate Sir Thomas's work in some tangible way, for, although his memory is safely enthroned in the minds of those who knew him, they too would eventually pass on. The medal and the biennial lecture would remain.



Dr. Dixon explained that the award had been endorsed by the Council of the R.I.C. which had made itself responsible for having a special die cut. He also pointed out the significance of the representation of Priestley and that the likeness had been taken from the statue in the Market Square in Birmingham.

It was greatly regretted that Lady Easterfield was unable to be present, owing to the fact that she is now unfortunately unable to leave home, but it was most fitting that among the audience, which included almost all the delegates to the Conference, one of the Misses Easterfield and a third married sister, Dr. Helen Deem, were present. Before the presentation Dr. Dixon and the Hon. Secretary had visited Lady Easterfield at home and had shown her the medal. She was delighted with the very fine workmanship that had been put into the striking of the medal.

The award was made to Mr. John. Rogers, Senior Lecturer in Mineral Engineering, School of Mines and Metallurgy, University of Otago. Educated at the Christchurch Boys' High School and the Canterbury University College, he graduated B.Sc. in 1940 and was awarded the Hayden Prize in Chemistry and a Sir George Grey Scholarship. He obtained his M.Sc. with first class honours in Chemistry in 1941 and in that year was released from the Army to join the physical chemistry section of the Division of Industrial Chemistry, C.S.I.R., Melbourne, where he worked on the development of new and improved methods of recovering strategic materials such as tin and tungsten. In 1946 he returned to New Zealand to an appointment at the Soil Bureau, D.S.I.R., where he began a study of clay minerals. In the following year he was appointed to equip and initiate teaching and research in the new Department of Mineral Engineering at the School of Mines and Metallurgy, University of Otago. The research work of this Department has been directed towards the more effective use of indigenous mineral resources and has covered a wide field, ranging from the separation of pumice from sand for use in building hydro-electric dams to the use of bentonite clays as a bond in foundry sands. In 1949-50 he was awarded a Nuffield Foundation Fellowship and a Fulbright grant to visit Canada and the U.S.A. to study research and practice in the mineral industry. In 1953 he was a delegate to the sessions of the Fifth Empire Mining and Metallurgical Congress held in Australia. From 1948 to 1953 he was secretary of the Otago branch N.Z.I.C. and was chairman last year.

EASTERFIELD ADDRESS

BY JOHN ROGERS,

School of Mines and Metallurgy, University of Otago.

On being informed that I had been chosen as the recipient of the first award of the medal honouring the memory of Sir Thomas Easterfield, I was surprised but pleasantly so, and deeply and sincerely grateful for this high honour that has been conferred on me. It is extremely gratifying to receive an award of this nature and it will always be treasured by me as a token of the esteem and friendship of the members of the profession of Chemistry to whom New Zealand—and the outside world—owes so much. It has been a privilege to meet Lady Easterfield and some members of her family and to hear from them of the great man, the fruits of whose labours we see in this city and its countryside.

I feel this opportunity must not be allowed to pass without publicly expressing to all those with whom I have been associated, not only here but also in Australia, my apprecatiion of their example and encouragement throughout the years I have been practising our profession of chemistry. It is to them I owe all and whatever success has attended my efforts to serve the important profession to which we belong.

Most of the work I propose to speak to you about has been done at the School of Mines and Metallurgy of the University of Otago since 1947, when, on the advice of Dr. G. J. Williams, Dean of the School of Mines, and with the support of the Mines Department, the University established a department of Mineral Dressing. Broadly, mineral dressing, or mineral engineering, can be defined as the study of the unit operations of crushing, grinding, sizing and the separation of one mineral from another. The relations with chemical engineering are obvious.

In New Zealand, with the exception of the depleted gold and silver, the titaniferous iron-sands and possible sources of aluminium and magnesium, the major mineral deposits and production are of industrial minerals such as coal, limestone, clays and the aggregates with which we build dams and pave roads. The value of the annual production of the mineral industry in this country now exceeds £10 million, of which coal accounts for more than half. At the end of last century and the beginning of this, the work of New Zealand chemists, like Dr. J. S. McLaurin, and of engineers, in developing the cyanide and dredging processes in the Thames and Otago goldfields respectively was the source of much capital for the country's expansion.

This address is concerned not with that "golden age," but with studies directed towards the use of New Zealand's resources of industrial minerals, important deposits of which occur in this province of Nelson. For example, the extensive talc-magnesite formation in the Cobb Valley and the felspar of the granites which extend from Kaiteriteri to the Hope Saddle.

Our studies of the separation from talc-magnesite of high quality talc and magnesite and of the recovery of felspar from granite have been applications of the flotation process. This process unknown at the beginning of the century, took the metallurgical world by storm after the 1914-1918 war and more than a quarter of a million tons of ore per day are currently passing through flotation machines. The broad physical principles of the process are simple. When fine bubbles of air are mixed into a pulp of finely ground mineral in water, and suitable chemicals are added, the bubbles attach themselves to some minerals but not to others. The bubbles carry the chosen minerals to the surface just as a balloon carries its undercarriage aloft. At the surface the mineralized air bubbles form a more or less stable froth which is removed. When the ore contains several minerals it is possible by suitable additions of chemicals to recover them one at a time in successive flotation operations.

The concentrates are, generally, far from pure and are usually cleaned and re-cleaned. The impurity arises from several causes such as:—

(i) incomplete freeing of the minerals one from another during grinding;
(ii) mechanical entanglement of particles of the gangue minerals in the froth;
(iii) imperfect choice of the chemicals added or of the conditions of flotation; and
(iv) activation of one mineral by soluble salts derived from another.

Most minerals do not float unless there is a chemical present to bind them to the air bubbles: this reagent is called a collector. An ideal flotation process would use in turn collectors specific for

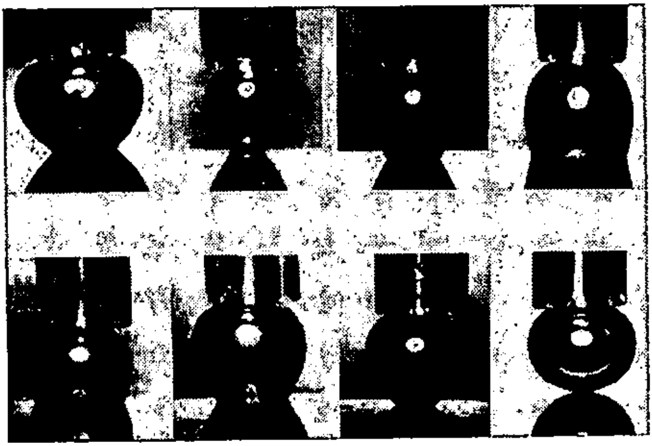


Fig. 1.—Contact angles of an air bubble on calcite in 100 mg/l solutions of sodium oleate at pH values 7, 8, 9, 10, 11, 12, 13, 13.5.

each of the minerals, each being recovered as a separate concentrate. Such an ideal process is not easily discovered as the fundamental problem of analytical chemistry is almost identical. Chemical analysis would be much simplified if specific reagents were discovered for every metal. The flotation problem can be even more complex because of the accidental activation of certain minerals by salts derived from others or other surface changes such as oxidation. Selective flotation may, therefore, always require the addition of some conditioning reagents to prevent this interference, even when specific collectors have been found for all minerals.

All collectors have a "dual personality" in that they have an active or polar group to attach themselves to the surface of the mineral and a paraffin or non-polar group with which the air bubbles can make contact. Collectors therefore are "amphipathic" molecules like wetting agents and detergents. Until the surfaces of most minerals are changed by the absorption of a collector they do not float—an important exception is talc. Figure 1 makes this clear. This shows the contact angles which an air bubble makes on calcite, calcium carbonate, in solutions of sodium oleate at various pH values. At pH 13.5 there is no absorption of collector and the air bubble does not adhere—bottom right hand corner. As the pH of the solution is reduced absorption takes place and a contact angle develops rising to a maximum of 78 degrees at pH 10 and then decreasing again. These photographs were obtained during a study by Mr. G. C. Lyon and myself of the flotation of calcite by oleic acid which arose out of work on increasing the percentage of calcium carbonate in cement rock from Portland, North Auckland.

An important feature of the use of collectors is that very little of them is required—from 1/20 lb. to several pounds per ton of ore treated. This is because less than a complete unimolecular film of collector is required to allow attachment between the mineral surface and air bubble. Unimolecular films contain but little matter. However, this fact has its disadvantages experimentally, as care must be taken to exclude even the most minute amounts of any oils or greases that might act as colletcors. Thus one must not touch the specimens or expose them to the atmosphere and all equipment must be scrupulously cleaned.

Selective flotation is based upon absorption of collector by one mineral but not on others. Chemicals, which are usually inorganic salts and known as activators and depressants, make this possible. Thus sodium fluoride will activate felspar so that it will absorb dodecylamine hydrochloride below pH 4, whereas quartz, the other important mineral in granite, does not. This makes possible the selective flotation of felspar under these conditions.

Depressants on the other hand prevent minerals from absorbing collectors and we have aready seen how alkalis prevent the absorption of oleate on calcite above pH 13.0.

At Otago our work has mostly been with the detergent or paraffin chain salt type of collectors as this is the class of compound effective with the silicates and salt-like minerals such as calcite and scheelite. In dilute solutions these compounds, the soaps, alkyl sulphates, long chain amines and quaternary ammonium salts, to mention a few of the more common, behave like electrolytes but at higher concentrations the ions form aggregates known as micelles and the properties of the solution become very different. The critical concentration for micelle formation depends on the nature of the molecule and the temperature and is often not sharply defined. An important practical point is that paraffin chain salts usually influence the colour of indicators making it necessary to use the glass electrode in measuring the pH value. The paraffin chain compounds are also frothers as well as collectors and this can introduce difficulty as the froths may be very stable: in an enclosed space they may persist for months.

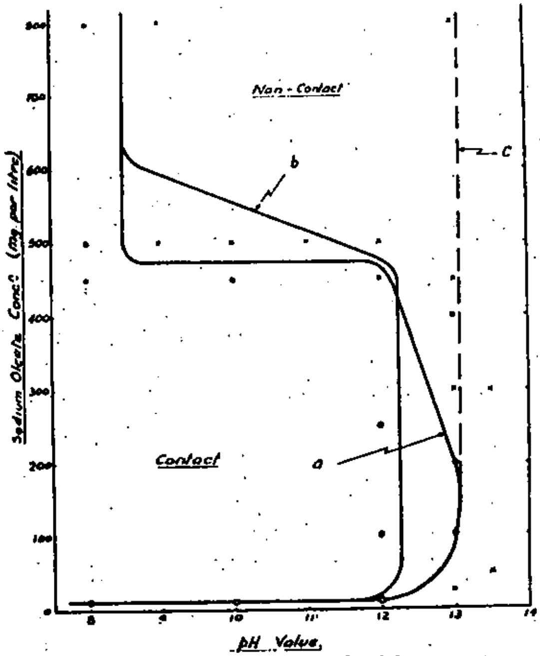


Fig. 2.—(a) Conditions for air bubble — polished calcite contact.
(b) Conditions for flotation of calcite in cylinder.
(c) Conditions for adsorption of oleate on calcite.

Figure 2 illustrates an important property of paraffin chain collectors and shows three complementary methods of experiment, the results being for calcite in a solution of sodium oleate. Curve (a) shows the region of contact between an air bubble and a polished calcite surface; curve (b) the region of flotation of ground calcite in a cylinder shaken by hand; curve (c) shows the region of absorption as determined by transferring the specimen fom the solution to water and testing for contact with an air bubble. At concentrations of sodium oleate above 500 p.p.m. some factor prevents contact between the mineral and air bubbles although a film of collector is present. This has been shown to be related to the absorption of a continuous film of collector by the air bubble so that it becomes "armoured." This is not the whole story as in some systems there is also the formation of a second layer of the collector on the mineral, this second layer being orientated with the polar groups outwards so that the surface is hydrophilic.

From the data of figure 2 I have been able to calculate the solubility of oleic acid. This was suggested by the sudden change in curve (a) between pH 8 and 9. Something has reduced the concentration of sodium oleate so that bubble "armouring" and/or the formation of a surface micelle no longer happens. The "something" is the precipitation of oleic acid the concentration of which can be calculated for any concentration of sodium oleate knowing the dissociation constant and pH value. The value obtained from this flotation work is in agreement with that determined by Stainsby and Alexander from hydrolysis measurements.

The basic principles outlined have been applied in work by C. C. White, M. H. Buckenham and myself on the recovery of high grade talc. Talc is one of the few so called "natural" floaters, as only a frother, such as pine oil, is required. In this project we had valuable material and financial support from the Lime and Marble Company of Mapua, Nelson, which is interested in the Cobb deposits. Mr. T. J. McKee, the Managing Director of this Company is well known for the enterprising way he has developed novel methods of grinding minerals and spray chemicals. Over two hundredweight of a flotation concentrate containing 98 per cent. talc was prepared in the mineral dressing laboratory at Dunedin for consumer trials by potential users in the paint, rubber, ceramic and cosmetic fields. Another of my colleagues, F. L. Sanderson, prepared detailed designs of a continuous plant based on our process. The decision to proceed with this venture is, I believe, still under consideration. To date attention has been focused on the talc in the Cobb ore, but the other major constituent, magnesite, is the raw material for high grade refractory brick in addition to its present use as a fertiliser on the magnesium deficient areas of this district.

Mr. McKee also supplied us with some of the felspar used by M. H. Buckenham and myself in our study of the flotation of quartz and felspar. Felspar is an important fluxing agent in the ceramic industry and the application of the long chain primary amines to the flotation of felspar from granites was one of the first commercial uses of these cationic collectors. The published accounts of the processes used are not precise and this was brought to our attention when studying ways of beneficiating various granites under consideration by the Pottery and Ceramic Research Association as potential sources of felspar for the ceramic industry in New Zealand.

I have already referred to the work done on the cement rock at Portland, North Auckland, where Wilson's Ltd., are engaged in an expansion of their plant and are considering washing and floating part of the rock to increase the calcium carbonate content, so I will pass to a novel application of the flotation process—the recovery of wool wax from scour liquors. The process was developed by L. F. Evans and W. E. Ewers in Melbourne, and I saw it in operation in a woollen mill there last year. The advantage of flotation over the centrifugal methods of recovery used at present in New Zealand is that it gives much more constant recoveries of 35% to 85% of the wax depending on the wax content of the scour liquor. Also the wax recovered is of a higher quality. Laboratory tests in Dunedin on local scouring liquors have been satisfactory and a flotation unit has been built for installation in a mill.

In concluding this outline of our work on flotation, I will illustrate the application of some of the principles described to the problem of "bloat" in animals—probably the most expensive and unpredictable disease the dairy farmer has to meet. When cows, in particular, are fed on clovers "bloat" may develop. This is a result of the cow not being able to eliminate the gas produced during the fermentation of pasture in its stomachs. Normally cows get rid of this gas quite happily by belching. Last August at the Institutes' Conference in Dunedin, Dr. A. T. Johns, of the Grasslands Division, discussed the problem with me. He had tried out several other theories of the cause of "bloat", such as allergy and muscle paralysis, and reached the conclusion that a stable foam or froth formed in the first stomach of the animal prevented belching. Froths which are too stable can be broken down in flotation practice by the addition of small amounts of hydrocarbons such as paraffin or kerosene. The same is true of the froths in an animal's stomach.

Let us look now at another method of separation which we have studied at Otago. Specific gravity differences are the basis for other methods of separation of minerals one from another, particularly when the particles are of sand size or larger. During a visit to my Department, some Engineers of the Ministry of Works engaged in building the dams on the Waikato suggested that we study the problem of removing the pumice and other light-weight material from the sand of the Waikato basin. The porous and light-weight particles make difficult the control of the water content and strength of concrete made with sand containing them. Mr. F. L. Sanderson and I showed by tests in heavy liquids that there was enough difference in specific gravity between the porous and sound sand grains to warrant study of methods of gravity separation and followed that up by jigging tests resulting in a sand substantially free of unsound particles. The homogeneous sand produced by jigging can also be more closely sized in an hydraulic classifier, and the Ministry of Works engineers are currently testing a jig of our design capable of treating twenty or thirty tons per hour of sand. The nature and grading of sand are vitally important in the production of high grade concrete and possible savings in cement costs on only one large dam could easily be more than £100,000.

The last project I wish to outline is our work on the bentonites of Hawke's Bay. Bentonites are clay minerals of the montmorillonite type with fascinating properties which largely follow from the very small size of their particles and their crystal structure. The small size of the individual particles means unit weight of these clays have a large surface area in the dispersed condition and important exchange properties. Our studies of the chemical and physical properties of samples of bentonite from Maungatu and Porangahau show that these clays are not simple montmorillonites. The different samples contained widely varying amounts of calcium carbonate, quartz and clay minerals. X-ray, differential thermal analysis, and infra-red analysis show evidence that the montmorillonite lattice is collapsed to some degree in these clays and that the clay mineral illite is present. There is also the possibility of mixed clay minerals consisting of layers of montmorillonite and illite crystal units. Figure 3 shows a comparison of one

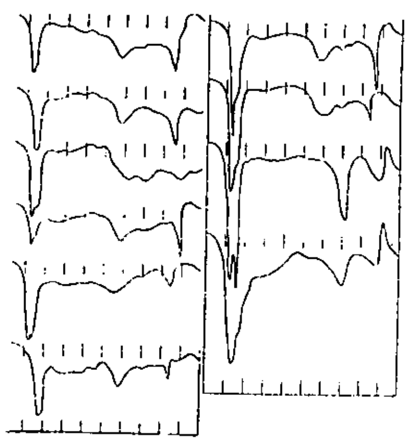


Fig. 3.—Differential Thermal Analysis diagrams for Bentonites. Curves on left for samples from Maungatu, Hawke's Bay. Right top two for samples from Porangahau, Hawke's Bay, followed by Volclay, Wyoming, U.S.A., and Panther Creek sample, Mississippi, U.S.A.

type of finger print of these clays and of two American bentonites. These finger prints are differential thermal analysis diagrams and they bring out most of the points mentioned. One of the principal uses of bentonites is as a bond for foundry sands. Grim and Cuthbert have shown that the montmorillonite clays like bentonite, which break down readily to individual units, become plastered regularly over the sand grains and bond them by forming wedge shaped blocks of clay and water at the grain boundaries. Mr. Russell and I have applied the work on the physico-chemical properties of the Maungatu and Porangahau bentonites to interpret measurements of the strength, permeability and bulk density of a standard sand bonded with these clays.

In the course of the work I have described there have been unusual opportunities, for a University teacher and research worker, of meeting other scientists in industry, in the research institutions and the other University Colleges. This has been stimulating and has brought me into contact with people combining first class fundamental work with applied research in fields where New Zealand workers do not have the disadvantage of continually struggling to keep abreast of much larger overseas teams. I feel that if more of us knew more of the work being done in our own country we would come much closer to resolving the differences of opinion on research in New Zealand expressed recently by Drs. McMeekan and Slater on the air and in the "Listener" respectively. The current practice of some University Colleges of paying only travelling expenses for members of staff presenting a paper at a conference such as this, does not help to improve the situation, especially for the younger people. However, this payment of fares is an advance in keeping with other improvements in the facilities and conditions for scientific work in this Dominion since Sir Thomas Easterfield did his work.

In preparing this address I have taken as my clue a story told about Lord Rutherford by Sir Henry Tizard. On one occasion, as President of the Royal Society, Lord Rutherford listened for half an hour to a young biologist reading a paper. When the paper was finished Rurtherford said: "Before I invite discussion on this paper there is one remark I should like to make. I have listened to you, Sir, for half an hour, and although I believe that I am considered to be a fairly intelligent man I have not understood a word you said. Now would you mind getting up again, and telling us in 5 minutes what you did, why you did it, and what results you got?" "And," said Rutherford, recounting the episode afterwards with great gusto, "he did get up again and he told us in 5 minutes, and it was very interesting."

In this Easterfield address, I have had the opportunity of telling you something of the research in which I have been interested. I hope the story has been in such terms that you will not feel as Lord Rutherford did about the young biologist's report. Rather, I hope my remarks have been like the last five minutes contributed by the young biologist in that they have provided the background and perspective to the details of the papers which the President and his co-examiners spent many half-hours considering.

THE RIGHT USE OF SCIENCE

BY KATHLEEN LONSDALE

Professor of Chemistry and Head of Department of Crystallography, University College, London.

(Based on a Lecture delivered at Victoria University College, Wellington, in September, 1954)

This is a scientific age and we have a great many problems to solve both as scientists and as citizens. They are not all connected with weapons, although the question of the relationship between security and rearmament and the part the scientist ought to play there, is one of the most pressing of these problems. But there are other problems. There is that of world population. In 100 years the population of the world has doubled. It was 1,170 million in 1850. It is about 2,400 million now and if present trends continue it will double again in the next century. Men do not die of disease if they can help it, and the result is that the world population is increasing by something like compound interest. That is a dilemma because these people then have to be fed and clothed, and in this science must play its part. Not only scientists but technologists and sociologists have to be called in to help.

However, the problem is not just that of the total number of people; it is a question of distribution. There are, to every square kilometre of cultivated land in Japan, 698 people. For Australia, the figure is 13, and for New Zealand, it is not much more. The figure is fairly high for other places, Ceylon for example, 451 and Puerto Rico 327, compared with Canada 16. Naturally agricultural areas are bound to be less densely populated than industrial ones. Nevertheless, it constitutes a real problem. In Japan every square inch of the land that can be cultivated is being cultivated and we now have the dilemma of a country that is not able to maintain its population unless it finds new markets or new land somewhere for its surplus population.

One of the difficulties in the way of emigration is concerned with race. That is another of our dilemmas: it is bound up with the question of minorities and with the fact that the people of Asia and Africa, generally speaking, are miserable and are becoming aware of their misery. They are also becoming aware of the fact that many white people despise them or, if they do not despise them, at least do not want to assimilate them. Now science states quite clearly that from the point of view of potential intelligence and character there is nothing fundamentally different between all the different races. But it is equally true that in their behaviour they may be very different. And if we break down the ancient taboos of subject peoples and do not replace them with any better kind of control, then many of them will become a danger. The trouble is that in many cases where we say we are educating people for self-government we in fact only educate them enough to know how to hold a rifle or to read comic strips. This problem will have to be dealt with because most of the population increase is just in the regions of the technically under-developed peoples.

Science is now helping industrialised peoples to have radios and electric lights and many other things that make them very comfortable. But the peoples of Asia also want electric lights and radios and bicycles and motor-cars and the things that they feel we value so much. Science could solve problems of operational research in connection with distribution, but we do need also to consider how fast we are using up the world's resources and whether we can replace them or conserve them, and how to do it. Related to this desire on the part of people to have the luxuries they see around them, is the spread of Communism. Communism effectively offers a man his landlord's land and it offers him a decent standard of living. Most men are not particularly concerned with Government—they are more concerned to have a good living than to have a good government. In Japan many people are troubled about the problem of Communism within their own nation. They are not particularly concerned with the problem of Communism outside their own nation. They realise that the best way of combating Communism within, is to put their house in order, but they do not know how to do it. Many of the young people are anxious to know how they can exercise their new-found democracy and at the same time keep their 'peace constitution'. They feel there must be some way of dealing with the possibility of revolution yet they dread the formation of the nucleus of a new army which might lead to a military dictatorship.

This is a real dilemma which brings us back to the question of security and rearmament. Can we, in fact, keep the peace by means of armaments? Can we get peace through strength, and in that case is it right for the scientist of any nation to take part in making his country strong? We must realise that there has been for many years a belief on the part of scientists who invented what they thought to be desperately dangerous weapons, that they would prevent war. Nobel thought that his invention of dynamite would prevent war, but it did not. The Cambridge Modern History of 1910 describing the condition of Europe at that time states: "On the whole, the acceptance of this tremendous military equipment makes for peace. The consequences of war would be felt in every household, and statesmen as well as nations shrink from the thought of a conflict so immense." We did not learn our lesson then and afterwards, between the wars, we began to rearm again. It is sometimes said that we were unilaterally disarmed. This is, of course, quite untrue. Winston Churchill said in the House of Commons in 1936, "I cannot believe that after armaments in all countries have reached a towering height, they will settle down and continue at a hideous level far above the present level, which is already crushing, and that that will be for many years a normal feature of the world's routine . . . Either there will be a melting of hearts and a joining of hands between great nations . . . or there will be an explosion and a catastrophe the course of which no imagination can measure, and beyond which no human eye can see." The point is that 'peace through strength' is a gamble. On the other hand it is realised by many people, particularly by statesmen in Great Britain, that you must either be one thing or the other. You must either be as highly armed as you can afford to be, or else you must be disarmed. But in that case, you have got to face the implication of complete defencelessness. Yet on the other hand, as scientists frequently tell us nowadays, there is no defence. We cannot therefore escape the dilemma.

A scientist by his training does have the qualities of a good citizen. In the first place he is seeking after truth and he must therefore be above all things honest. The scientist, if he makes a mistake, has to admit it; he has to publish a contradiction, a correction to his previous work. He indeed has to calculate his probable error. It would be a very good thing if statesmen had to calculate their probable errors, especially if they would sometimes admit that they had made a mistake. Certainly the scientist by virtue of his training ought to be able to distinguish fact from rumour, and he ought also to be able to realise when the deduction he is making from certain observations is fully justified, or when it needs further investigation before it can be said to be true.

The second thing about the scientist is that he must be objective and disinterested. He must never think in terms of prestige; neither his own personal prestige, nor the prestige of his own university, nor that of his nation. Science is something that is, or ought to be, shared. Truth is no monopoly of any nation, and the scientist's object is to advance knowledge. He must, if he can, put his own personal disabilities on one side. He uses instruments which are more trustworthy than his own unaided senses.

Then thirdly, he must have an open and flexible mind. He has to realise that he never has the whole of truth; that what is truth to him today will be error to the next generation. That is, he has to make his observations and his deductions objectively and as honestly as he can, recognising that they will almost certainly be superseded, and recognising that others will come after him who will know more than he does. He may sometimes find that he has two sets of apparently contradictory data, or that he has two theories which seem to explain the facts equally well. Sometimes he has to think on an entirely new plane. Sir William Bragg, referring to the difficulties of the electro-magnetic theory and the corpuscular theory in relation to the nature of X-rays, said that what had to be done was to find one theory that combined the nature of both. He was perfectly right. But in order to do that the scientist has to be prepared to think in a new way. We have got now to a stage in political affairs where we have to be prepared to think in a new way. Some of our dilemmas are otherwise apparently completely insoluble. In the words of Dr. Brock Chisholm, the former Director-General of the World Health Organisation, "We would do well to start from the assumption that all our ancestors have been wrong."

The scientist also has to have the courage of his convictions, even though he knows that he has not the whole of the truth. He must resist pressure whether by the Church or by the State to believe certain things. He cannot accept direction of that kind. Nor indeed should he submit to the pressure of public opinion. He has to state the truth as he sees it and to give his observations and deductions as honestly as he can, irrespective of pressure.

And of course he has to have an international outlook. Nearly 150 years ago, Sir Humphrey Davy was criticised for having accepted a medal from Napoleon at a time when England and France were at war, and his reply was: "Statesmen and nations may be at war, but men of science are not. That would indeed be civil war of the worst description." It is questionable whether we have gone forward or back since then. Nevertheless, scientists who travel in different parts of the world find that they have common ground even with those scientists who do not speak their language or who live under entirely different political systems. They have the same fundamental training and a common aim.

There are people who believe the world would be a better place if all scientific investigation were stopped. We cannot accept that point of view. It is true that scientific, like all other knowledge, can be used for good or evil. Those of us who undertake scientific research work often have to take that risk. Our work may be misused. But there is a difference between the acceptance of such a risk and the deliberate choice of work, however ordinary, which one either knows or suspects to be intended for wrong use. It is essential therefore that we, as scientists, should consider carefully the implications of the work that we do. We cannot evade that responsibility by pleading that the work, in itself, is good work and that it is others who decide to what use it should be put. In this connection secrecy should be a danger signal to any scientist. Secrecy is contrary to the scientific ethic. The scientist is dependent upon the freely-published work of his predecessors and he has no right to connive at the concealment of truth. We all realise that it is wrong to twist the truth at the direction of one's employer. It is equally wrong to hide the truth. It is not suggested that it is legitimate to break promises of secrecy that have been made—work that requires such promises should be avoided, or such promises should not be made.

Some scientists argue that because they are members of a democracy they have no right to refuse to do any kind of work that the people, through their elected Government, ask them to do. To this there are two answers. The first is that democracy does not mean the dictatorship of a majority: it means government by discussion. The opinion of a dissenter is of importance and no truly democratic government would force any man to do that which he believes to be wrong. The second answer is that most of these dilemmas occur in connection with war and war preparations. Now war itself, and negotiations from strength, are entirely undemocratic by nature; they decide who is strongest, not who is right, and no war service can therefore be demanded in the name of democracy.

The truth is that what faces us today is not just physical insecurity, but mental and spiritual insecurity. The question we really have to face is whether we can make the present scientific and technical revolution serve man instead of destroying him. To be able to do that we must also serve God; and there surely is the crux of the matter. Do we believe in God, and what sort of God do we believe in?

Sir Walter Moberly in "The Crisis in the University" has pointed out that our university education today is not merely agnostic, but definitely anti-God. By implying, in our teaching and our lives, that God can be left out of account, we teach, and teach most effectively, because most insidiously, that God does not matter. If it is true that God can be left out of account then that is all right. But if it is not true, then it may be that all our values are unreal and that nothing is quite what we think it is. It may be that the reason why we, as scientists, are unable to help solve the world's dilemmas, is that morally we ourselves are displaced persons and that essentially these dilemmas are moral and not technical ones. It is surely essential that we who are university teachers should clear our own minds, not in order to restore theology to the curriculum, but because what we believe will communicate itself through our way of life to our students and to others. We simply cannot sit on the fence: if we do that, we are effectively making our choice and conveying it to them.

Another very sound point that Sir Walter Moberly makes, is that many of our international difficulties come about, not through the villainy of villains, but through the canker in the righteous. No doubt if Hitler had had atomic and hydrogen bombs he would have used them. If he had, we would certainly have regarded it as his crowning villainy. But he did not. It was we who used them. The scientist must face the moral implications of this question and make up his mind about it.

Turning now to the problem of food production, it is possible for a great deal more to be done towards the alleviation of poverty and famine and misery in the world today. The world would support, and support well, a vastly increased population. At a recent British Association meeting, Sir John Russell and Sir William Slater both spoke on this problem and showed many ways in which we could actually increase the production of food in the world now. Sir John Russell pointed out that 1½ acres per head, if cultivated intensively, would give a British pre-war dietary and there is in fact a great deal more land than that in the world that could be intensively cultivated. He also pointed out that a great deal less land would do if we had a vegetarian diet. There are many ways of bringing more land under cultivation. We are beginning to know how to change climates, how to bring about changes by afforestation, and how to prevent erosion. It may be possible to initiate vast schemes of irrigation using sea water from which the salt has been removed. We could certainly do more research than we do at present if more money were available. We could do more to improve yields. Public health measures for plants and for animals could be undertaken on a much bigger scale than at present. We could find new sources of food. There is much food in the sea, quite apart from fish, that is not being used. There is also the possibility of synthetic foods, and it cannot be said that these need be dull when, for example, nylon is compared with cotton. We could use mechanisation in agriculture much more than we do. In order to do that we would have to have more power. The writer remembers seeing in India, five men pulling a lawnmower outside the Taj Mahal. Five men were cheaper than one motor, but you cannot have a decent standard of living when men do that kind of work. Yet India cannot mechanise her country and develop her resources as she should without capital and that capital cannot come from within when there is nothing to tax. It will have to come from without. You do not necessarily, by decreasing infant mortality and reducing disease, merely make more mouths to feed. Actually, and this is brought out very carefully in the United Nations document, "The Cost of Sickness and the Price of Health", what you do is to increase the number of breadwinners. A country is better off if there are more people in the breadwinning age group relative to the number of children and invalids and very old people. Therefore, by increasing the number of healthy breadwinners, you are in fact putting up the standards of living, provided that the natural resources are also there to be developed, and the capital is available to do it. One of the main difficulties is that of uneven distribution, and here again the scientists might be able to help but still more is the problem one for the citizen.

There are many economic problems that have to be faced when it comes to the question of the use of science. Artificial wool, provides a good example. We cannot forsee the extent to which this will be developed, but if it is, it will considerably affect the economy of many countries, including Australia and New Zealand. And indeed the work of the scientist does very often have the most profound effect on the economy of a country. The fact that uranium can be used to make bombs or to provide atomic power made Belgium prosperous just after the last war because of the high-grade uranium ore in the Belgian Congo. Anybody who travelled in Western Europe could see how prosperous the Belgians were compared with other nations. But there is uranium also in Czechoslovakia and in Eastern Germany, and since there is military and economic rivalry in the world, the Soviet Union had to get hold of those countries. You could not expect the Soviet Union to let all the uranium in the world come under the control of the Western nations as long as rivalry exists. Hiroshima made the rape of Czechoslovakia inevitable. Who foresaw that, when the pros and cons of the atomic bomb were considered. When the scientist has found something which is not evenly distributed, but which is concentrated in certain parts of the world, he is, by his work, contributing to political tension and he cannot disclaim the responsibility that is involved. He may not be able to exercise his responsibilities directly, except as a citizen; but even as a citizen he has special knowledge and therefore, since knowledge is power, he has special power.

That brings us back to the question of the choice between right and wrong. The story is told of an Irishman who had not led a very good life and who on his deathbed was asked whether he would return to God and renounce the devil. His reply was that he would very willingly return to God, but he hoped they would not ask him to renounce the devil, because just at that solemn moment he did not want to give offence to anybody.

You see he was not quite sure, and as scientists we are not quite sure whether evil is more powerful than good. We have got to make up our minds about that because it will affect our behaviour. We cannot have it both ways.

ORIGINALS FOR LANTERN SLIDES

BY R. M. DOLBY,

Dairy Research Institute (N.Z.), Palmerston North.

"Half way through the lecture the speaker apparently discovers that he needs slides. There is shouting for the lights to be put out, the blinds to be drawn. Down go the blinds and after a frantic hunt the switches are found. Out go the lights including that of the projector. In due course by tolerating one or two lights whose bulbs cannot be reached because of their height, the visual aids come into action. Something resembling the Rosetta stone appears on the screen. After several attempts on the part of the operator, the illumination is adjusted so that the dark shadows disappear and in due course the symbols can be recognised as our normal alphabet and numerals. But can we read them? No, sir! The original was hand printed without guides by an unskilled operator who found that he had more material than the foolscap page would hold so that some compression was needed at the bottom. To add to the hazards a projector was used with a wide angle lens placed well below the screen. The resultant angle made it impossible to have the whole picture in focus at once. The next slide is put in. This time the language is seen to be English but as in a mirror. This is rectified by the operator who produces an image which is upside down. And so it goes on. Our interest has evaporated, we light our cigarettes and pray for light. Do I exaggerate? Unfortunately no. The above recital is merely a condensed description of three lectures attended in the recent past—one of them given at one of our universities where the speaker was a famous overseas scientist. The lecturer threw on the screen an assortment of symbols with the comment. "It is obvious to the meanest intelligence that x shows a marked correlation with y." The slide was so congested that with the best intelligence, goodwill and eyesight it was impossible to assimilate the material in the time available."

This apt description by Whittlestone (1) pictures a misuse of slides which we have all experienced—even at Institute Conferences. The prevalence of illegible slides shows that many lecturers have a much too optimistic idea of the amount of material that can be included in a slide and imagine that the photographic process can correct the defects of a poorly lettered original. This article is intended to draw attention to the information available on the making of originals for satisfactory slides.

The two principal requirements of slides are:

1. Legibility.
2. Intelligibility.

The letters and figures on the screen must be large enough and sufficiently clear to be readily legible from all parts of the lecture room. The presentation must be such that the meaning is clear to the audience. The amount of numerical data or reading matter should not be more than can be read and assimilated in the short time the slide will be shown. A slide showing a table with many columns and rows of figures will certainly be illegible to most of the audience and the few who can decipher the figures will have difficulty in grasping the significance of the mass of data. If the table is subdivided and shown as two or more slides, each dealing with one section of the data, both legibility and intelligibility will be improved.

SIZES OF SLIDES

In recent years, small slides made on 35 mm. film and mounted in holders two inches square have largely displaced the older 3¼ x 3¼-inch slides. Any loss of quality through use of the smaller slides is barely detectable except with critical subjects requiring the maximum resolution. The 2 x 2-inch slides have great advantages in cheapness and ease of preparation. A set of slides for a lecture can be carried in the waistcoat pocket and can be shown efficiently with a projector which packs into a small attache case. In comparison with this, a projector for 3¼ x 3¼-inch slides is a very clumsy affair.

In most towns there are firms which will make up 2 x 2-inch slides.

Where slides are to be used for only one or two lectures, cardboard holders are quite satisfactory. Colour slides and slides which are to be shown repeatedly should be mounted in glass.

The discussion below applies particularly to 2 x 2-inch slides but, except for size and shape of frame, also applies to 3¼ x 3¼-inch slides.

The 2 x 2-inch slides give a rectangular frame 35 x 23 mm., i.e., a length to width ratio of approximately 3:2. The greater dimension may be either vertical or horizontal but in the majority of slides it is horizontal.

SIZE OF LETTERING

Saxby et al. (2) have concluded that, for optimum legibility in either large or small halls, the height of the letters or numerals should be not less than 1/40 of the greater dimension of the frame. Taking one letter space (width of letter + width of space between letters) as 1½ times the height of the letters, the width of the frame is 32 letter spaces (including margins of two spaces each). The maximum number of lines is 12.

Whittlestone (1) recommends approximately the same height of letters but by taking a letter space as equal to the letter height, arrives at 55 letter spaces per line.

Lower case letters, having only about 2/3 the height of corresponding capital letters are less legible. The letter heights given above, though based on capitals, make allowance for use of lower case letters.

Bold letters are more legible than larger, thinner letters. Saxby et al. (2) recommend that the thickness of the stem of the letter should be not less than 1/6 of the height of the letter. The thickness of lines on diagrams is also important. If too thin they will be lost in reproduction.

Slides with white lettering on a black background are less legible than slides with black lettering on a white background, since white letters tend to blur and run together. The short-cut of projecting a negative instead of a positive is therefore not to be recommended.

Apart from size of lettering, good legibility requires that the letters be sharply defined and show a maximum contrast with the background. It is, therefore, important that lettering and drawing should be done in Indian ink on good quality white paper. The photographic materials used must preserve this contrast.

The application of the above principles to various types of originals for slides will now be considered.

1. *TABLES*

(a) ***Hand-lettered material.*** No one but an expert should attempt freehand lettering on an original for a slide. Originals of excellent quality can be produced by use of lettering guides (Wrico or Uno). Whittlestone (1) recommends that the original be drawn on paper 18 x 12 inches using letters 3/8 inch high (Uno U.C.6, U.L.6 or U.F.6) and a pen which gives a line 1/16 inch wide (Uno No. 4). Lines should be spaced one inch apart between bottoms of letters.

The smallest size lettering which should be used on an original is about 0.2 inches high (e.g. Wrico VCN 200) for a frame size of 9 x 6 inches. Spaces between lines should not be less than the height of the letters.

(b) *Typed material.* A typed original gives a slide of somewhat lower quality than one from an original hand lettered as above. In the absence of lettering guides or where time is not available to use them, quite satisfactory slides can, however, be made from typed originals.

With pica type (10 spaces per inch) the table should not exceed 6 x 4¼ inches. The lines should be double spaced. The type must be clean and the ribbon (if used) should be new. The clearest results are obtained by disengaging the ribbon (as in stencil cutting) and typing direct through unused carbon paper on to white bond paper backed with another sheet of carbon paper reversed to print on the rear surface (3).

(c) *Printed matter.* In the reproduction of tables from books or journals the same ratio of letter size to frame should be observed. For a table in which the type corresponds to that used in this article, the maximum size for good legibility would be about 3½ x 2¼ inches.

2. *DIAGRAMS*

The rules for letter size given for tables apply equally to lettering and numerals on graphs or diagrams. All lines should be bold. Graph lines should be heavier than lines for axes or reference lines. Grid lines on graphs should be kept to a minimum or, better still, eliminated altogether. Whittlestone (1) recommends that on an 18 x 12 inch drawing the principal lines should be 1/16 inch thick and subsidiary lines not less than 1/32 inch thick.

The same principles apply to figures in publications. If the lines are thin or the lettering small in comparison with the size of the drawing, it will not reproduce well. In such a case it would be necessary to re-draw the figure on a larger scale with lines of appropriate thickness. A photographic enlargement of the figure would save a good deal of labour in this operation.

PHOTOGRAPHIC TECHNIQUE

Since many books on this subject are available it is unnecessary to discuss it here. For those interested in processing slides the Kodak Data Books on "Copying" and "Slides" will be found particularly useful.

"SPOTTING" THE SLIDE

The system accepted as a British Standard and also in current use in the U.S.A. is as follows:—

The slide is marked with a single spot on the lower left corner when the slide is viewed as it should appear on the screen. The slide is placed in the projector with the spot in the upper right corner facing the lamphouse.

An older system used two spots which marked the two top corners when the slide was placed in the projector. Many slides, however, are marked with two spots on the bottom corners. Confusion can be avoided if the standard single spot system is followed.

REFERENCES

1. Whittlestone, W. G. Proc. N.Z. Dairy Science Assn. 1953, 1.
2. Saxby, S. H., Scott, R. H., and Averis, M. W. N.Z.J. Sci.Tech. 36B, 191 (1954).
3. Kodak Data Book, "Slides".
4. Kodak Data Book, "Copying".

SPEAKING IN PUBLIC

By J. K. DIXON,
Deputy-Director, Soil Bureau, D.S.I.R., Wellington.

It is the experience of listeners at Scientific Conferences that much good material is spoilt by poor preparation or presentation. It is up to all of us to improve the verbal presentation of our results so that they are easily understood by the audience to whom they are directed. It requires just as much, but different, preparation in getting a message across to an audience as it does in assembling the scientific data. The following notes are compiled as a guide to speaking in public:—

BEFORE THE TALK

(1) Decide what your audience is likely to be and plan accordingly. Your aim is to hold the audience's interest from first to last. Therefore, use words they can understand. Make certain you know how long you are expected to speak. If you cannot find out do not speak over three-quarters of an hour. This is about all an audience can stand at one burst: they will appreciate the opportunity to ask questions.

(2) Write out what you want to say in the time available. For longer talks mark your notes with the times it should take to reach certain points so that you can judge whether you are keeping to schedule. It is very annoying to the chairman, the audience and yourself, if he has to tell you your time is up when you have barely passed your introduction.

(3) Get the material in a logical order so that a theme can be developed. If the title is not self-explanatory or is all-embracing, aim to tell the audience briefly the scope of your talk. Try always to stick to the title you gave originally as it is unfair to the audience not to do so. It is appreciated that sometimes you must give a title three months or so before a talk and in the intervening period the emphasis may be altered. This should be stated clearly. Try to start on a good point to catch the audience's interest, hide your weaker points in the middle; if they are very weak, say so boldly, rather than have it dragged out of you by a question afterwards. Finish with strong points so that the audience can come away with something positive. As you finish summarise the points that you have made.

(4) If you can speak extempore do so, as you can hold the audience's attention more easily that way. In this case, prepare headings to aid your memory so that you do not get off the track when you are on your feet. If you cannot speak fluently with the aid of headings only it is better to read your talk, in which case you should prepare a manuscript with key words underlined so that you can pick up your place easily and give a flow to your talk. If you decide to read your talk, try as far as possible not to look as though you were reading it. This can be achieved by thoroughly familiarising yourself with the text so that it becomes almost memorised; you will then find that a brief glance is all that is needed to enable you to read several sentences as though extempore. If you are going to have to read during the projection of slides see that a reading lamp is provided and that it does not throw a glare towards the audience.

(5) To aid your lecture you should use diagrams, maps and slides. All these reattract the audience's interest if it has been wandering. Try to integrate your talk and the slides so that there are no awkward pauses. Some speakers use slides, etc., in place of notes to guide them through a lecture. This should not be over done since you may have to speak in the dark most of the time and you thus lose a tie with your audience. Select your slides carefully and do not show any more than necessary to illustrate your points.

(6) Do not anticipate a good lantern or lighting. Make certain that any maps or diagrams you use have the main areas showing up boldly—if not, colour them up. Make sure that your slides are good ones. If possible, try out the lantern before the talk so that you can make any modifications to your material if necessary.

When using slides make sure that they are in the correct order. Either number them or provide the operator with a list so that if there is any mistake he can get them straight without interrupting your talk. Arrange for some unobstrusive signal for the operator for changing slides. This may be a low-voiced request for the next slide, a light tap with pointer on the floor, a press button with a light flash at the lantern or perhaps it is better still to work the clue into your talk such as "in the next slide you will see . . ."

(7) Rehearse your speech beforehand, either to yourself or a colleague so as to get the timing and to fit your illustrative material in to the best advantage. Be thoroughly familiar with your material. Read your speech or outline over a number of times before the day. Most facile speakers, although it may not be apparent, put a lot of preparation into their talks.

AT THE TALK

(1) Arrive early so that you can be sure the arrangements made are as you understand them.

(2) Make certain you choose a spot where your notes will be well illuminated and that there is some device that will hold your notes at breast level. This will mean that you will not have to keep your head down to read your notes and will enable you to keep an eye on your notes and yet look at the audience.

(3) Get your maps or diagrams pinned up before the time the lecture is due to start. Similarly, write up figures, etc., on the board beforehand so that you do not have to waste time writing up nor have to talk into the board. When you use aids such as this, try to face the audience as much as possible while pointing out the important facts on the board or diagram. If you use the pointer in your right hand stand in the audience's view, on the right hand of the board.

This means that in using the pointer you do not cover part of the board with your body and it enables you to face at least half right or left to your audience while still being able to see the board comfortably. Do not wave your pointer about unnecessarily as the audience will not know if you are bringing out a point or not. Use the pointer definitely and then take it away. When commenting on slides raise your voice if your head is turned away from the audience. Do not pass material round the audience because while they are looking at it they are missing your talk. Hold up material for illustration and tell the audience they can look at it more closely afterwards if they wish.

(4) Look at your audience when speaking so that some direct contact is obtained. It is good practice at the start to address someone at the back of the hall so as to project your voice but the experienced speaker will make the audience feel that he is addressing all of them. Try to speak with authority and enthusiasm. You were asked to speak because you have authority on your subject and if you are not enthusiastic about it you should not accept the invitation to speak. There is a speaker-audience interaction. If the audience feel that you are getting across an interesting message to them they will react and you will notice that they are following you closely; you will then speak better because of their interest.

(5) Do not apologise for any part of your speech. Whether you are asked to speak for fifteen minutes or an hour it is up to you to fit your speech to the time available and on no account should you exceed your time. If you have only fifteen minutes do not tell the audience how well you could have done it in an hour. That is a discourtesy not only to the organisers of your talk but also to the audience that came to hear you for fifteen minutes. If you cannot accept these conditions it would be better not to speak.

(6) Unless it is to a specialist audience of equal calibre to yourself, do not try to crowd too much into your talk—the audience will not appreciate it. They will appreciate it if you make three—five good points that you have logically developed.

(7) Stand up, speak up and look up. Don't drop your voice at the end of a word or for the latter part of a sentence. Try to enunciate all words clearly. Watch your phrasing. It is better to speak in short sentences than to leave your audience hanging in mid-sentence while you think out the end. A moderate rate of speaking is best but try to put some light and shade into your delivery so that your voice does not become monotonous. Open your mouth so that the words get out. Most halls have poor acoustics so make an earnest attempt to reach the man at the back.

COUNCIL MINUTES

ABRIDGED MINUTES OF THE COUNCIL OF THE NEW ZEALAND INSTITUTE OF CHEMISTRY HELD IN WELLINGTON ON THURSDAY, 24th FEBRUARY, 1955.

PRESENT:

K. M. Griffin, President, in the chair; Dr. M. M. Burns, Vice-President; B. E. Jackson, Auckland proxy; N. T. Clare, Waikato delegate; Dr. F. H. McDowall, Manawatu delegate; T. A. Rafter, Wellington delegate; F. H. G. Johnstone, Canterbury delegate; Dr. G. A. Bottomley, Otago delegate; V. J. Wilson, Registrar; W. G. Hughson, Hon. General Secretary-Treasurer. An apology was tendered on behalf of B. G. Stanley, Assistant Secretary.

WELCOMES:

The President welcomed Dr. Burns, Vice-President, to his first meeting, and on behalf of Council congratulated him on his appointment to the Council of Scientific and Industrial Research. Welcomes were also accorded the following newly elected delegates to Council:— N. T. Clare, Dr. McDowall, T. A. Rafter and Dr. Bottomley.

FEBRUARY MEETING OF COUNCIL:

Views were expressed for and against the present procedure of holding the first Council meeting of the year in February. The President pointed out that it was almost impossible to convene meetings of Branch Committees during the holidays. Minutes from the meeting of Council held on 26th November 1954 were not in his hands till a few days before Christmas and the Agenda for the February meeting was distributed too late to enable delegates to issue instructions to proxies.

Several members considered the February meeting necessary to ensure the efficient functioning of the Institute. Six months without a meeting would be a long gap.

Auckland tabled a motion that the February and May meetings be replaced by a Council-in-person meeting in late April. In the light of further discussion the motion was withdrawn in favour of the following motion and an understanding that additional meetings of Council-in-person would be considered under "Finance" (see below).

Resolved: That the main agenda calling meetings of Council be dispatched at least 15 days before the date of meeting.

SUB-COMMITTEES OF COUNCIL:

Conference 1955 *Speakers: Resolved:* That the principle of inviting an Overseas Speaker be approved and that the Conference Committee's suggestion of Professor C. M. Johnson be endorsed.

Presidential Address: Mr. Griffin suggested that the Chairman of the N.Z. Section of the Royal Institute of Chemistry be asked to give his Chairman's Address at Conference. Mr. Griffin was prepared to give his Presidential Address before the Auckland Branch.

Dr. McDowall agreed to bring the above matters before the Conference Committee.

Future Conferences: The following tentative list is submitted to branches for confirmation at the next meeting of Council:—

This year—Palmerston North
1956—Auckland.
(A.N.Z.A.A.S. in Dunedin in January, 1957)
1957—Canterbury
1958—Hamilton
1959—Dunedin
1960—Wellington

A.N.Z.A.A.S. (*Melbourne* 1955 *August*):

Resolved: That Mr. T. A. Rafter be appointed as one of our Delegates to A.N.Z.A.A.S., Melbourne, 1955, and that the President, Vice-President and Hon. Gen. Sec. be granted authority to select a further Delegate when names of members going are obtained.

Examinations Committee:

The official list of passes in the November examinations was received from the Committee. The Secretary of the Committee had tentatively advised candidates of the results.

Resolved: That the list of passes in the November Laboratory Assistant's Certificate examinations as forwarded by the Examinations Committee and as presented by the Registrar be approved and that official notification be now sent to each candidate.

Resolved: That the Examinations Committee be asked to consider ways and means of officially notifying candidates as soon as the pass list is prepared and to bring down proposals to the next meeting of Council.

Prizes:

A letter was received from Dr. W. S. Metcalf emphasising the difficulties facing would-be applicants for the various prizes, e.g., whether you applied personally, or waited to be nominated, and precisely what each prize was awarded for.

Resolved: That information of an explanatory nature be inserted in the Journal once a year, regarding prizes.

The President asked Delegates to stress the need for Branch Committees to make nominations for the I.C.I. prize and to suggest to likely members that they enter for the Morcom Green and Edwards prize (and the Chemical Essay prize in 1956).

MEMBERSHIP:

Resolved: That the resignation of L. R. L. Dunn be accepted with regret and that the official letter to him acknowledge the appreciation of Council for his active interest as a member and as an official.

Resolved: That the resignation of I. W. Knaggs, Auckland, be accepted with regret.

FINANCIAL:

Secretarial and Duplicating Expenses: Consideration was given to the figures in the agenda which showed over the past three years the amounts for printing, stationery, duplicating and addressing, portion of which is now included in the Registrar's salary. Consideration has already been given to the earlier issue of agendas but it was generally felt that routine correspondence should be speeded up.

Resolved: That Council agrees to increase the fee to Technical Publications from £120 to £200 per annum as from January 1st, 1955.

Meetings of Council-in-Person:

Travelling expenses for each of the quarterly meetings of Council over the past three years were set out to enable Council to consider the question of more Council-in-person meetings, i.e., meetings where delegates from the six branches attend with expenses paid. At present delegates attend two meetings on this basis and for the other two meetings they either appoint proxies or pay their own expenses.

Resolved: That Council pay Delegates' expenses for the May, August, and November meetings in 1955 and for four Council meetings in 1956 and that future policy be kept under review.

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

Resolved: That Council nominate Dr. H. N. Parton, Professor of Chemistry at Otago University as a member of the National Commission for U.N.E.S.C.O.

CHEMISTRY IN SCHOOLS:

This item is over to branches. Several Delegates stated that the teaching of General Science in schools did not help the study of Chemistry or the other pure sciences at University.

We must consider the future of our profession if teachers are not available and the Waikato Delegate said this was the case in girls' schools in the Waikato.

The Vice-President said that we had a large number of teachers in the Institute and he suggested that branches arrange special meetings of or with the teachers to discuss this question and to bring down recommendations.

SALARIES:

Recent rises in Australian salaries for scientists as reported in the morning's Dominion were discussed.

Resolved: "That telegrams be sent immediately to the Hon. R. M. Algie, Minister for Scientific and Industrial Research, and to the Hon. K. J. Holyoake, Minister for Agriculture, and Acting Prime Minister, worded as follows:—"The Council of the New Zealand Institute of Chemistry is deeply concerned at the almost certain loss of key scientific personnel to Australia following further major salary increases in New South Wales and reported in this morning's Dominion."

BRANCH LECTURES:

The agenda set out the text of a recommendation to Council that financial encouragement should be given to branches so that lecturers could be invited from other parts of New Zealand. After lengthy discussion the following resolution was passed—

Resolved: That this matter is of such importance that it be referred to branches, with notes of this discussion, and that it be further considered at next meeting of Council.

NOTES ON THE DISCUSSION FOR THE INFORMATION OF DELEGATES AND FOR BRANCH COMMITTEES:—

The President quoted instances of lecturers from other centres where increased attendances had not resulted. Wellington Branch, however, claimed much better attendances for outside speakers. Some branches favoured a direct increase of grant to branches, whereas others did not consider that this was the procedure to be adopted. The Vice-President instanced the fact that each branch had specific interests and had overseas visitors to their particular institutions. These visitors could be asked to give lectures at the expense of individual branches. Contra to this suggestion it was thought that a series of lectures would be better organised from headquarters. Further to this latter point it was suggested that perhaps any money available should be built up to bring or help to bring prominent overseas lecturers to New Zealand on the occasion of the annual Conference. This lecturer could then be paid expenses to lecture to the six branches.

The President said some of the money might be well spent in running a public speaking course for our own members as suggested by Professor Worley some years ago in Auckland.

(The attention of members is specifically drawn to the last two items in the above minutes. Both are extremely important to our Institute. Regarding Branch Lectures, the discussion originated from the Wellington Branch recommendation to Council that.—"This Branch considers that the regular lecture delivered to the branch a very important part of the contribution of the Institute to its members, to the profession, and to the subject of Chemistry. We believe that a proportion of the expenditure of the N.Z.I.C. commensurate with the importance of such activities should be set aside to finance them generously, thus allowing, among other things, a selection of lectures from throughout the country and the wider advertisement of their lectures."—Editor.)

Conference, 1955

Arrangements are now well in hand for the holding of the 1955 Conference at Massey Agricultural College, Palmerston North. A Conference Committee has been appointed and duties have been allocated amongst the members as follows:—

Chairman: Dr. F. H. McDowall.
Secretary-Treasurer and Excursions: Dr. G. W. Butler.
Refreshments: Professor C. R. Barnicoat.
Programme and Trade Displays: Dr. R. M. Dolby.
Publicity and Transport: Dr. J. W. Lyttleton.
Accommodation: Mr. C. V. Fife.
Booklet: Dr. W. A. McGillivray.

(Professor Barnicoat and Mr. Fife are representing the New Zealand Section of the Royal Institute of Chemistry.)

The date of the Conference is confirmed as midday Tuesday, 23rd to midday Friday, 26th August. All members should have received an invitation to Conference and replies were asked for by 25th March. However, every endeavour will be made to provide accommodation for late enrolments. These should be forwarded to Dr. G. W. Butler, P.O. Box 623, Palmerston North.

The Conference Programme will be finalised and, it is hoped, one or more symposia arranged, as soon as details are available of the papers offering.

NEWS AND NOTES

Dr. W. S. Metcalf has resigned from the position of senior lecturer at Victoria University College and in May will take up the appointment of senior lecturer in chemistry at Canterbury University College. Dr. Metcalf, who is at present a member of the Wellington Committee, has been senior lecturer at Wellington since 1946.

Dr. G. M. Richardson is transferring from the Nutrition Research Department, Dunedin, to the recently opened National Health Institute in Wellington.

Miss M. P. Bartrum, for several years a chemist in the Agriculture Department, at Lincoln and later at Ruakura, has joined the staff of the Dominion Laboratory, Auckland.

Dr. D. J. Ross has just returned from five years abroad as a member of the New Zealand Defence Scientific Corps. He spent three years at the London School of Hygiene and Tropical Medicine where he was awarded a Ph.D. for his work on the chemistry of mould products. He also obtained a Diploma in Bacteriology from the same school. Before returning to New Zealand, Dr. Ross spent two years at the Microbiological Research Department of the Ministry of Supply. He is now a member of the biological unit of the soil bureau and is working at the soil experimental station at Taita.

Mr. A. W. Mackney and Mr. D. L. Stacey, of N.Z. Forest Products' Ltd., Auckland, will attend the Annual Conference of the Australian Pulp and Paper Industry and Technical Associations, to be held in Melbourne early in March.

Mr. H. J. Wood, senior chemist of the food section of the Dominion Laboratory, has left for Australia where he will spend four weeks investigating recent developments in food analysis. Mr. Wood, who is particularly interested in the handling and processing of eggs, will visit Dr. Vickery, who is in charge of the food preservation and transport at the C.S.I.R.O.

In August of this year, Dr. H. Bloom, of the Chemistry Department, Auckland University College, will leave for the U.S.A. on sabbatical leave. Dr. Bloom has been granted a Fulbright award and will work at the University of Pennsylvania under a grant from the Atomic Energy Commission of the U.S.A. He will be away for about nine months and will be accompanied by his family.

Late in February, Mr. W. Wilson, of the Dominion Laboratory, Auckland, left for the United Kingdom and the Continent. Mr. Wilson intends to spend most of his leave of absence in Sweden, specialising in wood chemistry and geothermal work.

Mr. J. Barnes, formerly of Dominion Industries (Linseed Oil Division), Dunedin, has been appointed chemist in the new processing plant of the Dairy Products' Marketing Commission, Auckland.

Mr. Geo. Lambert leaves in April for America and Europe. He will be away for three months.

At the February meeting of Council, the Laboratory Assistants' Certificate was awarded to Miss Florence M. Rodgerson, who is working with Dr. R. Gardner, Dunedin.

Dr. J. W. Lyttleton, Grasslands Division, Palmerston North, has been awarded a Dominion Civil Services Commonwealth Fund Fellowship. Dr. Lyttleton will be leaving for the United States in October of this year and plans to work with Professor S. Wieldman at the University of California and with Professor J. Bonner at the Californian Institute of Technology. He will also be visiting a number of research centres, particularly the Biophysics Department of the University of Wisconsin.

Dr. S. Y. Thompson, a well known British worker in the fat-soluble vitamin field, is at present spending a period of leave in New Zealand. A graduate of the University of Reading, Dr. Thompson is Principal Scientific Officer in the Nutrition Department of the National Institute for Research in Dairying at Shinfield, Berkshire. His visit to New Zealand is sponsored by the Royal Society and the Nuffield Foundation and by the Dairy Research Institute (N.Z.). As well as visiting research centres throughout New Zealand, Dr. Thompson will be working for about nine months in the Biochemistry Department, Massey Agricultural College, investigating problems associated with the utilisation of carotene by cattle. Dr. Thompson is a son of the Christchurch artist, Mr. Sydney Thompson, O.B.E., whose painting, "The Seaward Kaikouras", was presented by the New Zealand Government to Sir Winston Churchill on the occasion of his 80th birthday.

The Business Manager of the Journal this year is Mr. D. G. Howard, a member of the Wellington Branch. Mr. Howard graduated M.Sc. in Chemistry at Victoria University College in 1946. He was employed in the laboratory of S. W. Peterson & Co., Ltd., of Wellington, from 1940 to 1948 and then joined the staff of the Shell Company of New Zealand Ltd. Mr. Howard held the position of Chief Analyst until in 1952 he was appointed to his present position of Laboratory Manager of the Shell Company's Hutt Road Laboratory. His chief interests lie in the industrial and manufacturing spheres and in analytical chemistry. He is married with two children.

The future expansion of the Journal depends to a large extent on the amount of advertising we are able to obtain. Would any members who come into contact with firms whose current, or newly introduced products are of general interest to readers, kindly advise the Business Manager, Mr. D. G. Howard, c/o Shell Company of N.Z. Ltd., P.O. Box 2091, Wellington.

BOOK REVIEWS

THE CONTRIBUTION OF DAIRY SCIENTISTS DURING THE LAST TWENTY-FIVE YEARS TO THE ADVANCEMENT OF THE NEW ZEALAND DAIRY INDUSTRY. (A Jubilee Publication of the New Zealand Dairy Science Association.) Cyclostyled. 89 Pages Quarto. 10/-.

This publication comprises the papers given during a special review symposium at the 25th Annual Conference of The New Zealand Dairy Science Association in August, 1954. The description "Dairy Scientist" has been given a liberal interpretation as the thirteen papers cover advances in knowledge of soils and pastures as well as in animal physiology, in the manufacture of butter, cheese and other dairy products and in the treatment of market milk. The reviewers have naturally been concerned more especially with scientific work done in New Zealand but overseas investigations have also been discussed wherever necessary to give a complete picture.

This symposium should serve as a valuable record of the application to a primary industry of scientific work in a number of fields. The standard of reproduction is excellent and the publication is attractively bound. Copies are available from the Secretary of the Association at Massey College. —R.M.D.

METHODEN DER ORGANISCHEN CHEMIE (Houben-Weyl). 4th Edition. Vol. 4, Part 2, General Chemical Methods. 1,004 pages, 1955. Stuttgart George Theime Verlag. DM. 152 (£13/10/-). Sixteen volumes, several of them in two or three parts are planned for the new edition of Houben-Weyl under the direction of Eugene Muller and this colossal task is expected to be completed in four years. The portion of the work now under review has been done with great thoroughness and detail: witness the fact that tables of compounds synthesised containing the C^{14} isotope cover 78 pages with a further ten pages of references, while the author and subject indexes alone cover a hundred pages. This part deals with catalytic methods, preparation of larger ring compounds, biochemical reactions, preparation of isotopic compounds, electrochemical reactions, and pyrolytic methods, and should prove a mine of well-ordered information. The printing, illustrations and binding are very good and the only criticism we could make is that the price of the full treatise will put it beyond the reach of those individuals and institutions who could make the best use of it. —S.G.B.

GENERAL CHEMISTRY: A Topical Introduction, by E. G. Rochow and M. K. Wilson; John Wiley and Sons, Inc., New York, 1954. 600 pages. Six dollars. "This book has been written to provide the freshman college student with a sound introduction to selected topics in general chemistry. Designed to cover portions of the field rather than the whole, the book relates chemical fundamentals to the present-day experience of students. By way of illustration, some inorganic chemistry and considerably less organic chemistry, has been introduced at appropriate places in the text." The book is a very readable discourse on general chemistry and is amply and well illustrated. It suffers, however, in lacking continuity in the development of the subject because of the inclusion of scattered chapters of descriptive chemistry. These chapters on descriptive chemistry cover far more material than is necessary to amplify the preceding theoretical text. In many respects the book presumes that the student has a good background of applied mathematics and physics and consequently general chemistry theory can be much more easily derived and discussed but in other sections the student is considered to have very little previous knowledge and the style becomes somewhat exhausting. —G.M.W.

THE TECHNOLOGY OF SOLVENTS AND PLASTICIZERS, by Arthur K. Doolittle, 1954. 1,056 pages. (New York), John Wiley & Sons. 18.50 dollars. It may be said quite briefly that the scope of this work is so wide that no one who is doing any work in this field will want to be without it, despite the rather high price. The only limitation is that the discussion of commercial products is entirely confined to those available in U.S.A., but the tables of properties of the various solvents and plasticizers are exhaustive to the point of repetition. There are also chapters on the nitrocellulose lacquers and other coatings, solvents for adhesives, solvent recovery, and on the theory of solvent and plasticizer action. An interesting point is that the Carbide and Carbon Chemicals Company, for whom the author is Assistant Director of Research, has donated any royalties acruing from the sale of the book to the American Chemical Society for the advancement of the profession of chemistry. —S.G.B.

(In connection with the above review, the following extract from a recent issue of the Wiley Bulletin will interest the wives of chemists who assist their husbands in the preparation of articles and the checking of proofs:

Arthur K. Doolittle's book, The Technology of Solvents and Plasticizers, has been quite a few years in the making. The young gentleman who drew the figures, obviously temporarily upset by the innumerable details of putting such a book together, sat down one day amid the shards of his illusions and penned this:

Lament for
DORTHA BAILEY DOOLITTLE,
on Editing Her Husband's Book,
"TECHNOLOGY OF SOLVENTS AND PLASTICIZERS",
John Wiley, 1954.

O hearken to my elegy,
And shed a tear for Dortha B.,
Who laboured long, for love alone,
And stifled many a weary groan
On Arthur's book, that massive jungle
Of pithy facts—a noble dung-hill
To fertilize man's growing knowledge;
Required reading soon in college.
For which great work, we all agree
He should be labelled PHD.

We common clods will never know
The zeal that made our Dortha glow.
She shepherded each wandering hyphen
And spent a large part of her life in
Spelling things one way—then t'other,
Then back again, until their mother
Wouldn't even know their name again!
John Wiley'll never be the same again.

The awful toil has left a strain
Upon her former normal brain.
Instead of talking, now she barks
And babbles in proof-readers' marks.
Her poor tired mind, that used to caper,
Is just as blank as fly-leaf paper.
And now inside her altered pate
Her noodle's like a paper weight.

A greater love hath yet no woman
To spend her years in task inhuman.
Alas, alas for Dortha B.!
(I'm glad it's her, and isn't me.)

—Robert William Callard,
December 16th, 1953.

Dortha, Dr. Doolittle's hard-working spouse, promptly replied:

Response to
"LAMENT FOR D. B. D."
By Robert Callard.

On me, you truly waste your sorrow.
I'd start another book tomorrow.

Dortha B. Doolittle,
January 11th, 1954.
—Ed.)

PAPER CHROMATOGRAPHY, by Friedrich Cramer, translated by Leighton Richards, 2nd Edn.; Macmillan and Co. Ltd., London; 1954. 124 pages, 25/-. In this revised and enlarged edition, Cramer has produced a very useful manual on paper chromatography. After a short historical introduction the general experimental technique and theory of paper chromatography and paper electrophoresis is discussed in sufficient detail for practical application. Subsequent chapters discuss 15 specific applications and include chapters on amino acids, sugars, purines, phenols, etc. Each chapter includes tables giving R.f. values for various solvents, methods for developing and quantitative estimation. The book is extremely well referenced and is rather in the form of an extensive critical review which includes practical details. The translation is good and the illustrations, some of which are in colour, and the transparent keys for sugars and amino acids are very useful inclusions. As a practical laboratory manual, this book is an excellent investment. —G.M.W.