THE PRESENTATION OF SCIENCE TO THE PUBLIC

"WHY do scientists want to communicate science to the public, while lawyers do not show any such desire to communicate law ?" To answer this question, asked by Dr. H. J. T. Ellingham in the recent symposium on "The Presentation of Science to the Public", is to explain why it was organized. Unlike lawyers or doctors, scientists work in comparative isolation from other people, and so they are apt to feel, as Dr. Ellingham put it, a little misunderstood. Scientists are aware that the general public sometimes fears or dislikes science, which makes some of them keener to explain how their work may ultimately be valuable to everybody. Knowing, too, that theirs is a social activity, which depends in the end on public support, some scientists believe that they owe society an account of their doings. If they themselves do not help to give this account, then others less informed may give a misleading version. Finally, the popularization of science helps to recruit young people to a scientific career and to incline their elders to accept scientific findings.

For many years, therefore, scientists have felt a need to inform the public about science, and a few of those who responded to this feeling in the past, such as Thomas Henry Huxley, achieved a skill that can scarcely be bettered. New discoveries and inventions, new ways of presenting information and a new public require the problem to be tackled over again in every generation.

For such reasons the Institute of Biology (London Branch), the Royal Institute of Chemistry (London Section) and the Institute of Physics (London and Home Counties Branch) jointly organized a symposium on the subject, which was held on March 21 in the Senate House of the University of London under the chairmanship of Mr. A. L. Bacharach. The symposium was opened with papers by three experts in different media of presentation: Dr. Archie Clow (sound radio), Mr. A. W. Haslett (printed word) and Mr. James McCloy (television).

Dr. Clow distinguished two main methods of communicating science by sound radio—the talk and the "dramatized feature". The talk, with which he has been mainly concerned, presents the scientist together with the science, and the requirements for its success are four: something to say, a valid reason for telling the public, imaginative treatment, and ability of the scientist to perform. Since radio is paradoxically an intimate medium, the art of putting good conversational English into the script is fundamental. A radio talk differs from a printed article not only in style, but also because the listener cannot go back to consider again what he has not understood. The order of presentation of a radio script has to be very carefully planned: it should arrest the listener's attention with the first sentence, it should never allow him to lose the thread, and repetition is no sin.

Dr. Clow said that the knowledge of the listener should not be over-estimated. Of a group of 21-year old soldiers, the bulk knew that microbes cause disease, less than half that living organisms cause fermentation of beer, and about one in twenty that they turn milk sour.

Mr. Haslett discussed both readers and authors. Of readers, he said that they need interest, knowledge and general education. The question of who should write for these rather rare characters depends on the technical level of treatment in a channel of communication which begins with a letter in *Nature* and ends with a man in a public house. On highly technical levels the scientist, who knows more about the subject but less about how to explain it, should be the author ; but at the other end of the scale, the professional science writer is essential. In between, both should collaborate.

Advising on how to write science, Mr. Haslett leaned heavily on Fellows of the Royal Society, individually and collectively. He passed on their recommendations to use short words and simple sentences, not to write for the half-dozen people in the world specially interested, not to be afraid of making a fool of oneself and to remember that no one really likes an equation. He also stressed the value of giving an honest account of how a discovery has been made, if by chance or through error, rather than tidying it up to look logical.

Mr. McCloy said that a television programme looks like film but is the child of radio. It differs from film in being a live act, in which the commentator visibly takes part. Science is a 'natural' for television, since experiments, demonstrations, models, charts, films, discussions and comment can all be built into one programme. As science programmes reach an audience of several millions, they have to be easily understood. It follows that a good science television broadcast is difficult to give and easy to receive.

No main speaker dealt with the role of museums ; but this gap was filled by Dr. F. A. B. Ward, who pointed out in the discussion that museums have the advantages of operating in three dimensions, and of being able to present historic notebooks, apparatus and machines.

Discussion centred mainly on what may be called the problem of 'resistance', which has two sides : resistance of the public to understanding science, and resistance of the scientist to telling the public about it. As might be expected, the scientists joining in the discussion were more aware of resistance on the part of the public, while the professional presenters of science were at least equally concerned at the resistance of the scientists themselves.

The discussion was opened by one member of each participating Institute. All the openers considered how science may be presented in a way that people can easily take in. Speaking from long experience, Dr. Maurice Burton advocated stressing the personal note and telling a story. Dr. Kenneth Pankhurst preferred the word 'communication' to 'presentation', because the former implies a certain intimacy between the giver and taker of information. Sincerity and enthusiasm are essential, but they must be accompanied by skill in the medium used. Mr. Geoffrey Parr deplored inadequate illustration in popular science books ; Beatrix Potter achieved the ideal relationship of words to pictures in "Peter Rabbit", and, as in "Peter Rabbit", illustrations should be coloured.

Mr. T. A. Margerison, on behalf of the Association of British Science Writers, welcomed the symposium, which he thought was the first of its type. He said there can be no question of the *élite* scientist spreading scientific enlightenment to the lay public, because the problem of spreading science among scientists is just as urgent as that of spreading it among the public at large.

Mr. Maurice Goldsmith discussed the resistance of scientists to appearing on television. In producing a weekly television magazine, he has found that a proportion of scientists hesitate to co-operate. Some are needlessly afraid of being used for commercial ends, others feel it beneath their dignity to appear on television or perhaps fear the disparagement of their colleagues, while some do not feel that anything can be achieved in the space of four minutes. He believes that scientists do not realize that 'cathode ray tube time' is quite different from any other form of time they know. It provides the opportunity for a new experiment in the popularization of science, enabling the scientist to put forward what he wants to say to an audience of five million.

The communication of science to scientists and to the public may be regarded as extensions of one another. It follows, as Mr. A. L. Bacharach[1] pointed out in a preceding symposium on "The Communication of Biological Knowledge", that the same underlying principles apply to the communication of science, whatever the audience. No mind, however good, can take in unfamiliar things without effort. The scientist, familiar with his own special field, should therefore present it to others (technically qualified or not) in such a way that the effort required is not beyond their capacities. Bad presentation on any level should be suspected as a cloak for muddled thinking or poor research. The present symposium, which showed that a representative sample of scientists recognizes such truths, may become a small landmark.

H. O. J. COLLIER

[1] Bacharach, A. L., *J. Inst. Biol.*, **3**, 57 (1956).

LOW-TEMPERATURE CRYSTALLOGRAPHY

MEETING IN OXFORD

THE first joint conference of the X-Ray Analysis Group of the Institute of Physics and of the Low Temperature Group of the Physical Society was held at the Clarendon Laboratory, Oxford, during April 12–13 under the joint chairmanship of Dr. K. Mendelssohn and Mr. H. P. Rooksby. The subject of the conference was "Low-Temperature Crystallography", and the invited speakers dealt with both the technical aspects of X-ray work at temperatures down to 1° K. and also with the actual type of experiments where a low temperature is an advantage.

The first session was opened with an introductory paper by Sir Francis Simon (Clarendon Laboratory, Oxford). In this he emphasized that transitions which were not thought possible a few years ago do take place at low temperatures and that X-rays are one method of investigating the nature of these transitions. X-ray analysis can be used for giving information on the state of order of a system, this order being determined by the influence of the interaction forces between the components of a system. Order can exist only at low temperatures, and perfect order is only possible at the absolute zero. What we mean by a low temperature depends, of course, on the system we are considering; for diamond 1,000° K. is low, whereas for hydrogen 50° K. is high. X-rays can also give information on the form of the vibrational spectrum, and a combination of X-ray and thermal data should prove useful in entropy calculations based on the third law.

Dr. M. Blackman (Imperial College, London) dealt with the theoretical aspects of the effect of temperature on the reflexion of X-rays. He showed that from a generalized form of the Debye–Waller theory for a complex crystal, a characteristic temperature Θ_x can be calculated, and this can be compared with the characteristic temperature, Θ_{el}, derived from elasticity theory. The theoretical value of the ratio Θ_x/Θ_{el} for sodium chloride and potassium chloride did not agree with the ratio obtained from experimental results, and this discrepancy cannot, as yet, be resolved.

In a paper on a theoretical study of the variation of vibration amplitudes with temperature in some molecular crystals, Dr. D. W. J. Cruickshank (University of Leeds) discussed how the root-mean-square amplitudes of the translational and angular oscillations in benzene and anthracene have been determined by three-dimensional Fourier refinements with anisotropic parameters. From these amplitudes the various characteristic temperatures have been determined, and the temperature variation of the vibrational and rotational oscillations has been calculated. These show that, for studying fine details of electron density, it is much more advantageous to take measurements at 90° K. (or better still at $\sim$ 20° K.) than at room temperature, but that little extra is gained in this particular work by taking readings below 20° K.

Dame Kathleen Lonsdale (University College, London), in her paper on the determination of Debye factors by intensity measurements at low temperatures, showed that there are two independent ways of determining the Debye factors for crystal diffraction spectra: one is the original method of comparing the intensities at different temperatures with due regard to the existence of zero-point motion; the other uses the intensities at one temperature only, taking account of the positions and motions of the atoms as determined through a complete structure analysis. These methods have been compared from data on urea, and they have been shown to agree better than might have been expected, bearing in mind the possibility of change of atomic parameters with temperature.

Discussing low-temperature X-ray work on alkali metals and alloys, Prof. C. S. Barrett (University of Chicago) described an X-ray spectrometer in which metals can be cold-worked at temperatures down to 5° K. The X-ray studies show that, down to this temperature, lithium and sodium are the only alkali metals which partially transform on cooling. This transition is from the body-centred cubic to the hexagonal close-packed structure, the axial ratio in the hexagonal phase being very close to 1·633, the theoretical value for close packing. The transformation in lithium occurs at 70° K. On cold-working the lithium at low temperatures, there is a further transition, this time to the face-centred cubic structure. This does not appear to occur when sodium is cold-worked; but a similar transition does occur for solid solutions of magnesium in lithium.

Dr. W. B. Pearson (National Research Council, Ottawa) described X-ray cameras which have been built for use down to liquid-helium temperatures. These have been designed to have an accuracy of