be carried out on the relationship between electron voltage and the characteristics of the photographic materials exposed to them. Very puzzling is the marked difference in response of photographic emulsions to electrons and X-rays.

Dr. J. W. Menter (Physics and Chemistry of Surfaces Laboratory, Cambridge) showed some very fine electron-reflexion micrographs of solid surfaces. These were obtained using a Metrovick *E.M.*3 electron microscope that had been adapted for reflexion work.

Mr. W. D. Kemp dealt with the application of television to the recording of motion-picture films. There is no space here to follow the detailed technical argument, but it was summed up well in the short film that was projected. The quality was far above anything seen on the broadcast television screen. Questioned as to whether the lines had been eliminated by spot-wobble, Mr. Kemp replied that they had been visible on the negative but were lost in the printing stage.

In the last paper of the symposium Mr. J. G. Yates described the experimental difficulties attending the slow-speed recording of low-frequency 'noises' such as the spontaneous variations in carbon resistors that occur under load.

FULMER RESEARCH INSTITUTE

OPEN DAY

An open day was held at the Fulmer Research Institute on September 30 to mark the completion of the first five years of work at the Institute; it was also the occasion for unveiling a memorial plaque to the founder, the late Colonel W. C. Devereux. After welcoming the guests, Mr. Percy Horsfall, chairman of the group of companies forming Almin, Ltd., explained that the Institute has been provided with the necessary capital by his organization, but that the Institute facilities are available to all without any preference to the Almin group. In the absence of Lord Hives, who had gone abroad, the unveiling ceremony was performed by Sir Archibald Rowlands, permanent secretary of the Ministry of Supply, who was a close personal friend of Colonel Devereux. In a memorable and moving speech Sir Archibald described Colonel Devereux as a happy man with great abilities, enormous drive and a warm heart, who had provided in the Fulmer Research Institute something for Great Britain similar to the well-known Battelle and Mellon Institutes of the United States.

After luncheon Lord Waverley (better known to many as Sir John Anderson) spoke on the successful efforts that have been made in Great Britain since the First World War to make good the deficiencies in the national scientific equipment, particularly in the application of science to industry. He recalled that some seven years ago at a conference of the Federation of British Industries on the application of science to industry, he had expressed regret at the absence in Britain of any institution comparable with the Battelle and Mellon Institutes. Despite the amazing increase in scientific effort through the larger industrial units, the universities and the research associations, and other establishments under the ægis of the Department of Scientific and Industrial Research, Lord Waverley still thought there is scope for further effort and expressed the hope that the work of the Fulmer Research Institute would be multiplied many times in other fields.

After paying a personal tribute to Colonel Devereux, Mr. E. A. G. Liddiard, director of research in the Institute, outlined the progress made by the Institute over the first five years, during which the income, now approximately £78,000 a year, has more than trebled and the staff more than doubled. All the income came directly from research contracts, and the Institute received no other income in the form of endowments or government grants. About half the total income was derived from government contracts, and there was a substantial proportion of direct dollar-earning sponsorship from the United States and Canada. There was, however, a steady increase in the volume of work for British industry and he looked for further growth in the future. He considered that the problem most appropriate to a sponsored research institute is one in which research results need considerable expenditure in subsequent development work, and it is essential that those incurring these costs should be assured of a return for their expenditure and for the risk taken by having some form of monopoly in these new developments—preferably in the form of patents covering the original research results. The connexions established in the United States and Canada would, he said, help in the full exploitation of research results obtained for British sponsors.

Sir Frederick Handley Page, on behalf of the guests, thanked the hosts and stressed the opportunities available in the Institute for British industry, particularly for small firms which cannot afford the equipment or staff necessary for the solution of a particular problem.

The laboratories of the Institute were open for inspection and contained exhibits of various items of work completed and in progress. In the Physical Chemistry Section the work of Dr. P. Gross and his colleagues on the refining of metals by reactions involving metal halide vapours was illustrated. This included the determination of heats of formation of metallic halides and the equilibrium and kinetics of various reactions, particularly the reaction $2Al + AlCl_3 \rightleftharpoons 3AlCl$, which forms the basis of the so-called 'catalytic' distillation of aluminium. A small pilot-plant operating this refining process was an important feature. Samples of titanium metal produced in the laboratory by different reactions, details of which were not available, were on show together with samples of titanium trifluoride and of beryllium produced by indirect distillation.

In the Physics, Metallurgy and Engineering Sections, under Dr. A. H. Sully, alloy research included an investigation into the mechanism of age-hardening and work on aluminium–bronze and aluminium–tin bearing metals. The aluminium–copper–cadmium alloys developed by the Institute were claimed to have properties similar to the duralumin-type alloys but to be free from any tendency to age at room temperature and to have exceptionally good hot-working properties. Work on high-temperature materials included an investigation into the ductile-brittle transition of chromium and of metal-ceramic aggregates, and a good deal of interest was shown in the development of low-emissivity protective ceramic coatings for combustion chambers of gas-turbine engines. The Physics Section employs Guinier-type single and double monochromators for studying structural changes in age-hardening alloys; and in the Engineering Section high-temperature fatigue

and creep testing in both tension and compression was in progress, and the use of strain gauges for evaluation of residual stresses and for recording movements in large structures was illustrated. In the Corrosion Section work was in progress on vapour-phase impregnation of iron and steel with silicon, hydrogen embrittlement of steel, and electrodeposition of manganese. Attention was directed to the marked influence of directionality in light-alloy extrusions on resistance to corrosion and stress corrosion.

A large proportion of the equipment and apparatus on view had been constructed in the laboratory workshops, including the pilot plant for aluminium distillation, the vacuum induction and arc-melting furnaces, gas X-ray sets, compression creep machines, furnaces and temperature controllers.

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

THE annual report of the Indian Association for the Cultivation of Science for 1951–52* records the completion of the transfer to the Association's new buildings at Jadarpur and the removal of the Department of Organic Chemistry in June 1951, but research work was considerably curtailed by the removal. Research schemes for the X-ray study of coal and for the construction of osmometers for high-polymer research, sanctioned by the Council of Scientific and Industrial Research, were continued, and a new scheme was sanctioned for the construction of a light-scattering apparatus for measuring the molecular weight, size and shape of high polymers.

In the Department of X-rays and Magnetism a systematic investigation has been undertaken into the structures of phenanthrene derivatives, particularly hormones, and N. N. Gupta has been able to show that the nature of the low-angle scattering of X-rays does not depend upon the internal structure of the crystal but only on the size and shape of the particle. R. K. Sen has perfected the method of determining the elastic constants of a crystal by the X-ray diffraction method, and the limitations of the Jahn–Jeller effect have been investigated. Measurement of the conductivity of single crystals of graphite from 80° to 500° K. has been completed, as well as the major equipment for the liquid hydrogen plant.

In the Department of Optics, studies on *p*-dichlorobenzene have shown that crystals cooled once below 0° C. give a different Raman spectrum from crystals not treated thus. New lines in the low-frequency region have been observed in the Raman spectra of *o*-xylene and benzyl bromide, and the ultra-violet absorption spectra of acetophenone, methyl benzoate ethylbenzene and *iso*propylbenzene have been studied in the liquid and solid states, as well as those of the cresols, *o*- and *p*-xylene, benzyl alcohol and benzyl chloride. In the Department of Theoretical Physics, besides work on the meson fields and nuclear scattering, good progress has been made in improving the Born approximation by taking higher terms of a consistent expansion in powers of the constant denoting the strength of the coupling between the field and the particle.

In the Department of Physical Chemistry detailed study has been undertaken of chain transfer in uncatalysed polymerization of styrene methyl methacrylate and methyl acrylate in solvents, and investigations have also been made of the polymerization of methyl methacrylate with hydrogen peroxide in non-aqueous solvents, triphenylmethylcellulose and the solubilization of mixed detergents. In the Department of Inorganic Chemistry, which formally started in July 1951, preliminary investigations were made on co-ordination complexes and ion-exchange methods in inorganic chemistry. Lists of papers published during the year are included, with lists of books and periodicals added to the Library.

* Indian Association for the Cultivation of Science. Annual Report for 1951–52. Pp. ii+40. (From the Association, Calcutta 32; 1952.)

THE CHAYEN PROCESS FOR EXTRACTION OF OILS AND FATS

THE normal process for the extraction of oils and fats from naturally occurring cellular material involves the use of a hot solvent. This process requires steam heating for many hours, resulting in the formation of some undesirable degraded products.

British Glues and Chemicals, Ltd., gave a demonstration of a new process devised by Mr. I. H. Chayen and his associates at their Stratford factory in London on October 28, when they were able to show an entirely new technique. In this process, crushed bones are passed, together with a stream of water, into a modified disintegrator where complete fat rendering is achieved in about one second while the material is in the mill. In this disintegrator, the normal blades had been replaced by beaters arranged to give a clearance of about 4 in. from the mill-casing. With a blade tip-speed of about 12,000 ft. per min., the high-speed impulses given to the water break open the cell-walls of the tissue and enable an easy extraction to follow.

The fat and degreased bone leaving the mill are separated by gravity from the water stream, the fat being skimmed off and purified and the bones passed on for drying, when they are ready for glue making or for incorporation in bone meal.

The importance of this technique lies not only in the fact that it has provided a much improved process for one industry, but also that it has provided a new chemical engineering tool and principle, namely, the use of high-speed impulses to break down mechanical barriers, in this case the cell-walls. The application of high-speed vibrations in the chemical process industries is as yet a largely unexplored field, but this application is already showing a great reward. The degreased bone is ready for glue making in 8 min. and the fats are of much finer quality, since the process is carried out in the cold. The continuous process offers many advantages compared with the old batch one in the form of simplified plant layout and operation, as well as very considerable saving in fuel.

This is an interesting example of a machine produced for one purpose being applied with but small alteration to provide a new mechanism in another industry. British Glues, Ltd., are to be congratulated not only on their discovery of a new principle, but also on the quick way in which they have passed from the pilot plant to the commercial plant, for they now have this process in use in four factories, including one in Canada. They were able to show on a pilot plant the same technique for handling herrings, and the next development may well be in the valuable fish-liver industry.

J. M. COULSON