A sensitivity allowing 0·05 μgm. per gm. of active mercury to be detected was achieved.

Methods of determining the resistance of slime organisms to chemicals were also shown.

Mr. I. W. McC. Callan dealt with tests for evaluating chemicals for use as seed fungicides. Laboratory phytotoxicity tests on wheat supplemented glasshouse disease control trials using oats leaf spot (*Pyrenophora avenæ*) and pea foot rot (*Pythium ultimum*) for determination of disinfectant and protectant properties respectively. Examples of these standardized replicated experiments were seen. In the experiment garden were demonstrations of the application of seed treatments for controlling seed- and soil-borne diseases, particularly seedling rots, of peas, maize, flax, sugar beet, spinach and cucurbits. The extensive 'rod-row' trials which were seen illustrated a replicated block technique based on single rows used for field assay of chemicals for controlling cereal diseases such as wheat bunt and oats and barley smuts.

Machinery for commercial application of dry and wet seed dressings was demonstrated, and in the laboratory an exhibit of a modification of Machacek's agar-sheet technique showed strikingly the extent of variation of load of toxicant on individual seeds obtainable by varying the seed-dressing formulation and the type of machinery used.

Threshing and winnowing equipment developed for accurate estimation of yields from metre-square cereal sampling plots was also shown.

Dr. J. Stubbs had exhibits of a range of plant diseases which were kept in culture and used for glasshouse evaluation of foliage fungicides. These included *Alternaria solani* and *Phytophthora infestans* on tomato, *Uromyces fabæ*, *Botrytis cinerea* and *B. fabæ* on broad bean, *Puccinia antirrhini* on antirrhinum, *Erysiphe graminis* on oat, *E. cichoracearum* on marrow, and *Septoria apii* on celery. The methods of using *A. solani* on tomato for detection and measurement of systemic activity were shown, using griseofulvin as example of an active systemic fungicide. They involved absorption by the plant of chemicals applied to roots or leaves. A 0·05 per cent solution of griseofulvin applied to the soil in which small tomato plants were growing afforded complete protection against disease, whereas the same concentration applied to foliage gave only partial disease control on leaves which had been shielded from the spray.

Mr. J. A. W. Turner dealt in detail with the equipment and methods used in the routine *A. solani* test as developed for the first *in vivo* assessment of potential foliage fungicides and for comparison of effects of formulation (for example, of copper and thiram fungicides) on disease control.

Three tomato plants were sprayed with each of a range of concentrations of a chemical under conditions giving standard deposits. After twenty-four hours drying, plants were inoculated by spraying with *A. solani* spore suspension, incubated at 100 per cent relative humidity for a further twenty-four hours and transferred to the glasshouse. Disease counts were made after three days. ED 50 and ED 95 values were obtained graphically from data from three such tests made at approximately weekly intervals. Thiram was used as standard reference fungicide.

Chemicals active against *A. solani* were then examined further, as required, on the range of diseases demonstrated by Dr. Stubbs, before field evaluation commenced.

Mr. C. E. D. Smith described investigations on the control of *Fusarium* patch of turf, storage diseases of gladiolus corms and narcissus basal rot (*Fusarium bulbigenum*).

Techniques for the bioassay of soil fungicides were shown, based on selective isolation of *Pythium ultimum* and *Thielaviopsis basicola* from soils containing the viable pathogens. These were coupled with further experiments to determine persistence of the chemicals in soil and their phytotoxicity. Successful chemicals were tested against clubroot (*Plasmodiophora brassicæ*) by a rapid laboratory method, and against *Colletotrichum atramentarium* attacking tomatoes. Demonstrations of this last disease included a character for its early diagnosis and a selective method for isolation of the pathogen.

A tour of the eight-acre experiment garden and trials field enabled further aspects of work described in the laboratories to be seen. These included gladiolus corm and narcissus bulb experiments, potato and tomato blight spraying plots and an orchard for investigation of apple, pear and bush fruit diseases.

R. V. Tipler

MELLON INSTITUTE

ANNUAL REPORT FOR 1951–52

THE annual report of the President of the Mellon Institute to the Board of Trustees for the year ended February 29, 1952*, which is published in the *Research Proceedings of the Mellon Institute*, includes a full list of fellowships in operation during March 1,1951–March 1, 1952. Of the Institute's expenditure of 3,835,314 dollars during the year, 727,654 dollars went to the support of investigations in pure science in the Institute's research departments and on nine fellowships, and these projects occupied 117 members of the Institute's staff. In applied science, seventy-seven other fellowships occupied 441 members, and the servicing staff of the Institute numbered 162. New fellowships put into operation during the year are concerned, respectively, with problems of air purification; the development of new chemicals and speciality products, other than fuels and lubricants, used in the operation and maintenance of automobile and aeronautical vehicles and equipment; the technology of glazed and unglazed structural clay products; the combustion of gaseous fuels; the fundamental molecular properties which limit the breaking strength of glass; and the thermostability of active dry yeast.

The Gas Purification Fellowship, which originated in 1939 and was terminated during the year, has led to the development of various new analytical methods, for example, for the rapid determination of hydrogen sulphide and mercaptan sulphur in gases and aqueous solutions, and to a process for reducing the organic sulphur content of coke-oven gas to about 0·5 gm./cu. ft. by scrubbing with an organic base. The Pipe Joint Fellowship, which also has been concluded, has led to the formulation of a product providing adequate thread lubrication during joint make-up and capable of forming a pressure-tight seal in the coupled joints. Other fellowships terminated during the year were the multiple fellowships dealing

* Research Proceedings of the Mellon Institute, 1951–1952 (Annual Report Series No. 39): Annual Report of the President, Edward R. Weidlein, to the Board of Trustees of the Institution for the Fiscal Year ended February 29, 1952. Pp. vi+50. (Pittsburgh, Pa.: Mellon Institute, 1952.)

with the following topics: polymers, in which during the tenure of the fellowship processes have been developed for lattices of styrene polymers and co-polymers; the kinetics and mechanism of the uncatalysed condensation of resorcinol with formaldehyde in various solvents; the efficiencies of light oil recovery and of the operation of Koppers's 'Elex' precipitators for removing suspended matter from coke-oven gas; and tar products, under which extensive studies of the rheological properties of bituminous compounds led to the development of improved industrial pitches, sealing compositions, mastics and protective coatings, and fundamental physico-chemical and rheological studies were made of the nature of coal-tar residual systems.

In the Institute's Department of Research in Chemical Physics a detailed study has been made of the infra-red spectrum of dicyanoacetylene, and its Raman spectrum was being studied. Experimental procedures have been developed for the infra-red study of inorganic salts, and the spectra of a hundred and sixty salts recorded. Emulsion calibration procedures in emission spectroscopy have also been investigated, as well as the fine structures of four reinforcing carbon blacks, with the view of detecting correlations between structure and wear resistance and the crystal structure of solid chlorine. In the Department of Physical Chemistry, four papers on distillation theory have been prepared, and work in this field includes the continued study of the relation between the concepts of the theoretical-plate and transfer units and an indefinite number of components. Much time has been spent on the design of a small automatic digital computing machine. The Department of Physical Measurements is continuously occupied with the determination for publication of the physical properties of compounds the properties of which are inadequately known and of new compounds.

In the Department of Organic Chemistry, the first part of a study in mental disease, involving the concentration of a hyperglycæmic factor from the urine of psychotic individuals, has been completed, confirming the presence of such a factor in the urine of some schizophrenics. In regard to the utilization of carbohydrates in mental diseases and in diabetes, it has been found that reduction of alloxan with excess hydrogen sulphide in acid solution invariably gives rise to dialuric acid and not to alloxantin, but that the latter is produced if exactly half the theoretical amount of the reducing agent is used. Also, in suitably acid aqueous solution (*p*H 1·6), cysteine, glutathione and ascorbic acid have no reducing action on alloxan. A series of 4-hydroxy- and 4-aminopteridines have been submitted for testing as tumour-inhibiting agents at the National Cancer Institute's Laboratory of Chemical Pharmacology.

Of the fellowships in pure science, the annual report refers particularly to those of the Industrial Hygiene Foundation on atmospheric pollution, in which an automatic smoke filter has been developed; on industrial dusts, in which the deposition of inhaled particulate matter in the respiratory tract has been studied; on orthopædic appliances, under which a new method of constructing 'Bunnell' hand splints for stretching contracted fingers has been worked out, foot-plates intensively studied and the relative merits of aluminium and steel for leg traces determined; and on mine-acid control, which point to control of the course of natural ground-water entering the mine as the most effective means. Under the multiple fellowship on synthetic rubber, work has been completed on the infra-red study of polyisoprene, which has been found to be a mixture of *cis-* and *trans-*forms in which the latter predominates at all ordinary temperatures of preparation. Fractionation work in dilute solutions has been completed on a synthetic polyisoprene and on polybutadienes prepared at 5° and 50° C., while the response of solid polymers to oscillating stresses and the ultimate strength of cross-linked rubbers are also being investigated. Under the Fellowship on Artists' Materials an attempt was being made to develop a picture varnish, using a synthetic resin, which will be non-yellowing, flexible and readily removable with mild solvents.

Among the applied science fellowships only a few can be mentioned. Promising results have been obtained under the Meter Technology Fellowship with a non-mechanical device for measuring gas-flow, and in work on sulphur, besides the publishing of revised data on the corrosion of steel by sulphur, a comprehensive study has been made of the metering of liquid brimstone. Developments have been made under the Marble Fellowship of a specification for the use of marbles in indoor and outdoor building construction, and, besides wide research on the effects of heat treatment on the physical properties of optical glass, the Optical Glass Fellowship has been expanded to include in its work the experimental heat treatment of larger pieces of finite geometric shape. Considerable progress is reported under the Ceramic Chemicals Fellowship in knowledge of the relative functions of the various components of enamels and in the control of reflectance, colour, colour stability over large ranges of firing temperature, and resistance to acids and alkalis.

Under the Multiple Fellowship on Acid Recovery a promising process has been developed for treating pickle liquor with raw coke-oven gas, while under that on Chemical Storage an improved method was devised for measuring stresses in large steel structures, which has given information on the stress intensities of various tank members, leading to better designs and economies in the use of scarce materials. Most of the work under the Nickel Fellowship has been directed towards studies of the detergent and other properties of oil-soluble nickel compounds with the object of establishing their suitability as lubricant additives, the wetting properties of nickel sulphide on various catalyst supports, and the effect of conditions of precipitation on the characteristics of nickel hydroxide. A Fellowship on Aromatic Anhydrides has continued to be used for the study of catalysts for the manufacture of phthalic anhydride, and under that on monomers an extensive study was made of catalytic dehydrogenation of alkylbenzenes. Geochemical studies under the Petroleum Fellowship have advanced the synthesis of porphyrin degradation products of chlorophyll and hæmin, while further success has been obtained in the sulphurization of olefins, and studies on Fischer–Tropsch catalysts have shown that primary alcohols can be built into higher hydrocarbons in this synthesis. Basic information on the chemical and physical properties of petrolatum is being accumulated by the Fellowship on Petrolatum, and further studies under the Bread Fellowship support the view that the flavour and aroma of salt-rising bread are due primarily to the acid by-products of a symbiotic fermentation of *Clostridium welchii* and *Clostridium tertium*.

In the research of the Insecticides Fellowship, new methods have been developed for the condensation

of aldehydes with ketones to give the piperonyl insecticides, and under the Felt Fellowship notable progress has been made in the evaluation of cloth filters and the mechanical napping of fabrics. Under the Fellowship on Match Technology researches have begun on improving the resistance of matches to water and high humidity, the selection of binders, etc. During the tenure of the Fellowship on Organic Synthesis new reactions of diketen with the sodium derivatives of pentadione and acetoacetic esters have been discovered, a study of the effects of chemicals on cellulosic and synthetic fibres has been inaugurated and a series of non-ionic surface agents elaborated, the functionality of which in aqueous solution is not greatly affected by temperature, concentration or the presence of polyvalent metal ions and neutral electrolytes; also real progress has been made in 'Vinylite' resin organosol decorative metal finishes. The development of the 'Stypol' resins, a series of liquid thermosetting materials, has continued under the Protected Metals Fellowship, while work of that on Protective Coatings has placed its main emphasis on the development of coatings for military use and the replacement of scarce materials. Two new types of floor coverings, 'Accotred' and 'Vinoflor', were developed under the Cork Fellowship, and research on synthetic paint-brush bristle was a feature of the work of the Special Fibres Fellowship.

PREPARATION AND PUBLICATION OF SCIENTIFIC PAPERS

IT is sometimes customary for scientific societies to give advice and guidance to intending authors as to the preparation of their articles in a form suitable for inclusion in the societies' journals. Usually the advice is limited to some warning about the best method of writing mathematical expressions or to the peculiar layout or spelling adopted by the journal.

A much more comprehensive and instructive manual for intending authors is the revised edition of the booklet "Notes on the Preparation of Contributions to the Institute's Journals and Other Publications" recently issued by the Institute of Physics. The "Notes" were first published in 1931 and were last revised in 1950. No fundamental changes have been made in the new edition; but the opportunity has been taken to make minor corrections and some alterations in acceptable spellings and abbreviations in conformity with recent international and other agreements. Information is given concerning the Institute's publications, the types of contributions acceptable and the conditions of acceptance. Though it is obviously advisable in order to avoid delay in appearance for contributions to conform rigidly with the usages set out in the "Notes", this is not a condition of acceptance.

The "Notes" deal in detail with the preparation, length and cost of text, the form of script and diagrams, the presentation of tabular matter and mathematical expressions and the correction of proofs. Four pages of the booklet are devoted to the proper presentation of circuit, mainly electronic, elements; this seems excessive when it is considered that the Institute's journals do not cater for purely electronic subjects. An interesting reference is to the present average total cost, £10, of each page of text; of a line figure £2 or half-tone £2 10*s*.; of a typical minor change to a line of type once it is set 5*s*., or of removing a comma 1*s*. 6*d*. This should act as sufficient warning to authors to be extremely careful, to be concise, to avoid unnecessary diagrams and figures and, above all, to revise their manuscripts before submission for publication.

A short bibliography of dictionaries and books on writing scientific and non-technical literature is included in the "Notes", and the detailed appendixes, containing notes and examples of spellings, symbols and abbreviations, the Greek alphabet in Greek and with English equivalents, and printers' marks for correcting proofs, should prove most useful and save authors much valuable time. It is a pity that in what is otherwise an excellent manual there are still a few misprints and that the graphical diagram given on p. 13 to indicate the usual faults made by authors is by no means a clear and good example.

S. WEINTROUB

DETERMINATION OF PROTEIN CRYSTAL DENSITIES

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THE accurate measurement of protein crystal densities under a variety of conditions is important for the determination of protein molecular weights by the X-ray diffraction method, and for the study of the composition of these crystals. In order to make best use of the results, it is essential that all the measurements be made on crystals of precisely the same composition. Protein crystals equilibrate rapidly by the loss or gain of water, or by the pene-

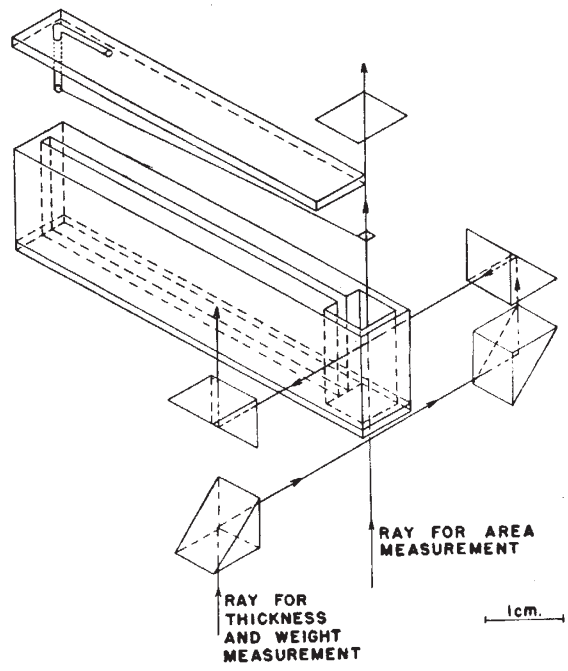

Fig. 1. Schematic diagram of microbalance assembly