

During the War, Adams's activities have been largely transferred to administrative spheres, where his foresight and organizing ability have enabled him to play an important part in the vast scientific effort of our American colleagues.

Hughes Medal

The Hughes Medal is awarded to Prof. B. F. J. Schonland, director of the Bernard Price Institute of Geophysics, University of the Witwatersrand, in recognition of his important physical studies of atmospheric electricity and thunderstorms.

Schonland's main contributions to physical research have been in the field of atmospheric electricity, and have dealt particularly with the complex series of electric discharges which constitute a 'stroke' of lightning. Although the study of phenomena associated with thunderstorms could be undertaken under especially favourable natural conditions in his native South Africa, it needed enthusiasm and perseverance to overcome the many technical difficulties encountered in a country in which physical research had not yet been greatly developed, and to bring the research to such definite and illuminating conclusions.

Schonland's early work (1927, 1928) dealt with the polarity of thunderclouds; it was established that the negative was below the positive pole of the thundercloud, and that the currents flow in such a direction that they carry negative charges to the earth. Schonland also studied the importance of point discharges (from trees, etc.) in the maintenance of the earth's negative charge. He next used (1934-38) a rotating lens camera of the type devised by the late Sir Charles Boys to photograph and analyse the lightning discharge, and obtained results of great importance for knowledge not only of the nature of the lightning discharge but also of electric discharges in air in a more general sense.

Schonland has taken an active part in the study of cosmic radiation and particularly of the relation between penetrating radiation and thunderstorms; there is a reduction in the intensity of penetrating radiation when thunderclouds are overhead, and this fact provides information as to the total charge carried by penetrating radiation. The occurrence of impulses in a Geiger-Müller counter coincident with discharges in distant thunderstorms shows that some type of penetrating radiation is produced by electrical discharges during thunderstorms. This work on cosmic rays in Schonland's laboratory is of special importance, since few such systematic observations have been continued over long periods in the southern hemisphere.

Schonland has also taken a prominent part in the study of the nature of the 'atmospherics' interfering with wireless transmission, and of the part played by the ionosphere in their structure. These studies have equipped him on the technical side for various military positions he has held during the War; for these, also, his experience in the War of 1914-18 as a captain in the Royal Engineers (Signals) had given him additional equipment. In the War now ended he rose to the charge of an Army Operational Research Group with the rank of brigadier, and later became scientific adviser to the 21st Army Group commanded by Field-Marshal Montgomery; and now General Smuts, as Prime Minister of the Union of South Africa, has claimed Dr. Schonland's services as his adviser on the promotion and development of scientific research in his own country.

BOSE RESEARCH INSTITUTE, CALCUTTA ANNUAL REPORTS

THE annual report of the governing body of the Bose Research Institute, Calcutta, for the year 1943-44 refers to the way in which the growing difficulty in securing photographic materials, glass goods and chemicals, especially organic chemicals, hampers the work of the Institute. With grants received from the Board of Scientific and Industrial Research, schemes of research on the setting up of a powerful generator of ultrasonic waves and on testing and cutting quartz plates for the radio industry have been undertaken, and with grants from the Bengal Immunity Co., Ltd., schemes for applied research in microbiology and on the vernalization of paddy in Bengal are also being undertaken. Among the investigations referred to in the report are those on cosmic rays, and an important paper on the Wilson chamber study of meson spectra has been published in the *Transactions* of the Institute, results obtained in the laboratory agreeing with the predictions of the theory of Moller and Rosenfeld. The investigations with the Wilson chamber photographs are being continued to verify and extend the results obtained with lead absorbers with other absorbers like iron and carbon. Other physical researches were concerned with nuclear fission, the nuclear isomerization of Br^{80} , the construction of a neutron generator and an ultrasonic generator. A valve tube amplifier circuit has been assembled for measuring dielectric potentials set up in plant tissues, either simultaneously or under stimulation, and the transmission of excitation in *Nitella* and *Chara* is being studied.

An important part of the activity of the Biochemistry Department is the preparation of biologically active compounds required for physiological and microbiological studies of plants, including such substances as glucose 1-phosphate, adenylic and nucleic acids, *cis*- and *trans*-crocetin dimethyl ester, crocin and picrocrocin, and it has been possible to isolate *cis*- and *trans*-crocetin dimethyl ester, crocin and saffranol from saffron obtained from Kashmir, the yields of these compounds from the Indian variety being higher than those obtained by Kuhn and Karrer from saffron from Spain, the south of France and Asia Minor. A series of manual experiments has been conducted with jute plants, and further investigations completed on the effect of the pH values of nutrient solutions on the growth of jute plants.

In the Biology Department preliminary experiments on the auxin effect on *Desmodium gyrans* indicate that at low concentrations the auxin is a respiratory catalyst for some substrates present in the cells of *Desmodium gyrans*, and that malate is one of the substrates on which this auxin acts. Different concentrations of synthetic auxin were tried to produce roots in gootes and cuttings of cinchona, indolylbutyric acid being the most effective in the formation of roots. The study of the growth of the root is being carried out by an automatic recording device previously constructed in the Institute. In the Microbiology Section, studies of the diseases of tropical fruits and vegetables are being undertaken to discover the nature of the relation between the parasites and their specific hosts, nature of infection, and mechanism of rotting, factors influencing the susceptibility of fruits and control of wastage. A

special retting substance named 'Hiparol' has been discovered which is capable of retting jute, coco-nut and other fibrous plants in 8-18 hours instead of the 6-10 weeks in the natural process. Strains of various species of *Penicillium* have been isolated and their growth-rates and rates of production of penicillin studied in modified Czapek-Dox and other media. These investigations on penicillin and yeast are being continued under a grant from the Bengal Immunity Co., Ltd.

In the report for the year 1944-45, reference is made to the working out of a theory of the mechanism of enzyme action, based on the assumption of differential catalysis for reversible enzymic processes, and the preliminary indications on the possible existence of two different phosphorylases in potato have been confirmed. Other investigations have related to the chemical transmission of stimulation and the problem of vernalization and the phasic development of some Indian crops, including wheat and paddy, and breeding work on cotton. The enzyme complex, hiparol, is also capable of yielding butanol and acetone when mixed with suitable substrates, and the industrial application of this result is being investigated. A strain of *P. notatum* isolated from local garden soil possesses certain advantages over strains imported from abroad. Large-scale production of the antibacterial agent is being undertaken; the crude filtrate is being used for surgical dressings on cases of *Staphylococcus* infection with very satisfactory results.

RECENT CHEMICAL RESEARCH IN THE U.S.S.R.

SEVERAL chemical journals from Soviet Russia have recently been received, and a few of the many interesting papers in them may be briefly mentioned.

Kapustinsky¹ has modified his well-known equation for the lattice energy of an ionic crystal by assuming an exponential equation for the repulsion force (Born-Mayer) instead of an inverse power law. The equation then becomes, in k.cal.mol.⁻¹,

$$E = 287.2 \Sigma n \frac{z_1 z_2}{r_1 + r_2} \left(1 - \frac{0.345}{r_1 + r_2} \right),$$

where Σn is the number of ions in the molecule, z_1 and z_2 are the valencies, and r_1 and r_2 the radii of the ions. The calculated values are compared with those determined by the Born cycle method and the discrepancies do not as a rule exceed 1 or 2 per cent. The new equation is only slightly more complicated than the older one, and comprises the same variables: it is likely to prove of service in the study of ionic crystals.

Zvektov and Sosnosky², by studying the dielectric properties of an anisotropic liquid (liquid crystal) in a rotating magnetic field, measuring the torque exerted on the substance, have extended the work of Zvektov³ to several other liquids. The results provide a measure of the specific diamagnetic anisotropy, that is, the difference between the susceptibilities parallel to and perpendicular to the axis of symmetry. It had previously been shown that the effect is due to the single molecules and not, as was once assumed, to molecular clusters. The effect is particularly marked in aromatic derivatives, and is in agreement with Pauling's view that in the benzene ring three of the four valency electrons of carbon

have orbits in planes uniformly distributed in space while the orbit of the fourth lies in the plane of the ring. The implications of this are fully discussed, and the general assumption that the magnetic anisotropy of the liquid crystals examined is determined by the number of benzene rings in the molecules is, on the whole, substantiated.

The mechanism of the combustion of carbon in oxygen has been studied recently by several investigators. Klibanova and Frank-Kamenetzky⁴ point out that the mechanism of reaction at ordinary pressure is quite different from that under very low pressures. It appears that at ordinary pressure at about 600° the surface of carbon in contact with carbon dioxide is covered with a film of surface oxides, CO and CO₂, and oxygen reacts with these much more easily than with a free carbon surface. At very low pressures, these surface oxides are absent. A difficulty in the kinetic measurements is that, in most cases, only the diffusion velocity is measured. In the present experiments, carbon filaments with a smooth deposited layer of crystalline carbon were used. The filament was electrically heated in a current of air or gas. The absolute reaction velocity was measured with oxygen (10⁻⁴ moles/cm.² sec.), and the order of reaction was found to be much lower than unity, varying from 0.4 to 0.8, the usual assumption of a first-order reaction not being confirmed. The deviation from unity is regarded as applying to the true order. Theory shows that the lower the order of reaction, the earlier and more sharply it passes into the diffusional region.

An acetylene flame emits a continuous spectrum and band spectra corresponding with CH, OH and C₂. Avramenko⁵, with a rarified acetylene-air flame, found a new band spectrum corresponding with the so-called 'ethylene bands' and supposed to be due to CHO. Changes of conditions led to its disappearance, so that CHO may be regarded as an unstable intermediate product in the combustion of acetylene.

Several papers on co-ordination compounds have appeared, for example, on hydroxylamine compounds of palladium⁶, [Pd₄NH₂OH](OH)₂ and salts, and very stable Magnus type compounds [Pd₄NH₂OH][PtCl₄]; thiosulphate compounds of palladium⁷ of two types; and iridium sulphites of the type of Claus's salt⁸.

Several interesting papers of metallurgical interest have been published⁹.

In the field of organic chemistry, mention may be made of a synthesis of cyclopentylpentene¹⁰, organometallic compounds of mercury¹¹, and the synthesis of olefins with a quaternary carbon atom¹².

It is not possible in such a short notice even to mention the many other interesting and important papers, but some indication has perhaps been given of the great activity in chemical research in the many institutions of the U.S.S.R.

¹ *Acta Physicochim. U.R.S.S.*, 18, 370 (1943).

² *Acta Physicochim. U.R.S.S.*, 18, 358 (1943).

³ *Acta Physicochim. U.R.S.S.*, 10, 555 (1939).

⁴ *Acta Physicochim. U.R.S.S.*, 18, 387 (1943).

⁵ *C.R. Acad. Sci. U.R.S.S.*, 40, 110 (1943).

⁶ Goremykin, *Bull. Acad. Sci. U.R.S.S. (Chim.)*, 248 (1943).

⁷ Riabchikov and Issakova, *C.R. Acad. Sci. U.R.S.S.*, 41, 161 (1943); Riabchikov, *ibid.*, 41, 208 (1943).

⁸ Lebedinsky and Gurin, *C.R. Acad. Sci. U.R.S.S.*, 40, 322 (1943).

⁹ For example, Mikheeva and Krjukova, on the ternary T-phase in the Al, Mg, Zn system, *Bull. Acad. Sci. U.R.S.S. (Chim.)*, 296 (1944); Boky and Wainstein, on crystal chemistry of Laves phases, *C.R. Acad. Sci. U.R.S.S.*, 40, 232 (1943); Sirota, on the thermodynamics of intermetallic compounds, *C.R. Acad. Sci.*, 44, 331 (1944).

¹⁰ Galpern, *Bull. Acad. Sci. U.R.S.S. (Chim.)*, 397 (1943).

¹¹ Nesmejanov and Luzenko, *Bull. Acad. Sci. U.R.S.S. (Chim.)*, 296 (1943).

¹² Lieberman and Kasansky, *C.R. Acad. Sci. U.R.S.S.*, 40, 353 (1943).