SMITHSONIAN INSTITUTION

ANNUAL REPORT FOR 1953–54

THE report of the Secretary of the Smithsonian Institution for the year ended June 30, 1954*, refers to the completion of a new exhibition hall, opened to the public on April 14, 1954, as the first installation of the programme of modernization and reconditioning of exhibitions in the Institution which during the next nine years should transform entirely the outmoded, inadequate and sometimes uninstructive features of the Smithsonian exhibitions so that they can be seen in a modern suitable setting. This first hall displays the development of the archæology of Central and South America before the coming of Columbus. Much progress was made during the year in developing detailed specifications for the new Museum of History and Technology, and further consideration has also been given to the buildings required for the National Zoological Park and the Natural History Building. The River Basin Programme was sharply curtailed, and the Secretary expresses anxiety lest, if funds are not made available next year, it will be forever too late to pursue the study of the early life of the original Americans, 80 per cent of whose important archæological remains are in river basins.

For further details of these surveys, the Secretary refers to the report of the Bureau of American Ethnology; this latter report and those of the other nine bureaux administered by the Institution, of the library, of the executive committee of the Board of Regents, and that on publications are appended. During the year 632,243 specimens were added to the collections in the United States National Museum, visitors to which numbered 3,262,150, and in which on an average at least a hundred scientists not on the Smithsonian staff are daily at work. Field-work was conducted in Thailand, Venezuela, Panama, the Caroline Islands, Fiji, Mexico, and many parts of the United States. Dr. M. W. Stirling, director of the Bureau of American Ethnology, continued his studies of Panamanian archæology, and Dr. H. B. Collins his Eskimo research and other arctic activities, including chairmanship of the committee supervising the preparation of the "Arctic Bibliography" for the Department of Defense. Studies of Olmec archæological materials from southern Mexico were continued by Dr. P. Drucker, while field activities in the river basin surveys consisted chiefly of reconnaissance or surveys to locate sites that will be involved in construction work or eventually submerged by reservoirs. By June 30, 1954, archæological surveys or excavations had been made since 1946 in 243 areas in 27 States and 4,345 archæological sites recorded, of which 852 were recommended for excavation or further testing. Activities of the Missouri Basin project were greatly reduced for lack of funds, but six field parties operated in the Basin during the year. In Tennessee detailed surveys were made of the Cheatham Lock and Dam and Old Hickory Lock and Dam projects on the Cumberland River near Nashville.

The Astrophysical Observatory completed work on the ninth revised edition of the "Smithsonian Physical Tables" and on Vol. 7 of the "Annals of the Astrophysical Observatory". Solar-radiation studies were continued at Table Mountain, California, and Mount Montezuma, in Chile; and besides routine work, calibrations were made of a silver-disk pyroheliometer for the Meteorological Service of Canada, a modified Ångström pyroheliometer for the Meteorological Service of the Belgian Congo, and a normal-incidence Eppley pyroheliometer for the United States Weather Bureau. The Division of Radiation and Organisms has shown that the apical stem hook is an excellent and reproducible test object for measuring the effect of radiant energy and chemical factors in the photomorphogenic response, and that triiodobenzoic acid, which opposes the effect of auxin in many other plant responses, produces an effect on the bean stem hook similar to that of the photo-reaction; studies have been completed of the effectiveness of various wave-lengths on the opening of the bean hook.

Progress was made in transport of the stored collections of the National Air Museum from Park Ridge, Illinois, to improved conditions at Suitland, Maryland, and three hundred and sixty specimens were added during the year. A special exhibit was arranged in December 1953 in connexion with the celebration of the fiftieth anniversary of powered flight, while the Museum's studies of the origin and history of the guided missile in the United States and of the pictorial history of the Wright brothers were materially advanced. Accessions to the National Zoological Park numbered 899 and visitors 3,616,220, but new buildings are urgently needed, as well as new paddocks. During the year twenty-two scientific workers went to the Canal Zone Biological Area for research, but the number of visitors decreased by a quarter.

The number of packages transmitted by the International Exchange Service decreased by 1,429 to 1,020,509; but 3,566 boxes, or 917 more than during 1952–53, were shipped to the foreign exchange bureaux, including sixty-two full sets and forty-three partial sets of United States government documents in exchange for official publications of foreign governments. Additions to the Library totalled 69,484 publications, and 515 new exchanges were arranged, while more than fifteen thousand reference questions were handled despite the fact that understaffing kept the bureau libraries closed except to staff and that overcrowding in the library of the National Collection of Fine Arts urgently needs to be relieved.

* Smithsonian Institution. Report of the Secretary and Financial Report of the Executive Committee of the Board of Regents for the Year ended June 30, 1954. (Smithsonian Publication 4182.) Pp. ix+175+4 plates. (Washington, D.C.: Government Printing Office, 1955.)

VISCOSITY OF POLYMER SOLUTIONS

AS a continuation of two earlier seminars on polymer science (see *Nature*, **171**, 65 (1953), and **172**, 102 (1953)), four lectures on the viscosity of polymer solutions were given in the Chemistry Department of University College, London, on March 11. Short abstracts of the lectures were circulated in advance, and this facilitated the discussions which followed the lectures. Prof. P. J. Flory dealt with relationships between the volume taken up by a flexible chain-like polymer and the viscosity of solutions containing such species. In good solvents the polymer molecules expand, and in poorer ones they assume a more nearly statistically unperturbed configuration. Through the use of suitable viscosity measurements, it is possible to

establish the unperturbed dimensions of the polymer chain, which depend on bond-lengths and -angles and on hindrance to free rotation. The theory, developed by Flory, enables, furthermore, an estimation to be made of thermodynamic parameters related to the heat and entropy of dilution of the polymer in a given solvent. It is also possible to explain the marked alteration of the viscosity of polyelectrolyte solutions brought about by changes of *p*H or ionic strength.

Prof. C. E. H. Bawn discussed intrinsic viscosity relationships for poly*iso*butylene and polystyrene in mixed solvents, some of the intrinsic viscosities being determined over a range of temperatures. These results were used to examine existing theories of the viscosity of polymer solutions and, in particular, the relationships dealt with by Prof. Flory.

Prof. J. A. V. Butler gave an account of viscosity measurements of two polyelectrolyte solutions, these experiments being done at low concentrations and rates of shear. Some of the results were interpreted with the help of an electrostatic theory of charged thread-like particles. Dr. B. A. Toms described a rheological investigation of about 3 per cent solutions of polymethylmethacrylate. The experiments were carried out with the help of a coaxial cylinder elasto-viscometer. The rheological behaviour of these solutions can be specified by a viscosity coefficient, a relaxation time and a retardation time. The variability of these parameters indicates that relaxation of shear and of rate of strain are effected by different mechanisms.

THE COUNCIL FOR THE PROMOTION OF FIELD STUDIES

AFTER a stringent period of economy caused by financial difficulties, the chairman of the Council for the Promotion of Field Studies, Prof. S. W. Wooldridge, reports that the increased bookings at the field centres and the careful husbanding and disposal of the Council's resources have led to a happier situation and a development of the Council's activities: a grant for equipment has been made to each of the four centres, while the teaching staff of three of them has been augmented by the appointment of a field assistant. In addition, substantial capital expenditure to improve comfort and acommodation has been approved at Dale Fort and Juniper Hall. The fourth annual report of the Council also describes the work at the field centres in 1954*.

At Dale Fort, marine biology again proved the greatest attraction at the centre, only geography with all its variations providing comparable numbers.

At Skokholm, work has been begun on the annual marking of puffin chicks, while many puffins were ringed to throw light on the movements, attainment of maturity, mortality and expectation of life of these birds.

Students again contributed to the long-term research projects at Flatford Mill; these included investigations into the distribution and feeding habits of flounders at the head of the estuary, and the study of the vegetational succession taking place on mud-banks forming at the lower edge of Sherbourne Brook.

At Juniper Hall, geographical subjects of all kinds were the main interest of 53 per cent of the total number of students, while biological studies of one kind or another accounted for 39 per cent of the attendance; courses for sixth-form students from grammar schools and public schools formed the most stable element in the centre's economy.

An interesting development at Malham Tarn was the arrangement of a special course for secondary modern school teachers; this was done in conjunction with the West Riding Local Education Authority.

The report also contains details of some of the specialized work that was carried out at different centres.

* Council for the Promotion of Field Studies. Annual Report, 1953–54. Pp. 60+8 plates. (London: Council for the Promotion of Field Studies, 1955.)

NEBULÆ AND STAR CLUSTERS

AT the meeting of the Royal Astronomical Society on February 12, 1954, at Burlington House, London, the presidential address (read by Prof. H. Dingle in the unavoidable absence of the president, Dr. J. Jackson) was delivered on the occasion of the award by the Society of its Gold Medal to Dr. Walter Baade, of the Mt. Wilson and Palomar Observatories, for his observational work on galactic and extra-galactic objects. The address, which has been published in full (*Mon. Not. Roy. Astro. Soc.*, **114**, 3 (1954); and also *The Observatory*, **74**, No. 879 (April 1954)), commenced with a brief outline of Baade's work with the reflector of 1 m. aperture at Hamburg Observatory from 1919 until 1931, when he joined the staff of the Mt. Wilson Observatory to work with Hubble on the branch which was his chief interest at Hamburg—the direct photography and photometry of nebulæ and star clusters. Soon after his arrival at Mt. Wilson Observatory he undertook an investigation for determining the distance of the wispy cloud in Cygnus, a region to which he had given special attention when he was at Hamburg and in which he had found that many of the variable stars were eclipsing variables. Three classes of stars were used from Mt. Wilson observations for determining the distance—the eclipsing variables; long-period variables; and early *B*-type stars—and they indicated distance moduli of 12·5, 13·0 and 12·7, respectively, the latter being adopted. The question of the absorption of light in space then arose, and from the colour indices of eighty stars of type *B*8 to *A*5 a colour excess of 0·25 was found. On the assumption that this was due to pure Rayleigh scattering, Baade deduced that the Cygnus cloud was 2,630 parsecs distant; if no correction for absorption had been applied, a distance of 3,500 parsecs would follow from the adopted modulus. The few Cepheid variables found in the cloud gave very unsatisfactory results: four of long period were so faint that they could not be fitted in with the adopted modulus; two could be explained by heavy absorption; and two others might be much farther off than the cloud. In addition, five short-period cluster-type variables could not be fitted into the general result, but it was possible to explain them as belonging to the general galactic field of such objects.

The address next turned to another branch of Baade's work—that connected with novæ and supernovæ. The discovery by Ritchey in 1917 of a nova