

secondly, with automata theory for the description of other phenomena as languages; artificial languages in information retrieval systems, including a brief consideration of the algorithmic language ALGOL; inference in information retrieval systems; and theoretical feasibility and complexity questions. The bibliography consists of 321 items.

Research in Space Science

SELECTED papers from the Special Reports in Space Science issued by the Astrophysical Observatory of the Smithsonian Institution during the years 1958-61 are brought together in *Smithsonian Contributions to Astrophysics*, 6, *Research in Space Science* (Pp. vii+242. Washington, D.C.: Government Printing Office, 1963. 2 dollars). The Smithsonian Astrophysical Observatory has been among the leaders in several branches of space research—the optical tracking of satellites, the determination of orbits from observation, the use of these orbits for geophysical studies, the development of orbital theory, etc.—and the papers are, therefore, of considerable interest as a record of progress in these subjects. Some of them are printed as they originally appeared (including one which was in error and is corrected 15 pages later); but others have been revised in varying degrees. The authors include regular members of the Smithsonian Astrophysical Observatory, such as L. G. Jacchia and I. G. Izsak, and visiting consultants, such as M. Nicolet and Sir Harold Jeffreys. This publication is supplemented by *Smithsonian Contributions to Astrophysics*, 8, No. 1, *Accurate Drag Determinations for Eight Artificial Satellites, Atmospheric Densities and Temperatures*, by L. G. Jacchia and J. Slowey (Pp. ii+99. Washington, D.C.: Government Printing Office, 1963. 65 cents). In this report the rate of decrease of orbital period for eight satellites during the years 1958-61 is evaluated from field-reduced observations with Baker-Nunn cameras, and the upper-atmosphere densities and temperatures are then determined. The report is notable for its accuracy and wealth of detail, the variations in density and temperatures at heights of 300-700 km, both short-term and year-by-year, being fully displayed.

Chesapeake Bay Bridge-Tunnel

SOME facts about the nearly completed bridge and tunnel crossing from Wise Point, Va., to the Virginia shore 15 miles from downtown Norfolk are of interest to Britain and France in view of the controversy that has raged over the possibility of bridging the English Channel, as opposed to a tunnel link under the Straits of Dover. This project overcomes the last and most formidable obstacle on the 998-mile Ocean Highway between New York and Florida. It is acclaimed not only as one of the world's modern engineering wonders but also as "... man's longest span across navigable ocean water". "The stream of seagoing traffic will inaugurate a spectacular 17.6-mile system of trestles, man-made islands and tunnels that draws the boundary between the Atlantic Ocean and Chesapeake Bay". More than two-thirds of this Highway is 30 ft. above water, elevated on 2,600 concrete logs, each 54 in. in diameter and embedded 100 ft. into the sea-floor. The structure is designed to withstand hurricane winds, a 10-ft. rise in sea-level, and even 14.5-ft. ocean swells. The tunnel sections account for two miles of the total span, one being 5,450 ft. long under the Chesapeake Channel, the other 5,738 ft. under Thimble Shoal—both are main shipping channels. Each tunnel, stated to be as wide and high as a three-storey building, was prefabricated, floated to site, then encased in concrete and sunk end-to-end in deep trenches excavated under the shipping lanes. The vital statistics of this bridge tunnel are that it took 1,000 men 3.5 years to construct, used 550,000 cubic yards of concrete; 55,000 tons of steel; 34,000 carloads of rock; and more than 5 million cubic yards of sand-fill. Another interesting feature of the

design is the use of 14,700 elastic bearing pads the size of "standard desk dictionaries". "Laminated pads of neoprene synthetic rubber around steel plates... the pads separate elevated 75-foot, 65-ton road sections from their supports. Thus they prevent concrete grinding and cracking caused by movement from thermal expansion and contraction or wind and water current". An illustrated article entitled "Seagoing Roadway Rides on Rubber", by H. E. Davis, published in the *Du Pont Magazine* (57, No. 4, 13; July-August, 1963) and from which the foregoing data are taken, gives many other technical details of this remarkable achievement.

Antibodies

Antibodies is the title of a recent issue of the *British Medical Bulletin*, which contains a series of authoritative articles by recognized experts each dealing with a particular aspect of the study of these substances (19, No. 3; September 1963. *Symposium on Antibodies*. Pp. 169-262+4 plates. London: The British Council, 1963. 30s.). Concise papers on the nature of antigen antibody reaction, sensitivity of methods of detecting antibodies, the isolation of antibodies, their chemical structure, γ -globulin metabolism, factors affecting antibody response, origins of immunological competence, as well as the nature of antitoxins, reagins, and auto-antibodies are among topics included. In the introduction, Prof. A. A. Miles, the chairman of the planning committee of *Antibodies*, reminds us that the story of antibodies began in 1890 with the demonstration by von Behring and Kitasato of the specific antitoxic property of the serum of animals some weeks after the injection of tetanus toxin. Almost three-quarters of a century has passed since then, and during that time not only has detailed knowledge of the subject increased enormously, but also we have a much deeper understanding of the process of antibody production. The editors are to be congratulated on having compressed so much into the space available and yet left us with a lucid and fascinating picture of present-day ideas on this important aspect of immunology.

Archæology in Western New South Wales

A RECENT issue of the *Records of the Australian Museum* contains an important article on "The Archæology of Mootwingee, Western New South Wales", by F. D. McCarthy and N. W. G. MacIntosh (Vol. 25, No. 13; December 3, 1962. Pp. 249-298+plates 19-27. Sydney: The Australian Museum, 1962). This describes the paintings and engravings which can be seen in two principal sites, called Main Gallery and Dingo Rock. The existence of this art has been known for 100 years, and was probably discovered by a member of the Burke and Wills party in 1860. The art consists of representations of humans, weapons and animals, and is considered in some cases to show incidents in the life of the Aborigines. The Dingo Rock decorations are believed to be at least 300 years old, probably more, on the basis of the fracturing and weathering of the rock following its engraving. The report attempts to interpret some of the scenes and objects in the light of local information; while knowledge of the technique of the engravings has been lost, certain groups can to-day be explained as portrayals of Aboriginal myths. In the same area, a series of painted rock shelters were recorded, and excavations made of certain of their floor deposits. In no case can the stone implements recovered be related to the series of paintings, and it seems probable that occupation of these shelters ceased well before the decoration was made.

Paul Instrument Fund Grants

THE Paul Instrument Fund Committee has made grants as follows: £12,800 to A. H. W. Beck, lecturer in engineering, University of Cambridge, for the construction of apparatus for the amplification and generation of