

THE NATIONAL SCIENCE FOUNDATION

THE fourteenth annual report of the National Science Foundation* covers the year ended June 30, 1964, the first year of Dr. L. J. Haworth's directorate. In his statement Dr. Haworth sets forth some of the factors which he believes are of special importance to the scientific community and to the United States at the present time, and the convictions from which they stem. For the rest the report follows the pattern of previous years, but the list of grants, contracts and fellowships is now published separately. The Science Development Programme commenced in March 1964 is intended to increase the number of institutions of recognized excellence in research and education in the sciences. Under this Programme grants will be made to colleges and universities judged to possess the greatest potential for attaining and maintaining a higher level of scientific merit. Grants are not expected to exceed 5 or 6 million dollars over 5 years, nor will more than 10-15 grants be made in any one year.

Under the scheme of Institutional Grants for science initiated in 1961, grants totalling 11.36 million dollars were made to 370 colleges and universities, ranging from 1,400 dollars to 150,000 dollars, and chiefly for purchasing scientific equipment. The programme of support for graduate science facilities was further expanded to 30.5 million dollars, from 2.1 million dollars in 1960, making a total of 96.2 million dollars for the period. Requests are now averaging nearly 500,000 dollars, 26 per cent of the requests and 15 per cent of the grants exceeding this figure, and of the 96.2 million dollars 60 per cent went to physical science facilities and 40 per cent to bioscience facilities.

On basic research activities, the Foundation distributed 266.4 million dollars in 1964—115 million dollars going to project grants and contracts, 3,105 in number. Of 2,915 proposals declined or withdrawn during the year, at least half were for projects which would have been supported if more funds had been available. Most of the grants went to 288 academic institutions, of whom 32 received grants of 1 million dollars or more. Fifteen of them were State institutions which are increasing in importance as sources of fundamental scientific knowledge and trained scientists; 41.3 million dollars went to the biological and medical sciences, 64.3 million dollars for mathematical, physical and engineering sciences, and 9.4 million dollars for the social sciences.

Among the projects thus supported, the report notes, as illustrative, Dr. W. J. Luyten's exploration of the relatively near and small stars which has revealed more than 12,000 such stars in apparent rapid motion, essentially all in a brightness range previously unchartable, and including one in the constellation Cetus which may be considerably smaller than the Moon. Data gathered by infra-red observations on the second flight of *Stratoscope II* observed that the atmosphere of the cool red giant stars has a very large water-absorption effect and that the amount of water vapour present in their atmospheres must be taken into account in computing the atmospheric temperatures and amounts of energy radiated from the stars. A successful synthesis of cubane has opened the way to an extensive study of the chemistry of box-like molecular structures. In high-energy nuclear physics the omega-minus particle postulated by the 'group

theory' advanced to explain strongly interacting particles was discovered and indicates that this approach may point to a complete physical understanding of the interactions between many types of nuclear particles. Workable operating systems have been developed at the Massachusetts Institute of Technology and Stamford University for sharing time on computers. An electron spin resonance spectrometer has been used to study the reaction of gas-phase hydrogen atoms with a solid film of propylene at 77° K.

In the biological and medical sciences, Foundation grants contributed to the development of chemical techniques which permit the assembly of deoxyribonucleic acid bases in known sequences; the new approach promises to overcome most of the decoding problems, while recent experiments indicate that the genetic code is probably the same in all organisms. Studies of the differentiation process in the mammalian pancreas have shown that the formation of pancreatic tissue depends on an interaction between two different tissues, an epithelium and a mesenchyme. Studies in the sea-urchin, coupled with evidence already available, suggest that the mature, unfertilized egg contains the stored information for synthesizing the essential proteins of early development. Two digestive enzymes produced by the pancreas, chymotrypsin and trypsin, have been found to possess completely different sequences of amino-acids in their structure but to contain the same amino-acids at their active sites, while the active site of phosphorylase has been identified as consisting of 14 amino-acids and capable of either taking on or giving up a phosphate. Identification of the red, green and blue pigments involved in colour perception has made possible an explanation of colour blindness. Other grants have supported work on the fine control of biological systems, the relative values of inheritance and learning in animal behaviour, on the relations between organisms and the effect of environmental influences on organisms, for example, the factors controlling productivity in a lake. Support in the social sciences has included archaeological projects, in connexion with the Aswan Dam projects and elsewhere, studies of the adaptation of native societies in New Guinea to administrative control, and the impact of the modern national economy on the traditional market system of Mexico. A survey of the prestige attached to occupations indicated a sharp rise in public esteem of scientific occupations since 1947.

Four national research centres are now supported by the Foundation: the National Radio Astronomy Observatory; the Kitt Peak National Observatory; the Cerro-Tololo Inter-American Observatory in Chile; and the National Center for Atmospheric Research. For these 4.6 million dollars, 4.4 million dollars, 1 million dollars and 9.3 million dollars, respectively, were allocated during the year, and the last-named had a staff of 154 scientists and engineers, in addition to 21 visiting scientists and 21 visiting students. Besides this, the Foundation contributed 7.4 million dollars to the Antarctic Research Programme, which included ecological and physiological investigations of the Weddell seal and extensive geological exploration of the ice-free ranges of West Antarctica; 3 million dollars on the deep crustal studies of the Earth, in which a key development during the year was the decision to design and construct a large floating platform from which the drilling operations will be conducted; 4.9 million dollars towards United States effort in the

* National Science Foundation. Fourteenth Annual Report for the Fiscal Year Ended June 30, 1964. Pp. xxix + 128. (Washington, D.C.: Government Printing Office, 1965.) 45 cents.

International Indian Ocean Expedition, in which the United States has 14 ships and 5 aircraft participating; 1.5 million dollars towards some 20 projects for the modification of the weather; 448,000 dollars for 5 projects in a co-operative science programme with Japan; and 3.7 million dollars for 48 projects in the International Year of the Quiet Sun.

Contributions to specialized research facilities included 5.3 million dollars for oceanographic vessels and facilities, 3.5 million dollars on 19 grants for biological research facilities, 4.5 million dollars on 18 grants for university computer installations, 5 million dollars for nuclear research facilities at universities, 700,000 dollars on 14 grants for university research facilities in atmospheric sciences, and 1 million dollars on 6 grants for research facilities in social science.

Under its science education programme, the Foundation awarded 3,226 graduate fellowships, 96 senior post-doctoral fellowships, 240 postdoctoral fellowships, 908 summer fellowships for graduate teachers, 325 science faculty fellowships and 292 summer fellowships for secondary school teachers, as well as 43 senior foreign science fellowships to scientists invited from other countries by universities in the United States. Much assistance was directed towards improving undergraduate courses, and nearly 9 million dollars went for equipment for this purpose and 688 institutions were assisted. The

Foundation contributed 39 million dollars towards institute training for secondary school teachers, 35,000 of whom attended such courses. Much progress is also reported on improving secondary school courses, and the Foundation also made grants totalling 2.4 million dollars for 185 special projects which provided training opportunities for 7,600 specially talented secondary school students. Attention was also given to the needs of elementary school teachers, about 3,350 of whom will receive training in teaching in science or mathematics as a result of Foundation grants, and the improvement of elementary school courses in science is also being assisted.

During the year the Foundation made six grants totalling 180,000 dollars in support of new periodicals, for the elimination of arrears and for experiments in more efficient production of periodicals; 17 grants totalling 140,000 dollars were awarded for the publication of scientific monographs; 390,000 dollars was awarded for the development by the Chemical Abstracts Service of a system of mechanical control of more than 2 million chemical structures with related technical information as a basis for a national computer-based chemical information service. Seventeen grants amounting to 859,000 dollars were made for research into the organization and searching of information, and during the year the Foundation supported 54 periodicals of translations, of which 10 became self-supporting during the year.

WILDLIFE RESEARCH IN THE UNITED STATES

THE activities of the Division of Wildlife Research in the Bureau of Sport, Fisheries and Wildlife of the U.S. Department of the Interior are described in the recently published report for 1963*. The Division serves as the fact-finding part of the Bureau, responsible for research on all wildlife—game and non-game, resident and migratory, harmful and beneficial. The results of the Division's investigations are used by the Bureau, and by co-operating Federal and State agencies in wildlife management, not only for the production of more and better public recreational facilities, but also for more effective control of wildlife injurious to agricultural, industrial and urban interests.

The research of the Division at present involves water-fowl and other migratory birds, upland wildlife with particular emphasis on problems occurring on public lands, pesticide-wildlife relations, diseases and parasites, control methods, and classification, distribution and life studies of wild birds and animals. Marine mammal research is at present being concentrated on the sea otter.

The expansion of the research programmes that began in 1958 continued, and programmes in animal-control methods and pesticide-wildlife relations were introduced. Disease and parasite research in the field of resident wildlife was expanded during the year through a contract with the University of Georgia. Smaller but significant growth characterized research on water-fowl and other migratory birds.

In meeting its wildlife research responsibilities, the Division co-operates with other agencies of the Department of the Interior, the Department of Agriculture, the Department of Health, Education and Welfare, and the Department of Defence. In its game-bird introduction programme, it is co-operating with the Wildlife Management Institute, the International Association of Game, Fish and Conservation Commissioners, more than forty State conservation departments, and various foreign

countries. Much of this research is in the native ranges of game birds considered potentially adaptable for release in selected game-deficient areas in the United States.

One of the oldest and best known of the Division's co-operative programmes is that of the Co-operative Wildlife Research Units. These are supported and administered under the terms of a memorandum of understanding signed by officials of the Bureau, the Wildlife Management Institute, and the land grant colleges and game and fish departments of the eighteen participating States. In addition to research, the Units facilitate training of qualified graduate students in wildlife studies and promote education in conservation through publication, demonstration, lecture and consultation.

The Division is concerned with numerous other instances of co-operative research, made possible by the interest of various conservation agencies, scientific institutions, and individuals. These programmes include the bird-banding record centre at the Migratory Bird Populations Station at Laurel, Maryland, where banding data on nearly 12 million birds of all kinds and recovery records on more than 1 million migratory birds are filed, and where more than 3 million cards on the migration and distribution of North American birds are housed. In another co-operative programme, bats have been banded, and the records are filed and kept up to date in the Bird and Mammal Laboratories housed in the U.S. National Museum.

The world's largest collections of North American birds and mammals are maintained at the U.S. National Museum, in co-operation with the Smithsonian Institution. These records, together with the professional taxonomic services provided by Division employees, are available to investigators whether they are members of the Bureau or not. The assistance of thousands of banders, observers and collectors, who have co-operated in obtaining these specimens or in providing data on them, makes this comprehensive service possible.

Within the Division the directors of the five research centres, the leaders of the eighteen Co-operative Wildlife Research Units, the leader of the foreign game introduction

* United States Department of the Interior: Fish and Wildlife Service, Bureau of Sport, Fisheries and Wildlife. Circular 188: *Wildlife Research—Problems, Programs, Progress*, 1963. Pp. viii+80. (Washington, D.C.: Government Printing Office, 1964.)