over-riding importance of the physical factors such as climate and soil, economic factors such as farm prices playing an obvious part, the imponderable social factors illustrated by religion and prestige are extraordinarily powerful and persistent.

In the discussion which followed, speakers raised such questions as the increased use of fertilizers and the 'cultivation of the sea'. Three other vice-presidents of the Union were present—Prof. Max Sorre (Paris), Prof. Orlando Ribiero (Lisbon) and Prof. Hans Boesch (Zurich). Prof. Boesch thought the papers emphasized the peculiarly difficult position of the older and more populous countries of Europe relying on their exports to purchase essential foodstuffs from overseas. It is clear, he said, that the great primary producers are not only using more and more of their home production, but are also regarding it as a matter of national prestige to develop their own manufactures. L. DUDLEY STAMP

[1] *Economic Geog.*, **29**, 1 (1953).

ACOUSTICS OF ORTHOPTERA

A SYMPOSIUM on orthopteran acoustics was held at Jouy-en-Josas, near Paris, during April 5–8 under the auspices of the French Ministry of Agriculture (Institut National de la Recherche Agronomique) and the able management of R.-G. Busnel, director of the Laboratoire de Physiologie Acoustique. It was intended both to be international and to be a meeting-ground for the scientific interests —physical, systematic, physiological, ethological and ecological—which touch each other in this field. In the event, although it is to be regretted that Italy, the Iron Curtain countries and the Americas were unrepresented, it provided the first opportunity since the Second World War for discussion of the subject between French, German and British scientific workers, a discussion much facilitated by comprehensive pre-circulation of individual contributions in two or three of their languages.

There has been little recent work on the physiology of hearing in insects; and apart from a useful survey of this part of the field by H. Autrum (Würzburg), the conference divided its time almost equally between papers on three aspects of the subject: the technique of recording and reproducing the sounds produced by insects; the analysis, oscillographic and spectral, of such sounds with attempts to relate the results, on one hand, to the structure and movements of the insect and, on the other, to the confusing and cumbrous terminology already in use; and the function of such sounds in communication between insects of the same species. Since the complete proceedings will be published shortly in French, it would be unprofitable, even if it were practicable, to abstract each contribution and each discussion here. It seems better to give what to one observer were the salient features of the conference as a whole.

The saltatorial Orthoptera, though not the only insects in which communication by sound has been established, are the best known and have shared with the cicadas the ability to interest and exasperate the human hearer for millennia. But it is only very recently that technical equipment has become available for recording, analysing and synthesizing their songs and so making possible an experimental investigation of their meaning. The pioneer observations of Regen and Faber had already established that different meanings inhered in different varieties of songs; but they had also shown that in certain circumstances a typical response could be obtained to the crudest of imitations while, in others, the insect was not seduced by what appeared to be a perfect copy. This contrast was sharply pointed by two contributions to the symposium. W. Loher (Paris) showed, in an attractive colour-film, how by an imitation made with his own mouth of the 'ordinary song' of *Chorthippus brunneus* (*ci-devant bicolor*), he could attract females of the species on to his person and even on occasion on to his lips. On the other hand, M. and Mme. Busnel described how they had completely failed to obtain a response from the females of *Oecanthus pellucens* by playing back a high-quality record of the song of the male until, with the introduction of a new type of transducer, the ionophone, they began to get positive results. The ionophone, described and demonstrated to the symposium by its inventor, M. S. Klein (Paris), is clearly a technical advance of the first magnitude. It is a completely aperiodic loud-speaker with a flat response up to more than 100 kc./s., and it has a large undistorted power output from what is virtually a point source. It is nevertheless very remarkable that it should be necessary to employ so perfect an instrument in order to make a passable copy of the song of *Oecanthus*, for analysis has confirmed the aural impression that this song is comparatively 'pure', with a fairly simple oscillogram and a relatively narrow spectrum. It is evident that there is still much to be learnt about how the gryllids and tettigoniids detect a spurious copy; and it by no means follows that because some acridiids respond by a tentative approach to an indifferent imitation of the song of their own species, they are unable to distinguish it from the real thing. It is inevitable that comparisons should be made with the experiments of Tinbergen, Lack, Hartley and others, who have shown that a stereotyped reaction can often be elicited from vertebrates by 'models' which correspond only in one or two essential features with the prototype which normally evokes the reaction. Thus small birds which customarily mob tawny owls will mob any dark mottled object of approximately the right size; but they ignore a living barn-owl which is paler, though in other respects it seems to us a much better 'model' of a tawny owl. The determination of what features of the structure of insect songs are 'essential' in this sense to their communicative function is a task for the future, though the investigation is now technically possible. It was interesting and suggestive to find that a comparison of the oscillograms of the 'ordinary song' of *Ch. brunneus* and of Herr Loher's oral imitation disclosed a similarity in structure which was obvious neither to the untutored human ear nor to the spectral analyser.

The majority of vocal saltatoria produce their songs by one or other of two methods which we are accustomed to regard as standard for the group; but D. K. McE. Kevan (Nottingham) gave a substantial list of species employing unorthodox stridulatory devices which he described and which could only be regarded as the result of independent evolution. Unfortunately, little is known of the degree of development of the auditory (tympanal) organs in the heterodox species, or of the importance of stridulation in their life-history; but their existence (many of them are exotic) is a warning not to generalize too widely from the relatively poor orthopteran fauna of Western Europe. B. P. Uvarov

(London) emphasized this danger in pointing out that tympanal organs (ears) are well developed in many dumb acridiids, and that, when the Australian groups are taken into the account, their presence appears to be correlated more closely with the power of flight than with the ability to stridulate. No plausible explanation of this curious paradox has been suggested.

Papers dealing with the sound-field of various types of saltatoria and its relation to their habitat were read by R.-G. Busnel and by P. T. Haskell (London). It is possible to make guesses at the range within which stridulation is an effective means of communication and to account plausibly for some of the characteristic differences of the stridulation patterns of acridiids and tettigoniids in terms of their different habitats, the former insects being relatively densely distributed at ground-level while the latter are scattered in three dimensions. Nevertheless, both these papers made clear the need for better determinations of the auditory threshold in a larger number of species than have yet been attempted. Moreover, as Autrum emphasized in his introductory survey, the division of the auditory function between tympanal organs, sub-genual organs and cerci is a complication of which the consequences are not understood and have scarcely begun to be investigated. One can only agree with the observations of Prof. P. P. Grassé in the address with which he brought the conference to an end: "On ne peut dire que les études faites jusqu'ici sur les sons en tant que facteurs de la structure sociale ou du simple maintien du groupe soient satisfaisantes. . . . Un des mérites du present Colloque sera d'avoir bien montré la necessité d'établir les veritables nature et signification des réactions aux stimulations sonores". It must be admitted that this symposium represented seed-time rather than harvest; but it has performed a service of value in stimulating a reorientation of ideas and in indicating lines of research which are likely to be profitable, which are now technically possible, and which, moreover, are certainly relevant to a much wider field than its deliberately restricted agenda might suggest.

R. J. Pumphrey

SMITHSONIAN INSTITUTION

REPORT FOR THE YEAR 1952–53

THE report of the Secretary of the Smithsonian Institution for the year ended June 30, 1953, to which are appended the usual reports on the United States National Museum, the Bureau of American Ethnology, the International Exchange Service, the National Zoological Park, the Astrophysical Observatory, the National Air Museum and the Canal Zone Biological Area*, points out that almost all the endowments were given for specific purposes and little of the income from the invested funds of the Institution is available for alteration or growth from year to year. Generally, the continuing activities of the Smithsonian Institution have financially remained static during the past twenty years or have even retrogressed. While the national collections in the care of the Smithsonian have increased by 130 per cent since 1934, the number of visitors to its five exhibition buildings has increased by 150 per cent, and the correspondence on scientific and other questions multiplied several times, the man-hours per week available at the Institution have decreased and the appropriation for functions other than staff is 11,000 dollars less than in 1933. Appropriations for the fiscal year 1954 will, however, permit first steps towards the overdue rehabilitation of its exhibitions and the renovation of some of its buildings, though funds for continued modernization and renovation will be urgently required in succeeding years as well as plans for new buildings.

At the end of 1952 the activities of the Institute of Social Anthropology were terminated, and anthropologists remaining on its staff were transferred to the Institute of Inter-American Affairs. Systematic researches of the anthropologists of the Bureau of American Ethnology included Dr. M. W. Stirling's archæological work in Darien and on the islands of the Gulf of Panama, Dr. H. B. Collins's studies on the Eskimo and arctic anthropology, Dr. J. P. Harrington's studies of the Chumash Indians of the Santa Barbara Channel region, California, and those of Dr. P. Drucker of Meso-American archæology. In the investigations of the River Basin Surveys carried out by the Bureau in co-operation with the National Park Service and the Bureau of Reclamation of the Department of the Interior, the Corps of Engineers of the Army Department and various State and local institutions, greater emphasis continued to be laid on excavation now that survey has largely caught up with the general programme. Of the 3,469 archæological sites located and recorded by the survey parties, 852 have been recommended for excavation or limited testing. Already 172 preliminary appraisal reports have been distributed, and excavations made in 42 reservoir projects located in 17 States. Palæontological surveys have been made in 121 reservoir areas, and archæological work has also been done in 88, while the remaining 33 will be visited by archæological parties. Already 273 reservoir basins, including those where archæological studies are still to be made, have been surveyed.

The collections of the National Museum increased by more than 1,607,000 specimens during the year, bringing the catalogue entries to nearly 35 million. Exploration and field-work during the year included C. O. Handley's observations and collections of mammals in the Kalahari desert region of north-eastern South West Africa, Dr. A. Wetmore's studies on the distribution of bird life in Panama, H. G. Deigman's ornithological work in Thailand, studies of coral-atoll ecology in Tahiti and on Raroia Atoll, and searches for invertebrate and vertebrate fossils by three parties at Adair, Oklahoma, in the Guadalupe Mountains of western Texas, in north, east and south Mexico and in south-central Wyoming. Accessions to the National Zoological Park numbered 810, bringing the net count of animals at the end of the year to 2,741, but there was a slight decrease in the number of visitors, who totalled about 3,231,000.

At the Astrophysical Observatory the manuscript of Vol. 7 of the *Annals* of the Observatory, covering its research during 1939–52, was completed and sent to press late in the year. A thorough study of the silver-disk pyroheliometer was completed in April 1953. Tape exposures to total sun and sky radiation continued at Montezuma, Chile, where a new modern seismometer is now being installed, and at Table Mountain, California, the permanence of the con-

* Smithsonian Institution. Report of the Secretary and the Financial Report of the Executive Committee of the Board of Regents, for the Year ended June 30, 1953. (Smithsonian Publication 4141.) Pp. x + 166 + 6 plates. (Washington, D.C.: Government Printing Office, 1953.)