SCIENTIFIC RESEARCH IN INDIA

THE Survey and Planning of Scientific Research Unit of the Council of Scientific and Industrial Research, New Delhi, has issued a survey of scientific research in Indian universities, based primarily on the annual reports of some twenty-five universities, and covering twelve scientific subjects*. Forty-eight universities have scientific departments, and nine sent reports for the full 10 years (1952-62); some of the new universities did not send annual reports. The survey gives the total number of papers published by the university departments each year since 1952-63, and the distribution by subject and by periodicals, with statistics of authors. In the period covered, the number of Indian universities has grown from twenty, with 108,722 students in science faculties, to fifty-five, with 1,386,374 in science faculties.

In agriculture, Allahabad, Andhra, Annamalai and Calcutta appear to have active research departments; at Calcutta and Banaras most of the emphasis is on agricultural botany, and at Annamalai on pathology; animal husbandry and veterinary science are receiving little attention. Most of the universities except Aligarh, Jabalpur, Jadavpur, Mysore, Saugar and Karnatak are active in botanical research, notably at Allahabad, in the physiology and ecology of angiosperms and plant pathology due to fungi. The morphology of angiosperms is being studied at Andhra, the physiology and ecology of angiosperms at Annamalai, cytogenetics of angiosperms and other groups at Calcutta, morphology and physiology of angiosperms at Delhi and Utkal, and plant pathology due to fungi at Madras. In chemistry, 589 papers came from Andhra, 438 from Calcutta, 374 from Delhi, 360 from Lucknow, 265 from Banaras, 236 from Jadavpur, 234 from Utkal and 216 from Madras. In Delhi, Lucknow, Calcutta, Banaras, Annamalai and Poona, the emphasis was mainly on organic chemistry; at Allahabad on physical chemistry; inorganic work came chiefly from Allahabad, Andhra, Banaras, Jadavpur and Utkal. Only Calcutta was concerned with research in industrial chemistry and work on analytical chemistry was mostly insignificant. In engineering, 80 per cent of the papers published were in

chemical engineering and only in Banaras was there any research in metallurgy.

There is considerable research activity in geology at Andhra, Calcutta, Jadavpur and Lucknow, while in mathematics the contribution has come mainly from Lucknow, Calcutta, Delhi and Banaras. Out of 95 papers from Banaras, 63 were published in 1961-62, the theory of numbers and theory of functions accounting for 60 per cent of the total. Those from Banaras were concerned mainly with relativity and theory of functions; from Lucknow, with algebra, theory of functions and mechanics; from Delhi, with geometry and mechanics; from Calcutta, with algebra and geometry; and from Allahabad, with the theory of functions. Research in the medical sciences was most active at Lucknow, followed by Andhra, Bombay, Delhi, Nagpur and Poona. Medicine and pharmacology, with some pathology and physiology (Lucknow), physiology and medicine (Bombay), physiology (including biophysics and biochemistry) (Calcutta), and pathology, anatomy, medicine and gynaecology (Andhra) were the chief fields. Only at Andhra, Banaras and Panjab was effective research in progress in pharmacology, about 90 per cent of papers from Andhra and 70 per cent from Banaras being in chemotherapy.

Most universities were consistently active in physics, especially nuclear physics (Bombay and Delhi); theoretical physics (Madras, Annamalai and Delhi); spectroscopy (Andhra); electronics (Andhra and Calcutta); microwaves and acoustics (Andhra); crystallography, biophysics and mechanics (Madras). Bombay and Calcutta have published a few papers on cosmic rays. Calcutta, Baroda, Bombay and Poona, with Karnatak (since 1958), have published most of the research papers in statistics, largely on the design of experiments, theory of inference and descriptive statistics. Only at Utkal, Kerala and Sri Venkateswara has there been any research in veterinary science, but Lucknow, Madras, Andhra, Baroda, Delhi, Allahabad, Annamalai and Sri Venkateswara have active research departments in zoology. Cytogenetics appears to be neglected except at Allahabad. Of the Council's total research grants to universities of 8.8 million rupees in 1958-65, 45 per cent was for chemical research, 22 per cent for physical research and 11 per cent for biological research.

* India: Council of Scientific and Industrial Research. Survey Report No. 6: *Scientific Research in Indian Universities*. By U. Sen, A. Rahman, S. P. Gupta, A. K. Roy, S. Malik, S. H. M. Husaini, S. Das Gupta and Y. K. Agarwal. (New Delhi: Council of Scientific and Industrial Research, 1965.)

FUNCTIONAL ARCHAEOLOGY

THE value to the prehistorian of experimentation with archaeological material has long been recognized. The list of materials submitted to testing for methods of production and for possible functions is a long one, ranging from the working of flint and stone to the firing of Romano-British pottery in reconstructed kilns, and this article draws attention to two recent experiments in functional archaeology.

Among the first archaeologists to consider the possibilities of this approach was Sir John Evans, who compared his prehistoric flintwork with that produced by his nineteenth-century contemporaries at Brandon in Norfolk and in other countries as well. In Scandinavia, Jorgensen and Steensberg have in recent years directed experiments

with flint axes to see how efficiently these could fell trees, and the next stages in primitive cultivation, burning and sowing of seed, have also not been neglected. In Britain, ploughing experiments with reconstructed Danish ards have recently been carried out, and these may be of real assistance in interpreting the traces of ploughing recovered from such sites as Gwithlan in Cornwall. The Council for British Archaeology has also carried out experimental work on storage pits to see how efficiently these basketry-lined pits preserved grain. In Ireland the cooking experiments on Bronze Age sites are quite well known, and seem to have been successful both in function and in the taste of the finished product. Many other experiments involving the reconstruction of larger-scale

monuments, defensive ramparts, standing stones and wattle-and-daub houses could be mentioned, but the present article emphasizes the experimental techniques involving the functions of actual or duplicated artefactual material. A considerable amount of experimental work has been carried out on the casting of copper and bronze products, and on the firing of Romano-British pottery, but these have been concerned mainly with production techniques, while it is the functional aspect that is particularly relevant at the moment. Recent work on this aspect has included the testing of the capabilities of sheet metal and leather shields to stand up to sword and spear blows, the determination of the range of musical notes obtainable from both Danish and Irish Bronze Age horns, the function of Upper Palaeolithic and early Mesolithic harpoon-heads, and, most recently, two papers in *Man* (65, 1965) which advance new interpretations of the function of well-known Palaeolithic artefacts. In one (No. 148) Dr. M. D. W. Jeffreys attempts to show that the handaxe, that characteristic tool of the widespread African Chelles-Acheul and European and western Asian Abbevillian and Acheulean industries, was not in fact a handaxe, but was a handbolt or missile. He defines a handaxe as an elongated tool with a pointed and a blunt end, bifacially worked with a cutting edge all the way around which shows no sign of wear. Because of the cutting edge, Jeffreys believes that such axes could not have been held in the hand, and he argues that these objects were hurled, the blunt end aimed at the quarry and thrown with the cutting edge horizontal to the ground. The weight distribution he thinks would cause the missile to revolve in such a way that the sharp-pointed end would move at great speed. In my opinion, experimental throwing of handaxes seems to disprove this theory; handaxes exhibit immense variation in their form, and many

of the type with one pointed end have a rounded butt deliberately left unretouched, presumably to provide a safe grip. That different shapes and sizes of axes were designed for different functions seems without question, but it is incorrect to call all these tools handbolts.

The second paper (No. 143) is a contribution by Leon Underwood and is concerned with Upper Palaeolithic perforated batons. These, often decorated, have been interpreted in the past as leather-working tools, arrow straighteners, or generally as emblems of authority and ceremony. Underwood argues that these batons were used as spear-throwers on the basis of analogous forms in Eskimo throwers. The latter have a prepared grip and a nipple to engage the end of the spear shaft. On not a single Palaeolithic baton has the end survived sufficiently to provide the slightest hint of a nipple or hook, and apart from this hypothetical appendage, there is really no point of comparison between the batons and the Eskimo throwers other than the hole or holes. That such batons, if provided with hooks, would function as spear-throwers is not disputed, because Underwood has provided models to show this. But there are a few complete Palaeolithic batons, and these show no sign of the hook nor of a bound-on hook. In any case it would seem strange if the development of the baton as a spear-thrower, from Aurignacian times through the Magdalenian, did not become abruptly altered by the apparently quite rapid appearance of the true spear-thrower in mid-Magdalenian times; in fact, there is a high degree of consistency in baton development over some 15,000 years. Underwood has made a number of provocative statements in his paper; although some of these are improbable, his ingenuity may nevertheless stimulate further work of this experimental kind.

J. M. COLES

THE TEACHING OF PARASITOLOGY

PARASITOLOGY is taught in schools, in agricultural and biological departments of universities and technical colleges and in schools of medicine and veterinary medicine. Parasitologists are employed in a wide range of research establishments and many people trained in parasitology have found employment outside this field. The British Society for Parasitology felt that a meeting on the teaching of this subject would bring together those who taught and those who employed parasitologists and that all would profit from an informal discussion of common aims and problems. Accordingly, a colloquium was held at the Imperial College of Science and Technology, London, on January 10.

The form of the colloquium itself was an experiment as a large number of people were expected to attend and the usual formal meeting was quite unsuitable as a basis for the informal discussion which was envisaged. It was eventually decided that four speakers should briefly discuss particular topics of a general or controversial nature and that the participants should then divide up into small groups to discuss the papers and a list of topics prepared by the organizers. Each group was to be led by a rapporteur and at the end of the group discussions the participants would reassemble and listen to summaries from the rapporteurs and discuss them. In advance, each participant received a summary of the replies to a questionnaire which gave some idea of how much and what kind of parasitology was being taught in Great Britain. Questionnaires had been sent to biology or zoology departments of universities, schools of medicine and veterinary medicine and certain colleges of technology. Forty-one biology or zoology departments in

universities were approached; thirty-five replied, and of these twenty-nine ran some sort of course in parasitology and twenty-three of these planned to expand their courses during the next 5 years. Eighteen of the twenty-two medical schools replied and twelve of these ran parasitology courses, three of which will be expanded. All six veterinary schools replied and four of these ran courses, one of which is to be expanded. Seventeen technical colleges were sent questionnaires and twelve replied; of these, nine ran courses and all planned some expansion. In all, fifty-four separate departments run eighty-three courses in parasitology each year and a considerable further expansion is envisaged. These courses are very varied and range from one or two lectures to postgraduate courses lasting a whole academic year. The content of the courses is also varied but, in general, the parasitology taught to the veterinary students is applied, while that taught to all other students ranges from wholly systematic to wholly experimental, although most courses cover all aspects of the subject to some extent. Other information obtained from the questionnaire dealt with the nature and content of parasitology courses and was intended to act as a stimulus for discussion.

Eighty-six people attended the colloquium, which opened under the chairmanship of Prof. B. G. Peters, who outlined the nature, aims and procedure of the meeting. Prof. W. E. Kershaw spoke in general terms about the teaching of parasitology and more particularly about the M.Sc. course at the University of Liverpool. The second speaker was Dr. H. D. Crofton, who discussed the different problems involved in teaching science and veterinary students. The latter, he said, regarded