Foot-and-mouth disease research can be carried out successfully only in a country relatively free from the disease and under elaborate conditions of isolation. Pirbright is ideally situated for this purpose. The results fully justify the existence of the Institute, and it is encouraging to read that "a large expansion of the buildings and facilities is planned" and that "When the additional facilities are available, the staff will be strengthened and the number of animals used for experiments at one time can be increased, with a corresponding speeding up of all the investigations".

TECHNICAL AIDS IN ARCHÆOLOGY

FOLLOWING the practice adopted at Edinburgh in 1951, a session on "Technical Aids for Archaeology" was organized by Section H (Anthropology and Archaeology) of the British Association at the meeting this year in Belfast. Being on the opening morning of the sectional sessions, however, and held in duplicate with one on Irish archaeology, attendance was disappointing.

Mr. G. F. Mitchell, Fellow and lecturer in Irish archaeology at Trinity College, Dublin, spoke first on vegetational environmental studies. It is now generally accepted that the palaeobotanist can be the archaeologist's most valuable collaborator, giving him some chronological framework in earlier periods, and at all periods an insight into early man's environment. The classical work in this field in Denmark¹ has related the earliest appearance of plantain pollen in Neolithic levels in peaty deposits to the development of agriculture at that period, for plantain is a weed of cultivation. In Denmark also, the appearance of beech pollen at a *Grenz-horizont*, or recurrence surface, in the raised bogs demonstrates a change in climatic conditions about 500 B.C.², and of rye and cornflower pollens at levels formed about A.D. 1200 indicates a change in agricultural activity³. In Ireland also, the rise of plantain pollen demonstrates the beginning of agriculture in Neolithic times, confirmed by the grain impressions on Neolithic pottery. There is also a well-marked recurrence surface, which, though not yet precisely datable in pollen terms, may lie at about 500 B.C.⁴, although there is a second, higher surface, datable perhaps to about A.D. 400.

In evaluating climatic changes the natural sequence of pollen proportions is required, and this must be sought so far as possible from man's activities at that period, for these tended to destroy the natural woodlands and, in some places, produced heaths which invaded abandoned fields. Study of the ratio of herb to tree pollen makes possible some estimate of early agricultural activity, and the shrinking of forests may be traced as more skilled methods of agriculture were developed.

The seeds, charcoals and woods associated with early human activity show that the wood of all native trees was used in some way, that blackberries, elderberries, raspberries, strawberries and hazel-nuts were collected⁵, that barley, oats, wheat and flax were cultivated, and that weeds were very abundant in prehistoric fields. The stomach of a Beaker period burial in the submerged clay of the Essex coast contained a pint of seeds, mostly blackberry⁶, and in that of an Iron Age corpse recently found in a Danish bog seeds of pale persicaria, white goosefoot,

corn spurry and black bindweed predominated. These plants were formerly cultivated, and, as they also occur in deposits of the early centuries of the Christian era in Ireland, they may have been cultivated for food there also.

Mr. E. M. Jope, lecturer in archaeology in Queen's University, Belfast, spoke next on "History, Archaeology and Petrology". During the past fifteen years the value of petrological examinations, especially of stone axes, has become fully appreciated by pre-historians. A number of axe factory sites are now known in the British Isles, and the petrologically determined distribution of their products is revealing wide, and sometimes unsuspected, contacts in Neolithic times. A lead was given by the Stone Axe Sub-Committee of the South-Western Group of Museums, which has published three reports⁷, and a more general view is emerging as studies appear from other areas⁸. But the petrological demonstration that the Stonehenge 'bluestones' were brought from the Presely mountains in Pembrokeshire⁹ nearly four thousand years ago still remains one of the most outstanding facts of British prehistory.

The study of building materials, particularly those in medieval buildings, can illuminate the economics and organization of the building trade; and as the material is bulky, when it is shown in use at a distance from its source reasonable transport facilities are implied, in many cases by road. Some valuable studies are already available¹⁰, but the rate of such work is usually determined by the availability of reliable petrology, without which it is valueless, and much remains to be done in this field largely ignored by architectural historians. Some materials are, however, recognizable macroscopically with small chance of error, and systematic study of some of these is now showing the possibilities of this approach. Thus, Purbeck marble was extensively used throughout the civil zone of Britain in Roman times¹¹ and, after a lapse of about 750 years, was again even more extensively used throughout the Middle Ages. The marble industries of the Mediterranean area in Roman times are being studied at the British School at Rome¹². Granite began to be commonly used in Devon and Cornwall churches during the fifteenth century, particularly as monolith arcade piers weighing often as much as five tons; and in a recent survey these have been found in nearly three hundred churches, some of them twenty miles or more from the granite outcrops, requiring land transport, in some documented instances by cart. The medieval export of blue slate from Wales¹³, and from Cornwall and Devon¹⁴, has also been studied. A survey of the medieval use of fine-quality building stone from the area of Great Oolite extending up the Cotswolds from Bath to Burford is now in progress, and it is already clear that such work can supplement surviving building accounts to give a more balanced estimate of the economic importance of such a stone industry¹⁵.

An understanding of the variety of stones used for different purposes in historic buildings is of the utmost importance as basic data for the architects and others responsible for maintenance, if the buildings are to be preserved in a condition as near as possible to the designers' and builders' intentions¹⁶. This aspect has, in the past, been much neglected, as many historic buildings, particularly in Oxford, bear witness.

The third paper, by Mr. L. Biek, of the Ancient Monuments Laboratory, Ministry of Works, was on "Antiquities, Ancient Monuments and Research on Materials". In it he discussed first the relation

between the scientific worker and the world's heritage of material culture¹⁷. A study of antiquities and ancient monuments by laboratory methods not only helps field archaeologists by correlating the condition of finds with their environment, but also leads to better preservation and a fuller understanding and appreciation of objects by presenting them as nearly as possible in their original forms, as they were conceived by their makers. The benefits of such collaboration may, moreover, be mutual, for men of science working in some fields, such as corrosion studies, may gain a new insight into their own problems. Such work requires properly staffed laboratories which are specially intended for the problems involved¹⁸.

Numerous illustrations of the results of such work, some with excellent coloured slides, were then given by Mr. Biek. Much new knowledge of early craftsmen's techniques comes from the detailed laboratory examination of their handiwork. Thus, the use of mercury in gilding sixth-century Merovingian brooches has been established, the mercury still being traceable microchemically. X-ray shadow-graphs have been invaluable in the study of antiquities, showing up even before cleaning, and without in any way altering the object, many details of their structure and decoration.

Recent studies in the Ancient Monuments Laboratory have shown that many of the rings used in making chain-mail of Roman times, found at Richborough, were punched out of cast sheet bronze. From a purely scientific point of view, the extreme fragility of similar rings, which must on internal evidence be taken to have been cold-worked, suggests that some ageing factor, as distinct from corrosion, may be operative under certain conditions. The survival on such rings of traces of suspension fibres (bast fibres, probably flax²⁰) may possibly have been aided by the presence of corrosion products. But the most definite pointer of scientific interest provided by archaeological finds was given by some excellently preserved iron objects of Roman and Saxon origin recently found at Hungate, York. Here research²¹ showed that corrosion had been inhibited by phosphate and tannate, and the latter's suppression of sulphate-reducing bacteria was demonstrated for the first time. Such work is of potential value in the protection of present-day buried pipelines, for it has been estimated that the cost to England and Wales is £5 million a year due to corrosion losses in water mains alone.

Mr. Biek discussed the detailed collaboration of the laboratory staff with the archaeologists in the field, not only on excavations but also in the study and preservation of buildings. Preservation of stonework has been much discussed in the past, and the study of masonry and brickwork in relation to their environment and the mortars used remains of greatest importance. It is also possible to learn something about early timberwork in buildings, and evidence of 'soft rot', a condition only recently recognized²², has now been detected in the cavities left by bonding-timbers in the medieval masonry at Framlingham Castle, Suffolk. Apart from one very small piece of wood carrying this information, no trace of woody material was found in any of the several cavities, which originally contained timbers 15 ft. long by 1 ft. in diameter. In more modern buildings, the copper roof at Lancaster House and the century-old cast-iron tiles on the Houses of Parliament have recently been studied.

It is in the nature of things that references to such work should be widely scattered among many journals over a number of years, and only if there is direct systematic contact between archaeologists and other scientists can the difficulties arising from such a state of affairs be reduced.

These three papers demonstrated selected aspects of collaboration between the natural sciences and archaeology, and emphasized how the whole scope of inquiry into the past is being widened by this approach to the material. More laboratory facilities are required, such as are already operating at the British Museum, the Courtauld Institute, the Ministry of Works Ancient Monuments Branch, or Dr. H. Godwin's Sub-Department of Palaeobotany at Cambridge, and in them workers are needed who by inclination are interested in archaeological and historical problems as well as in those of the natural sciences. Neither are surely unreasonable requirements. It was encouraging to see that all three speakers at this session ranged widely in time, treating the study of material remains in both prehistoric and historic times as a continuum, and emphasizing what is generally accepted in classical studies, that in the Middle Ages, and even in more recent periods, a complete historical picture is not to be derived from written sources alone.

E. M. JOPE

- ¹ Iversen, J., "Land Occupation in Denmark's Stone Age", *Danmarks Geologiske Undersøgelse*, 2nd ser., No. 66 (Copenhagen, 1941).
- Clark, J. G. D., "Prehistoric Europe", 91 (1952).
- ² Granlund, E., "De Svenska Högmosarnas Geologi", *Sveriges Geologiska Undersökning*, Ser. C, No. 373 (1932).
- ³ *Nature*, **168**, 672 (1951). Mikkelsen, V., *Res. Botanicae Danicae*, **13**, No. 5 (1949).
- ⁴ Jessen, K., *Proc. Roy. Irish Acad.*, **52** B, 88 (1949). Mitchell, G. F., *ibid.*, **53** B, 111 (1951). Hencken, H. O'N., *J. Roy. Soc. Antiq. Ireland*, **81**, 53 (1951).
- ⁵ Bertsch, K., *Badische Fundber.*, **2**, Pt. 9 (1932). Lechler, G., "The Nutrition of Palaeolithic Man", *Pop. Michigan Acad. Sci., Arts and Lett.*, **30**, 499 (1945).
- ⁶ Warren, S. H., *Essex Naturalist*, **16**, 201 (1911).
- ⁷ *Proc. Prehist. Soc.*, **6**, 50 (1941); **12**, 47 (1947); **17**, 99 (1951).
- ⁸ *Proc. Prehist. Soc.*, **15**, 1 (1949); *ibid.*, **17**, 159 (1951). *Adv. Sci.*, **8**, 15 (1951). *Ulster J. Archaeol.* (in the press). Brit. Assoc. Handbook, 78 (Belfast, 1952). Clark, J. G. D., "Prehistoric Europe", 243 (1952).
- ⁹ Thomas, H. H., *Antiq. J.*, **3**, 239 (1923). Stone, J. F. S., *ibid.*, **30**, 145 (1950).
- ¹⁰ Arkell, W. J., "Oxford Stone" (1947). Neaverson, E., "Medieval Castles in North Wales" (Liverpool, 1947). Wallis, F. S., *Proc. Somerset Archaeol. Soc.*, **94**, 78 (1948-49).
- ¹¹ Dunning, G. C., *Archaeol. Newsletter*, **1**, 15 (March 1949).
- ¹² *J. Roman Studies*, **41**, 89 (1951).
- ¹³ North, F. J., "The Slates of Wales" (2nd ed.), 88 (Cardiff, 1946).
- ¹⁴ *Antiq. J.* (In the press).
- ¹⁵ *Berkshire Archaeol. J.*, **51**, 58 (1948-49).
- ¹⁶ Arkell, W. J., "Oxford Stone", **79**, 162 (1947).
- ¹⁷ *Museum*, **5**, 45 (Unesco: Paris, 1952).
- ¹⁸ *Museums J.*, **51**, 291 (1952). *Museum*, **45** (Unesco, Paris, 1952).
- ¹⁹ *Museum*, **4**, 187 (Unesco, Paris, 1951).
- ²⁰ British Cotton Industry Research Association, 1952. Unpublished report on fibre from Jutish cemetery at Buckland, Dover.
- ²¹ Chemical Research Laboratory, D.S.I.R., 1952. An investigation of factors responsible for the preservation of iron articles on an archaeological site, Farrer, T. W., Biek, L., and Wormwell, F. (In preparation).
- ²² Forest Products Res. Lab., Ann. Rep., 31 (1949).

OBITUARIES

Prof. H. E. Roaf

WE regret to record the death of Herbert Eldon Roaf, professor emeritus in the University of Liverpool, on September 21 at the age of seventy-one.

Roaf was a Canadian who graduated at the University of Toronto and went to Liverpool to work under the direction of Benjamin Moore as Johnston Colonial Research Fellow. This early association