

voluntary group should have its own roof over its head. In addition, a more realistic policy is needed on the part of those who organize adult education. There is evidence that serious education will never appeal to more than a very small minority. Insipid forms of educational amusement are much more efficiently provided by the techniques of mass education (the film society, the B.B.C. Third Programme and television) than by the techniques of the tutorial class. Surely it is desirable to confine university participation in adult education to the supervision of small groups prepared to devote themselves to one topic for at least one year: discussing, arguing, writing about the fundamental unresolved problems of men and Nature; or seeking personal emancipation in a genuine scholarly understanding of some aspect of literature or the arts; or finding a deep satisfaction in doing some craftsman's work really well.

THE BRITISH MUSEUM ARCHAEOPTERYX

Archaeopteryx Lithographica

A Study based upon the British Museum Specimen. By Sir Gavin de Beer. Pp. xi+68+16 plates. (London: British Museum (Natural History), 1954.) 40s.

THE specimen of *Archaeopteryx*, 'the first bird', is certainly the best known fossil in the British Museum (Natural History), and it is proper that it should be examined as completely as is now possible, and lavishly published. Thus Sir Gavin de Beer's monograph is very welcome. In it he gives a detailed account of its discovery and purchase from Dr. Häberlein, the family doctor of Pappenheim, who received it in payment for medical services to the quarrymen. He gives also the facts, pungently published by John Ruskin in 1864, of the payment of the price—£700—in two instalments, the second guaranteed by Richard Owen, since the Museum Trustees were not in a position to do so. The sum paid formed the dowry of Häberlein's daughter.

The specimen so acquired was immediately described by Owen (1863). Then John Evans (later Lord Lubbock) discovered on the slab a jaw bone with teeth, and a brain cast, and it at once appeared in all general works dealing with geology and evolution. Later it has been the subject of very many papers. But only when a Serbian philosopher, B. Petronievics, examined it during the First World War was it actually prepared by Mr. F. O. Barlow, who exposed the shoulder girdle and pelvis, described by Petronievics in association with A. Smith Woodward. Petronievics returned to the work, and further preparation by Barlow and L. E. Parsons exposed much of the vertebral column and other elements of the girdles.

The next important contribution to our knowledge of its structure was the recognition by Dr. Tilly Edinger that Evans's brain cast was actually such, and that the brain it represented was of the type found in modern reptiles, and lacked the qualities characteristic of modern birds. Meanwhile, a second skeleton in Berlin was described by Dames and, as it has a good skull, was widely discussed. At first regarded as belonging to the same species as the

London specimen, it later came to be considered as a member of a different species, then genus, and finally family!

During recent years Mr. Parsons has carried out further preparation; the slab has been examined by X-rays, and examined under ultra-violet light by K. Lambrecht in 1928. Sir Gavin de Beer, photographing the specimen by its own fluorescence under ultra-violet light, has made out new structures, especially the long-sought sternum. He confirms Dr. Edinger's account of the brain cast and finds a continuous series of twenty vertebrae in front of the tail, and two displaced cervicals. He finds, too, many abdominal ribs, as in the Berlin specimen. But the most important discovery is of a sternum, a thin sheet of very spongy bone, transversely widened, very short along the bird's length, and appropriate to the short flattened coracoids, which presumably articulate with it. Little can be added to what is at present known about the limb skeleton; but Sir Gavin agrees with Lambrecht in holding that the skeleton was not pneumatic. The feathers of the wings have always been recognized as singularly resembling those of modern birds, and Steiner endeavoured to show that *Archaeopteryx* lacked a fifth secondary and was 'aquinto-cubital'. Sir Gavin shows that the feather impressions were made by the under-surface, and that sometimes a single feather made two impressions. His detailed discussion, based not only on direct visual observation but also on large photographs made with glancing illumination in four azimuths, is convincing. It shows that Steiner was wrong, and that the flight feathers are identical with those of modern flying-birds.

Sir Gavin compares the two specimens of *Archaeopteryx* and concludes, without certainty, that they may well belong to the same species. He then goes on to consider the affinities of the bird, holding that a derivation from some reptile of the general nature of *Euparkeria* is reasonable, in agreement with Robert Broom. Then he goes on to discuss the origin of flight, rejecting the 'pro-avis' theory of Steiner, the cursorial pro-avis of Nopsca, Beebe's tetrapteryx theory, and returning to the classical arboreal origin.

The whole work is most useful, it establishes definitely many previously doubtful structural features, and discusses many problems on a reliable basis of fact, and with a well-controlled imagination. The work is illustrated by fifteen large photographic plates, some taken by ordinary, often glancing light, others by phosphorescence under ultra-violet illumination. They establish the facts well enough; but it still seems to be difficult to take such good photographs, and to have such good blocks made from them, as the French museums regularly do.

D. M. S. WATSON

GENESIS OF MODERN SCIENCE

The Scientific Revolution 1500-1800

The Formation of the Modern Scientific Attitude. By Dr. A. R. Hall. Pp. xvii+390. (London: Longmans, Green and Co., Ltd., 1954.) 21s. net.

THE inauguration in Great Britain of the systematic study of the history and philosophy of science has promoted the publication of a number of works which have implicitly, or in some cases explicitly, aimed at particular readjustments in historical and sociological perspective. Few historians