

James Cossar Ewart, M.D., LL.D., F.R.S.

JAMES COSSAR EWART was the younger son of John Ewart of Penicuik, Midlothian, where he was born in November 1851. He spent his boyhood at Penicuik, and was educated there until he entered the University of Edinburgh as a medical student in 1871, graduating as a Bachelor of Medicine and Master of Surgery in 1874. He then became Demonstrator of Anatomy under William Turner, but he relinquished this post in less than a year on being appointed Curator of the Zoological Museum at University College, London. Here he made a number of skilful preparations of various animals, besides assisting Ray Lankester in organising his new class in practical zoology and in taking charge of the class in Lankester's absence. While he was in London he published several original papers dealing with the structure of the retina and lens, the sexual organs of the lamprey, the vascular peribranchial spaces and the valves in the umbilical arteries of the lamprey, and the placentation of the Shanghai River deer. He also contributed to the study of various bacterial organisms, being awarded a gold medal for a research on *Bacillus anthracis*, which he presented as a thesis for the degree of Doctor of Medicine at Edinburgh. In 1878 he returned to Edinburgh to become Lecturer in Anatomy in the Extra-mural School, but he held this position only two months, for at the end of the year he was appointed to the Chair of Natural History in the University of Aberdeen.

It was at Aberdeen that Ewart first became interested in marine biological investigation, and to further his researches he established an experimental station on the adjacent coast. Here he worked in his spare time for three years on fishery problems as well as on the locomotor system of echinoderms in conjunction with George John Romanes, with whom he gave jointly the Croonian Lecture to the Royal Society in 1881. The following year Ewart became Regius Professor of Natural History in his old University, and he held this position for forty-five years, retiring in 1927. Shortly after his appointment he reorganised the courses of instruction in zoology and established new practical classes, and at later stages he was the means of instituting new lectureships in embryology (held first by George Brook and afterwards by Dr John Beard), in invertebrate zoology (to which Dr J. H. Ashworth, now Professor of Natural History, was appointed), and in genetics (the occupant of which was the late A. D. Darbishire, who did valuable pioneer work on heredity).

Ewart joined the Fishery Board of Scotland as scientific adviser in 1882, and afterwards published a number of papers on the fertilisation of herring ova and the natural history of the herring, cod, and other

fish. These were followed by memoirs on the electric organ in the skate (three papers in the *Phil. Trans.*) and on the lateral sense organs of Elasmobranchs (two papers in the *Trans. Roy. Soc. Edin.*, one of which was published jointly with J. C. Mitchell). The work on the electric organ of the skate in particular attracted much attention, for Ewart showed that it was a rudimentary or developing organ and not a degenerate one, and he succeeded in tracing its evolution through such a species as *Raia radiata*, where the muscular tissue from which the structure is derived is only slightly modified, to *R. batis*, where the modification into electric tissue has much advanced, and so to other species in which the electric organ is functionally fully developed. The Duke of Argyll was not slow to point out that the existence of these transitional structures lent no support to the Darwinian theory of natural selection, since in their rudimentary condition they could be of no possible use to the possessors, and Romanes, in commenting on this criticism was forced to admit its validity, but at the same time remarked on the unique character of the organ in the skate.

Ewart next turned his attention to the development of the horse, and more particularly the bones of the limbs, in which he showed that at a certain stage of foetal development the vestiges of the phalangeal bones of the second and fourth digits were present, and that these subsequently became ossified, fusing with the metacarpals or metatarsals. This discovery was of great interest in the light of the theory of evolution, supplying a striking confirmation of the palæontological evidence relating to the reduction of the digits in the progressive history of the Equidæ as found fossil in successive strata.

It was about 1894 that Ewart started that long series of investigations in experimental breeding, which are probably the most widely known of all his work. In such researches he was to a large extent a pioneer, for since the work of Darwin there was no one, at any rate in Britain, who devoted himself to this kind of investigation. Much of his work was done before the rediscovery of Mendel's laws of heredity, but by adopting such methods as were known to him he carried out important researches on cross-breeding, inbreeding, reversion, etc., among various breeds of horses and other domestic animals. His most famous experiments were probably those on telegony, or the theory that a previous sire may so "infect" the dam served by him as to leave his mark on her subsequent offspring by other sires. The belief was widely entertained by practical breeders and has not yet been wholly discarded, but Ewart's carefully constructed and controlled experiments on various animals (horses, dogs, fowls, etc.) produced uniformly negative results. The classical case of supposed telegony and one in which Darwin himself

believed was that of Lord Morton's Arab mare which, after being mated with a quagga and producing a striped hybrid foal, was afterwards served by an Arab stallion by which she had a foal with certain striped markings that were believed to have resulted from the previous mating with the quagga. Ewart repeated the experiment, using a Burchell's zebra stallion which served a number of mares. These produced hybrid foals, and afterwards pure bred foals by stallions of their own breeds, but the pure bred foals never showed any evidence of having in any way been derived from the previous zebra sire. The results of these experiments, together with other investigations on animal breeding, were published in a volume entitled *The Penycuik Experiments* (1899). These studies led Ewart to investigate the ancestry and evolution of horses and ponies by adopting the methods of experimental cross-breeding, and he showed that the striping which often occurs on the shoulder and legs of the Norwegian pony, the Arab, and other breeds was of the nature of a reversion to a striped ancestor. As a further result of his experiments he arrived at interesting conclusions of far-reaching importance as to the multiple origin of modern horses, pointing out that the "Celtic pony" (still found pure or almost pure in the Hebrides, Iceland, etc.), which had no hind chestnuts or hock callosities, was almost certainly a different species from the primitive "forest type," represented by the heavy horses of the present day such as the Shire, Percheron, and Gudbrandsdal of Norway, which have large hock callosities. Ewart's views with their various implications are admirably summarised by him in an appendix, on *The Making of the Shetland Pony*, to Dr and Mrs Charles Douglas's book on that breed (1913).

Ewart's theories regarding equine ancestry received some support from the discovery of horses' skulls in the Roman Camp at Newstead where he found the "Celtic" or "plateau" type represented, and he contributed a paper on this subject to the *Trans. Roy. Soc. Edin.* (1907). He also found five fairly distinct types of oxen in the same camp and others that he supposed to have been probably cross-bred, and in the light of these discoveries, together with other facts, he wrote upon the origin of domestic cattle without, however, coming to any very definite conclusions (1911). Ewart next turned his attention to the study of sheep and their wild ancestors (1914-15), and expressed the view that not only the mouflon and the urial, but also the Argali or Ammon sheep had a share in forming certain modern breeds (*e.g.* the Scottish Blackface and the Merino). His conclusions were based on the examination of remains from Pleistocene deposits, on a comparison between the skeletons of wild species and primitive and modern breeds, and on cross-breeding experiments.

The work on horses and other animals referred to above was carried out at a private experimental station instituted by Ewart, and conducted very largely at his private expense at Penicuik, to which he returned after living a few years in Edinburgh. In 1913, however, the University of Edinburgh rented a farm at Fairslocks, where Ewart carried out investigations for the improvement of the sheep's fleece, and this work brought him into contact with the woollen industries of Great Britain, and he became an active member of the Council of the Woollen and Worsted Research Association at Leeds. In 1923, at the invitation of the New South Wales Government, he went to Australia, where he visited many important and some very remote sheep stations, and later he proceeded to New Zealand to conduct similar inquiries there. His work was recognised by the Worshipful Company of Woolmen of London, who in 1924 struck a gold medal which they presented to him at a dinner in the City.

It was chiefly as a result of Ewart's knowledge and experience that in 1913 the Board of Agriculture for Scotland formed a special committee on animal breeding. This committee became active again after the war, and Dr (now Professor) F. A. E. Crew was appointed director of research. Later, as a result of liberal benefactions, the scheme was enlarged, and a new and flourishing department of genetics with a large staff of workers was formed in the University of Edinburgh.

In the meantime Ewart turned his attention to the origin and history of feathers in birds, and their relation to scales in reptiles, and the rearing of penguins in the newly formed Zoological Park in Edinburgh gave him an opportunity for obtaining relevant material. He published a paper on the nestling feathers of the mallard in 1921, and this was his last considerable original research.

Ewart was elected a Fellow of the Society in 1879, and served on its Council from 1882 to 1885, 1904 to 1907, and from 1907 to 1912 as a Vice-President. He was awarded the Neill Medal and Prize of the Royal Society of Edinburgh in 1898.

He was elected a Fellow of the Royal Society of London in 1893. On retiring from his Professorship in 1927 he received the honorary degree of LL.D. from the University of Edinburgh. In 1901 Ewart was President of the Zoology Section of the British Association at Glasgow, where he gave an address on *The Experimental Study of Variation*. He was Swiney Lecturer in Geology at the British Museum in 1907, taking as the subject of his lectures equine ancestry.

He died on New Year's Eve, 1933, after a short illness at Penicuik. He leaves a widow, a married daughter, and a son who is a surgeon on the staff of St George's Hospital, London.

J. H. A. and F. H. A. M.