obituary

James Gray was born in London on October 14, 1891. His parents were both Scottish and he always felt himself to be an expatriate Scot. After early education at the Merchant Taylor's School he became first a Scholar and later a Fellow of King's College, Cambridge. Shortly after his election, his academic career was interrupted by the First World War, in which he served, with great distinction, as a Captain in the Queen's Royal West Surrey Regiment. He was awarded the Military Cross and had conferred upon him, by Marshall Foch in person on the field of battle, the Croix de Guerre with palms. After the war he returned to Cambridge to resume his Fellowship and soon to be married, in 1920, to Norah Christine King, who survives him. Not long after this he was appointed Lecturer, later Reader, and in 1937 he was elected to the Chair of Zoology which he occupied until he reached the retiring age, in 1959. During retirement he continued to reside in Cambridge, where he died peacefully in his own home on December 14, 1975.

Gray's first research was concerned with the fertilisation and early development of echinoderm eggs, but already he was a cell biologist rather than an embryologist. It was primarily his interest in cells that led him on to the study of ciliary movement on which he quickly became the world authority, as was recognised by his election to Fellowship of the Royal Society in 1929. After writing a notable book, *Experimental Cytology*, he made up his mind to leave this field; he felt that, using living cells, means were not then available to formulate meaningful questions and to obtain clear-cut answers—and he was not interested in dead cells. In deciding to move into the field of locomotion he was no doubt influenced by the circumstance that he had developed the techniques of cinematography for use on cilia, and these techniques could be applied to other types of movement. Animal locomotion occupied him over the next 25 years, bringing him the award of the Royal Medal of the Royal Society in 1948, and it is for his work in this field that he will be long remembered. His calculation that the power required to drag a dolphin's dead body through water is greater than the power available from its muscles has become widely known as Gray's Paradox. From the swimming of dolphins to the swimming of spermatozoa, from the movement of snakes to the movement of minute nematode worms he explored the undulatory mode of propulsion, and also investigated, in collaboration with H. W. Lissmann, the modes of terrestrial locomotion seen in amphibia. During the early part of his retirement he was able to bring all this work together in his second great book, *Animal Locomotion*.

Later in life Gray became increasingly involved in advisory work for national organisations. He was a trustee of the British Museum (1948–60), a member of the Agricultural Research Council (1942–47), President of the Marine Biological Association (1945–55) and President of the British Association in 1959. From 1951–59 he was a member of the Development Commission and at one time Chairman of its Fishery Advisory Committee. For his public work he was made CBE in 1946, and in 1954 he received a Knighthood. He was honoured by many universities, by Aberdeen and Edinburgh with the LL.D., by Durham, Manchester and Wales with the D.Sc.

Gray's influence upon the development of zoology was greater even than his direct contribution to it. He was foremost among a band of rising young biologists who in the years immediately after the First World War led the subject into new paths and established Experimental Zoology in the face of traditionalist opposition. He continued to foster this movement through the Society for Experimental Biology, at whose meetings he was regularly to be seen, and through the Journal of Experimental Biology which he edited from 1925 to 1954. His influence was, naturally, nowhere stronger than in his own university. During his tenure of the Chair the teaching of Zoology was transformed—but gradually, for he was emphatically opposed to unnecessary disturbance and dislocation. This was a time when the director of research and his team of research students were beginning to make their appearance on the university scene. Gray would have none of this. He looked upon research students as independent research workers in their own right; as long as they were swimming he left them alone, if ever they got into serious difficulty they were dramatically rescued. Gray believed passionately that the mainspring of a successful university department was the activity of the staff in research. What line of research they chose mattered nothing provided that it was scientifically sound and pursued with enthusiasm; for, he argued, this enthusiasm would rub off on the undergraduates and, far more than mere knowledge imparted to them, would bring out their best qualities. One has but to look at the list of zoologists who were at one time research students in Gray's department and then went off to become Heads of Departments themselves to see how well the system worked.

As Head of Department himself he was always approachable, always ready to listen to someone in trouble, always ready to step in where he could be of help. There was also a rough side to his character. He was slow to wrath, but it was always a grave matter when he was aroused. Yet he was scrupulous to keep his personal feelings to himself, and they were never allowed to influence his official policy or decisions. In private life, though he had many very close friends, his happiest hours were spent on summer holidays in Scotland with his family.

J. A. Ramsay

Joseph F. Foster, Professor of Chemistry in Purdue University and former Chairman of the Department, died suddenly on October 7, 1975 at the age of 57. He was distinguished for his research on the physical chemistry of macromolecules, especially on starch and proteins. He was probably the foremost contributor to our knowledge of the serum albumin molecule during the last twenty years. He demonstrated its reversible expansion in acid solutions, and discovered two Conformational transitions in albumin, one in acid solution (the $N \rightleftharpoons F$ transition) and another in neutral slightly alkaline solution. From this he inferred and demonstrated the microheterogeneity of albumin preparations. He was extending and deepening these important studies up to his untimely death. He will be greatly missed by his colleagues in protein chemistry.

John T. Edsall