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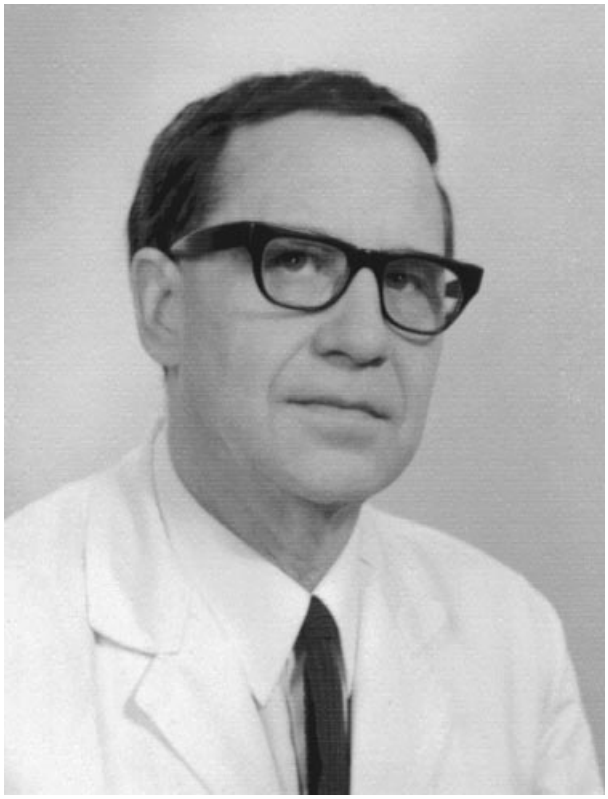
Obituary

Professor Edward George Gray, FRS (1924–1999)



Professor George Gray, who died in August 1999, had a notable career as a pioneer electron microscopist of neural tissues. His name is still attached to synapses, which can be classified as Gray type 1 (symmetric) or type 2 (asymmetric), and in addition he made a number of other profound contributions to our knowledge of synaptic structures.

He started his academic career late, having worked before the second World War as a bank clerk, and then serving in the Navy, patrolling for U-boats in the North Sea and Atlantic for 4 years during the latter part of the war. He had an early interest in zoology, particularly in marine biology and microscopy and when he left the Navy he took the opportunity to work for a degree in Zoology at the University of Wales in Aberystwyth. A first class honours degree was followed by a PhD on melanophores in teleosts. It was fortunate that the external examiner for the thesis was J. Z. Young, who was impressed by the work and by George, and who invited George to work as his assistant in the preparation of *The Life of the Mammals* in the Anatomy Department at University College London.

George Gray started at University College in 1956, spending some time assisting J. Z. Young, and also trying, unsuccessfully, to study the innervation of melanophores. Then on J. Z. Young's suggestion he undertook a study of frog muscle spindles. This was a light microscopic study leading to 2 papers, one in the *Proceedings of the Royal Society* and the other in the *Journal of Anatomy* in 1957 and 1958 respectively. In 1959 he was appointed to a lectureship in the Anatomy Department and spent some time learning to teach in the dissecting room. At that time J. David Robertson was establishing an electron microscopy laboratory in the Anatomy Department at University College, and George's next project, suggested by R. J. Pumphrey, was a fine-structural study of the insect ear. George had earlier had a hard time with the innervation of melanophores and now he had to struggle to get good fixation of this small organ. It was not easy, but George spent the time learning electron microscopical techniques from Robertson, and put together a detailed study of the locust ear.

At this time a group of investigators interested in the nervous system had been attracted to the department by J. Z. Young, who had himself published an early electron microscopic study of spinal cord synapses with R. W. Wyckoff. As George began to be independent in his choice of research projects, he was naturally attracted to the central nervous system and next started a study to look at the fine structure of synapses in the cerebral cortex, a subject that had proved particularly elusive for light microscopists. It may seem surprising today, but at that time no one had any clear idea about the structure of synapses in the cerebral cortex. Although dendritic spines were clearly recognised on cortical cells, no one knew how they related to the incoming or local axons, and there were no demonstrable axon terminals comparable to those that were easily seen in the spinal cord at that time.

The cerebral cortex proved a real catalyst for George's further career. Fixation was then by immersion, not perfusion, and cortex was near the surface so that it fixed well. George was working independently, faced by an exciting set of entirely new observations. He explored new techniques of fixation,

embedding and staining, and exploited these to demonstrate the cortical synapses. More detailed aspects of this work have been discussed elsewhere (Guillery, 2000: *Trends in Neuroscience*, in press). Here it is sufficient to recognize some of the major findings, which were published in the *Journal of Anatomy* in 1959. They included recognition of the dendritic spines as postsynaptic specialisations and the existence of pre- and postsynaptic thickenings, asymmetric about the synaptic cleft in synapses onto dendritic spines, symmetric on the dendritic stems and cell bodies.

The next few years saw George actively involved in furthering our knowledge of synaptic structures. He worked with V. P. Whittaker on the isolation of synaptosomes, he helped to define synaptic relationships in the cerebellum, and demonstrated serial axo-axonal synapses in the spinal cord. He studied degenerative changes in the central nervous system produced by experimental lesions, and later became interested in degenerative changes produced by disease processes. This was an exciting time for George and for those of us who were able to study with him. He was enthusiastic about each investigation, had a critical eye for detail seen on the screen of the electron microscope, and an almost uncanny ability to interpret the images that he obtained. In contrast to most other electron microscopists at the time, who invested heavily in obtaining beautiful images, George was concerned with obtaining pictures that had functional significance. For example, where tissue was damaged in processing, he did not pass on to study other areas that were better preserved, but noticed that in the damaged tissue the postsynaptic thickening could be separated from its neural process, but would still adhere to the presynaptic process, indicating the adhesive properties of the synaptic junction, which were later also evident in the synaptosomes. He would be impatient with those of us who hesitated to use a micrograph because it had some technical fault in it. If it demonstrated a critical, informative relationship, it was useful evidence, every bit as useful as a cleaner and aesthetically more pleasing picture. Above all, he was excited by what he was doing and he passed that excitement on to his students and colleagues.

When J. D. Robertson left University College, George had clearly established his abilities as an electron microscopist. J. Z. Young asked him to take charge of the electron microscope lab in the Anatomy Department, and in 1962 he was promoted to a readership and freed from his dissecting room teaching. He provided important leadership for the many people who passed through the department to learn electron microscopical methods. He was appointed as a Professor at University College London in 1967, and elected a Fellow of the Royal Society in 1976. Shortly thereafter he moved to the MRC at Mill Hill to head the Division of Biological Ultrastructure there. He retired from that position in 1983, but continued some investigative work even after his retirement. However, the later years were dogged by ill health and by severe depression, which he described in a self study in the British Journal of Psychiatry. The enthusiasm for the science would still appear on occasion, but it became rare as time passed and George found it more and more difficult to keep in touch with the science and with his colleagues.

Throughout his career George had a keen interest in drawing, painting and music. Some of this artistic inclination can be seen in some of his publications, and it continued towards the end of his career particularly with water colours. He was also enthusiastic about learning to play the violin. He would practice during his lunch breaks, and even when he went visiting to foreign parts, if he could borrow a violin he would practice quite intensively. He never claimed to be a good violinist, but he was seriously dedicated to the instrument.

He is survived by his wife May, by two sons, Timothy and Peter, and by two grandchildren, James and Christian. His very significant contribution to our subject, and to this Journal, will undoubtedly continue to be recognised for many years to come, as will the part that he played in introducing many others to the joys and frustrations of fine structural studies.

R. W. GUILLERY

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