Walter Gaskell: pioneer in the study of the autonomic nervous system

This year marks the centenary of the death, on 7 September 1914, of Walter Holbrook Gaskell, one of the small group of physiologists in Cambridge who did much of the early work on the 'involuntary' or 'autonomic' nervous system and its role in the control of the heart beat.

Up until 1880, most experimental work on the beating heart was carried out on lower vertebrates such as the frog, since the study of the mammalian heart presented many problems. These began to be overcome when Henry Newell Martin (1848–96), Professor of Physiology at Johns Hopkins Medical School in Baltimore, who had worked under Michael Foster in Cambridge, showed that the isolated mammalian heart could be kept alive and beating by means of a perfusion pump. His method remained standard until well into the 20th century, when Sir Ernest Starling (1866–1927), at University College, London, devised the perfused mammalian heart–lung preparation.

Sir Michael Foster (1836–1907), Professor of Physiology at Cambridge, who himself had studied heart contraction using the isolated heart of the snail as his experimental model, gathered about him a small group of workers, of whom John Newport Langley (1852–1925) and Walter Gaskell were the leading figures. Between them, these two interesting and exceptional men did much to elucidate the nervous control of cardiac muscle. Indeed, it was Langley who introduced the term 'the autonomic nervous system'.

Walter Gaskell was born in 1847, the twin son of a successful London barrister. At 17 years of age he entered Trinity College, Cambridge with a mathematics scholarship and obtained a first class degree in 1869. With the intention of a career in medicine, he entered University College Hospital, London as a student, but interrupted his studies in 1874 to work for a year under Karl Ludwig, Professor of Physiology in Leipzig, on problems of vascular innervation. (Ludwig was a leading figure in experimental physiology at that time. Among his many advances, he showed that stimulation of the vagus nerve produced slowing of the heart.) Gaskell then returned to Cambridge, obtained his Cambridge Doctor of Medicine (MD) degree in 1878 and devoted the rest of his life to a career in physiology at that university.

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Gaskell's initial work was on the innervation of blood vessels. He devised an ingenious method of watching the blood flow in the mylohyoid muscle of the frog during stimulation of its nerve. He then turned his attention to the heart. He demonstrated, in numerous experiments, the inherent rhythm of cardiac muscle and the influence on it of nerve supply and of drugs. He demonstrated that the normal beat starts at the sino-atrial node and propagates via the muscular tissue over the atrium and then to the ventricle. This work led to his election as a Fellow of the Royal Society (FRS) in 1882.

This discovery, which we take as granted today, was ground-breaking at that time. The standard teaching at that time was that the beat of the heart and the contraction of the muscle fibres in arteries was initiated by nerve impulses sent out from the nerve fibres of the peripheral ganglia.

In 1882, Gaskell took up the study of the sympathetic nervous system in general, beginning with an investigation of the anatomy and histology of the cardiac nerves. This work led to a whole series of valuable publications, dealing with the sympathetic quickening and parasympathetic slowing of cardiac contraction, which were brought together in a major article in the *Journal of Physiology* in 1886.

From this mass of studies, which included primitive animals such as Limulus and the lamprey, Gaskell formulated a theory which sounds quite bizarre. In a series of papers, he postulated that vertebrates are descended from arthropod stock, of which the king crab is the nearest living example. He accounted for the obvious differences in the relationships of the various organs in these two groups of animals by supposing that the alimentary tract of the arthropod, surrounded by its chain of ganglia, evolved into the central canal of the spinal cord. This theory, as it is easy to imagine, raised a storm of protests from eminent zoologists. Finally, Gaskell's book on the subject 'The Origin of the Vertebrates', which was published in 1908, passed almost without notice. It is salutary to remember that the greatest minds can sometimes come up with nonsensical ideas.

Gaskell was a brilliant experimentalist. For example, he was asked to investigate the action of chloroform, which was well known occasionally to induce cardiac arrest. Cross-circulation experiments were carried out, the brain of one dog being perfused by the carotid arteries of another. In this way, by limiting the action of the drug to the heart, it was proved that chloroform produces a fall in blood pressure by its action on the heart and not on the vasomotor centre of the brain.

Gaskell was a large, robust man, with abundant hair and beard. He enjoyed the outdoor life and his principal recreation was his garden. He was a popular teacher of his Cambridge physiology students – most destined for a career in medicine – and was generous in giving counsel and encouragement to them and to young research workers. He received numerous honours, including the gold medal of the Royal Society. He died from a cerebral haemorrhage on 7 September 1914 at his home outside Cambridge.

The early decades of the 20th century saw the publication of two important monographs: Walter Gaskell's 'The involuntary nervous system', published posthumously in 1916, and John Langley's 'The autonomic nervous system', which appeared in 1921. **BJHM**

Conflict of interest: none.