Augustus Volney Waller: physiologist who described distal degeneration of severed nerve fibres

Most readers will be familiar with the term 'Wallerian degeneration' – the degenerative changes that take place in nerve fibres distal to the site of their division. Few, I would respectfully suggest, would know very much about the discoverer of this phenomenon, Augustus Waller. This year marks the 200th anniversary of his death.

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Augustus Volney Waller was born in 1816, one of seven children of William Waller of Everton Farm, near Faversham in Kent. Soon after his birth, the family emigrated to Nice, where his father died in 1829. Waller's mother and the children returned to England, where his mother remarried and young Augustus was brought up by his late father's friend, William Lambe, a medical practitioner in London, and later with his son, Lacon Lambe, also a GP in Herefordshire.

Waller left his adoptive home to study medicine in Paris, obtaining his doctor of medicine degree with a thesis on indirect percussion of the chest. He returned to England and obtained his Licentiate of the Society of Apothecaries, and established himself as a GP in Kensington. Here, he married a solicitor's daughter and had a son and two daughters. The son, Augustus Desiré Waller, qualified in medicine in Aberdeen and, in turn, became a distinguished physiologist, who carried out the first recording of the human electrocardiogram in 1887.

Between 1840 and 1850, Augustus Waller senior combined medical practice with scientific research. First, in 1849, came a histological study of the frog's tongue. Then, in 1850 he published his seminal paper, in *Philosophical Transactions*, on the microscopic changes undergone in the transected peripheral nerve. This led to his election as Fellow of the Royal Society in 1851.

That same year, Waller gave up medical practice to concentrate on physiological research. He moved to the University of Bonn, where he worked with the ophthalmologist JL Budge. His research articles on the pathways of the cervical sympathetic nerves, mostly published in French, were well received. He and his colleague were awarded the Monthyon Prize of the French Académie des Sciences in 1852. Four years later, he moved to continue his work in the laboratories of the Jardin des Plantes in Paris and received a second Monthyon Prize.

In 1858, Waller was appointed Professor of Physiology at Queen's College Medical School, Birmingham. He kept in touch with clinical work by taking the additional appointment of physician at Queen's College Hospital, in addition to obtaining his Membership of the Royal College of Physicians. Unfortunately, the appointment at Birmingham was not a success. (The two medical schools in Birmingham were active rivals – the rivalry only coming to an end when the two schools merged.)

Waller resigned his post and moved to St. Leonard's in Sussex. He continued his scientific interests and in 1860 was awarded a gold medal by the Royal Society in recognition of his physiological research.

In 1862, he went to live abroad again, to Bruges and then Geneva, undertaking both clinical work and physiological research. In 1870 he visited London to deliver the Croonian Lecture at the Royal Society, but soon after his return to Switzerland he fell ill again and died of angina pectoris at his home in Geneva.

Waller's principal research tool was microscopy. He made no technical advances in the subject, apart from introducing the frog's tongue for the examination and study of the capillary circulation. However, he made simple yet crucial observations based on the division of the nerves supplying the eye, tongue and blood vessels and observing the functional changes of these organs. The pathway between the brain and the organ under investigation was traced by following the degenerative changes below the point of section

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of the supplying nerve. The nerve was effectively 'stained' in a manner analogous to the tracing of blood vessels by the injection of dyes.

These changes in the divided nerve trunk came to be known as 'Wallerian degeneration'. Their importance lies in their use to map the course of nerves in nerve trunks and in the CNS, sometimes termed the Wallerian system.

As an important example, Waller was able to demonstrate that the sympathetic nerve to the eye has its motor roots in the cervical spinal cord. From his work on degenerating nerves, Waller came to understand the essential nutritive function of the cell body at a time when the connection of the nerve cell and the nerve fibre was not clearly understood.

With his clinical background, Waller was always aware of the problems raised by clinical medicine. Throughout his career he undertook investigations that might have some practical application. As examples, he investigated cooling as a form of local anaesthesia and the use of vagal compression in the treatment of migraine and sea sickness. He was always prepared to carry out these procedures on himself. Truly a remarkable man.

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