An unappreciated pioneer in cardiology: Ernest Starling

Most doctors have only heard of Ernest Starling through his law of the heart, although this was not a particularly important part of his research output. Shortly after qualifying in medicine at Guy's Hospital, London, in 1888 (where he won the university gold medal in medicine), he began investigating the formation of lymph. To explain his findings, he proposed an inward osmotic force at the capillary: the only possible source of this force was the plasma proteins. At the capillary there was a balance between an inward (osmotic) force and an outward (hydrostatic) force. This became Starling's 'Filtration Principle', which, in retrospect, was a paradigm shift in our understanding of the circulation.

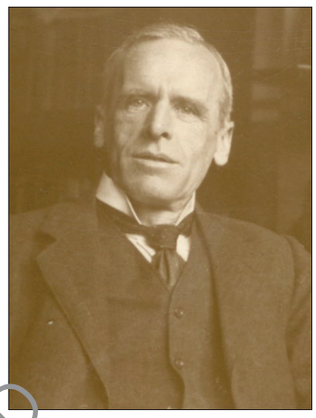
In a virtually unknown paper of 1899, Starling showed that urine could only be formed when the hydrostatic pressure in the glomerulus was greater than the colloid osmotic pressure of plasma (which he measured and showed to be 20-30 mmHg). These findings went virtually unnoticed at the time, because the world had not yet accepted Starling's Principle. If the work had been done a few years later, it would certainly have been considered for a Nobel Prize but instead it just earned him – in his early thirties – Fellowship of the Royal Society.

In the same year, Starling left Guy's to become a professor at University College London, where he established a world-class department that lasted until his death in 1927. Much of his research was done with William Bayliss, who subsequently became his brother-in-law. Psychologically the two men were totally unalike but, in research, their personalities were complementary. Moreover, their family lives were intertwined.

In 1903, Bayliss and Starling discovered secretin – the first hormone whose mechanism of action was remotely understood and three years later, Starling introduced the word 'hormone' into medicine. (It had been suggested to him by a Classics Fellow at Caius College, Cambridge, over dinner). He was nominated for a Nobel Prize for his hormone work but was rejected for an extraordinary collection of reasons (explored in my biography of Starling*).

It was several years later that Starling began work on his dog heart-lung preparation, which led to his law of the heart. He and his collaborators explored many aspects of the relationship between venous return and cardiac output. Some said his findings offered little that had not been shown by the German physiologist Adolph Frank 15 years earlier, But Frank's technique had used the frog's heart and involved no measurement of flow – he was only concerned with the relationship between ventricular diastolic volume and the force of contraction. Starling, on the other hand, thought about the whole circulation and fitted his law into situations such as exercise. It seems reasonable, therefore, to refer to the law as the Frank-Starling law, with both men sharing the credit.

'*A man before his time*'
Ernest Starling



A man of reform

Starling was a man of very strong beliefs. He was deeply concerned with medical education in London, seeing medical schools as 'trade schools' with the scientific basis of medicine playing little part in the student's education, which meant that clinical skills were based entirely on empiricism. Starling had spent much time in Germany, where each subject in the pre-clinical curriculum was taught by a scientific department, headed by a professor. Starling believed this was the right approach and made no secret of his views despite increasing anti-German feelings in Britain. This led to anti-Starling sentiments in the medical press.

Another Starling 'bête noire' was the number of medical schools in London. He believed it was inefficient for each small school to have at least one teacher for each pre-clinical subject. Instead, he thought schools should be merged so that pre-clinical teachers had larger classes. He called his scheme 'concentration' but with medical schools being proud and reactionary creatures, it has taken 80 years for concentration to come about in London.

His passionately held views were very conspicuous during the Great War. As a physiologist he was put in charge of defence from poison gas and as outspoken as ever on the country's poison gas policies, was sent to the remote Salonica battle-front (to keep him quiet!). Here he trained 12,000 British troops against gas attacks in just three months, and insisted on being sent back to London, where he was appointed to the Royal Society committee on Britain's nutrition. He rapidly became the committee's chairman and this committee set up the first

rationing system. Its success saw Starling elected to a European group that was to reorganise the continent's food distribution. He even wrote a book on the world's food problems.

After the war, he returned to UCL, where he saw his heart-lung preparation as being the way forward for a whole variety of subjects – especially the kidney. He began a series of studies with E B Verney that led to the discovery of anti-diuretic hormone (vasopressin). This led to another unsuccessful proposal for a Nobel Prize.

Research in his latter years was affected by ill health. He complained of abdominal pain in 1920 and had a hemicolectomy. He died alone on a journey to the West Indies on a banana boat. When the boat reached Jamaica, his death was discovered and as no autopsy was performed, we can only assume that he died of secondaries from his colon cancer.

Starling never received the conventional recognition that his life deserved. The Nobel Prize cruelly passed him by. He made enemies of the medical establishment, the government and the military authorities. Time, however, has vindicated his work and his views. His was the life of a romantic. There can be few other great scientists who can have had such strong feelings that dominated every aspect of their being.

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