

Richard Wolfgang Semon (1859-1918)

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The name of Semon may be familiar to some neurologists because of (Sir) Felix Semon (1849-1921), a significant pioneer in the field of otolaryngology who held an appointment at the National Hospital for the Paralysed and Epileptic at Queen Square in London between 1887 and 1909. In an 1881 publication he described the paralysis of extensor before flexor muscles in lesions of the anterior horn cells, later known as Semon's law (or the Rosenbach-Semon law) [10], although its status as a "law" may be contested.

Felix's younger brother, Richard Wolfgang Semon (1859-1918), may be less well remembered in neurological circles, but his contributions to the study of memory in the early twentieth century, though initially largely neglected, have recently been noted increasingly and indeed may possibly be more significant in the history of neurobiology than his brother's contributions. At this time surrounding the centenary of the translation of his key works into English, it is apposite to review Richard Semon's life and career.

Born in Berlin, he obtained a doctorate in zoology at the University of Jena (1883) and then a medical qualification (1886) after studying in Heidelberg but he never practiced medicine. His interests in evolutionary biology, prompted in part by his mentor Ernst Haeckel (1834-1919), led to an associate professorship in Jena (1891). From 1891-3 Semon undertook a zoological expedition to Australasia, the collections from which led to the identification of many new species [7]. Semon's name is commemorated in the Linnean binomial taxonomy by a species of green-blooded skinks and a family of parasitic spiny-headed worms discovered on this expedition.

He moved from Jena to Munich in 1897, following an affair with Maria Krehl, the wife of one of the professors in Jena. It was in Munich, as a private scholar (*Privatgelehrter*), that his work on memory developed. Because of his circumstances, this work was entirely theoretical, for although relevant literature was considered Semon undertook no empirical studies.

In his 1904 work *Die Mneme*, which attempted to link the mechanisms of heredity and memory, Semon introduced the concept of the engram: “the enduring though primarily latent modification of the irritable substance produced by a stimulus”. The process giving rise to new engrams he termed “engraphy”, hence stimuli acted engraphically to create engrams. He clearly envisaged engrams as physical changes in the state of the brain although did not speculate on the precise nature of such changes. Semon introduced a further term, ecphory, to describe memory retrieval: “the influences which awaken the mnemic trace or engram out of its latent state into one of manifested activity”. *Die Mneme* proved controversial, principally because of Semon’s apparent commitment to the neo-Lamarckian position of inheritance of acquired characteristics in his understanding of heredity. Consequently *Die Mneme* was generally not well received.

Semon’s second book, *Die mnemischen empfindungen*, published in 1909, was devoted entirely to memory, particularly retrieval phenomena, including the idea that “each ecphory of an engram-complex produces not only a mnemic sensation ... but through this creates a new engram”. Unlike *Die Mneme*, *Die mnemischen empfindungen* was largely ignored. This lack of recognition hurt Semon, as is evident from his correspondence with August Forel (1848-1931), an ardent supporter of his

work. This disappointment was compounded by the death of his wife Maria from cancer and Germany's defeat in World War 1, both in 1918, all of which may have been triggers for Semon's suicide later that year.

It was not until after his death that Semon's books were translated into English, as *The mneme* (1921) [8] and *Mnemic psychology* (1923) [9], but again little attention seems to have been paid to them. Donald Hebb was apparently unaware of Semon's notion of the engram when developing his ideas about modifiable synapses as the substrate of memory in the 1940s, and Karl Lashley's publication which popularised the term engram (1960) did not reference Semon's work [3]. Although Semon was still known in the German speaking world [6], it was not until the 1970s that his work was "rediscovered" by the Anglophone world, principally due to the work of Daniel Schacter [4,5].

Although published in its current form in 2001, Schacter's biography of Semon [4] was based on his research dating from the late 1970s and early 1980s. In the interim, there has been increased neurobiological interest in the notion of the engram, the only one of Semon's neologisms to have persisted and which has been largely equated with the notion of memory traces. Contemporary research seeking for "hippocampal memory engrams" and for "motor engrams encoding motor experience" may be found in the literature. Indeed, as a consequence of his apparent anticipations, for example of pattern completion and multiple trace theory, Semon has been accounted one of the "heroes of the engram" [2], a status which may serve to justify Semon's belief that recognition of his contributions would have to await future generations.

Be that as it may, and overlooking any anachronism in reinterpreting old works in the light of current ideas, Semon's core idea of the engram has served to perpetuate one of the most enduring confusions in neuroscience: the notion that possession of a memory implies its storage. Memory is knowledge retained, expressed as an ability that is neither plausibly dependent on storage nor meaningfully explained by it [1]. The etymology of "engraphy", the making of an engram, implies something being written down or engraved in the brain. However, it makes no sense to say that what one remembers, the ability to recollect, is dependent upon ~~something~~ its being written down (or stored, or encoded) in the brain. The storage of an engram, moreover, does not explain how it is differentiated from every other, unless there is a Cartesian homunculus to spot it on its neural shelf. Certainly one may not be able to remember without certain neural configurations or synaptic connections within the brain, and future empirical studies may further define with increasing precision what these may be, but they will not identify an engram because conceptually this idea makes no sense.

References

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