

C. S. Breathnach

Charles Scott Sherrington (1857–1952)

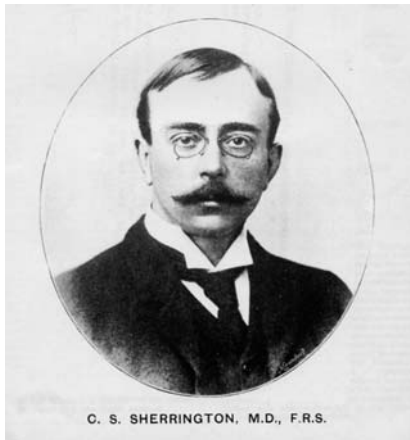


Fig. 1 Portrait of C. S. Sherrington, reproduced by kind permission of the Editor of GKT Gazette

At the turn of the twentieth century Charles Scott Sherrington surveyed the archipelago of neurophysiology and united the scattered islands into a commonwealth in the Silliman Lectures on *The Integrative Action of the Nervous System* (1906), providing a set of concepts by which the nervous system could be understood [1].

After training in Cambridge and St. Thomas's Hospital in his native London, Sherrington flirted with bacteriology, working under Virchow, Koch, Waldeyer and Zuntz before appointment at St. Thomas's as lecturer in physiology in 1889 [2]. In 1891 he was appointed superintendent of the nearby Brown Institution, a veterinary sanctuary. Working on segmental distribution of the spinal dorsal and ventral roots he mapped the sensory dermatomes, and discovered that muscle spindles initiated the stretch reflex (1892). His papers on reflexes and reciprocal innervation, after he moved to Liverpool in 1893, were synthesised in the Croonian Lecture (1898) [3].

Santiago Ramón y Cajal (1852–1934) had 'solved at a stroke the great question of the direction of the nerve currents in their travel through the brain and spinal cord'. Afferent and efferent elements were related in the grey matter by unidirectional contact between the neurons. To describe such activity Sherrington introduced the term

synapse in 1897 when Michael Foster invited him to revise the chapters on the nervous system in his *Textbook of Physiology*. Not surprisingly, E A Schäfer, editing his *Textbook of Physiology* (1900), turned to Sherrington for four chapters on the nervous system [4]. This carefully referenced, encyclopaedic knowledge of experimental neurophysiology prepared the ground for his Silliman Lectures, which introduced the term *integration* into scientific neurology.

Sherrington pointed out in *The Integrative Action* that reflexes had to be goal-directed, purposive [1]. The spinal cord provided him with the simplest examples of synaptic functions. The stretch reflex might be a 'convenient fiction' but with other spinal reflexes it provided the template for examining how motor mechanisms are progressively organised, how the different cortical, subcortical, cerebellar and spinal centres interact in initiating and monitoring movement, how sensory receptors control reflexes, and how neuronal networks are used by higher centres.

His analysis concentrated on the mechanisms whereby excitatory and inhibitory processes, initiated by different inputs, interact to grade the output of a pool of motoneurons for different purposes [1]. Excitation and inhibition were graded states of opposite character, capable

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of algebraic summation when they impinged on the same neuron, a prophecy later revealed as depolarisation and hyperpolarisation by the intracellular microelectrode.

Sherrington accepted the Waynflete chair at Oxford in 1913 where a stream of international post-graduates helped dilute his elaborate style in *Reflex Activity of the Spinal Cord* (1932) [5]. In 1932, when he shared the Nobel Prize with Cambridge's ED Adrian (1888–1973), he stated that it was the phenomenon of 'inhibition as a co-ordinative factor, as ubiquitous and as frequent as excitation itself', which enticed him to try to unravel its mysteries [6].

He retired in 1936 aged 79. *Man on His Nature* (1940, 1947) expanded on the *Integrative Action* to examine the place of mind in the universe [7], the historical aspect of

which was elaborated in *The Endeavour of Jean Fernel* (1945) [8]. With Goethe he shared the two cultures of science and poetry, but *The Assaying of Brabantius and other Verse* (1925, 1940) [9] did not measure up to Sherrington's physiology, much as Goethe's physiology, he deemed, did not match his poetry [10].

References

1. Sherrington CS (1947) *The integrative action of the nervous system*. New York, Charles Scribner's Sons. 1906; reprinted Cambridge, Cambridge University Press (with a new Preface and full Bibliography)
2. Anonymous (1952) *BMJ* 1:606–609
3. Sherrington CS (1898) The mammalian spinal cord as an organ of reflex action. *Phil Trans R Soc* 190B: 45–186
4. Schäfer EA (1900) *Textbook of physiology*, Edinburgh and London. Young J Pentland 2:698–1002
5. Creed RS, Denny-Brown D, Eccles JC, Liddell EGT (1932) *Reflex Activity of the Spinal Cord*. Oxford, Clarendon Press
6. Sherrington CS (1965) Inhibition as a co-ordinative factor. In: *Nobel Lectures, Physiology or Medicine 1922–1941*. Amsterdam, Elsevier, for the Nobel Foundation, pp 278–289
7. Sherrington CS (1940) *Man on His Nature*. Cambridge University Press; second edition 1951
8. Sherrington CS (1946) *The Endeavour of Jean Fernel*, Cambridge University Press
9. Sherrington CS (1925) *The Assaying of Brabantius and other Verse*. Oxford University Press; enlarged 1940
10. Sherrington CS (1949) Goethe on Nature and on Science, Cambridge University Press. 1942; Goethe: an appreciation. *BMJ* 2:449–450