



Sir Charles Scott Sherrington

English Neurophysiologist

1857-1952



Sir Charles Scott Sherrington was an English neurophysiologist who was instrumental in researching the role and function of reflexes. In fact, he was awarded the Nobel Prize in Physiology or Medicine in 1932 for “discoveries regarding the functions of neurons.” Born in London in 1857, Sherrington’s academic training progressed from the Ipswich School to medicine at London’s St. Thomas’s Hospital in 1876, and then on to Cambridge where he completed his medical studies and graduate work. He obtained his first professorship as Holt Professor of Physiology at Liverpool in 1895. In 1912, Sherrington’s dream of teaching at Oxford became a reality when he was offered the Waynflete Chair of Physiology, a position he would hold until retirement in 1936.

At the turn of the century, the scientific concept of the reflex had already been established moving from the early understanding presented by Marshall Hall regarding an independent spinal cord system of afferent-efferent nerves of the neural reflex arc to the more advanced discoveries by Sechenov of the reflex chain dynamics. Sherrington, like Sechenov, focused on physiology as he sought to quantify the nature of reflex interactions. However, unlike Sechenov, who expanded his physiological framework to incorporate psychological aspects (and consequently, added significant complexity to his work), Sherrington maintained a strict physiological approach to his study.

Sherrington’s main focus was on understanding the physical structures involved with reflexes and their contributions to local reflex circuitry. Prior to 1898, Sherrington undertook a detailed study of anatomy, through which he developed a particular interest for the spinal cord and its function. “Concomitant with these anatomical studies came a profusion of ideas and observations about the reflex functions of the spinal cord” writes Judith Swazey, in her book *Reflexes and Motor Function*. By restricting study to only the physiological aspects of anatomy, versus the behavioral aspects Sechenov had included, Sherrington was able to delve deeply into the biological importance of reflexes.

Sherrington postulated that the reflex is the simplest unit of nervous integration from which more complex, coordinated actions develop. He introduced the concept of the synapse as the site where elementary reflexes interact to enable more complex and unified behavior. This “compounding” of reflexes was a significant revelation and led Sherrington to advance his work from the study of simple reflexes to more complex reflexes. His extensive study of spinal animals demonstrated that reflex responses start in the skin (in the case of a topical irritant), travel by nerves from the skin to the spinal cord and then back to the periphery to the muscles that respond. He found that when the spinal cord is severed or a nerve detached from muscle, the reflex fails to respond. In this way, Sherrington determined that simple reflexes are governed by the spinal cord.

In addition to explaining spinal reflex activity, Sherrington uncovered the concept of proprioception and demonstrated that upright posture, maintained against gravity, is independent of cerebral function, and skin sensation. He investigated the relationship between the afferent and efferent pathways in the central nervous system, discovered the mechanisms of motor coordination, and formulated the principles of the convergence of sensory impulses at motor neurons, which form a common path. Sherrington determined the function of

synapses (a term that he coined) in the interaction of nerve cells, described reciprocal innervation, and suggested a physiological explanation for the antagonistic relationship existing between muscle groups in executing movements (he showed that when a muscle group is activated, the antagonistic muscles reflexively relax). He also advanced a theory on muscle reception and described the interrelations of the cerebral cortex and the motor centers of the spinal cord that regulate the functions of the skeletal muscles. He assigned to the distant receptors and the brain a leading role in the integration and control of all the processes in animals and man, significantly influencing the future development of brain surgery and the treatment of nervous disorders.

Sherrington strove to achieve an understanding of the organism as a whole, and he developed the concept of the integrative action of the nervous system. This is an area of importance to the Masgutova Method, particularly addressing the links between reflexes and their patterns in applying correction procedures for children with neuro-developmental deficits. Sherrington's work relating to the dual protection effect of a reflex pattern in the face of dysfunction or pathology helps Dr. Masgutova explain why standard physical, occupational, and speech therapy methods often have difficulty imparting functional change, if not targeted at the integration of primary motor reflex patterns.

In 1923, Sherrington wrote, "Reflexes interact with each other. The reflex response to a stimulus which is severely threatening to the well-being, or even to the life, of an animal, whilst commanding its own response, simultaneously switches off any other interfering reflexes that are less important in survival and that utilize the same muscle."

Credits and Additional Reading:

Sherrington, C. S., "The Integrative Action of the Nervous System," 1906

Sherrington, C. S., "The Integrative Action of the Nervous System," Reproduction of Original Work published in 1923 which is now in the public domain.

Sherrington, C. S., "Man on his Nature," 1940

Swazey, J. P., "Reflexes and Motor Integration: Sherrington's Concept of Integrative Action," Harvard University Press, 1969