

Aphasia Insights!

April 2023
Volume 5, Issue 05
April 4, 2023

“The nature of the nerve-impulse, the properties of cell-contacts as one-way gates compelling one-way traffic on nerve-paths, the occurrence not only of action but of active suppression of action, the knowledge that intensity of action means not larger impulses but more frequent impulses, that impulse-effects can sum, or cancel, that there are places where impulses spontaneously arise” (Sherrington, 1941, pp. 228).

Sherrington, CS. (1941)
Man on His Nature. Macmillan Publishing Co. Inc., New York.

Aphasia Nation, Inc. is committed to educating the wider public about stroke and aphasia and the “*Aim High for Aphasia!*” international Aphasia Awareness campaign.

Stroke Educator, Inc.
4 Aspen Drive
Brunswick, ME 04011
207-798-1449
tbroussa@comcast.net
www.strokeeducator.com
www.aphasianation.org
FB: DrTomBroussard
FB: StrokeEducatorInc
FB: AphasiaNationInc

Sir Charles S. Sherrington: Synapses & Integrative Action of the Nervous System.

By Tom Broussard, Ph.D.

This is the next in a series of articles about the science and scientists behind stroke, aphasia, plasticity and recovery.

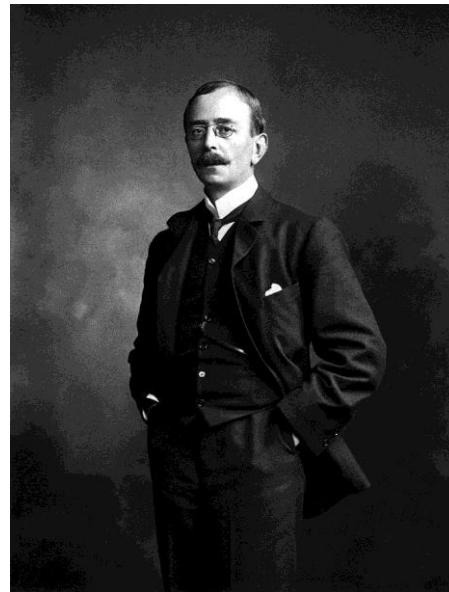
Sir Charles Scott Sherrington OM PRS FRCP FRCS was born in Islington, London and died at Eastbourne, Sussex, England, UK

(11/27/1857-3/4/1952) at 94 years old. He was an English neurophysiologist, histologist, bacteriologist, a pathologist, a Nobel Prize winner (with E.D. Adrian, 1932) and the president of the Royal Society (1920-25).

In addition to his studies, Sir Sherrington also taught many students at Oxford University as the Waynflete Chair of Physiology at Magdalen College (1913-1935), including Wilder Penfield

(US/Canada), who went on to map the neural representations of the topography of the brain (Penfield et al., 1937).

During World War I, he was the chairman of the Industrial Fatigue Board, and worked at a shell factory with daily shifts of 13 hours and a short shift of (only!) 9 hours on Sundays.



Sir Charles Scott Sherrington (1857-1952)

Sherrington’s research uncovered various aspects of neuroscience including the system that connects neurons (which became the “neuron doctrine”) and the way by which neurons communicate to other neurons using electrical, chemical, and

integrative activities.

“In the first place, nerve-cells, like all other cells, lead individual lives—they breathe, they assimilate, they dispense their own stores of energy, they repair their own substantial waste; each is, in short, a living unit, with its nutrition more or less centred in itself” (Sherrington, 1906/1947, pp. 1-2).

He goes on to describe the reactions of the nervous system in what he called, nerve-cell conduction as, "...nervous cells present a feature so characteristically developed in them as to be specially theirs. They have in exceptional measure the power to spatially transmit (conduct) states of excitement (nerve-impulse) generated within them" (Sherrington, 1906/1947, pp. 2).

Sherrington also described *integrative* as the third aspect of nerve activities that is "not the result solely of any single agency at work within it, but several. Thus, there is the *mechanical* combination of the unit cells of the individual into a single mass" (Sherrington, 1906/1947, pp. 2-3).

The integrative action of the nervous system is a tsunami that transmits the energy from a wave that moves as fast as a jet plane and crosses the oceans to distant shores in less than a day, while the integrative action ...

"is not mere intercellular material, as in connective tissue, nor the transference of material in mass, as by the circulation; it works through living lines of stationary cells along which it dispatches waves of physico-chemical disturbance, and these act as releasing forces in distant organs where they finally impinge. Hence it is not surprising that the nervous integration has as the feature of relatively high *speed*, a feature peculiarly distinctive of integrative correlation in animals..." (Sherrington, 1906/1947, pp. 3).

Sherrington coined the word "synapse" (in Greek, "to clasp") in 1897 to describe the mechanism bridging the gap between neurons, as stated, "In view, therefore, of the

probable importance physiologically of this mode of nexus between neurone and neurone it is convenient to have a term for it. The term introduced has been *synapse*" (Sherrington, 1906/1947, pp. 17).

Studying other histologists (the study of microscopic structures of tissues) throughout Europe, Sherrington became friends with Santiago Ramon y Cajal, the Spanish scientist and histologist (Nobel Prize, 1906), who had discovered that the nerves (neurons) are connected but independent with free nerve endings (Rapport, 2005).

Complementing his work, Sherrington invited Cajal, who he called a "peasant genius", to present at the Croonian Lecture in 1894 (Ehrlich, 2022). Sir Sherrington also presented at the Croonian Lecture three years later in 1897, the Silliman Lecture (1905), and the Gifford Lecture (1937-1938) to name a few of the most famous of his lectures.

After fifty years (1885-1935) of Sherrington's tireless work on the neuron theory, synapses, and the integrative action between the cells, the Physiological Society realized that Sherrington's masterful work, *The Integrative Action of the Nervous System* (1906) was out of print.

As a result, the Society created a new edition that included a signed copy of Sherrington's photograph, his CV and a complete bibliography of his published writings. The Society presented the new edition to every member at the XVII International Congress of Physiology in Oxford, England in July 1947 (Sherrington, 1906/1947, pp. viii).

Sherrington used his language to help people understand the complexities of the brain:

"It is as if the Milky Way entered upon some cosmic dance. Swiftly the head-mass becomes an enchanted loom where millions of flashing shuttles weave a dissolving pattern, always a meaningful pattern though never an abiding one; a shifting harmony of subpatterns" (Sherrington, 1941, pp. 184).

Signed: *The Johnny Appleseed of Aphasia Awareness*

The author is a three-time stroke survivor and aphasia. He could not read, write or speak well and it took him years to recover.

n.b. The author has one of the few (although quite tattered) copies of the signed, gold embossed book of *The Integrative Action of the Nervous System*.

He is Founder and President, Aphasia Nation, Inc., a non-profit organization whose mission is educating the wider public, national and international, about aphasia and plasticity, the foundation of all learning.

- Adrian, Edgar, *Nobel Lecture, The Activity of the Nerve Fibres*, December 12, 1932.
- Ehrlich, Benjamin. *The Brain in Search of Itself: Santiago Ramon y Cajal and the Story of the Neurons*. Farrar, Straus and Giroux, New York (2022).
- Penfield W, Boldrey E. Somatic motor and sensory representation in the cerebral cortex of man as studied by electrical stimulation. *Brain, Volume 60, Issue 4, 1 December 1937*, pp. 389-443.
- Rapport, Richard. *Nerve Endings, The Discovery of the Synapse*. W.W. Norton & Company, New York, London (2005).
- Sherrington, CS. *Inhibition as a Coordinative Factor*, Nobel Lecture, December 12, 1932.
- Sherrington, CS. *Man on His Nature*. Macmillan Publishing Co. Inc., New York (1941).
- Sherrington, CS. *The Integrative Action of the Nervous System*. Sir Charles Sherrington, O.M. Cambridge at the University Press, 1947 (1906).

