

Aphasia Insights!

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“If our professions do not allow us to devote more than two hours a day to a subject, do not abandon the work on the pretext that we need four or six, As Payot wisely noted, ‘A little each day is enough, as long as a little is produced each day’” (Cajal, 1999, pp. 38). (Jules Payot was a French educator and a friend of Santiago Ramón y Cajal).

Cajal, S. R. Advice for a Young Investigator. A Bradford Book, The MIT Press, Cambridge, Massachusetts. Translated by Neely Swanson and Larry W. Swanson 1999 (1898).

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

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Santiago Ramón y Cajal:

The Father of Modern Neuroscience.

By Tom Broussard, Ph.D.

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

Santiago Ramón y Cajal (1 May

1852 – 17 October 1934) was a Spanish neuroscientist, pathologist, and histologist (study of microscopic structures of tissues) specializing in neuroanatomy and the central nervous system. He received the Nobel Prize in Physiology or Medicine in 1906

(jointly with Camillo Golgi, an Italian scientist) and was the [first Spanish scientist to win the Nobel Prize](#) (Cajal, 1906). His research into the structure of the neurons (brain cells) made him the father of modern neuroscience.

Ramón y Cajal was born in Petilla de Aragon, the north-east corner of Spain. His father, Justo Ramón Casaus was a doctor and wanted Santiago to become a doctor too. He started teaching him very young and took him to an abandoned cave where he taught geography, French,

arithmetic, biology, and drawing, all by candle light.

By the summer of 1868, Santiago’s father was the anatomy teacher at the University of Zaragoza and he needed cadavers for his classes so the two went to a graveyard to find some. They “climbed the walls of the deserted cemetery. In a hollow in the plot of ground, we saw, [tumbled in confusion and half buried in the grass, various skeletal remains...](#)” (Cajal, 1996, pp 144).



**Santiago Ramón y Cajal
1852-1934**

Santiago studied pieces of the bodies and “felt a special delight, moreover, in taking apart and putting together again, piece by piece, [the organic clock](#), and hoped some day to understand something of its intricate mechanism.” (Cajal, 1996, pp 145).

He attended the medical school at his father’s university and graduated with a “Licentiate in Medicine” in 1873. He was recruited straightaway into the “*draft of Castelar*” for compulsory military service as a medical officer in the Spanish Army Medical Service (Cajal, 1996, pp 195).

Then *Lieutenant* Cajal became part of an “expeditionary force” to Cuba and arrived in Havana in 1874. He was assigned to a field hospital and almost immediately contracted malaria with

“clouds of mosquitoes” encircling him (Cajal, 1996, pp 217).

After he returned home, he received his doctorate in medicine in Madrid in 1877 and took a position as anatomy professor of the University of Valencia in 1879.

He started studying and drawing cells by hand until he learned years later about the Golgi’s ‘black reaction’ method that uses certain chemicals to stain some neurons dark while leaving the surrounding cells transparent (Ehrlich, 2022).

Cajal and Golgi became scientific rivals and shared their Nobel Prize with very different approaches to the nervous system and the brain. Golgi’s reticular theory contended that the nerve cells of the nervous system were a continuum of cells, fully connected (DeFelipe, 2015).

Once Cajal had improved Golgi’s staining method, he was able to see that the cells were individual entities that communicated between them with Sherrington’s newly labeled *synapses* that became part of the neuron doctrine (Rapport, 2005).

He was able to see the connection (dendrite/synapses) between the densely intertwined individual cells with his microscope. Before the term *dendrite* was first introduced in 1889 by Wilhelm His (an esteemed German anatomist), Cajal referred to the connection variously as protoplasmic processes, extensions, projections, bulbs, and even ‘kisses’ (Ehrlich, 2017) (Jones, 1994).

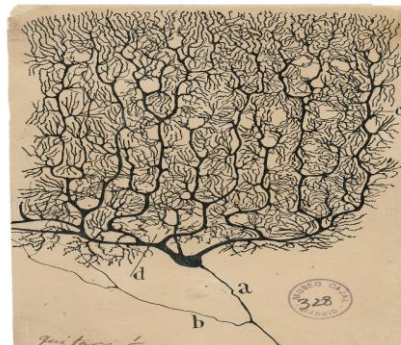
His detailed drawings of different cells identified the gap and the arborizations (“tree growing”) between one neuron and another (DeFelipe, 2010) (Newman et al, 2017).

At that point, he realized that the cells are independent and “insisted that at such a place there is *contact* of one nerve-cell with another, but no *conjunction* of one nerve-cell with another...” (Cannon,

1949, pp xii). That formed the basis for the neuron doctrine of today (Cajal, 1999).

The Royal Society invited Cajal to present at the Croonian Lecture in 1894 (Jones, 1994). After some hesitation, and after Sir Charles Sherrington’s welcoming letter, he agreed and stayed at Sherrington’s house for two weeks (Ehrlich, 2022).

His lecture provided the “... demonstration of his facts was arrestingly complete. His new teaching lent itself to explanation by diagram. In a few years it established itself in every up-to-date text-book of neurology and physiology.” (Cannon, 1949, pp xii).



Purkinje neuron from the human cerebellum

Cajal’s work transformed the scientific community, and as Sherrington remarked, “in the space of six short years, and single-handed, the ancient study of the functional anatomy of the vertebrate nervous system. Is it too much to say of him that he is the greatest anatomist the nervous system has ever known?” (Cannon, 1949, pp xii).

At the end of his Croonian Lecture, Cajal remarked that “The organ of thought is, within certain limits, malleable ... by well-directed mental gymnastics” (Jones, 1994).

His *mental gymnastics* were the precursor to what we now term, *experience-dependent neural activities* that induce plasticity which converts thought and cognitive activities into new brain matter. That is the foundation of all learning and recovery.

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.

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.

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