

Medicine in Stamps

Santiago Ramón y Cajal (1852–1934): pride of Petilla

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Ramón y Cajal remarked in his autobiography: “How many interesting facts fail to be converted into fertile discoveries because their first observers regard them as natural and ordinary things, unworthy of thought and analysis!” One cannot fault Cajal for his grandiloquence; his mind was so full of ingenuity and passion for his work that he could not have expressed himself otherwise. And indeed, one cannot fully describe Cajal’s contribution to the neurosciences without employing grandiloquence as well. Cajal did not merely contribute to the neurosciences, but built the neurosciences from dissociated fragments of knowledge to reach a synergistic level of understanding, just as the human brain builds upon its connections of randomly branching neurons to generate intelligent thought.

EARLY YEARS Cajal was born in the humble Spanish village of Petilla de Aragon on May 1, 1852. His father was Justo Ramón Casasús, a dedicated surgeon. As a child, Cajal had an endless supply of energy and loved the great outdoors. He wandered alone, blissful in his solitude, observing and sketching animals, insects, and the phenomena of nature. However, he often got himself into trouble by wandering too far. On one occasion, he remained stuck on a ledge for hours in his attempt to reach an eagle’s nest, and finally saved himself by carving grooves in the rock so he could climb his way down to safety.

As Cajal approached adolescence, he expanded his interests to great literary fiction, and was captivated by the adventures of *Robinson Crusoe* and *Don Quixote*. His academic interest increased, and he performed well in rhetoric and poetics while tolerating psychology, logic and ethics. He did not, however, find a passion until the age of 16 when he began his study of anatomy. After complete immersion into the worlds of pathology and osteology with much encouragement and guidance from his father, Cajal attributed his new love of anatomy as appealing to his “artistic idiosyncrasy,” as it provided him with more objects to sketch.

By the time he reached college, Cajal’s previous fascination with nature had taken a complete turn for the academic. He filled his hours with scientific activities and thoughts on chemistry, physics, natural history, and of course, anatomy. His father enrolled him in the premedical curriculum at Zaragoza. Father and son worked together there, dissecting side by side, learning about anatomy, and Cajal marvelled at the “marvellous workmanship of life” within the cadavers. His enthusiasm for science reached multiple levels, from anatomy to embryology, then to the cellular level when Virchow’s book *Cellular Pathology* was published.

FRAIL BEGINNINGS In 1873, at the age of 21, Cajal received the title of Licentiate in Medicine and began his career in Spain’s mandatory military service. During this time, the adventurer within him was excited to see the world, as he travelled first throughout Spain, then to Puerto Rico and Cuba. As a military physician, the most common conditions he treated were smallpox, chronic ulcers, dysentery and malaria. Soon, he himself acquired malaria as well as dysentery, and spent months with ailing health.

After two years in military service, Cajal returned to Spain. During this period, he rested and recuperated from his health problems. He reunited with his college sweetheart to whom he was betrothed, and in his autobiography, detailed his first kiss with her. He recalled an “ingenious anatomical classification” that a French medical man had devised to measure the sentimental worth of a kiss: the cutaneo-cutaneous kiss, mucoso-cutaneous kiss and mucoso-mucosal kiss. He commenced with the cutaneo-cutaneous kiss, but alas, was rejected. Cajal later learned that his fiancée was quite displeased to see her frail and sickly fiancé and felt pity for him rather than love.

LOVE REBUILDS CAJAL Rebounding from this setback, Cajal focused on his academic career. He set up a laboratory for himself and purchased a quality microscope of French make. With this investment, he was able to examine



red blood cells, epithelial cells, muscle fibres and nerve fibres. He persisted with his new research even through a bout of tuberculosis but then fell into a state of depression, which forced him to re-examine his priorities. Cajal decided that he wanted to marry. Soon after, he met a young woman while going for a stroll. He fell deeply in love with her to the chagrin of his father who feared that with this distraction, his son's potential for a great scientific career was lost forever.

His father, however, did not have to worry. Cajal, with the support of his new wife, recovered quickly from his medical ailments and became more productive than ever. Soon, he was the proud father of multiple children and multiple scientific publications. In one of these publications, he detailed the nerve fibres of amphibians and discussed the staining of the peripheral nervous system with ammoniacal silver nitrate, which was the first of his many publications focusing on neurons. In 1884, with a competitive curriculum vitae and impressive examination results, Cajal became the Chair of Anatomy at Valencia.

NEURONS AT WORK Cajal's most successful years began in 1887 when he read the newly reported method for staining nerve cells with silver chromate written by Golgi, the famous histologist. This method allowed for certain types of nerve cells to be easily seen under the microscope. With this novel finding, Cajal was able to disprove the old theory that neurons were arranged in a diffuse network. Instead, he noted that they branched out from each other and transmitted information in one direction. He also noted that different neuron types formed different organisational patterns based on their function, such as the Purkinje cells and the mossy fibres in the cerebellum. Cajal used his drawing skills to document his findings, and then proceeded to confirm these findings in nervous structures from the peripheral nerve to the cortex by using multiple staining techniques.

Cajal was entirely dedicated to "the noble worship of science," as he called it. In 1888, he published six scientific papers. In 1889, he published nine more papers, and in 1890, 14 more. He drew increasingly detailed models of nerve fibres, complete with labelled axons, synapses and dendrites that cemented his neuron theory. He described the organisation of major neural circuits such as the reflex and voluntary control pathways of the motor system.

Cajal studied neurons in both humans and animals, as well as neurons in embryos and adults. From his embryo research, the beginnings of the idea of neurotropism came about. Cajal documented his theory of how axons in development would "sniff out" and then migrate to other cell bodies. He also studied the idea of nerve regeneration and noted the lack of regeneration in the central nervous system.

RETIREMENT OF A GENIUS Success after success came for Cajal. In 1906, Cajal and Golgi were jointly awarded the Nobel Prize for their studies on the structure of the nervous system. By the time he retired in 1922 at the age of 70, Cajal's neuron theory was well established as the basis for all of neuroscience. In his old age, the typical honours for a scientist of his calibre were bestowed upon him. Monuments were placed, statues were erected and a research centre, the Instituto Cajal, was named in his honour. Cajal, true to his nature, did not let his retirement stop him from working. He installed a small private laboratory in the basement of his house and compiled a library of over 8,000 volumes. He spent much of his time writing, preparing both scientific works and personal narratives such as his book *The World as Seen at Eighty*. Into his old age, Cajal's neurons still fired at full force.

On October 17, 1934, Cajal passed away, leaving behind a body of research that had changed both science and medicine. Scientists from around the world as well as those in his homeland of Spain mourned his death. In his autobiography, Cajal had commented on his regrets that he was not born in "a great city, adorned with splendid monuments and illuminated by geniuses." His birthplace of Petilla remains a humble village to this day, but his legacy of genius and Spanish bravado provides enough illumination for Petilla to shine proudly for many years, in fond memory of Santiago Ramón y Cajal, father of the neuron.

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