History of Medicine

Cajal's hypothetical mapping of the neurological forest through histology drawings

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Abstract
One of the most significant steps taken to further the intimacy between medicine and art was taken by Santiago Ramón y Cajal, who was subsequently regarded as the father of modern neuroscience. In the late 19th century, Cajal started to draw neural tissues, and neurons in detail. As paradoxical as it may seem, the aesthetic quality of his drawings was so substantial that, in principle, they were not taken seriously by most of Cajal's professional colleagues. However, they were eventually proven wrong, and today Cajal's sketches are known for their brilliant clarity and accuracy. Indeed, in this article I provide a brief account of the scientific, aesthetic and even ethical relevance of Cajal's work, which ended up holding pride of place in the history of medicine.

Keywords: Anatomy, Art, History of medicine, Neurosciences, Observation, Santiago Ramón y Cajal

At the end of the 19th century, the scientific community accepted Gerlach's reticular theory according to which central nerve endings did not end freely, but continued with protoplasmic processes.[1] Nevertheless, it was Santiago Ramón y Cajal (figure 1) who provided more data to prove that the neuron constitutes the anatomical, physiological, genetic and metabolic unit of the nervous system.[2]

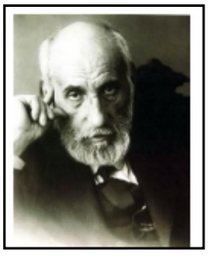

Figure 1: Cajal in 1920
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Besides showing that neurons have free terminations, he revealed that electric currents travel from the dendrites to the axon, thereby paving the way for the subsequent discovery of the synapse.[3] To make these discoveries, for which he was subsequently awarded the Nobel Prize (in 1906), he had to sketch what he saw under the microscope, as photography was then in its infancy, and was certainly not equipped to capture the finer details of a microscopic image.

Cajal's aim was also didactic, for he wished to inform medical students in the art of becoming skilled researchers. Thus, with regard to their initial phase as 'observers', he did not recommend the more conventional detached attitude, but rather suggested that the researcher always look at preparations as if for the first time. In fact, he pointed out that the things we observe will only surrender their secrets to us if we infuse them with "the intensity of our emotions", as "enthusiasm heightens and refines our perception" (Cajal 1999, p. 112).[4]

His goal was not as simple as copying images seen through the microscope, for he tried to interpret them in order to find out the structures and mechanisms underlying what he had observed. Cajal therefore devoted himself not only to draw neurons and their ramifications (figure 2), but also to reproduce the evolution of a given kind of neuron (figure 3), compare human neurons with the ones of diverse animals (figure 4) and indicate through arrows the direction of nervous conduction (figure 5). As regards the development of hypotheses, Cajal (1999) admitted the desirability of improving causal thinking, although he also provided some guiding principles: nature uses the same means for equivalent ends; problems must be viewed in their simplest forms; and all natural arrangements, however capricious they may seem, have a function.

Lastly, Cajal also seemed to believe that pride and excessive self-esteem should not prevent us from rejecting our ideas and hypotheses when data do not support them, as a result of which, Cajal disposed off many of his sketches. Furthermore, as stated above, the beauty of Cajal's drawings led many scientists to reject them, as they seemed more likely to be artistic interpretations, rather than exact copies of preparations. Sampedro (2017) considered Cajal's drawings as a sample of "scientific expressionism", even though Cajal later inveighed against surrealism, cubism and expressionism because he claimed that a respectful reproduction of nature, without deformations, was sufficient to communicate ideas and feelings.[5]

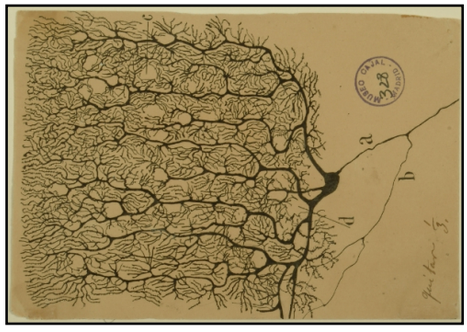

Figure 2: A Purkinje neuron and its ramifications
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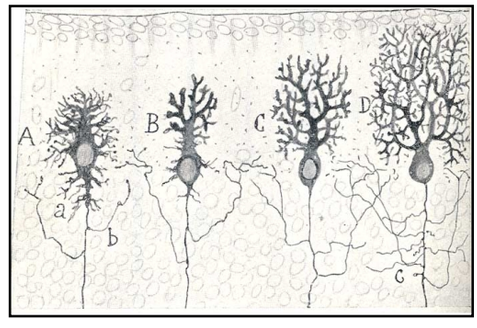

Figure 3: Evolution of a Purkinje cell
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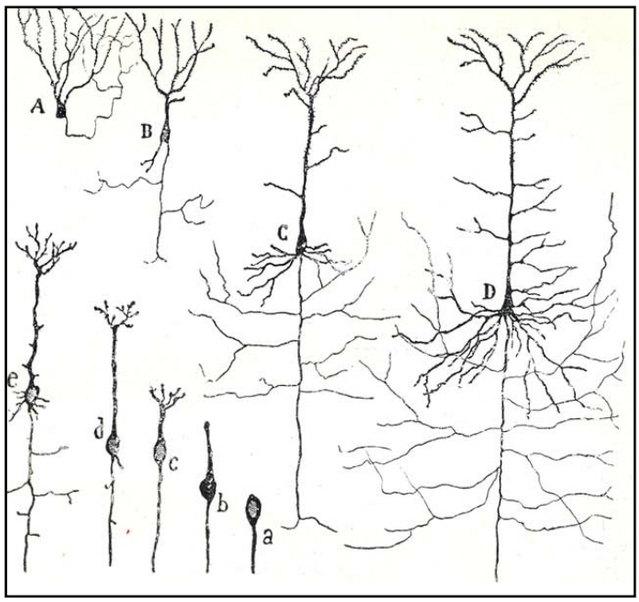

Figure 4: Schemes showing the phylogenetic and ontogenetic evolution of a pyramidal neuron. Evolution in (A) an amphibian, (B) a reptile, (C) a rabbit, and (D) a human being. (a), (b), (c) and (d) illustrate the evolutionary phases of a neuron in mammal embryos

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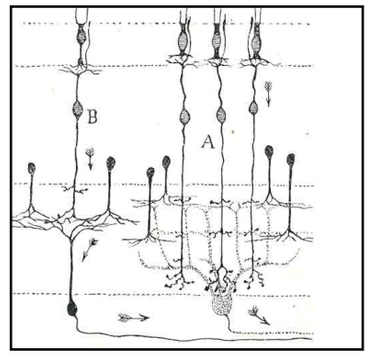

Figure 5: Scheme showing connections among neurons of birds retina and the direction of nervous conduction

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In conclusion, we can see that Cajal's work had not only a remarkable aesthetic character, but also an ethical one. Cajal believed that, there is no trick to avoiding the victory of truth. Therefore, he viewed scientific research as the conquest of truth and, by extension, the conquest of oneself.

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