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## Minds met at neuron junction

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Nerve Endings, the Discovery of the Synapse

Neuroscience owes much of its prominence to the establishment of the sciences of histology and physiology in the 19th century. These two fields epitomise the form-versus-function approaches to biology. Histology is the study of how cells form tissues; physiology is the study of how organs function.

In continental Europe, in the mid to late-19th century, the tendency was to bring physiological reasoning to bear on anatomical observation to elucidate function from form. This is what happened when a confluence of talented individuals, new tissue-staining techniques and advances in microscopy led to the histological foundation of the neuron doctrine, which states that the nervous system, like all other organs in the body, is made up of separate non-contiguous individual cells called neurons.

The neuron doctrine was hotly debated because under the microscope nervous tissue, specifically grey matter, seemed to be made up of an inseparable tangle of cell bodies and nerve fibres. This histological observation led scientists to ask: how are nerve cells connected to each other?

Richard Rapport's book personalises this question by presenting it as an intellectual duel between two scientists with markedly different temperaments: the Italian Camillo Golgi and the Spaniard Santiago Ramon y Cajal. Golgi thought the nervous system was a holistic network with no separation between nerve fibres. Cajal argued, instead, for the neuron doctrine. Golgi was proven wrong, although he never admitted it. Today, the name Golgi is associated with a few small body parts, whereas Cajal is remembered as one of the founders of modern neuroscience. The irony is that they were the first scientists to share a Nobel prize, Golgi for developing a crucial silver-staining technique and Cajal for using it to disprove him.

The neuron doctrine is of great importance to the history of science and has arguably been neglected compared with other major 19th and early 20th-century discoveries such as evolution and relativity.

Unfortunately *Nerve Endings* fails to give the neuron doctrine its due for reasons of style and content. Even the subtitle, *The Discovery of the Synapse*, is misleading because the synapse, the name given to the junction between neurons, was below the resolution of microscopes available at the time.

Cajal's great achievement was to infer, from ceaseless experimentation with staining techniques, endless hours of meticulous observation and a genius for choosing the right tissue to study that there was a "gap" between nerve fibres. However, at no point in the book are we told the profound implications of the truth of this gap for nervous-system function.

In *Nerve Endings*, the science, personal psychology and historical scene setting are all written in a manner that borders too frequently on the sophomoric and the clichéd. For example: "But whereas Cajal saw the world through

the eyes of a passionate, liberal south Mediterranean, Golgi saw the same world with the colder eye of a conservative northerner. Looking down similar microscopes, they each saw a different nervous system." Such stereotypes and pseudo-explanations get us nowhere. The book is full of novelistic foreshadowing as it hagiographically describes how the eccentric outsider from backward "wild" Spain defeated the "narcissistic" Italian and won over the "sophisticated" Germans and English. Cajal was indeed a great scientist, but to understand why requires an altogether more rigorous discussion about the differences between observational and experimental approaches, between the development of techniques and the formulation of hypotheses, and between personality and scientific ability.

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**Nerve Endings, the Discovery of the Synapse: The Quest to Find How Brain Cells Communicate**

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