Historical Profile

Angelo Ruffini: neuroanatomist of embryos and receptors

Italian physician and anatomist who discovered Ruffini's mechanoreceptors. He was born on July 17, 1864, in Arquata del Tronto, and died on Sept 7, 1929, in Baragazza.

Angelo Ruffini (1864–1929) was an Italian physician, anatomist, and embryologist. He is best known for his discovery of mechanoreceptors involved in proprioception, known as Ruffini corpuscles, and for his detailed studies on amphibian gastrulation. Ruffini is also remembered as an influential teacher and mentor; he had numerous alumni who praised him for his unwavering enthusiasm, including the preeminent anatomist Gastone Lambertini and the obstetrician Pasquale Sfameni, who was also the Chancellor of the University of Bologna from 1923 to 1927.

Born in Pretare, a town in Arquata del Tronto, Italy, and the eldest of five siblings, Ruffini studied medicine at the University of Bologna, where he gradudated in 1890. While still a student, he established a histology lab and began his research on nerve receptors. After completing his medical studies and working as a morphology researcher under the aegis of Augusto Murri, he taught histology, embryology, and anatomy at the universities of Bologna and Siena. Ruffini married and had a son, Giacomo, who would go on to study medicine too. To financially support his family, Ruffini had to reconcile his scientific endeavours with clinical work as the director of a small hospital in Tuscany. Imbued with patriotism—his grandfather had been killed because of his support of the unification movement—Ruffini was among the first academics that enthusiatically embraced the political movement of national renewal. Following the first unification of the Kingdom of Italy, in 1861, the movement focused on completing national unity with the unredeemed lands of Trentino and Venezia Giulia.

Ruffini maintained a scholarly correspondence with Sir Charles Sherrington, who helped him disseminate his findings in *The Journal of Physiology*. Ruffini was awarded a gold medal by the Italian Accademia Nazionale delle Scienze and also received financial support for the publication of his findings from The Royal Society in London, UK. Ruffini's work laid the foundations for the understanding of the morphofuncional role of sensory nerve endings and he was also a pioneer in the exploration of embryological development. His discoveries continue to have a profound influence on neuroscience and developmental physiology.

Despite limited recognition outside Italy during his lifetime, his contributions remain pivotal in the history of neuroanatomy. Ruffini became famous for his contribution to the first description of small, encapsulated nerve endings by use of gold chloride staining. These mechanoreceptors are now known as Ruffini corpuscles. He also conducted detailed studies on the anatomy and physiology of neuromuscular spindles, demonstrating that neurons can be tightly connected functionally to each other.

He authored the comprehensive treatise *Fisiogenia*, published in 1925, in which he described the dynamics of embryological development and introduced the concept of stichotropismus, a line-like movement of cells during gastrulation. Ruffini developed innovative histological staining and microscopy methods, including modifications to the Weigert method to visualise myelin sheaths and to the micrographic apparatus (ie, camera lucida). Some histological slides that Ruffini used to describe with great accuracy both the corpuscles as well as other findings were in possession of Isabella Galliani, a professor at the University of Bologna, who passed away in 2019. Galliani gave the slides to one of us (PG), and we have been able to analyse Ruffini's original histological work from 1892.

On his discovery of a new type of mechanoreceptor, in *Di un nuovo organo nervoso terminale* (Tipografia della Reale Accademia dei Lincei, Roma, 1894), Ruffini wrote (our own translation from the original Italian): "The nerve fibre intended for the formation of the terminal nerve plate [...] it is divided into secondary branches [...] to form a single plate. The nerve fibre penetrates the terminal organ from the side of it [...], becoming amyelinic fibres, resolving into terminal entanglements and thus forming a true nerve network with enlargements in their course and in the nodal points. Each of the very thin fibres, therefore, ends up as free terminals, almost always swollen [...] The terminal plate then takes on a cylindrical shape filled with the admirable fibre network." In addition to this fine description of the corpuscle, his slides prove the careful work of preparation and comparative study that Ruffini carried out to unequivocally demonstrate the novelty of his observations.

We'd like to pay homage to Angelo Ruffini and highlight the important role that morphology has always played in the progress of medical sciences.

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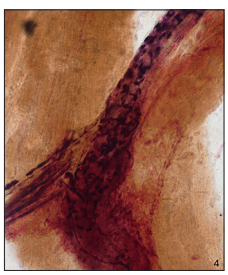

Microphotograph of a Ruffini's corpuscle