Gustaf Retzius (1842–1919)

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Gustaf Retzius is known mainly for his studies of the anatomy of the nervous system and his pioneering studies of the inner ear. He was born in Stockholm in 1842, son of Anders Retzius, Professor of Anatomy and President at Karolinska Institutet. He studied medicine at Uppsala University and in Stockholm and defended his doctoral thesis in Lund. He was appointed to a personal professorship in histology at Karolinska Institutet in 1877, the first chair in this subject. In 1888 he became Professor of

Anatomy at the same place, but he held this position only until 1890, when he resigned, 48 years old, as a protest against his candidate for a professorship in ophthalmology not having been appointed. He was not alone. Another colleague gave up his chair as well, and the Minister of Education and Ecclesiastic Affairs resigned as Minister. Economically independent, however, because of his marriage to the daughter of the owner of a well-known newspaper in Stockholm, Gustaf Retzius continued his research and writing more or less until his death in 1919 [1].

In 1869 Retzius had started working with Axel Key, who was a professor of pathology, on the anatomy of the nervous system and of connective tissue. The results of these studies were published in 1875 and 1876 [2]. Among the findings reported were the demonstration of an open communication between the ventricular system and the subarachnoid space via the foramen of Magendie and the foramina of Luschkae. They also made a complete investigation of the arachnoid villi and showed that fluid could pass from these structures into the intracranial veins. This was all found by injection of colored solutions either into the subarachnoid space or into the ventricles. These were all new findings. The two volumes were well received and won the Prix Montyon of the French Academy of Sciences.

Gustaf Retzius' most monumental studies, which are still highly appreciated internationally, dealt with the inner ear. They were published in 1881 and 1884 in two large volumes in folio entitled "Das Gehörorgan der Wirbelthiere" [3], containing detailed descriptions and extraordinary drawings of the inner ear of a large number of vertebrates, from myxine (hagfish) to man (48 different species of fish, 15 of amphibians, 22 of reptiles, 10 of birds, and several mammals, including humans). These volumes contain close to 600 pages of text and more than 70 pages with

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several hundred drawings accompanied by explanatory text. All the drawings were by Retzius.

Other important parts of Retzius' studies dealt with the nervous system in invertebrates as well as vertebrates. These were published first in two volumes in 1881 and 1882, "Biologische Untersuchungen" [4], and later in a series of 18 volumes, "Biologische Untersuchungen, Neue Folge", 1890–1914 [5]. Volume number 19, published in 1921 after Retzius' death, was published by his former pupil professor Carl Magnus Fürst. Altogether they count more than 2,000 pages and about 500 full-page plates with figures. All these books were published at Retzius' own expense and the editions sent as gifts to colleagues—several of the volumes had dedications to famous scientists like Kölliker, Nansen and Cajal—and to different scientific societies and institutions around the world.

In his histological studies Gustaf Retzius employed both Ehrlich methylene blue stain and the Golgi impregnation method. The latter stain was used in a study of the cerebral cortex in which he described a horizontal cell from a human fetus. Ramón y Cajal had also described this cell type in the rabbit, and it was later called the Cajal-Retzius cell. It is present at an early stage of the development of the cerebral cortex and releases a substance, reelin, which is of importance for the formation of the different cortical layers.

The studies that Retzius carried out on the peripheral nervous system in vertebrates became of great importance in support of Cajal's neuron doctrine, as opposed to the reticular theory championed by Golgi. The neuron doctrine, which later proved correct, meant that the single nerve cell with its extensions constituted a separate anatomical and functional unit. The reticular theory, in contrast, assumed that nerve cells were in continuity with each other. Retzius showed that sensory nerve fibers terminated as free endings and stated that in his studies of the inner ear; in 1884 he had found that the fibers of the auditory nerve were in contact with, but not in continuity with, the hair cells. Another example was the central ramifications of the olfactory nerve that—as he could show—terminated as free nerve endings in the olfactory bulb. His support for the neuron doctrine was greatly appreciated by Ramón y Cajal [6].

In addition to his "Biologische Untersuchungen, Neue Folge", Retzius published two more comprehensive studies

on the nervous system. The first one, "Das Menschenhirn" from 1896, is in two volumes, one with text, the other with magnificent plates containing more than 800 figures, reproduced from photographs and drawings of material prepared by Retzius [7]. The other study is "Das Affenhirn", published in 1906 [8]. It contains plates in folio with hundreds of photographs from 700 brains, prepared from 50 different species of monkeys.

Gustaf Retzius' reputation as a prominent scientist earned him membership and appreciation of several learned societies in Sweden, including the Academy of Sciences. He also became a member of many of the most prominent academies abroad, in Berlin, London, Paris, St. Petersburg, Rome, Washington and Vienna. He was also invited to London to give a "Croonian Lecture" in 1908 and "The Huxley Lecture" in 1909. Furthermore, he became honorary doctor at the University of Bologna and member of the Accademia dei Lincei, in Rome, the oldest scientific academy in the world, founded in 1603.

In addition, his international stature as a scientist was reflected by the fact that he was nominated for the Nobel Prize in Physiology or Medicine no less than 11 times, but he never received it.

References

1. Lindblad T (2007) Gustaf Retzius. A biography. The Hagströmer Medico-Historical Library, Stockholm
2. Key A and Retzius G (1875, 1876) Studien in der Anatomie des Nervensystems und des Bindegewebes
3. Retzius G (1881, 1884) Das Gehörorgan der Wirbelthiere. Morphologisch-histologische Studien. Band I. Das Gehörorgan der Fische und Amphibien. Band II. Das Gehörorgan der Reptilien, der Vögel und der Säugethiere
4. Retzius G (ed) (1881, 1882) Biologische Untersuchungen. Jahrgang 1881–1882
5. Retzius G (1890–1921) Biologische Untersuchungen. Neue Folge I–XIX. In 19 volumes
6. Cajal S, Ramón y (1989) Recollections of my life. Translated by E. Horne Craigie with the assistance of Juan Cano. MIT Press, Cambridge
7. Retzius G (1896) Das Menschenhirn. Studien in der makroskopischen Morphologie. I–II (Text und Tafeln)
8. Retzius G (1906) Cerebra simiarum illustrata. Das Affenhirn in bildlicher Darstellung