

Santiago Ramón y Cajal.

SANTIAGO RAMÓN Y CAJAL was easily the greatest scientific man that Spain has produced in modern days. Before he began his histological work our knowledge of the minute structure of the nervous system and the relations of its parts was fragmentary and inexact. It was largely based on conjecture, and the views which were held by physiologists regarding the relation of its parts to one another had no well-grounded basis of anatomical fact. Such a basis was supplied by Cajal, and led to a complete clearing up of our conceptions regarding its mode of operation.

This depends on the fundamental fact that the elements of the nervous system, both those which serve actively to carry nerve-impulses and those which play a more passive part, are morphologically disunited. Before Cajal the opposite view was universally held. The central nervous system was conceived as an intricate network of intercommunicating fibres which were not positively known to have any anatomical connection with nerve-cells. It is true that Waller had shown that certain nerve-fibres when cut off from the groups of cells from which they emanate undergo degeneration and death; but the relationship between cells and fibres was not understood, and nerve-cells were conceived and spoken of as distinct from nerve-fibres. Even to-day neurologists speak of the nerve-cells as distinct structures, although they are well aware that a nerve-fibre is always part of a nerve-cell, however far it may have extended away from the nucleated body whence it originated! It is Cajal's merit to have shown this relationship to be beyond question, that every nerve-fibre is part of a nerve-cell, and that to designate a nerve-cell by a special name (*neurone*) is unnecessary and misleading. Yet so universally has the term been adopted that he himself is constrained to employ it, much against his better judgment!

Cajal was fortunate that when his investigations on the nervous system were beginning a new method for showing the elements of that system in a manner in which they had never before been so clearly displayed was being evolved under the auspices of Camillo Golgi. By this (the silver chromate method) it is possible in any portion of the nervous system to select out of an intricate mass containing hundreds of nerve-cells a few—it may be only one or two—which are stained intensely black. These few are stained in every part, not only the main part or cell-body,

but all the processes, no matter how numerous nor how far they may extend from the cell-body; the rest of the cells remain wholly unstained. Taking advantage of this selective staining—which has never been properly accounted for—Golgi found that it is possible to trace nerve-fibres for long distances from their origin in one nerve-cell to their, generally arborised, termination in another part of the grey matter. Cajal adopted this method, modified it, and applied it successfully to all parts of the central nervous system, utilising especially young or foetal animals, for the greater ease of following the course of the nerve-tracts and fibres under investigation. Proceeding in this way he was able gradually to build up not only a clear idea of the relations with one another of the cells constituting the main nervous system, but also of the structure of outlying portions, such as the retina, and the relationship of its various layers to one another and to the main central nervous system itself. So extensive has been the range of his investigations that Cajal may be said to have left no part of the nervous system unexamined. In every case the same principle obtains, viz., that the nervous system is composed of anatomically disunited elements. When, in 1894, he began his investigations, the subject was chaotic; he has left it ordered and comprehensible. He has lived to see his life's work largely accomplished and his conclusions almost universally accepted. What the anatomist, the physiologist, the pathologist, and the clinician owe to that work cannot easily be overstated! No better illustration of the principle that for the investigation of function an adequate knowledge of structure and especially of minute structure must first be acquired can be adduced. Without the illumination which Cajal's work has thrown upon the structure of the nervous system, we should still be groping in the dark, still theorising about the manner in which its most fundamental functions are carried on!

Born in 1852, Ramón y Cajal was the son of a Professor of Anatomy; but so far as microscopic anatomy is concerned he appears to have been self-taught. In 1884 he was himself appointed to the Chair of Anatomy at Valencia, and it was here that he began the systematic study of the nervous system, which was to constitute his life's work and bring him fame. From Valencia he transferred to Barcelona and eventually to Madrid. Here he founded a school of histology which has become world-famous. Honoured all the world over, he was also appreciated by his own countrymen, who are justly proud of him. His name is perpetuated in Madrid by the magnificent "Instituto Cajal," where, after his retirement from active teaching, he continued his histological investigations, which later embraced many more subjects than the nervous system, and were conducted largely in association with his assistants and pupils.

He visited London in 1894 to give the Croonian Lecture before the Royal Society. The Physiological Society entertained him at an informal banquet—and many of us older physiologists had the opportunity of then making his acquaintance, which in some cases developed into an enduring friendship. It was only a few months ago that the writer received from him (with a charming personal message) a copy of his latest work, *Neuronismo o Reticularismo*, a short but very able recapitulation of the arguments and evidences which had led him to the conclusions regarding the structure of the nervous system upon which his fame will always be based. He died at the age of eighty-three on October 17, 1934, in full possession of his faculties and working until the last.

Ramón y Cajal's scientific communications were mostly published in Spanish, but some of the most important have been translated into French and English: amongst the latter may be mentioned an early work, *New Ideas on the Structure of the Nervous System*, the *Textura del Sistema Nervioso*, and the more recent *Degeneration and Regeneration of the Nervous System*. He edited for many years an important histological journal, which is largely constituted of articles by himself and his fellow-workers. Begun in 1896 as *Revista Trimestral Micrográfica*, and continued as *Trabajos del Laboratorio de Investigaciones Biológicas*, it has appeared also under the French title *Travaux du Laboratoire de Recherches Biologiques*, and is characterised by the excellent manner in which it is printed and illustrated as well as by the important nature of its articles, which furnish abundant evidence that the influence of Ramón y Cajal will long continue to assert itself in the sphere he had made peculiarly his own.

He was elected a Foreign Member of the Royal Society of London in 1909, and an Honorary Fellow of this Society in 1913.

E. S-S.