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and Karl E. Åström

Gliogenesis: Historical Perspectives, 1839–1985

With 39 Figures

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Cover Portraits
(Top) Rudolf Virchow (1821–1902) Discoverer of "glia" in the central nervous system.
(Bottom) Theodor Schwann (1810–1882) introduced the "Cell Doctrine" in 1839.

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Abstract

This historical review of gliogenesis begins with Schwann's introduction of the cell doctrine in 1839. Subsequent microscopic studies revealed the cellular structure of many organs and tissues, but the CNS was thought to be different. In 1864, Virchow created the concept that nerve cells are held together by a "Nervenkitte" which he called "glia" (for glue). He and his contemporaries thought that "glia" was an unstructured, connective tissue-like ground substance that separated nerve cells from each other and from blood vessels. Dieters, a pupil of Virchow, discovered that this ground substance contained cells, which he described and illustrated. Improvements in microscopes and discovery of metallic impregnation methods finally showed convincingly that the "glia" was not a binding substance. Instead, it was composed of cells, each separate and distinct from neighboring cells and each with its own characteristic array of processes. Light microscopic studies of developing and mature nervous tissue led to the discovery of different types of glial cells—astroglia, oligodendroglia, microglia, and ependymal cells in the CNS, and Schwann cells in the peripheral nervous system (PNS). Subsequent studies characterized the origins and development of each type of glial cell. A new era began with the introduction of electron microscopy, immunostaining, and in vitro maintenance of both central and peripheral nervous tissue. Other methods and models greatly expanded our understanding of how glia multiply, migrate, and differentiate. In 1985, almost a century and a half of study had produced substantial progress in our understanding of glial cells, including their origins and development. Major advances were associated with the discovery of new methods. These are summarized first. Then the origins and development of astroglia, oligodendroglia, microglia, ependymal cells, and Schwann cells are described and discussed. In general, morphology is emphasized. Findings related to cytodifferentiation, cellular interactions, functions, and regulation of developing glia have also been included.