# Glial cell

Sometimes called neuroglia or simply glia (Greek γλία, γλοία “glue”;, are non-neuronal cells that maintain homeostasis, form myelin, and provide support and protection for neurons in the brain and peripheral nervous system.

Glial cells function support neurons and, in the PNS, also include satellite cells, olfactory ensheathing cells, enteric glia and glia that reside at sensory nerve endings, such as the Pacinian corpuscle.

As the Greek name implies, glia are commonly known as the glue of the nervous system; however, this is not fully accurate. Neuroscience currently identifies four main functions of glial cells:

To surround neurons and hold them in place

To supply nutrients and oxygen to neurons

To insulate one neuron from another

To destroy pathogens and remove dead neurons.

## Roles

For over a century, it was believed that the neuroglia did not play any role in neurotransmission. However 21st-century neuroscience has recognized that glial cells do have some effects on certain physiological processes like breathing, and in assisting the neurons to form synaptic connections between each other.

Neuroglial cells—usually referred to simply as glial cells or glia—are quite different from nerve cells. The major distinction is that glia do not participate directly in synaptic interactions and electrical signaling, although their supportive functions help define synaptic contacts and maintain the signaling abilities of neurons. Glia are more numerous than nerve cells in the brain, outnumbering them by a ratio of perhaps 3 to 1. Although glial cells also have complex processes extending from their cell bodies, they are generally smaller than neurons, and they lack axons and dendrites.

The term glia (from the Greek word meaning “glue”) reflects the nineteenth-century presumption that these cells held the nervous system together in some way. The word has survived, despite the lack of any evidence that binding nerve cells together is among the many functions of glial cells. Glial roles that are well-established include maintaining the ionic milieu of nerve cells, modulating the rate of nerve signal propagation, modulating synaptic action by controlling the uptake of neurotransmitters, providing a scaffold for some aspects of neural development, and aiding in (or preventing, in some instances) recovery from neural injury.

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After traumatic brain injury (TBI), glial cells have both beneficial and deleterious roles in injury progression and recovery.

### Types

NG2 cells, or polydendrocytes, are defined as glial cells that express the NG2 proteoglycan and represent a fourth major glial cell population in the mammalian central nervous system. They are morphologically, antigenically, and functionally distinct from mature astrocytes, oligodendrocytes, and microglia. Although they are most often equated with oligodendrocyte progenitor cells, they exhibit some properties that are not commonly associated with those of progenitor cells that generate myelinating cells [1].

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see Ependyma

see Glial cell derived neurotrophic factor.

## Glial Cells Response in Stroke

As the second-leading cause of death, stroke faces several challenges in terms of treatment because of the limited therapeutic interventions available. Previous studies primarily focused on metabolic and blood flow properties as a target for ischemic stroke treatment, including recombinant tissue plasminogen activator and mechanical thrombectomy, which are the only USFDA approved therapies. These interventions have the limitation of a narrow therapeutic time window, the possibility of hemorrhagic complications, and the expertise required for performing these interventions. Thus, it is important to identify the contributing factors that exacerbate the ischemic stroke outcome and to develop therapies targeting them for regulating cellular homeostasis, mainly neuronal survival and regeneration. Glial cells, primarily microglia, astrocytes, and oligodendrocytes, have been shown to have a crucial role in the prognosis of ischemic brain injury, contributing to inflammatory responses. They play a dual role in both the onset as well as resolution of the inflammatory responses. Understanding the different mechanisms driving these effects can aid in the development of therapeutic targets and further mitigate the damage caused. In a review, Jadhav et al. summarize the functions of various glial cells and their contribution to stroke pathology. The review highlights the therapeutic options currently being explored and developed that primarily target glial cells and can be used as neuroprotective agents for the treatment of ischemic stroke [2].

1)
Nishiyama A. Polydendrocytes: NG2 cells with many roles in development and repair of the CNS. Neuroscientist. 2007 Feb;13(1):62-76. Review. PubMed PMID: 17229976.
2)
Jadhav P, Karande M, Sarkar A, Sahu S, Sarmah D, Datta A, Chaudhary A, Kalia K, Sharma A, Wang X, Bhattacharya P. Glial Cells Response in Stroke. Cell Mol Neurobiol. 2022 Jan 23. doi: 10.1007/s10571-021-01183-3. Epub ahead of print. PMID: 35066715.