**Introduction to “brain tumor segmentation project”**

A **glioma** is a type of [tumor](https://en.wikipedia.org/wiki/Tumor) that starts in the [brain](https://en.wikipedia.org/wiki/Human_brain) or [spine](https://en.wikipedia.org/wiki/Vertebral_column). It is called a glioma because it arises from [glial cells](https://en.wikipedia.org/wiki/Glial_cell).

**Neuroglia**, also called **glial cells:**

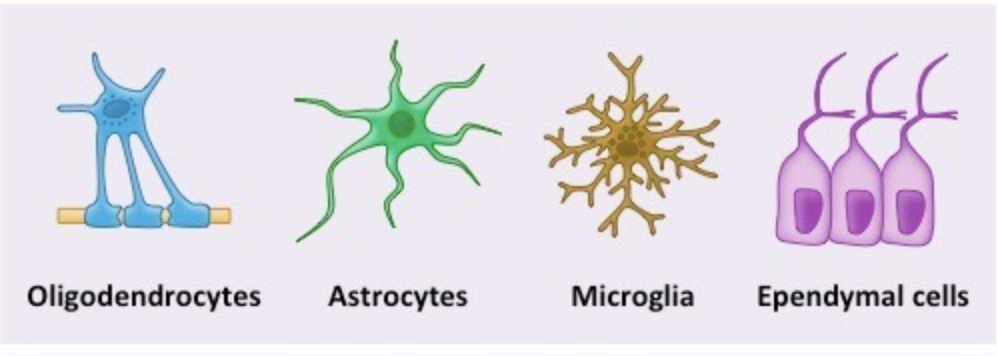
[**https://www.youtube.com/watch?v=fHY6PV-gBNM**](https://www.youtube.com/watch?v=fHY6PV-gBNM) **- until 5min**

Are non-[neuronal](https://en.wikipedia.org/wiki/Neuron) [cells](https://en.wikipedia.org/wiki/Cell_(biology)) that maintain [homeostasis](https://en.wikipedia.org/wiki/Homeostasis), form [myelin](https://en.wikipedia.org/wiki/Myelin), and provide support and protection for [neurons](https://en.wikipedia.org/wiki/Neuron) in the [central](https://en.wikipedia.org/wiki/Central_nervous_system) and [peripheral nervous systems](https://en.wikipedia.org/wiki/Peripheral_nervous_system).

In the central nervous system, glial cells include [oligodendrocytes](https://en.wikipedia.org/wiki/Oligodendrocyte), [astrocytes](https://en.wikipedia.org/wiki/Astrocyte), [ependymal cells](https://en.wikipedia.org/wiki/Ependymal_cell) and [microglia](https://en.wikipedia.org/wiki/Microglia).

[Neuroscience](https://en.wikipedia.org/wiki/Neuroscience) currently identifies four main functions of glial cells:

1. To surround neurons and hold them in place
2. To supply [nutrients](https://en.wikipedia.org/wiki/Nutrients) and [oxygen](https://en.wikipedia.org/wiki/Oxygen) to neurons
3. To insulate one neuron from another
4. To destroy [pathogens](https://en.wikipedia.org/wiki/Pathogens) and remove dead neurons.

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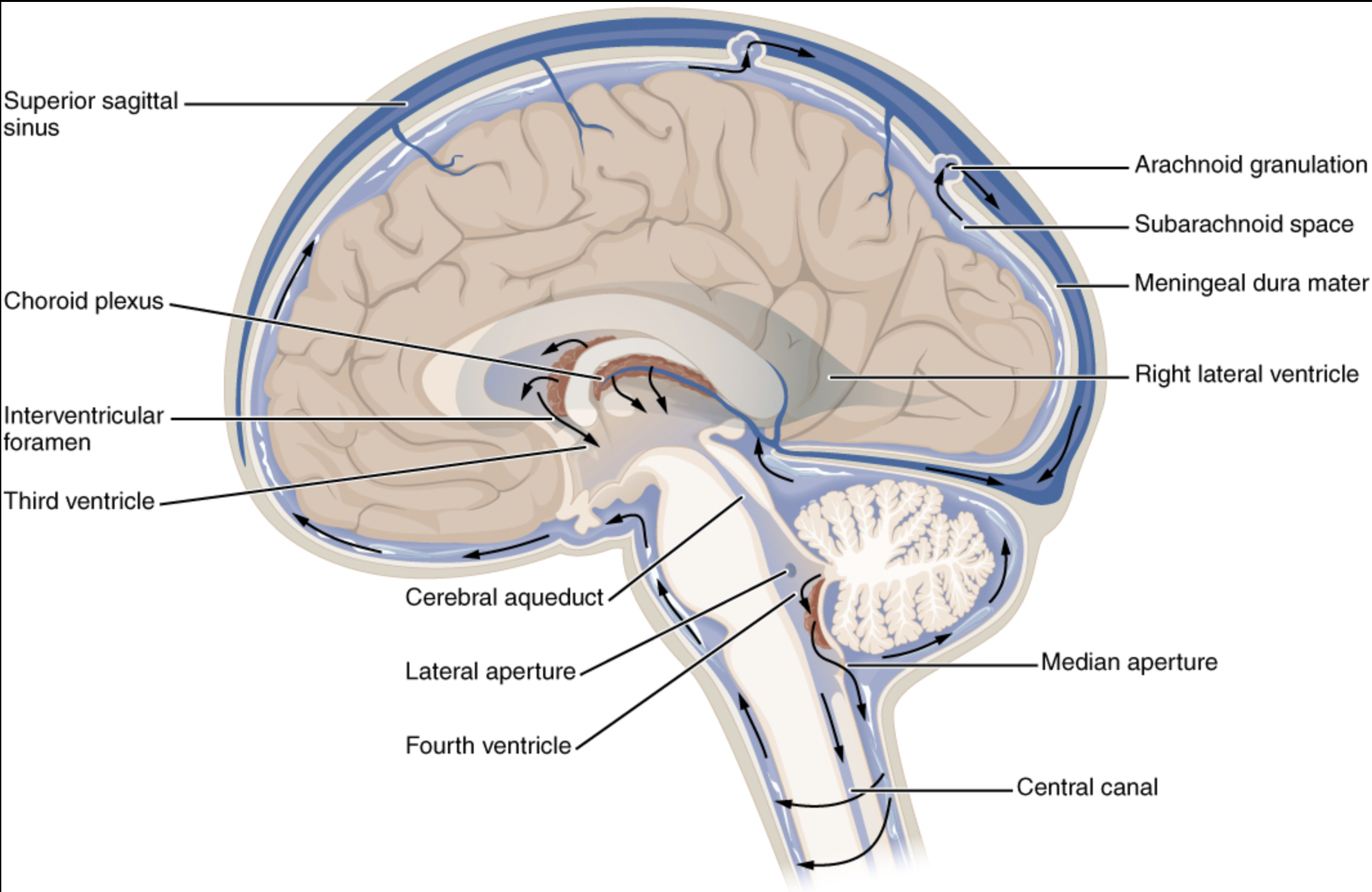
[Oligodendrocytes](https://en.wikipedia.org/wiki/Oligodendrocyte) –are cells that coat axons in the [central nervous system](https://en.wikipedia.org/wiki/Central_nervous_system) (CNS) with their cell membrane, forming a specialized membrane differentiation called [myelin](https://en.wikipedia.org/wiki/Myelin). The myelin sheath provides [insulation](https://en.wikipedia.org/wiki/Electrical_insulation) to the axon

[Astrocytes](https://en.wikipedia.org/wiki/Astrocyte) . Astrocytes are a type of glial cells and they hold various roles: mostly supporting [neurons](https://en.wikipedia.org/wiki/Neuron), provision of nutrients to the nervous tissue, maintenance of extracellular ion balance, and a role in the repair and scarring process of the brain.

[Ependymal cells](https://en.wikipedia.org/wiki/Ependymal_cell) –  line the spinal cord and the [ventricular system](https://en.wikipedia.org/wiki/Ventricular_system) of the brain. These cells are involved in the creation and secretion of [cerebrospinal fluid](https://en.wikipedia.org/wiki/Cerebrospinal_fluid) (CSF) and beat their [cilia](https://en.wikipedia.org/wiki/Cilia) to help circulate the CSF and make up the [blood-CSF barrier](https://en.wikipedia.org/wiki/Blood-CSF_barrier).

Microglia - they act as the first and main form of active immune defense in the [central nervous system](https://en.wikipedia.org/wiki/Central_nervous_system) (CNS).[[3]](https://en.wikipedia.org/wiki/Microglia#cite_note-Filiano_2015-3) Microglia

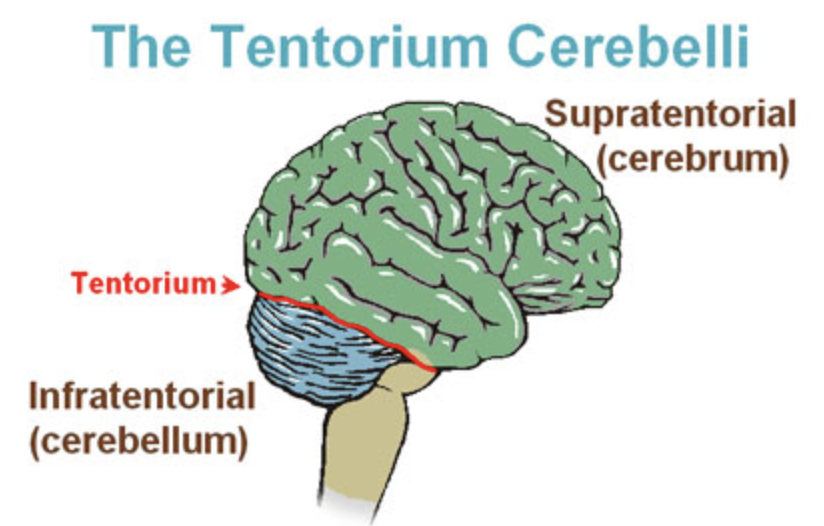
**The ventricular system** - a set of four interconnected cavities (ventricles) in the [brain](https://en.wikipedia.org/wiki/Brain), where the [cerebrospinal fluid](https://en.wikipedia.org/wiki/Cerebrospinal_fluid) (CSF) is produced. The ventricular system is continuous with the [central canal](https://en.wikipedia.org/wiki/Central_canal_of_spinal_cord) of the [spinal cord](https://en.wikipedia.org/wiki/Spinal_cord) (from the fourth ventricle) allowing for the flow of CSF to circulate.



Gliomas are named according to the specific type of cell with which they share histological features, but not necessarily from which they originate. The main types of gliomas are:[[3]](https://en.wikipedia.org/wiki/Glioma#cite_note-3)

* [Ependymomas](https://en.wikipedia.org/wiki/Ependymoma): [ependymal cells](https://en.wikipedia.org/wiki/Ependymal_cell)
* [Astrocytomas](https://en.wikipedia.org/wiki/Astrocytoma): [astrocytes](https://en.wikipedia.org/wiki/Astrocyte) ([glioblastoma multiforme](https://en.wikipedia.org/wiki/Glioblastoma_multiforme) is a malignant astrocytoma and the most common primary brain tumor among adults).
* [Oligodendrogliomas](https://en.wikipedia.org/wiki/Oligodendroglioma): [oligodendrocytes](https://en.wikipedia.org/wiki/Oligodendrocyte)
* [Brainstem glioma](https://en.wikipedia.org/wiki/Brainstem_glioma): develop in the brain stem
* Optic nerve glioma: develop in or around the optic nerve
* Mixed gliomas, such as [oligoastrocytomas](https://en.wikipedia.org/wiki/Oligoastrocytomas), contain cells from different types of glia

Gliomas can be classified according to whether they are above or below a membrane in the brain called the [tentorium](https://en.wikipedia.org/wiki/Tentorium_cerebelli). The tentorium separates the [cerebrum](https://en.wikipedia.org/wiki/Cerebrum) (above) from the [cerebellum](https://en.wikipedia.org/wiki/Cerebellum) (below).



* The [supratentorial](https://en.wikipedia.org/wiki/Supratentorial) is above the tentorium, in the cerebrum, and mostly found in adults (70%).
* The [infratentorial](https://en.wikipedia.org/wiki/Infratentorial) is below the tentorium, in the cerebellum, and mostly found in children (70%).
* The pontine tumors are located in the [pons](https://en.wikipedia.org/wiki/Pons) of the brainstem. The brainstem has three parts (pons, midbrain, and medulla); the pons controls critical functions such as breathing, making surgery on these extremely dangerous.

Magnetic resonance imaging

[medical imaging](https://en.wikipedia.org/wiki/Medical_imaging) technique used in [radiology](https://en.wikipedia.org/wiki/Radiology) to form pictures of the [anatomy](https://en.wikipedia.org/wiki/Anatomy) and the physiological processes of the body in both health and disease. MRI scanners use strong [magnetic fields](https://en.wikipedia.org/wiki/Magnetic_field), [radio waves](https://en.wikipedia.org/wiki/Radio_wave), and [field gradients](https://en.wikipedia.org/wiki/Field_gradient) to generate images of the organs in the body.

[**https://www.youtube.com/watch?v=rumRGO\_2H0E**](https://www.youtube.com/watch?v=rumRGO_2H0E)

[**https://www.youtube.com/watch?v=mOt2FeGHjaY**](https://www.youtube.com/watch?v=mOt2FeGHjaY)

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| [T1 weighted image](https://en.wikipedia.org/wiki/Magnetic_resonance_imaging#T1_and_T2) | T1 | Measuring [spin–lattice relaxation](https://en.wikipedia.org/wiki/Spin%E2%80%93lattice_relaxation) by using a short [repetition time](https://en.wikipedia.org/wiki/Repetition_time) (TR) and [echo time](https://en.wikipedia.org/wiki/Echo_time) (TE) | * Lower signal for more water content, [11]as in [edema](https://en.wikipedia.org/wiki/Edema), [tumor](https://en.wikipedia.org/wiki/Tumor), [infarction](https://en.wikipedia.org/wiki/Infarction), * [inflammation](https://en.wikipedia.org/wiki/Inflammation), [infection](https://en.wikipedia.org/wiki/Infection), hyperacute or chronic [hemorrhage](https://en.wikipedia.org/wiki/Hemorrhage) [12] * High signal for [fat](https://en.wikipedia.org/wiki/Fat)[11][12] * High signal for [paramagnetic](https://en.wikipedia.org/wiki/Paramagnetism) substances, such as [MRI contrast agents](https://en.wikipedia.org/wiki/MRI_contrast_agent)[12] | |  |
| [T2 weighted image](https://en.wikipedia.org/wiki/Magnetic_resonance_imaging#T1_and_T2) | T2 | Measuring [spin–spin relaxation](https://en.wikipedia.org/wiki/Spin%E2%80%93spin_relaxation) by using long TR and TE times. | * Higher signal for more water content.[11] * Low signal for fat.[11] * Low signal for [paramagnetic](https://en.wikipedia.org/wiki/Paramagnetism) substances.[12] | |  |
| [Fluid attenuated inversion recovery](https://en.wikipedia.org/wiki/Fluid_attenuated_inversion_recovery) | FLAIR | Fluid suppression by setting an inversion time that nulls fluids. | High signal in [lacunar infarction](https://en.wikipedia.org/wiki/Lacunar_stroke), [multiple sclerosis (MS) plaques](https://en.wikipedia.org/wiki/Multiple_sclerosis), [subarachnoid haemorrhage](https://en.wikipedia.org/wiki/Subarachnoid_hemorrhage) and [meningitis](https://en.wikipedia.org/wiki/Meningitis) (pictured).[67] |  | | |