# Gray Matter and White Matter Encyclopedia Article

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# Contents

Gray Matter and White Matter Encyclopedia Article.....1

Contents.....2

Gray Matter and White Matter.....3

# Gray Matter and White Matter

Gray matter and white matter are components of the **spinal cord** and the **brain**. The structure and composition of each allows differential functions in the transmission of information to and from the brain and in the processing of information by the brain.

Moving down the length of a neuron, after the dendrite-cell body area, the structure of the cell is that of long cable-like extension termed the axon. These are part of **neurons**, specialized cells that conduct electrochemical impulses. At one end of a neuron is a branching region that is visually reminiscent of a delta of a large river such as the Mississippi River. These branches are the dendrites. They receive nerve impulses that have traveled from the opposite end of an adjacent neuron. The dendrites come together in a region of the neuron called the cell body. The cell body contains the nucleus of the neuron cell. Axons can be as long as one foot in some nerve cells. Myelinated axons (axons with myelin sheaths) are bundled together to form white matter. The white matter axons are also enveloped by a myelin protective sheath.

Gray matter is composed of masses of cell bodies, dendrites and unmyelinated axons.

In the spinal cord, the inner core consists of neural cells in gray matter, with their axons radiating outward to form the external white matter. A cross sectional or transverse view of the spinal cord reveals an H-like shape of gray matter at the core of the spinal cord centered on the spinal canal. In the brain, especially the **cerebellum** and **cerebral cortex**, the gray matter-white matter relationship is reversed so that the gray matter is on the outside and the white matter is on the inside.

Varying types of nerve fibers (e.g., myelinated or demyelinated) that compose gray matter and white matter exhibit differences in how the **action potential** propagates down the axon and in the speed of transmission of neural signals along the axon. Because of the myelin sheath of white matter, ion movement associated with the neural impulse or action potential with the axon, takes place only at the Nodes of Ranvier that provide small gaps in the myelin sheath. The action potential jumps from node to node along the myelinated axon in a process termed salutatory conduction that is faster than transmission through unmyelinated fibers.