

CELLS of the NERVOUS SYSTEM

I. NEURONS

SOMA (CELL BODY), DENDRITES, AXON, AXON HILLOCK
AXON TERMINALS (TERMINAL BUTTONS/BOUTONS),
COLATERAL AXONS

NUCLEUS, MITOCHONDRIA, RIBOSOMES, ENDOPLASMIC
RETICULUM (SMOOTH, ROUGH), GOLGI BODIES,
VESSICLES, MICROTUBULES, CELL MEMBRANE (LIPID
BILAYER, TRANSMEMBRANE PROTEINS), CYTOPLASM

CHANNEL PROTEINS, SIGNAL PROTEINS, TRANSPORTER
PROTEINS, RECEPTOR SITES

Types of Neurons: by shape and by function:

BIPOLAR NEURON	PROJECTION NEURONS
UNIPOLAR NEURON	SENSORY = AFFERENT =
BIPOLAR NEURON	ASCENDING
	MOTOR = EFFERENT =
	DESCENDING
	LOCAL CIRCUIT = INTERNEURON

II. GLIAL CELLS

CENTRAL NERVOUS SYSTEM:
ASTROGLIA (ASTROCYTES)
MICROGLIA
OLIGODENDROGLIA

PERIPHERAL NERVOUS SYSTEM
SATELLITE CELLS (e.g. SCHWANN CELLS)

MYELIN, NODES OF RANVIER

Terminology:	CNS		PNS
	NUCLEI	=	GANGLIA
	TRACTS	=	NERVES
	GLIAL CELL	=	SATELLITE CELL

MULTIPLE SCLEROSIS

AUTOIMMUNE DISORDER

PREDNISONE

EPENDYMAL CELLS

CILIA, VENTRICLES, CEREBROSPINAL FLUID (CSF), CHOROID PLEXUS

HYDROCEPHALY

SHUNTS, CEREBRAL AQUEDUCT (between 3 & 4 ventricles)

BLOOD-BRAIN BARRIER

ASTROGLIA, ENDOTHELIAL CELLS (WALLS OF BLOOD VESSEL)

AREA POSTREMA (in MEDULLA)

New information on GLIA:

glia outnumber neurons 10:1, meaning that 90% of brain is glia and 10% neurons

1. glia perform **many of the same functions as neurons**
 - a. produce and deliver brain chemicals that regulate neurons (and therefore, regulate behavior, learning, etc.)
 - b. take up, store brain chemicals (e.g. **glutamate**)
 - c. can release glutamate too (and other NTs) at a synapse, and change activity of post-synaptic neurons
 - d. can soak up and release **calcium**, which also affects neuronal electrical activity
 - e. maybe produce some sort of electrical/chemical signals (to influence neurons)

2. **neurons cannot function without glial cells**

- a. regulating the chemicals that surround neurons
- b. neurons do not conduct electrical signals (down axon) without astroglial cells being present...the signals is 100x slower than would be expected (lack of glutamate?)

3. have **taken glial stem cells and turned them into neurons**

4. without glial cells around, neurons take hours to die when starved of blood flow and O₂; **when glial cells are present with neurons, neurons die within minutes when anoxicwhy?**
probably because glial cells are **releasing glutamate** --- causing neurons to fire more---neurons using up even more O₂ --- neurons die faster (cause of the so-called

One possible treatment for post-stroke victims would be to inhibit glial activity and reduce their release of glutamate

5. glial cells **are less numerous in brains of persons with depression** vs. NCs

6. glial cells may play a role in migraine headaches and in Alzheimers disease

7. astrocytes help build a wall around an area of damaged brain...which keeps out other cells that might help rebuild the area, repair the area; these astrocytes form a “**scartissue**” **wall** (e.g. in spinal cord injury) that hinder neural activity (sometimes called “reactive astroglia”)...why? A problem

8. And yet glial cells (probably astroglia) **produce neurotropic growth factors** that increase neural repair and regrowth...

9. **oligodendroglia** (surrounding axon, myelin sheath) help insulate axon
are destroyed in persons with **MS**, by the person's own immune system (form antibodies to the myelin protein)...why?

10. **Microglia** are the immune system cells in the brain
These cells actually migrate into the brain from bone marrow
Phagocytic – engulf the “garbage” left behind when cells are damaged or die

But microglia can make that can **make “free radical scavenger” cells that kill neurons** .These FRS microglia and the scar tissue forming astroglia are found in the brains of Alzheimer's patients, evidence of an inflammatory immune response. Is this a cause of or side-effect of the cause of Alzheimer's disease?

11. **tumors** arising from glial cells are the most difficult to treat
astrocytes are linked together by wide channels called “**gap junctions**”, that are so wide that even large molecules can travel through them easily/quickly
cancerous glioma cells can also travel very easily thru these wide gap junction channels, diffuse deeply into brain tissue, via these astrocyte pathways
e.g. malignant glioblastoma (rare but deadly, spreads thru out brain, cannot treat easily)