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

**EPENDYMAAL 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 anoxic** …why? 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)