

HISTOLOGY: NERVOUS TISSUE

NEURON: basic functional unit of the nervous system.

Generic nerve cell (neuron)

1. Soma (cell body)
 - a. nucleus, mitochondria
 - b. many lack centrioles (i.e., nerve cells can't divide)
 - c. nerves regenerate only from proximal stump
2. Dendrites - input from environment or other cells
3. Axon - conducts nerve impulse
 - a. hollow extension of soma - cytoplasm
 - b. "insulated" with myelin sheath
4. Synaptic terminals - output to muscle/gland/nerve

Groupings of cell bodies (grey matter)

1. CNS = nuclei
2. PNS = ganglia

Groupings of axons (white matter)

1. CNS = tracts, columns, commisures
2. PNS = nerves

Neuron classification

Structural types of neurons

1. Anaxonic - small, dendrites/axons look alike - CNS
2. Bipolar - soma situated between dendrite and axon
 - rare: sight, smell, hearing
3. Unipolar - soma to one side of axon & dendrite
 - sensory nerve endings of the PNS (> 1m long)
4. Multipolar - several dendrites and single axon
 - very common in CNS, skeletal muscle

Functional types of neurons

1. Sensory (afferent), 3 types of receptors
 - a. exteroceptors: info from environment (touch, temp.)
 - b. proprioceptors: position of muscles & joints
 - c. interoceptors: internal environment (GI, UG, Resp.)
2. Motor (efferent):
 - a. Somatic motor (PNS) = skeletal muscle
 - b. Visceral motor (ANS) = gut
 - pre-ganglionic fibers
 - post-ganglionic fibers
3. Interneurons - run btw. sensory & motor neurons
 - a. CNS only - coordinate sensory input & motor output
 - b. outnumber all other types of neurons

CNS - Neuroglia: cells that support neurons

1. Astrocytes - large, numerous, star-shaped cells
 - 3-D structural framework for the neurons
 - wrap around capillaries - blood-brain barrier
 - involved in growth and repair of neural tissue
 - maintain interstitial fluid balance in neural tissue
2. Oligodendrocytes - medium sized, several cyto. exts.
 - sheath of myelin wraps axons of several cells
 - insulates each axon from other axons
 - binds multiple neurons together (support)
3. Microglia - small cells with several small branches
 - removal (phagocytosis) of debris and pathogens
4. Ependymal cells - line each ventricle
 - covered with cilia, and produce CSF

PNS Neuroglia: cells that support neurons

1. Satellite cells – (found in large #'s in ganglia)
 - surround neuron cell bodies (soma)
 - exchange of nutrients/wastes
2. Schwann cells - neurolemmocytes
 - neurilemma - sheath of myelin that surrounds axon
 - aid in repair/regeneration of damaged nerves
 - *somewhat* similar to oligodendrocytes...but:
 - ...only associated with a SINGLE axon
 - ...runs for very short distance along an axon

Neural tissue is excitable

1. electrical charge (voltage) = chemical gradient (ions)
2. action potential: shifting chemical gradient
 - local ion imbalance triggers next section of axon
 - imbalance passes along axon as a wave
 - electrical signal eventually triggers synapse
 - neurotransmitter is released into synaptic gap

Speed of Transmission

- Proportional to axon diameter and degree of myelination
- Fast = thick axons and myelination
 - Slow = narrow axons and little myelination

Demyelination pathologies -

- a. occur in both CNS & PNS
- b. gradual loss of sensation/motor control
- c. varying degrees of numbness/paralysis
- d. caused by poisoning, disease, genetics
- e. examples
 - heavy metal poisoning (mercury & lead)
 - bacterial insult (diphtheria)
 - MS (Multiple Sclerosis) immune system dysfunction

Rabies virus

- a. typically found in carnivorous mammals
- b. body-fluid transfer (blood, saliva)
- c. virus specializes on nervous tissue
- d. travels from bite along PNS to CNS
- e. excitability, convulsions, coma, death
- f. virus is shed to saliva