

Nervous System First Lecture

Nervous System

- Allows the body to interpret and respond to changes in the external environment, and to respond to changes in the internal environment.
- Also stores information
- divided into the central and peripheral nervous system
 - **Central nervous system:** brain and spinal cord
 - **Peripheral nervous system:** all the nerves
- Divide nerves in many ways:
 - cranial nerves and spinal nerves
 - **Cranial:** leave or enter directly from the brain; only 12 pairs
 - **Spinal:** enter via the spinal cord
 - nerves can be **sensory (or afferent):** from outside to inside or **motor:** to respond to sensory input
 - third type of neuron called **interneuron** which we need because they activate more than one motor neuron at a time
 - can also define neurons by type of organs they affect, (ex. somatic (skeletal muscle), visceral (glands and organs that are involuntary))
 - **somatic** send message to muscle, it contracts, or don't and it doesn't
 - most **visceral** pathways include two types of information going to the organ. (can send an excitatory signal that can be turned up or down)
- **nissl bodies** associated with protein synthesis
- some axons extremely long
- most peripheral axons are covered with an insulating layer called the **myelin sheath** allows it to skip over their surfaces and perpetuate the signal
 - sheath composed of flattened individual cells called **Schwann cells** each having a nucleus
- **nodes of ranvier** the spaces between the schwann cells
 - this kind of conduction is salutatory conduction
- The axons end by splitting up again into fingerlike projections called **telodendria** that can meet with muscles or other neurons
 - ends of telodendria spread into **synaptic knobs** in close association with the target; space between in the **synapse or synaptic cleft**
 - knobs have lots of mitochondria in them that makes ATP producing a neurotransmitter chemical
 - **presynaptic vesicles hold the neurotransmitters**
 - when current comes down, neurotransmitters are released into cleft
 - many different kinds of neurotransmitters (serotonin, dopamine, acetylcholine, norepinephrin)
- neurons are individual cells, and the nerves are the bundles
- in higher vertebrates the nerves carry both sensory and motor information
- in some primitive organisms have separate sensory and motor nerves
- structural neurons called **neuroglia or glial cells**

Development of the Central Nervous System

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- called **neurulation**
- during, three distinct layers of cells: innermost layer called the **ependymal layer**, layer around that is the **mantle**, and the outer layer is the **marginal layer**
- ependymal layer is a germinal layer that divides and sends cells out to the other layers. other two grow at expense of the ependymal
 - when fully formed this layer is small and surrounds the neurocoel
- when spinal cord grows it grows outward
- marginal cells are myelinated= area mostly axons; appear to be lighter in color than the rest called **white matter**
- mantle layer is mostly cell bodies: called **grey matter**
- white matter represents all the spinal tracts that are carrying information to or from the brain that go up in spinal tracts
- **in amphioxus** cord never ends up fusing
- **agnathans** first organisms to exhibit fusion of spinal cord, but still no myelin, no true grey or white matter
 - no true vertebral column, but spinal cord rests on notochord; basal plate flat
- **fish and amphibians**: cord ends up being nearly circular with grey and white matter; finally start to see **dorsal sulcus and ventral fissure**
 - enlargements (bulges) in spinal cord in cervical region and lumbar region
- grey matter and white matter start to separate from each other in **amniotes**
 - grey matter looks like an H
- **mammals**: the spinal cord length develops more slowly than the vertebral column
 - spinal cord hasn't filled it in completely so ends before end of vertebrae
 - still have nerves coming out between vertebrae; looks like horses tail called **cauda equina**

-Brain and spinal cord covered by other tissues;

- **in most fish** covered with **meninx primitiva**: develops in all other vertebrate embryos **but amphibians up**, it gets replaced by two other layers: **dura mater and the lepto meninx**
- **in mammals** the **lepto meninx** splits into **arachnoid and the pia mater**
 - dura mater: tough leathery covering the arachnoid
 - space between them filled with cerebral spinal fluid cushioning the soft brain against the hard skull
 - arachnoid layers mainly capillaries