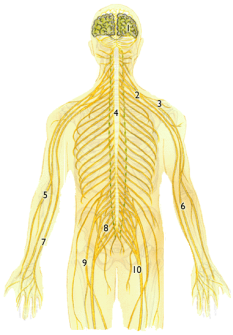
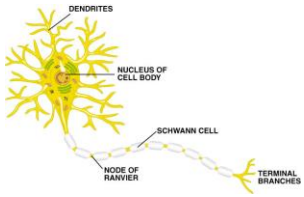
Chapter 22

The Nervous System

Nervous System - Function

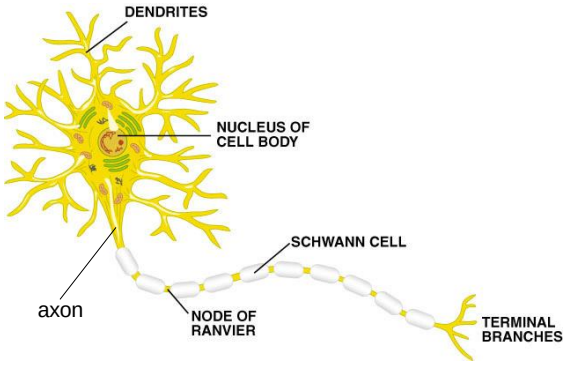
- Separated into Central and Peripheral Nervous Systems
- Receive information about what happening to the body (both inside & out)
- Responds to those internal and environmental stimuli
- Maintains homeostasis
- Nerve Impulse travels w/ microelectrical impulses.



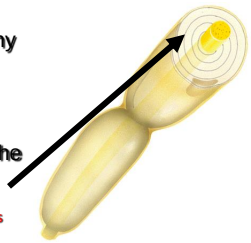


The Neuron

- The Neuron – the basic unit of structure & function
- Cells that carry information to, from & through the brain by way of nerve impulses.
- **Structure** – cannot grow back if cut or broken
- Large cell body contains the nucleus and multiple thread-like extensions.
- Dendrites – thread-like "fingers" that carry electrical impulses toward the
- Axon - thread-like "fingers" that carry electrical impulses away from the cell body

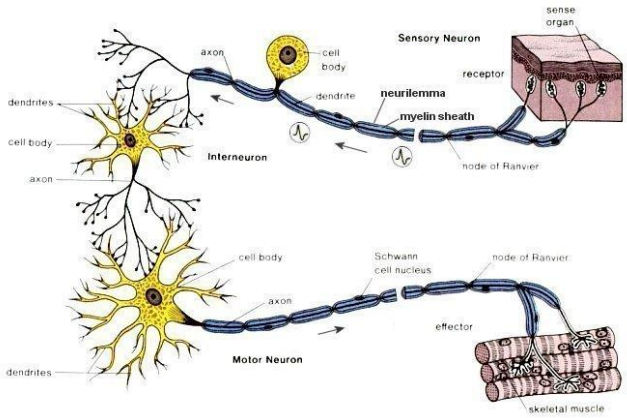


- **Myelin Sheath – made of Schwann Cells, surrounds & insulates the Axon leaving many gaps called Nodes.**
- **The electrical impulse jumps from one node to the next – which increases the speed of the impulse.**
  - **Layers of Schwann Cells make up a Myelin Sheath**

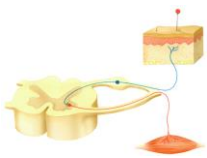


3 Types of Neurons

- **Sensory Neuron** – picks up stimuli from the body & environment and converts them into nerve impulses.
- **Interneuron** – the sensory neuron carries the impulse toward the brain until it reaches interneurons.
- Usually located in the spinal cord or the brain.
- **Motor Neuron** – Sends impulse from brain back to muscle

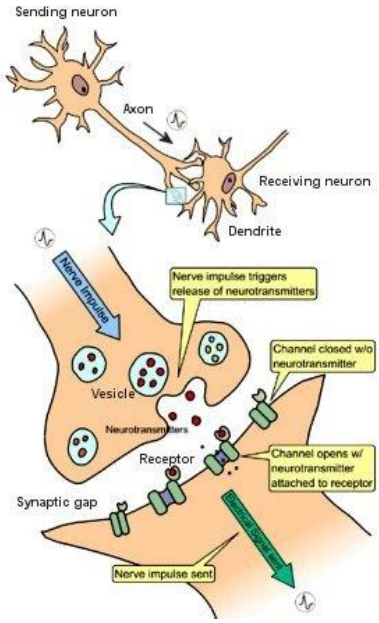


- Some interneurons carry impulses directly back to the motor neurons w/out going to the brain for interpretation (Reflex Arc)



Nerve Impulse

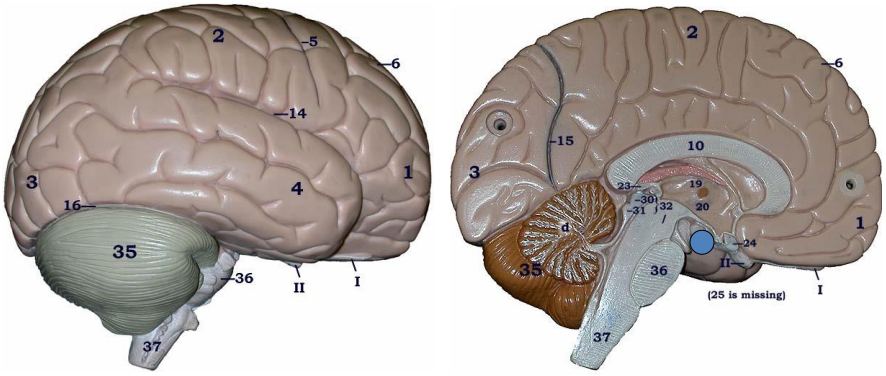
- An impulse begins when a **neuron** is **stimulated** by the environment or by another neuron. It uses **Sodium** and **Potassium Ions** to move the impulse (**action potential**)
- Impulse travels from the dendrites to the cell body and then along axons going away from the cell body until it reaches the end of an axon (**Axon Tip**)
- **Synapse** - The tiny space between the tip of one axon the tip of the next dendrite.
- When the impulse reaches the tip of the axon, packets of neurotransmitters **(acetylcholine**) are released into the synaptic gap.
- **receptors** on the adjacent dendrite receive the chemicals which starts a new impulse traveling.



Central Nervous System

Made up of the Brain and Spinal Cord

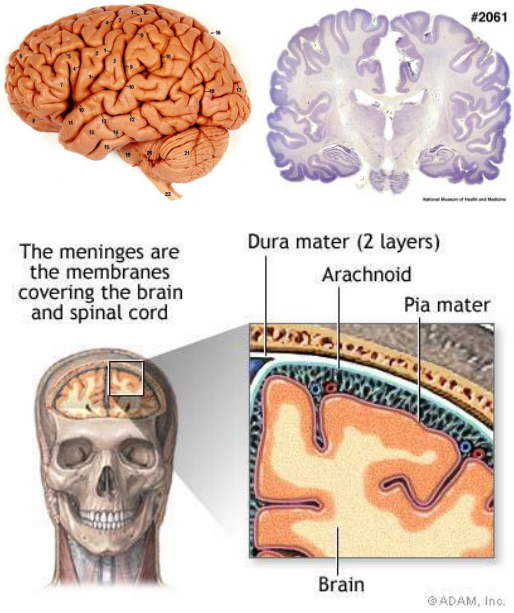
- Structure of the Human Brain (Need-to-Knows)



1.Frontal Lobe 2.Parietal Lobe 3.Occipital Lobe 4.Temporal Lobe 5. Sulcus 6. Gyrus 10.Corpus Callosum 14. Sulcus 25.Pituitary Gland 35.Cerebellum 35d.Arbor Vitae 36.Pons 37.Medulla Oblongata 19.Thalamus 20.Hypothalamus I. Olfactory Nerve II. Optic Nerve

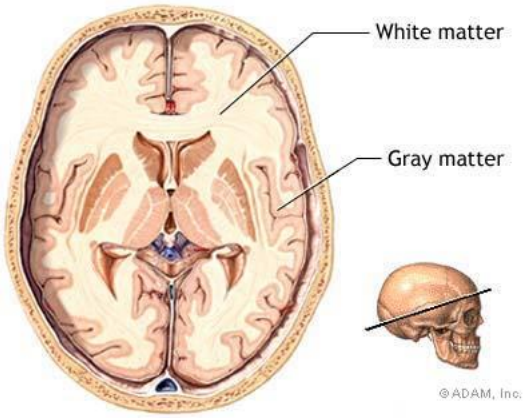
The Brain

- Consists of over 100 billion neurons. They are all Interneurons.
- Brain wrapped in 3 layers of connective tissue called **meninges**.
- Space between Meninges and brain filled w/ CSF (**cerebrospinal fluid**) used to protect & cushion the brain.
- Divided into left & right hemispheres, With "hills" (**Gyri**) & "valleys" (**Sulci**)
- 3 main areas
  - **Cerebrum**
  - **Cerebellum**
  - **Medulla Oblongata**



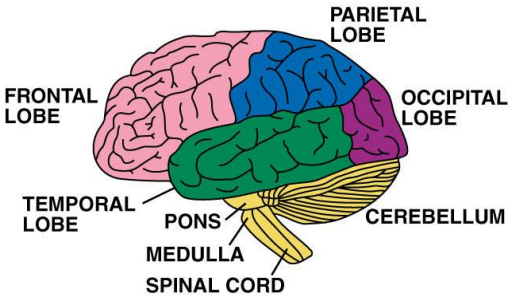
Gray & White Matter

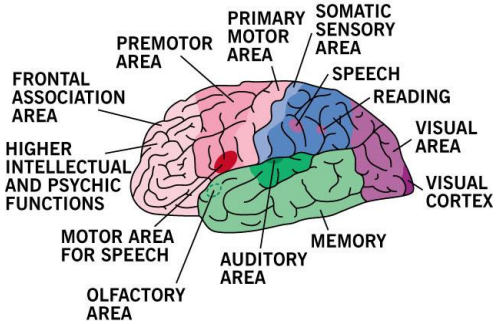
- **Gray matter**
  - the outer surface tissue of the brain
  - made up of the cell bodies & dendrites of the brain's interneurons.
- **White matter**
  - Composed of the axons of brain's interneurons.
  - White because of the myelin sheaths on the axons



Cerebrum

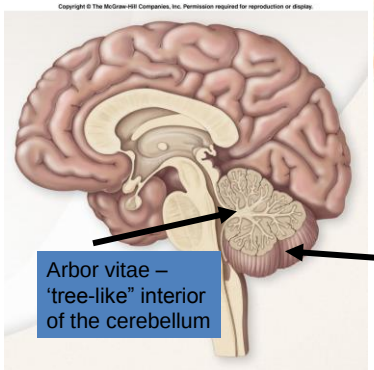
- Largest of the 3 brain areas, divided into lobes corresponding to the cranial bone they are beneath.
- Generally speaking:
  - Frontal Lobe – Intellectual Thought, motor skills (movement)
  - Parietal Lobe – Sensory, Speech, Reading
  - Occipital Lobe – Visual
  - Temporal Lobe – auditory, short & long term memory

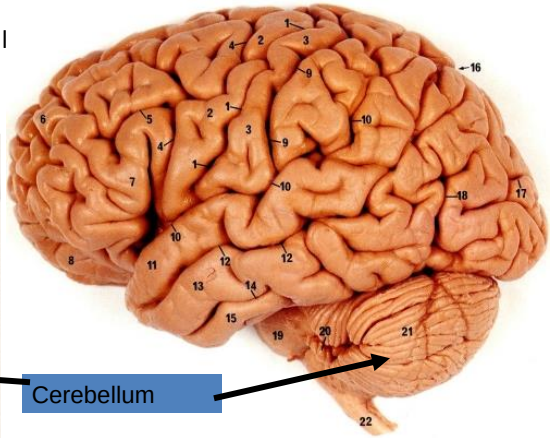




Cerebellum

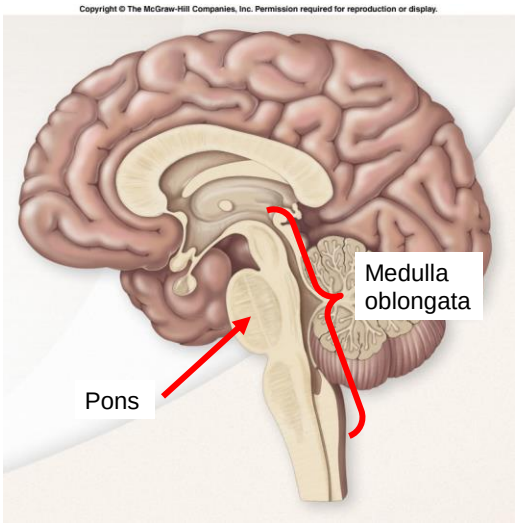
- 2nd largest area,
- Involved in coordination and balance
- Like a "clearing house" integrates work of multiple lobes to perform a single function
- White matter of the cerebell brain.

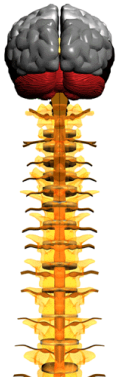


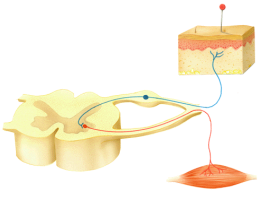


Medulla Oblongata (Brain Stem)

- Smallest area
- Controls involuntary actions
- Controls "Life & Death" Functions
- Breathing, heart rate, basic animal instincts
- Pons – "knob" on the medulla regulates breathing, active during dreaming

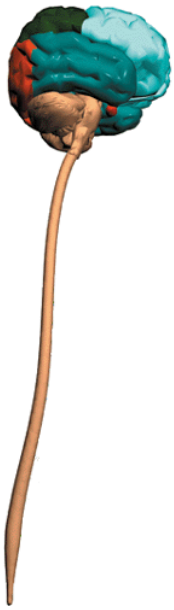




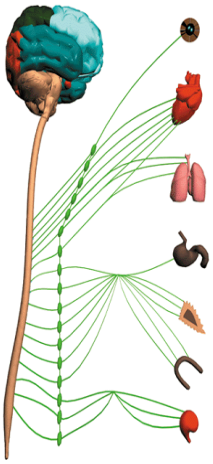


Spinal Cord

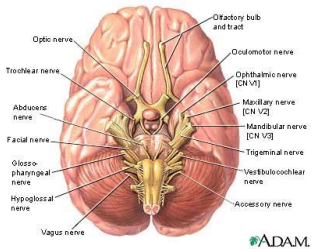
- Other part of the Central Nervous System (Brain is the other part)
- Runs inside the vertebral column for protection
- The link between the brain and peripheral nervous system.
- Like a major telephone cable w/ thousands of individual nerves.
- Has the consistency of a ripe banana & is very fragile.
- 12 cranial nerve pairs and 31 spinal pairs branch off
- Allows for the **reflex** – a rapid automatic response from a stimulus, without having to be processed by the brain.



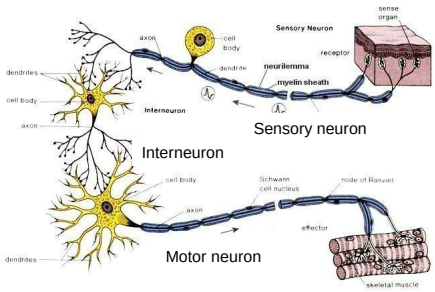
Peripheral Nervous System



- **12 cranial nerve pairs** and **31 spinal pairs** = **43 pairs of nerves** branching off the central nervous system.
- **Sensory neurons** bring signals from the body to the spinal cord
- **Motor neurons** carry impulses from the brain out to the muscles.



- **Somatic nerves** – voluntary actions, walking, picking up fork etc.
- **Autonomic nerves** controls involuntary behaviors, heart beats, peristalsis, breathing, etc.



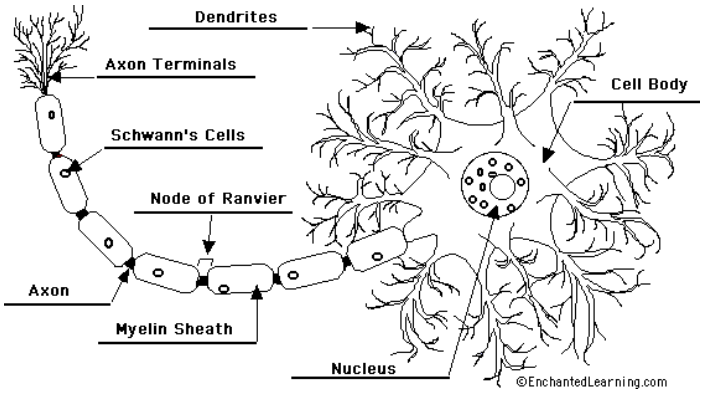
Let's Review w/ a "Quiz" or two

Here we go……

Axon Quiz: Need-to-Know's

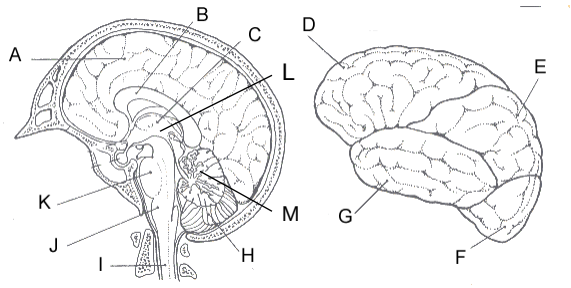
Identify:

- Cell Body
- Axon
- Dendrite
- Myelin Sheath
- Node of Ranvier
- Nucleus
- Schwann's Cell
- Axon Terminal



Brain Quiz: "Need-to-knows"

- Label the following
- Cerebrum
- Cerebellum
- Medulla oblongata
- Pons
- Arbor vitae
- Corpus calosum
- Spinal cord
- Thalamus
- Hypothalamus
- Frontal lobe
- Parietal lobe
- Occipital lobe
- Temporal lobe



A. Cerebrum
B. Corpus calosum
C. Thalamus
D. Frontal lobe
E. Parietal lobe
F. Occipital lobe
G. Temporal lobe
H. Cerebellum
I. Spinal cord
J. Medulla oblongata
K. Pons
L. Hypothalamus
M. Arbor vitae

That's Enough…

Let's stop here!!

The rest of chapter 22 – "The Senses"
is on another tutorial