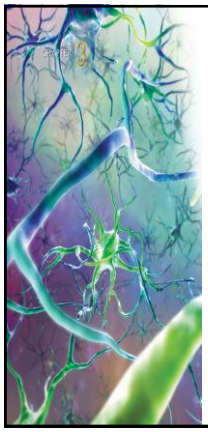


How is the Nervous System Organized?

The Biology of the Mind
Module 3:
Neural and Hormonal Systems

1

Class Objectives:

- Understand the function and purpose of the nervous system
- Identify and define the structures of the neuron
- Identify and discuss the role of neurotransmitters on behavior

2

What is the Nervous System?

- The *Nervous System* is the body's main _____
- This consists of structures and organs that facilitate **electrical and chemical communication** in the body.
  - This is the body's electrochemical communication circuitry

3

The Neuron

- *Nerve cells* that handle information-processing functions.
  - _____
    _____

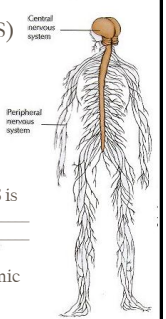
The Nervous System

Bundles of neurons communicating become systems

5

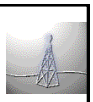
The Nervous System

- _____ (CNS)
  - The brain
  - The spinal cord
- Peripheral Nervous System (PNS)
  - The main function of the PNS is
    _____
    _____
  - Review Somatic and Autonomic NS



CNS Communication

The Spinal Cord



- The spinal cord transmits signals from the sensory organs, muscles and glands to the brain.
  - Controls reflexive responses
  - Conveys signals from the rest of the body

7

The spinal cord is like a **communication superhighway** between the brain and the rest of the body.

8

Brain and Spinal cord communication

- *Sensory neurons*
  - Carry incoming information _____ _____receptors to the brain and spinal cord.
- *Motor neurons*

  Carry outgoing information brain and spinal cord ___ _____
- *Interneurons*

  Neurons within the CNS that communicate internally and intervene between the sensory and motor outputs

9

The parts of the neuron

1. _____are specialized tree-like fibers that receive information from outside the neuron.
2. *The Cell body* relays the information down to the axon
3. *The Axon* _____from the cell body toward other neurons, muscles or glands.
   - _____is the knob-like end of the axon

10

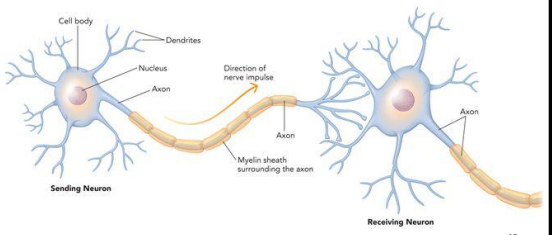
The structure of a neuron

The axon is covered by a _____, a layer of cells containing fat, encases and insulates most axons.

- By insulating the axons, myelin sheaths speed up transmission of nerve impulses

11

Information will be released from the Axon terminal to the next neuron



12

Once the information reaches the *axon terminal*, it is transmitted outside the cell by _____ which reside in the axon terminal.

13

The Electrical Part

(The Neural Impulse)

- To transmit information to other neurons, a brief electrical current impulses through its axon.
- _____
  - This current causes the neuron to "fire"

14

This is an "*all-or-nothing*" response

Once the electrical impulse reaches a _____ it fires and moves all the way down the

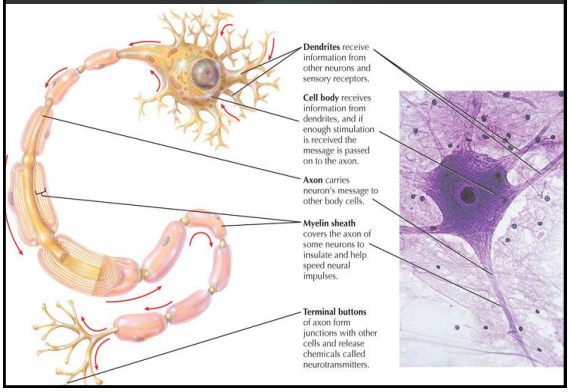
15

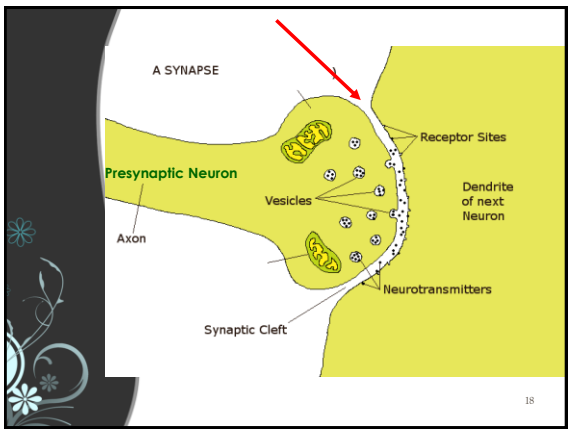
Synaptic transmission

- The *Synapse* is the space between neurons
  - The synaptic gap or cleft
- Before an impulse can go across the synapse, it must be converted into a chemical message (*Neurotransmitters*).
- This is an *electrochemical process*

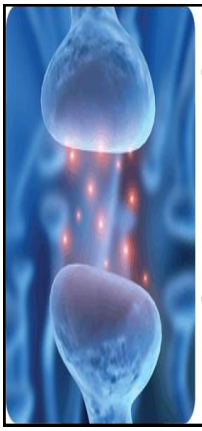
16

Let's Review!





18



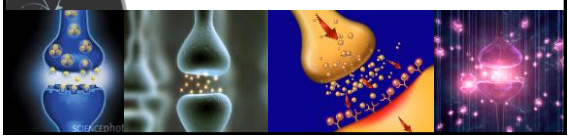
Chemical Communication

- *Neurotransmitters* carry _____
  - When a nerve impulse reaches the terminal button, it triggers the release of neurotransmitters from the synaptic vesicles
- They communicate to other _____

19

Synaptic Transmission

- The neurotransmitters are like pieces of a puzzle, and the receptor sites on the next neuron are differently shaped spaces.
  - The chemical is almost immediately destroyed or reabsorbed (reuptake)



Types of Neurotransmitters

- *Acetylcholine (ACh)* usually stimulates the firing of neurons and is involved in muscle action, learning, and attention and memory
- Why do people have *Botox* treatments?
- _____

THINK

21

Types of Neurotransmitters

- Gamma-aminobutyric acid (GABA) GABA is the brain's brake pedal, helping to regulate neuron firing and control the precision of the signal being carried from one neuron to the next.
  - It is associated with anxiety, alcohol abuse, seizure disorders, and sleep disorders.

22

Serotonin

- _____
  - Abnormal levels may contribute to depression and OCD
- The antidepressant drug Prozac works by slowing down the reuptake of serotonin into terminal buttons, thereby increasing brain levels of serotonin (Little, Zhang, & Cook, 2006).

23

Dopamine

- *Dopamine* helps to control _____ and affects sleep, mood, attention, learning, feelings of reward and pleasure
  - High levels of dopamine are associated with _____
  - Low levels of dopamine are associated with _____

24

Neurotransmitters

- *Norepinephrine* helps to control _____
  _____
  - Stimulated by _____, it is especially important for vigilance.
- *Endorphins* are natural opiates that are linked to _____
  - Similar to _____

25

How do drugs effect behavior?

26

Drugs Impact on the Brain

- Common drugs can alter the amount of a neurotransmitter released at the synapses
- Some drugs can mimic/facilitate the action of the neurotransmitters while others can block the action of the neurotransmitter.

27

Agonists versus Antagonists

- **Agonists** _____ or facilitate the actions of a neurotransmitter
- _____ oppose/block the actions of a neurotransmitter

Agonist

Antagonist

28

Next Class...

<u>The Brain</u>

- The structures and functions of the brain

29