

# **ANATOMY- PHYSIOLOGY-NERVOUSE SYSTEM IN RESPONSE TO CONVID 19 APRIL 2, 2020**

Dear students and parents,

April 2<sup>nd</sup> , 2020

Beginning two days prior to our last day at school I issued work packets to all students in all classes; the content of which was spanning a two-three week period. Now that our removal from school will continue to at least May 1<sup>st</sup>, I have provided the following work packets which will span the remainder of the year, should our crisis continue. **The following folders are available:**

## **ANATOMY – PHYSIOLOGY**

- 1. Packet – THE HUMAN REPRODUCTIVE AND ENDOCRINE SYSTEMS.**
- 2. Packet- THE HUMAN NERVOUS SYSTEM**
- 3. *Packet handed out prior to our last day:* THE HUMAN EXCRETORY SYSTEM**

## **ZOOLOGY**

- 1. Packet- STUDY OF THE CRUSTACEANS**
- 2. Packet- STUDY OF THE INSECTS**
- 3. *Packet- handed out prior to our last day- INTRODUCTION TO THE ARTRHROPODS- CLASSES MYRIAPODA AND ARACHNIDA***

**AP BIOLOGY** – as per the newly devised topics of study focus, structure of adapted test, test dates and supports provided as per the guidelines and policies of The College Board

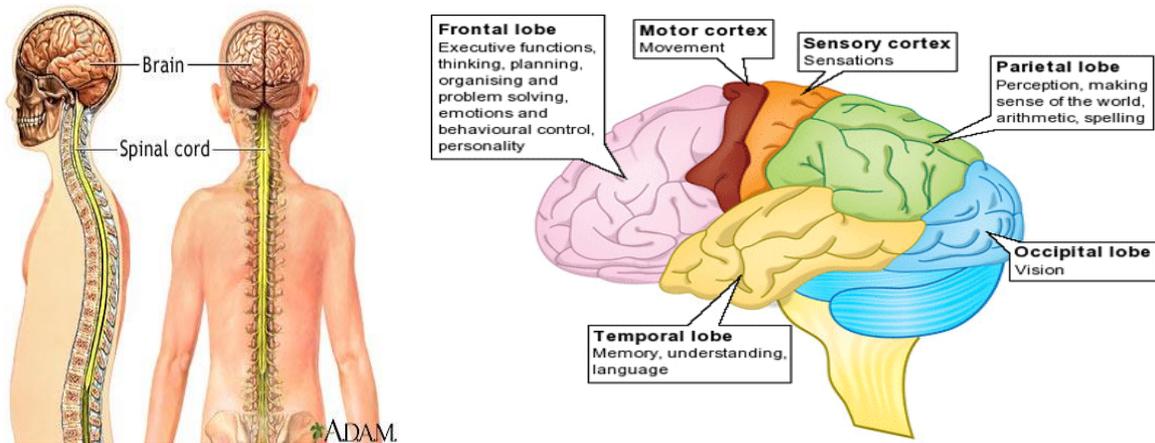
**TO ALL STUDENTS!** THESE PACKETS WILL BE GUIDED BY THE SAME PROCEDURES WE EMBRACED DURING FALL TECH WEEK WHERE YOU ARE RESPONSIBLE FOR THE WORK IN THE PACKETS- DELIVERED UPON YOUR RETURN TO SCHOOL OR AS PER UNFORESEEN CHANGES WHICH COME OUR WAY. COLLABORATION IS ENCOURAGED- SO STAY IN TOUCH AND DIG IN! YOUR **PACKETS WILL BE A NOTEBOOK GRADE.** EVENTUALLY YOU SHALL TAKE AN **INDIVIDUAL TEST OF EACH PACKET** = AN EXAM GRADE! SCHOOL IS OFF SITE BUT NOT SHUT DOWN SO PLEASE DO THE BODY OF WORK ASSIGNED IN THE PACKETS PROVIDED. YOU CAN'T PRINT THEM THEN WRITE YOUR ANSWERS ON SEPARATE PAPER AND TRANSFER THEM LATER UPON OUR RETURN! IF LEARN TOGETHER- ELECTRONICALLY THAT IS! STAY SAFE! BE SMART! BE A CITIZEN!

RIZZO- EMAIL PRIVATE: forestlone@earthlink.net

# The Structure Of The Nervous System – Once destroyed,nerve cells/tissues never grow back!

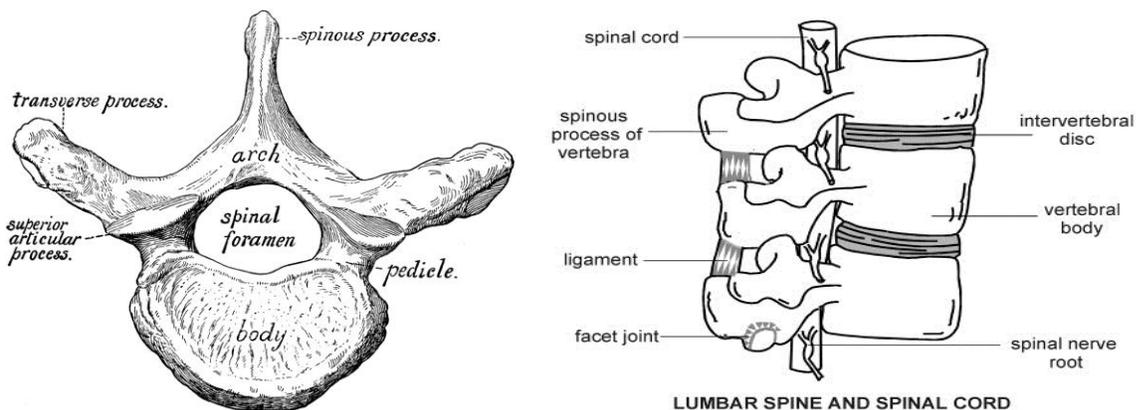
## Regions of the Nervous System.

### A. C.N.S. –Central Nervous System



The central nervous system (CNS) is the command and processing center for the nervous system. It receives information **from** and sends information **to** the **peripheral nervous system**. The two main organs of the CNS are the **brain** and **spinal cord**. The brain receives, processes and interprets sensory information sent from the spinal cord, and then sends an appropriate response back = STIMULI/RESPONSE MECHANISM (recall, all living things respond to their environment and bodily needs. )Both the brain and spinal cord are protected by three layers of connective tissue called the **meninges**. Furthermore, they are structurally protected by the skeletal components of the **skull** and the **spinal column**(backbone) where within these structures, the brain and spinal cord are housed in **cranial fluid** and **spinal fluid** respectively, and sometimes collectively termed **cerebrospinal fluid**. This fluid cushions these vital nerve tissues as well as providing them with vital minerals and nutrients. Such fluid exiting the ears indicates an extreme injury/trama to the CNS= do not move patient. Commonly spoken of as the same, the **spinal cord** and the **spinal column** are not the same structures. The spinal cord is the main wire leading out of the base of the brain with nerve circuitry which commands the entire body. It is a soft tissue which runs through the canal or openings in the center of each vertebrae which compose the spinal column, which is the backbone.

#### **A SINGLE VERTEBRAE SECTION      THREE VERTEBRAE CONNECTED**



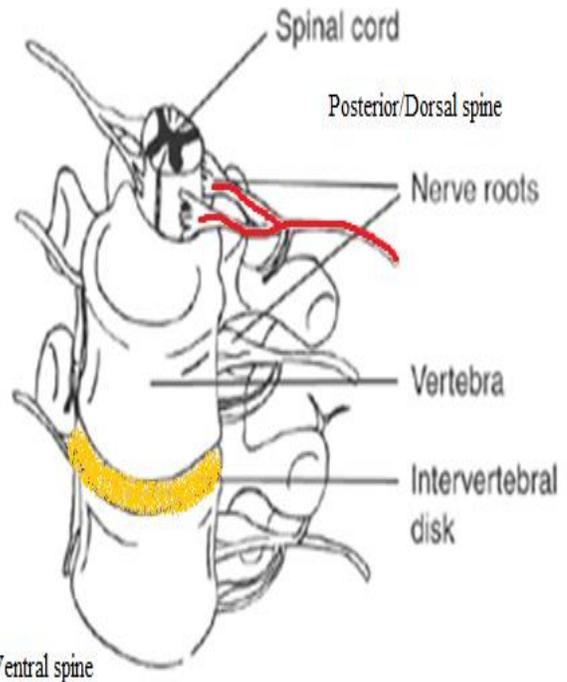
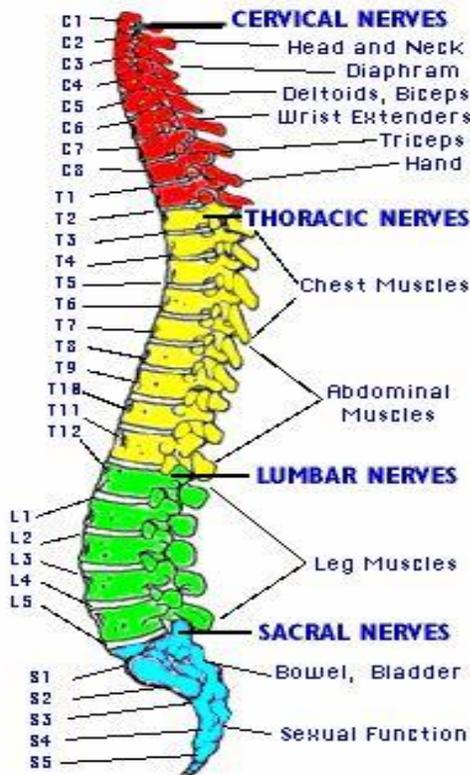
LUMBAR SPINE AND SPINAL CORD

NOTE THE CARTILAGE DISC WHICH SERVE AS CUSHIONS BETWEEN THE VERTEBRAE AS WELL AS SPACERS WHICH PROVIDE CANAL THROUGH WHICH THE NERVES OF THE SPINAL

CORD MAY EXTEND AWAY FROM THE SPINAL CORD, SERVING THEIR INTENDED PART OF THE BODY ( IE the medical conditions **slipped, herniated, degenerative disc**

**REGIONS OF THE SPINE AND WHAT THEY CONTROL-** Note how each vertebrae is numbered as to which vertebrae it is within the spinal column. (backbone)

**CERVICAL** =- Head    **THORACIC**= Torso    **LUMBAR** = Abdomen    **SACRAL** = Tailbone to legs



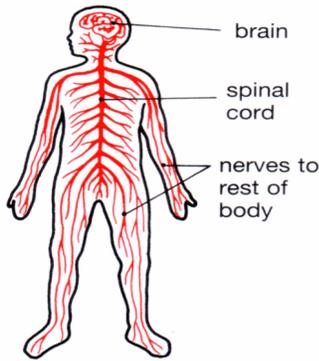
NOTE how nerves from the spinal cord protrude through canals between the vertebrae, made possible by the

disc working as spacers. If these degenerate or become herniated, the vertebrae will collapse down on the nerve causing extreme pain or complete shut down of the bodily area/function they serve.

cartilage

**B. THE PERIPHERAL NERVOUS SYSTEM = P.N.S.** The peripheral nervous system (PNS) is the division of the nervous system containing all the nerves that lie outside of the central nervous system (CNS). The primary role of the PNS is to connect the CNS to the organs, limbs and skin. These nerves extend from the central nervous system to the outermost areas of the body. The nerves that make up the peripheral nervous system are actually the axons or bundles of axons from neuron cells. In some cases, these nerves are very small but some nerve bundles are so large that they can be easily seen by the human eye.

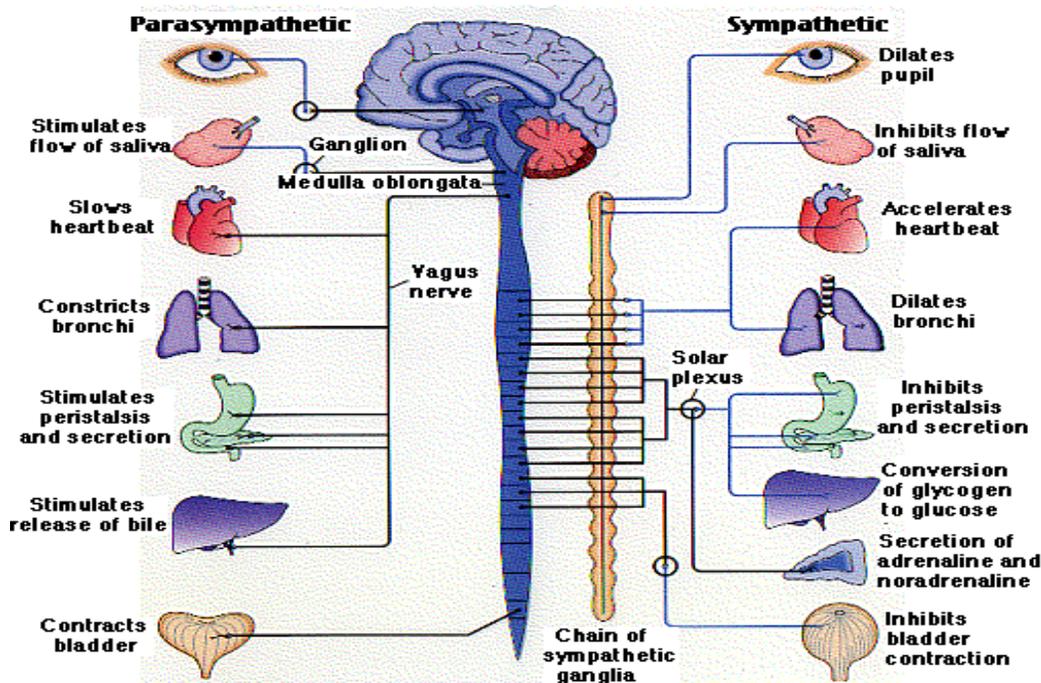
**BRAIN and SPINAL CORD = C.N.S    ALL ELSE = P.N.S.**



## CONTROL DIVISIONS OF THE NERVOUS SYSTEM

**The Sympathetic Nervous System (SNS)** is involved in the stimulation of activities that prepare the body for action, such as increasing the heart rate, increasing the release of sugar from the liver into the blood, and other generally considered as fight-or-flight responses (responses that serve to fight off or retreat from danger).

- The **Parasympathetic Nervous System (PNS)** activates tranquil functions, such as stimulating the secretion of saliva or digestive enzymes into the stomach.



## TYPES OF NERVE REFLEXES

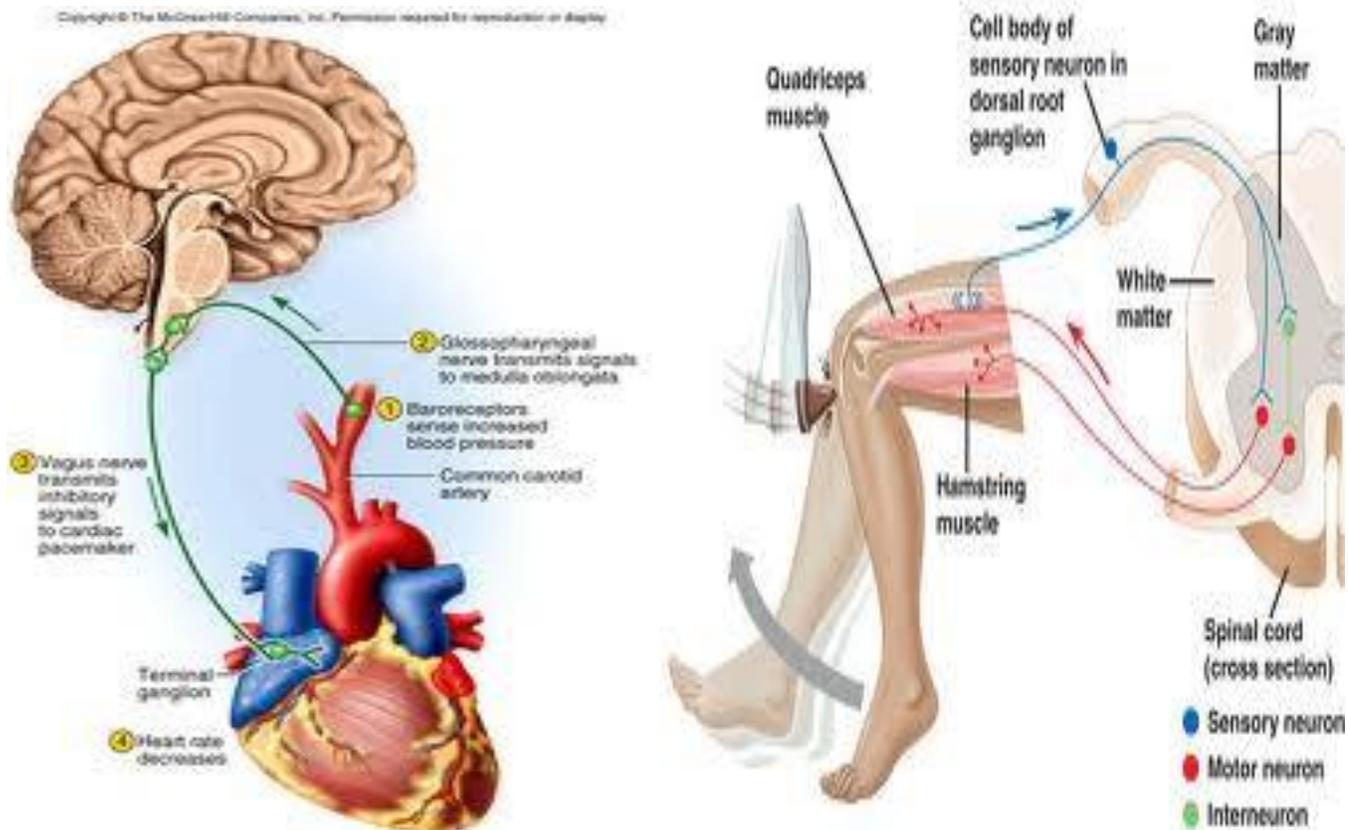
A. **Visceral Reflex- Autonomic Reflex- Involuntary Reflex** = Heart, Glands, Organs, Smooth muscle

B. **Somatic Reflex- Voluntary Reflex** = Skeletal muscle movement

An autonomic reflex is one that involves the response of an organ, such as the peristaltic contraction of the smooth muscle of the intestines, that is not controlled consciously. Somatic reflexes involve a

response that involves a skeletal muscle contraction in response to a stimuli. Sensory nerves send signals through an afferent pathway to the central nervous system for processing. If a quick response is needed, the spinal cord will send out a signal back out the efferent pathway to the appropriate skeletal muscle. The signal is also sent up the spinal cord to the brain for further processing. This 'splitting' of the signal allows the reflex to happen quicker than if the signal were sent only to the brain for processing before a response could be initiated.

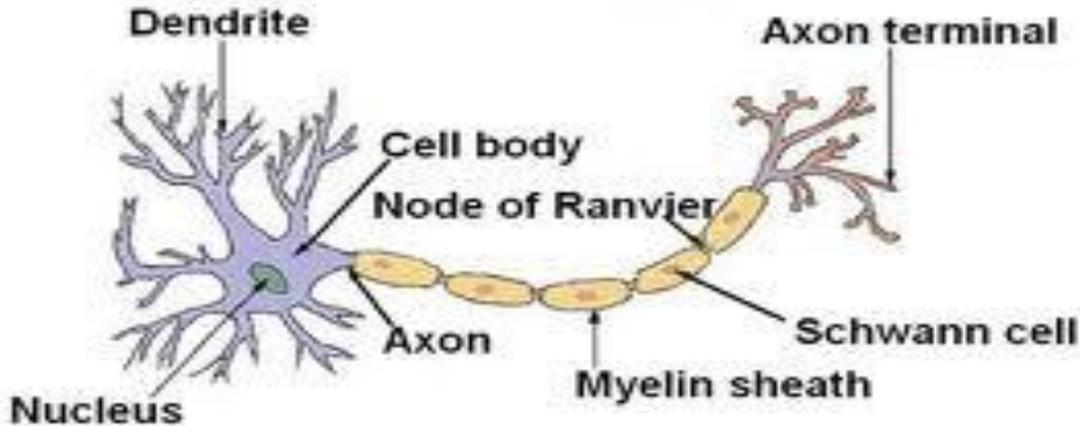
The autonomic reflex is associated with one branch of the peripheral nervous system that regulates the sympathetic and parasympathetic divisions; these include internal organs and glands. A somatic reflex is part of the other branch of the peripheral nervous system that controls skeletal muscle movements, including the reflexes, like the knee jerk test that a doctor would give you.



## **THE NEURON- THE BASIC FUNCTIONAL UNIT OF THE NERVOUS SYSTEM mo**

**SENSORY NEURONS pick up a stimuli and send it through the body via synapse networks which lead to the spinal cord and then to the brain. Once received, they are interpreted and an appropriate response is sent back to the stimulated area via a MOTOR NEURON which, as its name portrays, institutes a response of some kind.**

# Structure of a Typical Neuron



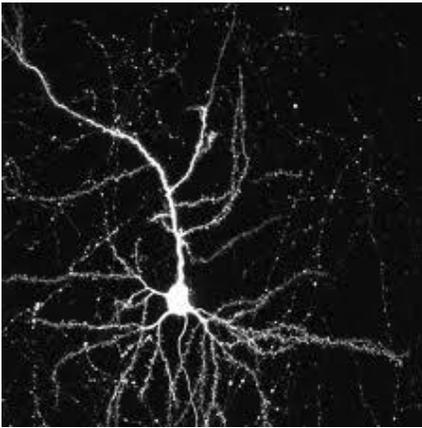
## Dendrites and Axons

### Dendrites

are the branched projections of a neuron that act to conduct the **electrochemical stimulation** received from other neural cells to the cell body, or soma, of the neuron from which the dendrites project. This may be more easily described as a Hand to Hand Off of a stimuli or response pathway. Electrical stimulation is transmitted onto dendrites by upstream neurons (usually their axons) via **synapses** which are located at various points throughout the dendritic tree. Dendrites play a critical role in integrating these synaptic inputs and in determining the extent to which **action potentials** are produced by the neuron. Recent research has also found that dendrites can support action potentials and release **neurotransmitters**, a property that was originally believed to be specific to axons.

**Axon** (from Greek, axis) also known as a nerve fibre; is a long, slender projection of a nerve cell, or neuron, that typically conducts electrical impulses away from the neuron's cell body. The function of the axon is to transmit information to different neurons, muscles and glands. In certain sensory neurons (pseudounipolar neurons), such as those for touch and warmth, the electrical impulse travels along an axon from the periphery to the cell body, and from the cell body to the spinal cord along another branch of the same axon. Axon dysfunction causes many inherited and acquired neurological disorders which can affect both the peripheral and central neurons.

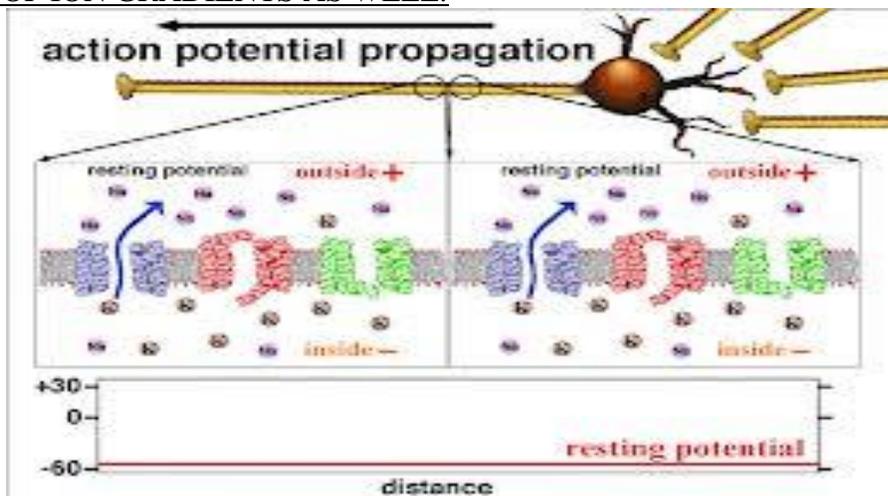
### A NERVE CELL



## Depolarization

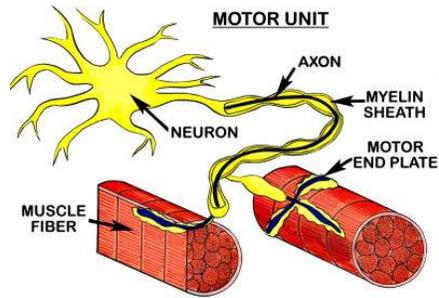
In biology, **depolarization** is a change in a cell's membrane potential, making it more positive, or less negative. In neurons and some other cells, a large enough depolarization may result in an action potential. **Hyperpolarization** is the opposite of depolarization, and inhibits the rise of an action potential. So, in essence, the mechanism is one which is a turn on and turn off action which is decided by the concentration gradient which exist between positive and negative **ionization**. In cases where balance is present, there exist a state of **resting potential** instead of **an action potential**

The resting potential indicates what happens when a neuron is at rest. An **action potential** occurs when a neuron sends information down an axon, away from the cell body. Neuroscientists use other words, such as a "spike" or an "impulse" for the action potential. The action potential is an explosion of electrical activity that is created by a **depolarizing current**. REMEMBER THAT ALL THING SEEK HOMEOSTASIS AND THIS IS TRUE OF ION GRADIENTS AS WELL.

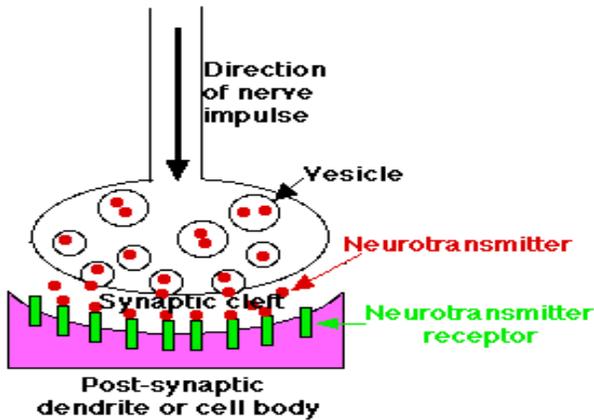


A **synapse** is a structure that permits a neuron (or nerve cell) to pass an electrical or chemical signal to another cell (neural or otherwise). The HAND TO HAND OR NERVE CELL TO NERVE CELL PASS OFF.

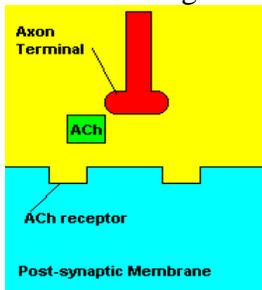
- 1, Note how the nerve connects to the muscle



2. In this diagram notice that the area of a Synapse is an open area between the nerve cell and the bodily area it serves to affect. This SYNAPSE area is termed the **SYNAPTIC CLEFT**



In a nutshell, the **aCh** or **ACETYLCHOLINE** ( **neurotransmitter** ) is present in abundance = connection and transmission of ionic nerve impulse via a charge transmission. An absence of aCh (acetylcholine) produces a termination of the impulse connection/transfer through the synaptic cleft and on to another cell of the target tissue.



LOW Ach = no connect. ADD aCh = neurotransmission of nerve impulse

## **THE STRUCTURE OF THE NERVOUS SYSTEM- PACKET QUESTIONS /RESEARCH**

1. \_\_\_ commands all bodily functions
2. \_\_\_ main highway of central command
3. \_\_\_ outside the brain and spinal cord
4. \_\_\_ provides canals for exiting nerves from spinal cord
5. \_\_\_ cushioning for the CNS
6. \_\_\_ referred pain
7. \_\_\_ bowel and bladder
8. \_\_\_ chest , abdominal
9. \_\_\_ arms
10. \_\_\_ hands
11. \_\_\_ fingers
12. \_\_\_ a helmet
13. \_\_\_ bodily armor
14. \_\_\_ reflex actions of no choice
15. \_\_\_ decision to move
16. \_\_\_ linked to axon terminal
17. \_\_\_ linked to dendrite
18. \_\_\_ a nerve action
19. \_\_\_ ready state
20. \_\_\_ chemical transporters
21. \_\_\_ synaptic cleft
22. \_\_\_ resting potential
23. \_\_\_ action potential
24. \_\_\_ contraction electrolyte(s)
25. \_\_\_ retraction electrolyte(s)

### **ONE LETTER WILL BE USED 3 TIMES**

- A. pain felt due to another location of cause
- B. sacral vertebrae
- C. thoracic vertebrae
- D. Cervical vertebrae
- E. cranial fluid
- F. disc
- G. spinal cord
- H. K<sup>+</sup>
- I. brain
- J. peripheral nervous system
- K. backbone
- L. cranium
- M. autonomic reflex
- N. somatic reflex
- O. axon terminal
- P. dendrite
- Q. synapse
- R. neurotransmitters
- S. action potential
- T. nerve to muscle area
- U. ions imbalance
- V. ions balanced
- W. Na<sup>+</sup> and Ca<sup>+</sup>

# **NERVOUS SYSTEM VIDEOS**

1. Neurons and What They Do ~ An Animated Guide,,,1:56

2. Nerve Impulse Mechanism [3D Animation]...4:14

3. Neuron Synapse,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,3:18

4. The Action Potential.....4:09

5. Neuron Resting Potential.....3:56

**8. The Nervous System - CrashCourse Biology  
#26.....12:03 ( HOMEWORK) ON BACK**

# “NEURO”



## NEURON PATHWAYS



Using your designed packet of information THE HUMAN NERVOUS SYSTEM, read the text and your notes from class discussion in order to determine if a nerve impulse is ACTIVE/ GO / ON , or INACTIVE/ STOP/ OFF, or NP =- not a function that is possible.

**3 CHOICES = GO= “G”      STOP= “S”      NOT POSSIBLE = “NP”**

1. \_\_\_\_\_ nerve impulse from a “dendrite – synaptic cleft – dendrite- synaptic cleft”
2. \_\_\_\_\_ sacral vertebrate grinding on C-4
3. \_\_\_\_\_ a synaptic cleft is absent of aCh and will cause no response
4. \_\_\_\_\_ neuron connections: axon terminal to dendrite to axon terminal to dendrite
5. \_\_\_\_\_ a motor neuron senses that the object touching you is hot.
6. \_\_\_\_\_ all disk in the spinal column are healthy
7. \_\_\_\_\_ a bulging disk creates much pain
8. \_\_\_\_\_ the brain sends a message via a motor neuron
9. \_\_\_\_\_ the brain receives a message from a sensory neuron
10. \_\_\_\_\_ the following sequence C5, T2, L3, C3, S1, S2
11. \_\_\_\_\_ sensory neurons in your hand connects to your CNS
12. \_\_\_\_\_ a lumbar to sacral disk compression.
13. \_\_\_\_\_ L4 and L7 are experiencing a common nerve compression.
14. \_\_\_\_\_ Vertebrae fusion involves the addition of cartilage.
15. \_\_\_\_\_ The brain acts on receiving a motor neuron’s message choosing to respond.
16. \_\_\_\_\_ A state of Action Potential
17. \_\_\_\_\_ A state of Resting Potential
18. \_\_\_\_\_ Hyperpolarization causes an increase in Action Potential
19. \_\_\_\_\_ Depolarization of the membrane of a nerve cell.
20. \_\_\_\_\_ dendrite – synapse – axon terminal
21. \_\_\_\_\_ axon terminal – synapse- dendrite
22. \_\_\_\_\_ depolarization leading to a synapse
23. \_\_\_\_\_ aCh presence in synaptic cleft
24. \_\_\_\_\_ muscle cell – sensory neuron- transduction to brain --- motor neuron – muscle
25. \_\_\_\_\_ muscle cell – aCh absent -- sensory neuron- transduction to brain -- motor neuron – muscle
26. \_\_\_\_\_ Visceral Reflex--- Autonomic Reflex--- Involuntary Reflex --- heart beats
27. \_\_\_\_\_ My Autonomic Reflex initiates my running after a paper I lost blowing in the wind
28. \_\_\_\_\_ Neurons communicate via the language of “Synapse”
29. \_\_\_\_\_ Neuron communication is experiencing a loss of neurotransmitters.
30. \_\_\_\_\_ Concentration gradients are balanced- nerves in resting potential
31. \_\_\_\_\_ Nerve entrapment
32. \_\_\_\_\_ Nerve compression
33. \_\_\_\_\_ The presence of acetylcholine in the synaptic cleft

# ASSESSMENT EXERCISE THE NERVOUS SYSTEM\

1-2 Define the two regions of the Nervous System \_\_\_\_\_ and \_\_\_\_\_

3-4 Define two structures of our Skeletal System which serve to protect our Central Nervous System

3. \_\_\_\_\_ 4. \_\_\_\_\_

5. What structural component of our Skeletal System provides ultimate flexibility?

\_\_\_\_\_

6.- 7 What structure exist in between each of our vertebrae and what tissue are they made of?

6. \_\_\_\_\_ 7. \_\_\_\_\_

8. Besides offering a cushioning affect between vertebrae, the structure cited in 6+7 above also serves the Nervous System in a very important way. Explain:

\_\_\_\_\_  
\_\_\_\_\_

9-10 What two tissue types, once destroyed, will never grow back?

\_\_\_\_\_

11. The basic cellular unit of the Nervous System is known as a \_\_\_\_\_

12-13 What two end point structures of the neuron serve to link the impulse transmission form one neuron to another?

\_\_\_\_\_

14. What is the name of the very thin space that exist between a **dendrite** of one neuron and the **axon terminal** of another neuron?

\_\_\_\_\_

15. What is the general term for any substance which floods the synaptic cleft between the axon terminal of

one neuron and the dendrite of another neuron, thus causing and **action potential** to be engaged.?

\_\_\_\_\_

**16.- 22 You are curious about how the velvety appearance of a large orange ant and so you reach down and touch it, whereupon you are stung and abruptly withdraw your arm away from the assaulting ant.**  
**Your finger began to swell and throb.**

16- 17 Define the Reception phase and indentify the type of neuron involved.

\_\_\_\_\_

18. Define the Transduction phase: \_\_\_\_\_

19-20 Define the Response phase and identity the type of neuron involved.

\_\_\_\_\_

21. Define the Somatic Response: \_\_\_\_\_

22. Define the Visceral / Autonomic Response: \_\_\_\_\_

23-32 The basic neurotransmitter that acts between axon and dendrite connections is known as \_\_\_\_\_ .

When this neurotransmitter is present in large quantities in the region of the \_\_\_\_\_ , the nerve impulse is in a state of \_\_\_\_\_ as the \_\_\_\_\_ of ions is greatly different. This, much like a light switch that is \_\_\_\_\_ will complete the transmission of an electrical current, so does the transmission of a nerve impulse from one \_\_\_\_\_ to another \_\_\_\_\_. If the concentration gradient of the neurotransmitter \_\_\_\_\_ in the synaptic cleft is nearly the same, then the neuron are said to exhibit a \_\_\_\_\_ whereupon no transmission will occur between the \_\_\_\_\_ of one neuron and the \_\_\_\_\_ of another neuron.

33. The Nervous System and its mechanisms which control the body's and its response to its present external environment, as well as its internal physiology is just another example of the basic Cell Signaling Pathway:

\_\_\_\_\_