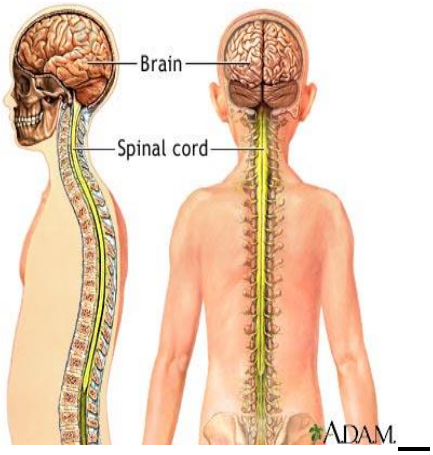
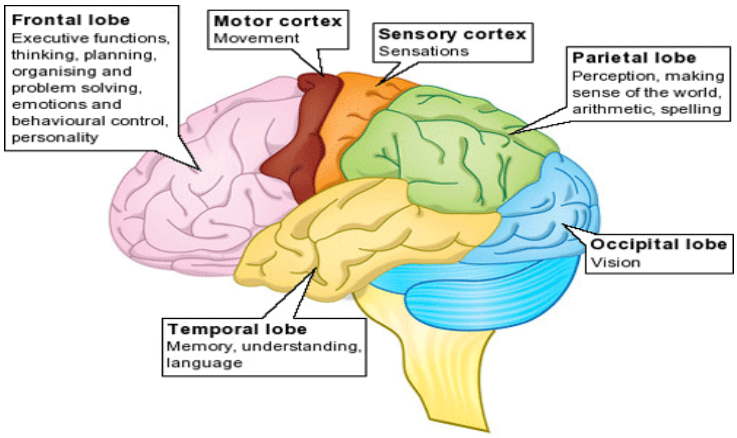
The Structure Of The Nervous System –
Once destroyed,nerve cells/tissues never grow back!

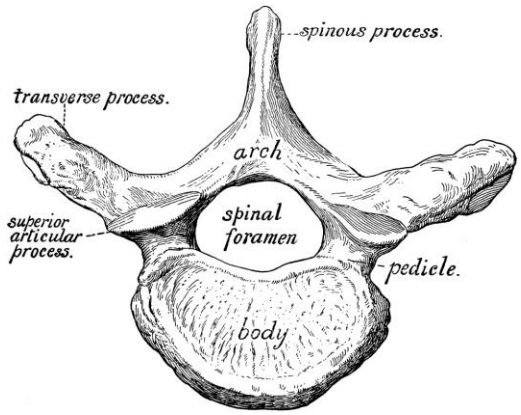
Regions of the Nervous System.
A. C.N.S. –Central Nervous System



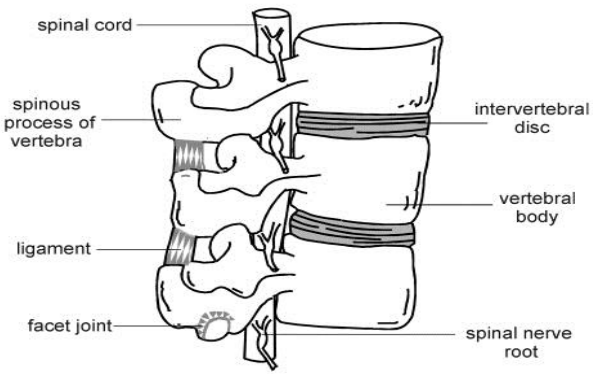


The central nervous system (CNS) is the command and processing center for the nervous system. It receives information **from** and sends information **to** the **peripheral nervous system**. The two main organs of the CNS are the **brain** and **spinal** cord. The brain receives, processes and interprets sensory information sent from the spinal cord, and then sends an appropriate response back = STIMULI/RESPONSE MEACHANISM (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** respectfully, 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 and 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 in 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



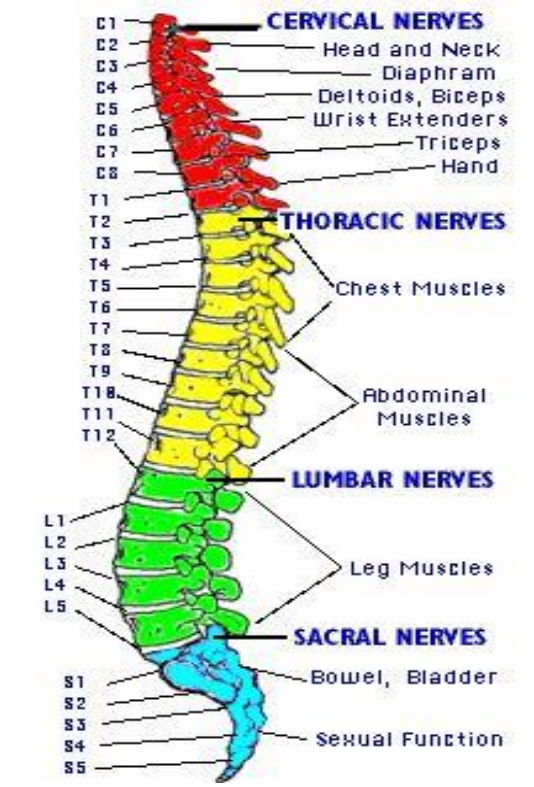
THREE VERTEBRAE CONNECTED

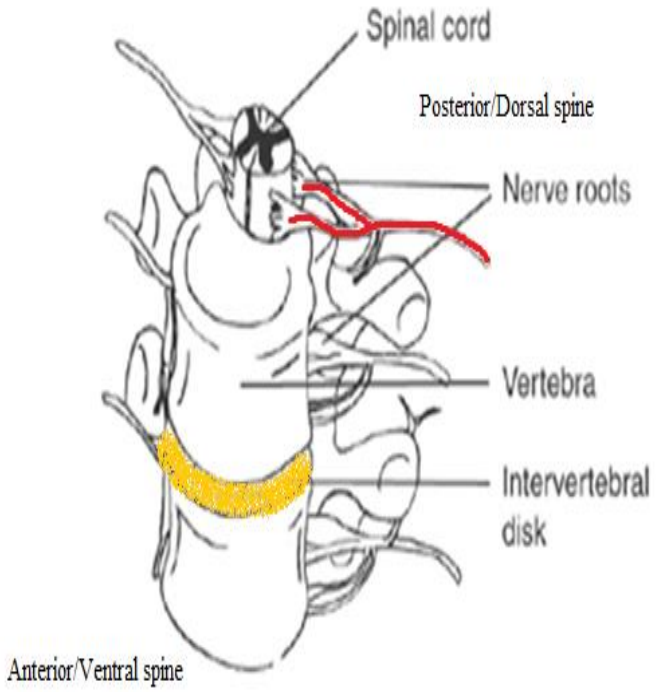


LUMBAR SPINE AND SPINAL CORD

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





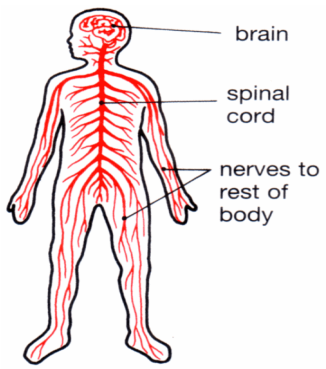
NOTE how nerves from the spinal cord protrude through canals between the vertebrae, made possible by the cartilage

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.

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 ra_te, 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.
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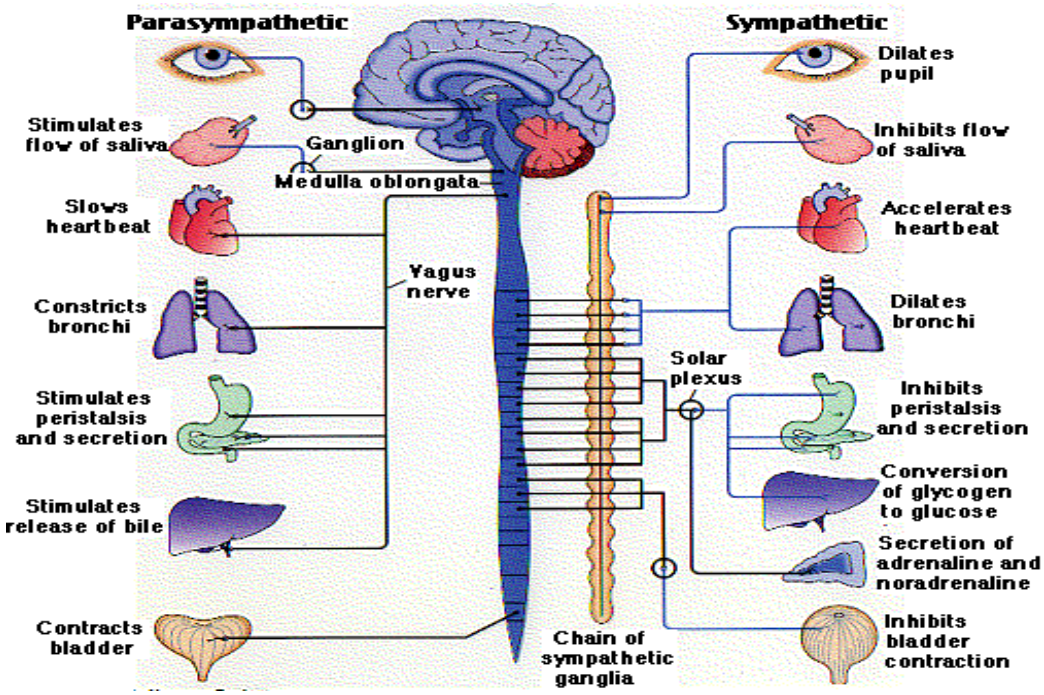

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TYPES OF NERVE REFLEXES

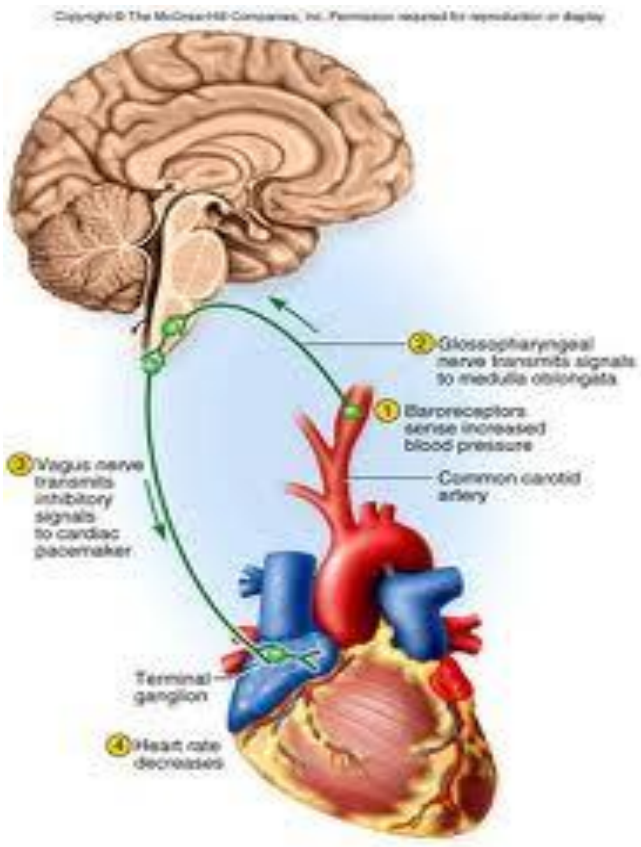
A.Visceral Reflex- Autonomic Reflex- Involunatary Reflex=Hart, Glands, Ortgans, Smooth muscle

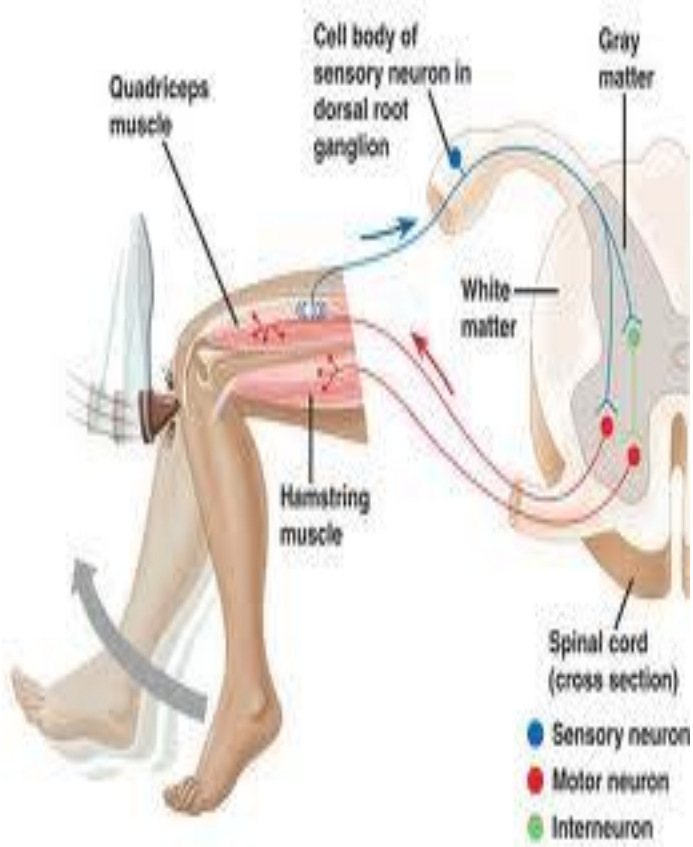
B. **Somatic Reflex- Voluntary Reflex-** Skeletal muscle movement

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.

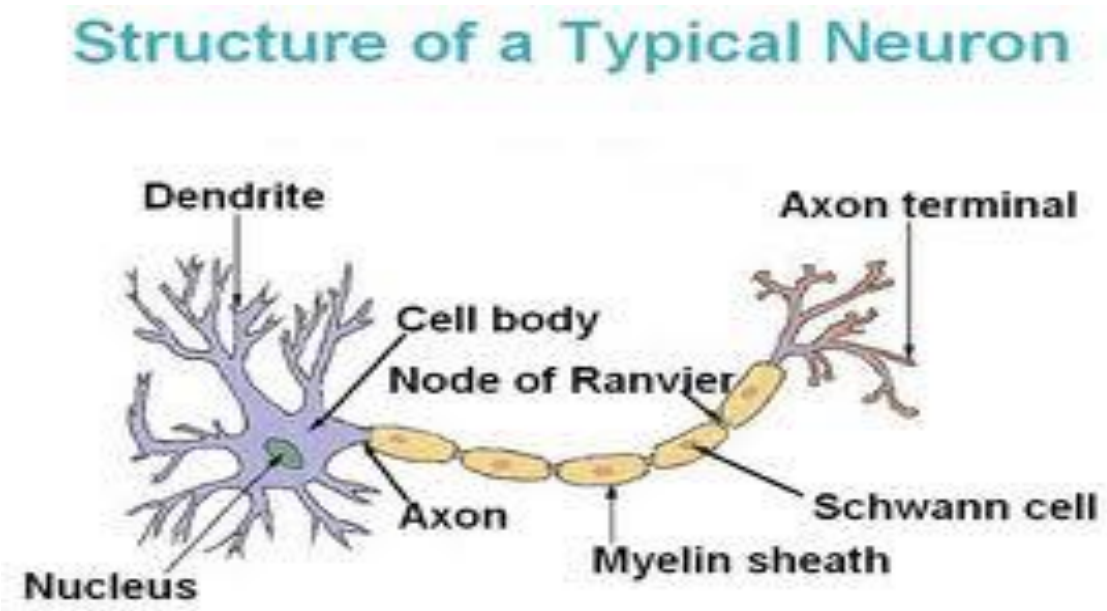
The autonomic reflex is associated with one branch of the peripheral nervous system that regulates the sympathetic and parasympathetic divisions; these include internal organs and glands. A somatic reflex is part of the other branch of the peripheral nervous system that controls skeletal muscle movements,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





<u>THE NEURON-</u> THE BASIC FUNCTIONAL UNIT OF THE NERVOUS SYSTEM mo

<u>SENSORY NEURONS</u> 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 <u>MOTOR NEURON</u> which, as its name portrays, institutes a response of some kind.



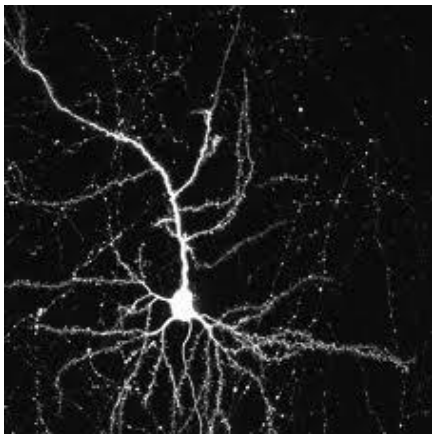
Dendrites and Axons

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.

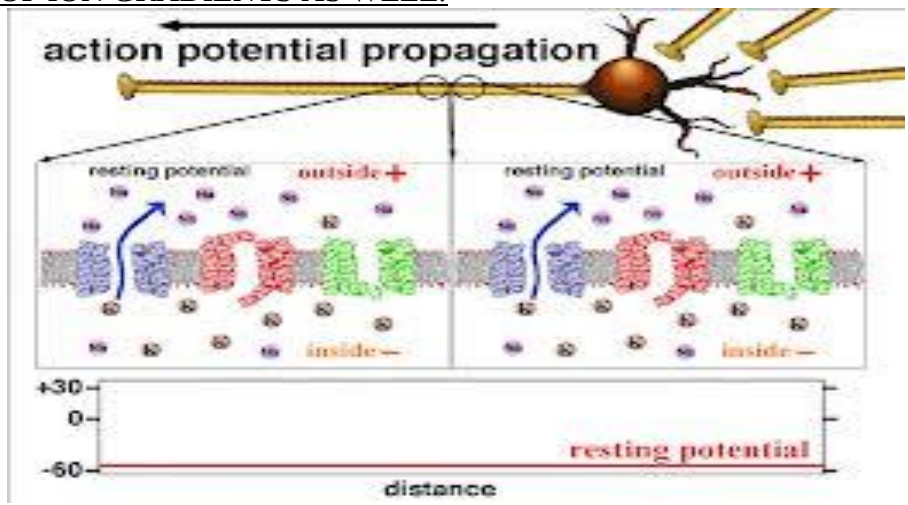
A NERVE CELL



Depolarization

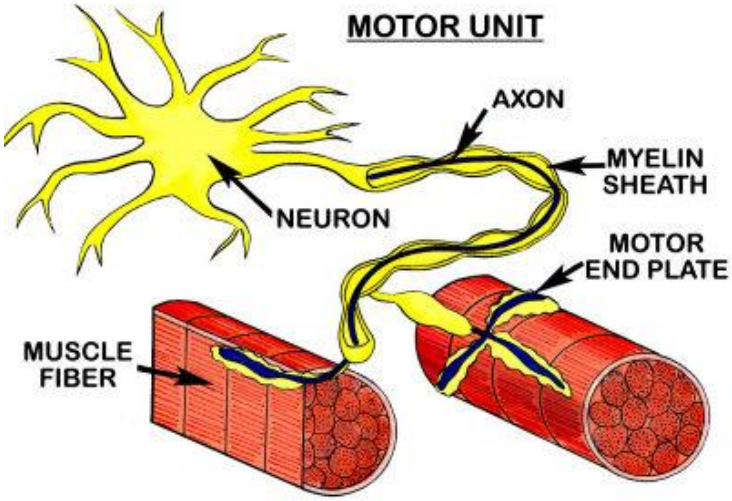
In biology, **depolarization** is a change in a cell's membrane potential, making it more positive, or less negative. In neurons and some other cells, a large enough depolarization may result in an action potential. **Hyperpolarization** is the opposite of depolarization, and inhibits the rise of an 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 potental** 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.

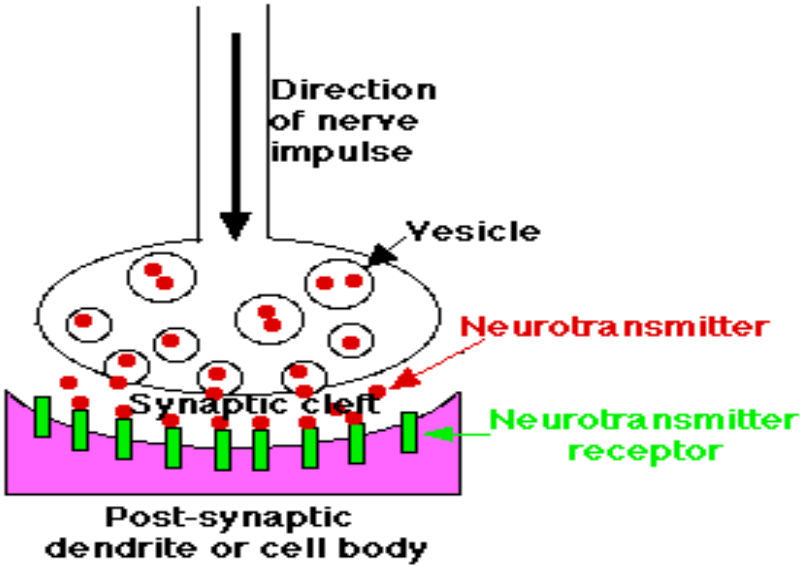


A **synapse** is a structure that permits a neuron (or nerve cell) to pass an electrical or chemical signal to another cell (neural or otherwise The HAND TO HAND OR NERVE CELL TO NERVE CELL PASS OFF.

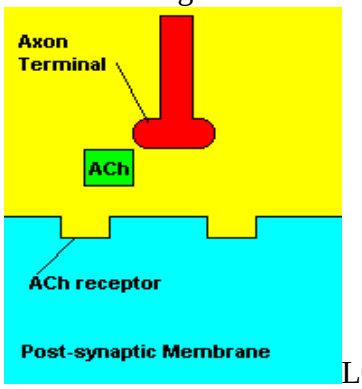
1, Note how the nerve connects to the muscle



2. In this diagram notice that the are 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 helmut
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

<u>ONE LETTER WILL BE USED 3 TIMES</u>
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+
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+ and Ca+