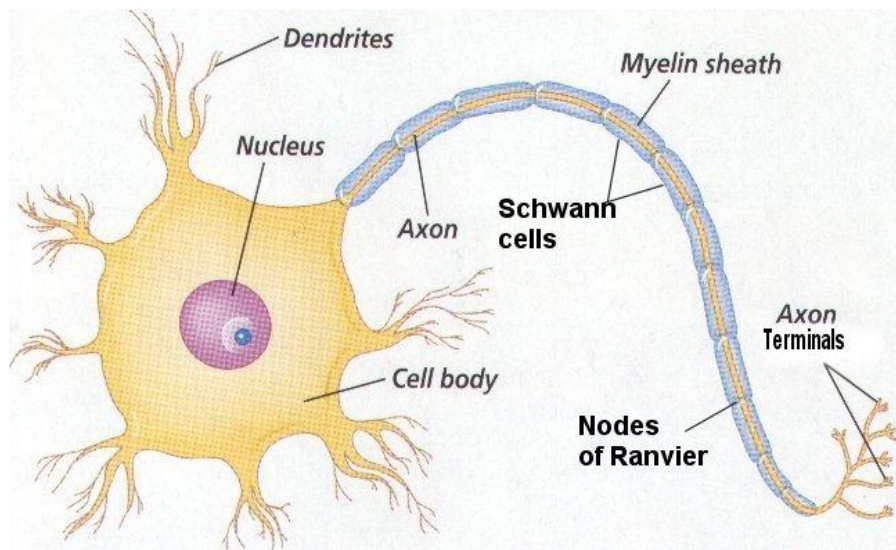


# ANATOMY & PHYSIOLOGY

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## CHAPTER 50, PART 1 THE NERVOUS SYSTEM



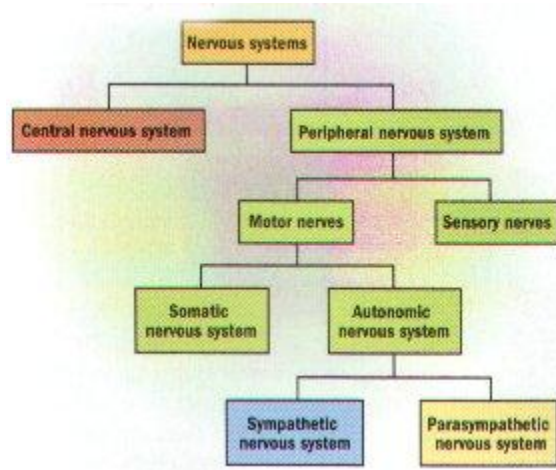
**A BASIC NEURON**

 [THE NERVOUS SYSTEM STUDY GUIDE](#)  
 [REVIEW THE NERVOUS SYSTEM](#)

### An Overview

The Nervous System is the body's information gatherer, storage center and control system. Its overall function is to collect information about the external conditions in relation to the body's internal state, to analyze this information, and to initiate appropriate responses to satisfy certain needs (Maintain Homeostasis). The most powerful of these needs is survival. The nerves do not form one single system, but several which are interrelated. Some of these are physically separate, others are different in function only. The brain and spinal cord make up the Central Nervous System (CNS). The Peripheral Nervous System (PNS) is responsible for the body functions which are Not under conscious control - like the heartbeat or the digestive system. The smooth operation of the Peripheral Nervous System is achieved by dividing it into Sympathetic and Parasympathetic Systems. These are opposing actions and check on each other to provide a balance. The nervous system uses electrical impulses, which travel along the length of the cells (Neurons). The cell processes information from the sensory nerves and initiates an action within

milliseconds. These impulses can travel at up to 250 miles per hour, while other Systems such as the Endocrine System may take many hours to respond with hormones.



## **50 -1, ORGANIZATION AND CENTRAL NERVOUS SYSTEM**

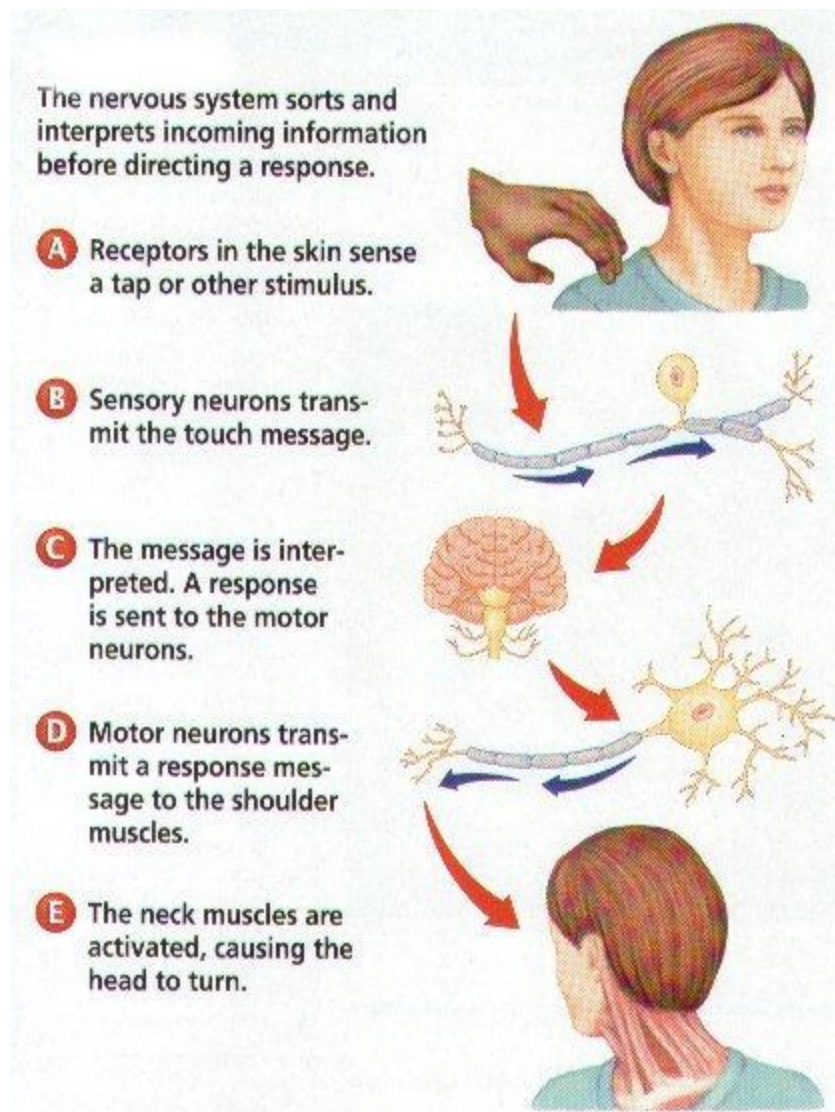
## **50-3, TRANSMISSION OF NERVE IMPULSES**

## **50-2 PERIPHERAL NERVOUS SYSTEM**

**OBJECTIVES:** Explain the general functions (Four Functions) of the nervous system. Identify the Two main organs of the Central Nervous System. Describe the structure of a neuron and describe the functions of each major part. Distinguish between sensory neurons (receptor), motor neurons and interneurons. Summarize the electrical and chemical conditions of resting potential. Describe the process of a nerve impulse. Describe how the central nervous system is protected from injury. Describe the structure of the spinal cord and its major functions. Describe the structure of a spinal nerve. Describe the role of neurotransmitters in transmitting a signal across a synaptic cleft. Explain how information passes from one neuron to another. Name the Two divisions of the peripheral nervous system and describe their functions. Distinguish between the somatic nervous system and the autonomic nervous system. Distinguish between the sympathetic division and the parasympathetic division. Describe a spinal reflex (The Patellar Reflex). Name the parts of a Reflex Arc, and describe the functions of each part. Name the cranial nerves and lists their major functions.

## **INTRODUCTION**

1. Communication is vital to the survival of living organisms.
2. To interact with their environment, multicellular organisms have developed a communication system at the Cellular Level.
3. Specialized Cells (Neurons) allow Messages to be carried from one cell to another so that communication among all body parts is smooth and efficient.



4. In HUMANS, these Cells called **NEURONS** make up the Nervous System.

5. The Nervous System **CONTROLS and COORDINATES ALL ESSENTIAL FUNCTIONS of the Human Body.**

6. The Nervous System **RECEIVES and RELAYS** information about activities within the body and Monitors and Responds to **INTERNAL and EXTERNAL CHANGES.**

7. The Nervous System has **FOUR FUNCTIONS** that enable the body to respond quickly. The Nervous System:

A. **Gathers information** both from the outside world and from inside the body. **SENSORY FUNCTION**

B. **Transmits the information** to the processing area of the brain and spinal

cord.

C. **Processes the information** to determine the best response. **INTEGRATIVE FUNCTION**

D. **Sends information to muscles, glands, and organs (effectors) so they can respond correctly.** Muscular contraction or glandular secretions. **MOTOR FUNCTION**

8. **The Nervous System has TWO Major Divisions.**

A. **The Central Nervous System (CNS)** consist of the Brain and the Spinal Cord. The Spinal Cord carries messages from the body to the Brain, where they are analyzed and interpreted. Response Messages are then passed from the Brain through the Spinal Cord and to the rest of the Body.

B. **The Peripheral Nervous System (PNS)** consists of the neurons NOT Included in the Brain and Spinal Cord. Some Peripheral Neurons Collect Information from the Body and Transmit it TOWARD the CNS. These are called **AFFERENT NEURONS**. Other Peripheral Neurons Transmit Information AWAY from the CNS. These are called **EFFERENT NEURONS**.

8. The Functioning Nervous System is an enormous network of "one-way streets".

## **THE NEURON**

1. The CELLS that Carry Messages Throughout the Nervous System are called **NEURONS**. (Figure 50-8)

2. The Neuron is the Basic Functional Unit of the Nervous System.

3. Whatever their specific function, all neurons have the same physical parts: The Cell Body, Dendrites and One Axon.

4. Messages take the form of **ELECTRICAL SIGNALS**, and are known as **IMPULSES**. A Neuron carries impulses in only ONE direction.

5. **Neurons can be classified into THREE TYPES:**

A. **SENSORY (RECEPTOR) NEURONS (AFFERENT)** - Carry impulses from the SENSE ORGANS (RECEPTORS) to the Brain and Spinal Cord. Receptors detect external or internal changes and send the information to the Central Nervous System in the form of impulses by way of the Afferent Neurons.

B. **MOTOR NEURONS (EFFERENT)** - Carry impulses from the Brain and Spinal Cord to MUSCLES or GLANDS. Muscles and Glands are Two Types of Effectors. In response to impulses, Muscles Contract and Glands Secrete.

C. **INTERNEURONS** - Connect Sensory and Motor neurons and carry impulses between them. They are found entirely within the Central Nervous System.

## **THE ANATOMY OF A NEURON**

6. A Neuron consists of **THREE MAIN PARTS: (Figure 50-8)**

A. **CELL BODY** - The largest part, contains the nucleus and much of the cytoplasm (area between the nucleus and the cell membrane), most of the metabolic activity of the cell, including the generation of ATP (Adenine Triphosphate Compound that Stores Energy) and synthesis of protein.

B. **DENDRITES** - Short branch extensions spreading out from the cell body. Dendrites Receive STIMULUS (Action Potentials) and carry IMPULSES from the ENVIRONMENT or from other NEURONS AND CARRY THEM TOWARD THE CELL BODY.

C. **AXON** - A Long Fiber that **CARRIES IMPULSES AWAY FROM THE CELL BODY**. Each neuron has only ONE AXON. The Axon Ends in a series of small swellings called AXON TERMINALS.

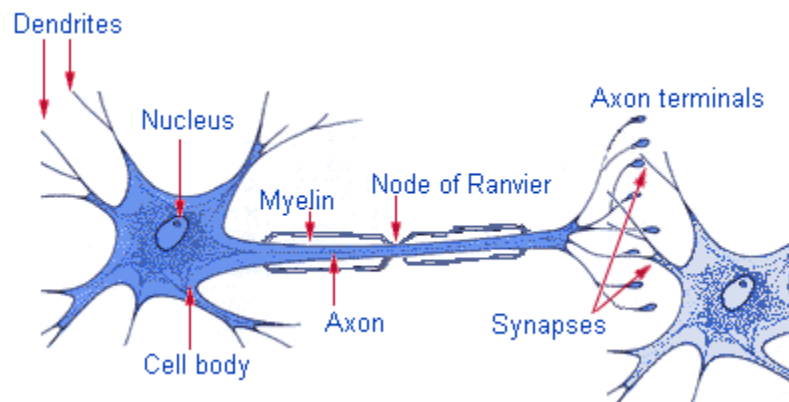
7. Neurons may have Dozens or even Hundreds of DENDRITES but usually ONLY ONE AXON.

8. The Axons of most Neurons are covered with a Lipid Layer known as the **MYELIN SHEATH**.

9. The Myelin Sheath both Insulates and Speeds Up transmission of Action Potentials through the Axon.

10. In the Peripheral Nervous System, Myelin is produced by **SCHWANN CELLS**, which surround the Axon.

11. GAPS (NODES) in the Myelin Sheath along the length of the Axon are known as the **NODES OF RANVIER**.



### **SECTION 50-3**

### **TRANSMISSION OF NERVE IMPULSES**

1. The Italian scientist Luigi Galvani found that nervous tissue (groups of cells that conduct impulses) displays Electrical Activity in the form of a Nerve Impulse, which is a flow of electrical charges along The Cell Membranes of a Neuron.

2. This Electrical Activity is due to Movement of **IONS** (charge particles) across the Cell Membrane. **SODIUM - Na+, AND POTASSIUM - K+**.

3. The movement of these Ions is affected by their ability to pass through the Cell membrane, their Concentration Inside and Out of the Cell, and Their Charge.

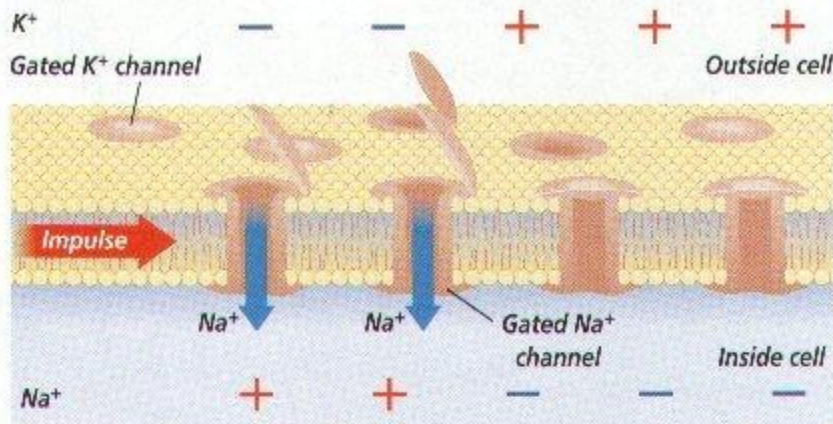
4. Neurons have an Electrical Charge Different from the Extracellular Fluid that surrounds them. A difference in electrical Charge between Two Locations is called a **POTENTIAL**.

## **RESTING POTENTIAL**

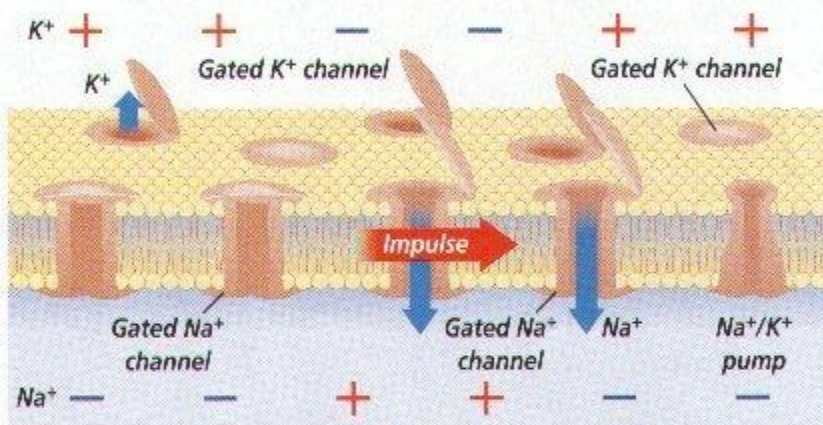
1. A Nerve Cell has **ELECTRICAL POTENTIAL** across its cell membrane because of a difference in the number of Positively and Negatively Charged IONS on each side of the Cell Membrane.
2. The Electrical Potential is due to PROTEINS in the Neuron known as Sodium-Potassium Pumps move Sodium ions (Na<sup>+</sup>) OUT of the Cell and Actively Pump Potassium ions (K<sup>+</sup>) INTO the Cell.
3. The result of this Active Transport of ions is the Cytoplasm of the neuron contains MORE K<sup>+</sup> IONS and FEWER Na<sup>+</sup> IONS than the surrounding medium.
4. The Cytoplasm also contains Many NEGATIVE CHARGES PROTEINS Molecules and Ions.
5. K<sup>+</sup> ions can leak out across the membrane more easily than Na<sup>+</sup> ions can leak in.
6. The Negatively charged protein molecules and ions do not leak in or out.
7. The Net Result of the leakage of positively charged ions out of the cell is a Negative Charge on the INSIDE of the neuron's Cell Membrane.
8. The Charge Difference is known as the **RESTING POTENTIAL** of the Neuron's Cell Membrane.
9. As a result of its Resting Potential, the Neuron is said to be **POLARIZED**.
10. **POLARIZED** = Negatively Charged on the inside of the Cell Membrane, and Positively Charged on the Outside.
11. A Neuron maintains this polarization until it is stimulated.
12. A **STIMULUS** is a change in the environment that may be of sufficient strength to initiate an impulse.
13. The ability of a neuron to respond to a Stimulus and Convert it into a nerve impulse is known as **EXCITABILITY**.

## **THE MOVING IMPULSE (Figure 50-9)**

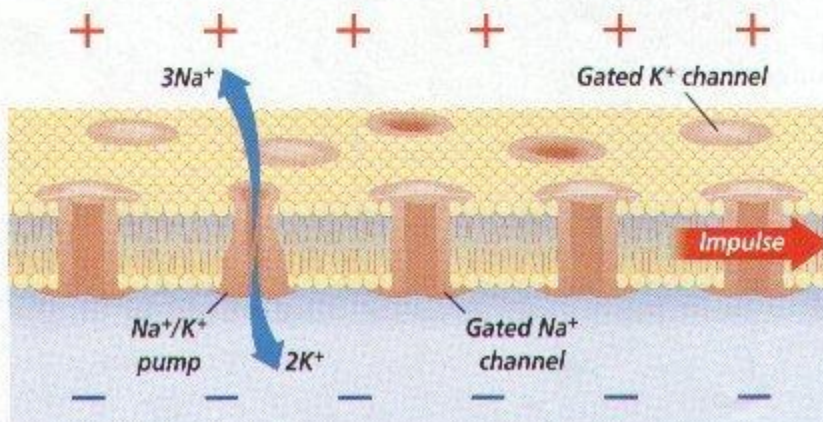
A wave of depolarization moves down the axon of a neuron.



**A** Gated sodium channels open, allowing sodium ions to enter and make the inside of the cell positively charged and the outside negatively charged.



**B** As the impulse passes, gated sodium channels close, stopping the influx of sodium ions. Gated potassium channels open, letting potassium ions out of the cell. This action repolarizes the cell.



**C** As gated potassium channels close, the  $\text{Na}^+/\text{K}^+$  pump restores the ion distribution.

1. A Nerve Impulse causes a movement of ions across the cell membrane of a neuron... Similar to a ripple passing along the surface of a pond.

2. The cell membrane of a neuron contains thousands of tiny molecules known as **GATES**. (Sodium and Potassium)

3. These Gates allow either Sodium or Potassium ions to pass through.

4. Generally the Gates on a neuron are CLOSED.

5. A Nerve Impulse STARTS when Pressure or other Sensory Inputs, Disturbs a Neuron's Plasma Membrane, causing Sodium Gates to OPEN.

6. At the beginning of an impulse, the Sodium Gates OPEN, allowing positively charged  $\text{Na}^+$  ions to flow INSIDE the Cell Membrane.

7. The INSIDE of the membrane temporarily becomes MORE POSITIVE than the OUTSIDE. THIS IS CALLED **DEPOLARIZED**

8. The Membrane is now said to be **DEPOLARIZED**: the charge inside the axon changes from negative to

positive as sodium ions enter the interior.

9. As the impulse passes, the Potassium Gates OPEN, allowing positively charged K<sup>+</sup> ions to FLOW OUT. **REPOLARIZED**: the inside of the axon resumes a negative charge.

10. The membrane is now said to be **REPOLARIZED**. Once again NEGATIVELY Charged on the INSIDE and POSITIVELY Charged on the OUTSIDE.

11. The **DEPOLARIZATION and REPOLARIZATION of a Neuron Membrane** is called an **ACTION POTENTIAL**. **Action Potential is another name for a Nerve Impulse or simply an impulse.**

12. After a nerve impulse is period when the neuron is unable to conduct a nerve impulse called the **REFRACTORY PERIOD**.

14. The Refractory Period is a very short period during which the sodium-potassium pump continues to return sodium ions to the outside and potassium ions to the inside of the axon. **THUS RETURNING THE NEURON TO RESTING POTENTIAL.**

15. An impulse is not an electric current; it is a wave of Depolarization and Repolarization. Or a nerve impulse is actually the movement of an action potential along a neuron as a series of voltage-gated ions channels open and close.

16. An impulse is much SLOWER than an electric current.

17. Unlike an electric current, the STRENGTH of an impulse is ALWAYS the SAME.

18. There is either an impulse to a stimulus or there is not. (ALL OR NOTHING)

## **PROPAGATION**

1. An impulse is self-propagating. Once started it continues, and moves only in one direction. Like the falling of Dominos.

## **MYELIN SHEATH**

1. Myelin Sheaths greatly increase the speed of impulse along an axon.

2. Myelin is composed of 80% lipid and 20% protein.

3. Myelin is made of special cells called Schwann Cells that forms an insulated sheath, or wrapping around the axon.

4. There are **SMALL NODES or GAPS** called the **Nodes of Ranvier** between adjacent myelin sheath cells along the axon. (Figure 50-8)



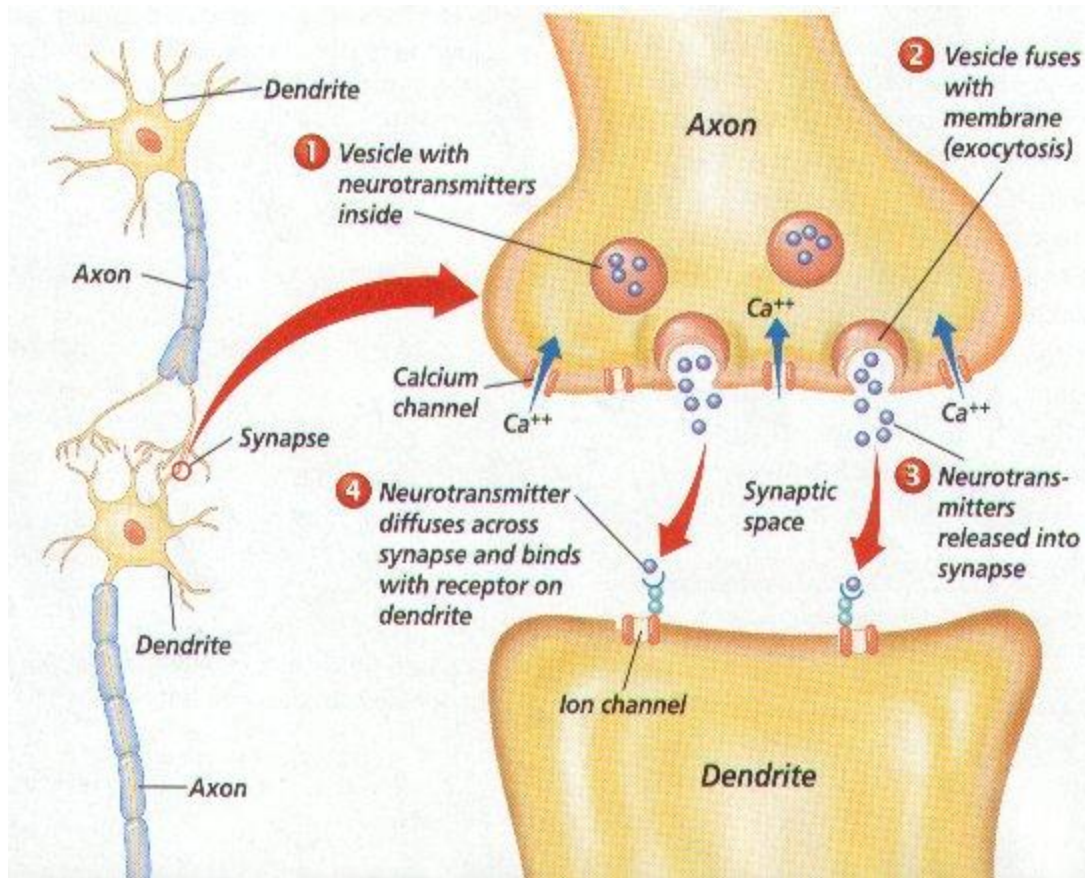
5. As an impulse moves down a myelinated (covered with myelin) axon, the impulse JUMPS from Node to Node instead of moving along the membrane.
6. This jumping from Node to Node greatly increase the speed of the impulse.
7. Some myelinated axons conduct impulses as rapid as 200 meters per second.
8. The formation of myelin around axons can be thought of as a crucial event in evolution of vertebrates.
9. Destruction of large patches of Myelin characterize a disease called **Multiple Sclerosis**. In multiple sclerosis, small, hard plaques appear throughout the myelin. Normal nerve function is impaired, causing symptoms such as double vision, muscular weakness, loss of memory, and paralysis.

### **THE THRESHOLD**

1. The Strength of an impulse is always the SAME.
2. Either there is an impulse in response to a STIMULUS or there is not.
3. A STIMULUS must be of Adequate Strength to cause a neuron to conduct an impulse.
4. The MINIMUM LEVEL of a STIMULUS that is REQUIRED to Activate a neuron is called the **THRESHOLD**.
5. Any Stimulus WEAKER than the Threshold will produce NO impulse.
6. Any Stimulus STRONGER than the Threshold WILL produce an impulse.
7. A nerve impulse follows the ALL-OR-NONE Principle.

### **THE SYNAPTIC CLEFT OR SYNAPSE**

1. The Axon ends with many small swellings called **AXON TERMINALS**. (Figure 50-10)
2. At these Terminals the neuron may make contact with the DENDRITES of another neuron, with a RECEPTOR, or with an EFFECTOR.
3. **RECEPTORS are special SENSORY NEURONS in SENSE ORGANS that RECEIVE Stimuli from the EXTERNAL ENVIRONMENT.**
4. **EFFECTORS are MUSCLES or GLANDS that bring about a COORDINATE RESPONSE.**



5. The point of contact at which impulses are passed from one cell to another are known as **THE SYNAPTIC CLEFT OR SYNAPSE**.

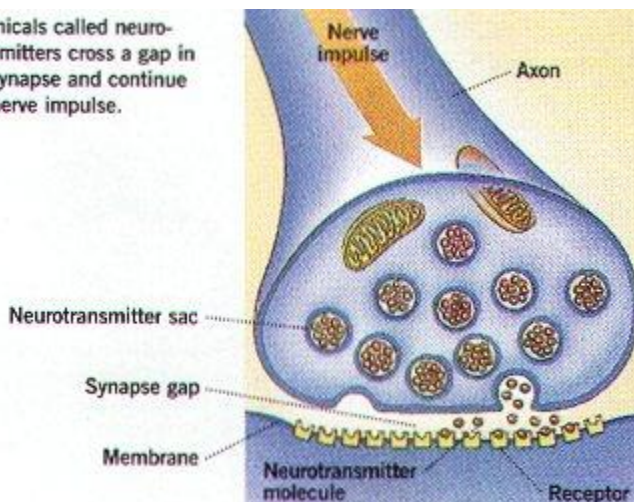
6. Neurons that transmit

impulses to other neurons DO NOT actually touch one another. The Small Gap or Space between the axon of one neuron and the dendrites or cell body on the next neuron is called the Synapse. One importance of the presence of Synapses is that they ensures one-way transmission of impulses in a living person. A nerve impulse CANNOT go backward across a Synapse.

7. The Axon Terminals at a Synapse contain tiny vesicles, or sacs.

8. These tiny vesicles are filled with CHEMICALS known as **NEUROTRANSMITTERS**. (Acetylcholine)

Chemicals called neurotransmitters cross a gap in the synapse and continue the nerve impulse.



9. A NEUROTRANSMITTER is a chemical substance that is used by one neuron to signal another. The impulse is changed from and Electrical Impulse to a Chemical Impulse (Electrochemical Impulses).

10. When an impulse reaches the Axon Terminal, dozen of vesicles fuse with the cell membrane and discharge the

Neurotransmitter into the Synaptic Cleft (GAP).

11. The molecules of the neurotransmitter diffuse across the gap and attach themselves to **SPECIAL RECEPTORS** on the membrane of the neuron receiving the impulse.

12. When the neurotransmitter becomes attached to the cell membrane of the adjacent nerve cell, it changes the permeability of that membrane.

13. As a result,  $\text{Na}^+$  ions diffuse through the membrane into the cell.

14. If enough neurotransmitter is released by the axon terminal, so many  $\text{Na}^+$  ions diffuse into the neuron that the neuron becomes **DEPOLARIZED**.

15. **DEPOLARIZED** = Inside the membrane becomes more positive than outside.

16. This causes a **THRESHOLD** to be **REACHED** and an impulse (**ACTION POTENTIAL**) begins in the second cell.

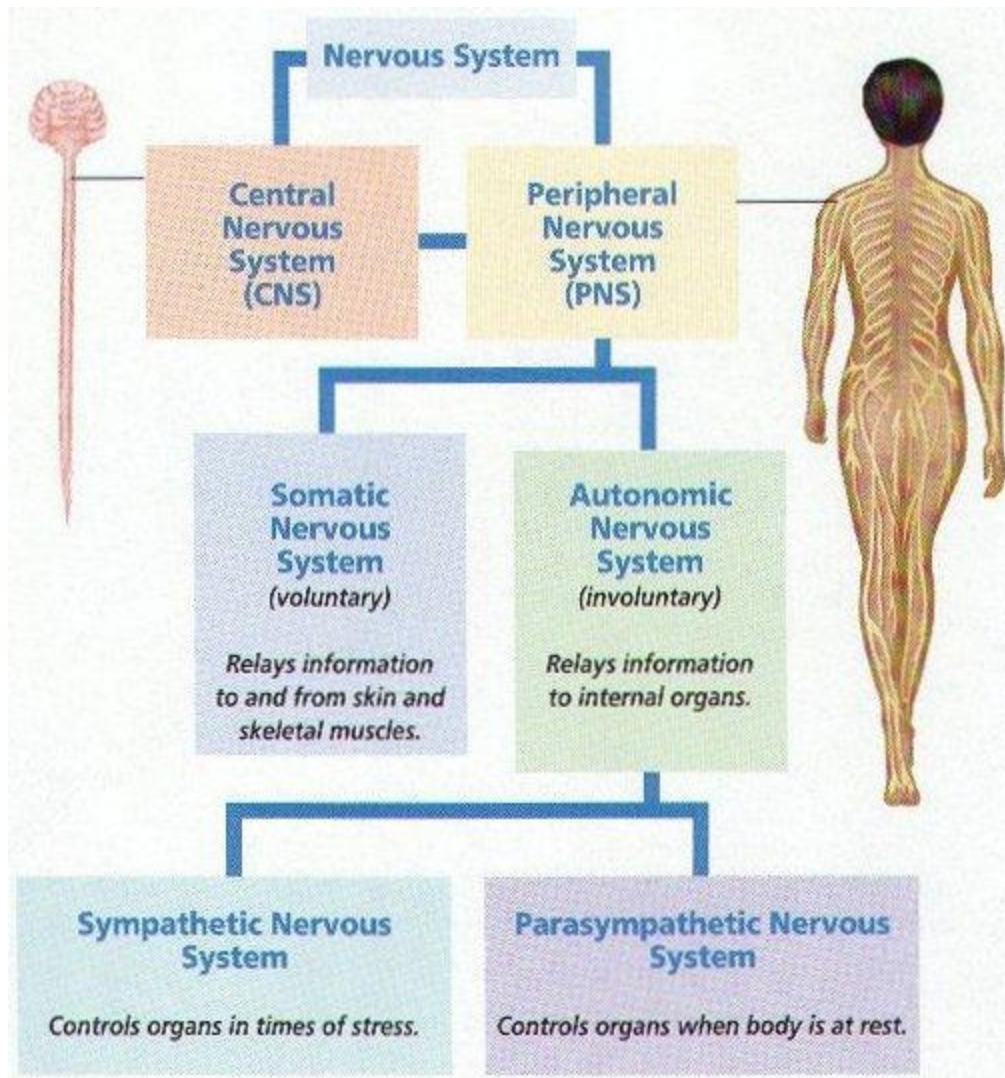
17. After the neurotransmitter relays its message it is rapidly **REMOVED** or **DESTROYED**, thus halting its effect.

18. The molecules of the neurotransmitter may be broken down by **ENZYMES**, taken up again by the axon terminal and recycled, or they may simply diffuse away.

19. Synapses are the slowest part of the nervous system. The advantage to having many neurons, with gaps between them, is that we can control and receive information from different parts of the body at different times. They also ensure **One-Way Transmission** of impulses in a living person.

20. **NERVE GAS** prevents enzymes from breaking down neurotransmitters, as a result muscles in the respiratory and nervous system become paralyzed.

## **DIVISIONS OF THE NERVOUS SYSTEM**



1. Neurons, which are the functional units of the nervous system, do not act alone as individual cells.

2. They are joined together to form a complicated communication network that gives rise to the nervous system.

3. **THE HUMAN NERVOUS SYSTEM IS DIVIDED INTO TWO MAJOR DIVISION:**

**A. THE CENTRAL NERVOUS SYSTEM (CNS)**

**B. THE**

**PERIPHERAL NERVOUS SYSTEM (PNS)**

4. **The CENTRAL NERVOUS SYSTEM serves as the CONTROL CENTER of the body.**

5. The Central Nervous System consists of the **BRAIN and SPINAL CORD.**

6. Both the brain and the spinal cord are encased in bone.

7. The Central Nervous System **RELAYS MESSAGES, PROCESSES INFORMATION, AND COMPARES AND ANALYZES INFORMATION.**

8. The Central Nervous system **DOES NOT** come in contact with the Environment.

9. This job is left to the other major division of the nervous system - **THE PERIPHERAL NERVOUS SYSTEM.**

10. THE BRAIN IS THE MAIN SWITCHING UNIT OF THE CENTRAL NERVOUS SYSTEM; IT IS THE PLACE TO WHICH IMPULSES FLOW AND FROM WHICH IMPULSES ORIGINATE.

11. THE SPINAL CORD PROVIDES THE LINK BETWEEN THE BRAIN AND THE REST OF THE BODY.

### **THE SPINAL CORD (Figure 50-5)**

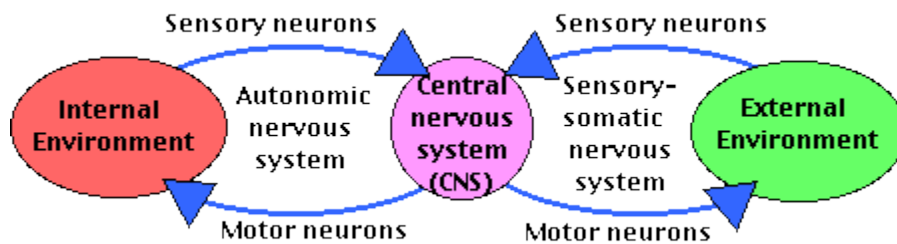
1. The spinal cord acts as a communication link between the Brain And the Peripheral Nervous system.
2. The spinal cord is continuous with the brain and emerges from an opening at the base of the skull. The spinal cord stretches downward for approx. 42 - 45 cm through the vertebral column.
3. There are 31 pairs of spinal nerves, part of the Peripheral Nervous system, that emerge from the spinal cord. The nerves are named according to their respective vertebrae. NERVES are AXONS that Are BUNDLED TOGETHER.
4. Each Spinal Nerve consists of a **DORSAL ROOT and a VENTRAL ROOT.** (Figure 50-5)
5. The **Dorsal Roots** contain Neurons that carry signals TO THE CENTRAL NERVOUS SYSTEM from various kinds of Sensory Neurons.
6. The **Ventral Roots** contain the Axons of Motor Neurons, which are neurons that contact and carry information to the Muscles and Glands (Effectors).
7. Within the Spinal Cord and else where in the body are Interneurons, which are neurons that connect neurons to each other.
8. In addition to carrying impulses to and from the brain, the spinal cord regulates **REFLEXES.**
9. **A REFLEX is the simplest response to a STIMULUS.**
10. Sneezing and Blinking are two examples of Reflexes.
11. A Reflex produces a rapid MOTOR RESPONSE to a STIMULUS because the Sensory Neuron Synapses DIRECTLY with a MOTOR NEURON in the Spinal Cord.
12. REFLEXES are very fast, and **Most Reflexes Never Reach the Brain.**
13. Blinking to protect your eyes from danger is a reflex.
14. 31 PAIRS of spinal nerves originate in the spinal cord and branch out to both sides of the body. Carrying messages to and from the spinal cord.

15. Sensory Neurons carry impulses from **RECEPTORS** to the spinal cord.
16. Motor Neurons carry impulses from the spinal cord to the **EFFECTORS**.
17. Within the spinal cord, motor and sensory neurons are connected by **INTERNEURONS**.

## **SECTION 50-2**

### **THE PERIPHERAL NERVOUS SYSTEM**

1. **ALL OF THE NERVOUS SYSTEM OUTSIDE THE SPINAL CORD AND BRAIN IS KNOWN AS THE PERIPHERAL NERVOUS SYSTEM (PNS) (Figure 50-7).**
2. **THE PERIPHERAL NERVOUS SYSTEM CAN BE DIVIDED INTO TWO DIVISION:**
  - A. **THE SENSORY DIVISION (AFFERENT)**
  - B. **THE MOTOR DIVISION (EFFERENT)**
3. **THE SENSORY DIVISION TRANSMITS IMPULSES FROM SENSE ORGANS - SUCH AS THE EARS AND TASTE BUDS- TO THE CENTRAL NERVOUS SYSTEM.**
4. **THE MOTOR DIVISION TRANSMITS IMPULSES FROM THE CENTRAL NERVOUS SYSTEM TO THE MUSCLES OR GLANDS (EFFECTORS).**
5. **THE MOTOR DIVISION IS FURTHER INTO:**
  - A. **THE SOMATIC NERVOUS SYSTEM**
  - B. **THE AUTONOMIC NERVOUS SYSTEM.**



### **THE SOMATIC NERVOUS SYSTEM**

1. The Somatic Nervous System regulates activities that **ARE UNDER CONSCIOUS CONTROL**, movement of skeletal muscles.
2. Every time you lift your finger or wiggle your toes, you are using the Motor Neurons of the Somatic Nervous System.

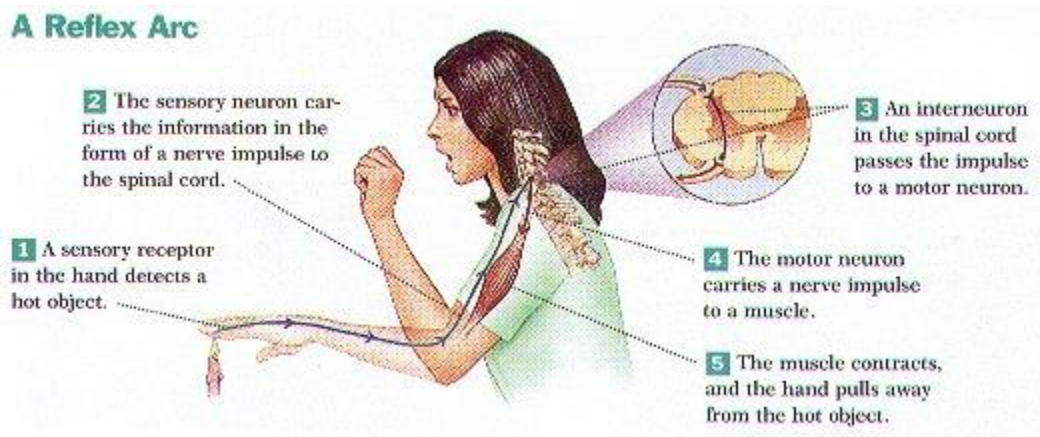
3. Many Nerves within this system are part of reflexes and can act automatically.

4. **A Reflex Sample:**

- A. Step on a tack with your bare foot.
- B. Receptors in the skin stimulated.
- C. The Sensory Neurons carry the impulse to Spinal Cord.
- D. A group of Neurons in the Spinal Cord **AUTOMATICALLY ACTIVATES** Motor Neurons.
- E. These Motor Neurons cause the Muscles (effectors) in your leg to contract, pulling you foot away.

5. Notice that this message did not go to the Brain, but was completed in the Spinal Cord. (REFLEX)

6. THE RECEPTOR, SENSORY NEURON, MOTOR NEURON, AND EFFECTOR THAT ARE INVOLVED IN THIS QUICK RESPONSE ARE TOGETHER KNOWN AS A **REFLEX ARC**.



**THE PATELLAR REFLEX (FIGURE 50-6)**

1. IN THE **PATELLAR REFLEX**, A SENSORY NEURON WITH A RECEPTOR THAT DETECTS STRETCH IN THE QUADRICEPS MUSCLE (UPPER THIGH) SENDS SIGNALS TO THE SPINAL CORD.

2. THIS IMPULSE ACTIVATES A MOTOR NEURON, THAT LEADS BACK TO THE QUADRICEPS MUSCLE (THE EFFECTOR), CAUSING IT TO CONTRACT.

3. THE IMPULSE ALSO ACTIVATES AN INTERNEURON, THAT HAS AN INHIBITORY, OR CALMING, EFFECT ON THE MOTOR NEURONS OF THE HAMSTRINGS IN THE LOWER THIGH.

4. THE CONTRACTION OF THE QUADRICEPS COUPLED WITH THE RELAXATION OF THE HAMSTRING EXTENDS THE LOWER LEG.

**THIS TYPE OF REFLEX IS A TRUE SPINAL REFLEX; THAT IS, IT INVOLVES ONLY NEURONS IN THE BODY AND SPINAL CORD, AND COMPLETELY BYPASSES THE BRAIN.**

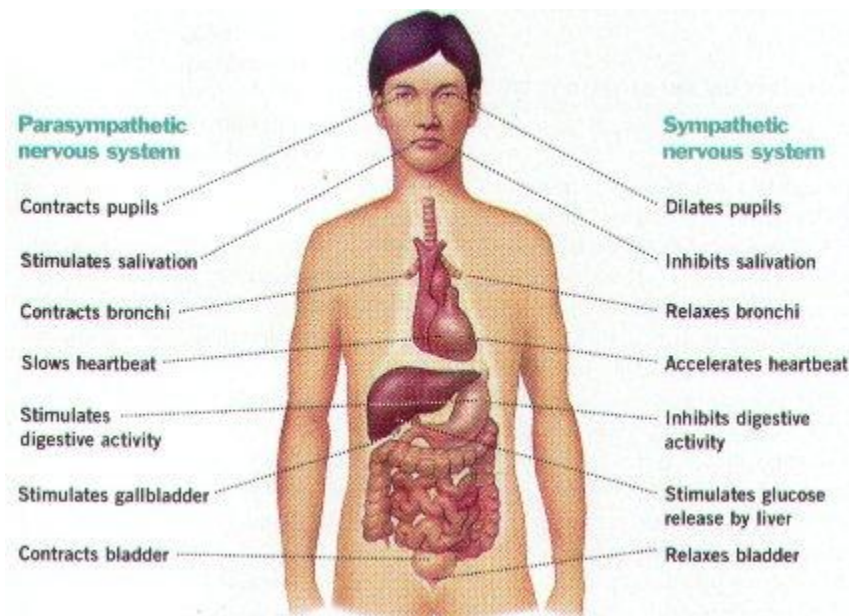
## **THE AUTONOMIC NERVOUS SYSTEM**

1. **THE AUTONOMIC NERVOUS SYSTEM** REGULATES ACTIVITIES THAT ARE AUTOMATIC, OR INVOLUNTARY.

2. The Nerves of the Autonomic Nervous System CONTROL Functions of the body that are NOT UNDER CONSCIOUS CONTROL.

3. The Autonomic Nervous system seems to be concerned with striking a balance or MAINTAINING HOMEOSTASIS IN THE FUNCTIONING OF MANY ORGANS OF THE BODY.

**EXAMPLES:** CONTRACTION IN THE HEART, DIGESTION, HEART RATE, BREATHING, SALIVATION, AND BLADDER.



4. THE AUTONOMIC NERVOUS SYSTEM IS FURTHER SUBDIVIDED INTO TWO PARTS:

A. THE SYMPATHETIC DIVISION

B. THE PARASYMPATHETIC DIVISION

5. The TWO parts have OPPOSITE EFFECTS on the ORGANS they control.

6. Most organs controlled by the Autonomic Division are under control of both Sympathetic and Parasympathetic Neurons.



**EXAMPLE: Heart Rate is SPEEDED UP by the Sympathetic Nervous System, and it is SLOWED DOWN by the Parasympathetic Nervous System.**

7. The Sympathetic Division generally **ACTIVATES ORGANS or SPEEDS UP.**

8. The Parasympathetic Division generally **RETARDS ORGANS or SLOWS DOWN.**