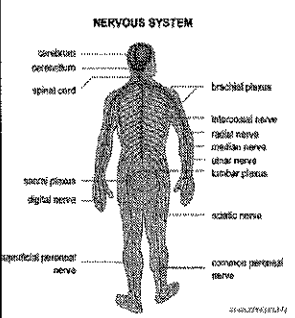


# NERVOUS SYSTEM

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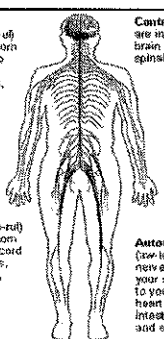
## What is the nervous System?



**NERVOUS SYSTEM**

- Includes the
  - Brain
  - spinal cord
- Sensory neurons
  - are neurons that are activated by sensory input (vision, touch, hearing, etc.)
  - they send projections into the central nervous system that convey sensory information to the brain or spinal cord
- Motor neurons
  - neurons that carries information from the central nervous system to muscle.

**Cranial** (put these up) nerves go from your brain to your eyes, mouth, ears, and other parts of your head.



### CNS v. PNS

**Central** nerves are in your brain and spinal cord.

**Peripheral** (put these up) nerves go from your spinal cord to your arms, hands, legs, and feet.

**Autonomic** (see link NCM-8) nerves go from your spinal cord to your lungs, heart, stomach, intestines, bladder, and sex organs.

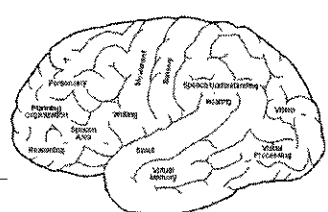
- CNS = central nervous system
- PNS = peripheral nervous system

## THE PERIPHERAL NERVOUS SYSTEM CAN BE BROKEN INTO 2 PARTS: SOMATIC AND AUTONOMIC

- Somatic
  - Usually voluntary
  - To and from skin and skeletal muscles
- Autonomic
  - Usually involuntary
  - To internal organs
  - Sympathetic (controls organs in time of stress)
    - Helps body to maintain homeostasis in a time of stress
    - Ex. Your hr increases during exercise stress
  - Parasympathetic (controls organs normally)
    - Restores body to a resting state (decrease HR after exercise)

## WHAT IS THE FUNCTION OF THE BRAIN?

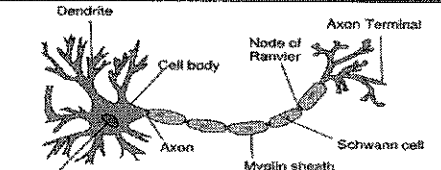
- mediates communication among different parts of the body
- mediates the body's interactions with the environment



## What is the basic unit of the nervous system?

**NEURON**

the basic unit of the nervous system that carries out the body's response to stimuli



### HOW DOES IT WORK?

**NEURON**

- Your dendrites receive an impulse
- The impulse is then conducted to the cell body
- The axon carries the impulse from the cell body to another neuron or muscle

Action potential is another name for a nerve impulse.

An impulse is able to travel down a nerve because it is an electrochemical disturbance.

A neurotransmitter is the chemical that diffuses across a synapse to the dendrites.

### VERTEBRAL SUBLUXATION AND NERVE CHAIN

Vertebrae	Associated Organs
Cervical	Brain, Thyroid, Larynx, Trachea, Esophagus, Heart, Lungs, Liver, Gallbladder, Stomach, Small Intestine, Pancreas, Spleen, Kidney, Adrenal Gland, Bladder, Uterus, Ovary, Testis, Prostate, Penis, Vagina, Rectum, Sigmoid Colon, Descending Colon, Sigmoid Colon, Sigmoid Colon
Thoracic	Heart, Lungs, Liver, Gallbladder, Stomach, Small Intestine, Pancreas, Spleen, Kidney, Adrenal Gland, Bladder, Uterus, Ovary, Testis, Prostate, Penis, Vagina, Rectum, Sigmoid Colon, Descending Colon, Sigmoid Colon, Sigmoid Colon
Lumbar	Heart, Lungs, Liver, Gallbladder, Stomach, Small Intestine, Pancreas, Spleen, Kidney, Adrenal Gland, Bladder, Uterus, Ovary, Testis, Prostate, Penis, Vagina, Rectum, Sigmoid Colon, Descending Colon, Sigmoid Colon, Sigmoid Colon
Sacral	Heart, Lungs, Liver, Gallbladder, Stomach, Small Intestine, Pancreas, Spleen, Kidney, Adrenal Gland, Bladder, Uterus, Ovary, Testis, Prostate, Penis, Vagina, Rectum, Sigmoid Colon, Descending Colon, Sigmoid Colon, Sigmoid Colon
Coccyx	Heart, Lungs, Liver, Gallbladder, Stomach, Small Intestine, Pancreas, Spleen, Kidney, Adrenal Gland, Bladder, Uterus, Ovary, Testis, Prostate, Penis, Vagina, Rectum, Sigmoid Colon, Descending Colon, Sigmoid Colon, Sigmoid Colon

### Acupuncture

Acupuncture is among the oldest healing practices in the world. A part of traditional Chinese medicine, a complex medical system that originated in China, it is based on the concept that energy flows through a network of energy channels in the body called meridians. The flow of energy is believed to be disrupted by illness. Practitioners use thin needles to stimulate the meridians and restore the flow of energy. Acupuncture is the insertion of specific needles into the body at specific points called acupoints. It is a form of complementary and alternative medicine. Acupuncture is used to treat a wide variety of conditions, including pain, stress, and anxiety. It is also used to prevent illness and maintain health. Acupuncture is a safe and effective treatment for many conditions. It is a part of traditional Chinese medicine. Complementary medicine is used together with conventional medicine. Acupuncture is used as a part of complementary medicine (CAM).

### Reflexology..

**RIGHT FOOT**

**LEFT FOOT**

- Reflexology is a non-invasive complementary modality involving the use of alternating pressure applied to the reflexes within the reflex maps of the body located on the feet, hands

- Nervous system helps to send messages throughout our body
- How else does our body communicate?
  - Cells?

## Cell Communication

Communication between cells is necessary for the coordination of body systems.

**(a) Local signaling**

- Paracrine signaling:** Local regulator diffuses through extracellular fluid. A secreting cell releases secretory vesicles that release signaling molecules near a target cell.
- Synaptic signaling:** Neurotransmitter diffuses across a synapse. A nerve cell releases neurotransmitters into a synaptic cleft, which then bind to receptors on another nerve cell.

**(b) Long distance (hormonal) signaling**

- An endocrine cell releases hormones into the bloodstream. The hormones travel through the blood to reach a target cell.

## Direct Communication

Cells must be next to each other to communicate directly. This is done by signaling molecules that pass between cells.

**(a) Cell-to-cell communication:** Gap junctions between animal cells and plasmodesmata between plant cells allow for direct passage of signaling molecules.

**(b) Cell-cell recognition:** Receptor proteins on the plasma membrane recognize signaling molecules from other cells.

## Neurons

Neurons are communication cells. Neurons: Neuron, Local signaling.

**Neuron:** An electrical signal travels down the axon. At the synapse, neurotransmitter molecules are released and bind to receptors on the target cell.

## Hormones

Hormones assist with long distance communication. They are in circulatory (blood or lymph) system.

**Hormones:** Released from an endocrine gland, hormones travel through the circulatory system to reach target cells. The hormone binds to a specific receptor on the target cell, initiating a response.

Note the importance of receptors!!!

## How was your nervous, muscular and skeletal system relate to your reaction time?

The diagram shows a stimulus (a hammer hitting a nail) being detected by a receptor (nerve ending in the hand). The signal travels through a sensory neuron to the spinal cord, where it meets an interneuron. The signal then travels through a motor neuron to an effector (a muscle), which contracts to pull the hand away.

```

    graph LR
      Stimulus[stimulus  
external stimulus  
internal stimuli] --> Receptor[receptor  
cell or organ]
      Receptor --> SensoryNeuron[sensory  
neuron]
      SensoryNeuron --> Coordinator[coordinator  
brain or spinal cord  
(interneuron)]
      Coordinator --> MotorNeuron[motor  
neuron]
      MotorNeuron --> Effector[effector  
muscles or  
glands]
      Effector --> Response[response  
movement, secretion,  
behaviour]
  
```

- In a simple reflex arc, such as the knee jerk, a stimulus is detected by a receptor cell, which synapses with a sensory neuron.
- The sensory neuron carries the impulse from site of the stimulus to the central nervous system (the brain or spinal cord), where it synapses with an interneuron. The interneuron synapses with a motor neuron, which carries the nerve impulse out to an effector, such as a muscle, which responds by contracting.

# Muscular/Skeletal System

9<sup>th</sup> grade Biology

## Muscular Skeletal System

- Responsible for movement, a major characteristic of animals
  - Muscles contract
  - Movement transmitted by skeleton

## Endoskeleton

- Made up of bones and/or cartilage
  - Types of connective tissues
- Muscles outside of endoskeleton
- Sharks have cartilaginous skeletons
- In some vertebrates, embryonic cartilage replaced by bone as they mature
- Humans have cartilage in joints & flexible structures: ribs, trachea, nose, ears

## Our Bones – 206!

Labels include: skull, clavicle, sternum, rib, liver, vertebrae, pelvis, sacrum, femur, tibia, fibula, and foot.

## Bone Structure

- Bones: composite material, mostly calcium phosphate
  - Support body structures
  - Protect internal organs
  - Facilitate movement (with muscles)
- Compact bone (outer layer)
- Cancellous (spongy) bone (inner layer)

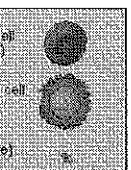
## Bones & Blood


- Bone marrow: soft tissue inside bones; produce 3 types of blood cells
  - Red blood cells (carry oxygen)
  - White blood cells (fight disease)
  - Platelets (clotting)

Red blood cell (erythrocyte)

White blood cell (leucocyte)

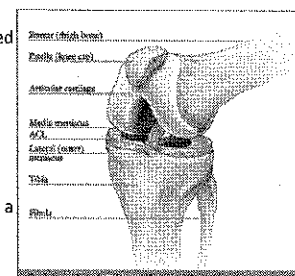
Platelet (thrombocyte)





## Bone Helpers

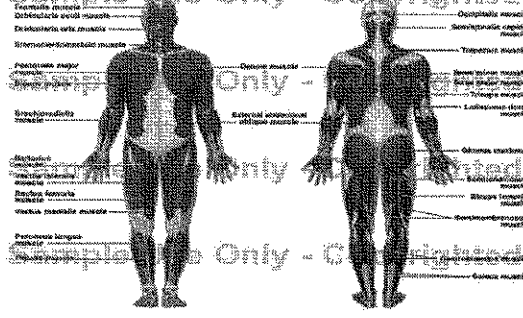
- Cartilage: chondrocytes in a firm, gel-like substance called a matrix
  - Provide a framework upon which bone deposition can begin
- Ligaments: connect two bones
  - ACL in your knee
- Tendons: connect a bone to a muscle
  - Achilles tendon in your ankle



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## Our Muscles

### Anatomy of the Muscular System



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## Types of Muscles

- Skeletal (striated) muscle
  - Attached to bones
  - Responsible for movement
  - Controlled by somatic nervous system → under voluntary control
- Smooth muscle
  - Found in walls of hollow internal organs (blood vessels, stomach, intestines, bladder, uterus)
  - Controlled by autonomic nervous system → acts involuntarily
- Cardiac muscle
  - Found in the walls of the heart
  - Controlled by autonomic nervous system → contractions are involuntary, strong, and rhythmic

Three Types of Human Muscle Tissue

