

# TEAS 6 Science by Kelly (Anatomy and Physiology) | GUARANTEED PASS 100%.

written by

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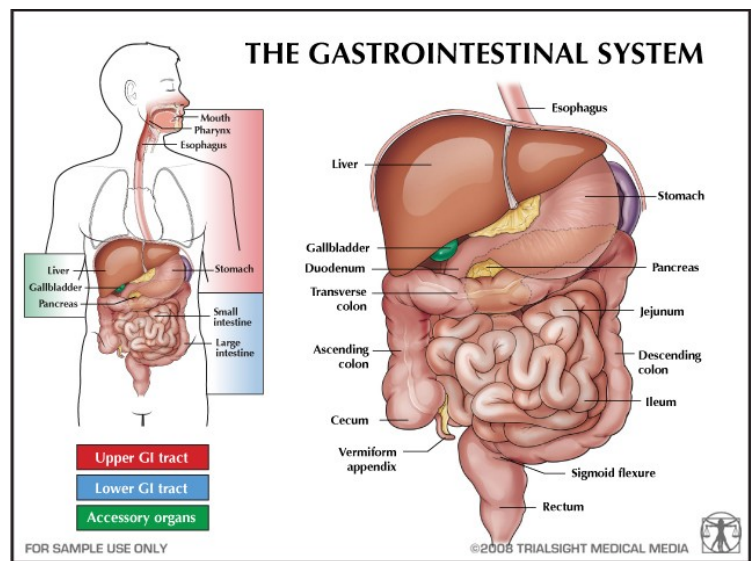
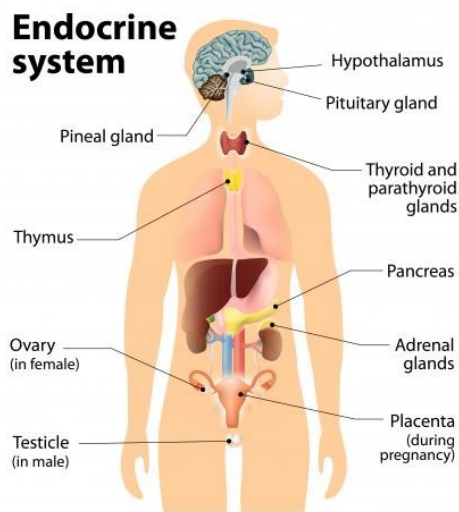
# ANATOMY AND PHYSIOLOGY

## Endocrine System

Gland/Organ	Hormone Secreted	Function
Hypothalamus	Releasing/Inhibiting hormones	Stimulate Pituitary
Anterior Pituitary (base of brain; controls growth and development)	Adrenocorticotrophic Hormone (ACTH)	Stimulate adrenal cortex to secrete glucocorticoids
	Thyroid Stimulating Hormone (TSH)	Stimulate the Thyroid gland
	Follicle Stimulating Hormone (FSH)	Stimulates production of ova (females) and sperm (males)
	Luteinizing Hormone (LH)	Stimulates Ovaries (females) and Testes (males)
	Prolactin	Stimulates milk production
	Growth Hormone (GH)	Stimulates growth (bones) and metabolic functions
Posterior Pituitary (back of anterior pituitary)	Antidiuretic Hormone (ADH)	Promotes retention of water by the kidneys
	Oxytocin	Stimulates contraction of uterus and mammary gland cells
Pineal Gland (center of brain)	Melatonin	Sleep cycles; biorhythms
Thyroid (neck; hormones regulate growth, development, and metabolism)	Triiodothyronine (T3)	Metabolism
	Thyroxine (T4)	Metabolism and temperature
	Calcitonin	Inhibits release of Calcium from bones
Parathyroid (4 glands on Thyroid)	Parathyroid Hormone (PTH)	Stimulates release of calcium from bones, back into blood.
Thymus (lymphoid organ that produces T-Cells)	Thymosin	Stimulates T-Cell Development
Adrenal Glands (Above Kidneys; regulate HR, BP, and other functions)	See below	See below
Adrenal Cortex (stimulates fight or flight response)	Cortisol/Glucocorticoids	Stress response; Increase blood glucose, Decrease immune response; metabolism
	Aldosterone	Regulates Na content in blood
Adrenal Medulla (stimulates fight or flight response)	Epinephrine	Fight
	Norepinephrine	Flight
Ovaries (female gonads)	Estrogen	Stimulates egg maturation, controls 2 <sup>ndary</sup> sex characteristics
	Progesterone	Prepares uterus to receive fertilized egg
Testes (male gonads)	Testosterone	Regulates sperm production and 2 <sup>ndary</sup> sex characteristics
Kidneys	Erythropoietin	Response to cellular hypoxia
	Renin	Promotes production of Angiotensin
Liver	Angiotensin II	Vasoconstriction, Increase BP
Pancreas	Glucagon (Alpha Cells)	Increase blood glucose
	Insulin (Beta Cells)	Decrease blood glucose
Stomach	Gastrin	Response to food; stimulates production of gastric juices
Intestine	Secretin	Response to acidity in small intestine; stimulates secretion by liver and pancreas
	Cholecystokinin	Production of Bile Salts

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Heart	Atrial Natriuretic Peptide (ANP)	Increase renal Na excretion, decrease ECF
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## Gastrointestinal System

	Enzyme	Production site	Release site
Carbs	Salivary Amylase	Salivary Glands	Mouth
	Pancreatic Amylase	Pancreas	Small Intestine
	Maltase	Small Intestine	Small Intestine
Protein	Pepsin	Chief Cells (gastric gland)	Stomach
	Trypsin	Pancreas	Small Intestine
	Peptidases	Small Intestine	Small Intestine
Nucleic Acids	Nuclease	Pancreas	Small Intestine
	Nucleosidase	Pancreas	Small Intestine
Lipids	Lipase	Pancreas	Small Intestine
	Bile Salt	Liver & Gallbladder	Small Intestine

\*Bile is technically not an enzyme, but a salt that emulsifies lipid into fatty droplets.

Chief Cells: Covert pepsinogen to pepsin

Goblet Cells: Mucus secretions

Parietal Cells: HCl production

Peyer's Patches: Lymphatic Tissue found in Ileum to protect GI tract from pathogens

## Integumentary System

**Epidermis**: Most superficial layer of skin; entirely epithelial cells

- Does NOT contain blood vessels
- 5 layers
  - o Stratum Corneum: "Top Layer"- Dead keratinocytes
  - o Stratum Lucidum: "Clear Layer"- Colorless protein eleidin
  - o Stratum Granulosum: "Thin Layer"- granular layer
  - o Stratum Spinosum: "Spiny Layer"- Thickest layer, keratinocytes, immune dendritic cells, sensory cells

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- o Stratum Basale: "Basal Layer"- Bottom layer; contains melanocytes.

**Dermis:** Directly below epidermis; mostly connective tissue

- Contains blood vessels
- Sensory receptors
- Hair follicles
- Sebaceous glands
- Sweat glands
- Elastin and Collagen fibers

**Hypodermis/SubQ:** Connective tissue

- Binds the skin to underlying muscle
- Fat deposits cushion and insulate the body

### Glands

**Exocrine:** Secrete substances into ducts

- **Holocrine:** secretory products; whole cells; connected to hair follicle
  - o Sebaceous Glands: secrete sebum: an oily mixture of lipids and proteins; waterproofs skin, protects from pathogens
- **Eccrine:** Not connected to hair follicle, activated by high body temperature, located throughout the body. A type of sweat gland (sudoriferous gland) in thermoregulation.
  - o Secrete a salty solution of electrolytes and water
    - NaCl
    - $\text{KHCO}_3$
    - Glucose
    - Antimicrobial Peptides
- **Apocrine:** Secrete an oily solution (fatty acids, triglycerides, and proteins)
  - o Located in:
    - Armpits
    - Groin
    - Palms
    - Soles of feet
  - o Secrete (sweat) during anxiety or stress
  - o Body Odor forms from bacteria feeding on apocrine sweat

## Urinary System

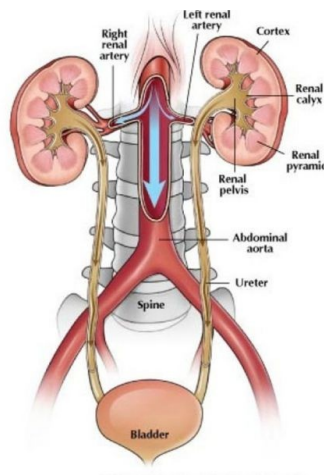
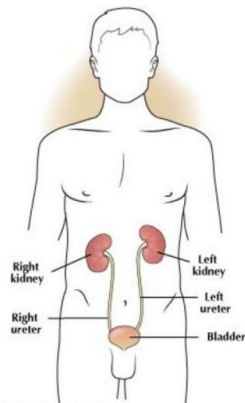
**Kidney (2):** Regulates fluid balance and filters waste from blood

- Receive blood from renal artery (extension of aorta)
- Filter blood
- Reabsorb need materials
- Excrete waste and water via urine
  - Renal Cortex: Outer Layer

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- o Contains ~1 million Nephrons (filters)
- o Glomerulus: Capillary in nephron
- o Bowman's Capsule: encapsulates the glomerulus
- Renal Medulla: Middle Layer
  - o Proximal Convoluted Tubule: Water, glucose, ions, and other organic molecules are reabsorbed back into the blood stream.
  - o Distal Convoluted Tubule: Urea and drugs are removed from blood. pH in blood is adjusted with  $H^+$  ions.
- Renal Pelvis: Inner Layer
  - o Materials arrive as urine from distal convoluted tubule.

### URINARY SYSTEM ANATOMY

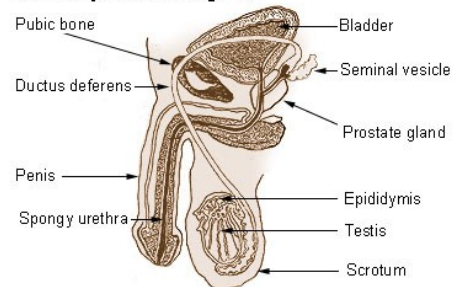


## Reproductive System

### MALES

- Produce, maintain, and transfer sperm and semen into the female reproductive tract.
- Produce and secrete male hormones.

### Male Reproductive System



### External Organs: Penis, Scrotum, Testes

- Scrotum: Protects testes; keeps optimal temperature for spermatogenesis.
- Testes: Male gonads; produce sperm and testosterone.

### Internal Organs: Epididymis, Vas Deferens, Ejaculatory Ducts, Urethra, Seminal Vesicles, and Bulbourethral glands

- Epididymis: Stores sperm as it matures
- Vas Deferens: Mature sperm move from epididymis to Vas Deferens to the ejaculatory duct
- Seminal Vesicles: Secrete alkaline fluids with protein and mucus into ejaculatory duct
- Prostate Gland: Secrete a milky white fluid with proteins and enzymes as part of semen
- Bulbourethral (Cowper's) Gland: Secrete a fluid to neutralize the acidity in the urethra

### Hormones

## TEAS 6 Science

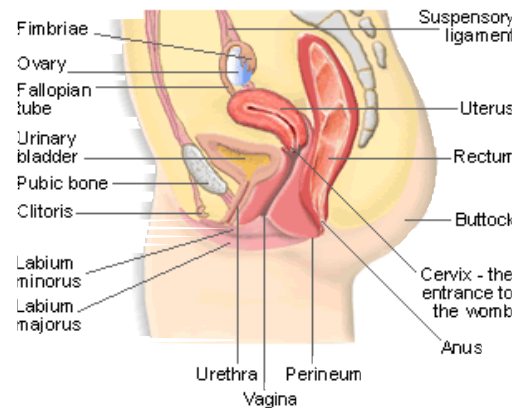
- FSH: Stimulates spermatogenesis
- LH: Stimulates testosterone production
- Testosterone: Male sex characteristics

### **FEMALES**

- Produce ova (oocytes/egg cells)
- Transfer ova to fallopian tubes for fertilization
- Receive sperm from male
- Provide a protective, nourishing environment for developing embryo

**External Organs:** Labia Majora, Labia Minora, Bartholin's Glands, Clitoris

- Labia (both): Close and protect vagina
- Bartholin's Gland: Secrete lubricating fluid
- Clitoris: Contains erectile tissue and nerve endings for sensual pleasure



**Internal Organs:** Ovaries, Fallopian Tubes, Uterus, Vagina

- Ovaries: Female gonads; produce ova, and secrete estrogen and progesterone
- Fallopian Tubes: Carry mature egg toward uterus; site of fertilization
- Uterus: Fertilized egg implants on uterine wall; protects and nourishes developing embryo until birth
- Vagina: Muscular tube from cervix to outside of body; receives semen, is site of intercourse, and birth canal

### **Hormones**

- Estrogen: Stimulates egg maturation; female sex characteristics
- Progesterone: Prepares uterus to receive fertilized egg
- FSH: Stimulates oogenesis
- LH: Stimulates estrogen production
- Oxytocin: Stimulates contraction of uterus and mammary gland cells
- Prolactin: Stimulates milk production

### **Immune System**

Function: Protects the body against invading pathogens including bacteria, viruses, fungi, and protists.

Lymphatic System: Lymph, lymph capillaries, lymph vessels, lymph nodes.

- Skeletal muscle contractions move the lymph one way through the lymphatic system to lymphatic ducts
  - Dump back into venous supply via lymph nodes
- Red marrow- produces blood cells
- Leukocytes- WBC

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Lymph Nodes: located in neck, armpit, and groin

- Small swellings in the lymphatic system where lymph is filtered and lymphocytes are formed

Lymph Tissue: Tonsils, adenoids, thymus, spleen, peyer's patches

- Tonsils: Located in pharynx
  - Protect against pathogens entering via mouth or throat
- Thymus: Maturation chamber for immune T Cells formed in bone marrow
- Spleen: Cleans blood of dead cells and pathogens
- Peyer's Patches: Located in ileum of Sm. Intestine.
  - Protects GI tract from pathogens

### General Immune Defenses

- Skin: Primary barrier (intact)
- Ciliated Mucous Membranes: Cilia protect respiratory system
- Glandular Secretions: Exocrine- destroy bacteria
- Gastric Secretions: Gastric Acid destroys pathogens
- Normal Bacterial Populations: Compete with pathogens in gut and vagina

### 3 Types of WBC

- Macrophage: Phagocytes that alert T-Cells to the presence of foreign substances
  - Largest, longest living phagocyte
  - Engulf and destroy pathogens
  - Found in lymph
- T Lymphocytes: Directly attack cells infected by viruses and bacteria
  - Helper T, Killer T, Memory T, Suppressor T
- B Lymphocytes: Target specific bacteria for destruction
  - Plasma Cells: Antibody production.

### Other Immune Cells

- Helper T-Cells: Activate **B-Cells** to make **Antibodies** and other chemicals
- Suppressor T-Cells: Stop other T-Cells when the battle is over
- Memory T-Cells: Remain in blood on alert incase invader attacks again
- Killer/Cytotoxic T-Cells: Destroy Cells infected with a pathogen, virus, or tumor

Leukocytes: WBC- Produced in Red Marrow

- Monocyte
  - Macrophage
  - Dendritic Cell: Present antigens to T Cell
- Granulocyte
  - Neutrophil: Short living phagocyte; responds quick to invaders
  - Basophil: Alerts body of invasion
  - Eosinophil: Large, long living phagocyte; Defend against multicellular invaders
- T Lymphocyte

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- B Lymphocyte
- Natural Killer Cell

Antibody Mediated Response: Response is to an antigen

Cellular Mediated Response: Response is to an already infected cell

Antigen: Foreign particle that stimulates the immune system

- Typically a protein on the surface of bacteria, virus, or fungi

Antibody: A blood protein that counteracts a specific antigen

### Steps of Immune System

1. Macrophage engulfs antigen and presents fragments of antigen on its surface
2. A Helper T Cell joins the Macrophage
3. Killer/Cytotoxic T Cells and B Cells are activated
4. Killer/Cytotoxic T Cells search and destroy cells presenting the same antigen
5. B Cells differentiate into Plasma Cells and Memory Cells

### Innate Immune System

- Born with it
- Non Specific response
- EX) Skin, hair, mucus, earwax, secretions, normal flora, antimicrobials, inflammation, interferons, complement, NK Lymphocytes, phagocytes

### Adaptive Immune System

- Responds to specific antigens
- Vaccinations or previous encounters
  - o Reaction: Cytotoxic T Cells kill pathogen
  - o Prevention: B Cells produce Antibodies
- Activated by Antigen and Helper T Cells
- Helper T Cells activated by Antigen Presenting Cells (APC)

Naturally Acquired Active Immunity: Exposure to pathogen without immunization

Naturally Acquired Passive Immunity: Occurs during pregnancy and during breast feeding

- Antibodies are passed from mother to child
- Provides protection from infancy to childhood

Artificially Acquired Active Immunity: Build immunity via Vaccination

Artificially Acquired Passive Immunity: Immunization given during an outbreak or emergency

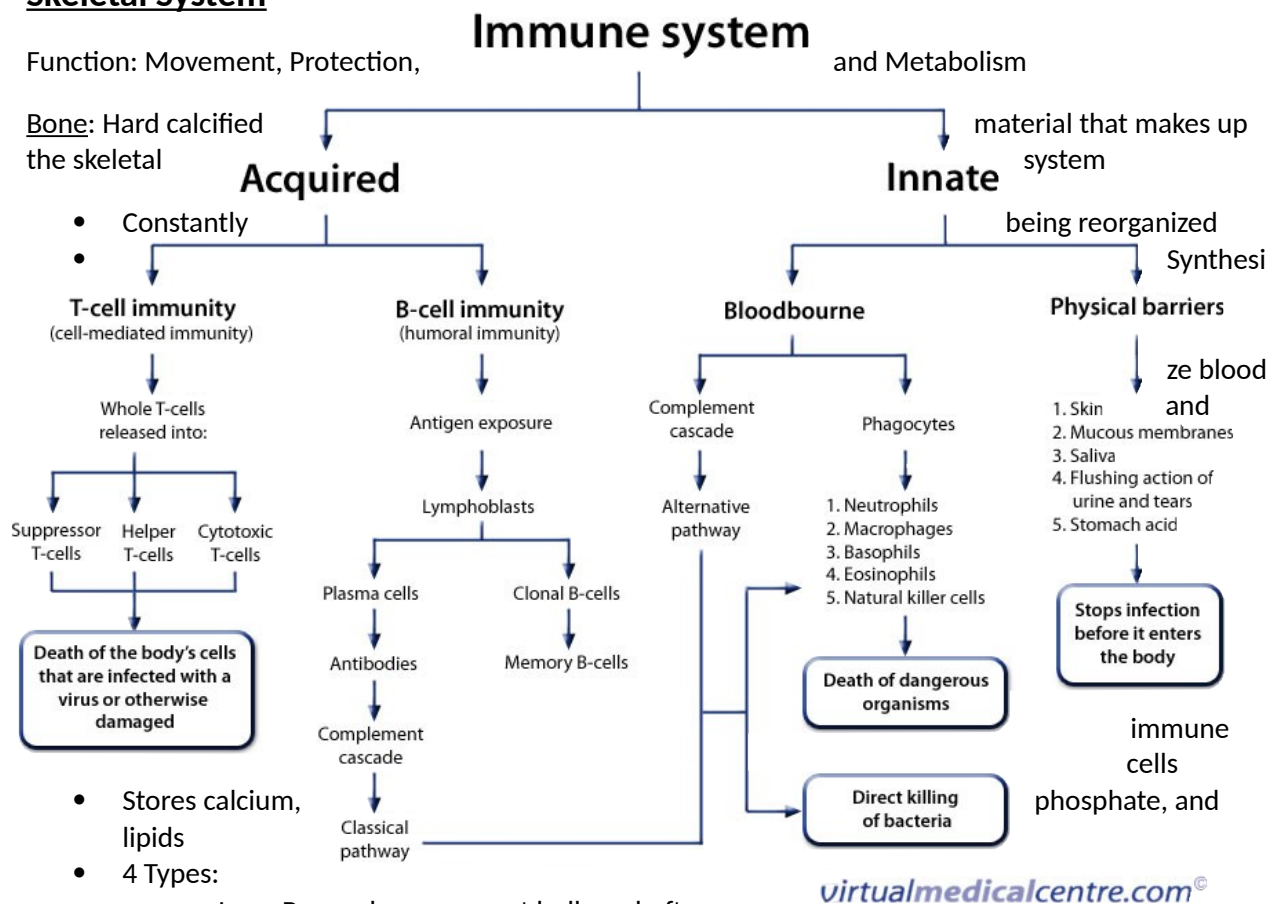
- Quick, short lived protection
- Antibodies come from another person or animal

## Skeletal System

Function: Movement, Protection,

and Metabolism

**Bone:** Hard calcified material that makes up the skeletal system



- Stores calcium, lipids
- 4 Types:

- o **Long Bones:** long compact hollow shafts containing marrow
  - Ends are spongy with air pockets
  - EX) Humerus, Ulna, Radius, Tibia, Fibula
- o **Short Bones:** Wider than they are long
  - EX) Metatarsals, Clavicle
- o **Flat Bones:** Not hollow, but contain marrow
  - EX) Scapula, Ribs, Sternum
- o **Irregular Bones:** Nonsymmetrical shape
  - EX) Skull, Knee, Elbow, Vertebra

**Ligament:** Articulates BONE to BONE

**Tendon:** Articulates MUSCLE to BONE

**Hyaline Cartilage:** Covers articulating surface of bones

- Prevents bone on bone grinding

## TEAS 6 Science

Synovial Joint: Contain lubricating synovial fluid

- **Pivot Joint**: Neck
- **Ball and Socket Joint**: Hip
- **Hinge Joint**: Knee

Osteocytes: Bone Cells

- Osteoclast: Multinucleate
  - Removes/absorbs bone tissue during growth and healing
- Osteoblast: Mononucleate
  - Cells that build bone

Periosteum: Fibrous sheath that covers bone and contains nerve and blood vessels

Osteon: Cylindrical structure that comprise, synthesize, and compact bone

- Composed of Calcium and phosphate rich Hydroxyapatite embedded in collagen matrix

Collagen: Primary structural protein of connective tissue

Canaliculi: Small channel or duct in ossified bone

Cartilage: Tough, elastic connective tissue found in parts of the body (Ear)

Haversian Canal: Channels in bone that contain BV and Nerves

Lamellae: Layers of the bone, tissues, or cell walls

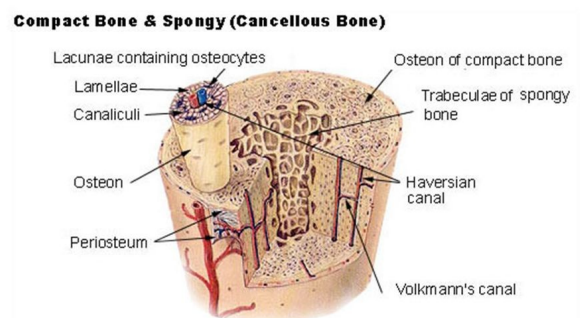
Lining Cells: Flattened bone cells that come from osteoblasts

Volkman Canal: Channels in bone that transmit BV and communicate with Haversian Canals

### Bone Disease

- Osteoporosis: causes brittle, fragile bones
- Brittle Bone Disease: Group of Diseases that affect the collagen (defect in the matrix) and results in fragile bones
- Osteoarthritis: Degenerative joint disease
- Rheumatoid Arthritis: Progressive disease the causes joint inflammation and pain

## Cross section of bone



## Cardiovascular/Circulatory System

Function: Movement of blood and lymph around the body, which permits nutrient distribution, waste removal, communication, and protection

## TEAS 6 Science

- Closed Double loop system
  - Pulmonary Loop: Deoxygenated blood from Rt. Ventricle to lungs and returns Oxygenated blood to Lt. Atrium
  - Systemic Loop: Oxygenated blood from Lt. Ventricle to body, returning Deoxygenated blood to Rt. Atrium
- Systole: Contraction of ventricles (heart expels blood)
- Diastole: Relaxation of ventricles (heart refills with blood)
- SA Node: "Pacemaker" controls contractions via electrical signals
- Blood Pressure: Fluid pressure generated by cardiac cycle (sys/dias)

**Artery:** Blood vessel that carries blood AWAY from heart

- Aorta: large artery branching off heart to the rest of the body
  - Coronary Artery
  - Carotid Artery
  - Subclavian Artery
  - Common Iliac Artery
  - Renal Artery

**Vein:** Blood vessel that carries blood TO the heart

- Vena Cava- All veins empty here prior to entering the heart
  - Jugular Vein
  - Subclavian Vein
  - Hepatic Portal Vein
  - Common Iliac Vein
  - Renal Vein

**Arteriole:** Small artery

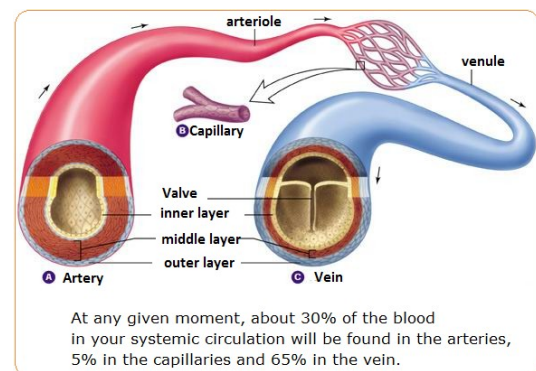
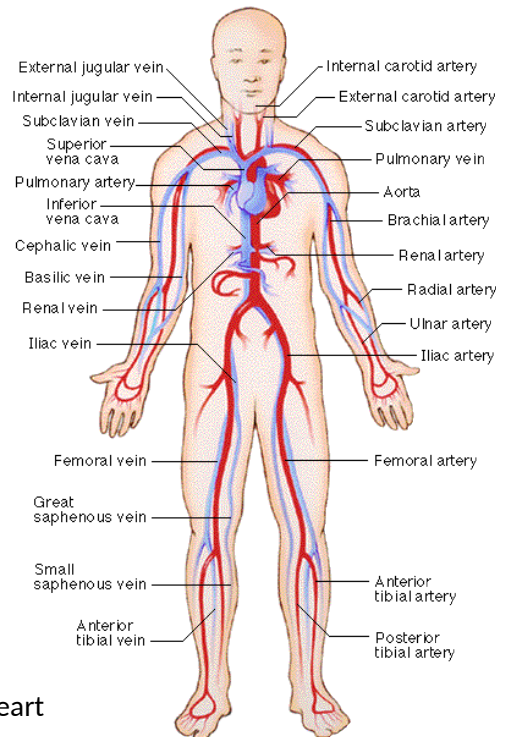
**Venule:** Small vein

**Capillary:** Small blood vessel that connects arterioles to venules

**Heart:** Muscle that pumps blood throughout the body

**Blood:** The red liquid that circulates in the arteries and veins

- Carries oxygen to and carbon dioxide from the tissues of the body.
- 4 Main Components:
  - RBC: Disc shaped cells that carry Hemoglobin and O<sub>2</sub>
  - WBC: Immune defense
  - Platelets: Clotting cells
  - Plasma: Liquid portion of blood (mostly water)



## TEAS 6 Science

### Disease:

Myocardial Infarction: Heart attack; Death of the heart muscle due to inadequate blood supply

Stroke: "Brain Attack." Damage to the brain due to inadequate blood supply

Aneurysm: Localized abnormal, weak spot on a blood vessel wall that causes an outward bulging, likened to a bubble or balloon. Hemorrhage occurs when it bursts.

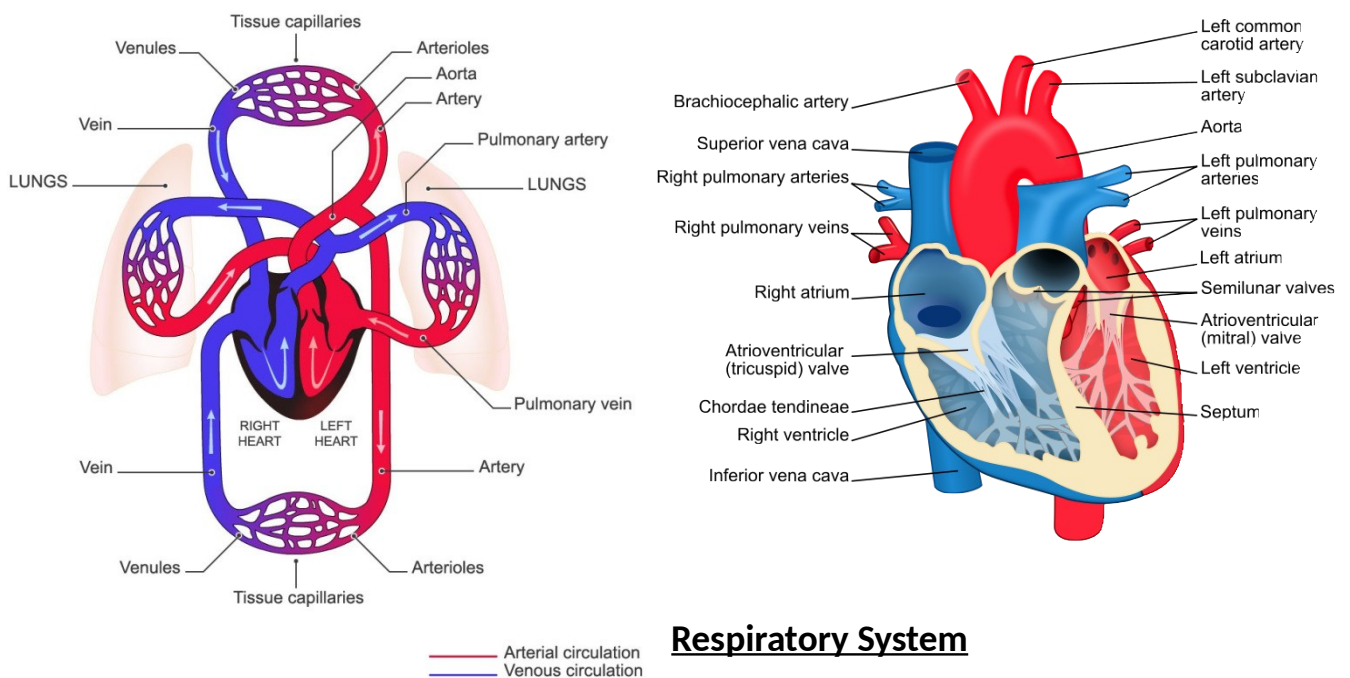
Atherosclerosis: Narrowing of arteries due to plaque buildup on artery walls

Anemia: Not enough healthy RBC

Arrhythmia: Abnormal heart rhythm

- Tachycardia: Too fast
- Bradycardia: Too slow

Hypertension: High blood pressure. Systole is over 140 mmHg; Diastole is over 90 mmHg



### Respiratory System

Function: transporting O<sub>2</sub> from the atmosphere into the body's cells and moving CO<sub>2</sub> in the other direction.

Lungs: 5 Lobes (2 left, 3 right). Main structure of respiratory system.

## TEAS 6 Science

**Alveoli:** Tiny air sacs; site of O<sub>2</sub> and CO<sub>2</sub> exchange.

- Occurs by diffusion (passive transport)

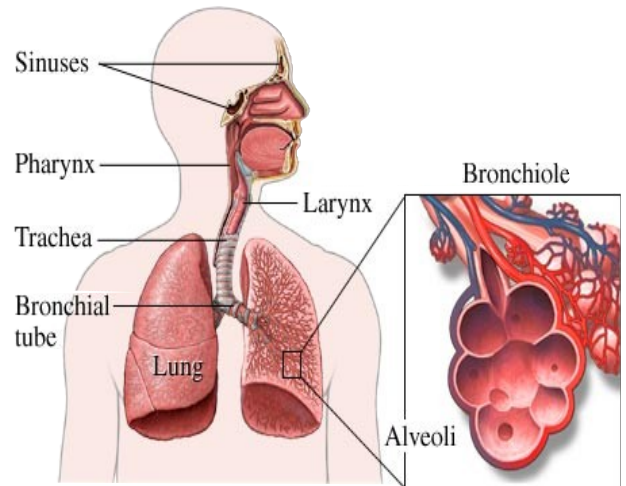
**Bronchi:** The main passageways directly attached to the lungs

**Bronchiole:** Small passages that connect bronchi to alveoli

**Trachea:** Windpipe, connects Larynx to lungs

**Larynx:** Voice box

**Pharynx:** Located behind mouth, also part of GI system



**Diaphragm:** Dome-shaped sheet of muscle and tendon that serves as the main muscle of respiration and plays a vital role in the breathing process

**Pleura:** Membrane around lungs, inside chest cavity

**Perfusion:** Passage of fluid to an organ or tissue

**Surfactant:** A fluid secreted by alveoli; reduces surface tension- Prevent lung collapse

**Tidal Volume:** The amount of air breathed in a normal inhalation or exhalation

**Ventilation:** Movement of air in and out of body via inhalation and exhalation

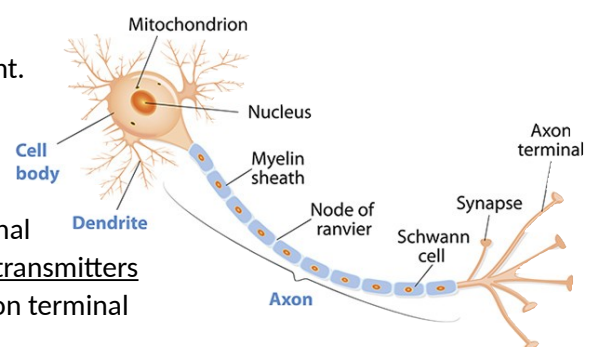
- Inhalation: Diaphragm contracts downward, ribs push out, lungs fill with air
- Exhalation: Diaphragm relaxes upward, ribs relax, air pushes out
- Hyperventilation: More CO<sub>2</sub> than the body can produce (breathing out more than in)
- Hypoventilation: Breathing at an abnormally slow rate, resulting in an increased amount of carbon dioxide in the blood

## Neuromuscular System

**Function:** Controls voluntary and involuntary movement.

**Nerve:** Long bundles of axons that transmit signals from the CNS

- Electrical impulse from dendrite to axon terminal
  - Transmitted from cell to cell via **neurotransmitters** secreted into the synapse from the axon terminal



**Synapse:** The structure that allows neurons to pass signals to other neurons, muscles, or glands

**Neurotransmitter:** A chemical substance that is released from the **AXON TERMINAL** by the arrival of a nerve impulse

- Diffuses across the **SYNAPSE**,

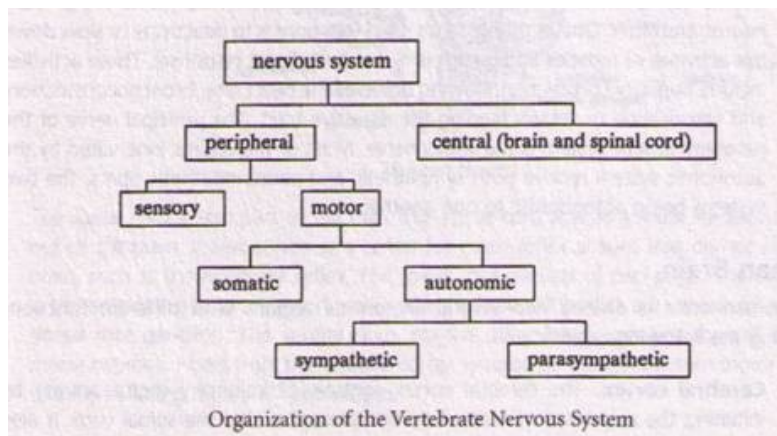
## TEAS 6 Science

- causes the transfer of the impulse to another nerve fiber, a muscle fiber, or some other structure at the **DENDRITE** of the other cell
  - Acetylcholine**: NT; causes muscle to contract
  - Dopamine**: NT; precursor to epinephrine

Central NS: Brain and Spinal Cord

Peripheral NS:

- Sensory NS: AFFERENT; send messages TO CNS
- Motor NS: EFFERENT; send messages TO MUSCLES
  - Somatic NS: Carries information to CNS from senses, and from CNS to skeletal muscles
  - Autonomic NS: Involuntary; controls actions involving cardiac and smooth muscle
    - Sympathetic NS: Arouses body; FIGHT or FLIGHT
    - Parasympathetic NS: Calms body; Rest and Digest



Brain: Control center

- 4 Lobes
  - Frontal Lobe: thinking, organizing, emotions, behavior, personality
  - Parietal Lobe: perception, making sense, arithmetic, spelling
  - Temporal: memory, understanding, language
  - Occipital: vision

## Brain Anatomy

Cerebellum: Balance and coordination

Cerebrum: Anterior brain

## TEAS 6 Science

Pons: Brainstem that links medulla and thalamus

Medulla Oblongata: Control center for heart and lungs

Brainstem: Contains the Pons, Medulla Oblongata, Midbrain

Midbrain: Develops from the middle of the embryonic brain

Thalamus: Relays sensory information; pain perception

Hippocampus: Emotion, memory, ANS

Amygdala: Emotions

## MUSCLES

Myosin: THICK FILAMENT; fibrous protein; forms the contractile filaments of muscle cells

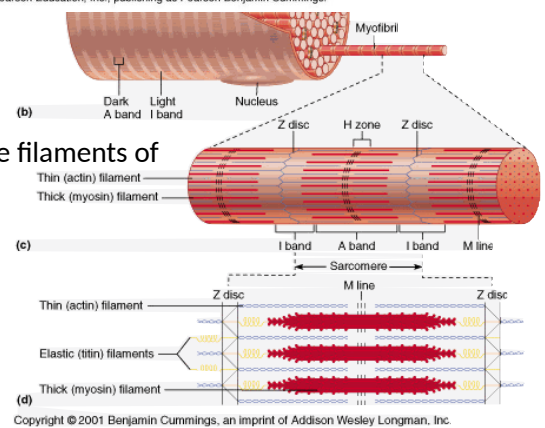
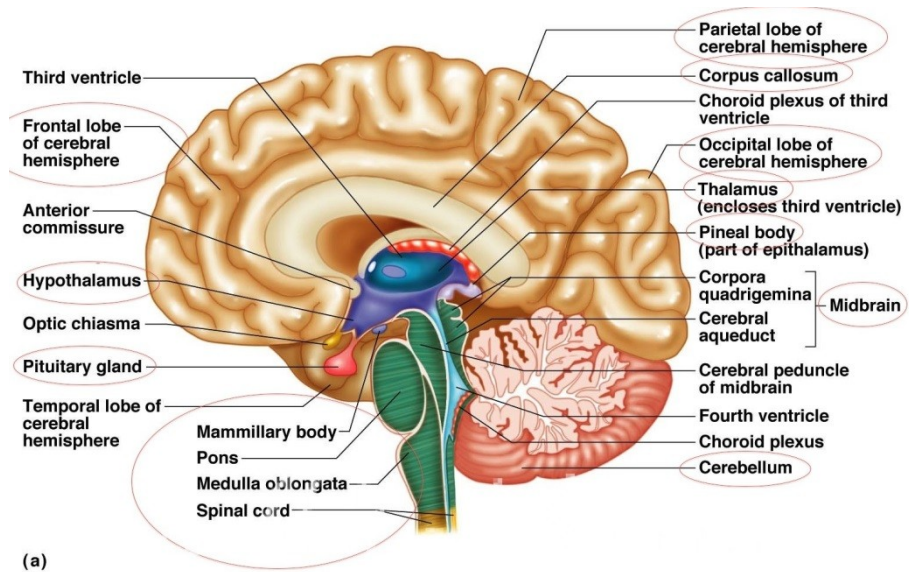
Actin: THIN FILAMENT; protein involved in motion; works with myosin

Sarcomere: Myofibril containing myosin and actin

Smooth Muscle: Involuntary muscle, not striated

- Stomach, lung, intestine...

Striated Muscle: Voluntary muscle; striated



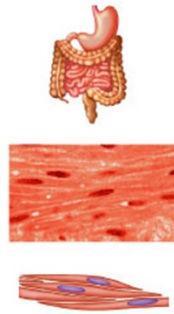
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- Biceps, triceps, gluteus maximus...

Cardiac Muscle: Involuntary muscle; striated

- Heart

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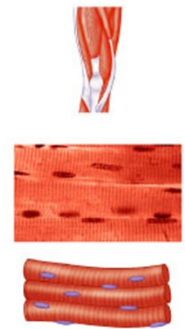
### Smooth muscle

- has spindle-shaped, nonstriated uninucleated fibers.
- occurs in walls of internal organs.
- is involuntary.



### Cardiac muscle

- has striated, branched, uninucleated fibers.
- occurs in walls of heart.
- is involuntary.



### Skeletal muscle

- has striated, tubular, multinucleated fibers.
- is usually attached to skeleton.
- is voluntary.

## BIOLOGY

### Macromolecules:

Carbohydrate, Lipid, Nucleic Acid, Protein, Enzyme

Carbohydrate: Sugars and starches which body breaks down to glucose

- Structural function: cellulose and chitin
- Energy storage: amylose, amylopectin, glycogen
- Recognition molecules: glycoproteins and glycolipids

Lipids: Fatty acids and their derivatives that are soluble in water

- H and C and main components
- Fats
- Hydrophobic- thus help separate aqueous compartments
- Store energy (fats, oils, adipose)

Protein: Molecules composed of amino acids joined by peptide bonds

- Monomer: amino acids (amino group + carboxylic acid)(20 types)
- Keratin and Collagen (hydrophobic)- not soluble in water, found in structural protein
- Globular proteins are hydrophilic (hemoglobin, antibodies, enzymes)
- Function as transport carries or signal transfer

Nucleic Acids: Long molecules made of nucleotides; DNA and RNA

- DNA stores genetic material
- Chromosomes
- RNA is a messenger (mRNA) also rRNA and tRNA

Enzymes: Class of protein that catalyze biochemical reactions

- Not consumed in reaction

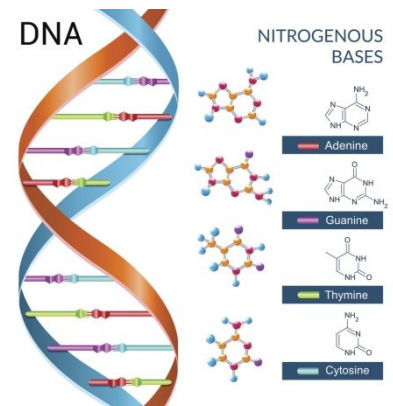
## TEAS 6 Science

- Speed up reaction by lowering activation energy
- Exergonic: release energy
- Endergonic: require energy
- Energy is supplied and released as ATP
- Lock and Key (substrate must fit into enzymes active site)

### DNA and RNA

DNA: macromolecule that contains coded instructions for the body to produce proteins

- Nucleotide: the building block of DNA and RNA
- Nitrogenous Base: Adenine, Thymine, Guanine, and Cytosine
- Purines: Adenine and Guanine
- Pyrimidines: Thymine and Cytosine
- Codon: A group of 3 nitrogenous bases used to synthesize amino acids (Synthesized from RNA during TRANSLATION)
- Hydrogen Bonds: Connect a Purine to a Pyrimidine (A-T) and (C-G). Non-covalent, weak.
  - o RNA: Uracil replaces Thymine
- Double Helix structure
- Coded or read 5'→3'
- Sugar(pentose)-Phosphate backbone (deoxyribose and phosphate group- bound to 4 oxygen atoms)



### DNA Replication

DNA Helicase: Unzips and Unwinds DNA strand

DNA Primase: Generates RNA Primer. Act as a template for starting point of DNA Replication

DNA Polymerase: Synthesize new DNA molecules by adding nucleotides to leading and lagging DNA strands in 5'→3' direction

Topoisomerase: Prevents supercoiling

DNA Ligase: Joins DNA fragments together by forming phosphodiester bonds between nucleotides

Okazaki Fragment: Short, newly synthesized DNA fragments that are formed on the lagging strand

Single Strand Binding Protein: Stabilize structure during replication

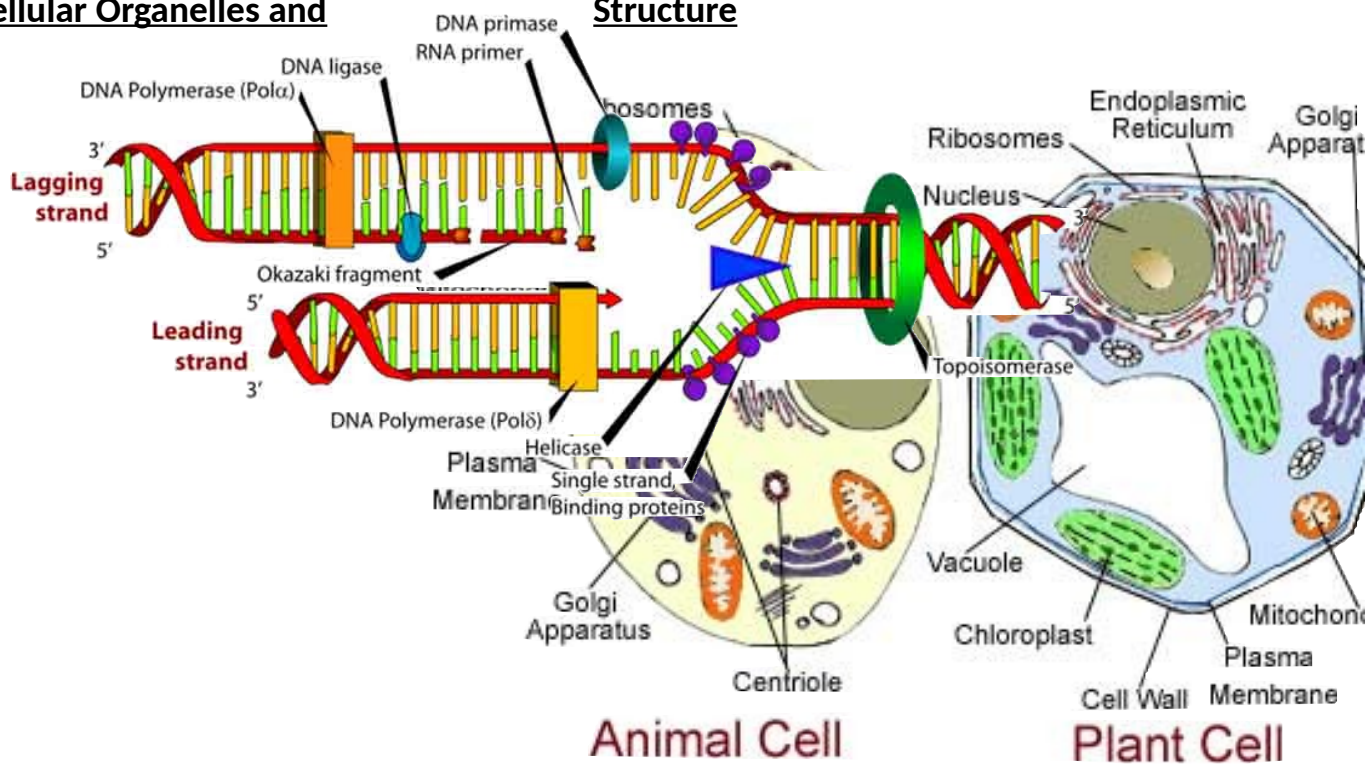
Leading Strand: Replicated continuously in the 3' to 5' direction

Lagging Strand: Replicated discontinuously in short sections

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## Cellular Organelles and

## Structure



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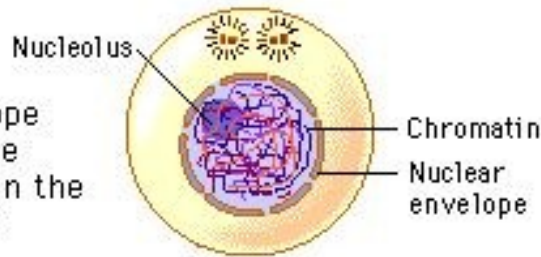
<b><i>Organelle</i></b>	<b><i>Responsible for</i></b>
Nucleus	Housing DNA, 'brain' of the cell
Mitochondria	Energy production, 'power house' of the cell
Golgi apparatus	Sorting, packaging and transport of proteins
Endoplasmic reticulum	Synthesis and processing of proteins, lipid expression
Chloroplast	Photosynthesis, only present in plants
Flagellum	Locomotion and sensory functions
Vacuole	Storage and maintaining homeostasis
Lysosome	Digestions of larger molecules
Peroxisome	Degradation of hydrogen peroxide
Ribosome	Synthesis of proteins
Proteasome	Break down of proteins with expired function

**Mitosis**

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### Interphase

The nucleolus and the nuclear envelope are distinct and the chromosomes are in the form of threadlike chromatin.



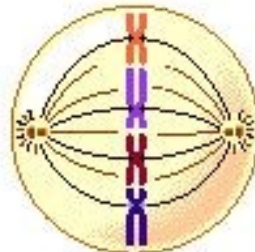
### Prophase

The chromosomes appear condensed, and the nuclear envelope is not apparent.



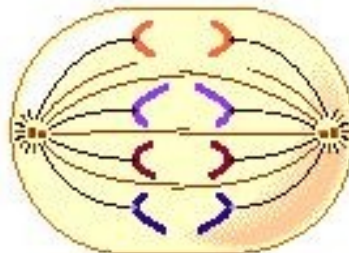
### Metaphase

Thick, coiled chromosomes, each with two chromatids, are lined up on the metaphase plate.



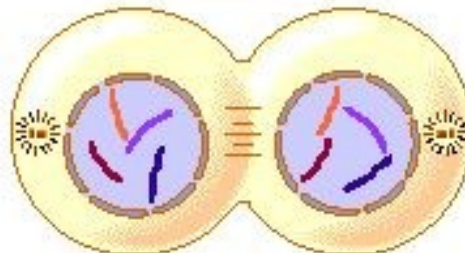
### Anaphase

The chromatids of each chromosome have separated and are moving toward the poles.



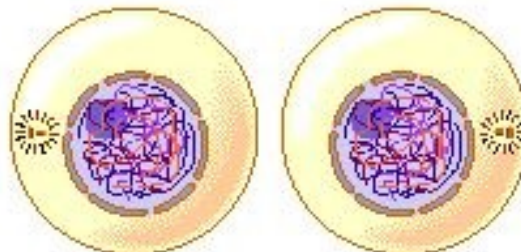
### Telophase

The chromosomes are at the poles, and are becoming more diffuse. The nuclear envelope is reforming. The cytoplasm may be dividing.



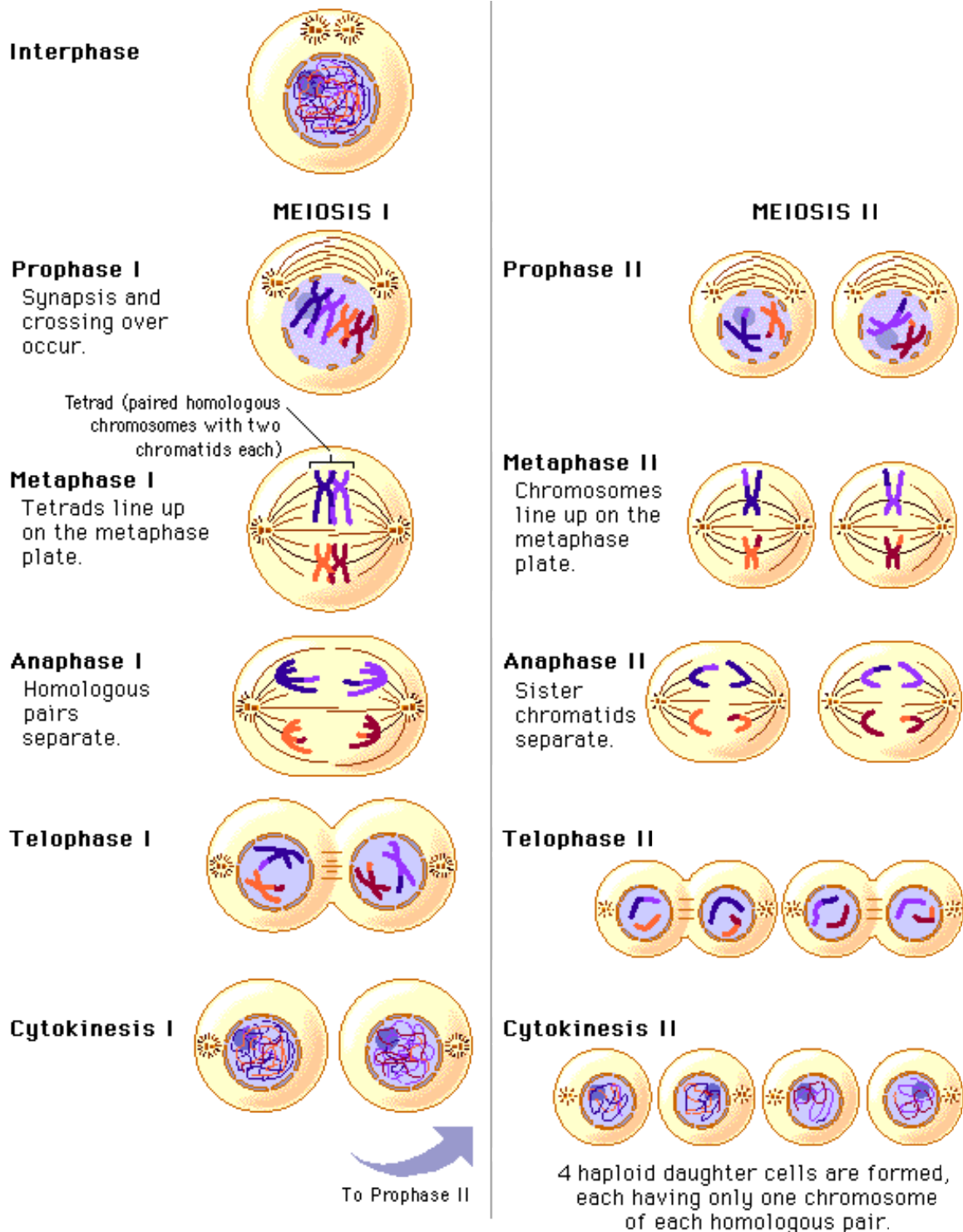
### Cytokinesis

Division into two daughter cells is completed.



## Meiosis

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## CHEMISTRY

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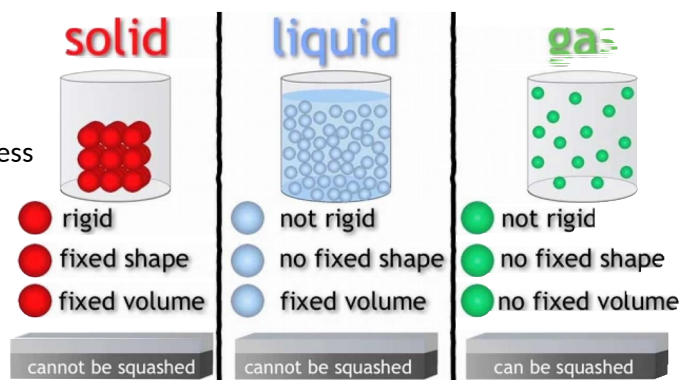
### States of Matter

Solid: rock, wood, paper...

- Molecules are packed together in a tight, orderly pattern
- Vibrational motion, not translational motion
- Retains shape
- Retains density

Liquid: water, juice, soda...

- Molecules are less ordered than solids, less tightly packed
- Vibrational and translational motion
- Shape is indefinite- takes shape of container
- Retains volume

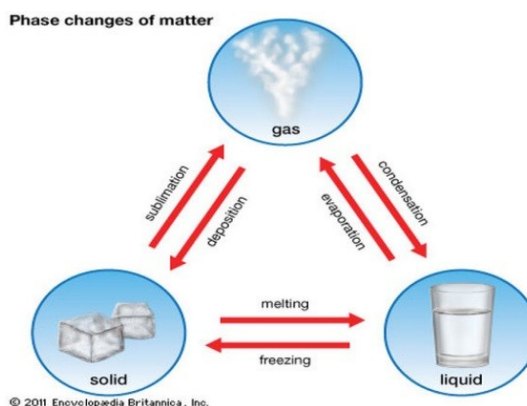


Gas: Oxygen, Methane, Carbon Dioxide...

- Molecules are rapidly moving and spread far apart
- Highly compressible- expands to fill container
- No definite shape
- No definite volume

### Change in Matter

- Condensation: Gas  $\rightarrow$  Liquid
- Deposition: Gas  $\rightarrow$  Solid
- Evaporation: Liquid  $\rightarrow$  Gas
- Freezing: Liquid  $\rightarrow$  Solid
- Melting: Solid  $\rightarrow$  Liquid
- Sublimation: Solid  $\rightarrow$  Gas



Boiling: The transition of liquid to gas when a substance has acquired enough thermal energy.

Critical Point: The temperature at which LIQUID and GAS phases have same density.

Phase Diagram: A graph of physical states of a substance under varying temperature and pressure.

Triple Point: The temperature and pressure at which all 3 phases of a pure substance coexists.

### Chemical Bonds and Structures

Covalent Bond: A chemical bond where electrons are **SHARED** between atoms (2 NON metals)

Ionic Bond: Between 2 metals or a metal and a nonmetal. Complete **TRANSFER** of electrons

Proton: positively charged atomic particle (determines atomic number)

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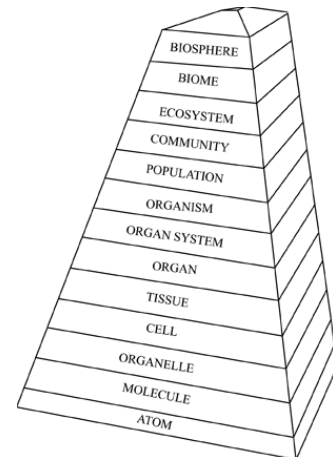
Electron: Negatively charged atomic particle- very small and irrelevant to mass of atom.

Neutron: Determines isotope. Added to number protons to get atomic mass. No electric charge.

Anion: Negatively charged ion

Cation: Positively charged ion

Atom: The most basic complete unit of an element



# The Main Types of Chemical Reactions

A chemical reaction may be regarded as the process that occurs when matter undergoes change in composition. To be able to understand chemical reactions, one needs to recognize the key types of reactions. Reactions may be classified in several different ways, namely:

**Synthesis (Combination) Reactions; Decomposition Reactions; Substitution (single replacement) Reactions; Precipitation (Double replacement) Reactions; Neutralisation (acid-base) Reactions; Redox (Reduction and Oxidation) Reactions.**

Type of Reaction	Explanation	General Equation (General form of change occurrences)	Example
Synthesis/ Combination	Reaction in which two or more simpler substances (elements) combine chemically to give a compound.	$A + B \rightarrow AB$	$2H_2 + O_2 \rightarrow 2H_2O$
Decomposition	Reaction in which a compound is broken down into simpler substances (elements).	$AB \rightarrow A + B$	$2H_2O \rightarrow 2H_2 + O_2$
Substitution (Single replacement)	Reaction in which an atom or group of atoms is replaced by another atom or group.	$A + BC \rightarrow AC + B$ OR $A + BC \rightarrow BA + C$	$Zn + 2HCl \rightarrow ZnCl_2 + H_2$ OR $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$
Precipitation (Double replacement)	Reaction in which a solid compound is formed when solutions of two soluble compounds are mixed.	$AB + CD \rightarrow AD + CB$	$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$
Neutralisation (Acid- Base)	Reaction in which an acid reacts with a base to give salt and water.	$HA + BOH \rightarrow H_2O + BA$	$HCl + NaOH \rightarrow H_2O + NaCl$
Redox (Reduction- Oxidation)	Reaction in which electron transfer occurs.	Reduction: $A \cdot \rightarrow A + e^-$ Oxidation: $B + e^- \rightarrow B \cdot$	$aCl_2 + 2e^- \rightarrow 2Cl^-$ (gain electrons) $Na \rightarrow Na^+ + e^-$ (loss of electrons) $2Na + Cl_2 \rightarrow 2 NaCl$

## SCIENTIFIC INQUIRY

### Scientific Method:

- I. Identify the problem
- II. Ask Questions (by conducting research)
- III. Develop Hypothesis (IF/THEN statement)

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- IV. Conduct Experiment
- V. Analyze Results
- VI. Form a Conclusion

### Independent variable

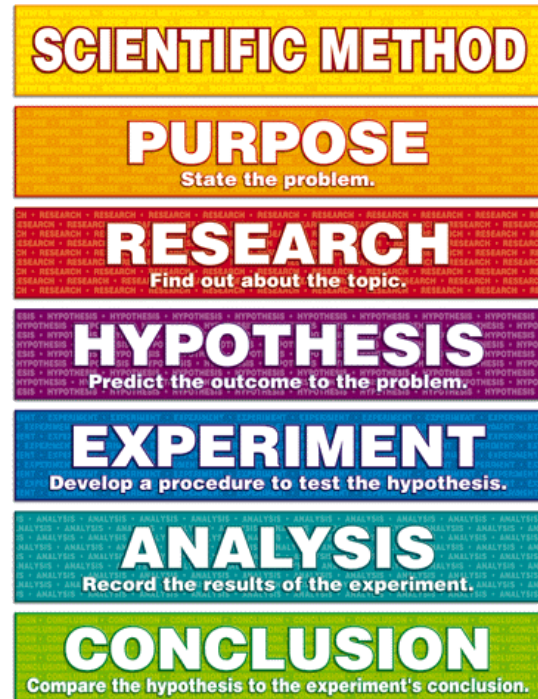
- The thing you are testing
- "If" statement of the hypothesis
- Cause

### Dependent Variable

- The thing you are measuring
- "Then" statement of the hypothesis
- Effect

### Control Variable

- Scientific Constant
- Remains unchanged throughout the experiment



\*Must be able to replicate data for a successful experiment and must have a large sample