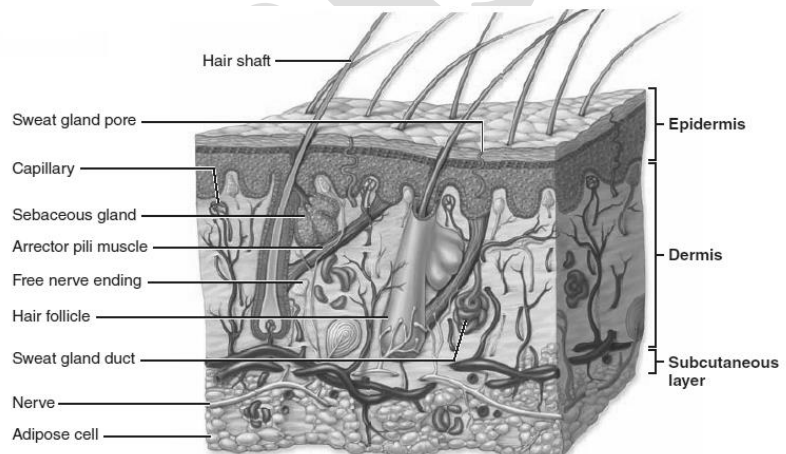


HUMAN ORGAN SYSTEMS

INTEGUMENTARY SYSTEM

- The integumentary system is the organ system that protects the body from damage, comprising the skin and its appendages (including hair, scales, feathers, and nails).
- **Functions:** Serve to waterproof, cushion, and protect the deeper tissues; Excrete wastes, and regulate temperature; is the attachment site for sensory receptors to detect pain, sensation, pressure, and temperature; Vitamin D synthesis.
- The human skin is composed of a minimum of 3 major layers of tissue:
- **Epidermis:** Thin, tough, outer layer made up of epithelial cells & it does not contain blood vessels.
- Stratum corneum is the outermost portion of the epidermis, prevents most bacteria, viruses, and other foreign substances from entering the body
- Melanocytes produce the pigment melanin, function is to filter out ultraviolet radiation from sunlight
- Langerhans cells are part of the skin's immune system which helps detect foreign substances and defend the body against infection.
- **Dermis:** Thick layer of fibrous and elastic that gives the skin its flexibility and strength. Contains nerve endings, sweat glands and oil (sebaceous) glands, hair follicles, and blood vessels
- Sweat glands produce sweat in response to heat and stress.
- The sebaceous glands secrete sebum into hair follicles. Sebum is oil that keeps the skin moist and soft and acts as a barrier against foreign substances.
- The blood vessels of the dermis provide nutrients to the skin and help regulate body temperature.
- **Hypodermis:** Its purpose is to attach the skin to underlying bone and muscle as well as supplying it with blood vessels and nerves.
- Fat Layer helps insulate the body from heat and cold, provides protective padding, and serves as an energy storage area.
- **Botox treatment:** It targets Epidermis layer of skin. Botox is a toxin produced by the bacterium *Clostridium botulinum*.
- Small, diluted amounts can be directly injected into specific muscles causing controlled weakening of the muscles. Botox blocks signals from the nerves to the muscles. The injected muscles can no longer contract, which causes the wrinkles to relax and soften.



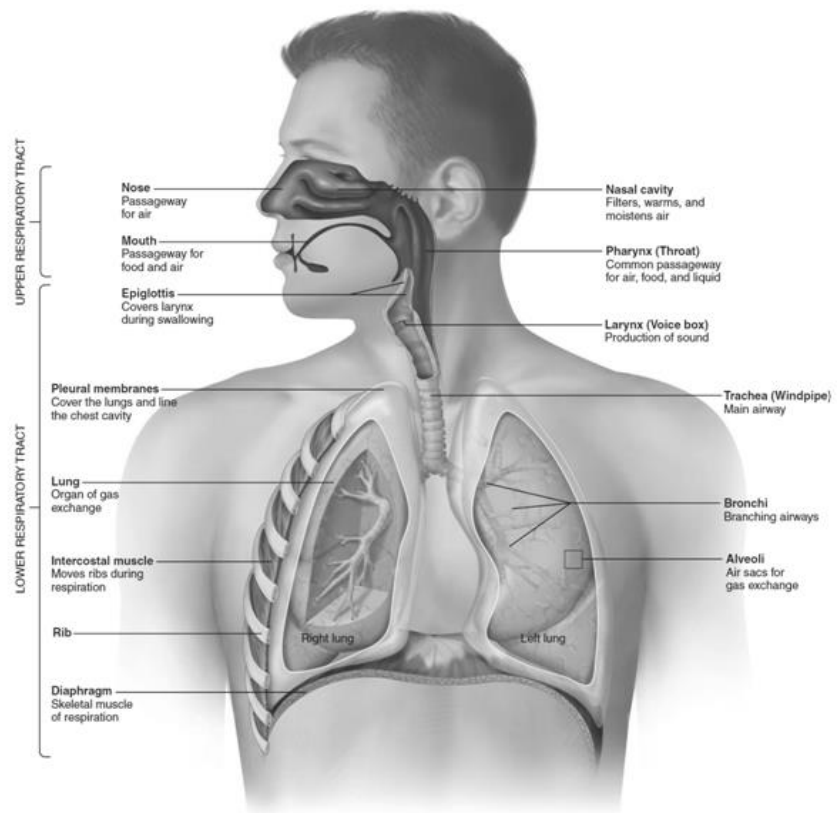
THE DIGESTIVE SYSTEM

- Steps in Digestion: Ingestion, Digestion (Mechanical and Chemical), Absorption, Elimination.
- Parts of Digestive system: The digestive system consists of the **alimentary canal** (Salivary glands, Pharynx, Esophagus, stomach, small intestine, large intestine ending in the rectum and anus) and **accessory digestive organs** (liver, gallbladder, and pancreas).
- Food moves from one organ to the next through muscle action called peristalsis
- The **Salivary glands** in the mouth produces Saliva which contains an enzyme amylase that digest the starch from food into smaller molecules

- The **Stomach** has three mechanical tasks. To store the swallowed food, to mix up the food, liquid, and digestive juice produced by the stomach and to empty its contents slowly into the small intestine.
- The **liver** is the largest gland of the body. It secretes bile which helps the body absorb fat
- The **pancreas** produces enzymes that help digest proteins, fats, and carbohydrates. It also makes a substance that neutralizes stomach acid.
- Small intestine has 3 divisions such as duodenum, jejunum and ileum. The inner wall of the small intestine is covered with millions of microscopic, finger-like projections called **villi**. The villi are the vehicles through which nutrients can be absorbed into the body.
- The **large intestine** secretes no enzyme and plays only a minor role in the absorption of nutrients. The three divisions of large intestine are Caecum, Colon and Rectum. The **rectum** is where feces are stored until they leave the digestive system through the **anus** as a bowel movement.
- **Disorders and Diseases of Digestive System: Gastrointestinal infections** can be caused by viruses, by bacteria such as *Salmonella*, *Shigella*, *Campylobacter*, or *E. coli*, **Hepatitis**, a condition with many different causes, is when the liver becomes inflamed and may lose its ability to function.

RESPIRATORY SYSTEM

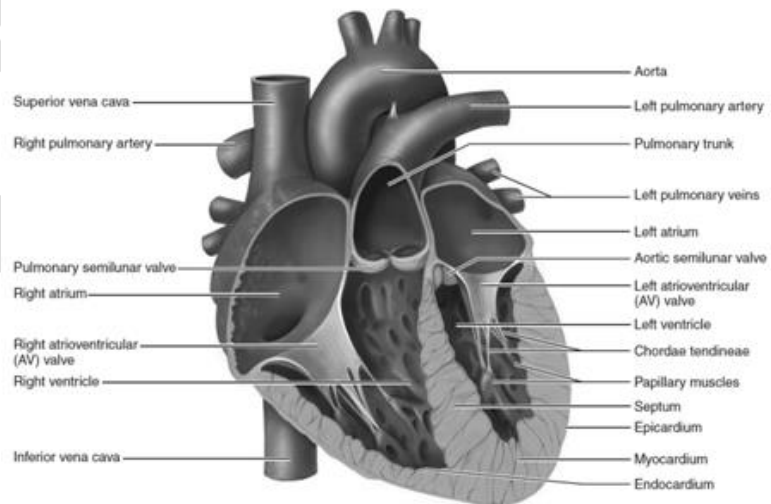
- The Respiratory system is the anatomical system of an organism used for respiration.
- **Parts of the Upper Respiratory Tract: Mouth, nose & nasal cavity:** The nostrils (also called nares) act as the air intake; called **cilia** protect the nasal passageways and other parts of the respiratory tract.
- **Pharynx:** Pharynx is part of the digestive system as well as the respiratory system because it carries both food and air. **Larynx:** This is also known as the voice box as it is where sound is generated. It also helps protect the trachea by producing a strong cough reflex if any solid objects pass the epiglottis
- **Trachea (Wind Pipe):** It carries air from the throat into the lungs. The inner membrane of the trachea is covered with **cilia**
- **Bronchi:** The trachea divides into two tubes called bronchi, one entering the left and one entering the right lung.
- **Bronchioles:** Tertiary bronchi continue to divide and become bronchioles, very narrow tubes, less than 1 millimeter in diameter.
- **Alveoli:** Individual hollow cavities contained within alveolar sacs. Alveoli have very thin walls which permit the exchange of gases Oxygen and Carbon Dioxide. **Thorax or the chest cavity** is the airtight box that houses the bronchial tree, lungs, heart, and other structures.



- **Diaphragm:** located below the lungs. It is a large, dome-shaped muscle that contracts rhythmically and continually, and most of the time, involuntarily. The **tidal volume** is the volume of air that is inhaled or exhaled in a single such breath.
- **Breathing** is a constant process where you breathe in and out constantly throughout the day. **Respiration** is a process where the body breaks down the oxygen, so that the cells in the body can use it.
- **The process of Respiration:** In a process called diffusion, oxygen moves from the alveoli to the blood through the capillaries (tiny blood vessels) lining the alveolar walls. Blood contains Hemoglobin – a specialized protein that binds to oxygen in the lungs so that the oxygen can be transported to the rest of the body.
- Carbon dioxide, which is produced during the process of diffusion, moves out of these cells into the capillaries, where most of it is dissolved in the plasma of the blood.
- **Asthma:** Asthma is a chronic inflammatory lung disease that causes airways to contract, tighten and narrow. Often triggered by irritants in the air such as cigarette smoke, asthma flares.
- Smoking has two fold effects on respiration; it may irritate the cells lining the respiratory tract. **Long term effects** include diseases like emphysema [over inflation of air sacs/alveoli] or fibrosis [excess of fibrous connective tissue] of which the earlier is much common.

CIRCULATORY SYSTEM

- The circulatory system is responsible for the transport of water and dissolved materials throughout the body, including oxygen, carbon dioxide, nutrients, and waste.
- The structure of Circulatory System, The heart has four chambers: Right Atrium, Left Atrium, Right Ventricle, and Left Ventricle.
- The bottom part of the heart is divided into two chambers called the right and left ventricles, which pump blood out of the heart.
- The upper part of the heart is made up of the other two chambers of the heart, the right and left atria.
- Arteries carry blood away from the heart. They are the thickest blood vessels, with muscular walls that contract to keep the blood moving away from the heart and through the body
- Two coronary arteries provide oxygen and nourishment to the muscles of the heart.
- Veins carry blood back to the heart; waste products such as carbon dioxide are also removed by the capillaries.
- The working of Circulatory system: One complete heartbeat makes up a cardiac cycle, which consists of two phases: In the first phase, the ventricles contract sending blood into the pulmonary and systemic circulation then the ventricles relax and fill with blood from the atria, which makes up the second phase of the cardiac cycle.
- The normal heart beat is 70-72 per minute in males and 78-82 per minute in females. The heartbeat of a child is more than that of an adult. I.e. 140/min.
- The sinoatrial or SA node, a small area of tissue in the wall of the right atrium, sends out an electrical signal to start the contracting of the heart muscle.

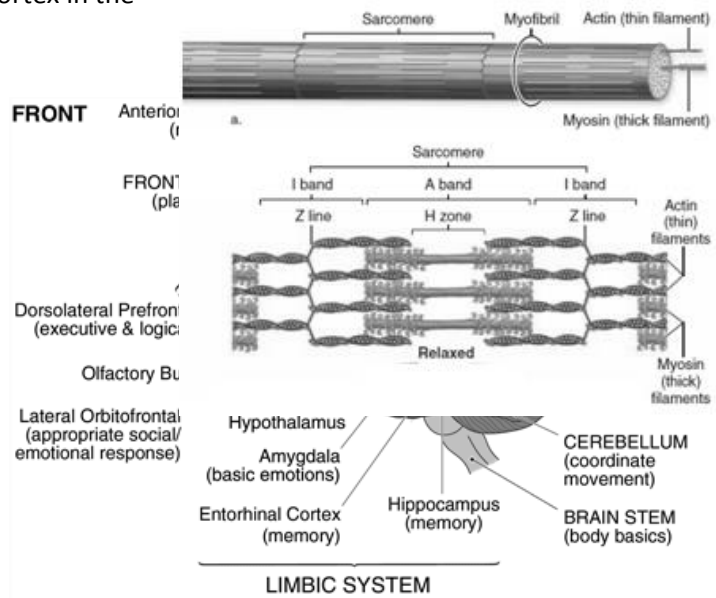


- These electrical impulses cause the atria to contract first, and then travel down to the atrioventricular or AV node. In the **systemic circulation**, blood travels out of the left ventricle, to the aorta, to every organ and tissue in the body, and then back to the right atrium.
- In the **pulmonary circulation**, blood low in oxygen but high in carbon dioxide is pumped out the right ventricle into the pulmonary artery, which branches off in two directions.
- Coronary Circulation: The coronary arteries supply blood to the heart muscle.
- **Blood**: The blood transports life-supporting food and oxygen to every cell of the body and removes their waste products
- Blood has two main constituents. The **cells, or corpuscles**, comprise about 45 percent, and the liquid portion, or **plasma**, in which the cells are suspended, comprises 55 percent
- The **blood cells** comprise three main types: Red blood cells, or Erythrocytes, White blood cells, or leukocytes, Platelets, or thrombocytes
- **Diseases of the Blood, Anemia**: Anemia is a deficiency of hemoglobin in the blood. It can be caused by blood loss, abnormal destruction of the red cells, and inadequate red cell formation by the bone marrow.
- **Leukemia**: A great increase in abnormal leukocytes may occur for unknown reasons, resulting in the diseases known as the leukemia's
- **Heart Diseases**: Atherosclerosis is a disorder of large and medium-sized arteries, such as the large coronary arteries that supply the heart muscle with oxygen. The disorder is characterized by a buildup of fatty deposits, called plaques, on the inner walls of arteries.
- **Vein Diseases**: The most important peripheral vascular disease of the veins is thrombophlebitis or phlebitis. This disorder involves the formation of a blood clot (or clots) in large veins, usually in the leg or pelvis.
- **Hypertension**: High blood pressure is often secondary to hardening of the arteries. As the arteries lose their elasticity, the heart has to beat harder to force the blood through. The result is high blood pressure.

NERVOUS SYSTEM

- The nervous system is a network of specialized cells called neurons that coordinate the actions and transmit signals between different parts of its body.
- The central nervous system of vertebrates contains the brain, spinal cord, and retina.
- The peripheral nervous system consists of sensory neurons, clusters of neurons called ganglia, and nerves connecting them to each other and to the central nervous system.
- **Neuron**: The neuron is the functional unit of the nervous system.
- All neurons have three parts: Dendrites receive information from another cell and transmit the message to the cell body. The axon conducts messages away from the cell body
- Three types of neurons occur: Sensory neurons carry messages from sensory receptors to the central nervous system. Motor neurons transmit messages from the central nervous system to the muscles (or to glands). Inter neurons are found only in the central nervous system where they connect neuron to neuron. Schwann cells serve as supportive, nutritive, and service facilities for neurons
- Node of Ranvier: serves as points along the neuron for generating a signal.
- The junction between a nerve cell and another cell is called a synapse.
- Neurotransmitters are endogenous chemicals that transmit signals from a neuron to a target cell across a synapse
- **Brain: The Forebrain**: The forebrain is the largest and most complex part of the brain. It consists of the cerebrum. The cerebrum contains the information that essentially makes us who we are: our intelligence, memory, speech, ability to feel etc.

- The outer layer of the cerebrum is called the cortex in the inner part of the forebrain sits the thalamus, hypothalamus, and pituitary gland.
- The thalamus carries messages from the sensory organs like the eyes, ears, nose, and fingers to the cortex. The hypothalamus controls the pulse, thirst, appetite, sleep patterns, and other processes in our bodies that happen automatically.
- **The Midbrain:** The midbrain, located underneath the middle of the forebrain, acts as a master coordinator for all the messages going in and out of the brain to the spinal cord
- **The Hindbrain:** The hindbrain sits underneath the back end of the cerebrum, and it consists of the cerebellum, Pons, and medulla.
- The brainstem takes in, sends out, and coordinates all of the brain's messages. It also controls many of the body's automatic functions, like breathing, heart rate, blood pressure, swallowing, digestion, and blinking.
- The sympathetic nervous system prepares the body for sudden stress.
- The parasympathetic nervous system helps the digestive tract move along so our bodies can efficiently take in nutrients from the food we eat.
- disease and Huntington's disease, are due to imbalances of neurotransmitters Parkinson's is due to a dopamine deficiency
- Alzheimer's disease is associated with protein plaques in the brain
- Problems of Nervous System, Brain tumors: Benign tumors usually grow in one place and may be curable through surgery.
- A malignant tumor is cancerous and more likely to grow rapidly and spread.
- **Meningitis and encephalitis:** These are infections of the brain and spinal cord that are usually caused by bacteria or viruses. Meningitis is an inflammation of the coverings of the brain and spinal cord, and encephalitis is an inflammation of the brain tissue.



MUSCULAR SYSTEM

- Based on their location, three types of muscles are identified:
 - (i) Skeletal (ii) Visceral (iii) Cardiac
- Muscle is a specialized tissue of mesodermal origin. About 40-50 per cent of the body weight of a human adult is contributed by muscles.
- Each myofibril has alternate dark and light bands on it. A detailed study of the myofibril has established that the striated appearance is due to the distribution pattern of two important proteins – Actin and Myosin.
- Utilizing the energy from ATP hydrolysis, the myosin head now binds to the exposed active sites on actin to form a cross bridge.
- The myosin, releasing the ADP and Pi goes back to its relaxed state. A new ATP binds and the cross-bridge is broken. The ATP is again hydrolyzed by the myosin head and the cycle of cross bridge formation and breakage is repeated causing further sliding.

Disorders of muscular system:

Myasthenia gravis:

- Auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

SKELETAL SYSTEM AND ITS FUNCTIONS, JOINTS

- Skeletal system consists of a framework of bones and a few cartilages. This system has a significant role in movement shown by the body. Bone and cartilage are specialized connective tissues.
- **Axial Skeleton:**
- Axial skeleton comprises 80 bones distributed along the main axis of the body. The skull, vertebral column, sternum and ribs constitute axial skeleton.

Skull: The skull is composed of two sets of bones – cranial and facial, that totals to 22 bones. Cranial bones are 8 in number.

Vertebral Column: Our vertebral column is formed by 26 serially arranged units called vertebrae and is dorsally placed. It extends from the base of the skull and constitutes the main framework of the trunk.

Rib Cage: There are 12 pairs of ribs. Each rib is a thin flat bone connected dorsally to the vertebral column and ventrally to the sternum. It has two articulation surfaces on its dorsal end and is hence called bicephalic.

Appendicular Skeleton: The bones of the limbs along with their girdles constitute the appendicular skeleton. Each limb is made of 30 bones. The bones of the hand (fore limb) are humerus, radius and ulna, carpals (wrist bones – 8 in number), metacarpals (palm bones – 5 in number) and phalanges (digits – 14 in number).

Joints: Joints are essential for all types of movements involving the bony parts of the body. Locomotory movements are no exception to this. Joints are points of contact between bones, or between bones and cartilages.

Fibrous Joints: Fibrous joints do not allow any movement. This type of joint is shown by the flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures, to form the cranium.

Synovial Joints: Synovial joints are characterized by the presence of a fluid filled synovial cavity between the articulating surfaces of the two bones. Such an arrangement allows considerable movement.

Cartilaginous Joints: In cartilaginous joints, the bones involved are joined together with the help of cartilages.

Arthritis: Inflammation of joints.

Osteoporosis: Age-related disorder characterized by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause.

Gout: Inflammation of joints due to accumulation of uric acid crystals.

