

Biology

CELL

Cell: It is the basic structural unit of life.

Cells were first discovered by **Robert Hooke**.

Note: The **smallest cell is 0.1 to 0.5 micrometre in bacteria**. The **largest cell** measuring 170 mm × 130 mm, is the **egg of an ostrich**.

Amoeba acquires its **food** through **endocytosis**.

- **Endocytosis** is a type of active transport that moves particles, such as large molecules, parts of cells, and even whole cells, into a cell.

Types of cell-

1. Prokaryotes cells

- Cells that have no defined nucleus or any other membrane-bound organelle
- It lacks chloroplast, lysosome, and mitochondria
- Eg: Bacteria & Blue-green Algae

2. Eukaryote

- Cells which have definite nucleus and is surrounded by nuclear membrane
- Chloroplast, lysosome, and mitochondria found in these cells
- Eg: Other than Bacteria & Blue-green Algae

Cellular components –

- **Cell membrane:** It is Outer layer of the cell. Compounds called proteins and phospholipids make up most of the cell membrane.
- **Cell Wall:** It is only found in the plant cells. It's function is to protect nucleoplasm and cell membrane from external invasion.
- **Nucleoplasm:** It is the protoplasm of the inside nucleus of the cell.
- **Cytoplasm:** It is the fluid that fills a cell. Scientists used to call the fluid protoplasm.

Nucleolus: The nucleolus is a round body located inside the nucleus of a eukaryotic cell. The nucleolus makes ribosomal subunits from proteins and ribosomal RNA, also known as rRNA.

Cell nucleus: The cell nucleus acts like the brain of the cell. It helps control eating, movement and reproduction. Not all cells have a nucleus.

The nucleus contain, the following components:

- (a) **Nuclear envelope (nuclear membrane)** - It is made up of protein and fat. It is connected through endoplasmic reticulum of the cell.

(b) **Chromatin:** When the cell is in resting state there is something called chromatin in the nucleus. Chromatin is made up of DNA, RNA and nucleus protein. DNA and RNA are the nucleus acids inside the cell. When the cell is going to divide, the chromatin become very compact. It condenses when the chromatin comes together we can see the chromosomes.

(c) **Chromosomes:** Chromosomes make organisms what they are. They carry all the information used to help a cell grow, thrive and reproduce.

- Chromosomes are made up of DNA. Chromosomes are not always visible. They usually sit around uncoiled and as loose shards called chromation.
- Chromosomes are usually found in pairs.
- Human Beings probably have 46 chromosomes (23 pairs).
- Peas only have 12, a dog has 78 chromosomes.
- The number of chromosomes is not related to the intelligence or complexity of the creature.
- Segments of DNA in specific patterns are called genes.
- In prokaryotes, DNA floats in the cytoplasm in an area called the nucleoid.

Ribosomes: It synthesis protein, and Endoplasmic reticulum sent these protein in various part of the cell. Whereas Smooth Endoplasmic reticulum helps in the manufacture of fats. It a made up of ribonucleic acid.

Functions of these proteins and fats:

- Protein and fat (lipid) help in building the cell membranes. This process is known as membranes biogenesis.
- Smooth Endoplasmic reticulum plays a crucial role in detoxifying many poisons and drugs.

Golgi apparatus: It is another packaging organelle like the endoplasmic reticulum functions: It is the organelle that builds lysosomes (cells digestion machines).

Lysosomes (suicidal bag): It is a kind of waste disposal system of the cell.

Mitochondria (power house): The energy required for various chemical activities headed for life is released by mitochondria in the form of ATP (adenosine-tri- phosphate) molecules.

- ATP is known as the energy currency of the cell.
- Mitochondria are strange organelles in the sense that they have their own DNA and ribosomes, therefore mitochondria are able to make their own protein.
- Mitochondria is absent in bacteria and the red blood cells of mammals and higher animals.

Plastids: These are present only in plant cells. Types of plastids:-

- Chromoplast (colour plastids) impart colour to flowers and fruits.
- Leucoplasts (white or colourless plastids) present in which starch, oils and protein are stored.

- Plastids are self-replicating. I.e. they have the power to divide, as they contain DNA, RNA and ribosomes.
- Plastids contains the pigment chlorophyll that is known as chloroplast. It is the site for photo synthesis.

Non – living parts with in the cell:-

Vacuoles: It is semi permeable membrane and its main function is to collect food stuff in which minerals salts, sugar, Co₂, organic acids are dissolved.

Granules: It is not bounded by any membranes. It store fats, proteins and carbohydrates.

Cell Division

Organisms grow and reduce through cell division.

There are two methods of replication **mitosis and meiosis**.

(a) **Mitosis:** It duplicates its DNA and the two new cells (daughter cells) have the same pieces and generic code. There are five steps in this process. You should remember the term **PMATI**. It breaks down to: **Prophase, Metaphase, Anaphase, Telophase and Interphase**.

(b) **Meiosis:** It occurs in the reproductive cells and it produce Gametes. It results in the reduction of chromosome in the daughter cells by half so it is called reduction division.

Centrioles: Centrioles are concerned with cell division. It initiates cell division.

Diffusion: It is a process of movements of substance from a region of high concentration to a region where its concentration is low. Water also obeys the law of diffusion.

Eg: Substances like Co₂ and O₂ can move across the cell membranes by a process called diffusion.

Osmosis: The movement of water molecules is called osmosis. Osmosis is a special case of diffusion through a selectively permeable membrane.

Types of Osmosis:

1. **Hypotonic:** more water will come into the cell than will leave. The cell is likely to swell up.
2. **Isotonic:** the amount going in is the same as the amount going out of the cell. The cell will stay the same size.
3. **Hypertonic:** more water leaves the cell than enters it. Therefore the cell will shrink.

When a living plant cell loses water through osmosis there is shrinkage or contraction of the contents of the cell away from the cell wall. This phenomenon is known as plasmolysis.

Some important facts regarding cells:

- Nerve cells in animals are the longest cells.
- Smallest human cell is red blood cell.
- Largest human cell is female ovum.

- The single largest cell in the world is of an ostrich.
- The smallest cells are those of the mycoplasma.
- Every minute about 3 million cells in our body die.
- Sieve tube in plants and the mature mammalian red blood cells do not have a nucleus.
- The red blood cell carries respiratory gases.
- Sieve cells in plants transport nutrients in plants.
- The lysosomal enzymes of the sperm cells digest the limiting membranes of the ovum (egg). Thus the sperm is able to enter the ovum.

TISSUE

Tissues are groups of cells that have a similar structure and act together to perform a specific function. There are mainly four types of tissue which are-

I. Epithelial Tissue

It forms a continuous layer over external and internal free surface of many organs.

❖ On the basis of **cell layers**

(a) **Simple epithelium:** It is formed from a single layer of cells. It is found on secretory and absorptive surface.

▪ On the basis of shape of cells simple epithelium is divided -

- (i) **Cuboidal:** These are cube-like cells and its occurrence is in kidney tubules, salivary glands, inner lining of the cheek. Its main function is to give mechanical strength.
- (ii) **Columnar:** These are 'column-like cells and its occurrence is in sweat gland, tear gland, salivary gland its main function is to gives mechanical strength concerned with secretions.
- (iii) **Squamous:** These are flattened and scale-like cell and it form inner lining of lung alveoli and blood vessels.

(b) **Compound epithelium:** It is consist of more than one layer of cells. It provide protection to issues against mechanical, chemical stress

II. **Connective Tissue:** These tissues are made up of fibers forming a framework and support structure for body tissues and organs. It connect and bind different tissues.

There are a **few types of connective tissue**.

A. **Areolar tissue:** It fills spaces inside organs found around muscles, blood vessels and nerves. Its main function is to joins skin to muscles, support internal organs, help in the repair of tissues. Whereas tendon's main function is to connect muscles to bones and ligament is connects bones to each other.

B. **Adipose tissue:** Its occurrence is below skin, between internal organs and in the yellow bone Marrow. Its main function is to storage of fat and to conserve heat.

- C. **Skeletal tissue:** Bone & cartilage occurrences are in nose, epiglottis and in intervertebral disc of mammals. Its main function is to provide support and flexibility to body part. Whereas bone protects internal delicate organs provides attachments for muscles, bone marrow makes blood cells.
- D. **Fluid tissue:** Blood & Lymph blood transport O₂ nutrients, hormones to tissues and organs. Whereas leucocytes fight diseases and platelets help in clotting of blood. Lymph transport nutrients into the heart and it also forms the defense system of the body.
- E. **Ligaments:** A ligament is the fibrous connective tissue that connects bones to other bones. It is made up of spindle shaped cells called fibrocytes.
- F. **Cartilage:** It consists of dense matrix of collagen fibers and elastic fibers embedded in rubbery ground substance. Example are peak of nose, exterior part of ear.

III. Muscular Tissue

It is specialized for ability to contract muscle cells. Its contraction and relaxations promote the movements and loco motional activities.

Types of Muscular tissue:

- A. **Skeletal muscle:** It attached primarily to bones. Its main function is to provide the force for locomotion and all other voluntary movements of the body.
- B. **Cardiac muscle:** It occurs only in the heart. The contraction and relaxation of the heart muscles help to pump the blood and distribute it to the various parts of the body.
- C. **Smooth muscle:** It can be found in stomach, intestines, and blood vessels these muscles cause slow and prolonged contractions which are involuntary.
- IV. **Nervous tissue:** This tissue is specialized with a capability to conduct electrical impulses and convey information from one area of the body to another. Most of the nervous tissue (98%) is located in the central nervous system. The brain and spinal cord.

Parts of Nervous Tissue

- **Cyton** – It is main part of nerve cell in which nucleus and cytoplasm are found.
- **Dendron** – These are thin fiber passes through the cyton, it carries impulses towards the cell body
- **Axon** - Axon, also called nerve fiber, portion of a nerve cell (neuron) that carries nerve impulses away from the cell body. A neuron typically has one axon that connects it with other neurons or with muscle or gland cells.

Important facts regarding animal tissue:-

- Muscles contain special protein called contractile protein. Which contract and relax to cause
- Fat storing adipose tissue is found below the skin and between internal organs.
- Two bones are connected to each other by a tissue called ligament. This tissue is very elastic.

- The skin, the lining of the mouth, the living blood vessels, kidney tubules are all made up of epithelial tissue.
- Voluntary muscles and cardiac muscles are richly supplied with blood whereas involuntary muscles are poorly supplied with blood.

MUSCULAR AND SKELETAL SYSTEM

Skeletal Systems of Various Animals

Types of skeleton –

1. **Exoskeleton** – It is found on the exterior layer of the body and it protects and preserves inner organs.
2. **Endoskeleton** – The skeleton found inside the body is called Endoskeleton and it originates from mesoderm.

Note: Spiders use a combination of an exoskeleton for protection and fluid pressure for movement.

- Sharks, and rays have skeletons composed entirely of cartilage; other vertebrates have an embryonic cartilage skeleton progressively replaced by bone as they mature and develop.
- Some areas of the human body, however, retain cartilage in the adult: in joints and flexible structures such as the ribs, trachea, nose and ears.
- The upper bones of the limbs are single: humerus (arm) and femur (leg).
- Below a joint (elbow or knee), both limbs have a pair of bones (radius and ulna in the arms; tibia and fibula in legs) that connect to another joint (wrist or ankle).
- The carpals make up the wrist joint; the tarsals are in the ankle joint.

Bone

- Bones have cells embedded in a mineralized (calcium) matrix and collagen fibers.

The spongy bone of the femur, humerus, and sternum contains red marrow, in which stem cells reproduce and form the cellular components of the blood and immune system. Yellow marrow, at the center of these bones, is used to store fats. The outer layer of the bones is known as the periosteum.

- When fractures occur, the pain is carried to the brain by nerves running through the periosteum.

Skeletal Muscle Systems

When one muscle flexes (or contracts) the other relaxes, a process known as antagonism.

Muscles have both electrical and chemical activity.

Contraction of Non-muscular Cells

Some fish have modified muscles that discharge electricity. These fish have electric organs consisting of modified muscles known as electroplates. The South American electric eel has more than 6000 plates arranged into 70 columns. Maximum discharge is 100 watts.

THE NERVOUS SYSTEM

- The Central Nervous System (CNS) includes the brain and spinal cord.
- The Peripheral Nervous System (PNS) connects the CNS to other parts of the body, and is composed of nerves (bundles of neurons)

The Neuron

Nervous tissue is composed of two main cell types: neurons and glial cells. Neurons transmit Nerve messages. Glial cells are in direct contact with neurons and often surround them.

The neuron is the functional unit of the nervous system. Humans have about 100 billion neurons in their brain alone! While variable in size and shape,

Functions of the three parts of a neuron:

- ❑ **Axon:** It conducts messages away from the cell body.
- ❑ **Dendrite:** It receives information from axon of another cell and conducts the messages towards the cell body.
- ❑ **Cell body:** It contains nucleus, mitochondria, and other organelles. It is mainly concerned with the maintenance and growth.

SYNAPSES

The junction between a nerve cell and another cell is called a synapse.

The space between two cells is known as the synaptic cleft.

- The function between two neurons is called a 'ganglion'.

HUMAN EYE

The human eye is like a camera. Its **lens** system **forms an image on** a light-sensitive screen called the **retina**.

The **eyeball** is approximately spherical in shape with a **diameter of about 2.3 cm**.

The **eye lens forms an inverted real image of the object on the retina**.

RETINA → The retina is a delicate membrane **having** enormous number of **light-sensitive cells**.

CORNEA → **Light enters** the eye through a thin membrane called the cornea. It is the eye's **outermost layer**. It is the clear, **dome-shaped surface** that covers the front of the eye. It plays an important role in focusing your vision.

PUPIL → The pupil is a **hole located in the center of the iris** of the eye that **allows light to strike the retina**. It appears black because light rays entering the pupil are either absorbed by the tissues inside the eye directly, or absorbed after diffuse reflections within the eye. The pupil regulates and controls the amount of light entering the eye.

IRIS → It is a **dark muscular diaphragm** that **controls the size of the pupil** and thus the amount of light reaching the retina.

CILIARY MUSCLE → The ciliary muscle is a **ring of smooth muscle in the eye's middle layer** that **controls accommodation for viewing objects at varying distances** and **regulates the flow of aqueous humour into Schlemm's canal**. It changes the shape of the lens within the eye, not the size of the pupil.

The light-sensitive cells get activated upon illumination and generate electrical signals. These signals are sent to the brain via the optic nerves. The brain interprets these signals, and finally, processes the information so that we perceive objects as they are.

Note: When the **light is very bright**, the **iris contracts the pupil to allow less light** to enter the eye. However, **in dim light** the **iris expands the pupil to allow more light** to enter the eye. Thus, the pupil opens completely through the relaxation of the iris.

A **human being** has a **horizontal field of view of about 150°** with **one eye** and of **about 180°** with two eyes.

HUMAN BRAIN

The brain is the most complex part of the human body. This three-pound organ is the seat of intelligence, interpreter of the senses, initiator of body movement, and controller of behavior.

The brain can be **divided into three basic units**:

- The forebrain,
- The midbrain, and
- The hindbrain

The **forebrain** is the **largest and main thinking part** of the brain. It has regions which **receive sensory impulses from various receptors**. Separate areas of the fore-brain are **specialized for hearing, smell, sight and so on**.

The **Midbrain connects the forebrain to the hindbrain**. The hindbrain **controls the body's vital functions** such as **respiration and heart rate**.

➤➤ CEREBRUM [Largest part of the human brain]

- It sits at the **topmost part** of the brain.
- It is the **source of intellectual activities**.
- It **holds your memories, allows you to plan, enables you to imagine and think**.

- It allows you to recognize friends, read books, and play games.
- It **controls** the **voluntary motor actions**.
- It is the seat of **learning and memory**.
- It is the site of **sensory perceptions**; like tactile and auditory perceptions.
- It is **divided into two hemispheres**; called **cerebral hemispheres**.

►►HYPOTHALAMUS

- It lies at the **base of** the **cerebrum**.
- It **controls sleep and wake cycle** (circadian rhythm) of the body.
- It also **controls** the **urges for eating and drinking**.
- It gets the **adrenaline flowing** during a test or job interview.

►►CEREBELLUM

- It lies **below** the **cerebrum** and **at the back of** the **whole structure**.
- It **coordinates** the **motor functions**.
- It is responsible for precision of voluntary actions and maintaining the **posture and balance of the body**.

Example: When you are riding your bicycle; the perfect coordination between your pedaling and steering control is achieved by the cerebellum.

►►MEDULLA

- It **forms** the **brain stem**; along **with** the **pons**.
- It **lies at** the **base of** the **brain** and **continues into** the **spinal cord**.
- It controls various involuntary functions

Example: heartbeat, respiration, size of the pupil, blood pressure, salivation and vomiting etc.

►►THALAMUS

- A **major clearinghouse for information** going to and from the spinal cord and the cerebrum.
- **Cerebrospinal fluid (CSF)** is a watery fluid that circulates through the brain's ventricles (cavities or hollow spaces) and around the surface of the brain and spinal cord.

►►SPINAL CORD:

The rear part of medulla oblongata forms the spinal cord. It control the activities of reflex actions. It carry forward the incoming pulse signal of the brain.

THE ENDOCRINE SYSTEM

This system is basically composed of various specific glands that produce and secretes hormones, chemical substance produced in human body.

Hormones

The **endocrine system** is a **collection of glands** that **secrete chemical messages** we call **hormones**. These signals are **passed through** the **blood** to arrive at a target organ, which has cells possessing the appropriate receptor.

Exocrine glands (not part of the endocrine system) **secrete products** that are **passed outside** the **body**. **Sweat glands, salivary glands, and digestive glands** are examples of exocrine glands.

Hormones are grouped into three classes based on their structure:

1. Steroids
2. Peptides
3. Amines

Types of gland –

(a) Exocrine gland-

- In this gland secreted fluid is transported through duct to various organs outside the body

(b) Endocrine gland-

- This is a ductless gland and secreted hormones are brought through the blood plasma.

ENDOCRINE GLAND OF THE BODY

Adrenal gland

The adrenal glands (**also known as suprarenal glands**) are endocrine glands that **produce a variety of hormones** including adrenaline.

They are **found above** the **kidneys**.

Hypothalamus

The hypothalamus is a portion of the brain that **contains a number of small nuclei** with a variety of functions.

Function: link the **nervous system** to the **endocrine system** via the **pituitary gland**.

Pituitary gland

It is an **endocrine gland** about the **size of a pea** and **weighing 0.5 grams** in humans.

Control:

- Growth,
- Blood pressure,

- Certain functions of the sex organs,
- Metabolism,
- Pregnancy,
- Childbirth,
- Nursing,
- Water/Salt concentration,
- Temperature regulation
- Pain relief.

Thyroid

The thyroid gland, or simply the thyroid is **one of the largest endocrine glands** in the body.

It is **found** in the **interior neck, below the Adam's apple**.

- It secretes two hormones: triiodothyro (T3) and tetraiodothysonine (T4), are called tyrosine. Both these **hormones contain iodine**.
- **Hypothyroidism (hypo, 'under')—diminished thyroid activity. Hypothyroidism in childhood gives rise to a conditions called cretinism.**

It **controls rate of use of energy sources, protein synthesis, controls the body's sensitivity** to other hormones.

Goiter – is **called enlargement of the thyroid gland**. It manifests itself as a swelling in the neck.

A goiter may be associated with increased, normal or decreased activity of the thyroid gland.

Government of India launched the Universal salt iodisation programme in 1986.

Adrenal gland

- It **produce adrenaline and steroid** and it is **located above the kidney**. It is also called as **fight hormone**. It has **two components- Cortex and Medulla**

Pancreas

The pancreas is a **glandular organ** in the **digestive system and endocrine system of vertebrates**.

In humans, it is **located in the abdominal cavity behind the stomach**.

It **produce several important hormones**

- **Including insulin,**
- **Glucagon,**

- **Somatostatin, and**
- **Pancreatic polypeptide which circulate in the blood.**

The pancreas is **also a digestive organ, secreting pancreatic juice containing digestive enzymes** that **assist digestion and absorption of nutrients in the small intestine**. These **enzymes** help to further **break down the carbohydrates, proteins, and lipids** in the chyme.

Reduction on the quantity of effective insulin gives rise to diabetes mellitus (diabetes, siphon, and mellitus of honey) commonly called simply diabetes.

Saliva: Tylenine, Maltase

Gastric Juice: Pepsin, Renin

Pancreatic Juice: Trypsin, Amylase, Lipase

Intestinal Juice: Erepsin, Maltase, Lactase, Sucrase, Lipase

LYMPHATIC SYSTEM AND IMMUNITY

The Lymphatic System

- The spleen serves as a reservoir for blood, and filters or purifies the blood and lymph fluid that flows through it.
- If the spleen is damaged or removed, the individual is more susceptible to infections.

Immunity

Antibodies: Antibodies are a **type of protein molecule known as immunoglobulins**.

BLOOD

- Blood is a fluid connective tissue.
- The quantity of blood in the human's body is 7% of the total weight.
- pH value of blood is 7.4.
- There is an average of 5-6 litres of blood in human body.
- Female contains half litre of blood less in comparison to male.
- It also fights infection and regulates temperature.

Blood cells are produced in BONE MARROW

The **main functions of blood** are to **transport oxygen, carbon dioxide, water, nutrients, hormones and waste around the body**. Blood also **fights infection and regulates temperature**.

Blood has **four components**:

1. **Plasma**
2. **Red blood cells**

3. **White blood cells**4. **Platelets****PLASMA → Liquid portion of Blood**

- It constitutes for about 54% of our blood. 92% of it is water.
- maintaining a satisfactory blood pressure
- Volume to supplying critical proteins for blood clotting and immunity.
- medium for exchange of vital minerals such as sodium and potassium
- Helps to maintain a proper pH (acid-base) balance in the body, which is critical to cell function.

RED BLOOD CELLS → Carry oxygen

- Red blood cells are disc-shaped cells containing hemoglobin,
- hemoglobin (haem=iron-containing)
- Hemoglobin enables the cells to pick up and deliver oxygen to all parts of the body, then pick up carbon dioxide and remove it from tissues.
- Its life span is from 20 days to 120 days and are then broken down into pigments called bilirubin and biliverdin in the liver.
- Its destruction takes place in liver & spleen. Therefore, liver is called grave of RBC.
- they are made in the bone marrow,
- they have no nucleus,
- N.B. oxyhaemoglobin = oxygen rich haemoglobin,
- Deoxyhaemoglobin = low oxygen haemoglobin

WHITE BLOOD CELLS → Defend Body (Fighter)

- White blood cells, also called leukocytes
- White cells are the body's primary defense against infection.
- They can move out of the blood stream and reach tissues to fight infection.
- They are essential for good health.
- Its life span is from 1 to 2 days.
- White blood cells have nuclei and are also made in the bone marrow.

PLATELETS → Responsible for clotting

Platelets are the **cells** that **circulate within our blood and bind together** when they recognize **damaged blood vessels**.

Study of blood = HEMATOLOGY

THE CIRCULATORY SYSTEM

HUMAN HEART

The human heart is an **organ** that **pumps blood throughout** the **body** via the circulatory system, **Supplying oxygen and nutrients to the tissues** and **removing carbon dioxide and other wastes**.

The human heart has **four chambers**:

- The **right atrium and right ventricle together** make up the "**right heart**,"
- The **left atrium and left ventricle** make up the "**left heart**."
- A **wall of muscle called the septum separates the two sides of the heart**.
- **Valves prevent backflow, keeping the blood flowing in one direction** through the heart.

A **double-walled sac called the pericardium** encases the heart, which **serves to protect the heart and anchor it inside the chest**.

Between the **outer layer, the parietal pericardium**, and the **inner layer, the serous pericardium**, runs **pericardial fluid**, which **lubricates the heart** during contractions and movements of the lungs and diaphragm.

The **heart's outer wall consists of three layers**:-

- The **outermost wall layer, or epicardium**, is the **inner wall of the pericardium**.
- The **middle layer, or myocardium**, contains the **muscle** that contracts.
- The **inner layer, or endocardium**, is the **lining that contacts the blood**.

The sinoatrial node produces the electrical pulses that drive heart contractions.

HUMAN HEART FUNCTION

The heart **circulates blood through two pathways**:

1. The **pulmonary circuit**
2. The **systemic circuit**

In the **pulmonary circuit**, **deoxygenated blood leaves the right ventricle** of the heart **via the pulmonary artery and travels to the lungs**, then **returns as oxygenated blood to the left atrium** of the heart **via the pulmonary vein**.

In the **systemic circuit**, **oxygenated blood leaves the body via the left ventricle to the aorta**, and from there **enters the arteries and capillaries** where it **supplies the body's tissues with oxygen**. **Deoxygenated blood returns via veins to the vena cava, re-entering the heart's right atrium**.

The **cardiovascular system circulates blood from the heart to the lungs and around the body via blood vessels**.

Blockage of any artery can cause a heart attack, or damage to the muscle of the heart. A **heart attack is distinct from cardiac arrest**, which is a **sudden loss of heart function** that usually **occurs as a result of electrical disturbances** of the heart rhythm.

The **heart contains electrical "pacemaker" cells**, which cause it to contract — **producing a heartbeat**. The **aorta** is the **main artery leaving the heart**.

The **pulmonary artery** is the **only artery that carries oxygen-poor blood**.

The **pulmonary artery carries deoxygenated blood** to the lungs.

The veins have valves that prevent backflow of blood.

Important Points:

◆Aorta

The largest artery in the body. It carries oxygen-rich blood away from the heart to vessels that reach the rest of the body.

◆Atria

The chambers of the heart, to which the blood returns from the circulation.

◆Capillaries

The smallest of the body's blood vessels. Oxygen and glucose pass through capillary walls and enter the cells. Waste products such as carbon dioxide pass back from the cells into the blood through capillaries.

◆Cardiac Valves (Heart Valves)

Any of the four heart valves that regulate the flow of blood through the chambers of the heart.

◆**Oxygenated Blood** -> Oxygen-rich blood.

◆**Deoxygenated Blood** -> Oxygen-poor blood.

◆Heart Ventricles

The lower right and left chambers of the heart.

◆Interventricular Septum

Interventricular septum is the stout wall separating the lower chambers (the ventricles) of the heart from one another.

◆Lungs

One of a **pair of organs in the chest** that **supplies the body with oxygen, and removes carbon dioxide** from the body.

◆Myocardium

The muscular substance of the heart; the middle of the three layers forming the outer wall of the human heart.

◆Pulmonary Artery

The pulmonary artery and its branches deliver blood rich in carbon dioxide (and lacking in oxygen) to the capillaries that surround the air sacs.

◆Pulmonary Circulation

The circulation of the blood through the lungs.

◆Pulmonary Veins

The veins that return the oxygenated blood from the lungs to the left atrium of the heart.

◆Superior Vena Cava

The large vein that carries blood from the head, neck, arms, and chest to the heart.

◆Vena Cava

A large vein which returns blood from the head, neck and extremities to the heart.

◆**Endothelium** is the innermost layer of blood vessels that consists of just a single layer of cells.

◆**Veins** are blood vessels that carry blood to the heart in an even flow. They have thin walls large lumens and valves.

◆ A **pulse** is the **alternate contraction and relaxation of an artery** as blood passes through it.

◆**Blood pressure** is the **force blood exerts on the walls** of blood vessels.

◆A **sphygmomanometer** is used for **measuring blood pressure** (normally 120/80 mmHg)

◆**Atherosclerosis** is the **hardening of artery walls due to** a build-up of **fatty deposits**.

◆Smoking causes heart rate and blood pressure to increase. Diet high in saturated fats increase blood pressure and atherosclerosis. Exercise helps lower blood pressure.

Blood Groupings

Father of Blood Grouping: Karl Landsteiner

He discovered A, B and O blood groups

Decastello and Sturle discovered AB blood groups

RH factor

- It is a **blood antigen** found in **RBC**
- A person can be **Rh+ or Rh-** depending upon the presence of Rh factor in RBC
- Rh+ can receive blood from both Rh+ and Rh- but Rh- can receive blood only from Rh- only

- Blood transfusion techniques was developed by Dr. James Blundell.

THE REPRODUCTIVE SYSTEM

- Asexual reproduction allows an organism to rapidly produce many offspring without the time and resources committed to courtship, finding a mate, and mating.
- The hydra produces buds; starfish can regenerate an entire body from a fragment of the original body.

Sexual Reproduction

- In sexual reproduction new individuals are produced by the fusion of haploid gametes to form a diploid zygote.
- Sperm are male gametes, ova (ovum singular) are female gametes.
- Meiosis produces cells that are genetically distinct from each other.
- Fertilization is the fusion of two such distinctive cells.

Human Reproduction and Development

- Gonads are sex organs that produce gametes. Male gonads are the testes, which produce sperm and male sex hormones. Female gonads are the ovaries, which produce eggs (ova) and female sex hormones.

The Male Reproductive System

Sperm production begins at puberty and continues throughout life, with several hundred million sperm being produced each day. Once sperm form they move into the epididymis, where they mature and are stored.

External Genitals

The female external genitals are collectively known as the vulva.

Sexually Transmitted Diseases

STDs can affect the sex partners, fetus, and newborn infants. STDs are grouped into three categories.

Category One

STDs that produce inflammation of the urethra, epididymis, cervix, or oviducts. Gonorrhea and chlamydia are the most common STDs in this category. Both diseases can be treated and cured with antibiotics, once diagnosed.

Category Two

STDs that produce sores on the external genitals. Genital herpes is the most common disease in this class. Symptoms of herpes can be treated by antiviral drugs, but the infection cannot be cured. Syphilis is a bacterially caused infection, and can, if left untreated, cause serious symptoms and death. However, the disease is curable with antibiotics.

Category Three

This class of STDs includes viral diseases that affect organ systems other than those of the reproductive system. AIDS and hepatitis B are in this category. Both can be spread by sexual contact or blood. Infectious individuals may appear symptom-free for years after infection.

The separation of intercourse from pregnancy uses methods blocking one of the three stages of reproduction

- release and transport of gametes
- fertilization
- implantation

PLANT REPRODUCTION

Flowers

Reproductive parts of the flower are the stamen (male, collectively termed the androecium) and carpel (often the carpel is referred to as the pistil, the female parts collectively termed the gynoecium).

Pollen

Pollen grains contain the male gametophyte (micro gametophyte) phase of the plant. They are produced by meiosis of microspore mother cells that are located along the inner edge of the anther sacs (microsporangia).

Pollination

The transfer of pollen from the anther to the female stigma is termed pollination. This is accomplished by a variety of methods:

- **Entomophily** is the transfer of pollen by an insect.
- **Anemophily** is the transfer of pollen by wind.

Other pollinators include birds, bats, water, and Humans.

Double Fertilization

The process of pollination being accomplished, the pollen tube grows through the stigma and style toward the ovules in the ovary.

Fruit

The ovary wall, after fertilization has occurred, develops into a fruit. Fruits may be fleshy, hard, multiple or single.

Note: - Seeds germinate, and the embryo grows into the next generation sporophyte.

PLANT HORMONES

| HORMONES | FUNCTION |
|----------|----------|
|----------|----------|

| | |
|----------------------|---|
| Auxin | <ul style="list-style-type: none"> Controls growth of plant |
| | <ul style="list-style-type: none"> Prevent separation of leaves |
| Gibberellins | <ul style="list-style-type: none"> It turns dwarf plant into long plants Break dormancy of plants Help seeds to sprout |
| Cytokinins | <ul style="list-style-type: none"> Help in the cell division and development. Break dormancy of plants Helps in making of RNA and Protein. |
| Abscisic Acid | <ul style="list-style-type: none"> It is growth against hormone. Helps seed and bud to be in the dormant conditions. |
| Ethylene | <ul style="list-style-type: none"> Ripening of fruits Increased number of female flowers. |

Xylem – It is a conducting tissue which has function of conduction of water and minerals

Pholem – It is a conducting tissue whose main function is to conduction of foods prepared by leaves to other part of plant.

Transpiration – It is loss of water of plant from its aerial part.

THE DIGESTIVE SYSTEM

Stages in the Digestive Process

1. **MOVEMENT:** propels food through the digestive system
2. **SECRETION:** release of digestive juices in response to a specific stimulus
3. **DIGESTION:** breakdown of food into molecular components small enough to cross the plasma membrane
4. **ABSORPTION:** passage of the molecules into the body's interior and their passage throughout the body
5. **ELIMINATION:** removal of undigested food and wastes

The human digestive system, is a coiled, muscular tube (6-9 meters long when fully extended) stretching from the mouth to the anus.

The Mouth and Pharynx

Chemical breakdown of starch by production of salivary amylase from the salivary glands into glucose. This mixture of food and saliva is then pushed into the pharynx and esophagus.

The STOMACH

Gastric juice in stomach contains:

- Hydrochloric acid (HCl),
- Pepsinogen, and
- Mucus

Functions of Hydrochloric Acid (HCl):

- It kills microorganisms.
- It lowers the stomach pH to between 1.5 and 2.5.
- It lowers pH of the stomach so pepsin is activated.

Pepsinogen is an enzyme that starts protein digestion and controls the hydrolysis of proteins into peptides.

Chyme, the mix of acid and food in the stomach, leaves the stomach and enters the small intestine.

Alcohol and aspirin are absorbed through the stomach lining into the blood.

Epithelial cells secrete mucus that forms a protective barrier between the cells and the stomach acids.

ULCERS

Peptic ulcers result when these protective mechanisms fail.

Bleeding ulcers result when tissue damage is so severe that bleeding occurs into the stomach.

Perforated ulcers are life-threatening situations where a hole has formed in the stomach wall.

At least 90% of all peptic ulcers are caused by *Helicobacter pylori*.

Other factors, including stress and aspirin, can also produce ulcers.

THE SMALL INTESTINE

- The small intestine is the major site for digestion and absorption of nutrients.
- It is about 22 feet (6.7 meters) long.

Parts of small intestine:

1. Duodenum
2. Jejunum
3. Ileum

- Sugars and amino acids go into the bloodstream via capillaries in each villus.
- Glycerol and fatty acids go into the lymphatic system.
- Starch and glycogen are broken down into maltose by small intestine enzymes.
- Maltose, sucrose, and lactose are the main carbohydrates present in the small intestine; they are absorbed by the microvilli.
- Enzymes in the cells convert these disaccharides into monosaccharides that then leave the cell and enter the capillary.
- Gluten enteropathy is the inability to absorb gluten, a protein found in wheat.
- Fat digestion is usually completed by the time the food reaches the ileum (lower third) of the small intestine. Bile salts are in turn absorbed in the ileum and are recycled by the liver and gall bladder.

LIVER

The liver produces and sends bile to the small intestine via the hepatic duct.

Bile contains cholesterol, phospholipids, bilirubin, and a mix of salts.

In addition to digestive functions, the liver plays several other roles:

1. Detoxification of blood;
2. Synthesis of blood proteins;
3. Destruction of old erythrocytes and conversion of hemoglobin into a component of bile;
4. Production of bile;
5. Storage of glucose as glycogen, and its release when blood sugar levels drop; and
6. Production of urea from amino groups and ammonia.

GALL BLADDER

It stores excess bile for release at a later time.

We can live without our gall bladders, in fact many people have had theirs removed. The drawback, however, is a need to be aware of the amount of fats in the food they eat since the stored bile of the gall bladder is no longer available.

Glycogen is a polysaccharide made of chains of glucose molecules.

In plants starch stored in the form of glucose, while animals use glycogen for the same purpose.

Low glucose levels in the blood cause the release of hormones, such as glucagon, that travel to the liver and stimulate the breakdown of glycogen into glucose, which is then released into the blood (raising blood glucose levels).

When no glucose or glycogen is available, amino acids are converted into glucose in the liver. The process of deamination removes the amino groups from amino acids. Urea is formed and passed through the blood to the kidney for export from the body. Conversely, the hormone insulin promotes the take-up of glucose into liver cells and its formation into glycogen.

Liver Diseases Jaundice occurs when the characteristic yellow tint to the skin is caused by excess hemoglobin breakdown products in the blood, a sign that the liver is not properly functioning. Hepatitis A, B, and C are all viral diseases that can cause liver damage.

Cirrhosis: Cirrhosis of the liver commonly occurs in alcoholics, who place the liver in a stress situation due to the amount of alcohol to be broken down. Cirrhosis can cause the liver to become unable to perform its biochemical functions. Chemicals responsible for blood clotting are synthesized in the liver, as is albumin, the major protein in blood.

(D) The Large Intestine

The large intestine is made up by the colon, cecum, appendix, and rectum.

VITAMINS

Vitamins: Vitamins are organic molecules required for metabolic reactions. They usually cannot be made by the body and are needed in trace amounts. Vitamins may act as enzyme cofactors or coenzymes.

VITAMIN K (Phylloquinone)

SOURCE

Green leafy vegetables, soya beans. The human body can also produce Vitamin K through germs in the colon (part of small intestine).

FUNCTION

- Helps blood clotting, prevent over bleeding
- Maintains health of the liver

SYMPTOMS OF DEFICIENCY

Uncontrolled bleeding from wounds due to clotting difficulty

SYMPTOMS OF EXCESS

Can lead to liver damage

VITAMIN E (Tocopherol) = Beauty Vitamin

It is also known as Antisterility Vitamin. **SOURCE**

Green leafy vegetables, whole-wheat cereals, nuts, sprouts, egg yolk

FUNCTION

- Maintains normal conditions of cells, and healthy skin and tissues
- Protects red blood cells
- Antioxidation
- Enhance immunity

SYMPTOMS OF DEFICIENCY

New born infants: hemolytic anemia

Adults: weakness

SYMPTOMS OF EXCESS

- Low thyroxin level
- Fertility Disease
- Headache, dizziness, fatigue
- Stomach discomfort, poor appetite

VITAMIN D (Calciferol)=(Sunhine Vitamin)**SOURCE**

Egg yolk, liver, cod liver oil, fish. Our skin also produces Vitamin D when exposed to sunlight.

FUNCTION

- Helps body absorb and utilize calcium and phosphorus, so as to maintain bones, teeth and brain healthy
- Maintains normal calcium level in blood

SYMPTOMS OF DEFICIENCY

Children: rickets

Adults: Osteomalacia, Osteoporosis

SYMPTOMS OF EXCESS

- Calcified cartilage
- High calcium level in the blood causes abnormal heart beat and damage to organs such as kidneys
- Vomiting, diarrhea
- Sore eyes
- Itchy skin

VITAMIN A (Retinol)**SOURCE**

Dairy products, cod liver oil, liver, dark green and yellow vegetables and fruits

FUNCTION

- Maintains eye health
- Promotes growth and development, maintains healthy bones and teeth
- Enhances the protection and regeneration of cells and mucous membrane
- Maintains healthy respiratory and intestinal tracts
- Maintain healthy hair, nails and skin

SYMPTOMS OF DEFICIENCY

- Night blindness, dry eyes
- Dry skin
- Stomach discomfort
- Poor growth
- Weak bones and teeth

SYMPTOMS OF EXCESS

- Dry, scaly, peeling, and itchy skin, rash
- Hair loss
- Poor appetite, fatigue, vomiting, stomach discomfort
- Liver injury
- Headache, bone pain
- Nervousness, irritability

VITAMIN B**VITAMIN B1 (Thymine)****SOURCE**

Sprouts, yeast

Beriberi

VITAMIN B2 (Ryboflabin)**SOURCE**

Sprout, present in cow's milk (yellowish) Disease

Cheilosis, ulceration

VITAMIN B6 (Pyridoxine)

FUNCTION

It is responsible for remember dreams.

SYMPTOMS OF DEFICIENCY

Anemia

Nervousness, insomnia, depression Muscle cramps

VITAMIN C (Ascorbic acid)

SOURCE

Citrus fruits (orange, grapefruit, lemon), strawberry, black current, kiwi fruit, tomato, green leafy vegetables, green pepper

FUNCTION

- Helps synthesize collagen; promotes the growth and repair of cells, gum, teeth, blood vessels and bones
- Helps healing after operation and injury
- Helps calcium and iron absorption
- Enhances immunity

SYMPTOMS OF DEFICIENCY

- Scurvy
- Gum
- Inflammation and bleeding, fall of teeth
- Susceptibility to skin bleeding, burst of capillary vessels
- Weakness, fatigue
- Bone pain, swollen and aching joints

SYMPTOMS OF EXCESS

- Abdominal pain
- Diarrhea
- Kidney stone

In smokers and drinkers vitamin C is absent.

| TYPES OF VITAMINS: | | | |
|--------------------|----------------------------------|--|--|
| Vitamin | Chemical Name | Food Sources | Deficiency Diseases |
| A | Retinol | Milk, eggs, fish, butter, cheese And liver. | Night blindness, Skin dryness. |
| B1 | Thiamine | Legumes, whole grain, nuts. | Beriberi. |
| B2 | Riboflavin | Egg, milk, cheese, nuts, bread products. | Inflammation n of tongue, sores in the corners of the mouth. |
| B3 | Niacin or Nicotinic acid | Meat, fish, pea nuts, whole grain. | Skin disease, diarrhoea, depression, dementia. |
| B5 | Pantothenic acid | Eggs, liver, dairy products. | Fatigue, muscle cramp. Pellagra |
| B6 | Pyridoxine | Organ meats, cereals, corn. | Anemia, kidney stones, nausea, Depression. |
| B12 | Cyanocobalamin | Meat, fish. | Pale skin, constipation, fatigue. |
| C | Ascorbic acid | Oranges, tomatoes, sweet and white potatoes. | Scurvy, anemia, ability to fight infections Decreases. |
| D | Calciferol | Direct sunlight, fish oils, eggs. | Rickets, osteomalacia. |
| E | Tocopherol | Vegetable oils, olives, tomatoes, almonds, meat, eggs. | Neurological problems, problems of reproductive system. |
| K | Phylloquinone or Naphthoquinon e | Soyabean s, green leafy vegetable s, dairy products, meat. | Failure to clot blood. |

Minerals: Iron (for hemoglobin), iodine (for thyroxin), calcium (for bones), and sodium (nerve message transmission) are examples of minerals.

Digestion in Animals

- Starfish feeds on animals covered by half shells of calcium carbonate.
- The saliva breakdown the starch into sugar.
- Liver situated in the upper part of the abdomen on the right side. It is the largest gland in the body.
- In the process of digestion carbohydrates get broken down into simple sugars such as glucose. Fats into fatty acid and glycerol. Proteins into amino acid.
- The grass is rich in cellulose a type of carbohydrates human cannot digest cellulose.
- Amoeba is a microscopic single celled organism found in pond water. When it sense food, it pushes out one or more finger like projection (pseudopodia) around the food particles and engulf it and then the food becomes trapped in a food vacuole.

THE EXCRETORY SYSTEM

Excretory Systems in Various Animals

Components of this system in vertebrates include the kidneys, liver, lungs, and skin.

Water and Salt Balance

The excretory system is responsible for regulating water balance in various body fluids.

Osmoregulation refers to the state aquatic animals are in: they are surrounded by freshwater and must constantly deal with the influx of water.

Excretory System Functions

1. Collect water and filter body fluids.
2. Remove and concentrate waste products from body fluids and return other substances to body fluids as necessary for homeostasis.
3. Eliminate excretory products from the body.

The Human Excretory System

The urinary system is made-up of the kidneys, ureters, bladder, and urethra. The nephron, an evolutionary modification of the nephridium, is the kidney's functional unit.

The nephron has three functions:

1. Glomerular filtration of water and solutes from the blood.
2. Tubular reabsorption of water and conserved molecules back into the blood.
3. Tubular secretion of ions and other waste products from surrounding capillaries into the distal tubule.

Kidney Stones

In some cases, excess wastes crystallize as kidney stones. They grow and can become a painful irritant that may require surgery or ultrasound treatments.

Kidney Functions

1. Maintain volume of extracellular fluid
2. Maintain ionic balance in extracellular fluid
3. Maintain pH and osmotic concentration of the extracellular fluid.
4. Excrete toxic metabolic by-products such as urea, ammonia, and uric acid.

Kidneys, the Fascinating Filters

Nephron is the filtration unit of kidney.

- Excessive eating (polyphagia), excessive drinking (polydipsia) and too much of urine (polyuria) are three cardinal symptoms of diabetes. The 'hypothesis' produces a chemical substance called 'antidiuretic hormone (ADH)'.
- The Adrenal gland maintains the regulating salt in the body and is located in an organ lying just over the kidney. As soon as the salt (sodium) concentration becomes just a little less than normal, it releases into the blood stream a substance called 'aldosterone'.
- Renal transplantation or dialysis (artificial kidney) are the supportive measures when the damage to kidney reaches a certain point.

Hormone Control of Water and Salt

Water reabsorption is controlled by the antidiuretic hormone (ADH) in negative feedback.

ADH is released from the pituitary gland in the brain. Dropping levels of fluid in the blood signal the hypothalamus to cause the pituitary to release ADH into the blood. ADH acts to increase water absorption in the kidneys.

Aldosterone, a hormone secreted by the kidneys, regulates the transfer of sodium from the nephron to the blood. When sodium levels in the blood fall, aldosterone is released into the blood, causing more sodium to pass from the nephron to the blood. This causes water to flow into the blood by osmosis. Renin is released into the blood to control aldosterone.

PHOTOSYNTHESIS

- The raw materials of photosynthesis, water and carbon dioxide, enter the cells of the leaf, and the products of photosynthesis, sugar and oxygen leave the leaf.
- Water enters the root and is transported up to the leaves through specialized plant cells known as xylem.
- Carbon dioxide cannot pass through the protective waxy layer covering the leaf (cuticle), but it can enter the leaf through an opening flanked by two guard cells.

- Likewise, oxygen produced during photosynthesis can only pass out of the leaf through the opened stomata.

Chlorophyll and Accessory Pigments

- Chlorophyll, the green pigment common to all photosynthetic cells absorbs all wavelengths of visible light except green, which it reflects to be detected by our eyes.
- Black pigments absorb all of the wavelengths that strike them.

DIVERSITY IN LIVING ORGANISMS

Differentiation in Plants

Thallophyta

- The plants in this group are commonly called algae. These plants are predominantly aquatic.

E.g. : Spirogyra, cladophora and chara.

Bryophyte

- These are called the amphibians of the plant kingdom. There is no specialized tissue for the conduction of water and other substances from one part of the plant body to another.

E.g. : moss (Funaria) and Marchantia

Pteridophyta

- In this group plant body is differentiated into roots, stem and leaves and has specialized tissue for the conduction of water and other substances from one part of the plant body to another. Eg- Marsilea, ferns, and horse tails.

Gymnosperms

- The plants of this group bear naked seeds and are usually perennial and evergreen and woody. Eg- pines such as deodar.

Angiosperms

- The seeds develop inside an organ which is modified to become a fruit. These are also called flowering plants.
- Plant embryos in seeds have structures called cotyledons. Cotyledons are called seed leaves because in many instances they emerge and become green when the seed germinates.
- Plants with seeds having a single cotyledon are called monocotyledons or monocots. Eg- Paspalum.
- Plants with seeds having two cotyledons are called dicots. Eg- Peas.
- Pisces These are fish. They are cold blooded and their hearts have only two chambers unlike the four that humans have.
- Some with skeletons made entirely of cartilage, such as shark.

- Some with skeleton made of both bones and cartilages such as tuna or rohu.
- Amphibian they have mucus glands in the skin and a three chambered heart. Respiration is through either gills or lungs.
Eg- frogs, toades, and salamanders.

Reptilia

These animals are cold blooded have scales and breathe through lungs. While most of them have a three chamber heart while crocodile have four heart chambers. Eg- snakes, turtles, lizards and crocodiles.

Aves

These are warm blooded animals and have a four chambered heart. They lay eggs. They breathe through lungs. All birds fall in this category.

Mammalia

- They are warm blooded animals with four chambered hearts.
- They have mammary glands for the production of milk to nourish their young. They produce live young ones.
- However a few of them like platypus and the echidna (Spiny Anteater) lay eggs.

MICRO ORGANISMS

Microorganisms are classified into four major groups. These groups are bacteria, fungi, protozoa and algae.

Viruses: They reproduce only inside the cells of the host organisms which may be bacterium, plants or animal.

Common cold, influenza and most coughs are caused by viruses.

Serious diseases like polio and chickenpox are also caused by viruses.

Microorganisms may be **single celled like bacteria**, some algae and protozoa. Multicellular such as algae and fungi.

Microorganisms like amoeba can live alone, while fungi and bacteria may live in colonies.

Advantages of Micro Organisms

Making of curd and breed:-milk is turned into curd by bacteria. The **bacterium "lactobacillus"** promotes the formation of curd.

Yeast reproduces rapidly and **produces CO₂ during respiration**. Bubbles of the gas fill the dough and increase its volume.

Yeast is used for commercial production of alcohol and wine. For this purpose yeast is grown as natural sugars present in grains like barley, wheat, rice, crushed fruit juice etc.

This process of **conversion of sugar into alcohol is known as fermentation. Lewis Pasteur discovered fermentation.**

Medicinal Use of Micro Organisms

- The medicine which kills or stops the growth of diseases causing microorganism is called antibiotics.
- Streptomycin, tetracycline and erythromycin are some of the commonly known antibiotics. Which are made from fungi and bacteria.
- Alexander Fleming discovered penicillin.
- Antibiotics are not effective against cold and flu as these are caused by virus.

Vaccine

Edward Jenner discovered the vaccine for small pox.

Harmful Microorganisms

- Disease-causing microorganisms are called pathogens.
- Microbial diseases that can spread from an infected person to a healthy person through air water, food, or physical contact are called communicable diseases. i.e.- cholera, common cold, chicken pox and TB.
- Female anopheles mosquito which carries the parasite of malaria.
- Female aedes mosquito acts as carrier of dengue virus.
- Robert Koch discovered the bacteria (bacillus anthracis) which causes anthrax disease.

Common Methods of Preserving Food in our Homes

- ❑ **Chemical method: salt and edible oils** are the common chemical generally used.
- ❑ **Sodium benzoate and sodium metabisulphite** are common **preservatives**. These are also **used in the Jams and squashes** to check their spoilage.

Preservation by sugar

- ❑ **Sugar reduces the moisture context** which **inhibits the growth of bacteria** which spoil food.
- ❑ **Use of oil and vinegar prevents spoilage of pickles** because bacteria cannot live in such an environment.
- ❑ **Pasteurized milk** : the milk is heated to **about 70°C for 15 to 30 seconds** and then suddenly chilled and stored.
- ❑ This process was **discovered by Louis Pasteur**. It is called **pasteurisation**.

SOME IMPORTANT TABLES

Classification of Animal Kingdom

| NAME | FEATURES |
|------|----------|
|------|----------|

| | |
|-------------------------------|---|
| A. Phylum Protozoa | <ul style="list-style-type: none"> • Made of only one cell • All activity take place in unicellular body • Respiration and excretion take place by diffusion. • Ex- Amoeba, Euglena |
| B. Phylum Porifera | <ul style="list-style-type: none"> • Multicellular animals • Found in marine water • Skeleton is made of calcareous • Ex- Sycon, Sponge |
| C. Phylum Coelenterate | <ul style="list-style-type: none"> • Animals are aquatic • It is present inside body • Ex- Hydra, jelly fish, sea Anemone |
| D. Phylum Arthropoda | <ul style="list-style-type: none"> • Body is divided into three parts – Head, Thorax and Abdomen • Jointed leg • Ex- Cockroach, prawn, crab |
| E. Phylum Annelida | <ul style="list-style-type: none"> • Unisexual and Bisexual • Annulus body • Ex- Earthworm |
| F. Phylum Mollusca | <ul style="list-style-type: none"> • Body divided into head and muscular foot • Respiration through Gills • Blood is colourless • Ex- Octopus, Loligo |

Important facts about Human Body

| | |
|---|---------------------------------------|
| Largest and strongest Bone in the body: | Femur (thigh bone) |
| Smallest Bone in the body: | Stapes in ear |
| Volume of Blood in the body: | 6 litres (in 70 kg body) |
| Number of Red Blood Cells(R.B.C.): | 1. In male: 5 to 6 million/cubic mm |
| | 2. In female: 4 to 5 million/cubic mm |
| Life span of Red Blood Cells(R.B.C.): | 100 to 120 days |
| Life span of White Blood Cell(W.B.C.): | 3-4 days |
| Time taken by R.B.C. to complete one cycle of circulation: | 20 seconds |

| | |
|---|--|
| Other name of Red Blood Cell (R.B.C.): | Erythrocytes |
| Largest White Blood Cells: | Monocytes |
| Smallest White Blood Cells: | Lymphocyte |
| Who discovered Blood Group: | Karl Landsteiner |
| Blood Platelets count: | 150,000 - 400,000 platelets per micro litre |
| Haemoglobin (Hb): | 1. In male: 14-15 gm/100 c.c. of blood 2. In female: 11-14 gm/100 c.c. of blood |
| Hb content in body: | 500-700 gm |
| pH of Urine: | 6.5-8 |
| pH of Blood: | 7.36-7.41 |
| Volume of Semen: | 2-5 ml/ejaculation |
| Normal Sperm Count: | 250-400 million/ejaculation |
| Menstrual cycle: | 28 days |
| Menopause age: | 45-50 years |
| Blood clotting time: | 3-5 minutes |
| Weight of Brain: | 1300-1400 gm in human adult |
| Normal Blood Pressure (B.P.): | 120/80 mm Hg |
| Universal blood donor: | O |
| Universal blood recipient: | AB |
| Average body weight: | 70 kg |
| Normal body temperature: | 37 degree Celsius |
| Breathing Rate at rest: | 12-16/minute |
| Number of Spinal Nerves: | 31 pairs |
| Largest Endocrine Gland: | Thyroid gland |
| Normal Heart Beat at rest: | 72 beats per minute |
| Largest Gland: | Liver |

| | |
|--|-----------------------------------|
| Largest Muscle in the body: | Gluteus Maximus or Buttock Muscle |
| Smallest Muscle in the body: | Stapedius |
| Largest Artery: | Aorta |
| Largest Vein: | Inferior Vena Cava |
| Largest and longest Nerve: | Sciatic Nerve |
| Longest Cell: | Neurons (nerve cells) |
| Minimum distance for proper vision: | 25 cm |
| Pulse rate: | 72 per minute |
| Thinnest Skin: | Eyelids |
| Weight of Heart: | 200-300 gm |

Common drugs and there use

| Drugs/Medicine | Use |
|-----------------------|---|
| Anaesthetics | It is a drug that induces insensitivity to pain. |
| Antiflatulent | It is a drug that reduces intestinal gas |
| Antipyretics | It is a drug used to lower body temperature. |
| Analgesics | It is a drug that is used to prevent or relieve pain. Eg. Aspirin. |
| Antibiotics | It is a drug that inhibits the growth of or destroys micro-organisms. Eg. Penicillin. |
| Antihistamines | It is a drug used to relieve symptoms of cold and allergies. |
| Antispasmodic | It is a drug used to relieve spasm of involuntary muscle usually in stomach. |
| Antacid | It is a drug used for preventing or correcting acidity, especially in the stomach. |
| Diuretics | It is a drug that promotes the production of urine. |
| Laxative | It is a drug used to provide relief in constipation. |

TYPES OF DISEASES

Disease caused by Viruses:

| | |
|---|---|
| 1. Chicken pox - | It is caused by Varicella-zoster virus. |
| 2. Small Pox - | It is caused by Variola virus. |
| 3. Common Cold - | It is caused by Rhinovirus. |
| 4. AIDS (Acquired Immunodeficiency Syndrome) - | It is caused by Human Immunodeficiency Virus (HIV). |
| 5. Measles - | It is caused by Measles virus. |
| 6. Mumps - | It is caused by Mumps virus. |
| 7. Rabies - | It is caused by Rabies virus (Rhabdoviridae family). |
| 8. Dengue fever - | It is caused by Dengue virus. |
| 9. Viral encephalitis - | It is an inflammation of the brain. It is caused by rabies virus, Herpes simplex, polio virus, measles virus, and JC virus. |

Disease caused by Bacteria:

| | |
|----------------------------|--|
| 1. Whooping Cough - | It is caused by a bacterium called Bordetella pertussis. |
| 2. Diphtheria - | It is caused by Corynebacterium diphtheriae. |
| 3. Cholera - | It is caused by Vibrio cholerae. |
| 4. Leprosy - | It is caused by Mycobacterium leprae. |
| 5. Pneumonia - | It is caused by Streptococcus pneumoniae. |
| 6. Tetanus - | It is caused by Clostridium tetani. |
| 7. Typhoid - | It is caused by Salmonella typhi. |
| 8. Tuberculosis - | It is caused by Mycobacterium tuberculosis. |
| 9. Plague - | It is caused by Yersinia pestis. |

DISEASE CAUSED BY PROTOZOANS:

| | | | |
|-----------------------------|--|----------------|---|
| 1. Malaria | It is spread by Anopheles mosquitoes. The Plasmodium parasite that causes malaria is neither a virus nor a bacteria | it is a single | celled parasite that multiplies in red blood cells of humans. |
| 2. Amoebic dysentery | It is caused by Entamoeba histolytica. | | |
| 3. Sleeping sickness | It is caused by Trypanosoma brucei. | | |

| | | | |
|---------------------|-------------------------------------|--|--|
| 4. Kala azar | It is caused by Leishmaniadonovani. | | |
|---------------------|-------------------------------------|--|--|

DISEASE CAUSED BY WORMS:

| | | |
|----------------------|--|--|
| 1. Tapeworm | They are intestinal parasites. It cannot live on its own. It survives within the intestine of an animal including human. | |
| 2. Filariasis | It is caused by thread | like filarial nematode worms. Most cases of filaria are caused by the parasite known as Wuchereriabancrofti. |
| 3. Pinworm | It is caused by small, thin, white roundworm called Enterobiusvermicularis. | |

VITAMINS AND MINERAL DEFICIENCY DISEASES:

| | |
|--|--|
| 1. Anaemia | It is caused due to deficiency of mineral Iron. |
| 2. Ariboflavinosis | It is caused due to deficiency of Vitamin B2. |
| 3. BeriBeri | It is caused due to deficiency of Vitamin B. |
| 4. Goitre | It is caused due to deficiency of Iodine. |
| 5. Impaired clotting of the blood | It is caused due to deficiency of Vitamin K. |
| 6. Kwashiorkor | It is caused due to deficiency of Protein. |
| 7. Night Blindness | It is caused due to deficiency of Vitamin A. |
| 8. Osteoporosis | It is caused due to deficiency of mineral Calcium. |
| 9. Rickets | It is caused due to deficiency of Vitamin D. |
| 10. Scurvy | It is caused due to deficiency of Vitamin C. |

COMMON HUMAN DISEASES AND AFFECTED BODY PART:

| Disease | Affected Body Part |
|-----------------------|---------------------------|
| AIDS | Immune system of the body |
| Arthritis | Joints |
| Asthma | Bronchial muscles |
| Bronchitis | Lungs |
| Carditis | Heart |
| Cataract | Eye |
| Cystitis | Bladder |
| Colitis | Intestine |
| Conjunctivitis | Eye |
| Dermatitis | Skin |
| Diabetes | Pancreas and blood |
| Diphtheria | Throat |
| Eczema | Skin |
| Goitre | Thyroid gland |
| Glossitis | Tongue |
| Glaucoma | Eye |
| Gastritis | Stomach |
| Hepatitis | Liver |
| Jaundice | Liver |
| Malaria | Spleen |
| Meningitis | Brain and spinal cord |
| Myelitis | Spinal cord |
| Neuritis | Nerves |
| Otitis | Ear |
| Osteomyelitis | Bones |
| Paralysis | Nerves and limb |
| Pyorrhoea | Teeth |
| Peritonitis | Abdomen |
| Pneumonia | Lungs |
| Rhinitis | Nose |
| Rheumatism | Joints |
| Tuberculosis | Lungs |
| Tonsillitis | Tonsils |
| Trachoma | Eye |

GROUP AND ITS CLASSIFICATION:

K. Landsteiner: Classified human beings (1900) in four groups on the basis of the reaction of their blood: A, B, AB and O.

| Blood group | Carries antigen | Carries antibody | Can donate blood to | Can receive blood from |
|--------------------|------------------------|-------------------------|----------------------------|-------------------------------|
| A | A | B | A,AB | A,O |
| B | B | A | B,AB | B,O |
| AB | A,B | None | Only AB | Universal Acceptor |
| O | None | A,B | Universal donor | Only O |

