Biology grade 10

Unit 5: Human biology

5.1 The Digestive system

The human digestive system is composed of four digestive processes:
1**. Ingestion** - the taking in of nutrients, in the mouth,
2. **Digestion** - the breakdown of complex organic molecules into smaller components by enzymes step-wise, physical, and chemical processes that begins in the oral cavity and extends to the small intestine,
3. **Absorptio**n - the transport of digested nutrients from the small intestine to the cells of the body though finger like projection called villi in the small intestine, and
4. **Egesting** - the removal of food waste from the body.

- The digestive tract of adult humans is normally 6.5 m to 9m long.

The Oral Cavity

In the oral cavity, both physical and chemical digestion begins. It is the point of entry (ingestion) of food into the digestive system. The process that takes place in the mouth includes:

- ✓ the food is broken into smaller particles by mastication, the chewing action of the teeth.
- ✓ saliva, the watery fluid produced by the salivary glands contains amylase enzyme, and breaks down starches into simpler molecules.
- ✓ saliva dissolves food particles and makes it possible to taste what is being eaten.
- ✓ saliva lubricates the food so that it can be swallowed.
- ✓ we detect the flavour when food particles dissolved in saliva penetrate the cells of the taste buds located on the tongue and cheeks.
- ✓ the tongue, positions and mixes food and forms a ball of food called bolus ready to be swallowed

The teeth

There are 4 types of teeth:
1.Incisors: are eight chisel-shaped teeth at the front of your mouth specialized for cutting.

2.Canine: teeth that are sharp, dagger-shaped specialized for tearing.

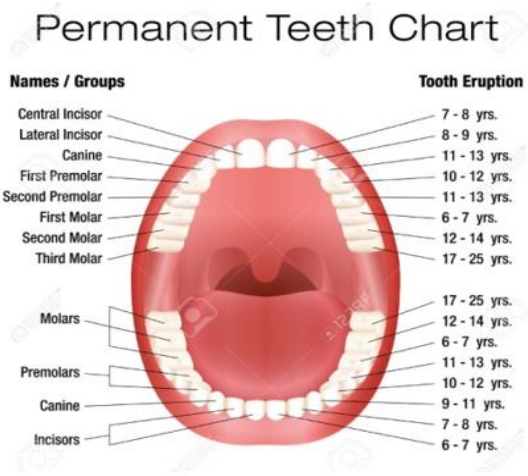
3.Premolar: teeth that are broad flattened specialized for grinding.

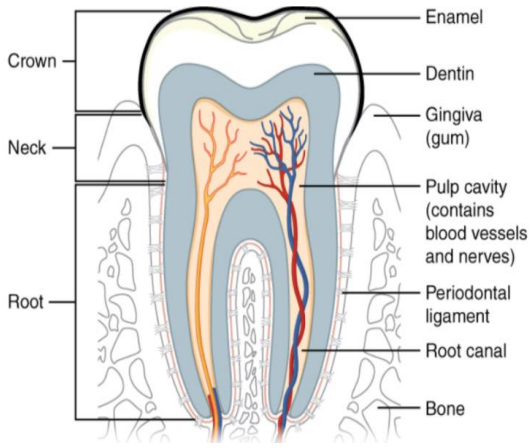
4.Molars: teeth tend to be even broader and have cusps that are even more flattened. They are designed for crushing and grinding food**.** Each tooth is covered with enamel, which is the hardest substance in the human body.

External and internal structures of teeth

The teeth are the hardest substances in the human body. Besides being essential for chewing, the teeth play an important role in speech. Parts of the teeth include:

- **Enamel**: the hardest, white outer part of the tooth. Enamel is mostly made of calcium phosphate, a rock-hard mineral.
- **Dentin**: a layer underlying the enamel. It is a hard tissue that contains microscopic tubes. When the enamel is damaged, heat or cold can enter the tooth through these paths and cause sensitivity or pain.
- **Pulp**: the softer, living inner structure of teeth. Blood vessels and nerves run through the pulp of the teeth.
- **Periodontal ligament**- tissue that helps to hold the teeth tightly against the jaw.
- **Roots**- is the part of the tooth that extends into the bone and holds the tooth in place. It makes up approximately two-thirds of the tooth
- **Gums.** Gums, also called gingiva, are the fleshy, pink connective tissue that's attached to the neck of the tooth and the cementum.
- **Crown**: the crown of a tooth is the top portion of the tooth that is visible.





Human dentition

It gives a set like I:C:P:M

- The dental formula of human beings (adults): (2123/2123) × 2 = 32(2123/2123) × 2 = 32
- In a child, there are 20 teeth present which are called milk teeth or deciduous teeth These are 2 incisors, 1 canine and 2 molars. (2102/2102) ×2=20(2102/2102) × 2=20

Keeping teeth health

- Regular brushing of your teeth and gums twice a day. This removes the plaque from the teeth, preventing the build-up of a sticky, acidic film over the enamel.

- Avoiding sweet, sugary foods – if the bacteria in your teeth are deprived of sugar, they cannot make acidic waste and your teeth are safe.
- Have regular dental check-ups.

The Esophagus

The swallowed food travels from the mouth to the stomach by way of the esophagus. The bolus of food stretches the walls of the esophagus, activating muscles that set up waves of rhythmic contractions called peristalsis. Peristaltic contractions, which are involuntary, move food along the gastrointestinal tract. Peristaltic action will move food or fluid from the esophagus to the stomach.

The stomach

- The stomach is the site of food storage and initial protein digestion.
- The stomach contains three layers of muscle, which run in different directions so that the muscle contractions can churn the food.
- The movement of food to and from the stomach is regulated by circular muscles called **sphincters**. Sphincters act like the draw strings on a bag.
- Contraction of the lower esophageal sphincter (LES) closes the opening to the stomach, while its relaxation allows food to enter.
- The lower esophageal sphincter prevents food and acid from being regurgitated up into the esophagus.
- A second sphincter, the pyloric sphincter, regulates the movement of food and stomach acids into the small intestine
- The J-shaped stomach has numerous ridges that allow it to expand so that it can store about1.5L of food.

Activities in the stomach:

- ✓ the cells secrete the various stomach fluids, called **gastric fluids** or **gastric juice**, that aid digestion,
- ✓ contractions of the stomach mix the food with the gastric fluids, and
- ✓ it is involved in both physical (churning action if stomach wall) and chemical digestion (e.g. digestion of proteins by the action of enzyme pepsin).

Gastric fluid includes:

- ✓ mucus -protects the stomach lining from being digested
- ✓ hydrochloric acid (HCl)), -kills many harmful substances that are ingested with food. It also converts pepsinogen into its active form, pepsin, which is a protein-digesting enzyme
- ✓ pepsinogens, and other substances.

- The partially digested food and gastric juice mixture are called **chyme**.
- Gastric emptying occurs within two to six hours after a meal. Only a small amount of chyme is released into the small intestine at a time.

- The movement of chyme from the stomach into the small intestine is regulated by hormones, stomach distension, and muscular reflexes that influence the **pyloric sphincter**.
- The low pH of the stomach will denature the amylase and lipase that were secreted in the mouth.
- Therefore, over time, the chemical digestion of starches and fats will decrease in the stomach and their further digestion will take place in the small intestine.

The small intestine

The small intestine is up to 7 m in length, but only 2.5 cm in diameter

Most chemical digestion takes place in the small intestine. Parts of the small intestine:

- ✓ **duodenum** the first 25 cm to 30 cm of the small intestine where the majority of digestion occurs,
- ✓ **jejunum** is the second component of the small intestine and
- ✓ **ileum** the third component

- Most absorption takes place within the small intestine. Long finger like projections called villi (singular: villus) greatly increase the surface area of the small intestine.
- Each villus is supplied with a capillary network that intertwines with lymph vessels called **lacteals** that transport materials.
- Some nutrients are absorbed by diffusion, but some nutrients are actively transported from the digestive tract. Monosaccharides and amino acids are absorbed into the capillary networks; fats are absorbed into the **lacteals**

The accessory organs

The organs discussed above are the organs of the digestive tract through which food passes. Accessory organs add secretions and enzymes that break down food into nutrients.

Accessory organs include:

- ✓ the salivary glands,
- ✓ the pancreas,
- ✓ the liver, and
- ✓ the gall bladder.

The secretions of the pancreas, liver, and gallbladder are regulated by hormones in response to food consumption.

- The **liver** is the largest internal organ in humans and it plays an important role in the digestion of fats and detoxifying blood. The liver produces **bile,** which is a digestive juice that is required for the breakdown of fats in the duodenum. The liver also processes the absorbed vitamins and fatty acids and synthesizes many plasma proteins.
- The **gallbladder** is a small organ that aids the liver by storing bile and concentrating bile salts.
- The **pancreas** secretes bicarbonate that neutralizes the acidic chyme and a variety of enzymes (trypsin, amylase, and lipase) for the digestion of proteins, carbohydrates, and fats, respectively

Pancreatic secretions contain the following digestive enzymes:

- ✓ **Trypsin**- a protein-digesting enzyme called trypsinogen is released from the pancreas
- ✓ **Erepsins**- complete protein digestion by breaking the bonds between short chain peptides, releasing individual amino acids.
- ✓ **Lipase**s-enzymes released from the pancreas that breaks down lipids (fats).
- ✓ **Amylase**- continue the digestion of carbohydrates that begun in the mouth by salivary amylase
- ✓ **Disaccharidases (**maltase, lactase, sucrose), which complete the digestion of carbohydrates. They produced by small intestine.

What is the importance of liver?

The liver continually produces fluid called bile. **Bile** is a greenish-yellow alkaline liquid that is produced in the liver (a large reddish-brown organ that carries out lots of important jobs in the body). Bile contains bile salts, which aid fat digestion. When the stomach is empty, bile is stored and concentrated in the gallbladder.

- ✓ Filtration
- ✓ Digestion
- ✓ Metabolism and Detoxification
- ✓ Protein synthesis
- ✓ Storage of vitamins and minerals

Large Intestine

The human large intestine is much smaller in length compared to the small intestine but larger in diameter. It has three parts: the **cecum**, the **colon**, and the **rectum.**

- The cecum joins the ileum to the colon and is the receiving pouch for the waste matter.
- The colon is home to many bacteria or intestinal flora that aid in the digestive processes
- The rectum stores feces until defecation.

Chemical digestion is complete by the time food reaches the large intestine. The colon, the largest part of the large intestine, must store waste long enough to reabsorb water from it. During this time, some inorganic salts, minerals, and vitamins are also absorbed with the water.

5.2 The circulatory and lymphatic system

The circulatory system is a means by which blood moves throughout your body.

The circulatory system:

- ✓ carries nutrients to cells,
- ✓ remove wastes away from cells,
- ✓ carry chemical messages from cells in one part of the body to distant target tissues,
- ✓ distributes heat throughout the body and, along with the kidneys,
- ✓ maintain levels of body fluid,
- ✓ provide oxygen for the cellular respiration and
- ✓ transport of immune cells throughout the body to defend against invading organisms

❖ The circulatory system consists of the heart, blood vessels, and blood.

Blood

- Blood is a fluid consisting of red blood cells, white blood cells, plasma, and platelets.
- The blood carries oxygen, nutrients, and waste to and away from all body tissues.

Blood Vessels: are the channels or conduits through which blood is distributed to body tissues. The vessels make up two closed systems of tubes that begin and end at the heart.

- ✓ The pulmonary vessels, transports blood from the right ventricle to the lungs and back to the left atrium.
- ✓ The systemic vessels, carries blood from the left ventricle to the tissues in all parts of the body and then returns the blood to the right atrium.

- **Arterie**s: carry the oxygenated blood to the tissues of the body from the heart.
- **Capillarie**s: Tiny tubes that carry blood from the arteries to the body's cells, and then back to the veins. Gas and nutrient exchange with the tissues occurs within the capillaries that run through the tissues
- **Vein**s: carry they the deoxygenated blood from the tissues of the body back to the heart.

The heart

It is a muscular organ that pumps blood to circulate throughout the body.
The heart wall consists of three layers: the endocardium, myocardium, and epicardium.

- ✓ The **endocardium** is the thin membrane that lines the interior of the heart,
- ✓ The **myocardium** is the middle layer of the heart. It is the heart muscle and is the thickest layer of the heart, and
- ✓ The **epicardium** is a thin layer on the surface of the heart in which the coronary arteries lie.
- ✓ The pericardium is a thin sac the heart sits in, often filled with a small amount of fluid, which separates the heart from the other structures in the chest such as the lungs

Valves

The heart valves permit forward flow of blood while preventing backward regurgitant flow.
In the cardiovascular system of the heart four valves prohibit the backflow of blood:

- **Tri-cuspid valve** (Right atrioventricular RAV) - valve separates the right atria from the right ventricle.
- **Bi-cuspid valve** (Left atrioventricular LAV) -valve separates the left atria from the left ventricle
- **Semi-lunar valves**
  - ✓ Valve that separates the right ventricle from the pulmonary artery and
  - ✓ Valve that separates the left ventricle from the aorta

❖ The human circulatory systems are a **double circulatory system**. It has two separate circuits and blood passes through the heart twice: pulmonary and systemic circulation.

- **Pulmonary circulation:** the movement of blood from the heart to the lungs for oxygenation, then back to the heart again

- **Systemic circulation** - is the movement of blood from the heart through the body to provide oxygen and nutrients to the tissues of the body while bringing deoxygenated blood back to the heart.

Cardiac Cycle: the period of time that begins with contraction of the atria and ends with ventricular relaxation is known as the cardiac cycle.

- ✓ The period of contraction that the heart undergoes while it pumps blood into circulation is called **systole.**
- ✓ The period of relaxation that occurs as the chambers filled with blood is called **diastole.**

Heart Sounds: the noises that occur when blood flows through the heart chambers as valves open and close during the cardiac cycle.

Stethoscope, medical instrument used in listening to sounds produced within the body, chiefly in the heart or lungs. Using a stethoscope to hear sounds is called **auscultation**

In a normal, healthy heart, there are only two audible heart sounds: Lub and Dup (or Dub).

Lub, or rest heart sound is the sound created by the closing of the atrioventricular valves during ventricular contraction.

Dup (or "Dub") is the sound of the closing of the semilunar valves during ventricular diastole.

Blood Pressure: is the force of the blood on the walls of the arteries.

- It can be measured indirectly with an instrument called a **sphygmomanometer.**
- Each time the heart contracts, the sound are heard. A gauge on the sphygmomanometer measures the pressure exerted by the blood during ventricular contraction. This pressure is called systolic blood pressure.
- Normal systolic blood pressure is less than 120 mmHg.
- Blood pressure is measured in the non-SI units of millimeters of mercury, or mmHg. The cuff is then deflated even more, until the sound disappears. At this point, blood flows into the artery during ventricular relaxation, or filling. This pressure is called diastolic blood pressure.
- Normal diastolic blood pressure is less than 80 mmHg.

A systolic pressure of 120 mmHg and a diastolic pressure of 80 mmHg would be reported as 120/80 (120 over 80).

Blood

Blood is a constantly circulating fluid providing the body with nutrition, oxygen, and waste removal. It is mostly liquid, with numerous cells and proteins suspended in it, making blood "thicker" than pure water

The main components of blood are**:**

- ✓ Red blood cells, which carry oxygen to the tissues
- ✓ White blood cells, which fight infections
- ✓ Platelets, smaller cells that help blood clot
- ✓ Plasma contains proteins that help the blood to clot, transport substances through the blood, and perform other functions.

Red blood cells, or erythrocytes

- ✓ RBC normally make up 40-50% of the total blood volume.
- ✓ They transport oxygen from the lungs to all of the living tissues of the body and carry away carbon dioxide.
- ✓ The red cells are produced continuously in our **bone marrow** from stem cells at a rate of about 2-3 million cells per second.
- ✓ Hemoglobin (containing iron) is the gas transporting protein molecule that makes up 95% of a red cell
- ✓ The
- ✓ red color of blood is primarily due to oxygenated red cells.

Red blood cell adaptation for efficient oxygen transportation:

- RBC have nucleus at the young stage and lose its nucleus when matured. Not having a nucleus means that there is more space inside for hemoglobin, so each red blood cell can carry more oxygen.
- Biconcave shape gives it a larger surface area for gaseous diffusion than a flat disc of the same volume.
- Very thin cell surface membrane enables oxygen and carbon dioxide can diffuse in and out rapidly.
- Flexible cell surface membrane allows it to squeeze along the narrowest blood capillaries.

White blood cells (leukocytes)

- Exist in variable numbers and types but make up a very small part of blood's volume; in normally exists among only about 1% in healthy people.
- Leukocytes are not limited to blood. They occur elsewhere in the body as well, most notably in the **spleen**, **liver**, and **lymph glands**.
- Most are produced in our bone marrow from the same kind of stem cells that produce red blood cells. Others are produced in the thymus gland, which is at the base of the neck.
- White blood cells (lymphocytes) are the first responders to our immune system. They seek out, identify, and bind to alien proteins on bacteria, viruses, and fungi so that they can be removed.
- Other white blood cells (called granulocytes and macrophages) then arrive to surround and destroy the alien cells.
- Have the function of getting rid of dead or dying blood cells as well as foreign matter.
- Individual white blood cells usually only last for 18-36 hours before they are removed though some types live as much as a year. There are several different kinds of white blood cells.

The two important types are:

- **neutrophil**s white blood cells that have a lobed nucleus, and
- lymphocytes white blood cells that are smaller than neutrophils and which have a large nucleus that takes up most of the cell.

Platelets or thrombocytes that are tiny cell fragments without nuclei enclosed in a membrane. Platelets play an essential role in blood clotting. Clotting has two important functions:

- ✓ it helps to stop blood from flowing out of the damaged vessel, and
- ✓ it prevents disease-causing pathogenic microorganisms (viruses, bacteria) from getting into the body.

- they collect where a damaged blood vessel is leaking blood and form a temporary plug by combining with fibers of collagen, a protein of the blood vessel wall.
- they release an enzyme that sets off a chain of chemical reactions in the blood. The result of these reactions is to change fibrinogen, a soluble plasma protein into a network of insoluble fibrin threads. These networks of fibrin threads, then plug in the cut and clot the blood.

Plasma

Plasma is a yellow-tinted water, sugar, fat, protein, and salt fluid that transports red blood cells, white blood cells, and platelets.

- Plasma makes up 55 percent of our blood volume.
- provides nutrients to cells while also removing metabolic waste.
- blood clotting factors, carbohydrates, lipids, vitamins, minerals, hormones, enzymes, antibodies, and other proteins are all found in it.
- includes some of every protein generated by the body; so far, only about 500 proteins have been discovered in human plasma.

Blood groups

The blood grouping depends on which antigens are on the surface of the red blood cells. Antigens are molecules. They can be either proteins or sugars.

The types and features of antigens can vary between individuals due to small genetic differences. The antigens in blood have various functions, including:

- ✓ transporting other molecules into and out of the cell,
- ✓ maintaining the structure of red blood cells, and
- ✓ detecting unwanted cells that could cause illness.

Scientists use two types of antigens to classify blood types: **ABO** antigens and **Rh** antigens.

Antigens and antibodies play a role in the immune system's defense mechanism.

White blood cells produce **antibodies**.

These antibodies will target an antigen if they consider it a foreign object.

- The ABO blood group system classifies blood types according to the different types of antigens in the red blood cells and antibodies in the plasma. They use the ABO system alongside the Rh antigen status to determine which blood type or types will match for a safe red blood cell transfusion.

There are four ABO groups: **A, B. AB, O**

Rhesus factor

The positive or negative sign next to the blood groups is known as the Rhesus (Rh) factor. The Rh factor is an inherited protein that can be found on the surface of the red blood cell.

- ✓ If your blood type is positive, then your blood cells have the Rh protein.
- ✓ If your blood type is negative, then your blood cells lack the Rh protein.

➢ Your Rh factor doesn't affect your overall health, It only becomes important when blood types are mixed together, like during pregnancy and childbirth. During pregnancy, complications may occur if you're Rh-negative and the fetus is Rh-positive. This is called Rh factor incompatibility. Treatments are available to prevent complications of Rh incompatibility.

Symptoms when a Rh-negative mother's antibodies attack the red blood cells of a Rh-positive fetus include **anemia, jaundice**, and an **enlarged liver**.

Blood Donation

- The process of transferring blood from a healthy person (donor) to a person deficient in blood
- (recipient) is called blood **transfusion.**
- If the blood from two different blood groups is mixed and if it is not compatible, there may be a reaction between the antigen and the complementary antibody which makes the red blood cells stick together, a phenomenon known as **agglutination.**
- Before a transfusion it is vital to know the blood groups of both the person giving the blood (the donor) and the person receiving the blood (the recipient).
- This means the right type of blood can be given to prevent agglutination.
- The blood groups must be compatible.

Blood group	Antigen on red blood cells	Antibody in plasma
A	A	B
B	B	A
AB	AB	none
O	none	AB

❖ The O blood groups is termed "Universal Donor" while the AB blood group is termed as a "Universal recipient"

The Lymphatic System

The key functions of the lymphatic system:

- returns excess interstitial fluid to the blood
- the absorption of fats and fat-soluble vitamins from the digestive system and the subsequent transport of these substances to the venous circulation. The blood capillaries absorb most nutrients, but the fats and fat-soluble vitamins are absorbed by the lacteals. The lymph in the lacteals has a milky appearance due to its high fat content and is called chyle.

- defence against invading microorganisms and disease. Lymph nodes and other lymphatic organs filter the lymph to remove microorganisms and other foreign particles. Lymphatic organs contain lymphocytes that destroy invading organisms.

The lymphatic system consists of a fluid (lymph), vessels that transport the lymph and organs that contain lymphoid tissue.

Lymph

Lymph is a fluid substance made up of lymphocytes and white blood cells that is clear to white in colour. It serves a variety of purposes:

- ✓ Removes metabolic wastes from tissue cells,
- ✓ Provides the body with nutrition,
- ✓ Aids in the invasion of microbe-caused pathogenic diseases,
- ✓ Through lymphatic vessels, absorbs fat-soluble vitamins and
- ✓ other digested fat molecules from the small intestine, and
- ✓ Maintain the composition of tissue fluid

Lymphatic vessels

lymphatic vessels transport only fluid away from tissues.

The lymph capillaries are the smallest lymphatic vessels, beginning in the tissue spaces as blind-ended sacs. Lymph capillaries can be found in every part of the body except the bone marrow, the central nervous system, and tissues that lack blood vessels, such as the epidermis. The wall of the lymph capillary is made up of endothelium, which is made up of simple squamous cells that overlap to form a simple one-way valve. This configuration allows fluid to enter the capillary but prevents lymph from exiting the vessel.

Organs of the lymphatic system

Among the lymphatic organs are:

- ✓ Lymph nodes
- ✓ Tonsils
- ✓ Spleen, and
- ✓ Thymus.

i**. Lymph nodes**

- Lymph fluid flows in the lymph nodes throughout the body before finally making its way back to the blood stream.
- The lymph nodes filter the fluid and release it back into the bloodstream.
- It also contains immune cells that help fight infection by attacking the germs that the body's lymph fluid has collected.
- The lymph nodes may swell when a person has a temporary infection. The swelling occurs as a result of immune cell activity in the lymph nodes. The location of the swelling often relates to the affected area.
- For example, an ear injury/infection may cause swollen lymph nodes near the ear, while someone with an upper respiratory tract infection may notice swollen lymph nodes in their neck.

ii. **Tonsils**

- Tonsils are lymphatic tissue clusters located just beneath the mucous membranes that line the nose, mouth, and throat (pharynx).
- The tonsils' lymphocytes and macrophages protect us from
- harmful substances and pathogens such as bacteria and viruses that enter the body through the nose or mouth.

iii. Spleen

The spleen is found in the upper left abdominal cavity, just below the diaphragm and posterior to the stomach. Its shape and structure are similar to that of a lymph node, but it is much larger.
The spleen performs the following functions:

- ✓ filters blood in the same way that lymph nodes filter lymph;
- ✓ lymphocytes in the spleen react to pathogens in the blood and attempt to destroy them;
- ✓ macrophages engulf debris, damaged cells, and other large particles;
- ✓ removes old and damaged erythrocytes from the circulating blood; and
- ✓ it produces lymphocytes, particularly in response to infection.

iv. **Thymus**

- The thymus is a soft organ with two lobes anterior to the ascending aorta and posterior to the sternum. It is relatively large in infants and children, but after puberty, it begins to shrink in size until it is quite small in older adults.
- The thymus' primary function is to process and mature special lymphocytes known as T-lymphocytes or T-cells.
- Pathogens and foreign agents are not recognized by lymphocytes while they are in the thymus. After maturing, lymphocytes enter the bloodstream and travel to other lymphatic organs, where they aid in disease defense.
- Thymosin, a hormone produced by the thymus, stimulates the maturation of lymphocytes in other lymphatic organs.

Diseases of the circulatory and lymphatic systems

Leukemia

- Leukemia is a type of cancer that affects blood-forming tissues, including bone marrow.
- There are several types of leukemia, including acute lymphoblastic leukemia, acute myeloid leukemia, and chronic lymphocytic leukemia. For example, many patients with slow-growing leukemia are asymptomatic, and rapidly progressing types of leukemia can cause fatigue, weight loss, frequent infections, and easy bleeding or bruising. Also, the treatment varies greatly.
- Treatment for slow-growing leukemia may include monitoring.
- Chemotherapy, sometimes followed by radiation and stem-cell transplant, is used to treat aggressive leukemia.

Varicose veins

- Varicose veins are enlarged, swollen, and twisting veins that often have blue or dark purple colour.
- They occur when faulty vein valves allow blood to flow in the wrong direction or pool.
- Varicose veins are thought to affect more than 23% of all adults. It is common in:
    - ✓ pregnant women are more prone to varicose veins, and
    - ✓ overweight people are more prone to varicose veins
- **Aching legs**, **swollen ankles**, and **spider veins** are some of the symptoms.
- It occurs when the valves in the veins fail to function properly, allowing blood to flow inefficiently.
- Treatment for varicose veins is rarely necessary for health reasons; however, if swelling, aching, and painful legs occur, and there is significant discomfort, treatment is available.
- There are several options, including some home remedies. In severe cases, a varicose vein may rupture or develop into varicose ulcers on the skin.

Elephantiasis

- Elephantiasis is a condition that causes a large enlargement of a part of the body, usually the limbs. External genitals are another area that is frequently affected.
- Elephantiasis is caused by a blockage in the lymphatic system, resulting in an accumulation of a fluid known as lymph in the affected areas.
- Elephantiasis is caused by parasitic worms transmitted by mosquitoes.
- *Wuchereria bancrofti, Brugia malayi*, and *Brugia timori* are the three worms involved.
- Worms have an impact on the body's lymphatic system. The lymphatic system is in charge of eliminating waste and toxins. If it becomes clogged, it is unable to properly remove waste. This causes a buildup of lymphatic fluid, resulting in swelling.

Cardiovascular diseases

Cardiovascular diseases are classified into several types. Among them are:

- ✓ Abnormal heart rhythms, also known as arrhythmias;
- ✓ Aorta disease and Marfan syndrome are two examples,
- ✓ Congenital heart disease is a condition that occurs at birth,
- ✓ Coronary artery disease is a condition that affects the arteries in the heart (narrowing of the arteries),
- ✓ Deep vein thrombosis (DVT) and pulmonary embolism (PE),
- ✓ A heart attack,
- ✓ Heart failure, and
- ✓ Muscle disease of the heart (cardiomyopathy).

Heart disease

Heart and blood vessel disease (also known as heart disease) encompasses a wide range of issues, many of which are linked to a process known as atherosclerosis.

Atherosclerosis is a condition that occurs when a substance called plaque accumulates in the artery walls. This buildup narrows the arteries, making blood flow more difficult. When a blood clot forms, it can obstruct blood flow. This can result in a heart attack or a stroke.

Heart attack

A heart attack occurs when a blood clot blocks blood flow to a portion of the heart. If the clot completely obstructs blood flow, the part of the heart muscle supplied by that artery begins to die. Most people recover from their first heart attack and go on to live normal lives, gaining many more years of productive activity. However, having a heart attack means that you must make some changes. The medications and lifestyle changes recommended by your doctor may
differ depending on how badly your heart was damaged and the degree of heart disease that caused the heart attack.

Stroke

It is a cerebrovascular disease. It occurs when a blockage or bleed of the blood vessels either interrupts or reduces the supply of blood to the brain. When this happens, the brain does not receive enough oxygen or nutrients, and brain cells start to die.

There are 2 types of strokes:

1. An **ischemic stroke** (the most common type of stroke) occurs when a blood vessel that supplies the brain becomes blocked, typically due to a blood clot. When a part of the brain's blood supply is cut off, some brain cells begin to die. This can lead to the loss of functions controlled by that part of the brain, such as walking or speaking.
2. When a blood vessel in the brain bursts, it causes a **hemorrhagic stroke**. Uncontrolled hypertension is the most common cause of this (high blood pressure). Some stroke effects are permanent if too many brain cells die as a result of oxygen deprivation. This population of cells is never replenished.

Heart failure

Heart failure, also known as congestive heart failure, occurs when the heart does not pump blood as efficiently as it should. Heart failure does not imply that the heart ceases to beat; this is a common misconception. Instead, the heart continues to beat, but the body's need for blood and oxygen is unsatisfied. If left untreated, heart failure can worsen. It is critical to follow the doctor's orders if your loved one has heart failure.

Arrhythmia

An abnormal heart rhythm is referred to as arrhythmia. Arrhythmias come in a variety of forms. The heart can beat too slowly, too quickly, or in an irregular pattern.

Bradycardia or a slow heart rate, occurs when the heart rate is less than 60 beats per minute. Tachycardia, or an abnormally fast heart rate, is defined as a heart rate of more than 100 beats per minute.

An arrhythmia can impair the function of your heart. Your heart may not be able to pump enough blood to meet your body's needs if it has an irregular heartbeat.

5.3 **The breathing system**

The breathing system organs' primary functions are to:

- ✓ provide oxygen to body tissues for cellular respiration,
- ✓ remove the waste product, carbon dioxide,
- ✓ help to maintain acid-base balance, and
- ✓ portions of the breathing system are also used for non-vital functions such as sensing odors, producing speech, and coughing.

- The nose, larynx, pharynx, trachea, bronchi, bronchios, and alveoli are the major structures of the breathing system

The Nose

- The nostrils are the main entry and exit points of breathing system which are located in the nose. The nasal cavity, which is divided into left and right sections by the nasal septum, receives the inhaled air. The air moves from the nasal cavities to the pharynx.
- Mucous membranes line portions of the nasal cavities, which contain sebaceous glands and hair follicles that prevent large debris, such as dirt, from passing through the nasal cavity

The pharynx

- It is a tube made up of skeletal muscle and mucous membrane that runs parallel to the nasal cavities. The pharynx, also known as the **throat,** is a tube that runs from the base of the skull to the sixth cervical vertebra.
- It receives air from the nasal cavity and air, food, and water from the oral cavity, serving the breathing and digestive systems. It opens into the larynx and esophagus from the back.
- Only air can pass through the upper part of the pharynx (throat).
- Air, food, and fluids can pass through the lower parts.
- The pharynx contains the pharyngeal, palatine, and lingual tonsils.
- Sometimes the pharynx can be infected by microorganisms. The pharyngeal tonsil has a large number of lymphocytes (a type of white blood cell) and is covered with ciliated epithelium that traps and destroys pathogens that enter through inhalation.

Larynx

- The larynx is a structure that connects the pharynx to the trachea and helps regulate the amount of air that enters and leaves the lungs.
- Several pieces of cartilage make up the structure of larynx. epiglottis is tissue flap at the entrance to the trachea that closes when you swallow to keep food and liquids out of your airway.
- larynx contains vocal cords, which create sound.

Trachea

- The trachea (windpipe) extends from the larynx toward the lungs.
- The trachea is formed by 16 to 20 stacked pieces of cartilage that are connected by connective tissue.

- The elastic membrane of the trachea allows it to stretch and expand slightly during inhalation and exhalation, whereas the rings of cartilage provide structural support and prevent the trachea from collapsing.

Bronchi and Bronchioles

- The right and left primary bronchi branch of the trachea towards the right and left lungs. The primary bronchi further branch into the secondary and tertiary bronchi.
- A bronchiole branches from the tertiary bronchi.
- Bronchioles, which are about 1 mm in diameter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gas exchange.
- The bronchi carry air into your lungs. At the end of the bronchi, the bronchioles carry air to small sacs in your lungs called alveoli. The alveoli perform body's gas exchange.

Alveoli

- An alveolar sac is a cluster of many individual alveoli that are responsible for gas exchange. An alveolus with elastic walls, stretch during air intake which greatly increases the surface area available for gas exchange.
- Alveoli are connected to their neighbors by alveolar pores, which help maintain equal air pressure throughout the alveoli and lung.

Breathing Movements

- Pressure differences between the atmosphere and the chest, or thoracic cavity determine the movement of air into and out of the lungs.
- Atmospheric pressure remains relatively constant, but the pressure in the chest cavity may vary.
- Gases move from an area of high pressure to an area of low pressure:
  - ✓ **Inspiration** occurs when the pressure inside the lungs is less than that of the atmosphere, and
  - ✓ **expiration** occurs when the pressure inside the lungs is greater than that of the atmosphere.
- The d**iaphragm**, a dome-shaped sheet of muscle that separates the thoracic, or chest cavity from the abdominal cavity, can regulate the pressure in the chest cavity

During inspiration

- ✓ The diaphragm muscle contracts, or shortens, pulling downward.
- ✓ The chest volume increases and pressure in the lungs decreases.
- ✓ The atmospheric pressure is now greater than the pressure in the chest cavity, and air moves into the lungs.

During expiration

- ✓ The diaphragm relaxes and returns to its dome shape due to the force exerted by the organs in the abdomen.
- ✓ The chest volume decreases and pressure increases.
- ✓ The pressure in the chest cavity is now greater than the atmospheric pressure, and air moves out of the lungs

Disorders of the Breathing System

All breathing disorders share one common characteristic: they all decrease oxygen delivery to the tissues.

Bronchitis

- Breathing difficulties can be caused by bacteria or viral illnesses, as well as reactions to environmental pollutants.
- Bronchitis is a condition in which the airways narrow and the mucous lining of the bronchial tubes becomes inflamed.
- Excess mucus production, tissue swelling, constriction of the airways, and restricted airflow through the bronchi are all symptoms of this condition.

Emphysema

- The alveolar walls become irritated in emphysema. The air sacs lose their flexibility, stretch, and eventually rupture as a result of this. As a result, exhaling becomes difficult, and air is trapped in the lungs. Because there are fewer alveoli, the surface area available for gas exchange is reduced, resulting in lower oxygen levels.
- Emphysema is caused by smoking, which is by far the most common cause.
- Chronic bronchitis has been linked to emphysema. COPD (chronic obstructive pulmonary disease) is the name given to both of these conditions. COPD, like bronchitis, causes the bronchioles to become more resist [pant to air movement.
- Although air moves freely into the alveoli, the smaller diameter of the bronchioles increases barrier to air movement out of the lungs, making exhalation difficult.
- The breathing rate increases as the body attempts to maintain homeostasis.
- The circulatory system responds by speeding up the heartbeat.

Bronchial Asthma

- The inflammation of the bronchioles is linked to bronchial asthma.
- Exhaling requires more work than inhaling in asthma.
- The imbalance between the amount of air entering and leaving the lungs must be addressed by increasing the exertion of expiration.
- Common causes for asthma are tobacco smoking, pollution, and allergens such as pollen, mold, dust, etc.