Chapter 5: Life Processes – Detailed Notes

◆ What are Life Processes?

Life Processes are the processes essential for maintaining life. These include:

- **Nutrition**
- **Respiration**
- **Transportation**
- **Excretion**

All living organisms perform these to survive, grow, and reproduce.

◈ 1. Nutrition

Nutrition is the process of obtaining food and converting it into energy.

◆ Types of Nutrition

1. **Autotrophic Nutrition** – Organisms make their own food (e.g., plants).
2. **Heterotrophic Nutrition** – Organisms depend on others for food (e.g., animals, fungi).

🌱 Autotrophic Nutrition (Photosynthesis)

Photosynthesis is the process by which green plants make their own food using sunlight.

Equation:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Key Components:

- **Chlorophyll**: Traps sunlight
- **CO_2**: From the atmosphere
- **Water**: From soil

🍽️ Heterotrophic Nutrition

Types:

- **Holozoic**: Ingestion, digestion (e.g., humans)

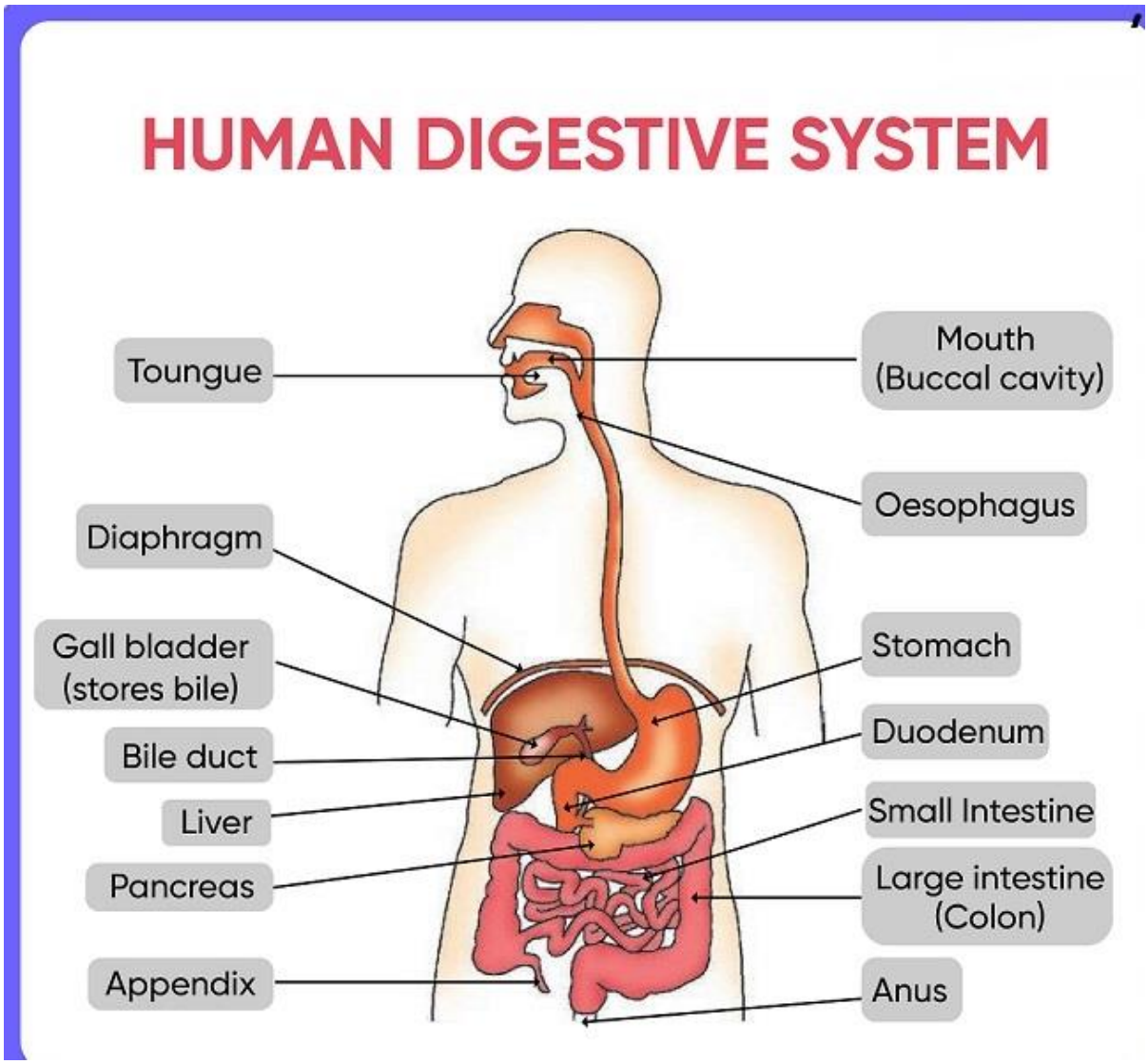
- **Saprophytic**: Feeding on dead organisms (e.g., fungi)
- **Parasitic**: Live on host (e.g., leech, tapeworm)

🍔 Nutrition in Humans

Involves:

1. **Ingestion**
2. **Digestion**
3. **Absorption**
4. **Assimilation**
5. **Egestion**

📷 Diagram: Human Digestive System



◆ 2. Respiration

Respiration is the process of breaking down glucose to release energy.

Types of Respiration:

1. **Aerobic Respiration** (with O_2):

   $C6H12O6+6O2 \rightarrow 6CO2+6H2O+Energy$

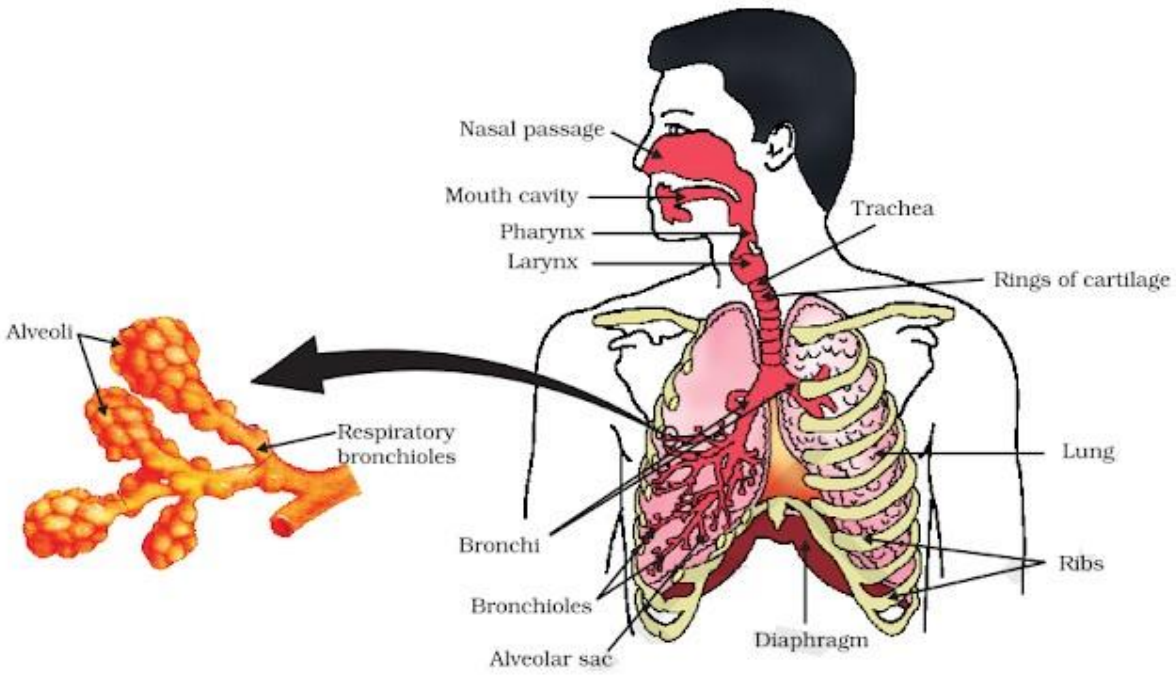
   Anaerobic Respiration (without O_2):

   - In yeast: Glucose → Alcohol + CO_2 + Energy

Respiration in Humans

- Takes place in **mitochondria**
- Involves **lungs** (breathing)

📷 Diagram: Human Respiratory System



◆ 3. Transportation

Transport of food, gases, and wastes in organisms.

In Humans:

The **heart** is a muscular organ located in the chest cavity. It acts like a **pump**, continuously circulating blood throughout the body to supply **oxygen** and **nutrients** and remove **carbon dioxide** and **wastes**.

□ Structure of the Heart

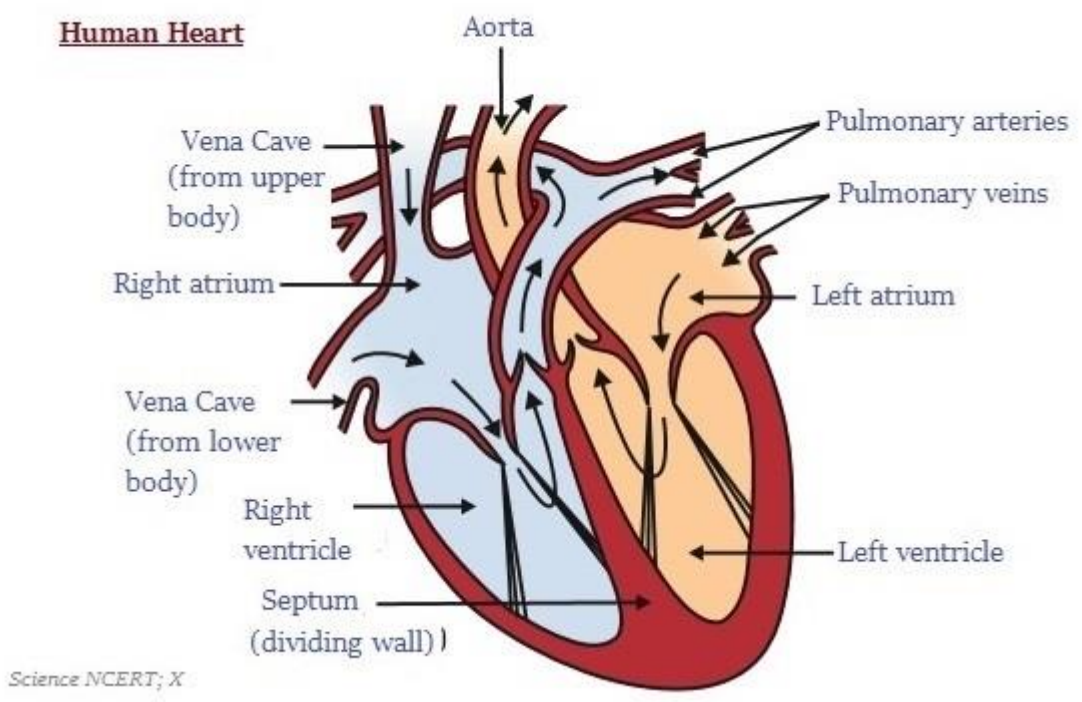
The heart has **four chambers**:

- **Right Atrium** (upper right)
- **Right Ventricle** (lower right)
- **Left Atrium** (upper left)
- **Left Ventricle** (lower left)

And **four valves** to prevent backflow:

- Tricuspid valve (between right atrium & right ventricle)
- Pulmonary valve
- Mitral (bicuspid) valve (between left atrium & left ventricle)
- Aortic valve

📷 Heart Diagram



🔄 Working of the Heart (Step-by-Step)

The human heart works in **two cycles** — **Pulmonary circulation** and **Systemic circulation**. The overall process is called **Double Circulation**.

Step 1: Collection of Deoxygenated Blood

- **Deoxygenated blood** (low in oxygen, rich in CO_2) comes from the **body** to the **right atrium** through **vena cava**.

Step 2: Blood moves to Right Ventricle

- When the right atrium contracts, blood flows through the **tricuspid valve** into the **right ventricle**.

Step 3: Blood sent to Lungs (Pulmonary Circulation)

- The right ventricle contracts and sends blood to the **lungs** through the **pulmonary artery**.
- In the lungs, **CO_2 is removed** and **oxygen is absorbed**.

Step 4: Oxygenated Blood Returns

- Oxygen-rich blood comes back from the **lungs** to the **left atrium** via the **pulmonary vein**.

Step 5: Blood moves to Left Ventricle

- The left atrium contracts and pushes blood into the **left ventricle** through the **mitral (bicuspid) valve**.

Step 6: Blood Pumped to the Body (Systemic Circulation)

- The **left ventricle** contracts and pumps oxygen-rich blood to the **entire body** through the **aorta**.

🔁 Repeat!

This cycle happens continuously (about **72 times per minute** on average in adults).

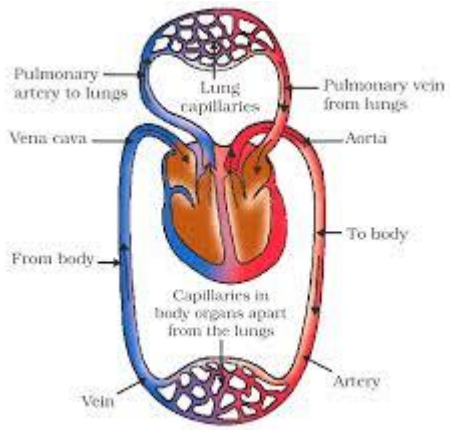
Double Circulation

- **Pulmonary circulation**: Right side of the heart → lungs → left side of the heart
- **Systemic circulation**: Left side of the heart → body → right side of the heart

 This ensures **oxygenated and deoxygenated blood don't mix**, and the body gets a continuous supply of oxygen.

Why is this Important?

- Keeps every cell alive by supplying oxygen and food
- Removes harmful wastes like CO_2
- Maintains blood pressure and body temperature



Transport in Plants

Plants, like animals, need a transport system to move water, minerals, and food throughout their body. But since they don't have a circulatory system like humans, they rely on **special tissues** called **xylem** and **phloem**.

Why Do Plants Need Transport?

- Roots absorb **water and minerals** from the soil.
- Leaves prepare **food** by photosynthesis.
- Different parts of the plant need both **water** and **food** to grow and function. Thus, **transport** is necessary.

1. Transport of Water and Minerals – Xylem

◆ What is Xylem?

Xylem is a **vascular tissue** that transports **water and minerals** from the **roots to all parts** of the plant.

◈ How it works:

1. Roots absorb water and minerals from the soil.
2. Water moves from **cell to cell** in the root.
3. It enters **xylem vessels**, which are like long pipes.
4. Water rises through the xylem due to:
    - **Root pressure** (push from roots)
    - **Transpiration pull** (main force)

What is Transpiration?

Transpiration is the **loss of water vapour** from the **aerial parts of a plant**, mainly through **stomata** in leaves.

Importance of Transpiration:

- Creates a **suction pull** to draw water upward (like a straw).
- Helps in **cooling** the plant.
- Distributes **minerals** and **water**.

2. Transport of Food – Phloem

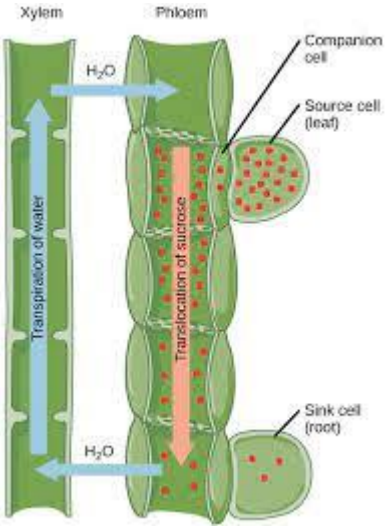
◆ What is Phloem?

Phloem is another vascular tissue that transports **food (mainly sugar)** from the **leaves** (where it's made) to other parts of the plant.

◈ How it works: (Process called Translocation)

- Food is made in **leaves** (source).
- It is transported through **sieve tubes** of phloem to:
    - Stem
    - Roots
    - Fruits (sinks)
- Transport occurs in **both directions**.
- Requires **energy (ATP)**.

📌 **Phloem moves food from 'source to sink'**



🌱 Difference Between Xylem and Phloem

Feature	Xylem	Phloem
Material Transported	Water and minerals	Food (mainly sugars)
Direction	Upward only (roots to leaves)	Both directions (leaves to other parts)
Requires Energy	No	Yes (active process)
Tissues involved	Vessels, tracheids	Sieve tubes, companion cells

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🔁 Summary:

- **Xylem** = Water + minerals, one-way (upward)
- **Phloem** = Food, two-way (source to sink)
- **Transpiration** drives xylem transport
- **Translocation** is phloem transport, needs ATP

◆ 4. Excretion

What is Excretion?

Excretion is the biological process of removing **waste products** (mainly nitrogenous wastes like **urea**) produced by **metabolic activities** in the body.

❗ *These waste substances are harmful if not removed.*

□ Why is Excretion Important?

- Maintains **chemical balance** in the body
- Removes **toxic wastes** like urea, uric acid
- Regulates **water and salt** levels (osmoregulation)

□♂□ Human Excretory System

The **main organ system** responsible for excretion in humans is the **urinary system** (also called excretory system), which includes:

◆ 1. Kidneys (Pair)

- Bean-shaped, located in the abdomen on either side of the backbone.
- Main organ of excretion.
- Filter blood and remove **urea**, **excess water**, **salts**.

◆ 2. Ureters (Pair)

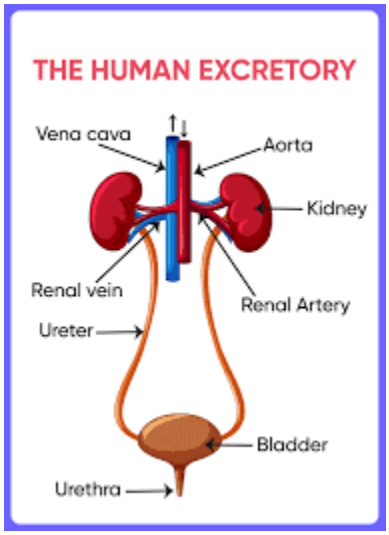
- Narrow tubes that carry **urine** from the kidneys to the bladder.

◆ 3. Urinary Bladder

- Muscular sac that stores urine temporarily.

◆ 4. Urethra

- Tube that carries urine from the bladder to **outside the body**.



How Kidneys Work: Role of Nephrons

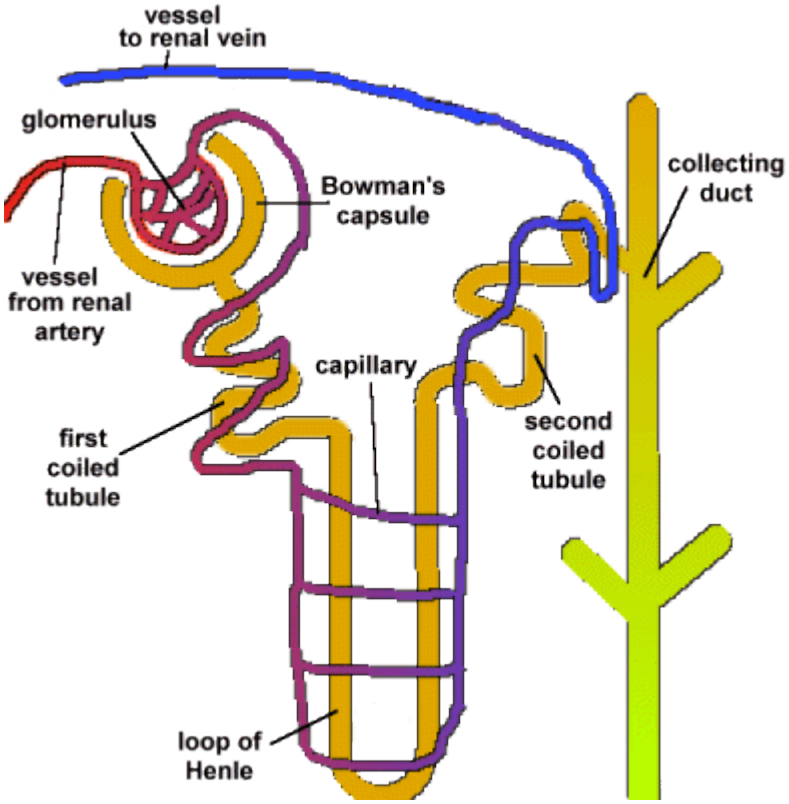
The basic filtering unit of the kidney is the **nephron**.

❖ Structure of a Nephron:

- **Bowman's capsule** (cup-shaped)
- **Glomerulus** (a bunch of capillaries)
- **Tubule** (long coiled tube)

🔄 Working of a Nephron:

1. **Filtration**:
   - Blood enters glomerulus under pressure.
   - **Water**, **glucose**, **salts**, **urea** filtered into Bowman's capsule.
2. **Reabsorption**:
   - Useful substances like **glucose**, some **salts**, and **water** are reabsorbed into blood from the tubule.
3. **Urine Formation**:
   - Leftover fluid in the tubule = **Urine** (mainly urea, water, salts)
   - Urine passes into collecting ducts → ureters → bladder.



Excretion in Plants – Detailed Notes

◆ What is Excretion?

Excretion is the process by which **plants remove waste products** formed during **metabolic activities** (like respiration, photosynthesis, etc.).

Unlike animals, **plants do not have a specialized excretory system** like kidneys or bladder. Instead, they use **simple and passive methods** to get rid of waste.

□ Major Waste Products in Plants

Metabolic Process	Waste Produced
Respiration	Carbon dioxide (CO_2), water
Photosynthesis	Oxygen (O_2)
Other processes	Resins, latex, gums, oils

🌬️ □ 1. Removal of Gaseous Wastes

- **Oxygen** (from photosynthesis) and **Carbon dioxide** (from respiration) are removed by **diffusion** through **stomata** (in leaves) and **lenticels** (in stems).
- This is a **passive process**, meaning it requires no energy.

💧 2. Removal of Water – Transpiration

- **Excess water** is lost through **transpiration** (mainly via stomata).
- This also helps in **cooling** the plant and **transport** of minerals.

🌳 3. Storage of Wastes in Old Tissues

- Plants often **store harmful wastes** in **old leaves**, **bark**, or **vacuoles**.
- When these parts fall off, the waste is removed from the plant.

□ 4. Formation of Non-toxic Compounds

- Plants **convert harmful substances** into **non-toxic forms** like:
  - **Resins**, **latex**, **gums**, **essential oils**
- These are stored in special tissues and may even help defend the plant from herbivores.

✿ 5. Excretion Through Leaf Fall

- Some waste products accumulate in **leaves**.
- When leaves fall (called **abscission**), wastes are removed naturally.

□ Summary Table

Waste Type	Method of Removal
CO_2 & O_2	Diffusion through stomata/lenticels
Water	Transpiration
Other wastes	Stored in vacuoles, bark, or exuded as gums, resins, etc.
Old leaves/bark	Waste removed through shedding

🔄 Key Points:

- Plants **do not need a complex excretory system** due to their low metabolic rate and less mobility.
- Excretion is done via **diffusion**, **transpiration**, and **storage**.

□ Summary Table of Life Processes

Life Process	Organs/Systems Involved	Function
Nutrition	Digestive System	Break down food into nutrients
Respiration	Respiratory System	Release energy from food
Transportation	Circulatory System (Blood, Heart)	Transport nutrients, gases, wastes
Excretion	Excretory System (Kidneys, etc.)	Remove metabolic waste