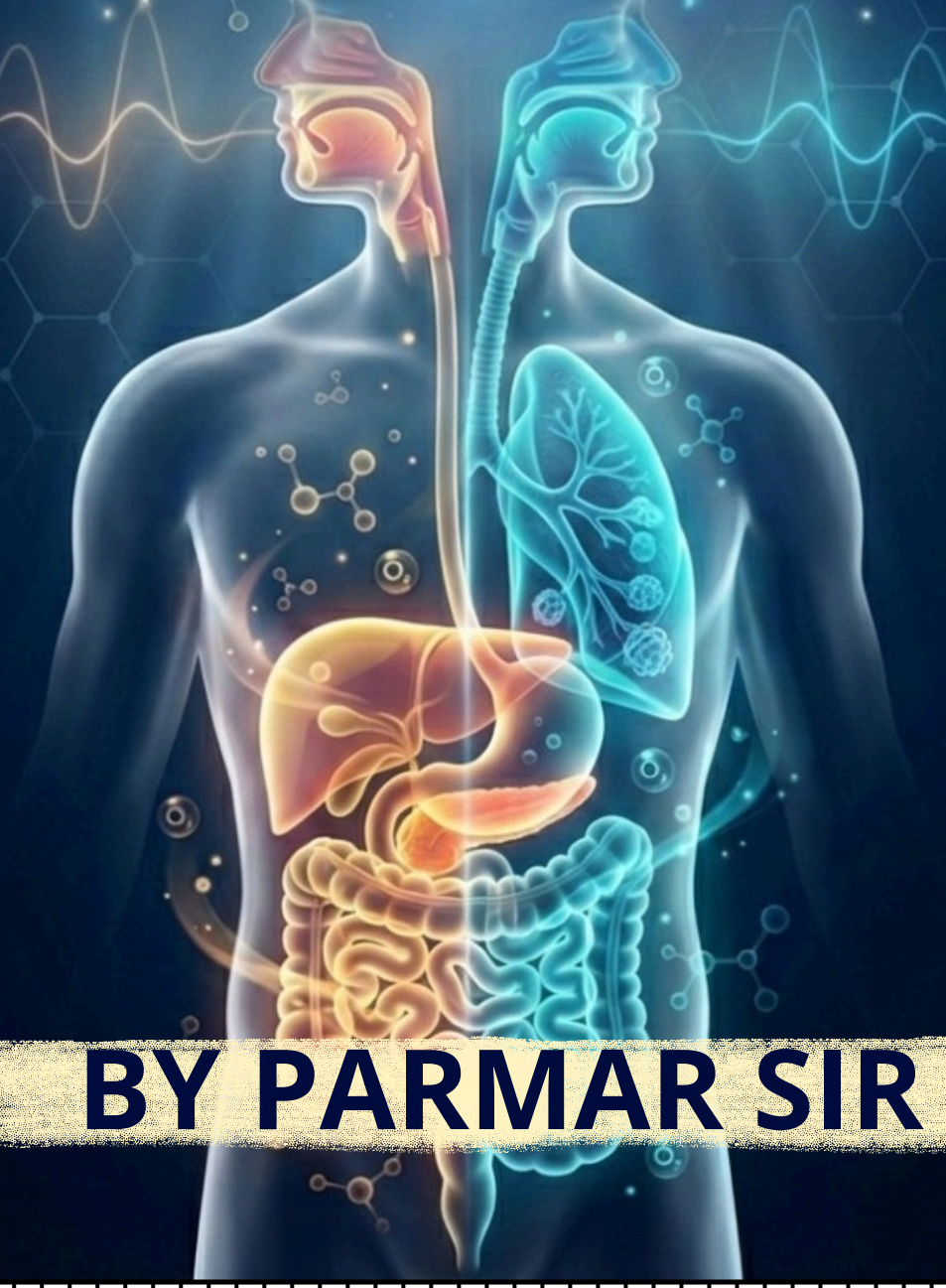
PARMAR SSC

DIGESTION & RESPIRATION

Lecture - 9

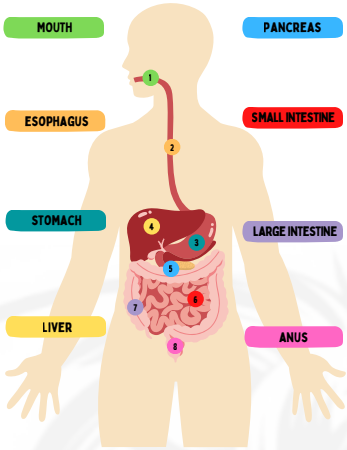


BY PARMAR SIR

THE HUMAN DIGESTIVE SYSTEM

Digestive System

- The process of breaking down food into simpler substances for nutrient absorption.



Main organs of Digestive System

Mouth (Oral Cavity/Buccal Cavity)

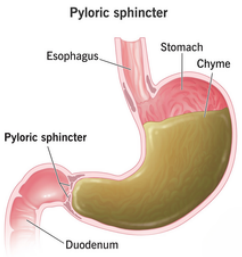
- Digestion starts here. Teeth chew the food (mechanical digestion).
- Saliva (from salivary glands) contains salivary amylase, which breaks down starch (complex carbohydrates to simple carbohydrates).
- Tongue helps in mixing food and swallowing.

Pharynx and Oesophagus

- Pharynx connects mouth to esophagus.
- Oesophagus (length: 25 cm) is a muscular tube that pushes food to the stomach through peristalsis (wave-like movement).

Stomach

- J-shaped muscular organ.
- **Secretion of Stomach:**
  - **Hydrochloric acid (HCl):** Kills germs and provides acidic medium. HCl is present in gastric juice (pH: 1.6).
  - **Pepsin:** Digests proteins (works in acidic medium only).
  - **Mucus:** Protects the delicate stomach lining from acid.
- **Sphincter Muscule:**
  - It allows food to pass from stomach to small intestine.



Small Intestine

- It is the longest part of the alimentary canal (6.5 to 7.5 meters). It is the main site of digestion and absorption.
- **It is divided into three parts:** duodenum, jejunum, ileum.

Digestive Juices Received in Small Intestines from Liver

Largest Organ:- Skin

Bile (bile juice)

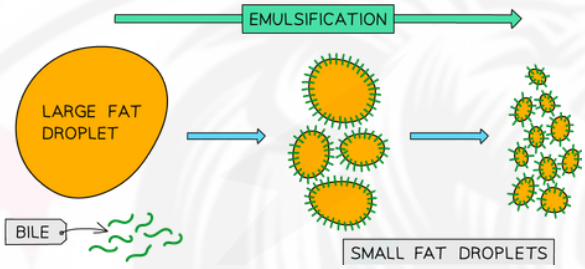
- Bile juice is stored in gall bladder and released by liver.
- Bile is not an enzyme but plays a crucial supporting role in digestion.

Function of Bile:

- Bile is alkaline (basic) in nature.
- It neutralizes the acidic food before it enters the small intestine.
- This creates a favorable pH for the action of pancreatic and intestinal enzymes.

Emulsification of Fats

- Bile breaks down large fat globules into smaller globules. This process is called emulsification.



Pancreas

- **Function:** Digests carbs, proteins, and fats.
- **Pancreas release pancreatic juice:**
  - **Amylase:** Breaks down carbs.
  - **Lipase:** Breaks down fats into fatty acids and glycerol.
  - **Trypsin (works in basic medium):** Breaks down proteins into amino acids.

Large intestine

- **Length:** 1.5 m.
- **Function:** Absorbs water and electrolytes from the remaining undigested food, solidifying it into feces for elimination.
- **Large intestine comprises of:**
  - **Cecum**: First part of the large intestine, and it connects the small intestine to the colon.
  - **Colon**: Responsible for absorbing water from indigestible food residues.

Liver

Hematology: Study of blood

- The study of the liver is called Hepatology.
- The liver is the largest gland in the human body.
- It is located on the right side of the abdomen and is dark red-brown in color

Function of liver

- It converts glucose into glycogen for storage (process known as glycogenesis).
- Synthesizes plasma proteins and carries out amino-acid metabolism (deamination and urea formation).
- It stores glycogen in liver cells to maintain blood sugar levels.

Important cells of Liver

Kupffer Cells

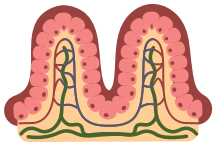
- Star-shaped phagocytic cells found in the lining of liver sinusoids.
- **Functions:**
  - They are involved in the breakdown of RBCs old, damaged.
  - They clean pathogens and debris from the blood.
  - Kupffer cells have regenerative ability.

Hepatocytes

- The main parenchymal (functional) cells of the liver.
- Perform various cellular functions, including:
- Metabolism of carbohydrates, proteins, and fats and detoxification of blood.

Villi

- Villi are finger-like projections found in the inner wall of the small intestine.
- They significantly increase the surface area of the intestinal lining, enhancing nutrient absorption (assimilation).



Rectum and Anus

- Rectum stores feces.
- Anus is the opening through which waste is excreted from the body.

HUMAN DIGESTIVE SYSTEM – PATHWAY OF FOOD

MOUTH → PHARYNX → ESOPHAGUS → STOMACH → SMALL INTESTINE (DUODENUM → JEJUNUM → ILEUM) → LARGE INTESTINE (CECUM → COLON → RECTUM) → ANUS

RESPIRATION IN PLANTS

- It is a biochemical process of enzyme, including oxidative breakdown of organic compounds inside living cells, releasing energy in the form of ATP (Adenosine Triphosphate).

Breathing

- Breathing is the process of inhaling oxygen and exhaling carbon dioxide by the lungs.

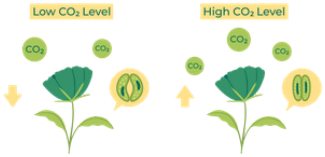
By Roots:

- Air is present in the spaces between soil particles (soil interspaces).
- The root hairs and epiblema cells (outermost layer of young roots) are in direct contact with this soil air.
- Oxygen from the air in the soil diffuses through the root hairs and epiblema cells into the inner tissues of the root.

- This oxygen is then used in aerobic respiration by root cells to break down glucose and release energy.

By Leaves:

- Leaves and young stems are well-suited for the quick exchange of gases due to their thin structure and presence of pores.
- Stems, especially mature ones, are covered by an impermeable epidermis to prevent water loss. This outer layer helps in conserving moisture.
- The epidermis of leaves contains **tiny openings called stomata**.
- Each stoma is bordered by two specialized cells known as guard cells.
- Guard cells control **the opening and closing of stomata**, regulating gas exchange and water loss (transpiration).



Guttation

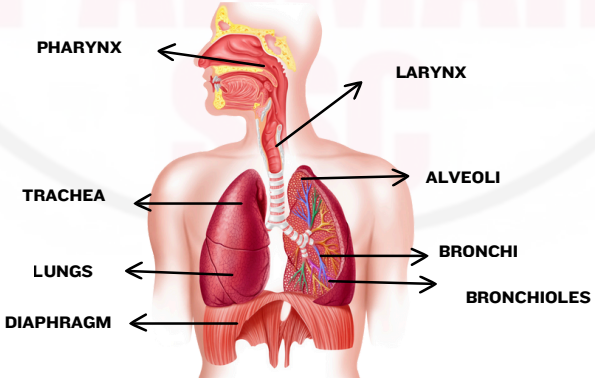


Water loss in plants during night through hydathodes present in leaf edges.

THE HUMAN RESPIRATORY SYSTEM

Mechanism of Respiration

- Nose → Pharynx → Larynx → Trachea → Bronchi → Bronchioles → Alveoli.



Nose and Nasal Cavity

- First entry point for air into the respiratory system.
- Hair inside the nose traps dust and impurities, allowing only filtered air to pass through.
- Mucus lining inside the nose moistens the air, traps dust particles and bacteria. It also helps in cleaning and protecting the respiratory tract.

Pharynx

- A common passage for both air and food.
- It connects the nasal cavity to the larynx.
- It ensures air is directed towards the windpipe (trachea).

Larynx (Voice box)

- It also known as the Adam's Apple.
- It contains vocal cords, which produce sound when air passes through them.
- It is located at the top of the trachea.

Trachea (Windpipe)

- A long tube that carries air from the larynx to the bronchi.
- Surrounded by C-shaped cartilage rings that prevents the trachea from collapsing during inhalation and keeps the airway open at all times.

Bronchi

- The trachea divides into two bronchi – one for each lung.
- Each bronchus enters a lung and carries air deeper inside.
- Bronchi also contain mucus and cilia to trap dust and microbes.

Bronchioles

- Inside the lungs, each bronchus further branches into smaller tubes called bronchioles.
- These are narrower and more numerous, spreading air throughout the lungs.
- Bronchioles lead directly to the air sacs (alveoli).

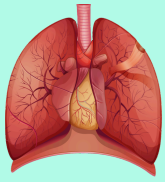
Alveoli

- Tiny balloon-like structures present at the ends of bronchioles.
- The lungs contain millions of alveoli that are surrounded by capillaries (tiny blood vessels).

Function of Alevoli

- Exchange of gases occurs here, oxygen from the air diffuses into the blood and carbon dioxide from the blood diffuses into the alveoli to be exhaled.
- Their thin walls and large surface area make gas exchange very efficient.

- **Diaphragm:** Forms the floor of the chest cavity.
- Respiration centre is in Medulla Oblongata.



Inhale VS Exhale

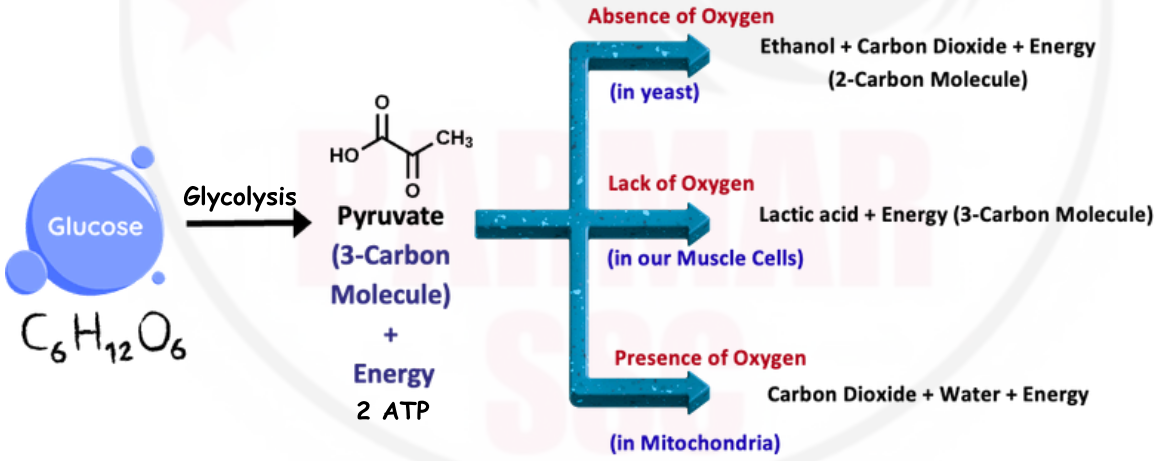
Process	Rib Cage Movement	Diaphragm Movement	Lungs	O_2 (%)	CO_2 (%)
Inhale	Goes up	Goes down	Expands	21%	0.04%
Exhale	Goes down	Goes up	Contract	16.40%	4.4%

Epiglottis

- It protects our airway and prevents food and liquid from entering our lungs while we swallow.

Aerobic Vs Anaerobic Respiration

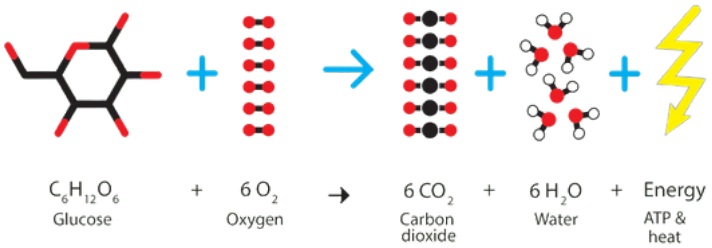
Basis	Aerobic Respiration	Anaerobic Respiration
Requirement of Oxygen	It requires molecular oxygen	It does not require molecular oxygen
Site of Occurrence	It occurs in mitochondria and cytoplasm	It occurs in cytoplasm
End Products	CO_2, H_2O and energy	CO_2, C_2H_5OH (ethanol) and energy
Energy Released	Large amount of energy is released	Small amount of energy is released
ATP Produced	38 ATP molecules are generated	Only 2 ATP molecules are generated



- Yeast is used in dough to make baked goods. It makes the dough soft and fluffy.
- Accumulation of lactic acid in the muscles causes cramps.

Cellular respiration

- Cellular respiration is the process by which cells break down glucose (sugar) in the presence of oxygen to release energy in the form of ATP (Adenosine Triphosphate).



Steps in Cellular Respiration

Glycolysis (in the cytoplasm)

- Glucose (6C) is broken down into **2 molecules of pyrwvate** (3C each).
- In this process a small amount of **ATP** and **NADH** is produced.

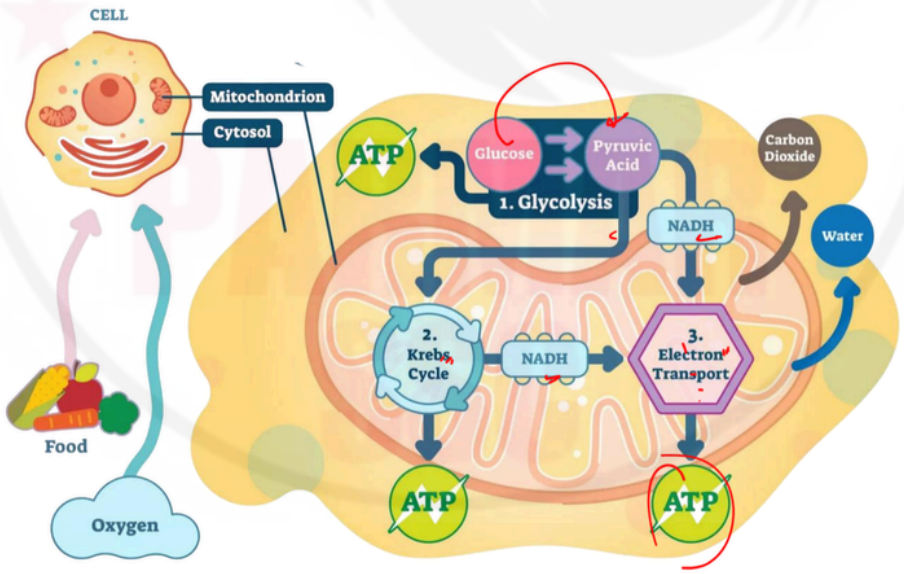
Krebs Cycle (Citric Acid Cycle) (in mitochondria)

- Pyruvate is further broken down.
- CO_2 is released, and energy carriers NADH and $FADH_2$ are produced.

Electron Transport Chain (ETC) (in the inner mitochondrial membrane)

- NADH and $FADH_2$ donate electrons.
- Oxygen acts as the final electron acceptor.
- Large amounts of ATP are produced (up to 34 ATP).
- About 38 ATP molecules are produced per molecule of glucose during aerobic respiration.

Nicotinamide adenine dinucleotide (NADH) is a coenzyme that plays a vital role in cellular respiration by transporting electrons to the Electron Transport Chain.





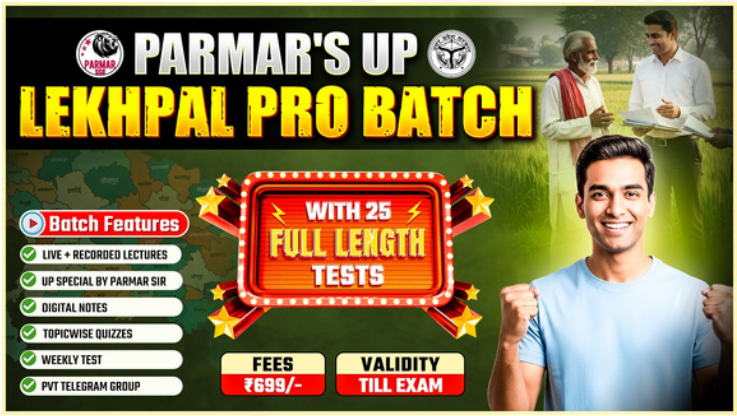


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