LIFE PROCESSES part - 1

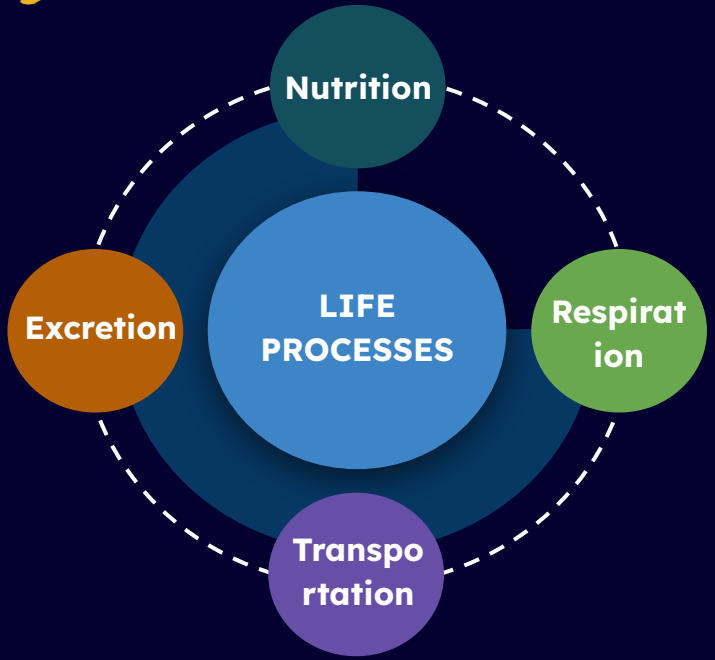
CLASS X | BIOLOGY

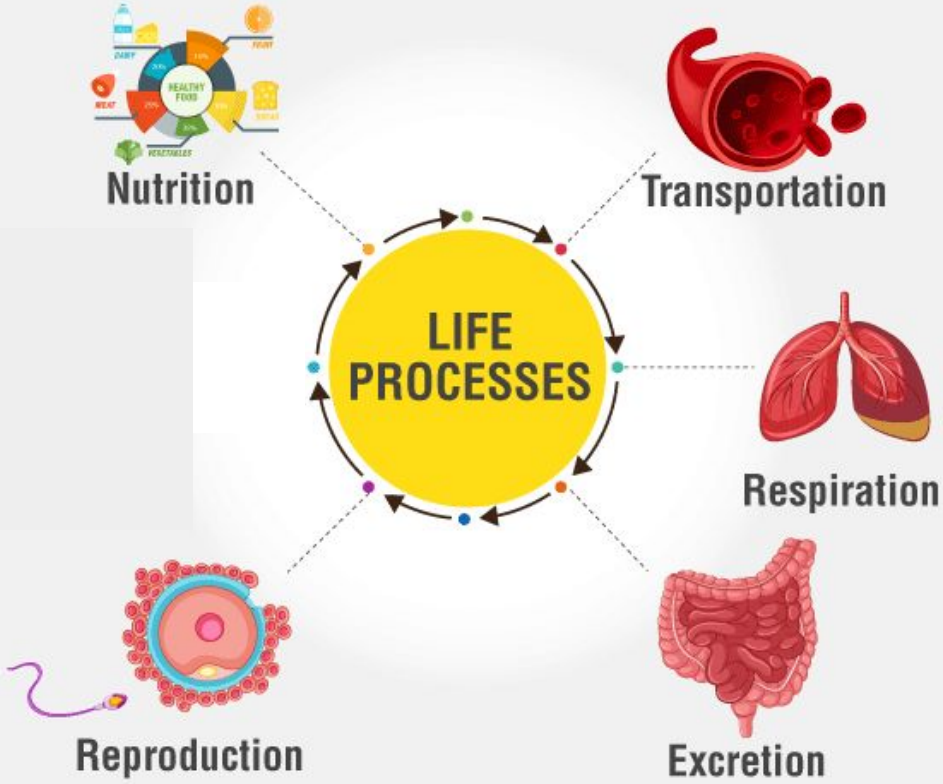
The maintenance functions of living organisms must go on even when they are not doing anything particular.

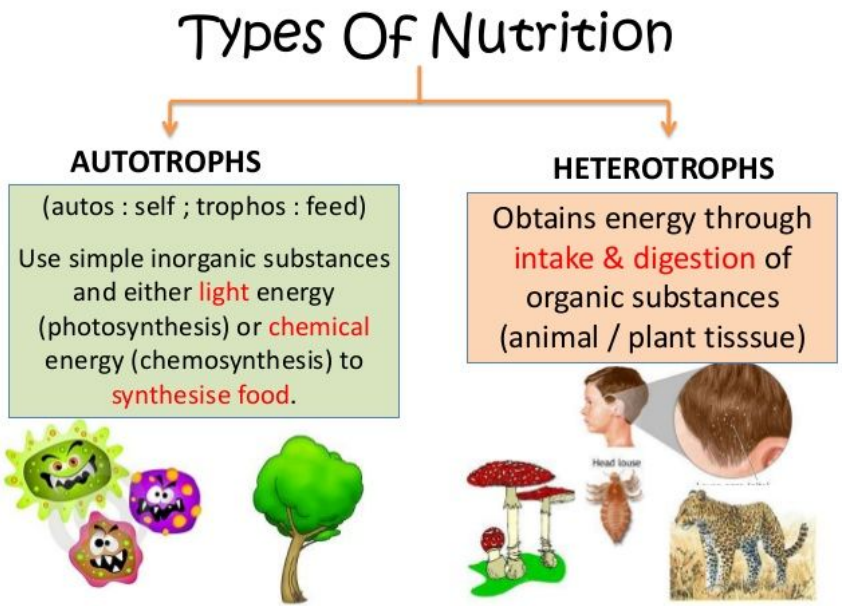
Even when we are just sitting in class, even if we are just asleep, this maintenance job has to go on.

WHAT ARE LIFE PROCESSES?

The basic function performed by living organisms to maintain their life on this earth are called life processes.




Nutrition
Transportation
LIFE PROCESSES
Respiration
Reproduction
Excretion



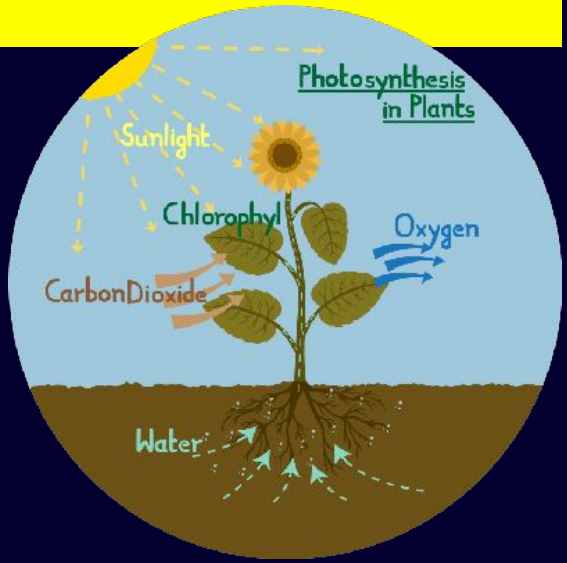
Autotrophic Nutrition: The mode of nutrition in which organisms synthesis their own food from simple inorganic substances like carbon dioxide and water in the presence of sunlight.

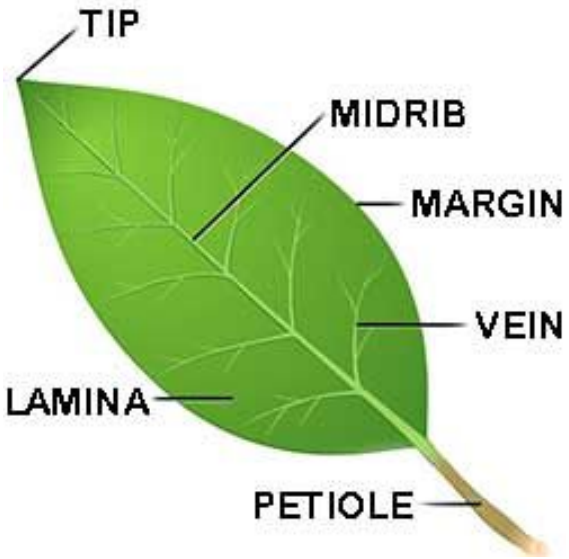
For e.g. Plants and Blue-green algae.

Photosynthesis: the process in which green plants use sunlight to make their own food.

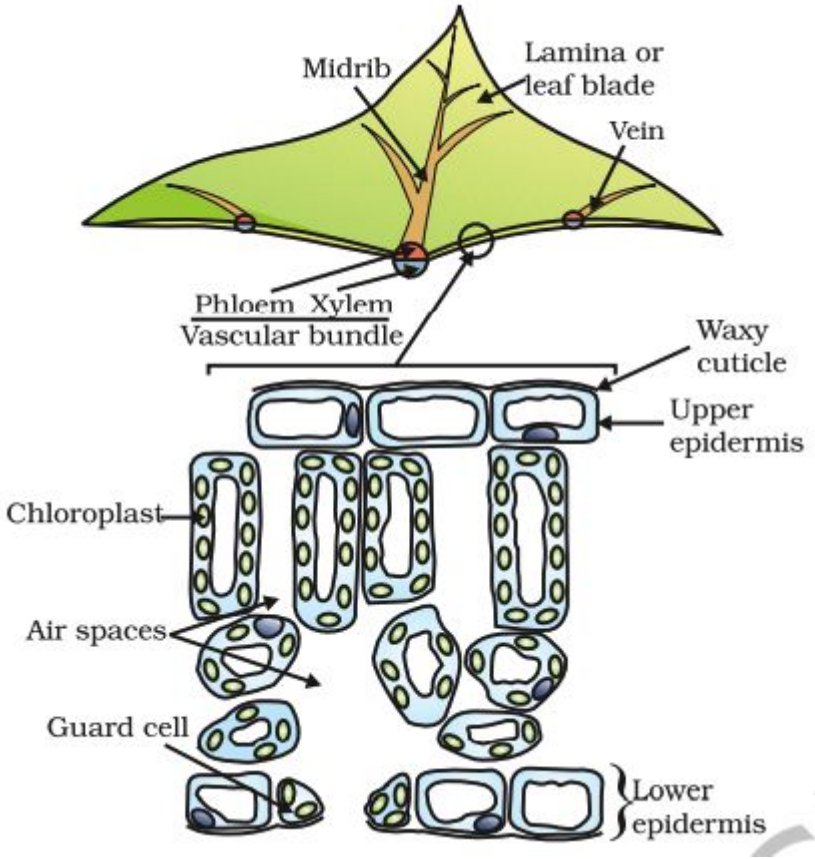
Conditions necessary for photosynthesis : Sunlight & Chlorophyll

Site of Photosynthesis: Chloroplast

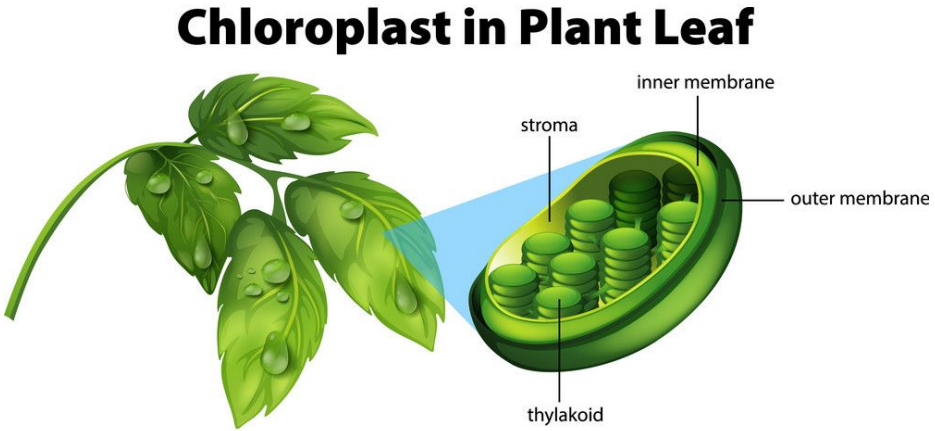




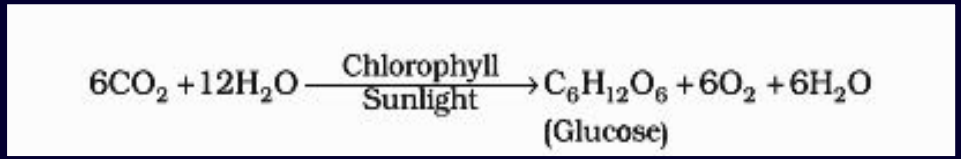
Cross-section of a leaf



Site of Photosynthesis: Chloroplasts



PHOTOSYNTHESIS IN PLANTS



Raw Materials:

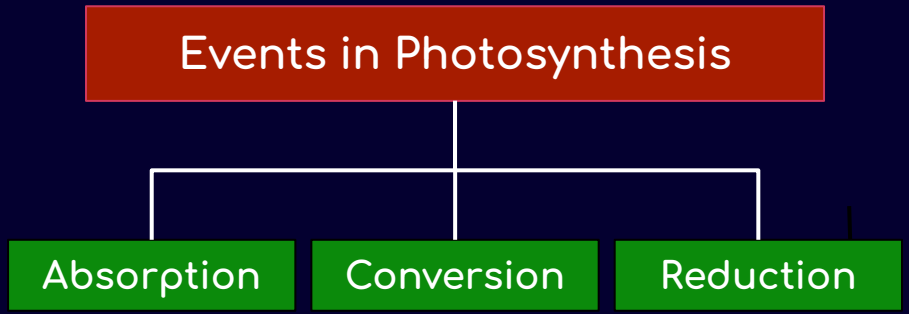
1. Carbon Dioxide (through environment by Cellular Respiration)
2. Water: By Xylem tissues (carried through root hairs on the roots to leaves)

End Products:

1. Glucose (carbohydrates)
2. Oxygen

Other raw materials required by plants for building their body

- Other materials like nitrogen, phosphorus, iron and magnesium are taken up from the soil with water.
- Nitrogen is an essential element used in the synthesis of proteins and other compounds.
- This is taken up in the form of inorganic nitrates or nitrites.



Absorption: of light energy by Chlorophyll

Conversion: of light energy into chemical energy and splitting of water molecules into Hydrogen and Oxygen.

Reduction: of Carbon Dioxide to carbohydrates.

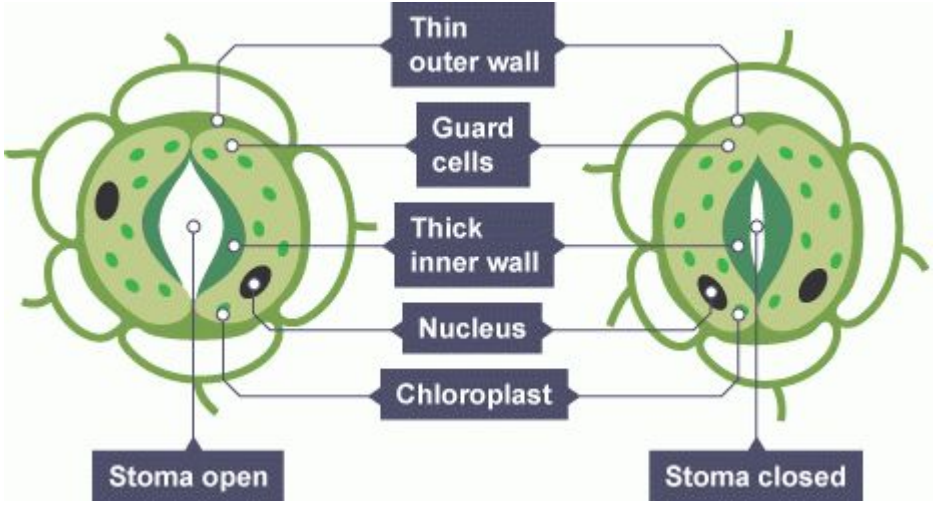
These three steps need not take place one after the other immediately. Plants modify the timings according to their environmental conditions.

For e.g. Desert plants (Xerophytic mostly) take up carbon dioxide at night and then they prepare an intermediate compound *(malic acid)* which gets absorbed by chlorophyll during the day for photosynthesis.`

How do plants obtain carbon dioxide? : Stomatal Opening

Plants obtain carbon dioxide from the atmosphere with the help of minute pores present on the surface of the leaf. These pores are called the stomata.

Stomata or stomatal pore are framed by kidney shaped cells called GUARD CELLS which contain chloroplast.



Opening and closing of stomatal pore facilitate the gaseous exchange in plants.

HOW DOES OPENING HAPPEN?

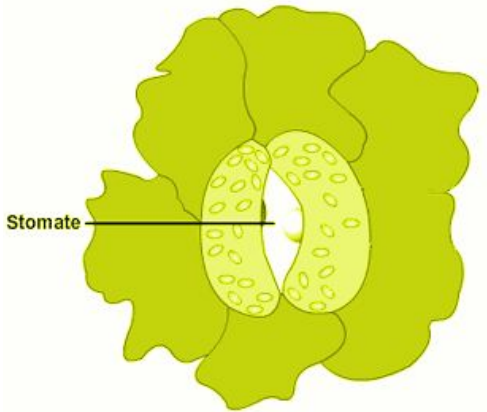
A plant cells becomes turgid (high water pressure) due to high sugar content in it. This causes the guard cells to swell up and the stomatal pore to open.

HOW DOES CLOSING HAPPEN?

When guard cell loses water (shrinks). The stomatal pore closes.

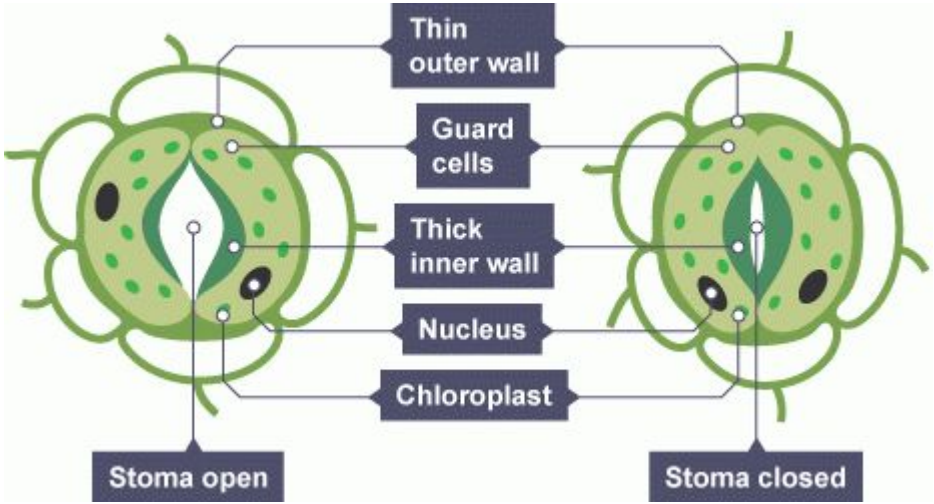
Stomata are open during the day because this is when photosynthesis typically occurs.

Stomata are closed during the night to avoid water loss during the occurrence of photosynthesis

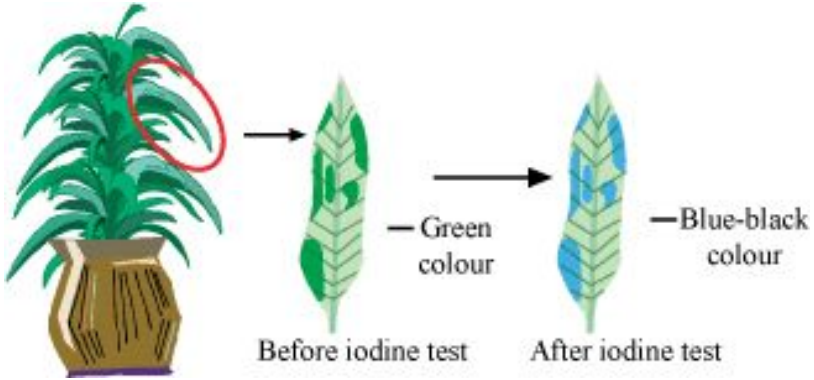


Stomata has two main functions:

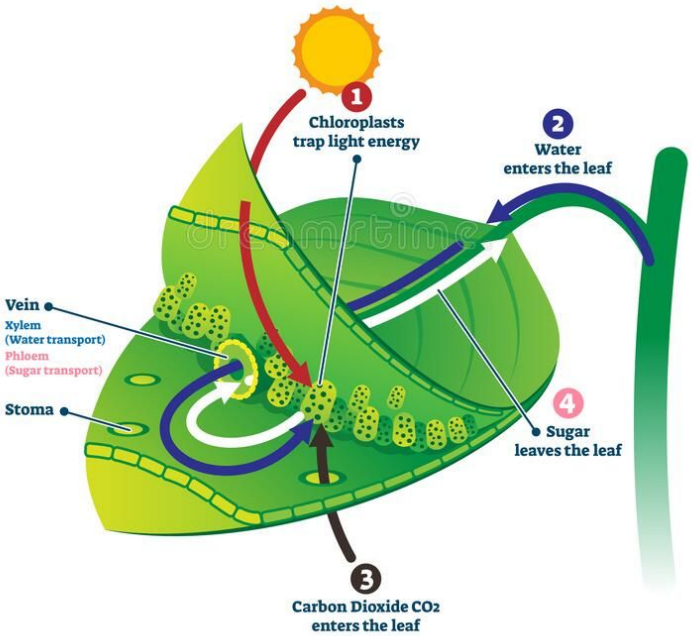
- Gaseous exchange i.e. intake of carbon dioxide and release of oxygen.
- Process of transpiration in plants, i.e., that is loss of excess water from the aerial parts of the plant.



Experiment to prove that chlorophyll is essential for photosynthesis:



- Take a potted plant with variegated leaves – for example, money plants or crotons.
- Keep the plant in a dark room for three days so that all the starch gets used up.
- Now keep the plant in sunlight for about six hours.
- Pluck a leaf from the plant. Mark the green areas in it and trace them on a sheet of paper.
- Dip the leaf in boiling water for a few minutes.
- After this, immerse it in a beaker containing alcohol.
- Carefully place the above beaker in a water-bath and heat till the alcohol begins to boil.
- What happens to the colour of the leaf? What is the colour of the solution?
- Now dip the leaf in a dilute solution of iodine for a few minutes.
- Take out the leaf and rinse off the iodine solution.
- Observe the colour of the leaf and compare this with the tracing of the leaf done in the beginning.

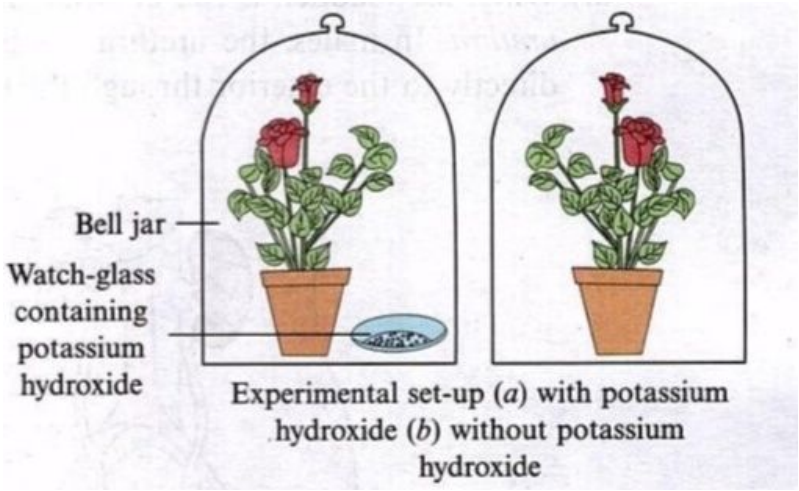


CONCLUSION

- The presence of blue-black colour in the areas where chlorophyll was present shows that these areas of the leaf have performed photosynthesis and the glucose so produced has been stored in the form of starch.

- Hence, chlorophyll is required for photosynthesis.

Experiment to see if carbon dioxide is essential for photosynthesis:



Experimental set-up (*a*) with potassium hydroxide (*b*) without potassium hydroxide

- Take two healthy potted plants which are nearly the same size.
- Keep them in a dark room for three days.
- Now place each plant on separate glass plates. *Place a watch-glass containing potassium hydroxide by the side of one of the plants. The potassium hydroxide is used to absorb carbon dioxide.*

- Cover both plants with separate bell-jars..
- Use vaseline to seal the bottom of the jars to the glass plates so that the set-up is air-tight.
- Keep the plants in sunlight for about two hours.
- Pluck a leaf from each plant and check for the presence of starch as in the above activity.
- Do both the leaves show the presence of the same amount of starch?
- What can you conclude from this activity?

CONCLUSION

- The leaves kept in a jar along with potassium hydroxide will not show the presence of starch.
- This is because potassium hydroxide absorbs the carbon dioxide making it unavailable for the plant.
- In the absence of carbon dioxide, the plant fails to form the glucose which cannot be stored in the form of starch.

Heterotrophic Nutrition

Heterotrophic nutrition is the mode of nutrition where the organism is unable to prepare its food and hence, depends upon plants or other organisms for nutrition.

Types of Heterotrophic Nutrition

Saprotrophic Nutrition:

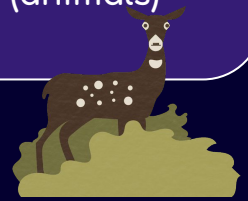
Organism obtains its food from decaying organic matter of dead plants, animals and rotten bread etc.

Parasitic Nutrition:

Organism derives its food from the body of another living organism without killing it. (Roundworms, Plasmodium, etc)

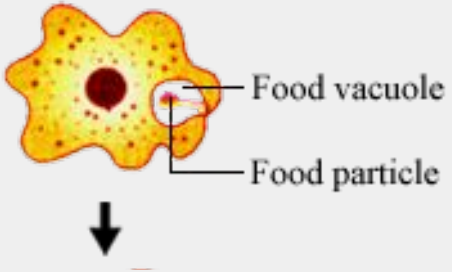
Holozoic Nutrition:

Organism takes the complex organic food material into its body by the process of ingestion, the ingested food is digested and then absorbed into the body cells of the organism. (animals)



NUTRITION IN AMOEBA

Ingestion: With the help of pseudopodia, Amoeba encircles the food and engulfs it forming a food vacuole. This process is known as phagocytosis.

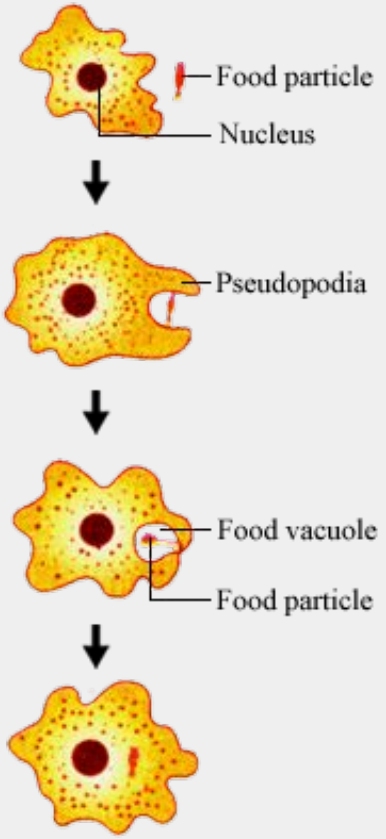


Digestion: Food vacuoles are transported deeper into the cell and with the help of the digestive enzymes, the large insoluble particles are broken down to the simplest molecules.

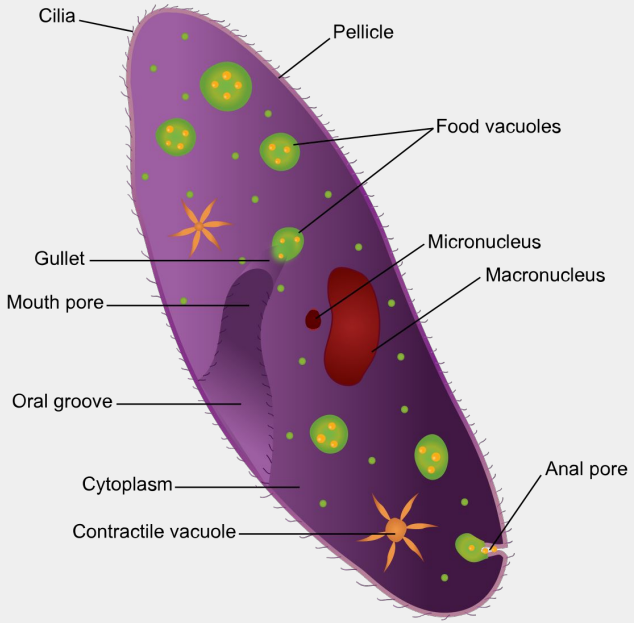
Absorption: Nutrients from the digested food material are absorbed into the cell's cytoplasm by leaving behind the undigested particles. This process is called diffusion.

Assimilation: It is a process of obtaining energy from the absorbed food molecules.

Egestion: Egestion is the process of excretion of undigested food material. In amoeba, this process is carried out by rupturing the cell membrane to remove the undigested food material from its body.



NUTRITION IN PARAMECIUM



This is also a unicellular organism, the cell has a definite shape and food is taken in at a specific spot. Food is moved to this spot by the movement of cilia which cover the entire surface of the cell.

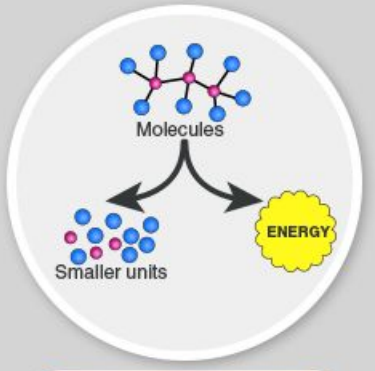
NUTRITION IN HUMAN BEINGS

Combination of digestive organs is called- digestive system.

A long tube running from mouth to anus of a human being (or other animals) in which digestion and absorption of food takes place is called alimentary canal.

Humans have an entire (complex) system known as digestive system for it. The mode is HOLOZOIC.

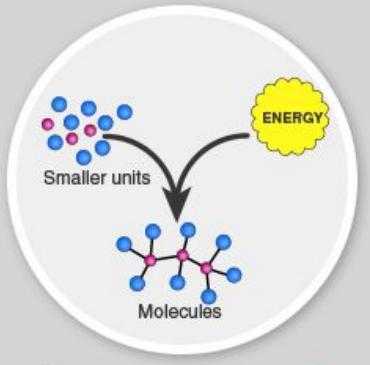
DIGESTION IN HUMANS IS A CATABOLIC PROCESS.



Eg.: digestion.

CATABOLISM

CATABOLISM IS THE SET OF METABOLIC PATHWAYS THAT BREAKS DOWN MOLECULES INTO SMALLER UNITS THAT ARE EITHER OXIDIZED TO RELEASE ENERGY OR USED IN OTHER ANABOLIC REACTIONS.



ANABOLISM

ANABOLISM IS THE SET OF METABOLIC PATHWAYS THAT CONSTRUCT MOLECULES FROM SMALLER UNITS, THESE REACTIONS REQUIRE ENERGY, KNOWN ALSO AS AN ENDERGONIC PROCESS.

Eg.: Bone development, muscle mass gain.

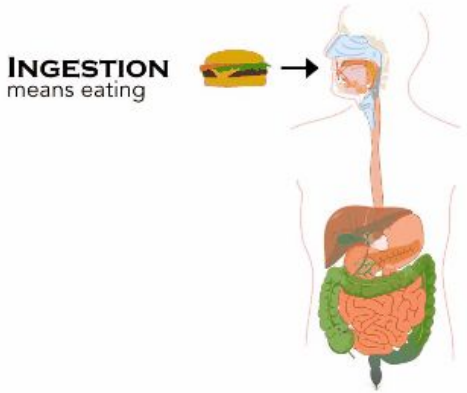
Nutrition in human beings takes place through human digestive system.

Human digestive system in sequence have :

- Alimentary Canal: It is a long tube starting from the mouth and ending at the anus
- Digestive glands

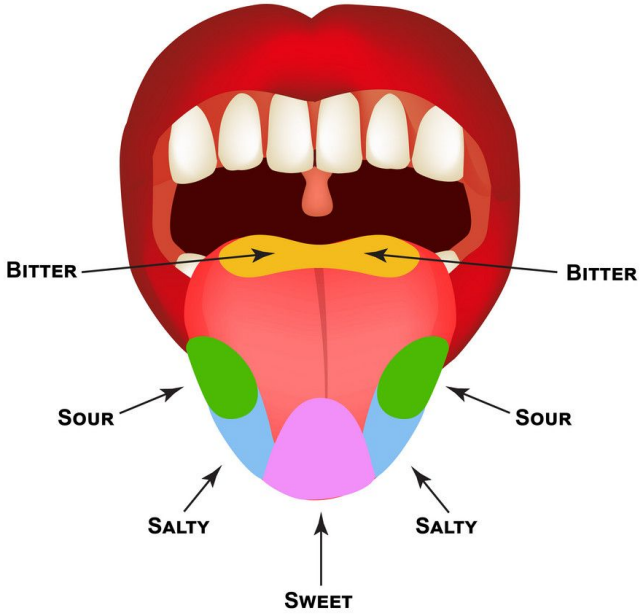
5 steps in human nutrition:

- Ingestion (AC)
- Digestion (AC)
- Absorption (AC)
- Assimilation (Entire body)
- Egestion (AC)



ALIMENTARY CANAL

Parts	Functions	Components & its functions
Mouth	Digestion first takes place in-Mouth. Food enters into body through mouth.	Tongue: Muscular structure, present at the floor of buccal cavity. Helps in mixing food with saliva. Teeth: Hard structures & present on both upper and lower jaw. They help in the crushing of food (mastication) through grinding, cutting and chewing of food.


BITTER
BITTER
SOUR
SOUR
SALTY
SALTY
SWEET

Milk teeth

Incisors, I = 2
Canines, C = 1
Molars, M = 2

$$\frac{212}{212} \times 2 = 20$$

Permanent teeth

Incisors, I = 2
Canines, C = 1
Premolar, PM = 2
Molars, M = 3

$$\frac{2123}{2123} \times 2 = 32$$

Milk teeth

Incisors, I = 2
Canines, C = 1
Molars, M = 2

$$\frac{212}{212} \times 2 = 20$$

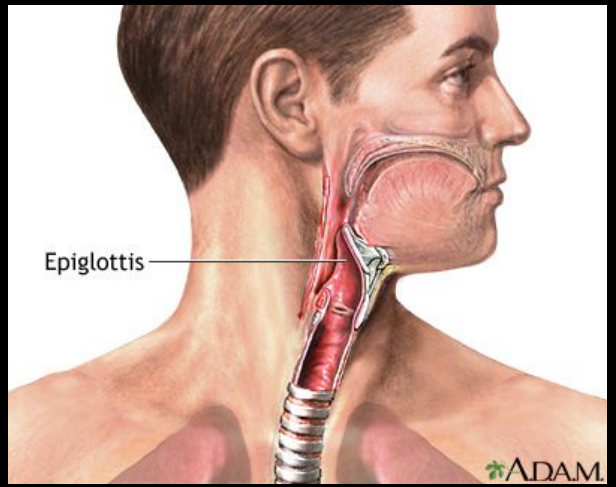
Permanent teeth

Incisors, I = 2
Canines, C = 1
Premolar, PM = 2
Molars, M = 3

$$\frac{2123}{2123} \times 2 = 32$$

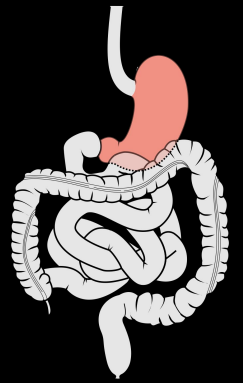
- Dental caries or tooth decay causes gradual softening of enamel and dentine.
- Begins when bacteria acting on sugars produce acids that softens or demineralised the enamel.
- Masses of bacterial cells together with food particles stick to the teeth to form dental plaque.
- Saliva cannot reach the tooth surface to neutralise the acid as plaque covers the teeth. Brushing the teeth after eating removes the plaque before the bacteria produce acids.
- If untreated, microorganisms may invade the pulp, causing inflammation and infection.

Pharynx :



Oesophagus :

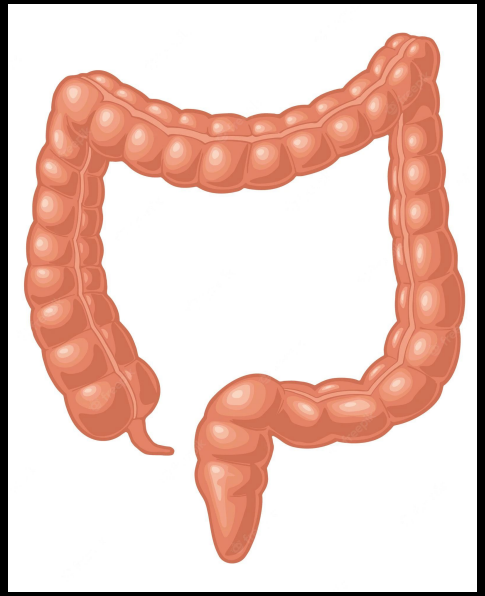
Stomach :



ALIMENTARY CANAL

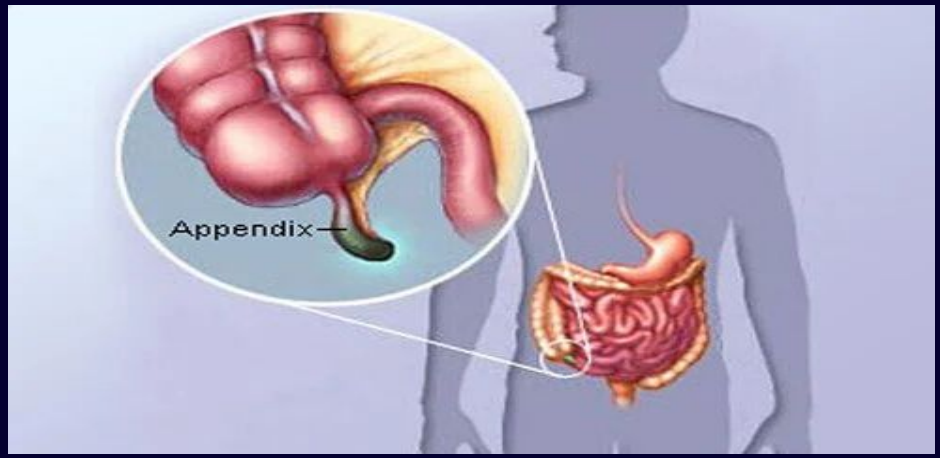
Parts	Functions	Components & its functions
Small Intestine	Longest part of alimentary canal. It is very coiled in a small space (hence, the naem). Main site of digestion. Receive secretion from Liver & Pancreas.	1. Duodenum: Receives secretion from liver & pancreas. 2. Jejunum: Coiled mid-section of small intestine. 3. Ileum: Final portion that leads to large intestine.
Large Intestine	It is wider than small intestine (hence, the name).	1. Caecum: Partly digested food moves through the cecum into the colon. 2. Colon: removes water and some nutrients and electrolytes from partially digested food. 3. Rectum: serves as a temporary storage site for undigested food.

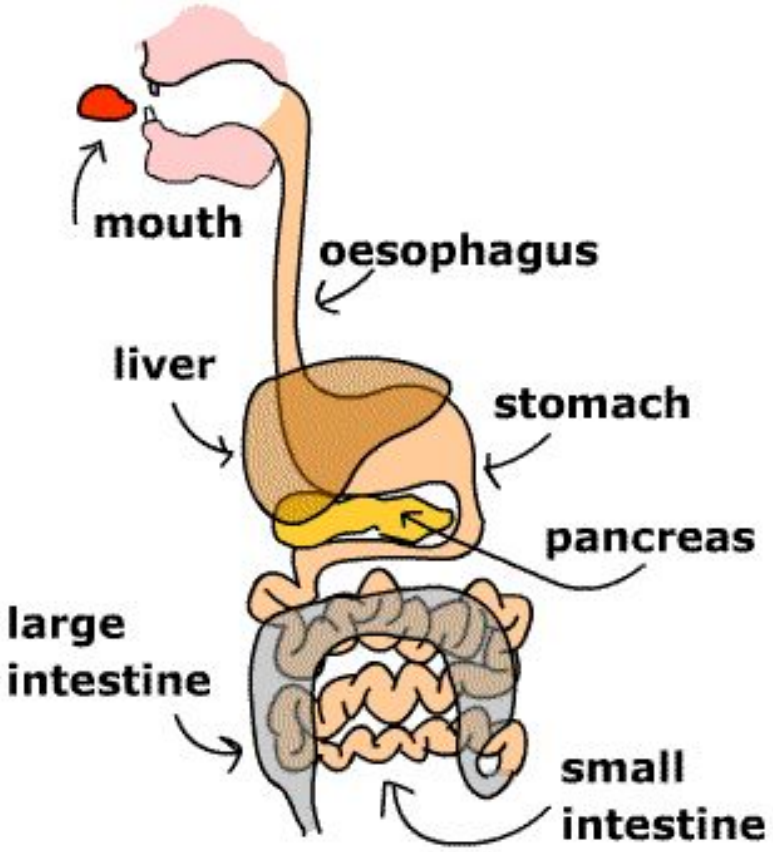
ALIMENTARY CANAL

Parts	Functions	Components & its functions
Rectum	It is the last chamber that stores fecal matter (digested food) temporarily.	
Anus	It is the end point to our alimentary canal. It helps in the exit of undigested food from our body. They are aided by anal sphincter (external and internal).	

Appendix is a vestigial organ which once had an important function but has lost its function on evolution as it is not used over generations of time.

It has no function in digestion in human beings. But it is believed to provide shelter for few beneficial bacteria residing in the intestine.




mouth
oesophagus
liver
stomach
pancreas
large intestine
small intestine

DIGESTIVE GLANDS

GLANDS	FUNCTION
Salivary	
	Produce saliva. Contains an enzyme called salivary amylase which digests the starch present in food into sugar.
Gastric (found in wall of stomach)	HCL: Kill bacterias present in food (if any) , and creates an acidic medium of pH about 2, facilitating the action of pepsin. Pepsin: This enzyme does the digestion of proteins. Mucus: Protect the stomach wall from its own secretions of HCL.

DIGESTIVE GLANDS

GLANDS	FUNCTION
Liver (Largest gland)	Secretes bile juice. It is a greenish yellow liquid made in liver But it is stored in the gallbladder.
Pancreas	Lies parallel to and beneath the stomach. Contains digestive enzymes pancreatic amylase, trypsin, lipase.
Intestinal Glands	The walls of the small intestine contain numerous glands that secrete intestinal juice containing amylolytic, proteolytic and lipolytic enzymes.

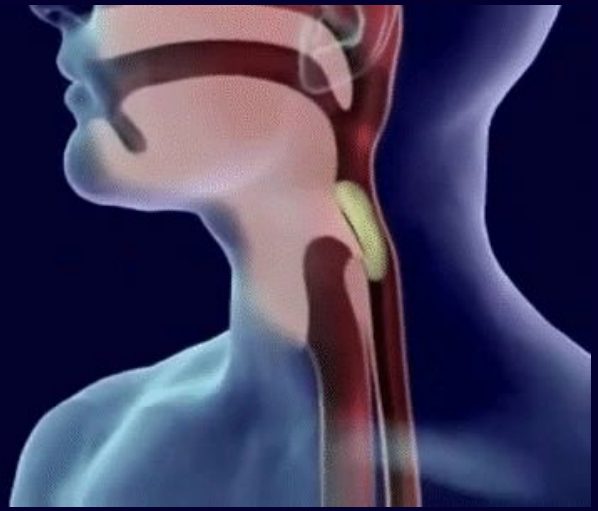
STEPS OF NUTRITION IN HUMAN BEINGS

1

Ingestion: The human beings have a special organ for the ingestion of food. It is called Mouth.

2

Digestion: Digestion first begins in the mouth itself. It starts as soon as we put food in our mouth. This happens as follows:



Digestion:

Digestion first takes place in- Mouth. Food enters into body through mouth, where the teeth help in the mastication (chewing food).

The food is mixed thoroughly with saliva and moved around the mouth while chewing by the muscular tongue.

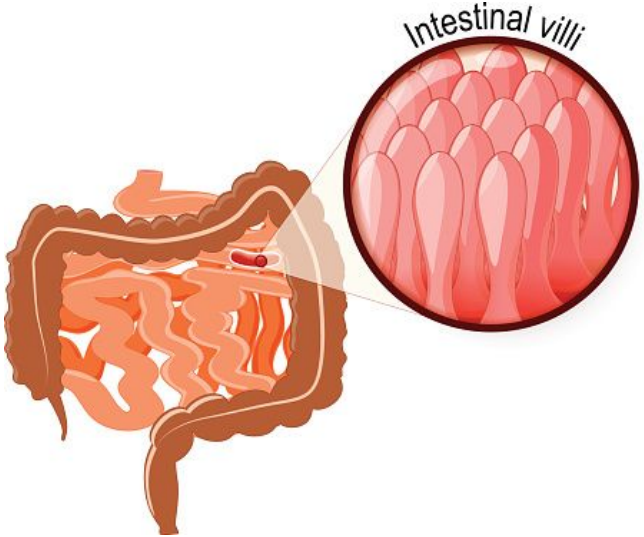
From the mouth, the food is taken to the stomach through the food-pipe or oesophagus.

How does this happens?

The walls of the food pipe start contraction and expansion movements. The contraction and expansion movement of the walls of food pipe is called peristaltic movement.

This peristaltic movement of food pipe pushes the slightly digested food (bolus) into the stomach.

- The muscular walls of the stomach help in mixing the food thoroughly with more digestive juices.
- *The digestion in stomach is taken care of by the gastric glands present in the wall of the stomach.* These release hydrochloric acid, a protein digesting enzyme called pepsin, and mucus.
- The partially digested food then goes from stomach into small intestine.
- The exit of food from the stomach is regulated by a sphincter muscle which releases it in small amounts into the small intestine.
- The small intestine is the main site of digestion. It also has tiny finger like projections called as Villi that increases its surface area and helps in absorption of food as well.
- The small intestine receives the secretion of two glands (Liver and Pancreas).



3

Absorption: Small Intestine has villi for it.

The small intestine is the main region for the absorption of digested food.

The villi are richly supplied with blood vessels which take the absorbed food to each and every cell of the body, where it is utilised for obtaining energy, building up new tissues and the repair of old tissues.

4

Assimilation: The blood carries digested and dissolved food to all the parts of the body where it becomes assimilated as a part of the cells.

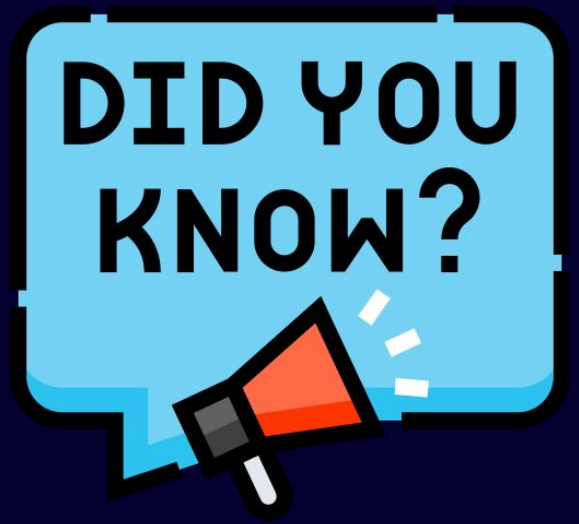
The energy is then released by the oxidation of assimilation food in the cells during respiration.

5

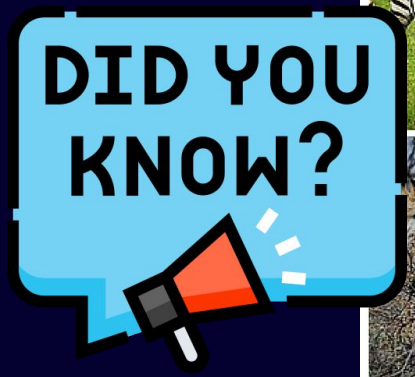
Egestion: Unabsorbed food is sent into the large intestine where its wall absorbs more water from this material, due to which undigested part becomes almost solid.
The final exitit of this waste material is regulated by the anal sphincter.

Digested food which is not used by our body immediately is stored in the liver in the form of carbohydrate called ‘glycogen’.

This glycogen can be used as a source of energy by the body as and when required.



Herbivores eating grass need a longer small intestine to allow the cellulose to be digested. Meat is easier to digest, hence carnivores like tigers have a shorter small intestine.



IMPORTANT DIGESTIVE PARTS AND THEIR FUNCTIONS

PARTS	FUNCTION
STOMACH	HCL: Kill bacterias present in food (if any) , and creates an acidic medium of pH about 2, facilitating the action of pepsin. Pepsin: This enzyme does the digestion of proteins. Mucus: Protect the stomach wall from its own secretions of HCL. If mucus is not secreted, HCL will cause the erosion of inner lining of stomach leading to formation of ulcers in stomach.
SMALL INTESTINE	About 6.5 mt long in an adult. It is the site of the complete digestion of carbohydrates, proteins and fats. Receives secretion from liver (bile) & pancreas.
LIVER- BILE JUICE	Secretes bile. Bile is alkaline & contains salts which help to emulsify or break the fats present in the food. a. Makes the acidic food coming from the stomach alkaline so that pancreatic bile enzymes can act on it. b. Bile salts break the fats present in the food into small globules making it easy for enzymes to act and digest them.
Pancreas	Secretes pancreatic juices: Enzyme Amylase- breaks down the starch. Enzyme Trypsin- Digests the proteins. Enzyme Lipase- Breaks down the emulsified fats.