



المدرسة
الوطنية الأرثوذكسية
الشميساني



The National
Orthodox School
Shmaisani

Digestion

Small and Large intestine

Accredited by



معتمدة من

In the small intestines : (duodenum and Ileum)

A. In the duodenum:

<https://www.youtube.com/watch?v=mKAJDLJQt6k&t=1s> bile

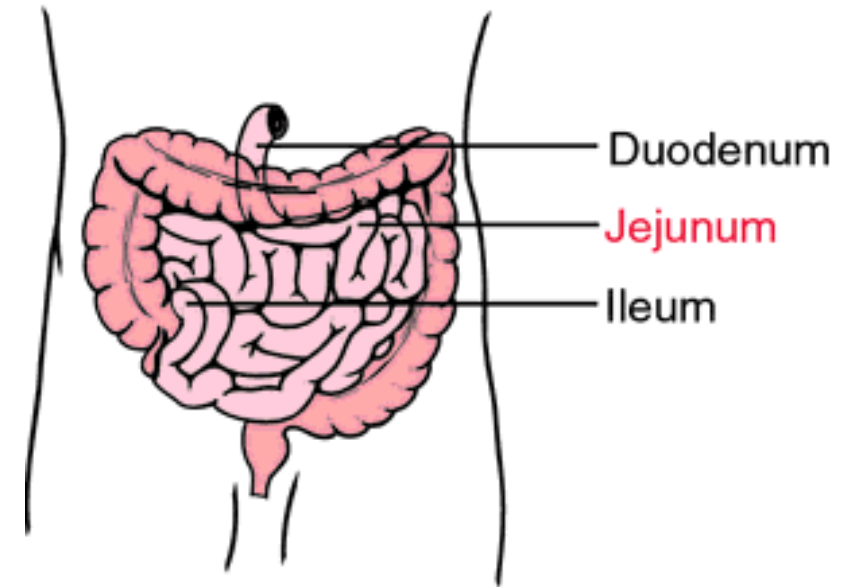
- first part of the small intestines <https://www.youtube.com/watch?v=TNG-RRzwBVU> liver
- receives two kinds of juices: <https://www.youtube.com/watch?v=dvWDRRyT9As&t=9s> pancreas

1. **Bile Juice from the liver (stored in gall bladder)**

2. **Pancreatic juice from the pancreas**

Bile Juice:

- produced in the **liver**
- stored in the **gall bladder**
- doesn't contain enzymes
- moved through the bile duct
- contains **bile pigment**
- contains **organic bile salts** that help in fat digestion
- contains **inorganic bile salt**

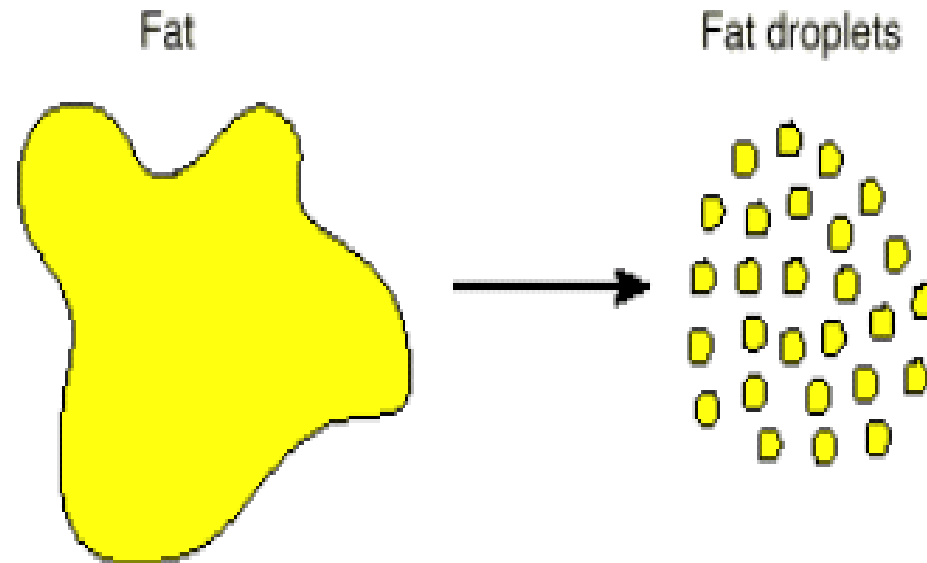


Organic bile salts

- **Emulsification of fat**
- Activate the production of **pancreatic lipase**

Inorganic bile salts (NaHCO₃)

- **Neutralize** stomach acidic food
- **Alkaline** solution (pH>7) for enzymes



Which of the following is a correct function of bile?

- A** To emulsify proteins
- B** To provide enzymes for the digestion of lipids
- C** To neutralise the alkaline conditions of food entering the duodenum
- D** To increase the surface area of lipids for digestion

2. Pancreatic juice:

- carried to the small intestines by the pancreatic duct

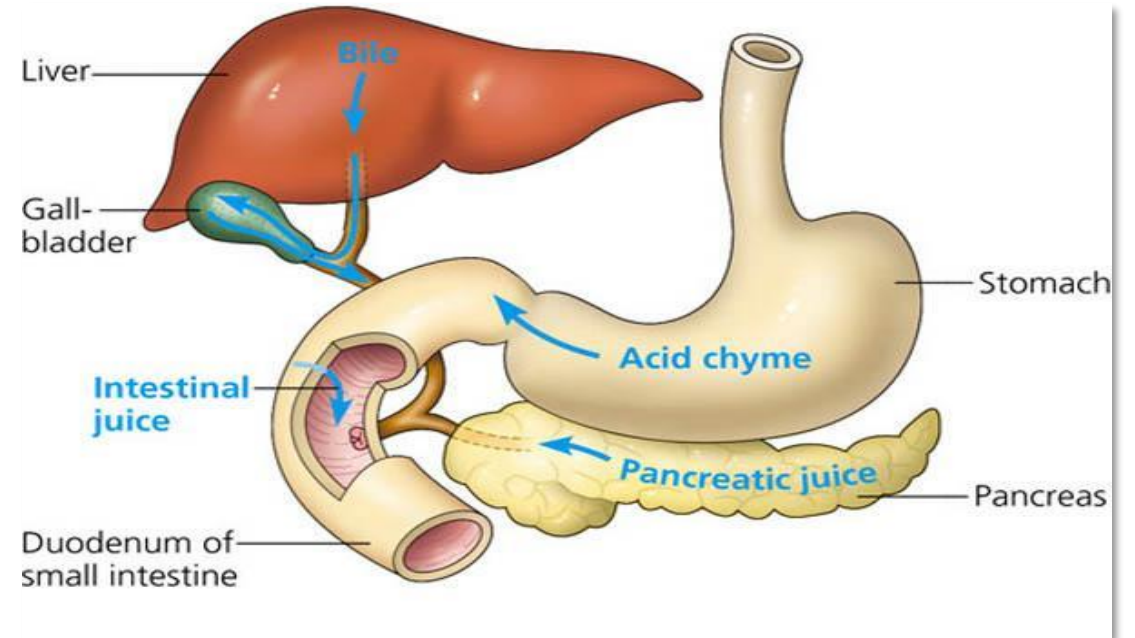
- Contains:

- **NaHCO₃**
- protease called **trypsin**
- carbohydrase **Amylase**
- **lipase** enzyme

- ❖ **Lipase** starts to digest fats into **fatty acids and glycerol (partially)**

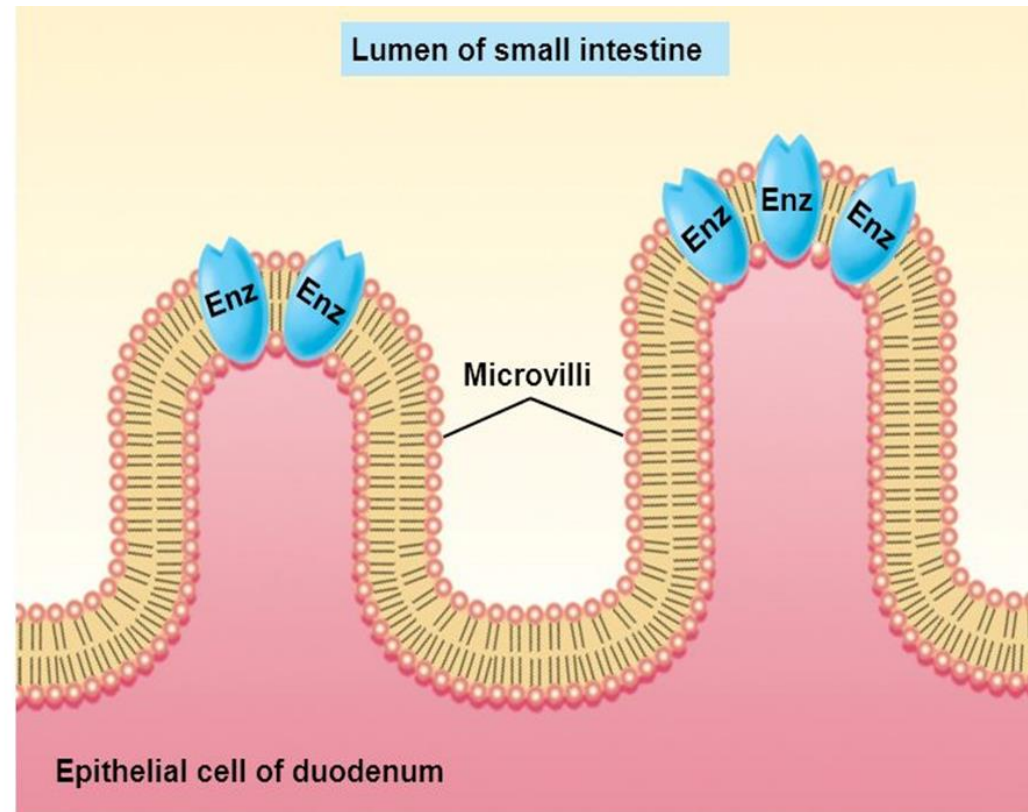
- ❖ **Trypsin** continues to break large proteins into **short polypeptide chains**

- ❖ **Amylase** breaks down the **polysaccharides** that were not broken down in the mouth into **maltose**



B. Ileum:

- Long (6m)
- **Digestion is completed**
- Inner walls of both parts are covered with tiny projections called **villi**
- **Intestinal enzymes**: enzymes produced by the cells of villi

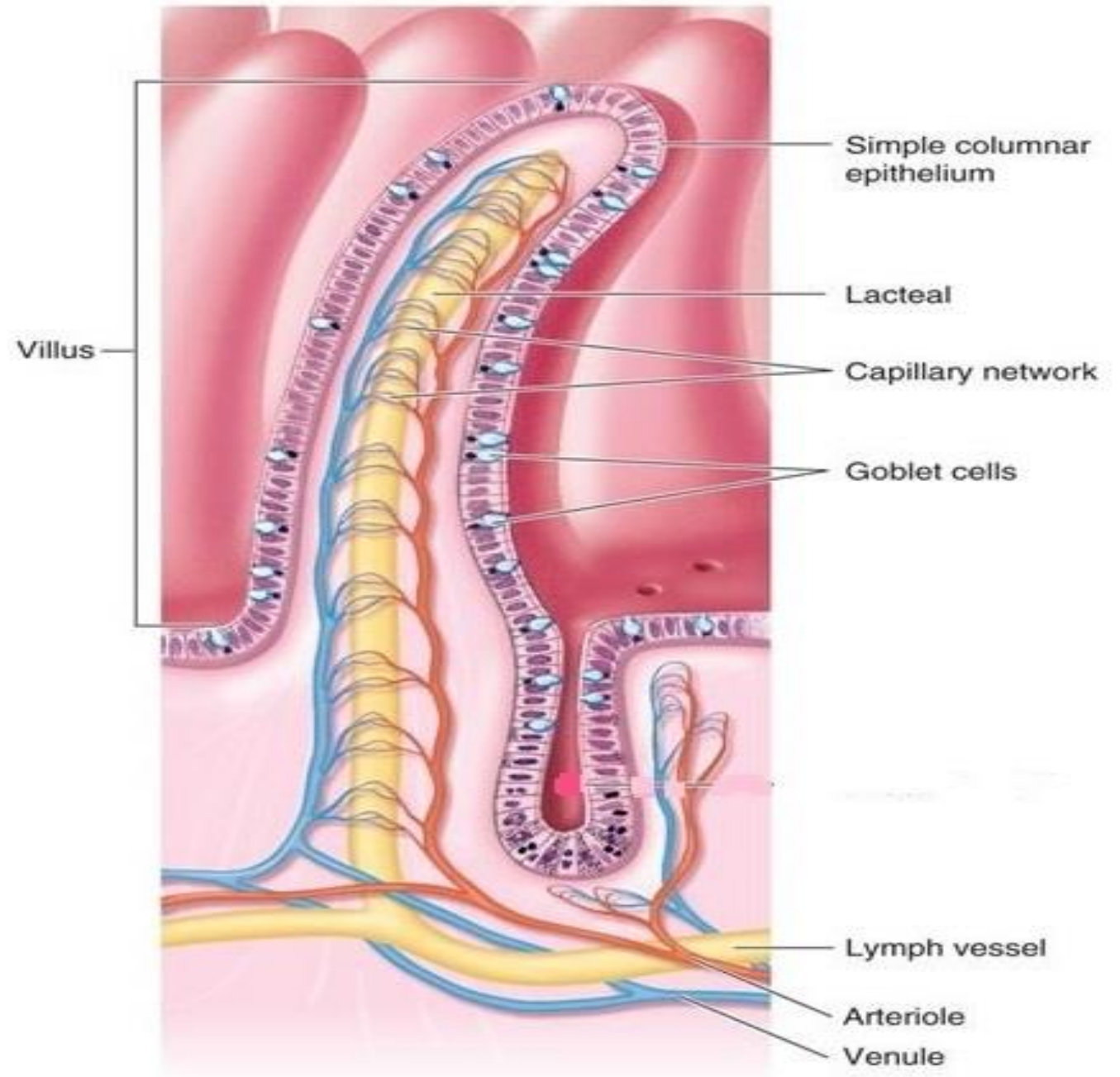


❖ Structure:

- **Goblet cells:**
produce **mucus**
- **Blood capillaries:**
epithelial cells, absorption, diffusion, osmosis, active transport
- **Lacteals:** absorption of **fatty acids and glycerol**

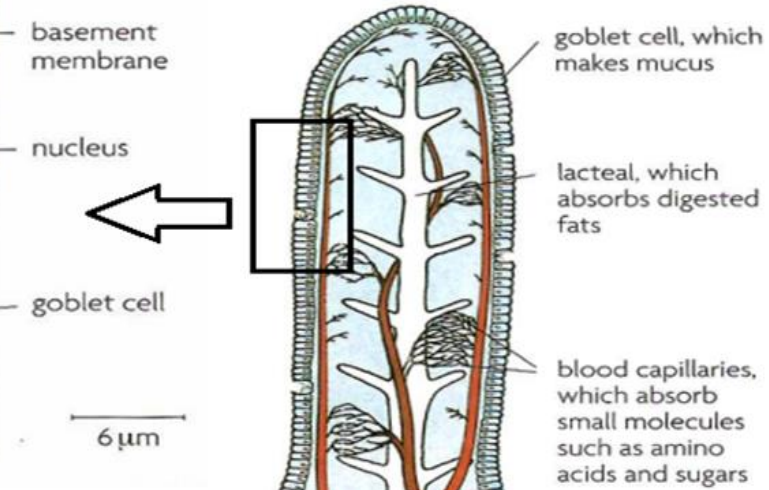
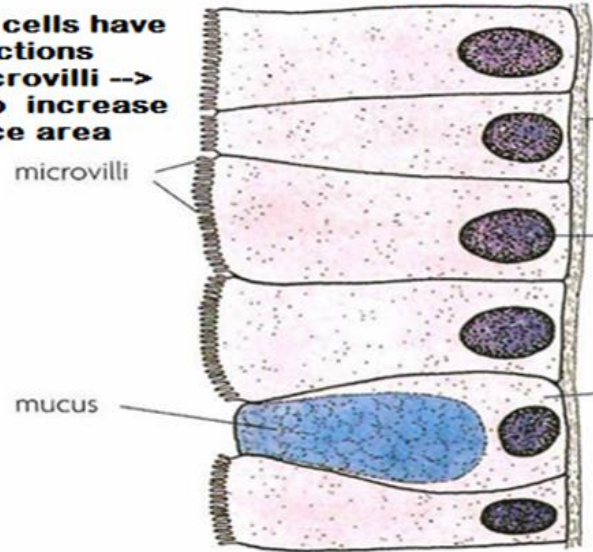
<https://www.youtube.com/watch?v=5BeCEO96LFg>

<https://www.youtube.com/watch?v=6nonjzzCSUU>

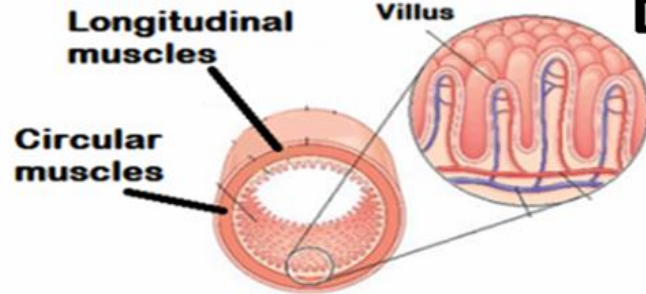


Epithelial cells have large numbers of mitochondria for aerobic respiration which generates energy required for active transport

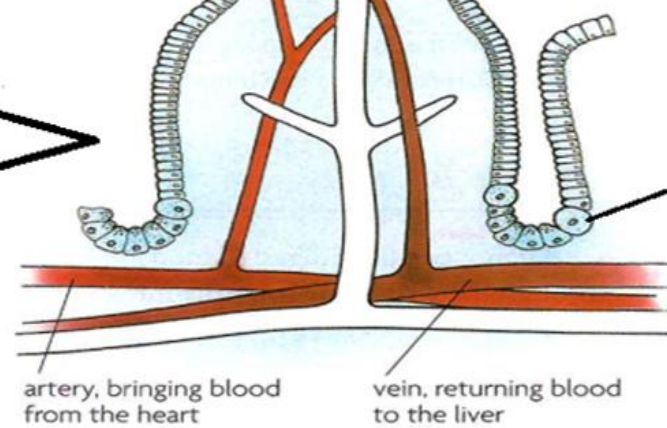
Epithelial cells have tiny projections called microvilli → these also increase the surface area



cross-section through the ileum



Intestinal glands that produce intestinal juice



Enzyme	Action
Sucrase	Sucrose into glucose and fructose
Lactase	Lactose into glucose and galactose
Maltase	Maltose into glucose
Lipase	Fats into fatty acids and glycerol
Peptidase	Polypeptides into amino acids

The small intestine is responsible for two main functions: completing digestion and absorption. *Extra information (reading only)*

1. Completing digestion. Three important digestive juices are added to the food in the small intestine to complete digestion. These juices are:

- Pancreatic juice, which is secreted by the pancreas and transferred via a duct to the small intestine. Pancreatic juice contains enzymes such as lipase (breaks down fats into glycerol and fatty acids), amylase (breaks down starch to maltose) and protease (breaks down proteins to amino acids).

It also contains bicarbonate ions which are alkaline and neutralize stomach acids in the duodenum to maintain the pH between 7 and 8.

- Bile, which is produced by the liver and stored in the gallbladder until release. It enters the small intestine through the bile duct. It helps in the digestion of lipids as it emulsifies fats. This means that it breaks down large drops of fats into small droplets, and therefore increases the surface area of the fat for the enzyme lipase to act upon.
- Intestinal juice, which is secreted by glands in the wall of the small intestine. Intestinal juice contains carbohydrases, lipases and proteases to complete digestion. The digestive enzymes in the small Intestine are immobilized on the epithelial membrane, which prevents the enzymes from being removed from the body

❖ Large intestine:

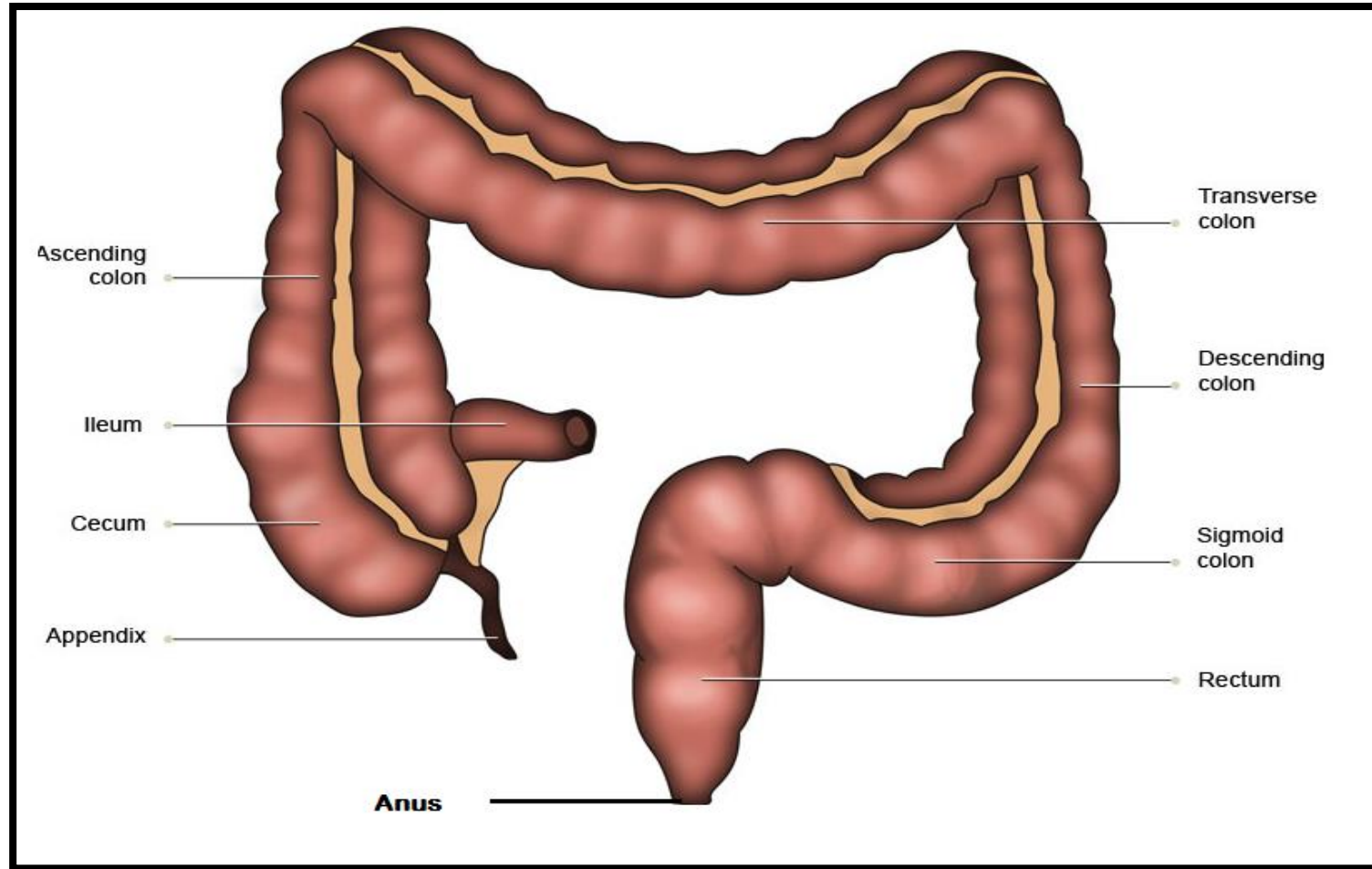
Undigested food



caecum



colon



- Water and minerals are **reabsorbed from the undigested food** in the large intestines
- Semi-solid **faeces** contain undigestible food/fibers, cellulose, dead cells and bacteria
- Faeces are stored in the **rectum**
- Faeces are removed outside the body through the anus in a process is called **egestion (defaecation)**

Egestion:

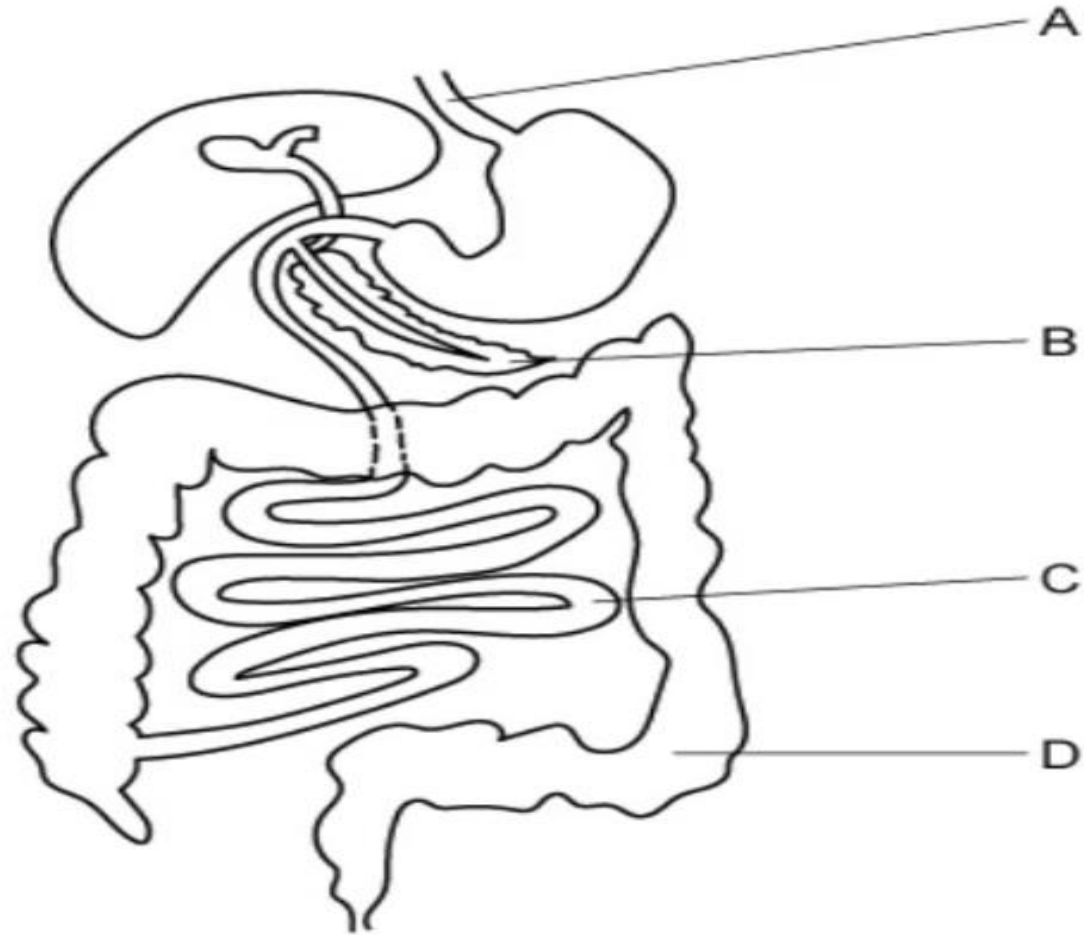
passing out of food that has not been digested or absorbed , as faeces, through the anus

- **Colon absorbs much less water than the small intestines**

Loss of large amount of water in faeces causing diarrhea which leads to dehydration of the body

The diagram below shows part of the human digestive system.

In which structure is most of the water from food absorbed?



Dietary fibre contains complex carbohydrates which cannot be broken down by enzymes produced in the human digestive system.

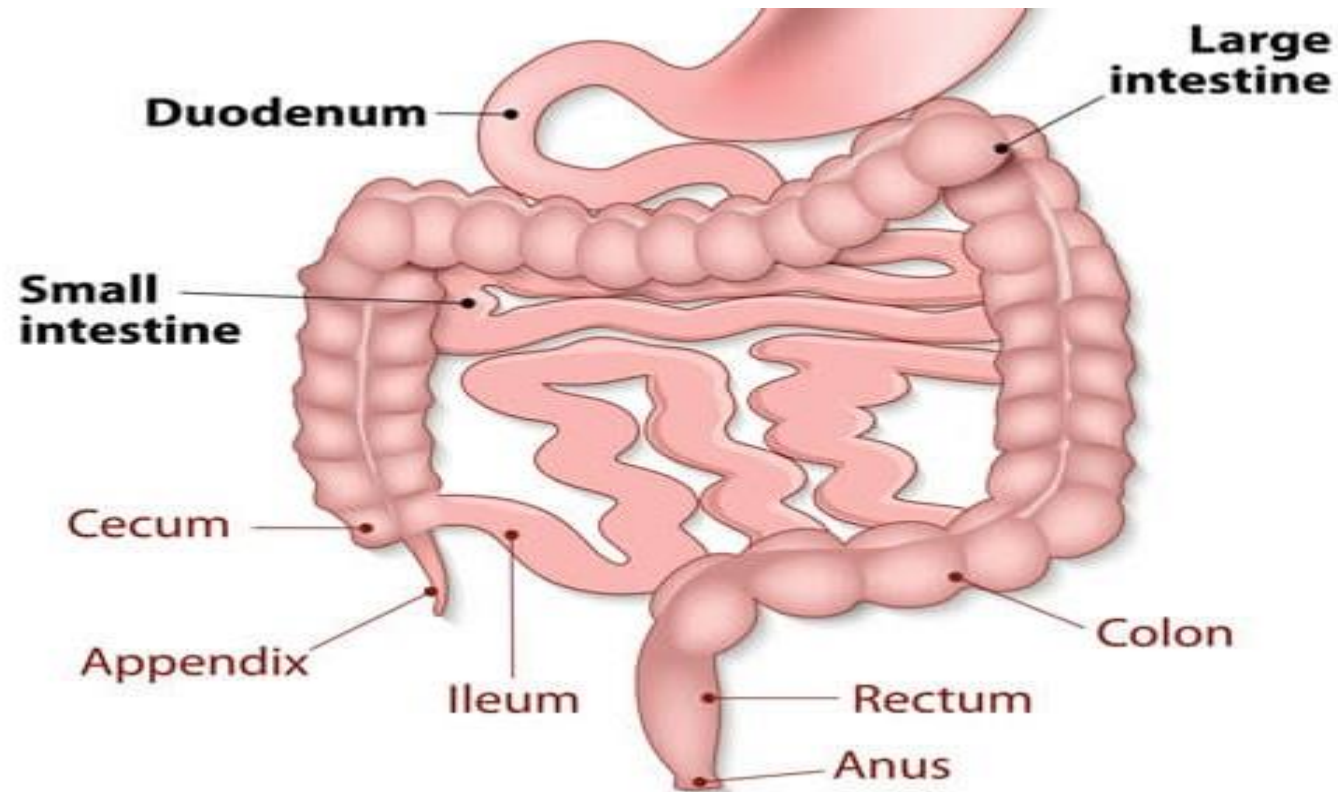
Fibre passes through several structures after leaving the stomach.

In which order does dietary fibre pass through these structures?

- A** Pancreas → duodenum → ileum → rectum
- B** Duodenum → ileum → colon → rectum
- C** Duodenum → pancreas → ileum → rectum
- D** Ileum → duodenum → colon → rectum

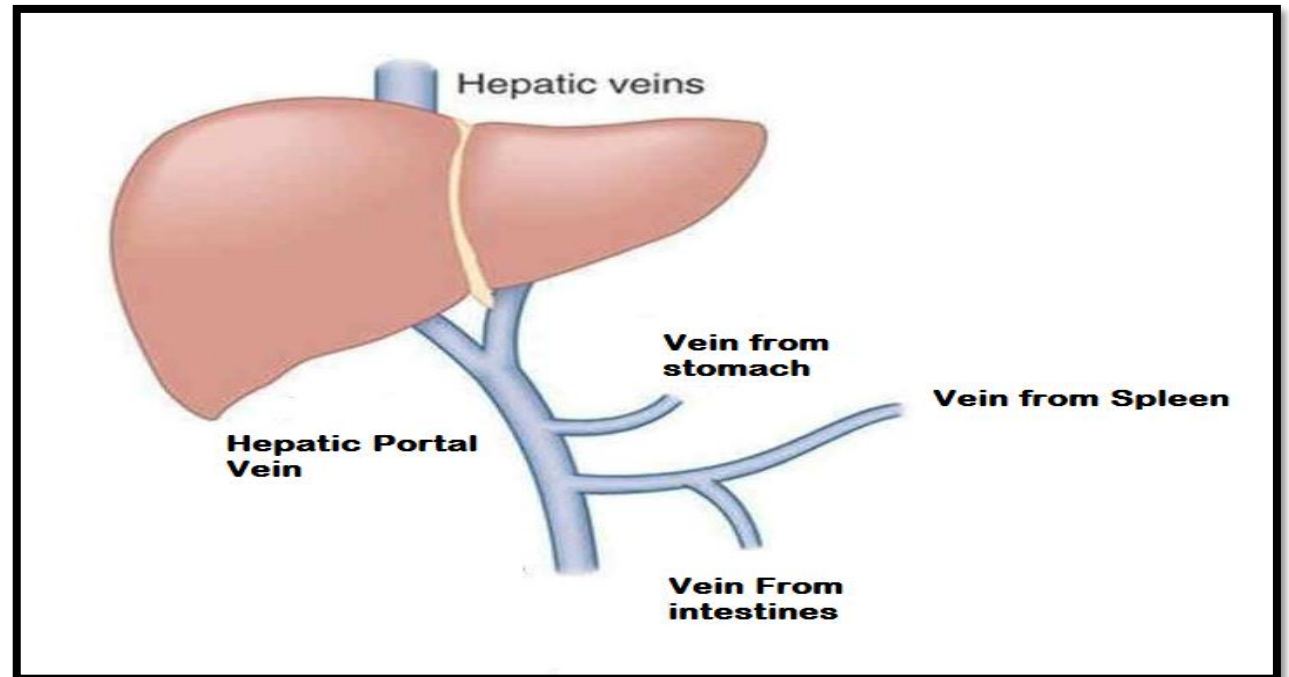
❖ Notes:

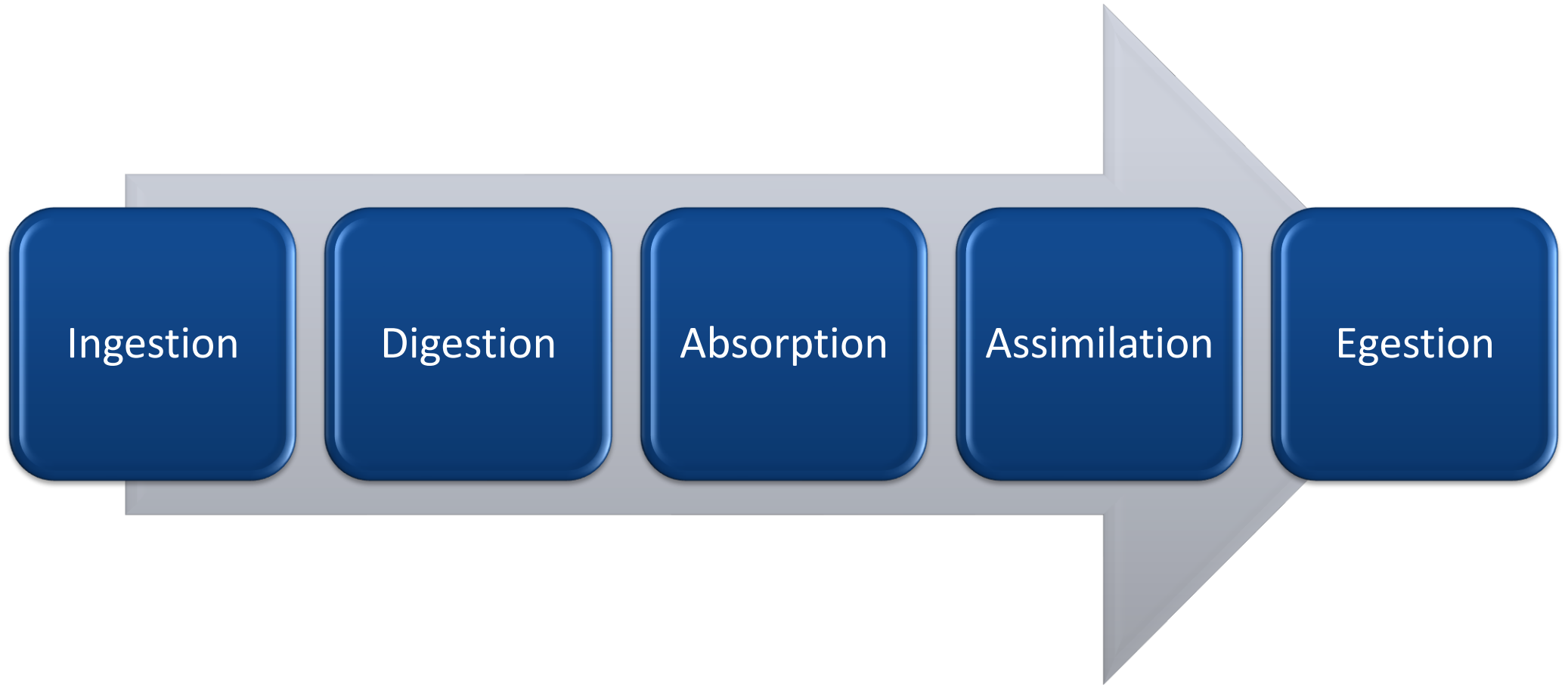
- Ileum and duodenum make up the small intestines
- Caecum , colon , rectum and anus make up the large intestines
- Large intestines are wider than duodenum and ileum



Liver

- Glucose is converted into glycogen; **regulate blood glucose level**
- Excess amino acids are **deaminated**; **regulate amino acids and proteins**
- **Detoxification**
- **Storage of vitamins and minerals**; liver stores vitamins A ,D , B12 and the mineral Iron
- **Production of Fibrinogen; blood clotting**
- **Production of bile; fat digestion**





Ingestion

Digestion

Absorption

Assimilation

Egestion

❖ Celiac Disease:

- Autoimmune disease that is triggered by gluten
- Gluten is a protein found in many grains, gives elastic texture
- Small intestine becomes inflamed and unable to absorb nutrients



A student ate a meal which contained a type of biomolecule, **X**.

The digestion of biomolecule **X** started in the mouth, and finished in the duodenum.

What is the product of the digestion of biomolecule **X**?

A Amino acids

B Protein

C Glucose

D Starch

Below is a list of chemical reactions that occur during digestion.

- 1 Protein → amino acids
- 2 Starch → maltose
- 3 Lipids → fatty acids + glycerol
- 4 Maltose → glucose

Which of the chemical reactions above might occur in the duodenum?

- A** 1, 3 and 4 **B** 4 only **C** 2, 3 and 4 **D** All 4

Which of the following is not a function of salivary amylase?

- A** Increasing the rate of breakdown of starch molecules
- B** Increasing the rate of starch breakdown into maltose molecules
- C** Breaking a large insoluble molecule into smaller soluble molecules
- D** Increasing the rate of starch breakdown into glucose molecules

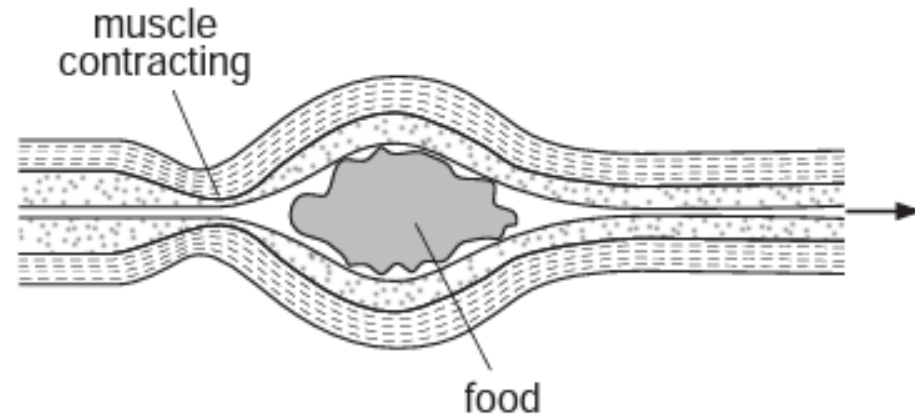
The small intestine of a person contains a lower concentration of glucose than is present in the blood.

The cells of the villi absorb glucose.

By which process is the glucose absorbed?

- A** by active transport against the concentration gradient
- B** by active transport down the concentration gradient
- C** by diffusion against the concentration gradient
- D** by diffusion down the concentration gradient

The diagram shows some food moving through the digestive system.



Which process is shown?

- A** diffusion
- B** digestion
- C** ingestion
- D** peristalsis

What is an example of assimilation?

A absorption of glycerol into lacteals

B breakdown of alcohol in the liver

C building of proteins from amino acids

D release of a hormone from a gland

المدرسة
الوطنية الأرثوذكسية
الشميساني



The National
Orthodox School
Shmaisani



NOS

شكراً

Thank you