

# Structure of the alimentary canal in relation to digestion and absorption essay S...



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1. Mechanical breakdown-the large particles of ingested food are broken down into smaller pieces by the teeth in the mouth.
2. Chemical breakdown – the large molecules of food are hydrolysed (broken down) by digestive enzymes into smaller, soluble molecules.

The alimentary canal (human gut) has the same general structure along its whole length but in some areas, it is specialised to carry out various roles. It extends as a tube from the mouth to the anus and along its length, the wall is composed of four layers:

1. Mucosa- This is the innermost lining of the gut wall. It lubricates the passage of food with mucus and also protects it from the digestive action of enzymes. The mucosa surrounds the lumen which is made up of glandular epithelium and connective tissue containing blood vessels and lymph vessels.
2. Submucosa- This is a layer of connective tissue that contains nerves, blood vessels and lymph vessels together with elastic fibres and collagen.
3. Muscularis Externa- This is made up of circular and longitudinal layers of smooth muscle fibres which control the shape and movement of the gut.
4. Serosa- This is the outermost layer and is made up of loose connective tissue which provides protection from friction against other organs.

Different parts of the alimentary canal play a role in the journey of food from when it enters the mouth to when it leaves the body as waste:

1. Mouth: This is where mastication happens. Mastication is the process of breaking down food into smaller pieces by the teeth. This provides a larger surface area so that enzyme action during chemical breakdown is more effective. The saliva in the mouth lubricates the smaller pieces of food and the tongue and cheek muscles help to make the lubricated food into a mass called a bolus so that it can be easily swallowed. The enzyme amylase in the mouth hydrolyses starch into maltose.

2. Oesophagus: This tube takes food from the mouth to the stomach using waves of muscular contractions called peristalsis. The food bolus stretches the gut wall and the circular muscle behind the bolus contracts, pushing the food forward. The circular muscle in the area surrounding the bolus is relaxed which increases the size of the lumen pushing the food forward.

Mucus is secreted from

glandular tissues in the walls to lubricate the food's passage downwards. An illustration of peristalsis is shown by the diagram

on the right.

From here, chemical digestion takes place and complex organic molecules are broken down in stages until simple, smaller soluble molecules are formed which can then be absorbed. There are three major groups of digestive enzymes involved:

\* Carbohydrases- these hydrolyse the glycosidic bonds in carbohydrates

\* Proteases- these hydrolyse the peptide bonds in proteins and polypeptides

\* Lipases- these hydrolyse the ester bonds in triglycerides

### Carbohydrases

The carbohydrate from the food is mainly in the form of polysaccharides so needs to be digested. Carbohydrate digestion occurs in the mouth, duodenum and ileum under alkaline conditions (above pH 7). In the mouth, at pH 7.0, salivary amylase hydrolyses carbohydrates into short chain glucose residues and some maltose. In the duodenum, at pH 7.0, the pancreatic amylase hydrolyses the starch in the carbohydrates to maltose. In the ileum, at pH 8.5, the enzymes, maltase, lactase and sucrase from cells in the mucosa of the small intestine, hydrolyse the maltose in the carbohydrates to glucose, the lactose to glucose and galactose and the sucrose to glucose and fructose.

3. Stomach: The stomach walls produce gastric juice which consists of hydrochloric acid (HCl), the enzyme pepsin and mucus. Pepsin only works in acidic conditions which are provided by the HCl and its job is to hydrolyse the peptide bonds in the middle of polypeptide molecules (proteins) breaking them down into smaller chains. No carbohydrate digestion occurs here as there is no carbohydrase enzyme present in the stomach.

4. Duodenum (small intestine): This contains pancreatic juice which contains proteases and lipases and also alkaline salts to neutralise the acid from the stomach. Bile from the liver is also added via the bile duct. This contains hydrogencarbonate ions which help in creating the alkaline conditions in which the enzymes from the pancreas and on the surface of the cells in the duodenum and ileum work most effectively. Pancreatic amylase hydrolyses <https://assignbuster.com/structure-of-the-alimentary-canal-in-relation-to-digestion-and-absorption-essay-sample/>

any remaining starch to maltose. Once the hydrolysis is complete, the resulting monosaccharides can then be absorbed by the body.

5. Ileum (small intestine): The small soluble molecules of digested food such as glucose, amino acids, fatty acids and glycerol, are absorbed through the microvilli lining the gut wall. Absorption here occurs through diffusion, facilitated diffusion and active transport.

6. Colon: Water is absorbed by the body and waste is pushed along towards the rectum.

7. Rectum: Stores faeces until they are expelled through the anus.

#### Absorption and Histology of the Ileum Wall

The final stages of digestion of carbohydrates, lipids, and proteins take place in the duodenum and ileum and at the same time the process of absorption is occurring. This part of the gut has several features which contribute to the efficiency of absorption:

- \* It is long which provides a large surface area for efficient absorption
- \* The large numbers of finger-like projections known as villi, in the mucosa increase the surface area for absorption
- \* The villi contain smooth muscle fibres which contract and relax, mixing up the contents of the ileum and bringing the epithelial cells of the absorptive surface into greater contact with digested food

- \* The epithelial cells possess microvilli to further increase the surface area for absorption
  
- \* Each villus has a large capillary network so that absorbed food is transported very quickly which maintains the concentration gradient
  
- \* Lymph vessels take away absorbed glycerol and fatty acids to join the lymphatic system
  
- \* A moist lining helps substances dissolve so they can pass through cell membranes