

# The Digestive System

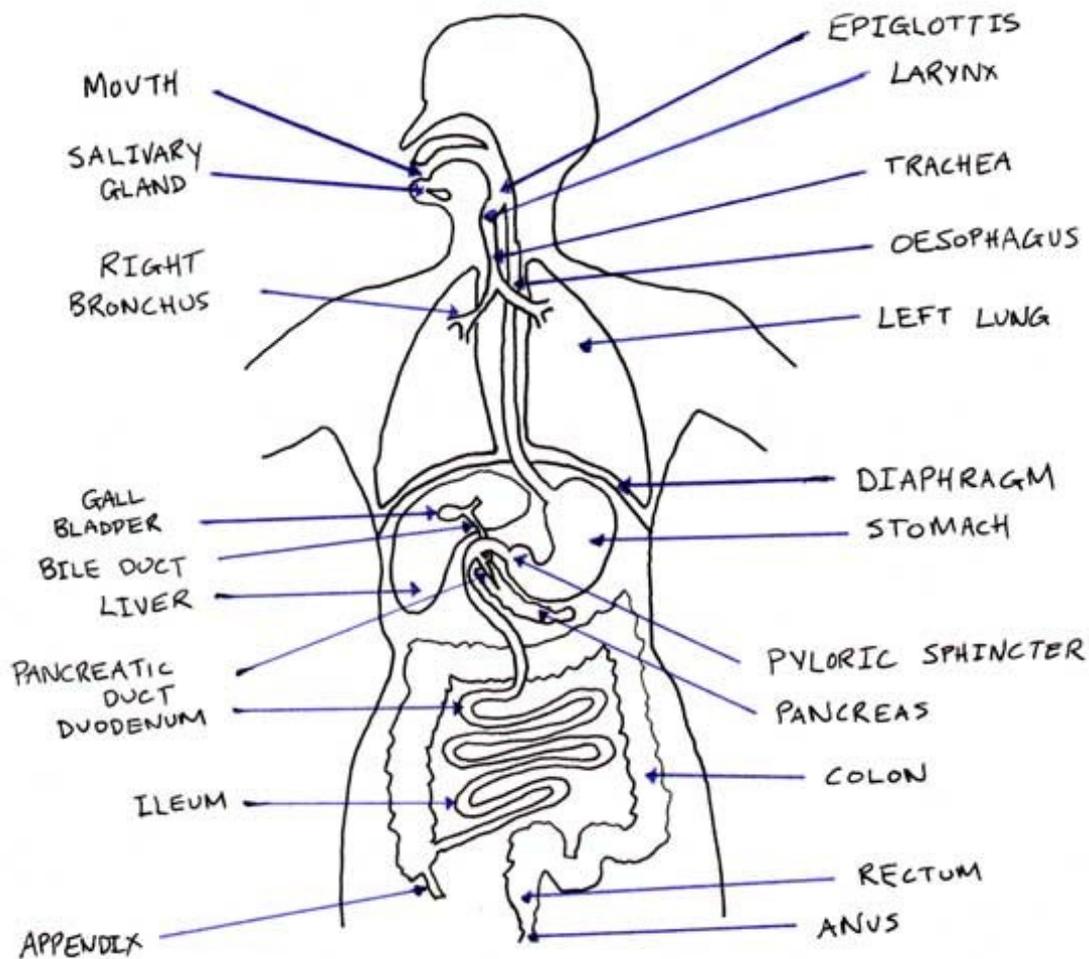


Diagram showing the body, mainly showing the digestive system.

Digestion is the breaking down of chemicals in the body to a form that can be absorbed and used. Digestion begins, in mammals, with the saliva in the mouth.

## The Mouth

- This is the buccal cavity in a human and is where mechanical digestion and mastication (chewing) takes place.
- Saliva in the mouth consists of mucin (binds food together), salivary amylase (digests starch to maltose) and mineral salts (regulates pH around 7, neutral).

## Oesophagus

- Peristalsis of the circular muscle contracts and relaxes to push food down.
- The upper part of the oesophagus is under conscious control until a point when it becomes involuntary.
- It usually takes between 4 and 8 seconds for food to travel from mouth to stomach.

## Stomach

- Acidic conditions (pH 1/2, enzyme optimum pH).
- Mechanical digestion takes place here (churning of the stomach makes food break down in size giving it a larger surface area).
- While food is in the stomach it mixes with gastric juice by churning.
- Food in the stomach stimulates stomach wall to produce gastrin (transported in the blood).
- With a fatty meal enterogasterone is produced to slow churning, it also weakens the acidic pH of the stomach.
- The gastric juices produced consist of, pepsinogen, made inactive to prevent autolysis and when added to HCl become active and is called pepsin used to convert proteins. Pro-rennin, a part of the gastric juices and when added to HCl forms rennin used to coagulate caseinogen, increasing surface area allowing a chance to digest. Hydrochloric acid (HCl) and mucus are also part of these gastric juices.
- Pro-rennin is only found in babies though, used for the digestion of the mothers milk.
- Mucus is used for the protection from excess stomach acid and most of all autolysis. It also acts as a lubricant, reducing friction.
- The stomach wall contains **oxyntic cells** which secrete hydrochloric acid (HCl), **goblet cells** which secrete mucus and **peptic cells** which secrete pepsin.

## Duodenum (early small intestine)

- This is the first 20cm of small intestine and receives secretions from the liver and pancreas.
- Further digestion takes place.
- Input of pancreatic juices.
- Lipids broken down into fatty acids.
- Protein broken down into amino acids.
- Large surface area due to a large number of villi (villus).
- The digestion of carbohydrates takes place inside cells.

## Liver

- Produces bile (stored in gall bladder, transported by the bile duct).
- Bile made from **bile salts** and **mineral salts**.
- Bile salts help with the digestion of fats by breaking them down from large globules to smaller globules, lowering surface tension and making a larger surface area.
- Mineral salts neutralise the stomach acid (HCl) to around 7/8 pH in the small intestine.

## Pancreas

- Produces pancreatic juices which contain pancreatic amylase, pancreatic lipase and trypsinogen (or trypsin in its active form).
- Pancreatic amylase converts the remaining amylose (starch) into maltose.
- Pancreatic lipase converts lipids into fatty acids and glycerol
- Trypsinogen, upon meeting with the enzyme enterokinase, is activated and is called trypsin. Trypsin then continues to break down proteins in digestion.

## Brunner's gland

- Located in the wall of the duodenum.
- Secretes alkaline juices (which help maintain the correct pH) and mucus (for lubrication and protection).

## Ileum

- This is the longest part of the small intestine.
- Secretes endopeptidases and exopeptidases.
- Endopeptidases breaks proteins into small polypeptides by breaking the bonds in the middle.
- Exopeptidases also breaks down protein but by taking single amino acids of the end. Both work together to break down the proteins into small amino acids.
- Sucrose is hydrolysed into fructose and glucose by sucrase.
- Maltose is also hydrolysed into two glucose by maltase.
- Contains crypts of Lieberkuhn which secrete maltase, sucrase, endopeptidases and exopeptidases.

## Small Intestine in General

- Glucose and amino acids are absorbed over the epithelium of the villi by [diffusion](#) and [active transport](#) into the capillaries of the villi.
- Once absorbed from the small intestine and into the capillaries, the products travel through the venules and the hepatic portal vein into the liver. Here in the liver toxins like alcohol, drugs, spent hormones and other toxins get converted into a non-toxic form. When they're safe and non-toxic they can be transported to the kidney in the form of urea.
- The absorption of fatty acids and glycerol don't enter straight into the capillaries instead entering the lacteal of the villi and then into the lymphatic system and then via the thoracic duct into the blood system.
- Products from digestion do one of three things, they either get stored (**assimilation**), used or converted (**deamination**). An example of assimilation is excess glucose being stored in the liver as glycogen. In the case of deamination an example could be an excess of amino acids, they then get converted into urea by the removal of the amino group ( $\text{NH}_2$ ) which combines with  $\text{CO}_2$  to form  $\text{CONH}_2$  (urea). The remaining organic molecule can be broken down and respired.
- The final products of digestion, carbohydrates in the form of monosaccharides, proteins in the form of amino acids and lipids in the form of fatty acids and glycerol.

## Large Intestine

- The large intestine absorbs water (by osmosis), minerals and vitamins.
- Chyme at the start of the large intestine consists of water, bile, mucus, dead cells, bacteria and undigested food.
- The large intestine has a larger lumen, is smaller in length and has a thinner wall than the small intestine.
- Faeces is stored in the rectum and then egested by the sphincter muscle called the anus.
- Diarrhoea causes dehydration because of the lack of absorption. Pernicious Anemia is another disease and is caused by not absorbing enough vitamin B and can be a side effect of diarrhoea.