



THE DIGESTIVE SYSTEM 1

Domain: 4.8
describes features of living things

Digestion

Digestion is the process involved in **breaking down** large food pieces into smaller units which can be absorbed by the **bloodstream**. The processes which achieve this are:

1. **Mechanical actions**- such as **biting and chewing**.
2. **Action of acid- gastric juices in stomach**.
3. **Action of enzymes**- enzymes are chemicals which speed up chemical reactions involved in digestion.

The Human Digestive System

The changes to food during digestion occur in a long tube running from the mouth to the anus. This tube is called the **alimentary canal**. The main parts of the alimentary canal are:

The mouth contains **teeth** which bite off and chew food. The food is mixed with **saliva**. This lubricates the food so that it can be easily swallowed. The saliva also contains an enzyme which starts the digestion of **starch** into glucose. When you swallow, a flap covers the windpipe. This is called the **epiglottis**. The food is then pushed into the oesophagus.

The oesophagus carries food down to the stomach by a process called **peristalsis**. This is a wave of contractions in the oesophagus.

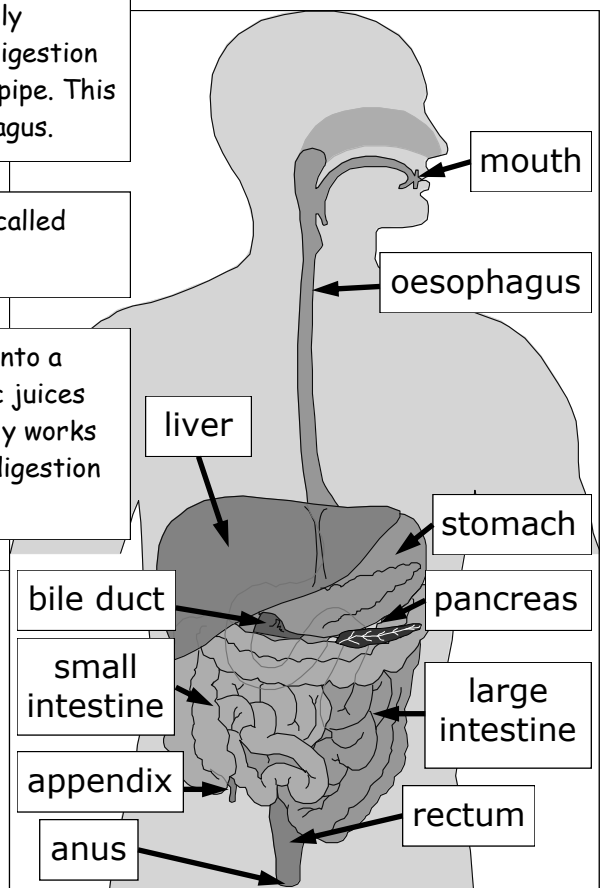
The stomach grinds and mixes the food, transforming the food into a milky liquid. The stomach secretes **gastric juices**. These gastric juices contain **hydrochloric acid** and an enzyme, **protease**. Protease only works in the presence of an acid and is responsible for beginning the digestion of **proteins**. The food now enters the small intestine.

The small intestine is the single most important part of the digestive system. It is here that **most** digestion occurs. It is also here that the **absorption** of food starts. The three processes which occur are:

1. **Pancreatic juices** from the pancreas contain enzymes which digest proteins, starch and fat. It also contains sodium carbonate which neutralises the acid from the stomach.
2. **Intestinal juices** secreted by the wall of the intestine also contains enzymes that complete the digestion of proteins, starch and fat.
3. **Bile** from the liver which also helps break down fats.

The small intestine is about 7 metres long in an adult and the interior wall is made up of projections called **villi**.

What remains of the food spends 10-12 hours in the large intestine. During this period it loses large quantities of **water** and some more **nutrients**. **Bacteria** decay the remains of the food. These bacteria also contain certain vitamins and tend to prevent disease-causing bacteria from establishing themselves. Unwanted material that we cannot digest such as roughage and dead bacteria are expelled as a semi-solid mass called **faeces**. The faeces is stored in the **rectum**. The faeces is expelled (eliminated) from the body through the **anus** by contraction of the muscles in the rectum. This is called **defecation**.





Digestion of food:

Food enters mouth. Food is chewed. Teeth cut, crush and grind food.

Saliva moistens food. An enzyme (salivary amylase) starts the breakdown of starch.

Food is swallowed. Passes down oesophagus by peristalsis.

Food enters stomach. Stomach squeezes and grinds the food by muscular action. Food is mixed with gastric juices.

Protease, an enzyme in gastric juices, starts breaking down proteins.

Food passes into small intestine. Absorption of food begins. This occurs through villi which have very thin walls.

- Pancreatic juices from pancreas continue digesting proteins.
- Intestinal juices containing enzymes complete digestion of proteins, starch and fat.
- Bile from liver helps break down fat.

Food passes into large intestine. Waste material is converted into a semi-solid state (faeces). The faeces is stored in the rectum until it is expelled through the anus.

Water is absorbed. Bacteria help break remaining material down.

Questions:

- (a) What is digestion? (b) What are three processes which achieve digestion? (c) Where does digestion occur? (d) What are the five main parts of the alimentary canal?
- (a) What does the mouth contain? (b) Why is food mixed with saliva? (c) What does saliva contain which starts the digestion of starch? (d) What happens to the windpipe when you swallow?
- How is food carried down the oesophagus?
- (a) What does the stomach transform food into? (b) What does the stomach secrete? (c) What is the function of protease?
- (a) What process starts in the small intestine? (b) What do pancreatic juices do? (c) Why do pancreatic juices contain sodium carbonate? (d) What do intestinal juices do? (e) From what organ is bile released from? (f) What does bile do? (g) What is the interior wall of the small intestine made up of?
- (a) What does the remaining food material lose in the large intestine? (b) What do bacteria do in the large intestine? (c) What do faeces consist of? (d) Where is faeces stored? (e) How does defecation occur?



THE DIGESTIVE SYSTEM 2

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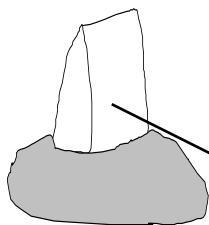
Additional Information on The Digestive System

1. Teeth-

Teeth allow you to **bite off** and **chew** food. The food has to be chewed so that it is broken down into pieces small enough to swallow. An adult has 32 teeth- 16 in each jaw. There are different types of teeth for different functions as shown below:

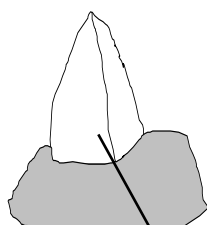
Incisors-

The front teeth are called incisors. They cut food. They are chisel-shaped. An adult has four incisors in each jaw.



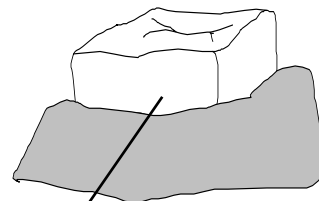
Canines-

The next tooth either side of the incisors is the canine or "eye" tooth. Canine teeth are for tearing food.

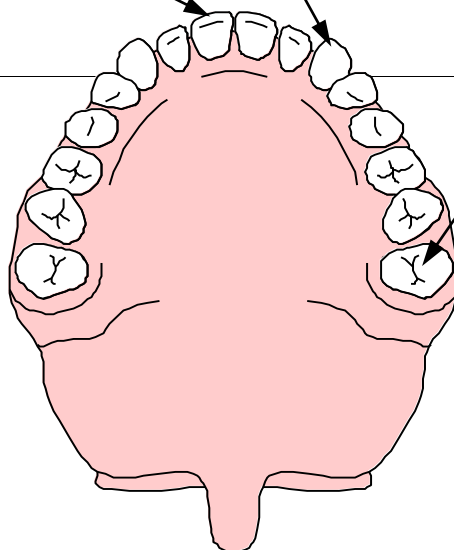


Molars-

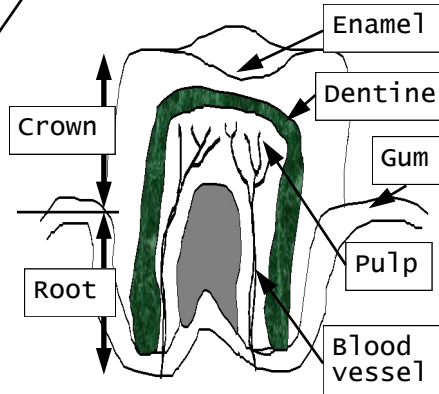
After the canines are four pre-molars (two on each side) and then six of the largest teeth, the molars (three on each side). The molars grind food.



A tooth consists of a shiny white outer layer of **enamel**. The enamel is non-living. Under the enamel is a softer layer of **dentine**. Dentine is living tissue. The centre of the tooth consists of the **pulp cavity**. The pulp cavity contains nerves and blood vessels.

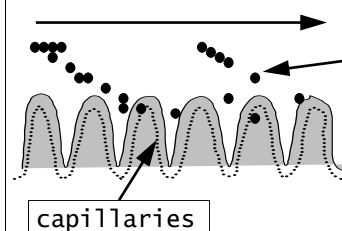


Structure of a tooth:



As mentioned, the small intestine consists of projections called **villi** (each projection is called a villus). The villi increase the surface area of the small intestine allowing more food to be in contact with wall of the small intestine. This means more food is able to pass into the bloodstream by absorption. This results in faster digestion of food.

A section of the small intestine showing villi:



Food particles are absorbed into the bloodstream. Each villus has an arterial capillary which becomes a vein capillary.



3. The appendix-

The **appendix** is located in the large intestine. In humans the appendix is no longer a functioning organ. In some animals which are plant-eaters, the appendix does have an important role. It is known as a **caecum**. Its function is to store bacteria which can digest **cellulose** in plant material. Koalas, with their diet of gum leaves, have a caecum up to 2 metres long.

4. Problems with the digestive system-

Problem	Description
Appendicitis	The appendix becomes infected with germs. It is corrected by removal of the appendix.
Bowel Cancer	Is cancer of the intestine (usually the small). It can be treated by a number of methods if detected early enough. It is thought a diet high in fibre (roughage) helps prevent this cancer.
Constipation	Is caused when the faeces moves too slowly in the large intestine with more water than usual being absorbed. Roughage helps prevent constipation.
Diarrhoea	Is the excessive discharge of watery faeces. It results from the faeces being moved too quickly along the large intestine. Diarrhoea is often caused by germs.
Flatulence	Flatulence is the release of built-up gas from the large intestine. The average adult should release this gas about 15 times per day. Excessive flatulence can result from poor diet or eating particular types of food or even from stress.
Gallstones	Form in the organ which stores bile from the liver. It is called the gall bladder. If the bile becomes too concentrated then crystals of cholesterol may form. These build-ups are called gallstones and they prevent bile entering the intestine. They can be removed surgically.
Haemorrhoids	These are painful swellings of blood vessels usually near the muscles of the anus. There are a number of causes, these include regularly failing to defecate when it is required or forcing faeces from the rectum on a regular basis.
Indigestion	Is caused by the stomach producing too much gastric juice. If the excessive juice enters the oesophagus then it begins to digest the tube. This results in a burning sensation. Indigestion often results from eating too much food.
Ulcers	Occur in people who constantly have too much gastric juice in their stomach. The juice attacks the lining of the stomach. It is thought nervous tension and stress contributes to the condition.

Questions:

- What are the three types of teeth and what is the function of each?
 - How many of each type of teeth are there in a normal adult?
 - Which of the following parts of a tooth is living tissue?- (i) dentine or (ii) enamel.
 - What does the pulp cavity in a tooth contain?
- What structures in the small intestine are designed to increase the rate of digestion of food?
- Where is the appendix located?
 - What is the function of the appendix (caecum) in plant-eating animals?
- Name a problem which can occur with the: (a) stomach; (b) small intestine; (c) large intestine.