

# Biology 90166 v2 Describe the functioning of human digestive and skeletomuscular systems

## Part 1: Digestive system

### Digestive system

Role of the digestive system – to break down large insoluble materials into smaller soluble ones that will pass through the villi in the small intestine into the blood stream.

**Mouth:** Physical and chemical digestion. Saliva contains the enzyme amylase; breaks down the substrate starch into maltose (a sugar). Teeth bring about mechanical digestion, breaking up food, moistening it, increasing the SA, and making it able to be swallowed.

**Stomach:** Sphincter muscles control the movement of food into and out of the stomach (relaxing to let food enter or leave). Pepsin (a protease / protein digesting enzyme) breaks down proteins into amino acids. Needs acidic conditions. Stomach secretes dilute hydrochloric acid.

**Small intestine:** The pancreas releases enzymes and sodium bicarbonate – this neutralises the acid stomach contents. Bile is a yellow green liquid – also alkaline. Lipases break down fats into fatty acids and glycerol. Trypsin breaks down protein further. Amylase breaks down starches into maltose, and maltase breaks maltose into glucose. In the ileum the digested food molecules are absorbed into the blood through the villi (finger like projections). The villi increase the surface area to which increase the efficiency of **absorption**. Each villus contains a network of blood capillaries which carry the small food molecules from the 'gut' to the cells in the body that needs them.

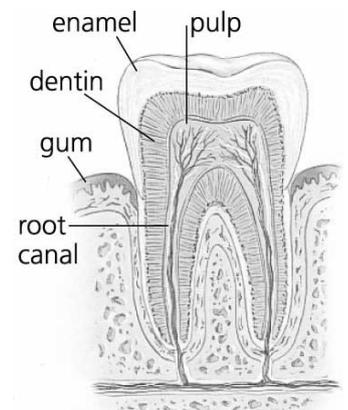
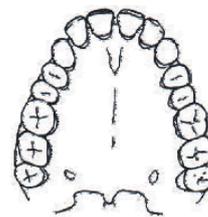
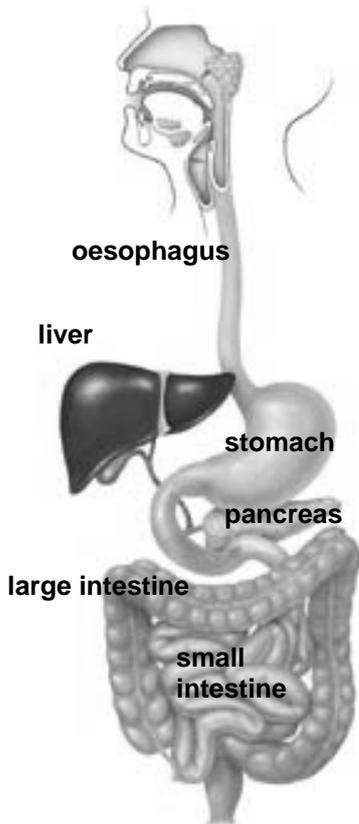
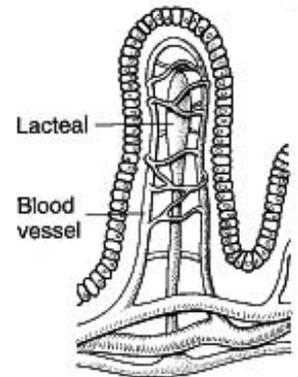
**Large intestine:** The material that enters the large intestines (or colon) consists of mainly water and undigested food (cellulose). About 95% of the water in the digestive juices is reabsorbed in the small and large intestines. The water is absorbed into the blood and the semi-solid faeces pass down the rectum and out the anus.

**Egestion:** Removal of waste.

### Physical digestion

Teeth – incisors cut/slice, canines tear, premolars and molars grind and chew.

Stomach – Physical digestion occurs as the relaxing and contracting of muscles in the stomach wall churn food.



### Chemical digestion

**Enzymes** – biological catalysts. They are specific (work on only certain molecules – called the substrate), work best near body temperature (lower temperatures they work slower, at higher temperatures they are denatured (destroyed), work best at particular pH values. They are protein molecules.

Carbohydrases – digest carbohydrates into sugars

Proteases – digest proteins into peptides and then amino acids

Lipases – digest fats/oils into fatty acids and glycerol

**Bile** – not an enzyme! Bile is produced by gall bladder. It emulsifies fats (breaks big globules of fat into smaller globules, increasing the surface area for the fat digesting enzymes to work on.

### Peristalsis

Food is moved along the digestive system by waves of **peristalsis**; muscles contract and relax pushing the bolus along.



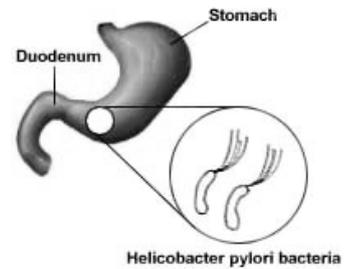
## Malfunctions (causes, effects, correction)

**Ulcer** – small hole in the stomach (gastric ulcer) or in the first region of the small intestine beyond the stomach (duodenal ulcer).

**Cause:** the destruction of the stomach lining by hydrochloric acid; Infection by *Helicobacter pylori* bacteria is thought to play a role as is genetic predisposition, stress, chronic use of anti-inflammatory drug, alcohol and smoking.

**Effect:** Major symptom is burning feeling in the stomach; Recurrent vomiting, blood in the faeces and bleeding from ulcers (causing anaemia) are other symptoms. Stomach ulcers can cause haemorrhages (by erosion of a major blood vessel); peritonitis (from a tear in the gut wall); Obstruction because of spasm or swelling in the ulcer area.

**Correction:** Pain can be relieved by drinking milk, eating, resting, or taking antacids. Taking antibiotics can kill the *H. pylori* and eradicate the bacterial infection.



**Constipation** – infrequent or hard pellet faeces, or difficulty in evacuating faeces. While troublesome, constipation is not usually a serious disorder.

**Cause:** An excessive amount of water is extracted from the faeces in the colon. A “lazy colon” that does not contract properly fails to move the faeces to the rectum. A “spastic colon” can remain contracted for a prolonged time and the faeces cannot move along. Again too much water is absorbed and hard pellet-like faeces develops. Constipation also can result from a mechanical obstruction such as a tumour or advanced diverticulosis (disorder that distorts and narrows the lower-left colon). Other conditions that can produce constipation include: pregnancy, certain drugs, thyroid hormone deficiency, the chronic abuse of laxatives, travel, and stress.

**Effects:** Constipation does not cause health problems. No 'toxins' or poisons are absorbed from the large bowel. However constipation can feel uncomfortable and passing hard faeces hurts and also can tear the skin of the anus, causing bleeding. However prolonged constipation can be a sign of more serious problems such as bowel cancer.

**Correction:** Chronic constipation usually responds to simple measures, such as adding fibre, bran or a bulking agent to the diet, eating regularly, drinking plenty of liquids each day, regular walking and performing aerobic exercise. Foods that are high in roughage, bran and fibre are essential in correcting and preventing constipation – eg whole grain bread, bran, fruit, and vegetables. Laxatives occasionally help temporary constipation problems but chronic use of laxatives is discouraged because the bowel becomes dependent upon them.

**Diarrhoea** - loose, watery faeces occurring more than three times in one day.

**Cause:** Reduced absorption of fluid from the intestine or too rapid passage of chyme through the intestine. It can be a symptom of: Diseases (eg. colitis, Crohn's disease, colon cancer, and irritable bowel syndrome: certain foods for some people (eg. hot peppers, milk products, or very fatty food); food poisoning illness eg salmonella from contaminated poultry; excessive use of chemical laxatives; taking prescription drugs eg antibiotics.

**Effect:** It is usually accompanied by abdominal pain and often nausea and vomiting. It can cause dehydration (body lacks enough fluid to function properly), particularly dangerous in children and the elderly. Dehydration may cause fainting due to low blood pressure, reduced urine output, severe weakness, shock, kidney failure, confusion, acidosis (too much acid in the blood), and coma. Major effects of prolonged diarrhoea are malnutrition, and weight loss.

**Correction:** Diarrhoea is a common problem which is usually not serious. If it is severe or persistent, a specific diagnosis should be sought. Treatment may include avoiding certain foods or drugs. A doctor may arrange a barium X-Ray examination of the bowel or colonoscopy where a flexible video camera is guided around the colon and samples are taken for laboratory testing, to check for other problems.

**Bowel cancer:** Usually begins as a small non-cancerous growth – polyp - which undergoes changes resulting in uncontrolled growth and spread - now called cancer. Much evidence links diet (especially high fat and low fibre diets) and the risk of developing bowel cancer.

**Cause:** Fewer people get bowel cancer if their diet contains vegetables, fruit and fibre like grains, cereals and so on, but not much fat. Although diet is important, it is unlikely to be the only reason for bowel cancer.

**Effects:** Bleeding from the rectum; change in bowel function - diarrhoea or constipation; abdominal pain or distension; vomiting; weight loss and a feeling of incomplete rectal emptying after passing faeces.

**Correction:** Untreated bowel cancer usually continues to grow and eventually spreads to the liver and other organs, which is fatal. If detected at an early stage the disease can be cured by removal either during colonoscopy (if small) or surgery.