

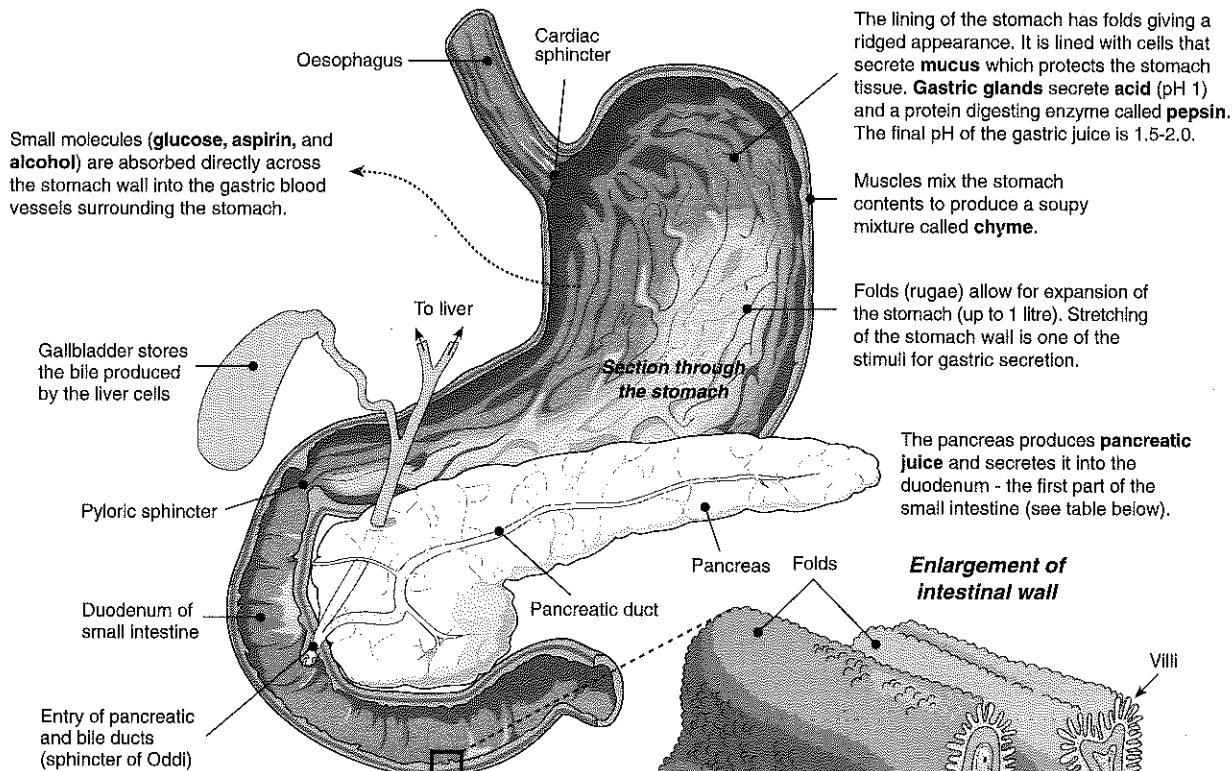


Stomach and Intestines

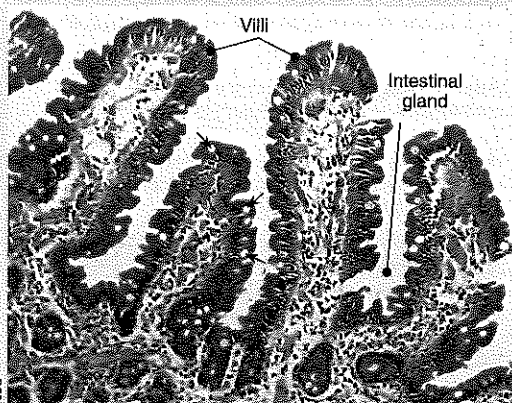
Digestion in the gut depends on both the physical movement of the food and its enzymatic breakdown into constituent components. Most digestion occurs in the stomach and small intestine. The digestive enzymes involved may be bound to the

surfaces of the intestinal epithelial cells or occur as components of the secretions of digestive glands (e.g. pancreas). The structure and functions of the stomach, intestines, and the accessory organs of the gut are shown on this and the next page.

The Stomach and Organs of the Small Intestine



Photographic Enlargement Of Intestinal Villi



The photograph (left) shows a close up of the **intestinal villi** and **intestinal glands** (crypts of Lieberkühn) in cross section. The intestinal glands secrete mucus and alkaline fluid. **Epithelial cells** line the surface of the villi. These are regularly worn off and replaced by new cells migrating from the base of the intestinal glands. Enzymes bound to the microvilli surfaces of the epithelial cells (peptidases, maltase, lactase, and sucrase) break down small peptides and carbohydrate molecules into their constituent parts. The breakdown products (monosaccharides, amino acids) are then absorbed into the underlying blood and lymph vessels. **Mucus cells** (white spots arrowed) produce mucus to protect the epithelial cells from enzymatic digestion. The **blood vessels** transport nutrients to the liver. **Lymph vessels** transport the products of fat digestion.

Enzyme Secretions of the Stomach and Pancreas and their Role in Digestion

Secretion and Source	Site of Action	Active Enzyme	Substrate and Products	Control of Secretion
Gastric juice: stomach	Stomach	Pepsin	Protein → polypeptides	Hormonal: release of gastrin into the blood stimulates gastric secretion. Nervous: stimulation via a branch of the vagus nerve.
Pancreatic juice: pancreas (exocrine portion)	Duodenum	Pancreatic amylase Trypsin Chymotrypsin Peptidases Pancreatic lipase Nucleases	Starch → maltose Protein → polypeptides Protein → polypeptides Polypeptides → amino acids Fats → fatty acids + glycerol Nucleic acids → nucleotides	Hormonal: control of pancreatic secretions is via release of secretin and cholecystokinin . These hormones stimulate the production of pancreatic juice and its secretion into the gut.

The large intestine (or colon), rectum, and anus make up the final part of the mammalian gut. In humans and other omnivores, this section of the gut is concerned mainly with the reabsorption of water and the formation of faeces. In

herbivores with hind gut fermentation, bacteria in the colon or caecum act on undigested cellulose in the plant foods that are eaten, producing sugars that are absorbed before the faeces are egested (eliminated).

The Colon and Faeces Formation

Composition and Formation of Faeces

The movements of the large intestine are sluggish, so bacteria have time to grow and multiply. It may take 1 to 3 days for the slow journey to the anus. After eating, peristaltic movements push food into the rectum. Defaecation is reflex but there is voluntary control over the sphincter muscles in the anus. Relaxation of the sphincter enables the faeces to be expelled. During infection or disease, gut movements increase and not enough water is reabsorbed from the faeces. When gut movements become too slow, too much water is reabsorbed and the faeces become hard and dry.

1. List the three main functions of the stomach in humans:

- (a) _____
- (b) _____
- (c) _____

2. Movements of the gut push food through the gut tube. State their other important role: _____

3. Protein-digesting enzymes (e.g. trypsin, chymotrypsin, and pepsin) are secreted in an inactive form and activated after release. Explain why it is necessary for these enzymes to be secreted in an inactive form: _____

4. Suggest why the various secretions of the gut are of a particular pH (acid in the stomach, alkaline in the small intestine): _____

5. The effects of an alcoholic drink are felt soon after drinking, rapid pain relief can be gained from taking aspirin, and blood sugar rises shortly after sucking a glucose sweet. Explain why these substances have such a rapid effect when ingested: _____

6. Explain the general role of sphincter muscles in the digestive tract: _____

7. State which three essential components of the diet are taken in and absorbed but not digested: _____

8. Explain how faeces are formed: _____

9. Explain the importance of dietary fibre: _____