Human Digestion

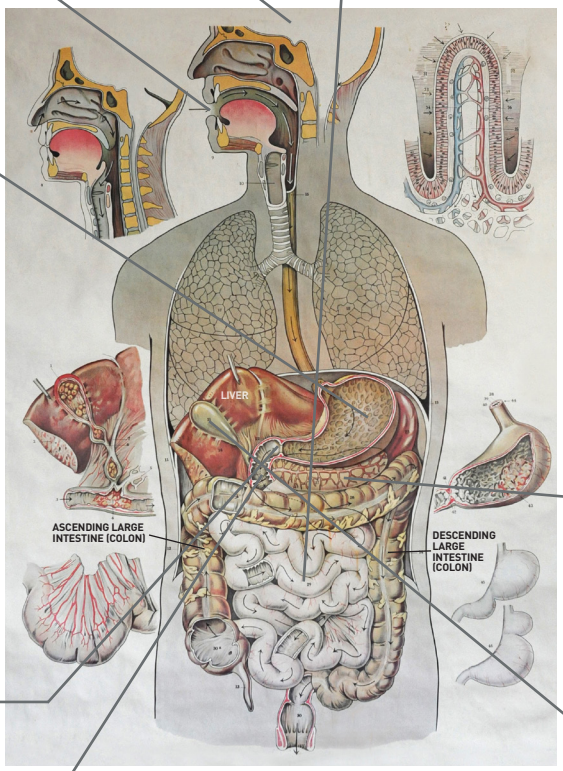
The upper gastrointestinal tract
Digestion actually starts in the brain. When you smell the bread and begin to chew, your brain activates the production of gastric juices and signals down to the stomach.

Chewing
Chewing begins to break down the food, increasing the surface area that the digestive enzymes will work on. Salivary glands produce salivary amylase which begins the breakdown of polysaccharides in the mouth. Once the bread has been chewed and mixed with saliva, it travels via the oesophagus down to the stomach.

Stomach
The stomach has a muscular elastic wall. In the epithelial layer of the wall are millions of pits – these are the entrances to gastric glands which secrete gastric juices. The gastric juices help to liquefy the food. In addition, a major component of gastric juice is hydrochloric acid. The acid kills almost all of the bacteria which has been ingested with the bread. It also causes the salivary amylase to become inactive, leaving the polysaccharides that had begun to be digested in the mouth only partially digested. The stomach is also where zymogens are secreted. Zymogens are inactive precursors of enzymes that require change to be activated (that comes in a little later in the digestive system). At the same time as the gastric juices are being secreted, there is an activation of the smooth muscles of the stomach wall, which churns up the mixture and breaks it down into more liquid. The enzymes in the stomach work best in acid conditions.

Pyloric sphincter
This acts as a valve, allowing the partially digested food to move from the stomach to the duodenum.

Digestion of Carbohydrates
This begins in the mouth, where salivary amylase starts to break down polysaccharides in the bread. There is no digestion of carbohydrates in the stomach because the acid environment stops the action of amylase. In the duodenum the pancreas releases pancreatic amylase which breaks the polysaccharides down into disaccharides. These are then broken down to monosaccharides through the action of lactase, sucrose and maltose. The monosaccharides can then be absorbed in the small intestine.



Lower gastrointestinal tract (gut microbiome)
There are three parts to the lower gastrointestinal tract – the duodenum, the jejunum, and the ileum. The first section, the duodenum, is where the pancreas, gall bladder and liver add digestive enzymes, water and bile. As the food enters the duodenum it is still acidic. To counteract this, bile (produced in the liver and stored in the gall bladder) is secreted into the small intestine. Bile has two functions. As well as neutralising the acid to create the alkaline conditions needed by the enzymes in the small intestine, it also emulsifies fats giving the lipase enzyme a larger surface area to work on. The pancreas secretes enzymes, including trypsin and chymotrypsin to digest proteins, amylase to digest carbohydrates and lipase to break down fats.

The lower two sections of the small intestine (the jejunum and the ileum) are the main sites of absorption. They have an epithelial layer which is structured with large folds, which increases the surface area. This area is further increased by the presence of villi. These are small projections, almost like fingers to capture the digested food. The undigested food then moves into the large intestine, or the colon. The main functions of the colon are to reabsorb water, and to process the waste material (faeces) ready for excretion via the anus.

Digestion of Proteins
Occurs in the stomach and the duodenum. There are three main enzyme involved in the digestion of proteins – pepsin (secreted by the stomach), trypsin and chymotrypsin (secreted by the pancreas). Together these break down proteins into polypeptides, which are then further broken down into amino acids before absorption.

Digestion of Fats and Lipids
These are hydrophobic, making them poorly soluble in the watery environment of the digestive system. To aid digestion, bile is secreted into the duodenum. This emulsifies the fats, forming smaller fat globules which gives a larger surface area for the enzyme lipase to work on. Fats are broken down into monoglycerides and fatty acids. These can then be absorbed by the small intestine.