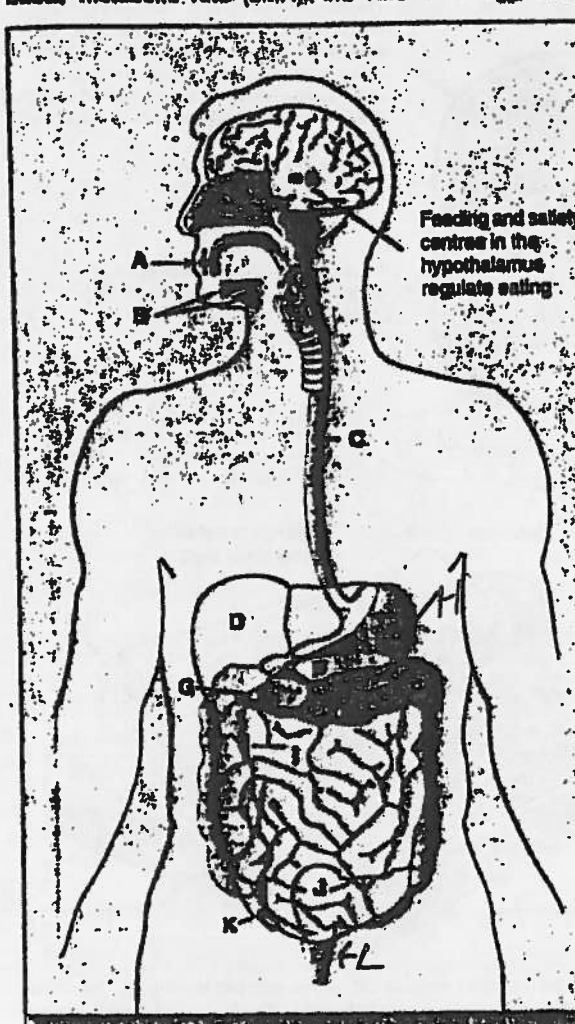
Key

RA 2

Introduction to Human Digestion

It is estimated that an adult consumes about 20,000kg of food between the ages of 18 and 35 years – about a metric tonne a year. Although babies grow rapidly from birth, growth is not the most significant reason for our ongoing eating. Our bodies require a constant source of energy for the vast number of biochemical reactions that constitute metabolism. Food provides the source of this energy. Human energy requirements are governed by basal metabolic rate (BMR): the rate of energy use by an inactive, rested person in warm conditions. BMR varies depending on sex, age, size, and body composition. For an 75-80 kg male at rest, this is about 7140 kJ. The daily energy requirement of an individual is equal to BMR plus the energy needed for activity and growth and repair of tissue. The digestive system prepares the food we eat for use by the body's cells through five basic activities: eating (ingestion), movement (of food through the gut), digestion (physical and chemical breakdown), absorption, and elimination.



Structures of the Human Digestive System

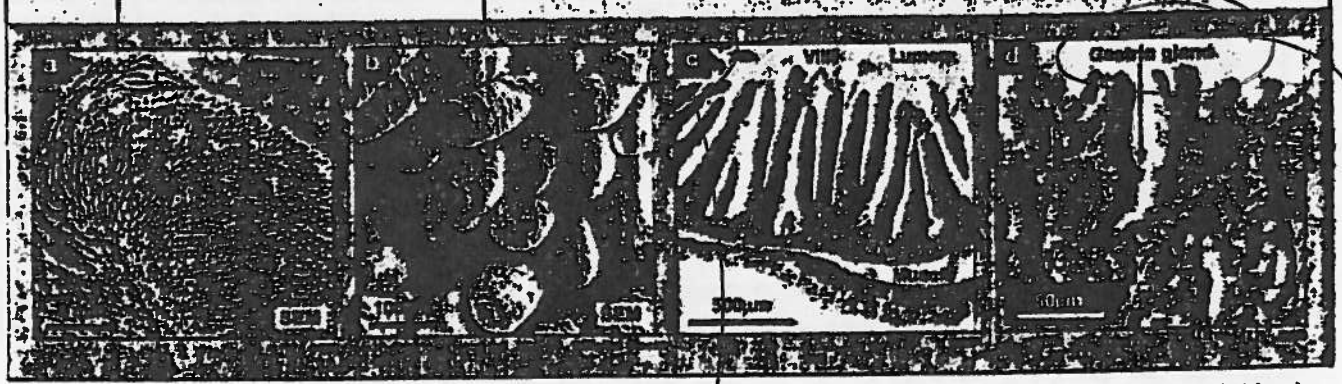
~~Word lists: Liver; small intestine; gall bladder; stomach; salivary glands; colon (large intestine); oesophagus; pancreas; mouth and teeth; anus; rectum; appendix~~

A mouth + teeth	G appendix
B salivary gland	H stomach
C esophagus	I small intestine
D liver	J large intestine
E gall bladder	K anus
F pancreas	L rectum

Functions of the Human Digestive System

In the boxes provided, write the letter (A-L) that represents the part of the gut responsible for each of the functions summarised below:

small	(a) Main region for enzymatic digestion & nutrient absorption
anus	(b) Consolidation of the faeces before elimination
large intestine	(c) Main function (humans) is water and mineral absorption
stomach	(d) Secretes acid and pepsin, stores and mixes food
Salivary gland	(e) A gland which produces an alkaline, enzyme-rich fluid (base, bile)
liver	(f) Produces bile and has many homeostatic functions



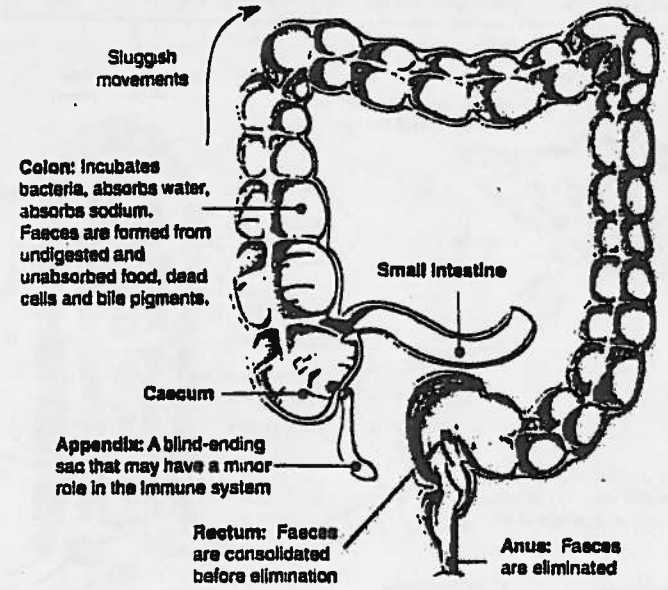
1. In the spaces provided on the diagram above, name the parts labelled A-L (choose from the word list provided). Match each of the functions described (a) – (f) with the letter that represents the corresponding structure on the diagram:
2. On the diagram, mark with lines and labels: anal sphincter (AS), pyloric sphincter (PS), cardiac sphincter (CS): bottom of stomach; top of stomach
3. Identify the region of the gut illustrated by the photographs (a) – (d) above (use the labelled parts and scale to assist you):

(a) _____ (b) _____

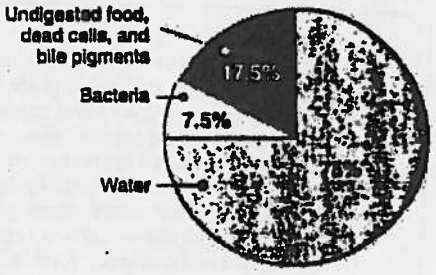
(c) small intestine (d) stomach

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) mechanical digestion
   (b) digestion of proteins + alcohol.
   (c) holds food
2. Movements of the gut push food through the gut tube. State their other important role: mechanical digestion
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:
   because they like an acidic pH also, could digest proteins of the stomach!
4. Suggest why the various secretions of the gut are of a particular pH (acid in the stomach, alkaline in the small intestine):
   Acid kills any unwanted bacteria on food. → neutralize stomach acid
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:
   They are absorbed in the stomach, not small intestine
6. Explain the general role of sphincter muscles in the digestive tract: control the passage in + out of organs -
7. State which three essential components of the diet are taken in and absorbed but not digested: vitamins water, salt.
8. Explain how faeces are formed: water + vitamins are absorbed in large intestine
9. Explain the importance of dietary fibre: Helps movement through the intestine