Chapter 5
Input and output systems

Unit
1A

Unit content

Body systems

The body is organised from cells to tissues, organs and systems. The major body systems are the digestive, excretory, skeletal, muscular, respiratory, circulatory, nervous, endocrine, immune and reproductive systems and are related to life processes.

Organisation:
- hierarchy of organisation in the body
- location of organs associated with each body system in the body.

Functions:
- function of each organ system related to life processes *e.g. digestive system—feeding*.

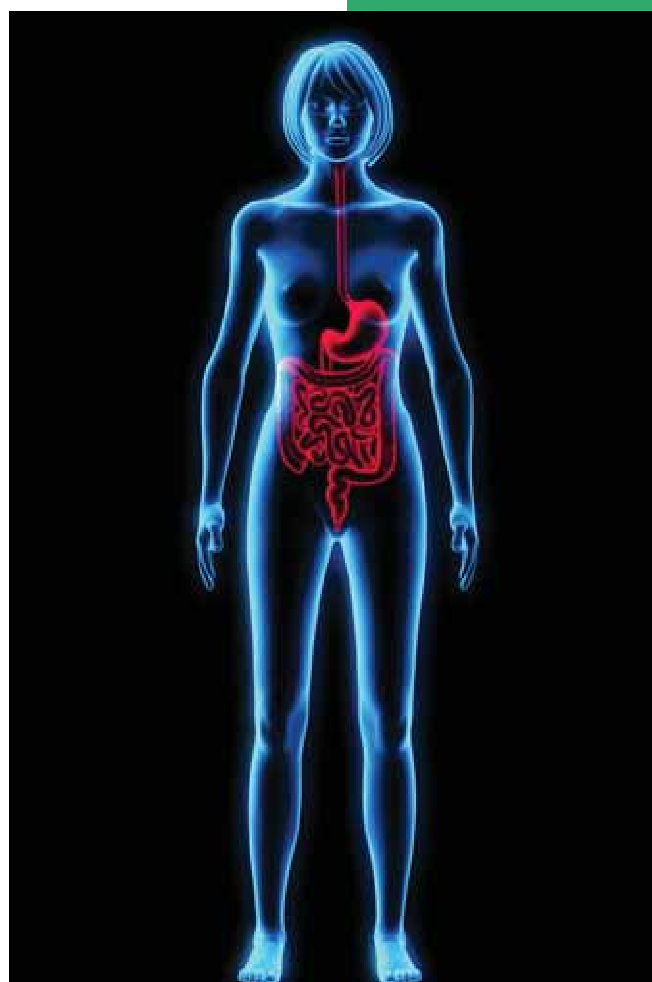


Figure 5.1 The digestive system

All cells need a constant supply of oxygen and nutrients. The carbon dioxide and other wastes produced by cells must be continually removed. In this chapter we discuss the body systems that take in essential materials and remove wastes.

Digestion and absorption of food

Substances that the body needs to live and grow are called **nutrients**. The nutrients needed by body cells are simple sugars, amino acids, fatty acids, vitamins, minerals and water.

Vitamins, minerals and water are in the form of small molecules that are able to pass through the differentially permeable membrane that surrounds each cell. The simple sugars, amino acids and fatty acids come from large molecules that must be broken down before they can be absorbed into the cells. Simple sugars come from complex carbohydrates, amino acids come from proteins, and fatty acids come from fats and oils.

The process of breakdown of carbohydrate, protein and fat molecules to products small enough to be absorbed into the blood and into the cells is called digestion. **Digestion** involves the physical break-up of food into small particles and the chemical breakdown of large molecules into smaller units. The physical break-up into smaller particles is called **mechanical digestion**. The chemical breakdown of larger molecules into smaller molecules is called **chemical digestion** (see Table 5.1, p. 54).

The organs involved in the mechanical and chemical digestion of food make up the **digestive system** (see Fig. 5.2). Some of these organs, including the stomach and intestines, form a continuous tube running from the mouth to the anus: this is the **alimentary canal** (or **digestive tract**). Other organs of the digestive system, such as the liver and pancreas, are not part of the canal.

The organs of the digestive system carry out six basic activities:
1. intake, or ingestion, of food
2. mechanical digestion of food
3. chemical digestion of food
4. movement of food along the alimentary canal
5. absorption of digested food into the blood and lymph
6. elimination of material that is not absorbed.

Digestion in the mouth

Food is taken in by the mouth. This is called **ingestion**. The main function of the mouth cavity is mechanical digestion, although some chemical digestion does occur. The chewing action of the teeth and jaw breaks the food up mechanically into smaller particles (see Fig. 5.3).

Saliva is secreted into the mouth cavity by three pairs of **salivary glands**. The location of the salivary glands and the functions of saliva are shown in Figure 5.4.

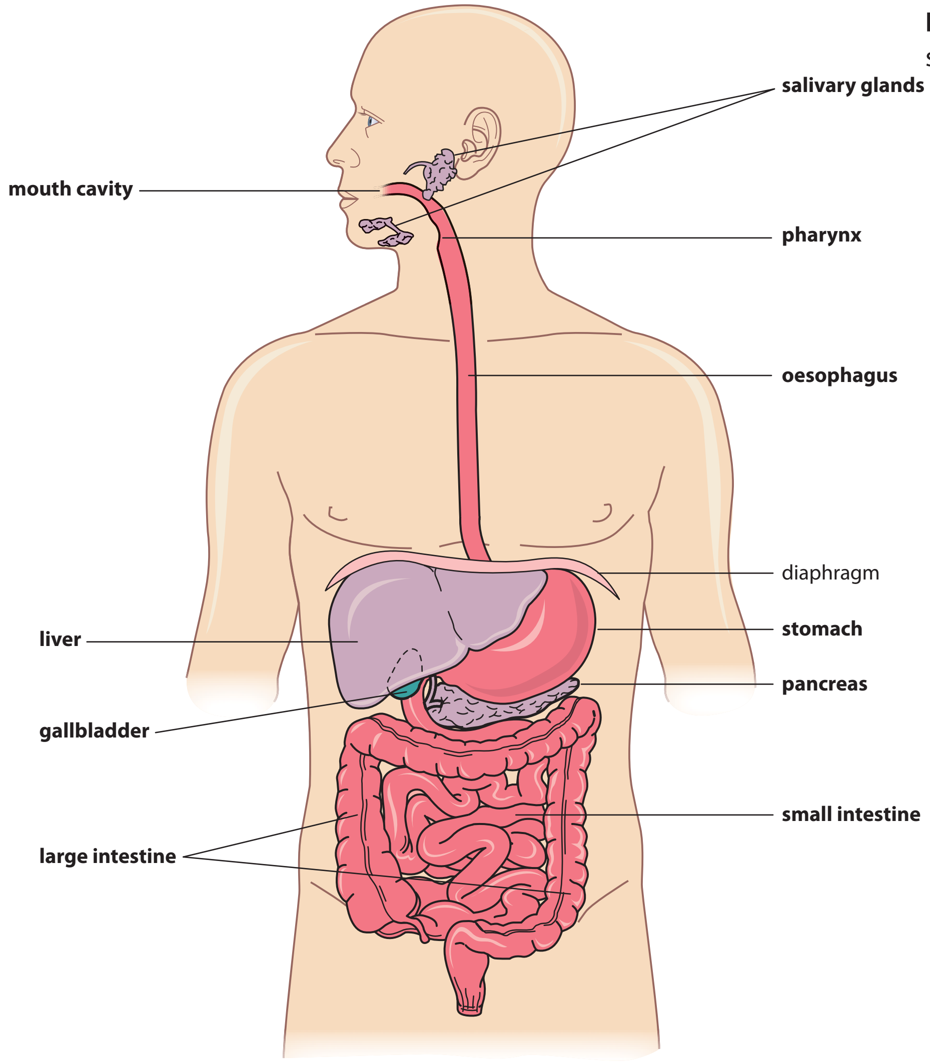


Figure 5.2 Organs of the digestive system

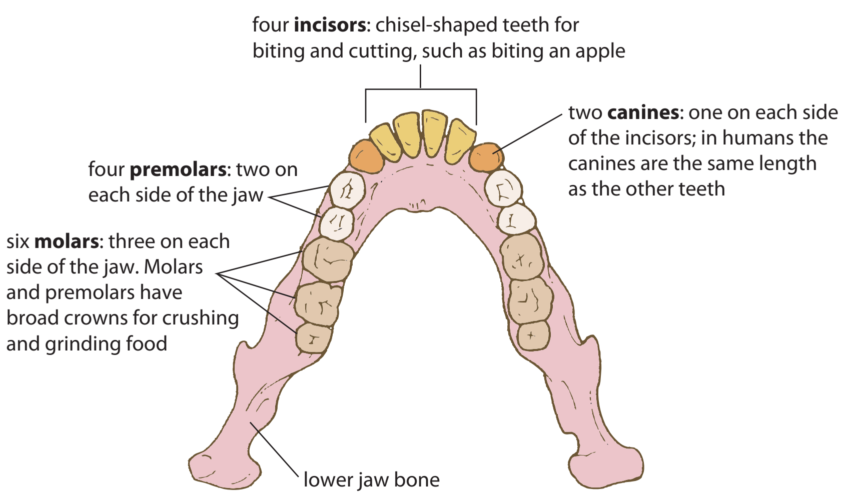
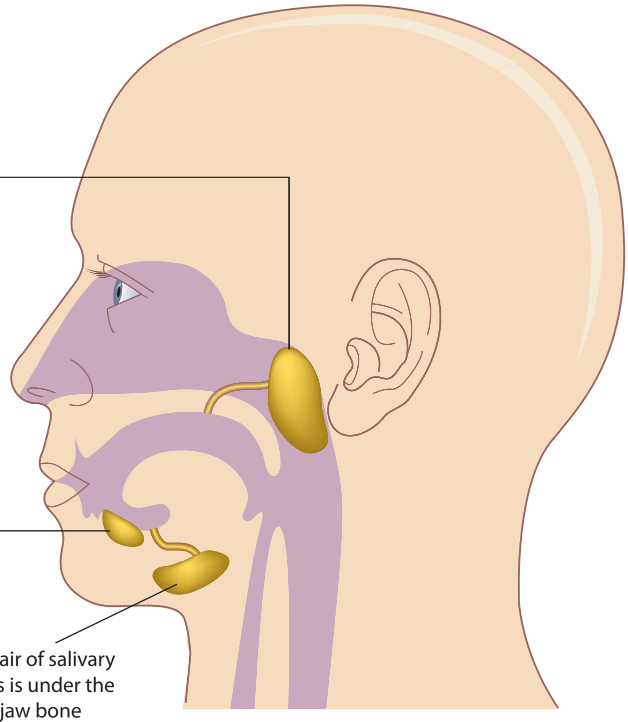


Figure 5.3 The teeth in the lower jaw and their functions

For more on teeth go to http://www.cyh.com/HealthTopics/HealthTopicDetails.aspx?p=243&np=292&id=2173



The saliva secreted by the salivary glands:
- contains **mucus** that lubricates the mouth and food
- dissolves food so that the taste receptors can be stimulated
- contains mucus that holds the food together in a lump for swallowing
- has an enzyme, **salivary amylase**, that breaks starch molecules into smaller units—the only chemical digestion that occurs in the mouth
- contains substances that kill many of the bacteria present in the food

Figure 5.4 The salivary glands and the functions of saliva

Swallowing

After being chewed in the mouth, the food is formed by the tongue into a rounded lump (called a bolus). In swallowing, the tongue moves upwards and backwards, pushing the food into the back of the mouth, the **pharynx**. The pharynx leads into the **oesophagus**, a tube about 25 cm long that connects the pharynx to the stomach. As the food moves through the pharynx, a flap of tissue closes off the opening to the windpipe (the trachea).

The wall of the alimentary canal has two layers of muscle: a **circular muscle** layer, with fibres arranged in a circle around the alimentary canal, and a **longitudinal muscle** layer, with fibres arranged along the length of the canal. The bolus is pushed along the oesophagus by a wave of contraction of the circular muscles. This wave of contraction is called **peristalsis** (see Fig. 5.5).

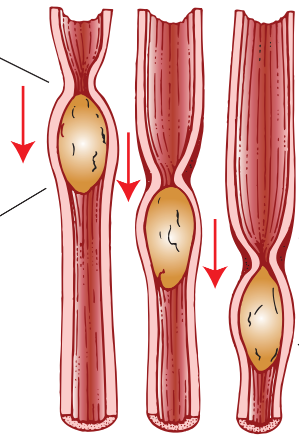


Figure 5.5 Food is moved along the oesophagus and along the rest of the alimentary canal by peristalsis

Digestion in the stomach

The oesophagus passes through the diaphragm, a sheet of muscle that separates the chest cavity from the abdominal cavity. Just after passing through the diaphragm it opens into the **stomach**, a roughly J-shaped, enlarged section of the alimentary canal (see Fig. 5.6).

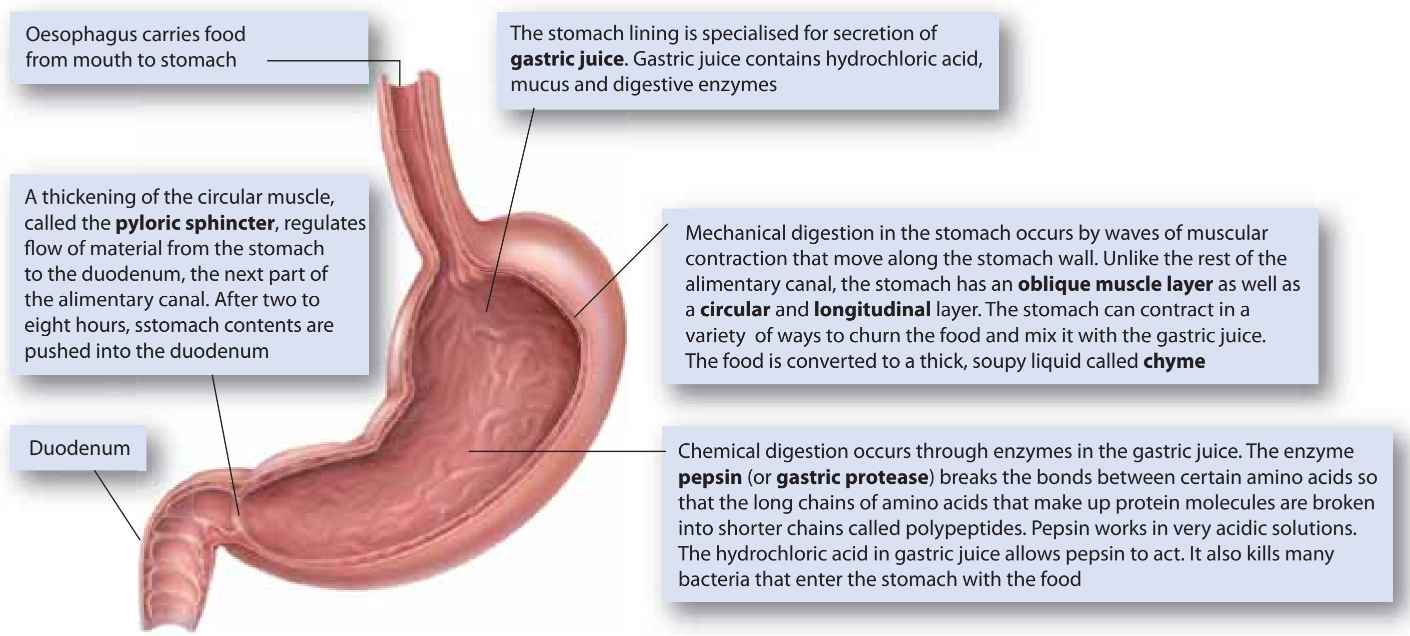


Figure 5.6 The stomach and its functions

The small intestine

The **small intestine**, about 6 m in length, is the longest part of the alimentary canal. The first part, about 25 cm long, is called the **duodenum** (see Fig. 5.7). Digestion of food continues in the small intestine and it has a huge surface area for absorbing the products of digestion.

Secretions in the small intestine

There are three digestive juices that are active in the small intestine—intestinal juice, pancreatic juice and bile.

Glands in the lining of the small intestine produce **intestinal juice**.

Pancreatic juice is secreted by the pancreas, a gland that lies between the stomach and the curve of the duodenum (see Fig. 5.7). The pancreatic juice is carried through a duct into the duodenum.

Bile is produced by the liver, a very large organ that lies below the diaphragm on the right side of the abdominal cavity (see Fig. 5.7). It leaves the liver through a duct that carries it to the **gallbladder**, a bag-like structure on the outside surface of the liver (see Fig. 5.7). The gallbladder stores and concentrates the bile, which can then be carried through a duct to the duodenum.

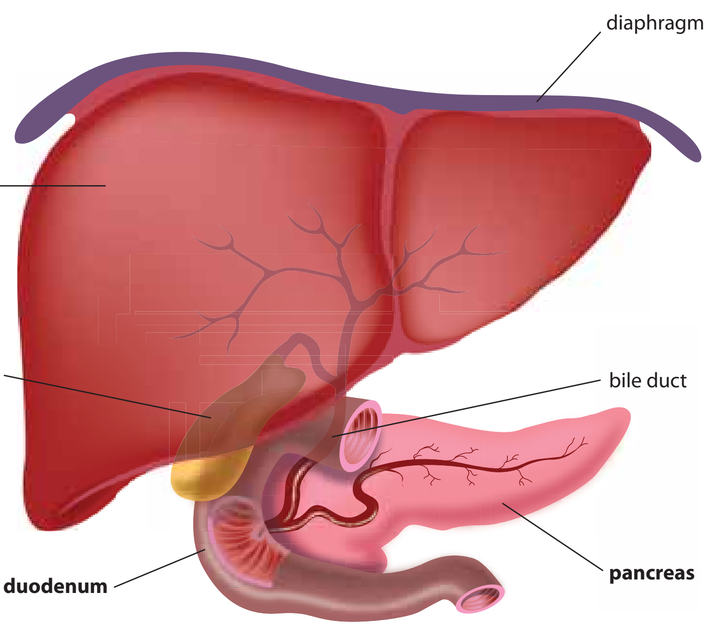


Figure 5.7 Relative positions of the duodenum, pancreas, liver and gallbladder

Digestion in the small intestine

Food entering the small intestine from the stomach is only partly digested. Most of the organic molecules are still too large to be absorbed into the blood. The small intestine completes the chemical breakdown of these large molecules. The contents of the small intestine must be well mixed with the various digestive juices. Circular muscle fibres in the intestinal wall contract to divide the intestine into segments. With successive contractions the contents of the small intestine are sloshed back and forth, thoroughly mixing the contents with the digestive juices.

There are many good websites about the digestive system. Some that you could try are:
- http://library.thinkquest.org/5777/dig1.htm
- http://digestive.niddk.nih.gov/ddiseases/pubs/yrdd
- http://kidshealth.org/kid/htbw/digestive_system.html
- http://www.innerbody.com/image/digeov.html
- http://www.dummies.com/WileyCDA/DummiesArticle/Running-through-the-Human-Digestive-System.id-1204.html

As a result of chemical digestion in the small intestine:

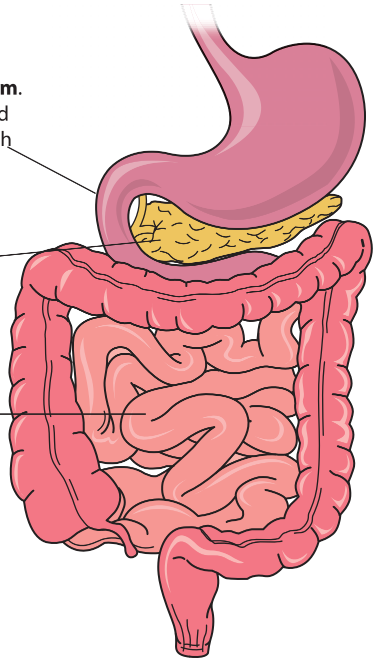
- complex carbohydrates have been broken down to simple sugars
- proteins have been broken down to amino acids
- fats have been broken down to fatty acids and glycerol.

Absorption from the small intestine

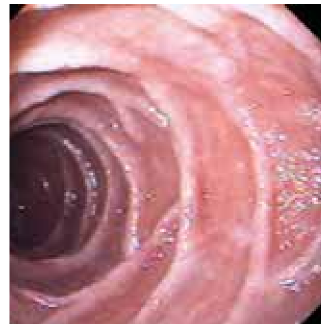
The mechanical and chemical digestion that occurs in the mouth, stomach and small intestine ensures that the food is broken down to small molecules. Small molecules can diffuse through the cells lining the outside of the villi and into the blood and lymph vessels. Movement of the digested food into the blood or lymph is called **absorption**.

The small intestine is the most important part of the alimentary canal for absorption of digested food. So that absorption can be effective, it has an enormous surface area. This is achieved by its great length, by the folding of the lining, and by the villi and the microvilli (see Fig. 5.8).

Absorption occurs through the villi, and the structure of the villi suits them to this function (see Fig. 5.10). Some absorption occurs through simple diffusion, as there is a higher concentration of nutrient materials in the interior of the small intestine than in the cells lining the villi. Absorption also occurs through **active transport**, which involves the cells of the villi using energy to take in nutrients.

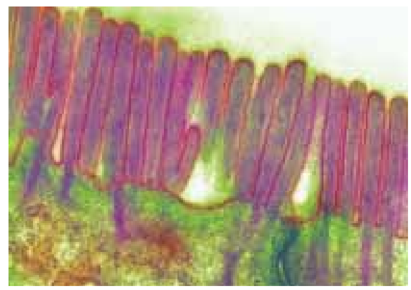


(a) Location of the small intestine



(b) The lining of the small intestine is folded

(c) The folds of the lining have tiny projections called **villi**



(d) The cells that make up the villi have tiny projections called **microvilli**

Figure 5.8 **(a)** Location, **(b)** internal folding, **(c)** villi and **(d)** microvilli give the small intestine a huge surface area

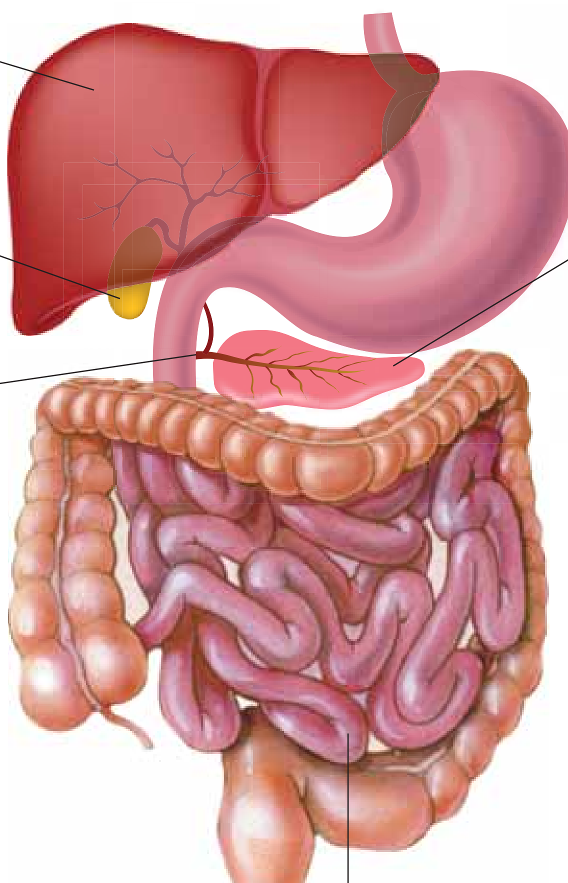


Figure 5.9 Digestion in the small intestine

The absorption of the main nutrients is summarised in Figure 5.10.

The substances that are absorbed into the blood capillaries are transported to the liver. Here they may be removed for further processing, or they may remain in the blood to be carried to other body cells. Substances absorbed into the lacteals are transported in the lymph system, which eventually empties into the blood through veins in the upper part of the chest.

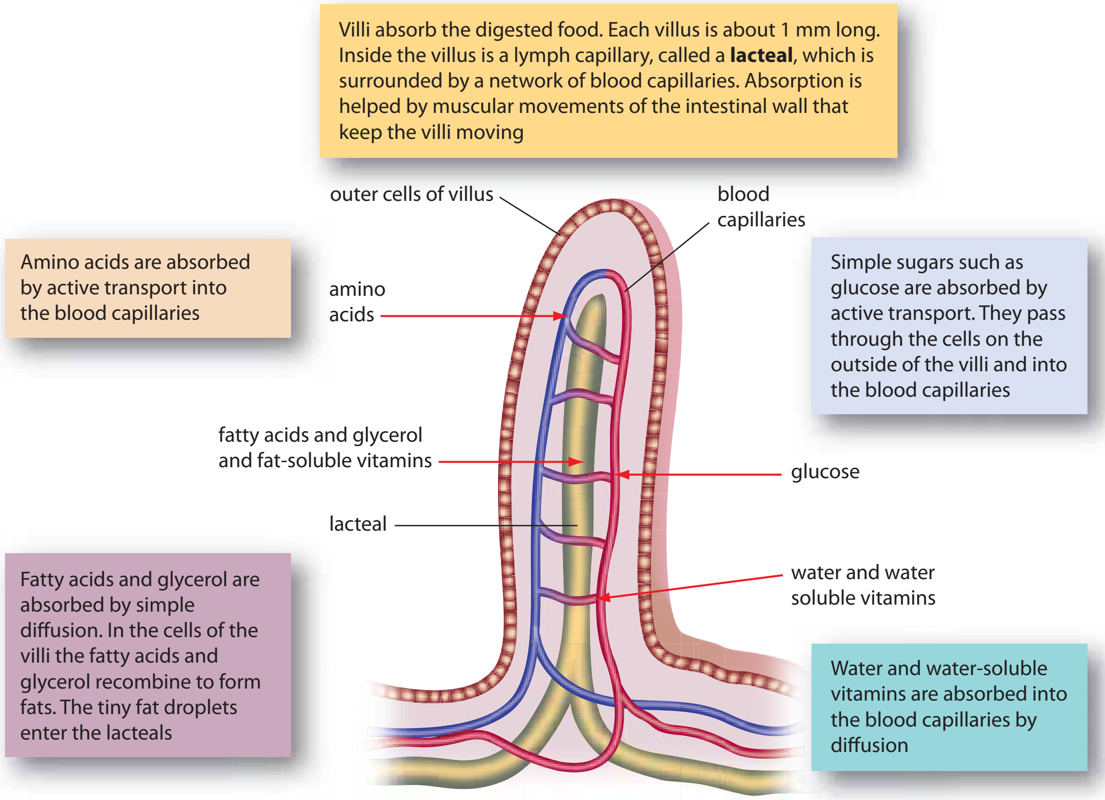


Figure 5.10 Some nutrients are absorbed into the blood capillaries and some into the lymph

The large intestine

The **large intestine** is about 1.5 m long. It is known as the large intestine because it has a much larger diameter than the small intestine. Figure 5.11 describes the parts and the functions of the large intestine.

There are no villi in the large intestine, and no enzymes are secreted. Material moves fairly slowly. It may take 18 to 24 hours for material to pass through the colon. Most of the remaining water is absorbed in the colon, so that the contents became more solid.

Bacteria break down much of the remaining organic compounds and gases such as carbon dioxide, methane and hydrogen sulfide are produced. Some bacteria produce vitamins, which are absorbed into the blood through the walls of the large intestine. Mineral nutrients are also absorbed.

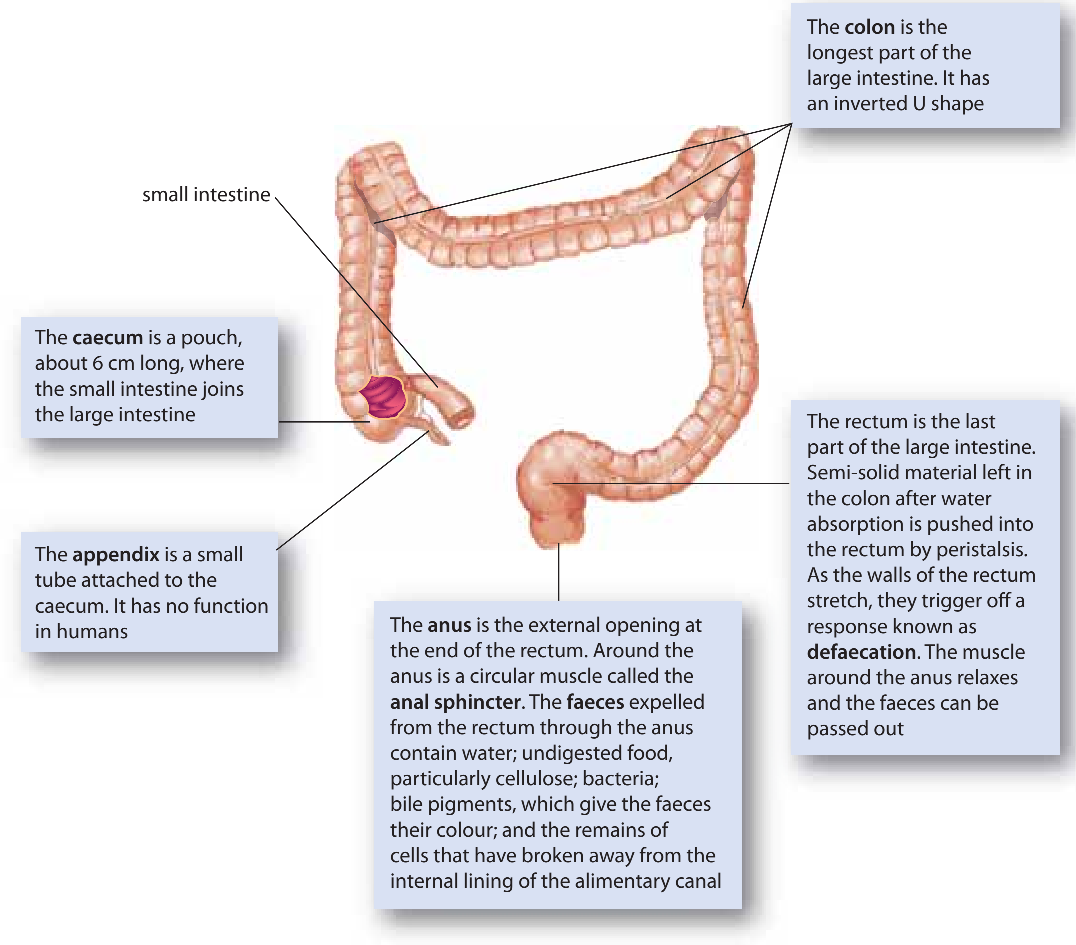


Figure 5.11 The parts of the large intestine and their function

Disorders of the alimentary canal

Vomiting is an automatic response that pushes the contents of the stomach out through the mouth. Muscles of the diaphragm and abdomen contract, increasing the pressure in the abdomen and forcing the stomach contents into the oesophagus. A great many stimuli can induce vomiting, including unpleasant sights or smells, dizziness, or irritation of the stomach.

Ulcers may occur in the wall of either the stomach or the duodenum, or sometimes the oesophagus. They usually result from pepsin and acid eroding part of the lining. If untreated, the ulcer may eventually make a hole right through the wall. It was once believed that ulcers were caused by stress and diet. Dr Barry Marshall, of the University of Western Australia, and Dr Robin Warren, working at Royal Perth Hospital in the early 1980s, found that stomach ulcers are actually caused by an infection of the bacterium *Helicobacter pylori*. As a result of their work, ulcers are now treated by antibiotics. In recognition of their discovery Barry Marshall and Robin Warren were awarded the Nobel Prize for Medicine in 2005.

Indigestion is a term used to describe any sensation of discomfort in the stomach or duodenum. Such discomfort may result from overstretching of the stomach through eating too much or through the accumulation of gas. Another cause may be excessive production of hydrochloric acid.

Table 5.1 A summary of the digestive processes

Organ	Mechanical digestion	Chemical digestion	Other functions
Mouth	Breaks food into smaller particles by chewing	**Saliva** containing *salivary amylase* begins starch digestion	Food dissolves in saliva so that it can be tasted
Oesophagus			Carries food from mouth to stomach
Stomach	Waves of peristalsis churn food	**Gastric juice** containing *pepsin* breaks down protein to polypeptides	Stores large quantities of food as it is eaten; absorbs certain drugs, including alcohol
Small intestine	Peristalsis and other muscle contractions mix the food; bile salts break fats into tiny droplets	**Pancreatic juice** contains *pancreatic amylase*, which breaks down starch; *pancreatic protease*, which breaks proteins and polypeptides into small amino acid chains; *pancreatic lipases*, which break fats into fatty acids and glycerol; *nucleases*, which digest RNA and DNA **Intestinal juice** contains *amylases*, which break down complex carbohydrates to simple sugar; *peptidases*, which break down amino acid chains to individual amino acids; *lipases*, which break down fats to fatty acids and glycerol	Absorbs simple sugars, amino acids, fatty acids, glycerol, vitamins, mineral nutrients, water
Large intestine			Absorbs water and vitamins; stores faeces; defaecation

Constipation occurs if movement of material through the colon is very slow. This means that more water is absorbed than usual and the faeces become dry and hard. Defaecation is then difficult and possibly painful. Constipation may be caused by a lack of cellulose in the diet. Although cellulose cannot be digested it stimulates the movements of the alimentary canal. A balanced diet should include an adequate amount of fibre to avoid constipation. Other causes may be lack of exercise or emotional problems.

Diarrhoea is characterised by frequent defaecation of watery faeces. It is caused by an irritation of the small or large intestine, which increases peristalsis. The contents of the intestines then move through before very much water has been absorbed. Such an irritation may be the result of a bacterial or viral infection. Bacteria that produce food poisoning may cause diarrhoea.

Appendicitis is inflammation of the appendix. It usually occurs when the appendix is blocked by faecal matter or a foreign body.

Intake of oxygen, removal of carbon dioxide

Oxygen is used by cells for respiration. **Respiration** is a series of chemical reactions that make energy available to the cells. A waste product from these chemical reactions is carbon dioxide. The organs involved in taking oxygen into the body, and removing carbon dioxide from the body, make up the **respiratory system**.

The organs of the respiratory system include the nose, through which air is taken in; the trachea, or 'windpipe', which branches into two tubes; the bronchi; and the two lungs (see Fig. 5.12).

The lungs

The two lungs take up the whole of the chest cavity except for a space between them that is occupied by the heart and blood vessels. A membrane covers the surface of the lungs and also lines the inside of the chest. Between the two layers of membrane is a thin layer of fluid. The fluid holds the lungs against the inside of the chest wall and allows the lungs to slide along the wall when breathing.

Inside the lungs the bronchi branch many times and eventually end in very fine tubes called **bronchioles**. The smallest bronchioles open into clusters of tiny air sacs called **alveoli**. The structures inside the lungs and their functions are shown in Figure 5.13.

There is more information on the respiratory system at:

- http://www.betterhealth.vic.gov.au/BHCV2/bhcarticles.nsf/pages/Respiratory_system

or

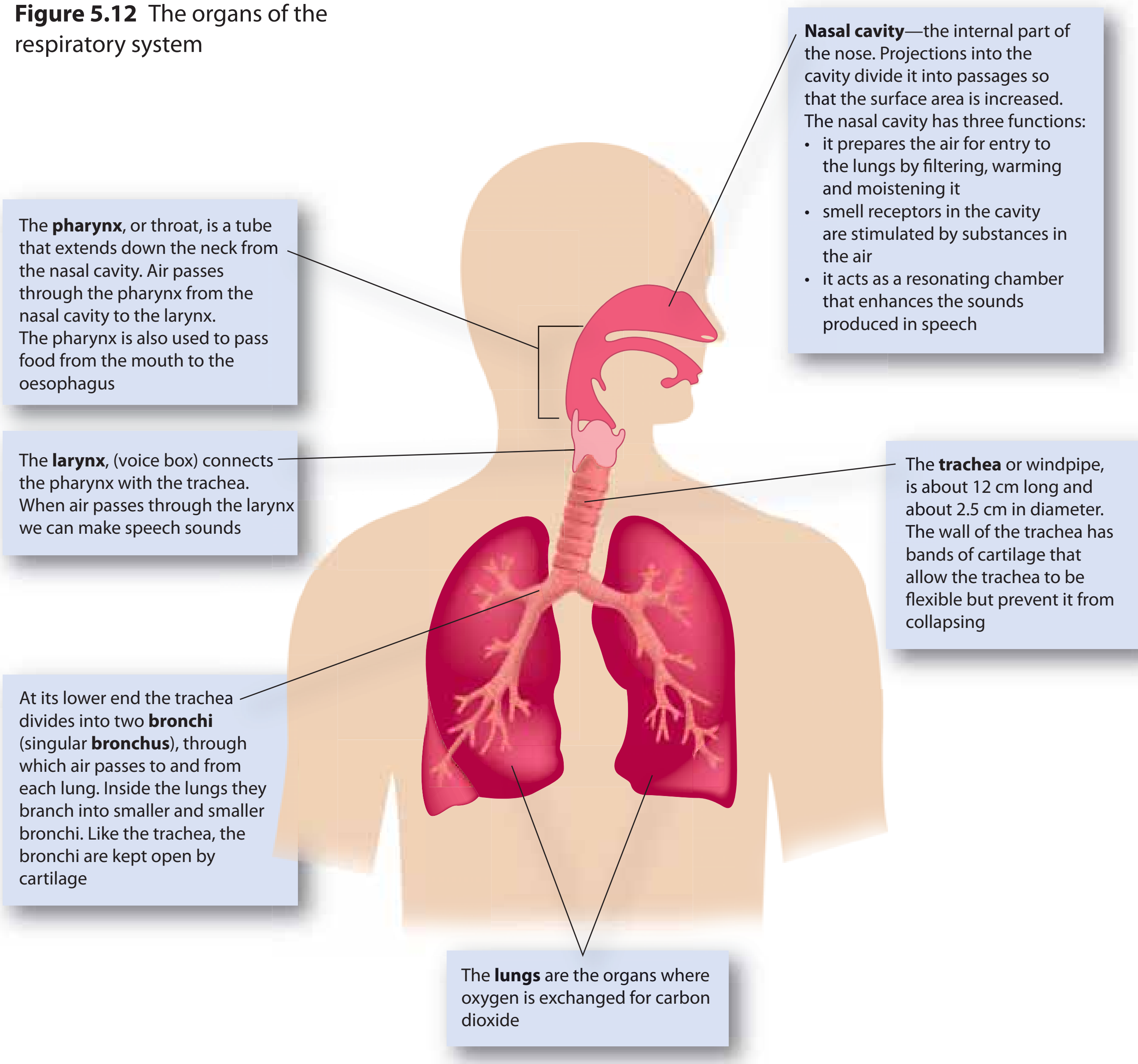
- http://library.thinkquest.org/5777/resp1.htm

Breathing

The muscles used in breathing are the diaphragm and the intercostal muscles. The **diaphragm** is a dome-shaped muscle that separates the chest cavity from the abdominal cavity (see Fig. 5.15). Passing through the diaphragm are the oesophagus and blood vessels. When the diaphragm contracts, the dome flattens and the volume of the chest cavity increases.

Intercostal muscles are the muscles between the ribs. The intercostal muscles contract to pull the ribs upwards and outwards, so that the volume of the chest cavity is increased.

Figure 5.12 The organs of the respiratory system



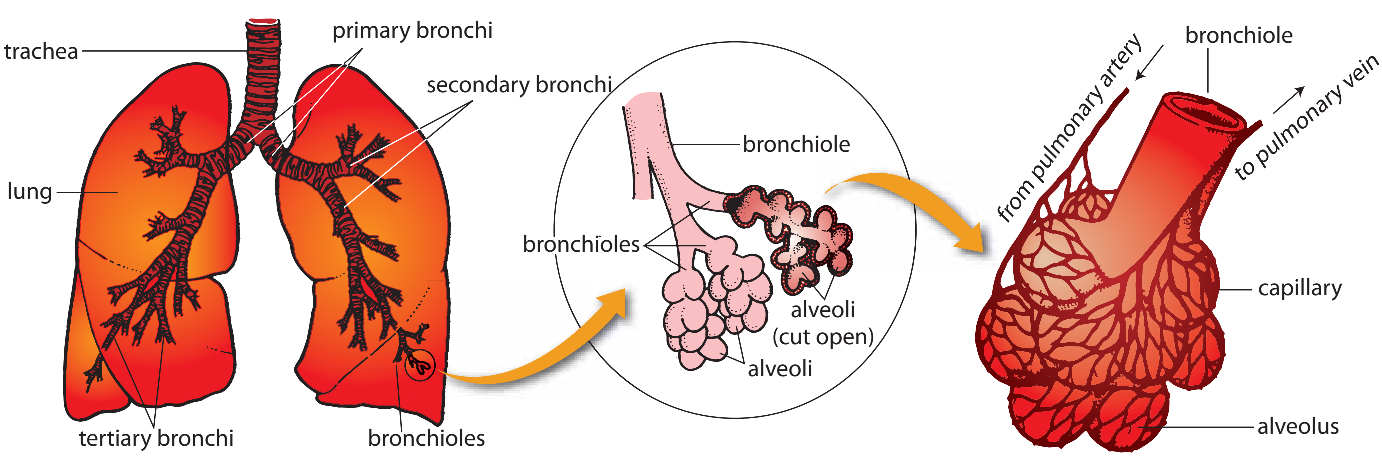


Figure 5.13 The structure of the lungs

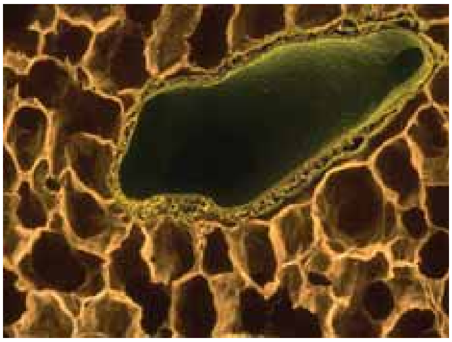


Figure 5.14 Photomicrograph of a section of lung tissue, showing the alveoli and a bronchiole

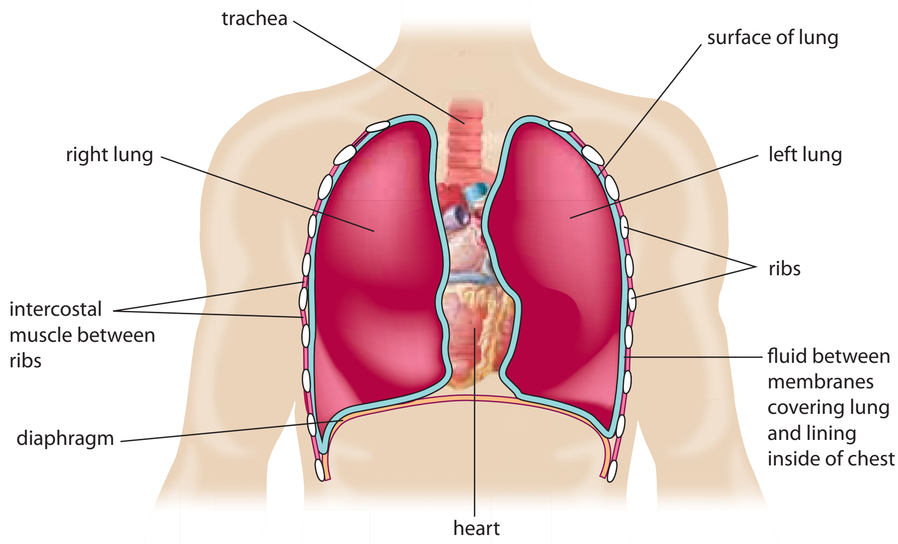


Figure 5.15 The lungs, diaphragm and intercostal muscles

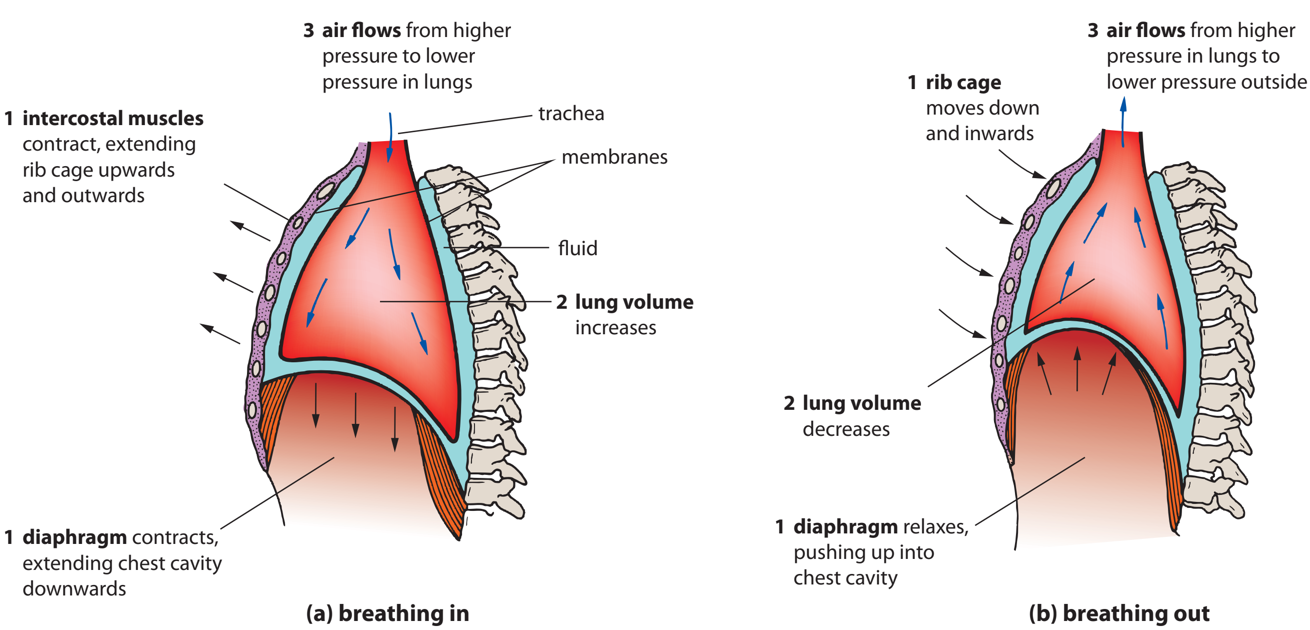
When we breathe in:

1. The diaphragm contracts and flattens so that the chest cavity is extended downwards. The intercostal muscles contract so that the ribs move upwards and outwards.
2. Since the lungs are attached to the inside of the chest, extension of the chest cavity downwards, upwards and outwards increases the volume of the lungs.
3. Since the volume of the lungs has increased, the air pressure in the lungs is now a little lower than the air pressure outside. Air flows into the lungs from the higher pressure outside to the lower pressure inside (see Fig. 5.16).

When we breathe out:

1. The diaphragm relaxes and bulges up into the chest cavity. The intercostal muscles relax and the ribs move downwards.
2. The volume of the chest cavity and the lungs is therefore reduced.
3. Because the volume of the lungs is less, the air pressure in the lungs is a little higher than outside. Air flows out of the lungs from the higher pressure inside to the lower pressure outside (see Fig. 5.16).

Figure 5.16 The events that occur when **(a)** we breathe in and **(b)** we breathe out



Gas exchange

Inside the alveoli of the lung, oxygen diffuses from the air into the blood in the capillaries that surround each alveolus. At the same time carbon dioxide diffuses from the blood in the capillaries into the air in the alveolus. This occurs because the concentration of oxygen is higher in the air than in the blood and the concentration of carbon dioxide is higher in the blood than in the air. Taking oxygen into the blood and removing carbon dioxide from the blood is called **gas exchange**.

Disorders of the respiratory system

Asthma is an allergic response to particles that are foreign to the body. Pollen grains, dust from feathers or animal fur and house dust mites are common examples. During an asthma attack the muscles around the bronchioles contract so that the air passages become very narrow. This makes breathing very difficult.

Lung cancer is often caused by tobacco smoke or by breathing other pollutants like asbestos fibres. An uncontrolled growth of cells occurs, usually in the bronchi.

Emphysema is caused by breathing irritating particles for long periods. Smokers and people who work in dusty situations are most at risk of emphysema. The walls of the alveoli break down so that the surface area inside the lung is reduced. A person with emphysema has difficulty getting enough oxygen because of the reduced surface area for gas exchange.

Bronchitis may be caused by an infection by microorganisms or by inhaled irritants such as smoke. The irritation causes an increase in mucus production in the bronchi and bronchioles. The person attempts to clear the mucus by coughing.

Pneumonia is an acute infection of the alveoli by bacteria, viruses or fungi. The infection causes fluid to accumulate in the alveoli so that the area for exchange of gases is reduced.

For games and puzzles on the respiratory system go to http://www.lung.ca/children/grades7_12/respiratory/index.html

Excretion by the kidneys

Excretion is the removal from the body of wastes that are produced in the cells. We have already seen how the lungs remove carbon dioxide from the blood and pass it into the air, which is then breathed out. This is excretion, because the carbon dioxide is produced in the cells when oxygen is used to break down glucose.

The kidneys excrete waste compounds that contain nitrogen. The most important of these waste compounds is urea, which comes from the breakdown of proteins in the cells. To be excreted, urea and other wastes containing nitrogen have to be dissolved in water. They are excreted as **urine**. By regulating the concentration of urine the kidneys can regulate the amount of water in the body fluids.

The kidneys and the other organs involved in the excretion of urine are known as the **excretory system** (see Fig. 5.17).

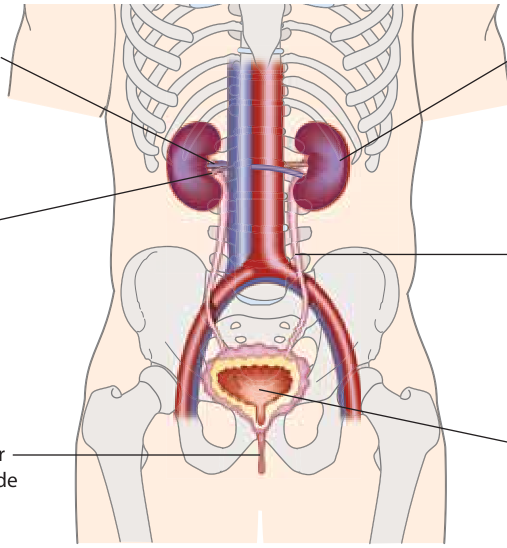


Figure 5.17 The organs of the excretory system

Kidney structure

The kidneys are made up of tiny units called **nephrons**. There are over a million of them in each kidney. The nephrons filter water and dissolved substances from the blood. This is called **filtration**. In another part of the nephron useful substances and some of the water are taken back into the blood—a process known as **reabsorption**. The water that is left, with dissolved wastes, becomes the urine. Urine is carried away from each kidney in a tube called the **ureter**. The ureters take urine to the **bladder**, where it is stored until it is passed out of the body. Figure 5.18 shows how the nephrons produce the urine.

Kidney disorders

Learn more about the kidneys at http://kidshealth.org/kid/htbw/kidneys.html

Kidney stones are formed from solid crystals that build up inside the kidneys. They usually form when urine becomes too concentrated. Some doctors believe that kidney stones are caused by insufficient fluids in the diet. If the crystals are small enough they may pass down the ureter and out of the body through the urethra without being noticed. Crystals may combine to form stones. Large stones may get stuck in the ureter, bladder or urethra, causing intense pain.

Kidney failure occurs when the kidneys lose their ability to excrete waste and control the level of fluid in the body. It can happen suddenly but is more likely to develop over a number of years. If a person's kidneys do fail, a technique called **dialysis** may be used to remove wastes from the blood. When kidney failure occurs the only way to maintain the person's life is by dialysis or by a kidney transplant.

For an animation showing how the kidneys work and for a kidney quiz go to http://www.kidney.org.au/flash/kidney_animation/kidneys.html

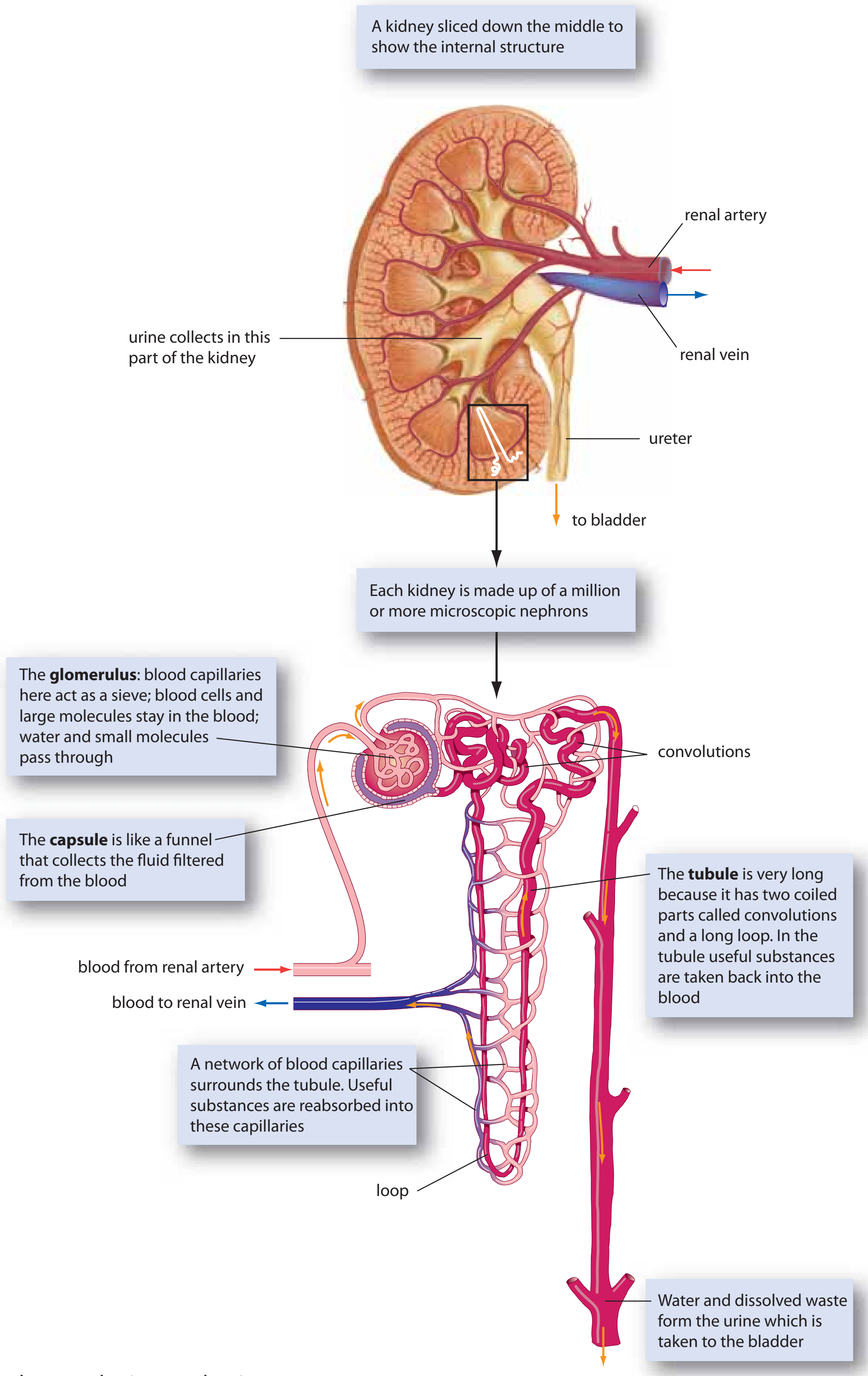


Figure 5.18 The nephron and urine production

Working scientifically

Activity 5.1 Comparing rat and human digestive systems

Humans and rats are both mammals and therefore share many basic similarities. A study of the digestive system of a rat will help you to understand your own digestive system.

You will need

A dead rat; dissecting instruments (scalpel, scissors, probes, forceps); string; dissecting board or tray; newspaper; disposable gloves

What to do

Your teacher will demonstrate how to open the mouth and abdomen of the rat. Alternatively you may examine photographs or diagrams showing the digestive organs of the rat or watch a video of a rat dissection.

1. Examine the mouth of the rat and observe the teeth.
2. Identify and examine the alimentary canal of the rat and its associated organs.
3. It may be possible to remove the alimentary canal and spread it out on newspaper so that you can compare the relative length of the parts.

Studying your observations

Discuss and record answers to the following questions.

1. What differences were there between the teeth of the rat and the teeth of a human? Consider differences in the number, type, arrangement and shape of the teeth. Relate the differences to the diet of rats and of humans.
2. The mesentery is a transparent tissue (it looks like Gladwrap) that links the organs within the abdominal cavity. What do you think is the function of the mesentery?
3. Compare the digestive organs of the rat with those of a human (refer to Fig. 5.2). Are any of the rat's organs proportionally much larger or smaller than the human's organs? Relate any differences to the diet of the two animals.

Activity 5.2 Starch digestion

This activity demonstrates the chemical breakdown of starch and the reason why starch has to be digested.

You will need

Three large test tubes; 500 mL beaker; thermometer; two pieces cellulose tubing 10 cm long; cotton thread; source of hot water; distilled water; 2% starch solution, Benedict's solution or Diastix (or other glucose test material); iodine solution (I_2KI)

What to do

1. Use a test tube to collect about 5 mL of saliva from a member of your group. Dilute the saliva with an equal amount of distilled water and test it for glucose using Benedict's solution or a glucose test such as Diastix.

2. Tie a tight knot in one end of each of the two pieces of cellulose tubing. To one piece of tubing (tube A) add starch solution only, to the other (tube B) add starch solution plus an equal amount of saliva solution.
3. Tie the open end of each piece of cellulose tubing with cotton and wash them under a tap.
4. Place the two cellulose tubing bags into separate test tubes and add distilled water to cover the bags (see Fig. 5.20).
5. Put the two test tubes in a water bath and keep them at about 37°C.
6. After about 30 minutes test the contents of the cellulose tubing, and the water outside the tubing, for both glucose and starch. Do this for both tube A and tube B.
7. Draw up a table and record your results.

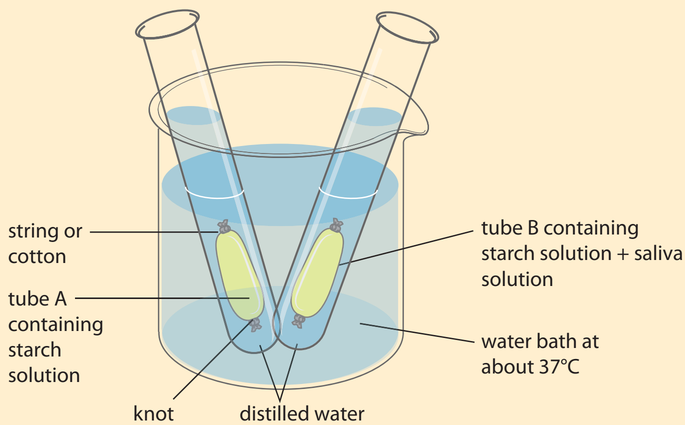


Figure 5.20 The apparatus for Activity 5.2

Studying your results

Discuss answers to the following questions with members of your group.
1. Why was the saliva tested for sugar before beginning the experiment?
2. Tube A contained no saliva. Why was it necessary to have tube A?
3. Why were the test tubes kept at 37°C?
4. What was the effect of saliva on starch?
5. Was starch able to pass through the cellulose tubing?
6. Was glucose able to pass through the cellulose tubing?
7. In the human body, what is the equivalent of the cellulose tubing?
8. Why does starch have to be digested?

Activity 5.3 A digestive enzyme

The enzyme pepsin breaks down protein to polypeptides (see Fig. 5.6). You will be provided with a suspension of egg white, which will be milky in appearance. When pepsin acts on egg white the suspension becomes clear. Your task is to design and carry out a controlled experiment to find out:
1. whether pepsin works best in an acid, alkaline or neutral medium
2. the temperature at which pepsin works best
3. the effect of boiling on the enzyme

Your teacher may wish you to choose one of the above alternatives. You may also be required to write up a formal report of your investigation.

Activity 5.4 Structure of the lungs

This activity may be done as a demonstration by your teacher.

Examine a set of sheep or pig lungs.

1. Identify the structures that can be seen:
   - **(a)** the lungs themselves divided into a number of lobes
   - **(b)** the trachea with its rings of cartilage; examine the rings to see whether they form a complete circle
   - **(c)** the two bronchi that branch from the trachea
   - **(d)** the thin transparent membrane that covers the lungs
2. Squeeze the lungs between your thumb and a finger. Describe what you feel.
3. Cut off a piece of lung and place it in a beaker of water. Does it float? What does this tell you about the lung?
4. Cut open the trachea and observe the interior. Record your observations.
5. Continue the cut in the trachea down through one of the bronchi, then through a secondary bronchus. Keep cutting until the air tubes become too small to see. Do the secondary bronchi have rings of cartilage? As you go along the air tubes from large to small, where do the cartilage rings stop?

Activity 5.5 Kidney output

Table 5.2 shows the amount of water and other substances filtered out of the blood of a healthy person in one day.

Table 5.2 Quantities of some substances filtered from the blood and in the urine of a healthy person over twenty-four hours.

Substance in the blood	Amount that is filtered out of the blood	Amount that is in the blood leaving the kidneys	Amount in urine
Water	180 L	178 L	2 L
Sodium, chloride and others	1500 g	1485 g	15 g
Proteins	0 g	120 g	0 g
Glucose	180 g	180 g	0 g
Urea	53 g	28 g	25 g
Uric acid	8.5 g	7.5 g	1 g
Creatinine	1.6 g	0 g	1.6 g

Use the information in the table, and your knowledge of how the kidney functions, to answer the following questions.

1. If 180 L of water are filtered out of the blood in twenty-four hours, why don't we produce 180 L of urine per day?
2. Why is there no protein in the fluid that is filtered out of the blood?
3. A large quantity of glucose is filtered out of the blood but there is none in the urine. What happens to the glucose that is filtered out of the blood?
4. Of the substances listed in the table, which ones would be considered to be wastes? That is, for which of the substances does a high proportion of the filtered amount end up in the urine?

5. Suggest how the figures in the table might change if the person drank a large volume of water.
6. Table salt is sodium chloride. If a person ate very salty foods, what changes might be seen in the figures in the table?
7. Urea, uric acid and creatinine are formed when proteins are broken down in the liver. Suggest how the figures in the table might change if the person consumed a high protein diet.

REVIEW QUESTIONS

1. Draw up a table showing the organs that are included in each of the three systems discussed in this chapter. For each of the organs listed briefly describe its function. The table below shows you how to start.

System	Organs	Function of organ
Digestive system	Mouth Oesophagus Stomach, etc.	
Respiratory system		

2. Of the organs that you listed for the digestive system (in your answer to question 1), which ones are not part of the alimentary canal?
3. Explain the difference between mechanical and chemical digestion.
4. Explain how the structure of each of the four types of teeth is suited to the function each tooth performs.
5. List the functions of saliva.
6. Explain how peristalsis moves materials along the alimentary canal.
7. Digestive enzymes break down large molecules to smaller ones. Bile does not contain any enzymes. What part does bile play in digestion?
8. Explain the difference between constipation and diarrhoea.
9. What is the purpose of the cartilage in the trachea?
10. Draw a diagram showing what happens when we breathe in. Put labels on your diagram to explain what happens to each of the structures that you have drawn.
11. What is meant by gas exchange?
12. A person suffering an asthma attack has difficulty breathing. Explain why.
13. The nephrons of the kidney produce urine. Describe what happens during filtration and reabsorption in the kidney nephrons.

APPLY YOUR KNOWLEDGE

1. Proteins, complex carbohydrates and fats have to be chemically digested. Vitamins, minerals and water do not have to be digested. Explain the reasons for this difference.
2. Figure 5.3 shows the teeth of the lower jaw of an adult. Use the figure to calculate the total number of teeth in an adult.
3. For each of the six basic activities of the digestive system that are listed on page 46, explain how the structure of the digestive system suits it to each activity.
4. Surfaces where materials are taken into, or passed out of, the body must have a large surface area. Explain how a large surface area is achieved in the alimentary canal, the lungs and the kidneys.
5. Would a person be able to swallow food when hanging upside down? Explain.
6. Explain why the small intestine needs a much larger surface area than the large intestine.