

Unit 3

Internal Systems and Regulation

Are You Ready? (pages 198–199)

- 1 = veins from the lung, 2 = right atrium, 3 = left ventricle, 4 = aorta, 5 = arteries to the body
- In Figure 2, x represents carbon dioxide, y represents oxygen.
Oxygen is required for cellular respiration. The oxidation of organic compounds provides cellular energy. Carbon dioxide is a waste product of respiration.
Students will learn the importance of carbon dioxide as a stimulus for breathing movements. At this point they may only identify carbon dioxide as a waste product.

3.

1. gills	(c)
2. lung	(h)
3. artery	(a)
4. vein	(i)
5. heart	(l)
6. red blood cell	(j)
7. white blood cell	(g)
8. stomach	(k)
9. esophagus	(e)
10. small intestine	(f)
11. pancreas	(d)
12. large intestine	(b)

- Heart rate, blood pressure, and breathing rate will increase as the body attempts to provide more oxygen to the tissues. Digestion will decrease because blood flow is diverted to the muscles and nerve cells involved in exercise.
- (a) subject 4, because the proportion of red blood cells is lower than normal. Fluid plasma helps maintain blood volume.
(b) subject 3, because the proportion of red blood cells is higher than normal. High red blood cell volume will compensate for lower levels of oxygen.
(c) subject 2, because the proportion of white blood cells is higher than normal. White blood cells fight disease.
- (b) and (c)
- (a) and (c)
- (a)
- (b)
- (b) and (c)
- (a), (b), and (d)
- When handling the preserved earthworm the preservatives should be rinsed off of the earthworm because some people are allergic to odors or the fluid itself. When handling the hand lens you should never hold the lens up to sunlight and look into the lens. When handling the dissecting pan, dissecting pins, and dissecting probes always rinse and disinfect. When handling the dissecting scissors, scalpel, or single-edged razor blade always rinse and disinfect them; always cut away from yourself and from others. An apron, safety goggles, and latex gloves should be worn if available.

Chapter 6

Digestion and Nutrition

Try This Activity (page 202)

(a) Recommendations include: eat a variety of foods, eat lower fat foods, eat the recommended number of servings of each type of food per day. The Food Guide recommends eating more of certain foods than others because some foods contain greater energy than others. Foods that are rich in energy, such as lipids, should be consumed in lower quantities. In addition, some foods are associated with health problems while others can improve health.

Although energy and nutrient requirements change with age, there are some general guidelines for a good healthy diet that can apply to all ages. These data below show the different energy needs by age group. Students can be speculate about why different age groups require different amounts of food energy.

Female (weight = 54 kg, height = 165 cm)

Age	Energy per Day (kJ)
15–18	8800
19–22	8800
23–50	7900

Male (weight = 60 kg, height = 175 cm)

Age	Energy per Day (kJ)
15–18	13 400
19–22	13 400
23–50	11 300

(b) Carbohydrates should be eaten in larger quantities. Fats should be eaten in smaller quantities.

Reflect on Your Learning (page 202)

1. The essential nutrients that must be included in every diet are carbohydrates, lipids, proteins, vitamins, minerals, and water.
2. There are many possible answers, some diet related disorders are bulimia, anorexia nervosa, beriberi, osteoporosis, and rickets.

6.1 Practice (page 207)

1. Tissues are groups of similarly shaped cells which carry out the same function (e.g., muscle tissue). Organs are groups of tissues working together for a common function (e.g., heart). Organ systems are composed of many organs which carry out a common function (e.g., circulatory system).
2. Classification systems are socially constructed ways of organizing knowledge, so different scientists might classify things differently. Organ systems can be classified by structure or by function.
3. The hand is complex because it is made up of four types of tissues: epithelial tissues (outer layers of skin); connective tissues, which provide support and strength (tendons and ligaments); blood, a fluid tissue, and cartilage (in the joints).

4.

Procedure	Advantages	Disadvantages
X rays	<ul style="list-style-type: none">• relatively common procedure, and thus widely available	<ul style="list-style-type: none">• cannot give as much detail as a CAT scan• cannot give information about organ function• X rays carry small degree of risk
CAT scan	<ul style="list-style-type: none">• provides more detailed picture of organ structure than X rays• allows for 3-D imaging	<ul style="list-style-type: none">• cannot give information about organ function• X rays carry small degree of risk
nuclear imaging	<ul style="list-style-type: none">• allows organ function to be studied	<ul style="list-style-type: none">• uses radioactive matter in the body
MRI	<ul style="list-style-type: none">• allows organ function to be studied• does not use radioactive matter in the body	<ul style="list-style-type: none">• not commonly available

5. Expect a wide variety of answers. Encourage students to consider multiple points of view and to reflect their understanding of alternate perspectives in their answer. Assessment can be provided if you consider the coherence of expression and the tolerance of alternate perspectives.
8. Expect a wide variation of opinions. Students may want to conduct more research on the advantages and disadvantages before forming an opinion. Religious beliefs often affect attitudes toward new technologies. It is important to recognize and respect divergent belief systems that may conflict with the use of emerging technologies.

6.2 Practice (page 210)

- 1 ingestion: taking in food
digestion: breakdown of larger molecules into smaller components
absorption: uptake and transport of nutrients
egestion: removal of undigested materials from the body
- 2 The amoeba engulfs food and digests it within the cell. Birds and earthworms digest food inside a gastric cavity composed of multiple cells. The bird and earthworm both have a specialized organ, the gizzard, designed to grind food particles into smaller pieces.
- 3 Food passes along a single tube in one direction. This allows for the specialization of cells along various areas of the canal, which makes digestion more efficient.

6.3 Practice (page 212)

1. Saliva contains amylase enzymes that initiate carbohydrate breakdown. It lubricates food passage, dissolves food particles, and activates taste buds.
2. Chewing breaks food particles into smaller pieces, thereby increasing the surface area of the foods for enzyme action. This increases the speed of digestion.
3. Amylase enzymes are necessary for initiating the hydrolysis of carbohydrates.

Activity 6.3.1 (page 213)

Analysis

- (a) Step 4 indicated the presence of starch.
- (b) Step 5 identified the sugars from starch digestion.
- (c) Starch is digested when amylase enzymes are present.

- (d) Starch is digested to reducing sugars by amylase enzymes.
- (e) Starch is no longer present. Starches are converted into reducing sugars.

Sections 6.1–6.3 Questions (page 214)

1. Cells of the digestive system require oxygen and nutrients carried by the circulatory system. The digestive system breaks down foods into components which can be transported to other cells of the body.
2. A gastrovascular cavity serves as both the entry and exit point for food. Little specialization of cells occurs in the sac because it is used for both functions. A digestive tract allows for one-way movement of food and the specialization of cells along various areas of the canal. Specialization makes digestion more efficient.
3. Birds have a gizzard that grinds food into smaller pieces. Being able to swallow larger pieces of food reduces eating time. Many animals are vulnerable to predators when they eat.
4. physical digestion—breakdown of large particles into smaller particles, e.g., chewing and emulsification
chemical digestion—breaking of chemical bonds. Larger macromolecules are digested into component parts. Trypsin and pepsin are enzymes which regulate chemical digestion of proteins.
5. The only voluntary actions are at the beginning (swallowing) and end (egestion) of the digestive tract. Peristaltic contractions move food along the GI tract.
6. (a) Carnivores need well-developed canines for tearing flesh and puncturing hides.
(b) Herbivores need well-developed molars and premolars for grinding plant material.

Practice 6.4 (page 216)

1. The movement of food into and out of the stomach is regulated by sphincter muscles. These circular muscles act like the drawstrings on a bag.
2. Gastric fluid is composed of mucus, hydrochloric acid, pepsinogens, and other substances. Mucus provides a protective coating. Hydrochloric acid kills many harmful substances that are ingested with food. It also converts pepsinogen into its active form, pepsin, which is a protein-digesting enzyme.
3. The mucous layer protects the cells of the stomach against protein digesting enzymes and acids.
4. An endoscope is a small instrument used to view the inside of the body. Forceps can be attached to the endoscope to conduct a biopsy.
5. Two factors that affect enzyme activity are pH level and temperature. Changes in temperature can alter the shape of enzymes; also, enzymes have an optimal pH level at which they operate. Low temperatures slow the movement of molecules. High temperatures can alter the shape of the enzyme (denaturation). Pepsin is an enzyme that works best at low pH levels, most enzymes in the human body function best at approximately 37°C.
6. Most ulcers are linked to *Helicobacter pylori*. Pepsin and stomach acids destroy the cells lining the stomach. This may occur if the mucous cells are impaired, or if an emulsifying agent reduces the protective covering.