# Chapter 35 Organizer

Refer to pages 475-57 of the Teacher Guide for an explanation of the National Science Education Standards correlations.

## Section 35.1
### Following Digestion of a Meal
National Science Education Standards UCP-1-3, UCP-5, A.1, A.2, B.2, B.3, B.6, C.5, C.6, F.1 (1/2 session, 1/2 block)

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Activities/Features</th>
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<td>1. Recognize the different functions of the organs of the digestive system.</td>
<td>Inside Story: Your Mouth, p. 949 Problem-Solving Lab 35-1, p. 952</td>
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<tr>
<td>2. Outline the pathway food follows through the digestive tract.</td>
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<td>3. Interpret the role of enzymes in chemical digestion.</td>
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## Section 35.2
### Nutrition
National Science Education Standards UCP-2, UCP-3, A.1, A.2, B.2, B.3, B.6, C.1, C.5, C.6, F.1 (1/2 session)

<table>
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<th>Objectives</th>
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<td>4. Summarize the contribution of the six classes of nutrients to body nutrition.</td>
<td>MiniLab 35-1: Evaluate a Bowl of Soup, p. 957</td>
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<td>5. Identify the role of the liver in food storage.</td>
<td>Problem-Solving Lab 35-2, p. 958</td>
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<td>6. Relate caloric intake to weight loss or gain.</td>
<td>Biology &amp; Society: The Promise of Weight Loss, p. 960</td>
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## Section 35.3
### The Endocrine System
National Science Education Standards UCP-1-3, UCP-5, A.1, A.2, B.2, B.3, B.6, C.1, C.5, C.6, F.1 (1/2 session, 1 block)

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<td>7. Identify the functions of some of the hormones secreted by endocrine glands.</td>
<td>Problem-Solving Lab 35-3, p. 962  MiniLab 35-2: Compare Thyroid and Parathyroid Tissue, p. 964</td>
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<td>8. Summarize the negative feedback mechanism controlling hormone levels in the body.</td>
<td>Investigate BioLab: Average Growth Rate in Humans, p. 966</td>
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<td>9. Contrast the actions of steroid and amino acid hormones.</td>
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## Teacher’s Corner

### Teacher’s Resources

#### Section Focus Transparency 86
- **L1** | **ELL**
- **L2** | **ELL**
- **L3** | **ELL**

#### Section Focus Transparency 85
- **L1** | **ELL**
- **L2** | **ELL**

#### Section Focus Transparency 84
- **L1** | **ELL**
- **L2** | **ELL**

#### Section Focus Transparency 50
- **L1** | **ELL**
- **L2** | **ELL**

#### Section Focus Transparency 51
- **L1** | **ELL**
- **L2** | **ELL**

### Assessment Resources

- Chapter Assessment, pp. 205-210  Mindlogger Videoquizzes
- Performance Assessment in the Biology Classroom  Cooperative Learning in the Science Classroom
- Alternate Assessment in the Science Classroom  Lesson Plans/Block Scheduling
- Computer Test Bank  BDOL Interactive CD-ROM, Chapter 35 quiz

### Additional Resources

- Spanish Resources  English/Spanish Audiocassettes  Cooperative Learning in the Science Classroom
- National Geographic Society  Teacher Classroom Resources
- Athletic Corner  BioQuest: Body Systems
- Videodisc Program  X-Ray of Swallowing
- The Infinite Voyage  A Taste of Health

### Materials List

#### BioLab
- p. 966 blue pencil, red pencil, graph paper, ruler

#### MiniLabs
- p. 957 paper, pencil

#### Alternative Lab
- p. 950 Lactaid solution, glucose test paper, glucose solution, milk, graduated cylinder (2), test tubes (4), dropper

### Key to Teaching Strategies

- **L1** Level 1 strategies should be appropriate for students with learning difficulties.
- **L2** Level 2 strategies should be within the ability range of all students.
- **L3** Level 3 strategies are designed for above-average students.
- **ELL** ELL activities should be within the ability range of English Language Learners.
- **COOP LEARN** Cooperative Learning activities are designed for small group work.
- **P** These strategies represent student products that can be placed into a best-work portfolio.
- **LS** These strategies are useful in a block scheduling format.

### Quick Demos
- p. 948 barium X ray of digestive tract
- p. 950 dialysis bag (2), starch solution, pancreatic enzyme solution, beaker, distilled water, Benedict’s solution
- p. 955 paper grocery bags, assorted food samples, water
- p. 960 human skull
- p. 961 microprojector, prepared slide of pancreas
- p. 963 preserved whole kidney

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### Teacher’s Corner

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**GLENCOE TECHNOLOGY**

The following multimedia resources are available from Glencoe.

**Biological: The Dynamics of Life**
- **CD-ROM**
  - Video: X-Ray of Swallowing
  - BioQuest: Body Systems
  - Exploration: Nutrition

**Videodisc Program**
- **X-Ray of Swallowing**

**The Infinite Voyage**
- **A Taste of Health**
The Digestive and Endocrine Systems

What You’ll Learn

- You will trace the journey of a meal through the digestive system.
- You will recognize different nutrients and their uses in the body.
- You will outline how endocrine hormones control internal body processes.

Why It’s Important

By examining the functions of your digestive and endocrine systems, you will understand how your body obtains energy from food and how it controls your behavior and development.

35.1 Following Digestion of a Meal

Eating is something you probably spend a lot of time thinking about—what will you eat, when you will eat, and who you will eat with. Your digestive system helps turn food into energy for your body. As in many animals you have studied, the human digestive system is essentially a specialized tube that has evolved over millions of years to form digestive organs, each of which performs a unique function.

Functions of the Digestive System

The main function of the digestive system is to disassemble the food you eat into its component molecules so that it can be used as energy for your body. In this sense, your digestive system can be thought of as a sort of disassembly line.

Digestion is accomplished through a number of steps. First, the system takes ingested food and begins moving it through the digestive tract. As it does so, it digests—or breaks down mechanically and chemically—the complex food molecules. Then, the system absorbs the digested food and distributes it to your cells. Finally, it eliminates undigested materials from your body. As you read about each digestive organ, use Figure 35.1 to locate its position in the system.

Vocabulary

- amylase
- esophagus
- epigastrium
- stomach
- pancreas
- small intestine
- pancreas
- large intestine

Figure 35.1

All the digestive organs work together to break down food into compounds that can be absorbed by the body.

Portfolio Assessment

- Portfolio, TWE, pp. 949, 964
- Alternative Lab, TWE, pp. 950-951

Problem-Solving Lab, TWE, p. 952

MiniLab, TWE, pp. 956, 964

Knowledge Assessment

- Section Assessment, SE, pp. 953, 958, 965
- Chapter Assessment, SE, pp. 951, 967
- Section Assessment, TWE, pp. 953, 958, 965
- Chapter Assessment, TWE, pp. 951, 967
- Performance Assessment
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- Alternative Lab, TWE, pp. 950-951

Problem-Solving Lab, TWE, p. 952

Skill Assessment

Assessment, TWE, pp. 951, 953, 961

1 Focus

Bellringer

Before presenting the lesson, display Section Focus Transparency #4 on the overhead projector and have students answer the accompanying questions.

Chapter 35

The Digestive and Endocrine Systems

Getting Started Demo

Getting Started

Visual-Spatial

Test a cracker for starch by adding a few drops of iodine to the ground crumbs. A dark brown/purple indicates the presence of starch. To demonstrate the effects of saliva on starch, add about 1 g of ground crackers to 1-2 ml of water. Add a small amount of amylase (available from biological supply companies) and let sit for a few minutes. You can test for the breakdown of starch by periodically using the iodine test.

Eating is something you probably spend a lot of time thinking about—what will you eat, when you will eat, and who you will eat with. Your digestive system helps turn food into energy for your body. As in many animals you have studied, the human digestive system is essentially a specialized tube that has evolved over millions of years to form digestive organs, each of which performs a unique function.

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- Alternative Lab, TWE, pp. 950-951

Problem-Solving Lab, TWE, p. 958

Assessment, TWE, p. 957

BioLab, TWE, pp. 966-967

Performance Assessment

- MiniLab, SE, p. 964
- Alternative Lab, TWE, pp. 950-951

Problem-Solving Lab, TWE, p. 952

MiniLab, TWE, pp. 956, 964

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Theme Development

The theme of systems and interactions is developed by looking at the role of the digestive and endocrine systems in regulating body functions.
The Mouth

The first step along the digestive disassembly line is your mouth. Suppose it's lunchtime and you have just prepared a bacon, lettuce, and tomato sandwich. The first thing you do is bite off a piece and chew it.

What happens as you chew?

As you chew, your tongue moves the food around and helps position it between your teeth so that it can be chewed. Chewing is a form of mechanical digestion, the physical process of breaking food into smaller pieces. Mechanical digestion prepares food particles for chemical digestion. Chemical digestion is the process of changing food on a molecular level through the action of enzymes. What purpose do the different structures inside your mouth serve? Find out by reading the Inside Story.

Chemical digestion begins in the mouth

Some of the nutrients in your sandwich are starches, large molecules known as polysaccharides. As you chew your bite of sandwich, saliva glands in your mouth secrete saliva, as shown in Figure 35.2. Saliva contains a digestive enzyme called amylase, which breaks down starch into smaller molecules such as di- or monosaccharides. In the stomach, amylase continues to digest starch in the swallowed food for about 30 minutes. Table 35.1 lists some digestive enzymes that aid in breaking food molecules apart.

Swellling your food

On one side of the burgh of sandwich, your tongue shapes it into a ball and moves it to the back of your mouth to be swallowed. Swallowing forces food from your mouth into your esophagus, a muscular tube that connects your mouth to your stomach. Food moves down the esophagus by way of skeletal muscles that contract the tube and propel food in one direction.

Critical Thinking

Why do your teeth come in various shapes?

1. Teeth

The incisors are adapted for cutting food. The canines, or teeth, tear or shred food. The three sets of molars can crush and grind food. Often, there is not enough room for the third set of molars, called wisdom teeth, which then must be removed.

2. Tongue

The tongue is attached to the floor of the mouth. It is made of numerous skeletal muscles covered with a mucous membrane.

3. Structure of a tooth

Teeth are made mainly of dentin, a bone-like substance that gives a tooth its shape and strength. The dentin encloses a space filled with pulp, a tissue that contains blood vessels and nerves. The dentin of the crown is covered with an enamel that consists mostly of calcium salts. Tooth enamel is the hardest substance in the body.

The tongue is covered by projections that contain numerous taste receptor cells like the one shown here.
Alternative Lab

Digesting Lactose

Purpose

Students test whether Lactaid or another lactose digestive aid will digest lactose.

Preparation

Do not use the tablet form of Lactaid; it tests positive for glucose. If you use another liquid lactose digestive aid, test it for glucose first.

Materials

Lactaid or another liquid lactose digestive aid, glucose test paper, glucose solution, milk, glycinated cylinders, droppers, test tubes

Procedure

Give students the following directions.

1. Label four test tubes 1, 2, 3, and 4.

2. Place 2 mL of glucose in test tube 1, 2 mL of milk in test tube 2, 2 mL of milk in test tube 3, and 2 mL of Lactaid in test tube 4.

3. Place 5 drops of Lactaid in test tube 3.

4. Allow all tubes to sit for 5 minutes.

5. Doing the glucose test paper, test each tube for glucose.

Analysis

1. What did Lactaid do to the lactose in milk? It broke down the lactose.

2. What is the function of test tubes 1, 2, and 4? They are controls.

3. How will Lactaid help people who cannot digest lactose? Lactaid will help break down the lactose present in dairy products.

Chemical digestion in the stomach

The inner lining of the stomach contains millions of glands that secrete a mixture of chemicals called gastric juice. Gastric juice contains pepsin and hydrochloric acid. Pepsin is an enzyme that begins the chemical digestion of proteins in food. Pepsin works best in the acidic environment provided by hydrochloric acid, which increases the acidity of the stomach contents to pH 2.

Knowing that the stomach secretes acids and enzymes, you may be wondering why the stomach doesn’t digest itself. The stomach lining is protected by mucus that forms a layer between it and the acidic environment of the stomach. The mucus is secreted by the stomach lining itself.

Food remains in the stomach for approximately two to four hours. By the time the food is ready to leave the stomach, it is about the consistency of tomato soup. At that time, the peristaltic waves gradually become more vigorous and begin to force small amounts of liquid out of the lower end of the stomach and into the small intestine.

The Small Intestine

From your stomach, the liquid food moves into your small intestine, a muscular tube about 6 m long. This section of the intestine is called small intestine, not because of its length, but because of its narrow diameter—only 2.5 cm. Digestion of your meal is completed within the small intestine. Muscle contractions contribute to further mechanical breakdown of the food; at the same time, carbohydrates and proteins undergo further chemical digestion with the help of enzymes produced and secreted by the pancreas and liver.

Secrations of the pancreas

The pancreas is a soft, flattened gland that secretes both digestive enzymes and hormones, which you will learn more about in the last section of this chapter. The mixture of enzymes it secretes breaks down carbohydrates, proteins, and fats. Alkaline pancreatic juices also help to neutralize the acidity of the liquid food, stopping any further action of pepsin.

Secrations of the liver

The liver is a large, complex organ that, among its many functions, produces bile. Bile is a chemical solution made up of bile salts, which help break down fats, and bilirubin, which is a waste product of red blood cells.

Visual Learning

Have students look at Figure 35.3, Ask: What type of muscle makes up the walls of the stomach? smooth muscle

Figure 35.3

Smooth muscle contractions are responsible for moving food through the digestive system.

peristalsis (per uh STAT us), a series of involuntary smooth muscle contractions along the walls of the digestive tract. Figure 35.3 shows how the food is moved along from the mouth to the stomach. The contractions occur in waves; first, circular muscles relax and longitudinal muscles contract; then circular muscles contract and longitudinal muscles relax.

Have you ever had food go down the wrong way? When you swallow, the food enters the esophagus. Usually, a flap of cartilage called the epiglottis (ep uh GLAHT us) closes over the opening to the respiratory tract as you swallow, preventing food from entering. After the food passes into your esophagus, the epiglottis opens again. But if you talk or laugh as you swallow, the epiglottis may open, allowing food to enter the upper portion of the respiratory tract. Your response, a reflex, is to choke and cough, forcing the food out of the respiratory tube.

Peristalsis

Five parts of the digestive system function in a wave-like motion called peristalsis.

1. Muscular churning

Three layers of involuntary muscles, lying across one another, are located within the wall of the stomach. When these muscles contract, as shown in Figure 35.4, they work to physically break down the swallowed food, creating small pieces. As the muscles continue to work the food pieces, they mix with digestive juices produced by the stomach.

2. Chemical digestion in the stomach

The inner lining of the stomach contains millions of glands that secrete a mixture of chemicals called gastric juice. Gastric juice contains pepsin and hydrochloric acid. Pepsin is an enzyme that begins the chemical digestion of proteins in food. Pepsin works best in the acidic environment provided by hydrochloric acid, which increases the acidity of the stomach contents to pH 2.

Knowing that the stomach secretes acids and enzymes, you may be wondering why the stomach doesn’t digest itself. The stomach lining is protected by mucus that forms a layer between it and the acidic environment of the stomach. The mucus is secreted by the stomach lining itself.

Food remains in the stomach for approximately two to four hours. By the time the food is ready to leave the stomach, it is about the consistency of tomato soup. At that time, the peristaltic waves gradually become more vigorous and begin to force small amounts of liquid out of the lower end of the stomach and into the small intestine.

The Small Intestine

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The liver is a large, complex organ that, among its many functions, produces bile. Bile is a chemical solution made up of bile salts, which help break down fats, and bilirubin, which is a waste product of red blood cells.

Figure 35.4

Smooth muscle contractions churn the food in the stomach until it becomes a thin liquid.

35.4

Small intestine

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Secrations of the liver

The liver is a large, complex organ that, among its many functions, produces bile. Bile is a chemical solution made up of bile salts, which help break down fats, and bilirubin, which is a waste product of red blood cells.

Figure 35.5

Both the pancreas and the liver produce chemicals needed for digestion in the small intestine.

35.5

1. What did Lactaid do to the lactose in milk? It broke down the lactose.

2. What is the function of test tubes 1, 2, and 4? They are controls.

3. How will Lactaid help people who cannot digest lactose? Lactaid will help break down the lactose present in dairy products.
Thinking Critically

1. Liver, gallbladder
2. Bile physically changes fat into smaller droplets.
3. Liver, hepatic duct, gallbladder, bile duct, duodenum
4. Liver, hepatic duct, bile duct, duodenum
5. Only a small, but continuous, amount of bile reaches the duodenum. Large amounts needed to break up fats efficiently are not available.

Assessment

Performance: Have students make a poster illustrating why gallstones cause discomfort. Ask them if gallstones can block the bile duct and (b) the gallbladder contracts automatically when fats are in the duodenum. Have them explain what could cause the considerable discomfort associated with gallstones, the gallbladder squeezing and not being able to empty. Use the Performance Task Assessment List for foster patients in PASC. p. 73.

Assessment

Performance: Have students conduct library research to find out how meat tenderizer works. Have them use the information they gather to design a demonstration that can be used to explain the process to others. Encourage students to write out the procedural steps for their demonstration and explain the purpose for each step. Finally, have students complete their demonstration with information that relates the function of meat tenderizer to its complementary organ of the digestive system.

Meat Tenderizer

Interpersonal Have students conduct library research to find out how meat tenderizer works. Have them use the information they gather to design a demonstration that can be used to explain the process to others. Encourage students to write out the procedural steps for their demonstration and explain the purpose for each step. Finally, have students complete their demonstration with information that relates the function of meat tenderizer to its complementary organ of the digestive system.

Meat Tenderizer

Project

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Problem-Solving Lab 35-1

Purpose

Students compare the path of bile from the liver to the duodenum with and without the gallbladder.

Process Skills

analyze information, compare and contrast, draw a conclusion, interpret scientific illustrations, sequence, think critically

Teaching Strategies

■ Demonstrate the role of bile by adding a small amount of oil to a test tube of water. Shake it and have students note what happens to the oil after waiting a few minutes. (Oil reforms on top of the water.) Repeat the demonstration using liquid detergent to simulate bile. (Oil will remain as small droplets.)

Thinking Critically

1. Liver, gallbladder
2. Bile physically changes fat into smaller droplets.
3. Liver, hepatic duct, gallbladder, bile duct, duodenum
4. Liver, hepatic duct, bile duct, duodenum
5. Only a small, but continuous, amount of bile reaches the duodenum. Large amounts needed to break up fats efficiently are not available.

Assessment

Performance: Have students make a poster illustrating why gallstones cause discomfort. Advise them that (a) gallstones can block the bile duct and (b) the gallbladder contracts automatically when fats are in the duodenum. Have them explain what could cause the considerable discomfort associated with gallstones, the gallbladder squeezing and not being able to empty. Use the Performance Task Assessment List for foster patients in PASC. p. 73.

Assessment

Performance: Have students conduct library research to find out how meat tenderizer works. Have them use the information they gather to design a demonstration that can be used to explain the process to others. Encourage students to write out the procedural steps for their demonstration and explain the purpose for each step. Finally, have students complete their demonstration with information that relates the function of meat tenderizer to its complementary organ of the digestive system.

Problem-Solving Lab 35-1

Sequencing

Is it possible to live without a gallbladder? Apparently yes, as many people have had this organ surgically removed and are still alive.

Analysis

The following diagrams show the appearance of a normal liver and gallbladder (diagram A) and the appearance when the gallbladder has been removed (diagram B).

Thinking Critically

1. Where is bile produced? Where is bile stored?
2. Does bile bring about a chemical or physical change to fat? Explain.
3. Sequence the pathway for bile from the liver to the duodenum in the person with a gallbladder.
4. Sequence the pathway for bile from the liver to the duodenum in the person with no gallbladder.
5. The gallbladder is a musculature. It swells and discharges a large quantity of bile when fats are present in the duodenum. Explain why a person without a gallbladder is unable to digest fats as efficiently as someone who has a gallbladder.

Figure 35.6 Gallstones can form in the gallbladder or bile duct. They consist mainly of precipitated bile salts.

Understanding Main Ideas

1. Sequence the organs of your digestive system according to the order in which food passes through them.
2. In which sections of the digestive system are starches digested? Which enzymes break down starches?
3. How do villi of the small intestine increase the rate of nutrient absorption?
4. What role does the pancreas play in digestion?

Thinking Critically

5. How would chronic diarrhea affect the balance of fluids in your body?
6. Making and Using Graphs. Prepare a circle graph representing the time food remains in each part of the digestive tract. For more help, refer to Organizing Information in the Skill Handbook.

Section Assessment

1. mouth, esophagus, stomach, small intestine, large intestine, rectum
2. mouth, small intestine, salivary amylase, pancreatic amylase
3. By increasing the total surface area, villi allow for increased absorption rates.
4. The pancreas secretes digestive enzymes, which break down carbohydrates, proteins, and fats.
5. Loose stool has an unusually high water content. Patients suffering from diarrhea lose tremendous amounts of fluids every day. These fluids must be restored by drinking water regularly.
6. Students' graphs should show approximately these percentages: large intestine, 75%; small intestine, 15%; stomach, 11%; mouth and esophagus, 1%
The Vital Nutrients

Six basic kinds of nutrients can be found in foods: carbohydrates, fats, proteins, minerals, vitamins, and water. These substances are essential to proper body function. You supply your body with these nutrients when you eat foods from the five main food groups shown in Figure 35.5.

Carbohydrates

Perhaps your favorite food is pasta, fresh-baked bread, or corn on the cob. If so, your favorite food contains carbohydrates, important sources of energy for your body cells. Recall that carbohydrates are starches and sugars. Starches are complex carbohydrates found in bread, cereal, potato, rice, corn, beans, and pasta. Sugars are simple carbohydrates found mainly in fruits, such as plums, strawberries, and oranges.

During digestion, complex carbohydrates are broken down into simple sugars such as glucose, fructose, and galactose. Absorbed into the bloodstream through the villi of the small intestine, these sugar molecules circulate to fuel body functions. Some sugar is stored in the liver where it is stored as glycogen.

Cellulose, another complex carbohydrate, is found in all plant cell walls and is not digestible by humans. However, cellulose (also known as fiber) is still an important item to include in the diet as it helps in the elimination of wastes. Sources of fiber include bran and spinach.

Fats

Many people think that eating fat means getting fat, yet fats are an essential nutrient. They provide energy for your body and are also used as building materials. Recall that fats are essential building blocks of the cell membrane. They are also needed to synthesize hormones, protect body organs against injury, and insulate the body from cold.

Sources of fat in the diet include meats, nuts, and dairy products, as well as cooking oils. In the digestive system, fats are broken down into fatty acids and glycerol and absorbed by the villi of the small intestine. Eventually, some of these fatty acids end up in the liver. The liver converts them to glycogen or stores them as fat throughout your body.

Proteins

Your body has many uses for proteins. Enzymes, antibodies, many hormones, and substances that help the blood to clot are all proteins. Proteins form part of muscles and many cell structures, including the cell membrane.

During digestion, proteins are broken down into amino acids. After the amino acids have been absorbed by the small intestine, they enter the bloodstream and are carried to the liver. The liver can convert amino acids to fats or glycogen, both of which can be used for energy. However, your body uses amino acids for energy only if other energy sources are depleted. Most amino acids are absorbed by cells and used for protein synthesis. The human body needs 20 different amino acids to carry out protein synthesis, but it can make only 12 of them. The rest must be consumed in the diet and so are called essential amino acids. Sources of essential amino acids include meats, dried beans, whole grains, eggs, and dairy products.

Planning

Purchase a school lunch for Meeting Individual Needs. Acquire foods and brown paper for the Quick Demo. Gather Calorie charts for the Project Focus.  

1 Focus

Bellringer

Before presenting the lesson, display Section Focus Transparency 85 on the overhead projector and have students answer the accompanying questions. L1 L2 L3

SECTION PREVIEW

Objectives

- Summarize the contribution of the six classes of nutrients to body nutrition.
- Identify the role of the liver in food storage.
- Relate specific foods to weight loss or gain.

Vocabulary

- mineral
- vitamin
- calorie

Section 35.2 Nutrition

What’s your favorite food? How often do you eat it? Of what nutritional value is it?

The food pyramid is a diagram that indicates the number of servings a person should have daily from each of the food groups. How do you meal fit into this pyramid?

Carbohydrates

Perhaps your favorite food is pasta, fresh-baked bread, or corn on the cob. If so, your favorite food contains carbohydrates, important sources of energy for your body cells. Recall that carbohydrates are starches and sugars. Starches are complex carbohydrates found in bread, cereal, potato, rice, corn, beans, and pasta. Sugars are simple carbohydrates found mainly in fruits, such as plums, strawberries, and oranges. During digestion, complex carbohydrates are broken down into simple sugars such as glucose, fructose, and galactose. Absorbed into the bloodstream through the villi of the small intestine, these sugar molecules circulate to fuel body functions. Some sugar is stored in the liver where it is stored as glycogen.

Cellulose, another complex carbohydrate, is found in all plant cell walls and is not digestible by humans. However, cellulose (also known as fiber) is still an important item to include in the diet as it helps in the elimination of wastes. Sources of fiber include bran and spinach.

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When you think of minerals, you may picture substances that people mine, or extract from Earth. As shown in Figure 35.9 on the previous page, the same minerals can also be extracted from foods and put to use by your body.

A mineral is an inorganic substance that serves as a building material or takes part in a chemical reaction in the body. Minerals make up about four percent of your body’s total weight, most of it in your skeleton. Although they serve many different functions within the body, minerals are not used as an energy source. Unlike vitamins, minerals are organic nutrients that are required in small amounts to maintain growth and metabolism. The two main groups of minerals are fat-soluble and water-soluble, as shown in Table 35.2. Although fat-soluble vitamins can be stored in the liver, the accumulations of excess amounts can cause toxicities. Water-soluble vitamins cannot be stored in the body and so must be included regularly in the diet. Table 35.2 lists foods that contain fat-soluble and water-soluble vitamins.

Vitamin D, a fat-soluble vitamin, is synthesized in your skin. Vitamin K and some other vitamins are made by bacteria in your large intestine. The rest of the vitamins are consumed in your diet.

### Table 35.2 Vitamins

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Function</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>maintain health of epithelial cells; formation of key enzymes; synthesis of hormones in gonads and thymus</td>
<td>liver, broccoli, green and yellow vegetables, wheat bran, and nuts.</td>
</tr>
<tr>
<td>D</td>
<td>absorption of calcium and phosphorus in digestive tract</td>
<td>egg yolks, shrimp, yeast, fortified milk; positioned in the skin upon exposure to ultraviolet rays in sunlight.</td>
</tr>
<tr>
<td>E</td>
<td>formation of DNA, RNA, and red blood cells</td>
<td>leafy vegetables, milk, butter.</td>
</tr>
<tr>
<td>K</td>
<td>blood clotting</td>
<td>green vegetables, tomatoes, produced by intestinal bacteria.</td>
</tr>
<tr>
<td>Water-soluble</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( B_1 ) (thiamine)</td>
<td>sugar metabolism; synthesis of neurotransmitters</td>
<td>eggs, green vegetables, chicken, raisins, seaweed, soybeans, milk, poultry.</td>
</tr>
<tr>
<td>( B_2 ) (riboflavin)</td>
<td>sugar and protein metabolism in cells of eyes, skin, intestines, blood</td>
<td>green vegetables, meats, yeast, eggs.</td>
</tr>
<tr>
<td>Niacin</td>
<td>energy-releasing reactions; fat metabolism</td>
<td>yeast, meats, liver, fish, whole-grain cereals, nuts.</td>
</tr>
<tr>
<td>( B_6 )</td>
<td>fat metabolism</td>
<td>salmon, yeast, tomatoes, corn, spinach, liver, green vegetables, peas, whole-grain cereals, and breads.</td>
</tr>
<tr>
<td>( B_12 )</td>
<td>red blood cell formation; metabolism of amino acids</td>
<td>liver, milk, cheese, eggs, meats.</td>
</tr>
<tr>
<td>Folic acid</td>
<td>aminosynthesis; synthesis of hormones</td>
<td>milk, beans, green vegetables, whole-grain cereals and breads.</td>
</tr>
<tr>
<td>( B_6 )</td>
<td>synthesis of DNA and RNA; production of red and white blood cells</td>
<td>leafy green vegetables, nuts, orange juice.</td>
</tr>
<tr>
<td>Biotin</td>
<td>aminosynthesis; fat metabolism</td>
<td>yeast, liver, eggs.</td>
</tr>
<tr>
<td>C</td>
<td>protein metabolism; wound healing</td>
<td>citrus fruits, tomatoes, leafy green vegetables, broccoli, potatoes, peppers.</td>
</tr>
</tbody>
</table>

### Minerals and vitamins

Water

Water is the most abundant substance in your body, making up 60 percent of red blood cells and 75 percent of muscle cells. Water facilitates the chemical reactions in your body and is necessary for the breakdown of foods during digestion. Water is also an excellent solvent; oxygen and nutrients from food can enter your cells if they did not first dissolve in water.

Recall that water absorbs and releases heat slowly. It is this characteristic that helps water maintain your body’s internal temperature. A large amount of heat is needed to raise the temperature of water. Because the body contains so much water, it takes a lot of added energy to raise its internal temperature. Your body loses about 2.5 L of water per day through exhalation, sweat, and urine. As a result, water must be replaced constantly.

### Calories and Metabolism

The energy content of food is measured in units of heat called calories. Each calorie is equivalent to the amount of heat required to raise the temperature of 1 mL of water by 1°C. Some foods, especially those with fats, contain more calories than others. In general, 1 g of fat contains nine Calories, while 1 g of carbohydrate or protein contains four Calories. To learn more about Calories in meals, complete the MiniLab on this page.

The number of Calories needed each day varies from person to person, depending on the person’s metabolism, or the rate at which they burn energy. Metabolic rate, in turn, is determined by a person’s body mass, age, sex, and level of physical activity. In general, males need more Calories per day than females, teenagers need more than adults, and active people need more than inactive people. Physicians have determined that many Americans are overweight. Calculate your Body Mass Index by doing the Problem-Solving Lab on the next page.

### Water

Water is a substance that serves as a building material or takes part in a chemical reaction in the body. Minerals and vitamins are necessary for life. Do not hallucinate.
Students learn how to calculate their Body Mass Index and determine whether or not their weight is within accepted values.

Process Skills
- think critically, apply concepts, collect data, interpret data, recognize cause and effect, use numbers

Teaching Strategies
- Allow students to use calculators.
- Review the technique for squaring a number.
- Working an example on the board.

Teaching Strategies
- Using Numbers

Problem Solving Lab 352

Purpose
Students learn how to calculate their Body Mass Index and determine whether or not their weight is within accepted values.

Problem Solving Lab 352

Using Numbers

What is your BMI? Fifty-five percent of adults in the United States are considered overweight. How can you tell if you fall into this category? Use the following equation to find out where you rank in relation to the rest of the population.

Analysis
- Compute your BMI, or Body Mass Index, using the following formula:
  \[
  \text{BMI} = \frac{\text{weight (in pounds)}}{\text{height (in inches)}^2} 
  \times 703.5 
  \]
- The federal guidelines are as follows:
  - A BMI 25 or below is normal weight, overweight, or obese.
  - A BMI 25 or below is normal weight, overweight, or obese.

Thinking Critically
1. According to federal guidelines, are you normal weight, overweight, or obese?
2. How might a person with a BMI of 27 reduce his or her BMI? Consider both nutritional intake and physical activity.
3. Since 1960, the population of obese individuals in the United States has risen from 13 to 22 percent. Formulate a hypothesis that may explain this rise.

Figure 35.10 When the energy taken in is greater than the energy expended, a person gains weight.

What happens if you eat more Calories than your body can metabolize? As Figure 35.10 shows, you store the extra energy as body fat and gain weight. On the other hand, if you eat fewer Calories than your body can metabolize, you use some of the energy stored in your body as fat and lose weight. Millions of people put themselves on diets every year in hopes of losing weight. While many diets are nutritionally sound, others prescribe eating habits that are not sensible and usually fail to produce the desired result. Read more about fat diets in the Biology & Society section at the end of this chapter.

Control of the Body
Internal control of the body is directed by two systems: the nervous system, which you will learn more about later, and the endocrine system. The endocrine system is made up of a series of glands, called endocrine glands, that release chemicals directly into the bloodstream. These chemicals act as messengers, relaxing information to other parts of the body. Whereas the nervous system produces an immediate, appropriate response, the endocrine system induces gradual change. Let’s take one of the football players as an example. While his nervous system is directing his legs to run in order to catch a forward pass, his endocrine system is controlling the rate at which he grows. The first response is instant, the second takes years.

Interaction of the nervous system and endocrine system
Although endocrine glands are found throughout the body, most of them are controlled by the action of the pituitary gland (see p. 959), the master endocrine gland. Because there are two control systems within the body—nervous and endocrine—coordination is needed.

The pituitary gland releases chemicals important in controlling the growth of these tissues.

Understanding Main Ideas

In what ways are proteins used in the body?
1. They provide energy for the body.
2. They are necessary for the growth and development of cells.
3. They are the main ingredient of body tissues.
4. They are the building blocks of enzymes.
5. They are used in the synthesis of antibodies.

Thinking Critically
1. Why are proteins necessary for growth and development?
2. How are proteins involved in the maintenance of body tissues?
3. What role do proteins play in the synthesis of antibodies?

Internet Address Book
Note Internet addresses that you find useful in the space below for quick reference.

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The hypothalamus is the portion of the brain that controls the pituitary gland. The pituitary gland is located in the skull just beneath the hypothalamus, and the two are connected by nerves and blood vessels. The hypothalamus sends messages to the pituitary, which then releases its own chemicals, or stimulates other glands to release theirs. Other endocrine glands under control of the pituitary include the thyroid gland, the adrenal glands, and glands associated with reproduction.

Endocrine control of the body

The chemicals secreted by endocrine glands into the bloodstream are called hormones. Recall that a hormone is a chemical released in one part of an organism that affects another part. Hormones convey information to other cells in your body, giving them instructions regarding your growth, development, and behavior. When released by the glands, the hormones travel in the bloodstream and then attach to specific binding sites on the plasma membranes, or in the nuclei, of target body cells. When these binding sites on cells are called receptors. Figure 35.11 summarizes the action of endocrine hormones.

Example of endocrine control

Human growth hormone (hGH) is a good example of an endocrine system hormone. When your body is actively growing, blood glucose levels are slightly lowered as the growing cells use up the sugar. This low blood glucose level is detected by the hypothalamus, which stimulates the production and release of hGH from the pituitary into the bloodstream. hGH binds to receptors on the plasma membranes of liver cells, stimulating the liver cells to release glucose into your blood. Your cells need the glucose in order to continue growing. Figure 35.12 summarizes the control of hGH by the pituitary gland. You can further investigate growth rate in humans by doing the BioLab at the end of this chapter.

Negative Feedback Control

The amount of hormone released by an endocrine gland is determined by your body’s demand that hormone at a given time. In this way, the endocrine system ensures that the appropriate amounts of hormone are present in the system at all times.

How do your endocrine glands know when you need a certain hormone? The endocrine system is controlled by a self-regulating system called the negative feedback system. The negative feedback system is a system in which the hormones, or their effects, are fed back to inhibit the original signal. The thermostat in your home is controlled by a similar negative feedback system. It maintains the room at a set temperature. When the temperature drops, the thermostat senses the lack of thermal energy and signals the heater to increase its output. When the thermal energy of the room rises again to a certain point, the thermostat reduces the heating. When the temperature drops again, the process repeats itself. In this negative feedback system, the increase in temperature leads to a decrease in the temperature, which then reduces the temperature, which then reduces the temperature.

Control of blood water levels

Let’s take a look at an example of a hormone that is controlled by a negative feedback system. After working out in the gym and building up a sweat, you are thirsty. This is because the water content of your blood has been reduced. The hypothalamus, which is able to sense the concentration of water in your blood, determines that your body is dehydrated. In response, it stimulates the pituitary gland to release antidiuretic hormone (ADH) in your blood.

Feedback control of hormones

The majority of endocrine glands operate under negative feedback systems. A gland synthesizes and secretes its hormone, which travels in the blood to the target tissue where the appropriate response occurs. Information regarding the hormone level or its effect on the target tissue is fed back, usually to the hypothalamus or pituitary gland, to regulate the gland’s production of the hormone.
Problem-Solving Lab 35.3 Interpreting Data

What are the effects of glucagon and insulin during exercise? Exercise represents a special example of rapid mobilization in the body. The body must gear up to supply more glucose and oxygen for muscle metabolism. The glucose use in a resting muscle is generally low but increases dramatically with exercise. Within ten minutes of beginning exercise, glucose uptake from the blood may increase by fifteenfold; within 60 minutes, it may increase by thirtyfold.

**Analysis**

The graph here shows the effects of prolonged exercise on blood insulin and glucagon levels in humans.

**Thinking Critically**

Glucagon causes blood glucose levels to rise by increasing the conversion of glycogen into glucose. The body needs more glucose during exercise. Insulin acts to lower blood glucose levels by converting glucose to glycogen. Consequently, its levels are reduced during exercise.

**Assessment**

Knowledge Ask students to summarize in their journals the changes in blood glucose levels by lowering blood glucose levels by...
**Analysis**

1. Student may notice that thyroid gland tissue contains many large spaces surrounded by a thin band while parathyroid tissue contains no large spaces or follicles.

2. a. thyroid tissue

3. Both glands are located in the general area of the neck. The parathyroids lie on the thyroid gland itself.

3 Assess

Check for Understanding

Have students make a diagram that summarizes the control of calcium levels in the body.

Reteach

Have students go around the room, with the first student naming a gland, the second naming a hormone, and the third naming the function of the hormone.

Extension

Have students look up information on scientists who have discovered or synthesized endocrine hormones. F. G. Banting and C. H. Best discovered insulin, while F. C. Kendall isolated thyroxine and cortisone, and P. S. Hench discovered that cortisone had a beneficial effect on inflamed tissues.

**Section Assessment**

Knowledge Ask students to summarize hormonal control of blood sugar levels.

4 Close

Discussion

Discuss with students what might happen if their thyroid gland became over- or underactive.

---

**Resource Manager**

**Parathyroid Hormone**

- **Intrapersonal** Have students sequence the pathway of parathyroid hormone from the parathyroid glands to its target tissue. Have students capture their flowcharts with a summary of the effects the hormone has on its target tissue.

- **Interpersonal**

**Enzyme Function** Have students identify the enzyme that catalyzes a specific chemical reaction. Have students describe the effects of the enzyme on the reaction rate.

- **Grouping**

**Portfolio**

**Reinforcement and Study Guide,** p. 158

**Content Mastery,** pp. 173, 175-176

**Block and MiniLab Worksheets,** p. 156

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**Assessment**

**Performance** Ask students to research the cause and appearance of thyroid goiter. Provide students with prepared slides of normal thyroid and thyroid tissue. Have students compare and contrast the two tissues. Ask them to relate their microscopic observations to the human macroscopic appearance of a goiter. Use the Performance Task Assessment List for Making Observations and Inferences in PASC, p. 17.

---

**Figure 35.15** Calcitonin and parathyroid hormone (PTH) have opposite effects on blood calcium levels.

<table>
<thead>
<tr>
<th>Blood calcium levels decreased</th>
<th>Blood calcium levels increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTH</td>
<td>Calcitonin</td>
</tr>
</tbody>
</table>

**Discussion**

1. A steroid hormone passes through the target cell membrane and activates protein synthesis. An amino acid hormone activates ion channels or enzyme pathways in the cell from its position outside the membrane.

2. The hypothalamus, part of the brain (central nervous system), controls the parasympathetic, or motor, endocrine gland.

3. In a negative feedback system, when a hormone reaches an appropriate level, it affects its effectors to feed back to inhibit the release of more hormone.

4. The adrenal glands secrete glucocorticoids and epinephrine, hormones involved in stress reactions.

5. Glucose is the fuel for body cells and a constant level needs to be maintained for normal body functions.

6. Parathyroid hormone raises blood calcium levels by increasing the rate of absorption in the intestines, while calcitonin lowers blood calcium levels by increasing its excretion rate.
Average Growth Rate in Humans

Human growth results from more than one hormone. Human growth hormones, thyroid hormones, and the reproductive hormones that are produced during puberty are all important in human growth at various ages. Together, these hormones stimulate the growth of bone and cartilage, protein synthesis, and the addition of muscle mass. Because the reproductive hormones are involved in human growth, perhaps there is a difference in the growth rate between males and females.

**Problem**
Is average growth rate the same in males and females?

**Objectives**
In this BioLab, you will:
- Graph the average growth rates in males and females.
- Identify any differences in the average growth rates of males and females.

### Materials
- blue pencils
- graph paper
- red pencils
- ruler

### Skill Handbook
Use the Skill Handbook if you need additional help with this lab.

### Procedure
1. Construct a graph for the growth rate data that shows mass on the vertical axis and age on the horizontal axis.
2. On the graph, plot the data shown in the table for the average female growth in mass from ages 8 to 18. Use a ruler to connect the data points with a straight red line.
3. On the same graph, plot the data for the average male growth in mass from ages 8 to 18. Connect these data points with a straight blue line.

### Data Table: Averages for growth in humans

<table>
<thead>
<tr>
<th>Age</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>9</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>10</td>
<td>37</td>
<td>33</td>
</tr>
<tr>
<td>11</td>
<td>40</td>
<td>39</td>
</tr>
<tr>
<td>12</td>
<td>47</td>
<td>45</td>
</tr>
<tr>
<td>13</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>14</td>
<td>54</td>
<td>53</td>
</tr>
<tr>
<td>15</td>
<td>62</td>
<td>60</td>
</tr>
<tr>
<td>16</td>
<td>65</td>
<td>63</td>
</tr>
<tr>
<td>17</td>
<td>68</td>
<td>66</td>
</tr>
<tr>
<td>18</td>
<td>70</td>
<td>68</td>
</tr>
</tbody>
</table>

### Analyze and Conclude
1. **Analyzing Data**
   - During what ages do females and males increase the most in mass? In height?
2. **Analyzing Data**
   - Interpret the data to find if the average growth rate is the same in males and females.
3. **Thinking Critically**
   - How can you explain the differences in growth rates between males and females?
4. **Relating Concepts**
   - Why do you think male and female growth rates increase during the teen years?

### Teaching Strategies
- Have students refer to the Making and Using Graphs section of the Skill Handbook for help.

### Troubleshooting
- As students connect their data points, they should draw a line closest to the given set of points. Remind them that not all of the points will be on the line.

### Data and Observations
- Students will observe that females have an earlier growth spurt than males, but on the average, males grow taller and heavier than females.

### Going Further
**Application**
Determine the height of all the students in your biology class. Compare the range of heights in your class to the statistical average.

**Going Further**
Ask students to research which factors are known to affect growth rate in humans, including hormones, genetics, and diet.
The Promise of Weight Loss

You’ve probably come across statements like these in magazine and television advertisements. Take a pill, sip a shake, or follow a certain eating plan and those extra pounds will just slip away—or so the headlines claim.

The appeal of fad diets

Many people who are overweight (or who simply think they are) are often willing to do almost anything to lose unwanted pounds. Most fad diets look like a fast and easy solution to a weight-loss problem. But do fad diets work as advertisements claim they do? And are they safe?

Types of fad diets

Some fad diets involve fasting—going without food for a period of time. Some require taking diet pills that depress the appetite, or that cause the body to lose water. Other fad diets involve eating around eating only one food, or a certain kind of food. Thus there are liquid diets, in which a special drink replaces breakfast and lunch, and a dieter eats only one meal of solid food each day.

A temporary solution

Many people who start a fad diet shed weight quickly in the first week or two. After that, however, weight loss usually slows dramatically. This is because the initial weight loss is mostly due to loss of water, not fat. When people quit a fad diet, they usually return to their old eating habits and rapidly regain the lost weight.

What the advertisements don’t say

Nearly all fad diets are based on unhealthy nutritional principles. People on fad diets usually are not eating a balanced diet, and, therefore, not getting enough of the vitamins, minerals, and other important compounds their bodies need to grow and function properly.

Section 35.1

Following Digestion of a Meal

Main Ideas

- Digestion begins in the mouth with both mechanical and chemical action. The esophagus transports food from the mouth to the stomach.
- Chemical and mechanical digestion continue in the acidic environment of the stomach.
- In the small intestine, digestion is completed and food is absorbed. The liver and pancreas play key roles in digestion.
- The large intestine absorbs water before indigestible materials are eliminated.

Types of fad diets

- Some fad diets also can cause serious health problems. High-protein diets, for example, are very high in fat and cholesterol, substances that promote heart disease and circulatory problems.
- Fad diets may help some people lose a few pounds temporarily. But for safe, long-term weight loss, nutritionists recommend a diet based on healthy eating habits: balanced, regular meals and those extra pounds will just slip away—or so the headlines claim.

Investigating the Issue

Analyzing Information

Collect advertisements for three different fad diets that promise “miracle” results. Based on what you know about good nutrition, would you recommend any of these diets to a friend who is trying to lose weight? Why or why not?

To find out more about fad diets, visit the Glencoe Science Web Site.

www.glencoe.com/sec/science

Section 35.2

Nutrition

Main Ideas

- Carbohydrates are the body’s main source of energy. Fats are used to store energy. Proteins are used as building materials.
- Minerals serve as structural materials or take part in chemical reactions. Vitamins are needed for growth and metabolism.
- Metabolic rate determines how quickly energy is burned.

Section 35.3

The Endocrine System

Main Ideas

- The endocrine glands work with the nervous system to regulate body functions.
- Blood hormone levels are controlled by a negative feedback system.
- Steroid hormones bind to receptors inside the target cells and cause acid hormones bind to plasma membrane receptors.

Vocabulary

- adrenal gland (p. 943)
- anterior lobe of the pituitary gland (p. 959)
- posterior lobe of the pituitary gland (p. 959)
- thyroid gland (p. 944)

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Chapter 35 Assessment

Main Ideas

- A diet high in protein, especially from meat, helps promote healthy muscle growth.
- A diet high in fiber helps regulate digestion.
- A diet high in calcium helps prevent bone loss.

Vocabulary

- protein (p. 904)
- carbohydrate (p. 904)
- fat (p. 904)
- fiber (p. 904)
- calcium (p. 904)

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- fiber (p. 904)
- calcium (p. 904)

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Vocabulary

- protein (p. 904)
- carbohydrate (p. 904)
- fat (p. 904)
- fiber (p. 904)
- calcium (p. 904)


15. C.

16. Taste buds.

17. Liver, bile, small intestine, stomach, pancreas.

18. The ________ gland is controlled by the hypothalamus.

19. Hormone released by ________ glands affect specific areas known as ________.

20. Salivary glands in your mouth produce ________, an enzyme that breaks down the ________ into the bloodstream.

21. A(n) ________ is an inorganic substance that is required for muscle contraction.

22. How could removal of the parathyroid glands affect muscle contraction?

23. Recognizing Cause and Effect: How is the role of pancreatic hormones in glucose regulation important for homeostasis?

24. Interpreting Data: The relationship between parathyroid hormone secretion and blood calcium levels is shown in the graph below. To what level does the blood calcium level have to fall in order to get maximum parathyroid hormone secretion?

25. Concept Mapping: Complete the concept map by using the following vocabulary terms: liver, bile, small intestine, stomach, esophagus, gallbladder.

26. Chlorophyll is a condition in which the stomach fails to secrete hydrochloric acid.

27. How would this condition affect digestion?

28. The glucose concentration in the blood is maintained in a very narrow range. The pancreas releases insulin to remove glucose from the blood and glucagon to cause the release of glucose into the blood.

29. Blood calcium levels must drop below 8 mg/dL to get maximum parathyroid hormone secretion.


32. Interpreting Data: Use the data in Table 35.5 to answer the following questions.

33. 1. How many Calories are there in one serving of macaroni and cheese?

34. 2. Being fond of macaroni and cheese, Juan eats five servings each day. Assuming this is all he eats, how many Calories does Juan eat each day?

35. 3. What percent of Juan's Calories are derived from fat?

36. 4. If Juan should eat only 1800 Calories a day, is all he eats, how many Calories does Juan eat each day?

37. 5. Interpreting Data: The following table contains nutritional information for a meal of macaroni and cheese.

38. 6. The enzyme pepsin would not function in an acidic pH of the stomach.

39. 7. Which enzymes functions best in the acidic pH of the stomach? a. pepsin b. amylase c. lactase d. lipase

40. 8. Which of these is NOT a function of the thyroid gland? a. controls growth and development b. regulates metabolism c. regulates blood calcium levels d. responds to stressful situations

41. 9. Which unit is used to measure the energy content of food?

42. 10. What is the most abundant substance in the human body? a. carbohydrates b. water c. vitamins d. proteins

43. 11. Hormones released by ________ glands affect specific areas known as ________.

44. 12. What is the primary function of the large intestine? a. food absorption b. vitamin synthesis c. food digestion d. water absorption

45. 13. The ________ prevents swallowed food from entering the ________.

46. 14. When your body needs energy, it breaks down carbohydrates, lipid, protein, and ________ into the bloodstream.

47. 15. The pancreas releases the hormone ________, which removes ________ from the blood.

48. 16. A(n) ________ is an inorganic substance that serves as a building material or takes part in a chemical reaction in the body.

49. 17. Hormones are made from lipids; the other group of hormones is made from ________.

50. 18. A negative feedback system controls the level of hormones by feeding back information to the ________ or the ________.

51. 19. The ________ is a muscular tube of the digestive system that connects the ________ to the ________.

52. 20. Where’s the fire? Slow down! Go back over reading passages and double-check your math. Remember that doing most of the questions and getting them right is always preferable to doing all the questions and getting lots of them wrong.