OVERVIEW

Chapter 9, Nutrition and the Digestive System, focuses on why animals need nutrition in order to properly function, and how they process and use food in order to obtain that nutrition and provide themselves with energy. Students learn about the nutritional contents of various food sources and how the body utilizes carbohydrates, fats, proteins, and other nutrients. Once an understanding of basic nutritional needs is established, students explore the components of a healthy diet and some of the most common eating disorders. The remainder of the chapter covers the various components of the human digestive system and how these structures work together to break down food, process it to obtain nutrients, and remove the associated waste from the body. Throughout the chapter, information is supplemented with hands-on activities that illustrate some of the biochemical processes that the body uses to process food.

Chapter 10, The Respiratory System, begins with an overview of cellular respiration and the exchange of oxygen and carbon dioxide at the cellular level. Students then explore the anatomy and physiology of the respiratory system in animals. Relevant investigations present opportunities to explore how lung volume and capacity affect respiration. The underlying principles that govern the exchange of oxygen and carbon dioxide across membranes are also discussed. Finally, students learn about disorders that interfere with gas exchange and some of the technologies used to treat such disorders.

In Chapter 11, The Circulatory System, students learn how oxygen and nutrients are distributed throughout the body and how cellular waste is collected and removed. They explore the roles of the various tissues and organs that constitute the circulatory system, including blood, blood vessels, and the heart. The chapter covers a number of clinically important topics such as the cardiac cycle, various diseases of the cardiovascular system, and the technologies used to diagnose and treat these diseases. Students also conduct several investigations in this chapter, including the dissection and study of a fetal pig.

TEACHING NOTES

- Have students look at the Key Concepts and the Starting Points at the beginning of each chapter and at the Summary Questions in the Chapter Summary at the end of each chapter. Ask students, How could you use these two features to help you understand the ideas presented in the unit?
- This unit includes hands-on activities and has students working with scientific equipment. Review laboratory safety procedures and refer students to Appendix A1 Safety. Also review the importance of reading and checking directions before beginning an activity, thinking about the purpose of an activity or the testable question, and directing questions to other members of their group before asking you.
- You may want to use or adapt the assessment rubrics found in the Assessment Tools section on the Teacher eSource.

ENGAGE THE LEARNER

UNIT PREVIEW

- Call students’ attention to the images on page XX of the Student Book. Ask, What type of images are these? (Sample answers: X-rays, MRIs, CT scans) Ask, Are some reasons a doctor might use such images? (Sample answers: to detect an injury, to diagnose a disease, to follow the progression of a disease, to determine if a treatment was successful)
- Have students work in groups to create three-column charts. In the first column, instruct them to list all of the body systems they see represented in the Unit Opener photograph. In the second column, tell them to list the primary function(s) of each of the systems listed in the first column. Finally, in the third column, have them list diseases or disorders affecting each of the body systems.
Compile the groups' answers into a master chart. Encourage students to make corrections and additions to the chart as necessary based on their knowledge and experience.

• Have students read the Big Ideas on page XXX of the Student Book. Ask the class to name ways that the body systems listed on their master chart interact with and depend upon one another.

UNIT TASK PREVIEW

• Formulate a plan for incorporating the Unit Task into the whole learning experience for the unit. Whenever possible, highlight ideas that relate to or might be helpful in carrying out the Unit Task. Consider the following questions to help you decide how to manage the Unit Task:
  – Will students begin the Unit Task early in the unit or toward the end of the unit?
  – Will students work on the Unit Task as individuals, in pairs, or in small groups?
  – Will you set aside class time for students to work on the task or will students be expected to complete it on their own time?
  – How will the task fit into the overall assessment plan for the unit?

• Point out the Unit Task Bookmark found within some sections (The first Unit Task Bookmark appears in Chapter X on page XXX of the Student Book). Explain that these icons alert students to information or procedures that may be helpful in completing the task.

• The Unit Task involves profiling the health and fitness of a real or hypothetical person, and then making recommendations for improving the individual’s physical condition.

• For further support with the Unit Task, refer to pages xx–xx of this resource.

FOCUS ON STSE

• This reading feature focuses on the practice of using whole-body scans as a primary means of detecting various health problems.

• Have students preview the title and examine the photographs that accompany the article. Revisit the students’ suggestions on why a doctor might order such scans for a patient. Ask, In each of these cases, is the doctor looking for something specific, or screening the patient for any possible problems? (Sample answer: The doctor is always looking for something specific.)

• Ask, What are some advantages and disadvantages to using these scans as preventive health screening? (Sample answers: Disadvantages include prohibitive cost and excessive exposure to radiation. Advantages include the fact that it is non-invasive and may reveal conditions in early stages before they could be detected in a routine physical examination.) As students name advantages and disadvantages, write them on the board or chart paper. Survey the class and write down how many students think the use of whole-body scans for preventive screening is a good idea or a bad idea.

• Once students have read the feature and completed the activity, ask for further advantages and disadvantages to add to the class lists. Survey the class again and see how many students believe the use of whole-body scans for screening is a good idea or a bad idea. Ask students who changed their minds to share what information in the feature changed their opinions.

ARE YOU READY?

• You can use the questions in this feature as a quick review of relevant concepts and skills and as a means of assessing student understanding of them. Several years may have elapsed since students last encountered some of these concepts or skills, so in many cases it will feel like a first time introduction for students. Use this feature as an instructional opportunity and do not assume students will know the answers.

• Use student responses to identify concepts and subject areas that students may need to review.

• Should weaknesses or needs be identified, you may want to set aside time for review before students begin to work on the unit. Alternatively, you might review the targeted concepts as they present themselves in the unit.

CAREER PATHWAYS PREVIEW

• Formulate a plan for incorporating Career Pathways into the whole learning experience for the unit.

• Point out the Career Links found within some sections (The first Career Link appears in Chapter 9 on p. XXX of the Student Book). Explain that these icons alert students to information or procedures that may be helpful in completing the Career Pathways assignment.

• For further support with Career Pathways, refer to pages xx–xx of this resource.

DIFFERENTIATED INSTRUCTION

• Provide several organ system models, cut outs, or handouts for them to manipulate. In groups, have students prepare a wall chart about the body system of their choice. Have them briefly present their findings to the class. Encourage them to include graphics, sounds, and actions in their presentations to engage all learner types.

• If computers are accessible have students find an animation and a sound file and post it to a class website for future reference.

• Create a word wall in the classroom with the vocabulary from this unit. Encourage students to make suggestions for the word wall, and to use the vocabulary on assignments.
ENGLISH LANGUAGE LEARNERS

- Provide English language learners with extra time to complete the Are You Ready? questions, or allow them to preview the questions a day or two before the lesson so that they can make necessary translations and read the material at their own pace.
TEACHING NOTES

- Have students examine the Chapter Opener photograph. Ask, Why is it important to eat a variety of foods? (We need a lot of different nutrients in order to stay healthy, and we get those nutrients from a variety of sources.)
- As a class, read the key question at the start of the chapter aloud: How is food made usable for cells? (Students may discuss the measures taken to prepare food for consumption, as well as the various stages of digestion.)

ENGAGE THE LEARNER

CHAPTER INTRODUCTION

- To preview the major ideas that will be explored in the chapter, review the Key Concepts. Ask a student volunteer to read each Key Concept aloud before it is discussed. Ask prompting questions to assess students’ prior knowledge and to engage students in the topics. Examples are given:
  1. What kinds of foods are found in a healthy diet? Why? (Vegetables, fruits, whole grains, lean meats and fish, beans, nuts, and low fat dairy products contain the nutrients that our bodies need to grow and repair cells.)
  2. What kinds of foods should be avoided? Why? (Food that is high in fat or highly processed should be avoided because it often contains harmful or unnecessary substances and may not have much nutritional value.)
  3. How does our digestive system maintain our health? (The digestive system delivers nutrients to the body’s cells and tissues.)
  4. How is food broken down in the mouth? (Food is broken down through chewing, mixing with saliva, and swallowing.) How is food broken down in the stomach and intestines? (Food is broken down through chemicals such as enzymes and acids.)
  5. How does your food change as it travels through your digestive tract? (It gets softer and breaks into smaller pieces in the mouth. In the stomach, it gets broken down further. Once in the intestines, the leftover waste gets compacted so that it can pass out of the body.)
  6. What are some examples of digestive disorders and how are they diagnosed? (Bowel diseases such as IBD and cancer can be diagnosed through endoscopy and biopsy. Some metabolic diseases can be diagnosed with blood tests.)
  7. How would vomiting or diarrhea affect our health? (dehydration and loss of nutrients) Are there any benefits to these conditions? (Yes, if toxins or bacteria are present, they will be flushed out by vomiting and diarrhea.)
  8. Why are the discoveries of bacteria such as E. coli and Salmonella important? (These bacteria cause diseases of the digestive system and affect human health.)

- Have students complete a K-W-L graphic organizer about digestion and nutrition. Students should write what they know about digestion and nutrition in the first column and what they wonder about digestion and nutrition in the second column. At the end of the chapter have students fill in what they learned in the third column.
- Have students complete Mini Investigation: Digestion Can Be a Mouthful!

MINI INVESTIGATION: DIGESTION CAN BE A MOUTHFUL!

Skills: Performing, Observing, Analyzing, Communicating

Purpose: Students will use iodine to observe the chemical changes that food undergoes during digestion.

Equipment and Materials (per student): watch glass, unsalted soda cracker, Lugol’s iodine stain.

Student Safety
- Remind students to wear goggles, gloves and lab aprons.
- Caution students that they must not eat or drink anything in the lab unless specifically given permission.

Notes
- Amylase speeds up the breakdown of starch into maltose. Maltose is a disaccharide which has a sweet flavor.

DIFFERENTIATED INSTRUCTION

- To engage auditory learners, have students describe their favorite meals to one another. Using computers or their own knowledge, they can analyze the healthfulness of the meal. Visual and kinesthetic students can use cut outs from the newspaper to make sample meals and develop posters about their diets.
- You may want to have students who are interested in computers set up a class blog, wiki, or website for posting reports, lab results, presentations, images, videos, links, and other forms of information.

ENGLISH LANGUAGE LEARNERS

- As students encounter vocabulary words or the names of organs throughout the chapter, have them create index cards with the word on one side and the definition on the
other, and post the cards in an appropriate space on an unlabeled diagram of the digestive system.
9.1 Why We Need to Eat

OVERALL EXPECTATIONS: A1; E3

SPECIFIC EXPECTATIONS
Understanding Basic Concepts: E3.2

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
• nutrient
• metabolism
• catabolism
• anabolism
• metabolic rate
• basal metabolic rate

SKILLS
Observing
Analyzing

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Summary 1: Knowledge and Understanding

PROGRAM RESOURCES
BLM XXX: Compare and Contrast Chart
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• explain that nutrients are used by the body for growth and repair
• explain that the basal metabolic rate is the minimum amount of energy required to keep an organism alive and is determined by age, height, and mass.

SCIENCE BACKGROUND
• Cold-blooded organisms do not use metabolic reactions to produce body heat. These organisms have low metabolic rates and a low food intake. This means that cold-blooded organisms cannot sustain high-energy activity. Muscle contractions, sitting in the sun, and countercurrent heat exchange are all adaptations that allow cold-blooded organisms to increase their body temperature.
• Warm-blooded organisms use metabolic reactions to maintain a stable body temperature. These organisms can heat and cool themselves. Increases in metabolic activity, fat metabolism, and shivering all generate heat. Panting, sweating, and dilation of the blood vessels near the surface of the body are cooling mechanisms. Warm-blooded organisms are able to sustain high energy activities but must balance that with a constant and high food intake.

POSSIBLE MISCONCEPTIONS
Identify: Students might not understand that size is not the only factor that determines an organism’s food intake.
Clarify: Explain that warm-blooded organisms must eat more food than cold-blooded organisms, and small warm-blooded organisms must eat more food as a percentage of their body mass compared to large warm-blooded organisms.

Ask What They Think Now: At the end of this discussion, ask, Who eats the highest amount of food for their size per day: A 5g mouse, a 5g frog? Why? (the mouse, because it is a warm-blooded organism)

TEACHING NOTES
ENGAGE
• In order to assess students’ prior knowledge of metabolism, ask, What happens to the food you eat? (Sample answers: it gets digested, our bodies burn the calories, nutrients get used by our cells)

EXPLORE AND EXPLAIN
• Ask students, How do you think the human body might be affected by poor general nutrition or a lack of a particular nutrient? (Sample answers: low energy, poor immune function, unhealthy weight, scurvy, goiter)
• Have students use BLM XXX: Compare and Contrast Chart to compare the energy needs of warm-blooded organisms and cold-blooded organisms. Prompt students with questions such as, How often do warm-blooded organisms and cold-blooded organisms eat? How much do they eat at one time? and, How do they regulate their body temperature?
• At the end of the activity, ask, What are metabolic reactions? (Metabolic reactions are all of the anabolic and catabolic reactions that happen in an organism.)
• Explain that chemists use calories to measure the energy in a chemical reaction. Ask, How do you think the use of “calories” in chemistry relates to the Calories that we refer to when describing food? (Calories also relate to
energy; they measure the amount of energy in food that can be used to fuel metabolic reactions.)

- Have students complete Mini Investigation: How Much Energy Do You Need?

**MINI INVESTIGATION: HOW MUCH ENERGY DO YOU NEED?**

**Skills:** Observing, Analyzing

**Purpose:** Students will use the Harris Benedict formula to determine their basal metabolic rate.

**Equipment and Materials (per student):** Pen or pencil, paper, calculator

**Notes**
- Exercising increases the amount of energy a person burns but does not necessarily increase BMR. Only an increase in lean muscle mass has been shown to increase BMR at any age.

**EXTEND AND ASSESS**

- Assign each student an anabolic reaction or a catabolic reaction to research further. Ask students to write out the equation for the assigned anabolic or catabolic reaction, identify the products and reactants, and identify the cells that carry out the reaction. Then have students share their findings with the class.

- Have students complete the Questions on page xxx of the Student Book.

**DIFFERENTIATED INSTRUCTION**

- Allow students to present their research results about anabolic and catabolic reactions in a manner of their choosing. Visual learners may prefer flow charts, diagrams, and compare-and-contrast graphic organizers, while auditory learners may use oral summaries or recordings. Kinesthetic learners may prefer to develop a small model.

**ENGLISH LANGUAGE LEARNERS**

- When discussing anabolism and catabolism, provide visual aids to clarify the difference between the two. For example, connect some interlocking building blocks when describing anabolism, and disassemble the blocks when discussing catabolism.

**9.2 What and How Much We Need to Eat**

**OVERALL EXPECTATIONS:** A1; E3

**SPECIFIC EXPECTATIONS**

**Scientific Investigation Skills:** A1.1; A1.3; A1.7; A1.10; A1.13

**Understanding Basic Concepts:** E3.2, E3.4

**VOCABULARY**

- hormone
- triglyceride
- vitamin
- mineral

**ASSESSMENT RESOURCES**

Assessment Rubric 2: Thinking and Investigating
Assessment Summary 2: Thinking and Investigating

**PROGRAM RESOURCES**

Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

**RELATED RESOURCES**


**EVIDENCE OF LEARNING**

Look for evidence that students can

- name the three essential nutrients and explain their role in the maintenance of good health
- explain that vitamins, minerals, and water are also necessary for maintenance of good health
- explain how a balance between energy input and energy output results in a healthy weight

**SCIENCE BACKGROUND**

- Carbohydrates are the body’s main source of glucose which is broken down during cellular respiration. Some excess glucose is stored as glycogen, however most excess glucose is stored in adipose (fat) cells. Proteins and lipids can be broken down to produce glucose when carbohydrate stores are low and do not yield as much ATP. The amino acids used to produce glucose are taken from muscle protein which can lead to muscle loss.

- Lipids are part of a healthy diet. Lecithin and cholesterol are part of the cell membrane, adipose stores vitamins and energy, cushions organs, and insulates the body. Saturated fats and cholesterol promote brain development in infants and toddlers. However, in adolescents and adults, high saturated and trans fat consumption can contribute to heart attacks and strokes.

- Vitamin and mineral deficiencies include scurvy (vitamin C), rickets (vitamin D), and iron-deficient anemia. Excess sodium intake can lead to high blood pressure. High
doses of vitamins A and D can be toxic. Vitamins and minerals are best absorbed from whole foods. Caution should be taken with supplements to prevent overdoses.

POSSIBLE MISCONCEPTIONS
Identify: Students might think that all fats are bad for them.
Clarify: There are different types of fats, and some of them are good for us. The types of fats we eat are more important than the amount of fats we eat. Saturated and trans fats increase the risk of many diseases. However, unsaturated fats can actually lower the risk of heart disease, and our bodies need fat to perform vital functions such as the absorption of certain vitamins.

Ask What They Think Now: At the end of this discussion, ask, How should your food choices change? (Sample answer: I should add a fruit or vegetable to every meal.)

TEACHING NOTES

ENGAGE
• Engage students’ interest by having them create a class list or menu of the items that are part of a healthy diet and those that are not.

EXPLORE AND EXPLAIN
• Have students create a four column chart that summarizes the information on carbohydrates, proteins and lipids. Have students label column 1 “nutrient,” column 2 “structure,” column 3 “function,” and column 4 “examples.” Review the charts as a class.
• Have students create a poster that describes the function of one vitamin and one mineral in the human body. The poster should include pictures of the foods where the vitamin and mineral are found as well as information on the risks of deficiency and overdose of the vitamin and mineral. Students should share their findings with the class. Create a class list of foods students should eat in order to incorporate the vitamins and minerals into their diets.
• Have students calculate their body mass index (BMI). Students do not have to share the result with the class. Explain to students that BMI is a useful tool for screening for weight problems such as obesity, anorexia, and bulimia. Be aware that eating disorders can be a sensitive subject for some students, depending on their personal histories.
• Lead the class in creating a triple Venn diagram comparing and contrasting the behaviors, symptoms, and health risks associated with obesity, anorexia, and bulimia.

EXTEND AND ASSESS
• Have students apply what they learned about metabolism and nutrition by keeping a daily food and activity diary for one or two days. Students should log every food and beverage that they consume, along with the approximate calories and nutrients found in the food. They can find this information by examining the nutritional labels on the items they consume or the ingredients used to make the items. In many cases, this information can easily be found online. Students should also keep track of all physical activity they do, and use the Internet to determine the approximate number of calories they burned with each activity. Students should compare the calories they consumed with the calories they burn. Have students analyze their eating and exercise habits. Students should determine if they consume an adequate amount of calories, nutrients, vitamins, and minerals and if they engage in enough physical activity. Students should identify their healthy habits and develop a plan for improving in areas where they are deficient.
• Have students complete the Questions on page xxx of the Student Book.

DIFFERENTIATED INSTRUCTION
• Have students work in groups to create a presentation for young children about what constitutes a healthy diet. Their presentation method should address the needs of all styles of learners. Kinesthetic learners can use model kits to help them distinguish between the different types of molecules. Visual learners can develop graphic organizers with pictures of foods that contain the different nutrients the body needs.

ENGLISH LANGUAGE LEARNERS
• Canada’s Food Guide has been translated into a number of different languages including Arabic, Chinese, Farsi, and Spanish. Provide English language learners with copies of the Food Guide in their native language. Suggest that they also customize the Food Guide to their own culture’s diet.

9.3 Introducing Digestion

OVERALL EXPECTATIONS: A1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.2; E3.4

The full Overall and Specific Expectations are listed on pages xx–x.

VOCABULARY
• gastrovascular cavity
• gastrointestinal tract (GI tract)
ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Summary 1: Knowledge and Understanding

PROGRAM RESOURCES
BLM XXX Compare and Contrast Chart
BLM XXX Concept Map
BLM 9.3-1: Comparing Digestive Systems
Skills Handbook 1. Safe Science
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• name the major functions of digestion
• explain that animal diets vary depending on size, complexity, habitat, and diet
• explain that the human digestive system is a complete tube with two openings through which food is processed to obtain nutrients

SCIENCE BACKGROUND
• Invertebrate digestive systems are relatively simple. Cnidarians and flatworms have a gastrovascular cavity with just one opening. Every cell lining the cavity is involved in digestion, absorption, and circulation. Roundworms, earthworms, mollusks, arthropods, and echinoderms have digestive systems with two openings. There are also specialized regions along their digestive tracts such as a pharynx, gizzard, stomach, and intestines. These regions are specialized for ingestion, storage, digestion, absorption, or elimination.
• Vertebrate digestive systems are highly specialized and show adaptations related to diet. All vertebrates ingest and process food in the mouth, store and digest food in the stomach, digest and absorb nutrients in the small intestines, and concentrate and eliminate wastes in the large intestine and rectum. The diets of different mammals are shown in their digestive systems. For example, herbivores eat foods that have high amounts of cellulose. These animals have a four chambered stomach and a large cecum which allows the animal to regurgitate food, which they chew and swallow again. Carnivores have short intestines because the food they eat is easier to digest.

TEACHING NOTES

ENGAGE
• Engage students’ interest by providing them with models or images of the digestive systems of a human, another vertebrate, and an invertebrate. Challenge them to name as many organs from each system as they can, and to compare and contrast the appearance of each system.

EXPLORE AND EXPLAIN
• As a class, have students use BLM XXX: Compare and Contrast Chart to summarize animal digestive systems. The chart should include jellyfish and hydras, earthworms, and a few vertebrates in order to have a broad comparison of digestive systems. Tell students to include whether the digestive system has one opening or two, the digestive organs in each organism, and the functions of each of the digestive organs.
• Have students complete BLM XXX: Concept Map to show how the different systems of the human body rely on the digestive system. Tell students to use “digestive system” as the central term, and to connect it to other body systems and list how each system relies on the digestive system.
• Have students complete BLM 9.3-1: Comparing Digestive Systems.

EXTEND AND ASSESS
• Divide the class into groups of two or three, and have each group research and present to the class information about one of the organs shown in Figure 4 on page xx of the Student Book. Presentations should include the main function of the organ, how its function contributes to the function of one or more of the other organs shown in the figure, and what can happen to a person if the organ functions abnormally or becomes diseased.
• Have students complete the Questions on page xxx of the Student Book.

DIFFERENTIATED INSTRUCTION
• In small groups, have students examine a plastic bag and a hose. They can manipulate, discuss, draw, and record on paper how the two different objects can be used in the digestion process.
• Encourage students to use different formats to present the information they find about their assigned organ. For example, interpersonal and auditory learners may wish to present their research results by teaching a lesson to the class. Visual and kinesthetic learners may prefer to create informative posters, flow charts, or three-dimensional models.

ENGLISH LANGUAGE LEARNERS
• Explain to students that the difference between gastrovascular and gastrointestinal can be discerned based on their word roots. Both terms contain the root
gaster/ gastros, which is Greek for stomach. Vas/ vasculum is Latin for vessel. Gastrovascular, therefore, refers to a stomach that is like a vessel or container. Intestinal refers to the intestines (from the Latin intestinus, meaning internal) and therefore refers to a stomach that connects to the intestines.

9.4 Digestion in the Mouth and Stomach

OVERALL EXPECTATIONS: A1; A2; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.3; A1.7
Career Exploration: A2.1; A2.2
Relating Science to Technology, Society, and the Environment: E1.2
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.2; E3.4

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
• enzyme
• amylase
• mucus
• esophagus
• peristalsis
• sphincter
• gastrin
• pepsin
• ulcer

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

PROGRAM RESOURCES
Skills Handbook 3: Scientific Inquiry Skills
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES


EVIDENCE OF LEARNING
Look for evidence that students can
• explain that food exits the mouth and enters the esophagus after it is swallowed
• explain that physical and chemical digestion begin in the mouth through chewing and with the action of amylase
• explain that food is both chemically digested and stored in the stomach
• explain the roles of gastric juice, mucus, gastrin, and pepsin in digestion
• explain that most ulcers are caused by the presence of H. pylori bacteria in the stomach

SCIENCE BACKGROUND
• Mammals have heterodont dentition, meaning there is more than one type of tooth in their mouths. The fibrous plant matter that herbivores eat must be ground up by broad flat molars before the bacteria in their stomachs can further digest it. The canine teeth of carnivorous mammals only cut and slice their prey as their digestive enzymes can easily digest animal cells. Human teeth show an omnivorous pattern. We have moderately developed canines and molars.
• Saliva is secreted when taste buds and olfactory neurons send a signal to the brain. In response, the brain triggers the release of saliva. Acidic solutions stimulate the highest rate of salivation.
• The first phase of swallowing is voluntary while the second phase is involuntary. The tongue, soft palate, and pharynx are all involved in voluntary swallowing. Peristalsis in the esophagus is involuntary. The epiglottis prevents food from entering the trachea during swallowing.
• There are three types of secretory cells in the mucosa of the stomach: mucus secreting cells, parietal cells, and chief cells. Parietal cells secrete hydrochloric acid and chief cells secrete pepsin. Stomach acid converts pepsin into pepsinogen, denatures food proteins, and kills harmful microorganisms. Some beneficial microorganisms pass through the stomach and enter and colonize the intestines.
• H. pylori is a harmful microorganism that is able to tolerate the acidity of the stomach. About 20 % of people under 40 and 50 % of people over 50 are colonized by H. pylori.

TEACHING NOTES
ENGAGE
• To engage students’ interests discuss the statement “Form determines function.” Discuss as a class how the anatomy
of an organ can be used to determine how that organ works. Explain to the class that digestive organs provide an opportunity to study the relationship between form and function. For example, the small intestine is long and slender to maximize the surface area available for absorption of nutrients from the food that passes through it.

**EXPLORE AND EXPLAIN**

- Divide students into pairs and have each pair create a flow chart that shows the events of swallowing and identifies the role of each part of the mouth in swallowing and in beginning the digestion process.
- As a class create a concept map that summarizes digestion in the stomach. The map should include how gastric juice, hydrochloric acid, chief cells, parietal cells, mucus producing cells, stomach muscles, and sphincters all play a role in digestion.

**EXTEND AND ASSESS**

- Have students research the case of Alexis St. Martin and describe the discoveries about digestion that Dr. William Beaumont made while caring for him. St. Martin was a 19th-century Canadian voyageur who received an abdominal gunshot wound that removed muscle and ribs and healed in such a way that left a hole exposing the interior of the stomach. Beaumont was a surgeon in the U.S. army, stationed at a nearby fort. After nursing St. Martin back to health, Beaumont used St. Martin’s wound to directly study the function of the digestive system.
- Divide the class into small groups. Each group should select a disorder that affects the stomach and research it further. Have students use the information they obtain to create a presentation that identifies the illness or disorder, its symptoms, causes, treatment, and prognosis, and people at risk for the disorder. Stomach disorders include ulcers, acid reflux, gastritis, hiatal hernia, and gastric cancer. Once completed the students should present their results to the class.
- Have students complete the Questions on page xxx of the Student Book.

**DIFFERENTIATED INSTRUCTION**

- Use a model to help the class, especially visual and kinesthetic learners, better understand the process of peristalsis. Provide students with tube socks or pantyhose that have been cut so that both ends are open, and tennis balls. Challenge students to move the ball through the tube without handling the ball. They should be able to determine that the ball will move through the tube if they repeatedly squeeze the tube just behind the ball. Explain that this process models peristalsis.
- Kinesthetic learners can act out the steps that occur as food is digested in the stomach, with different students taking on different roles. Auditory learners may want to make an audio recording of the summary of each of the steps in the digestive process.

**ENGLISH LANGUAGE LEARNERS**

- Permit English language learners to conduct research using sources in their native languages, as long as their final presentation is in English.

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**9.5 Digestion in the Small and Large Intestines**

**OVERALL EXPECTATIONS:** A1; E1; E2; E3

**SPECIFIC EXPECTATIONS**

**Scientific Investigation Skills:** A1.1; A1.3, A1.5; A1.6; A1.8; A1.10
**Relating Science to Technology, Society, and the Environment:** E1.2
**Developing Skills of Investigation and Communication:** E2.1
**Understanding Basic Concepts:** E3.2; E3.4

*The full Overall and Specific Expectations are listed on pages xx–x.*

**VOCABULARY**

- duodenum
- villus
- microvillus
- lacteal
- secretin
- trypsin
- enterokinase
- lipases
- bile
- passive transport
- diffusion
- concentration gradient
- osmosis
- facilitated diffusion
- active transport
- cecum
- colon
- rectum
- anus
- egestion
- feces
- endoscopy

**SKILLS**

<table>
<thead>
<tr>
<th>Controlling Variables</th>
<th>Analyzing</th>
</tr>
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<tbody>
<tr>
<td>Performing</td>
<td>Evaluating</td>
</tr>
<tr>
<td>Observing</td>
<td>Communicating</td>
</tr>
</tbody>
</table>
EQUIPMENT AND MATERIALS
per student:
• eye protection
• lab apron
• 5 cm X 5 cm piece of corrugated cardboard
• ruler
• 6 test tubes
• dissolved gelatin
• unpasteurized juices or fresh fruits: apple, orange, kiwi, pineapple, papaya

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

PROGRAM RESOURCES
BLM XXX Concept Map
BLM 9.5-1: Optional Mini-Investigation: Diffusion
BLM 9.5-2: Review of the Human Digestive System
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• explain that most digestion takes place in the duodenum in the small intestine through the action of bile, hormones, and many pancreatic and liver enzymes.
• explain that villi and microvilli greatly increase the surface area of the small intestine for absorption
• explain the roles of the jejunum, ileum and colon, rectum, and anus
• explain the differences between active and passive transport

SCIENCE BACKGROUND
• It is estimated that the surface area of the human small intestine is 300 m². (The average home in Ontario is approximately 400 m².) The surface of the mucosa lining the small intestine has a hairy or fuzzy appearance due to the presence of microvilli. This fuzzy surface is referred to as the brush border.
• The accessory organs of the digestive system secrete enzymes into the duodenum. The pancreatic enzymes break down proteins, polysaccharides, and lipids into smaller molecules. Digestion is completed by brush border enzymes, which are located within the plasma membranes of the microvilli. Gallstones form when some of the components of bile harden into pebbles. Gallstones may produce mild symptoms such as abdominal discomfort. The stones may also leave the gallbladder and enter one of the ducts that lead to the small intestine. This is very painful and may require surgical removal of the gall bladder. People without a gall bladder lose the ability to store bile but can still produce bile in the liver.
• Microorganisms in the large intestine play a key role in human health. New research suggests people with type 1 diabetes, irritable bowel syndrome, and obesity have altered populations of microorganisms in their colon. The human colon evolved to digest food that is high in fiber. Low dietary fiber intake slows the passage of food through the colon and is associated with colon cancer. Colon cancer is the second leading cause of cancer deaths in Canada, after lung cancer.

TEACHING NOTES
ENGAGE
• Engage students’ interest with a demonstration that simulates the action of bile salts. Add a few drops of oil to a small beaker half-full of water. Instruct the students to observe the interaction of water and oil as you swirl the beaker. Next, add a few drops of detergent and swirl the beaker again. Ask, How does the interaction of oil and water change once the detergent is added? (The oil breaks into small droplets that mix with the water). Explain to students that bile salts in the small intestine act like a detergent and emulsify large drops of oil into smaller droplets. Once emulsified the droplets mix with the water in the small intestine and become completely digested.

EXPLORE AND EXPLAIN
• Have students complete Mini-Investigation: Explore Surface Area.

MINI-INVESTIGATION: EXPLORE SURFACE AREA
Skills: Observing, Analyzing, Evaluating, Communicating
Purpose: Students will demonstrate how to increase surface area in a limited space.
Equipment and Materials (per group): 5 cm X 5 cm piece of corrugated cardboard
Notes
• Remind students that area is calculated by multiplying length x width
• As a class, use BLM XXX Concept Map to summarize digestion in the small intestine. Include the structures, cells, enzymes, and hormones active in the small intestines.
• Review the role that the pancreas plays in digestion and discuss why it is referred to as an accessory organ. (The pancreas is referred to as an accessory organ because, though it plays a role in digestion, it is not physically part of the alimentary canal.) Lead students in creating a chart that summarizes the role of each organ.
• Have students complete Mini-Investigation: Chemical Reactions with Fruit Juice!

MINI-INVESTIGATION: CHEMICAL REACTIONS WITH FRUIT JUICE!

Skills: Controlling Variables, Performing, Observing, Analyzing, Communicating

Purpose: Students will test fruit juices for the presence of digestive enzymes.

Equipment and Materials: Per student: eye protection; lab apron; Per group: 6 test tubes, dissolved gelatin, unpasteurized juices or fresh fruits: apple, orange, kiwi, pineapple, papaya.

Student Safety:
• Caution students that they must not eat or drink anything in the lab unless specifically given permission.
• Students need to always be wearing their lab apron and safety goggles when working with chemicals.

Notes
• Make sure to use fresh, unpasteurized juices or fresh fruit. The fruit enzymes are destroyed by heat during canning and pasteurization.
• Pineapples contain the enzyme bromelain and papayas contain the enzyme papain. Both enzymes are proteolytic, so they aid in the digestion of proteins.
• To save time, prepare the gelatin just prior to beginning the activity. However, do not prepare it any earlier or it may begin to set.
• Use a more concentrated gelatin mix (about half of the water recommended on the package) to create a firmer gel.
• Students may not understand the purpose of observing the setting of the gel. Stress that the setting of the gel is NOT the chemical reaction they are observing. The reaction they are observing is the action of enzymes on the protein that causes the gel to set. Therefore, the absence of setting is evidence of the reaction. If enzymes are present to degrade the protein, the gel will not set. If enzymes are not present, as in the case of the control, the gel will set.

• Discuss the mechanisms of cell transport. Challenge students to identify which substances move through diffusion, osmosis, or active transport.
• Have students complete BLM 9.5-1 Optional Mini-Investigation: Diffusion.
• As a class research how endoscopes are used to study the colon and to perform surgery. Ask, Why would procedures using an endoscope be preferable to invasive procedures like surgery? (They create smaller wounds or no wounds at all, and patients would experience less pain and shorter recovery times.)

EXTEND AND ASSESS
• As a class, create a chart to summarize all of the information learned about digestive organs. Have students label column one “organ”, column two “physical
digestion, chemical digestion or both”, and column 3 “anatomy of organ.”
• Use BLM 9.5-2: Review of the Human Digestive System to help students review what they have learned.
• Have students complete the Questions on page xxx of the Student Book.

DIFFERENTIATED INSTRUCTION
• Have students work in pairs to develop a model of the processes of osmosis and diffusion. Auditory learners may wish to develop a podcast or mnemonic. Visual learners may wish to create an illustration, flow chart, or organizer. Kinesthetic learners may wish to put together a skit or demonstration.
• Visual and auditory learners will benefit from seeing narrated video of endoscopic scans. This will help them better visualize the inner workings of the digestive system.

ENGLISH LANGUAGE LEARNERS
• Use a variety of visual aids to demonstrate abstract concepts such as diffusion and osmosis in order to reinforce the concepts without relying too heavily on language. Examples of visual aids include watching food colouring disperse through water, or spraying a fine mist of water and watching the droplets disperse through the air.

9.6 Nausea, Vomiting and Diarrhea

OVERALL EXPECTATIONS: A1; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.3; A1.7; A1.9
Relating Science to Technology, Society, and the Environment: E1.2
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.2; E3.4

The full Overall and Specific Expectations are listed on pages xx-x.

SKILLS
Researching Evaluating

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding Assessment Rubric 2: Thinking and Investigation Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

OTHER PROGRAM RESOURCES
Skills Handbook 1. Safe Science
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• explain that vomiting and diarrhea can be beneficial by eliminating toxic or foreign substances, and harmful by causing dehydration.
• explain that diarrhea is often caused by an infection

SCIENCE BACKGROUND
• The term “stomach flu” is not a medical diagnosis. Stomach flu is actually gastroenteritis, which is inflammation of the stomach and intestines. Symptoms of gastroenteritis include diarrhea, abdominal pain, vomiting, headache, fever, and chills. Most people recover without medical treatment in a few days.
• Gastroenteritis can be caused by a virus, parasite, or bacterium in either food or water. Cholera, traveler’s diarrhea, rotavirus, and typhoid fever are just a few of the thousands of infections that can be caused by drinking contaminated water. There are many governmental and charitable organizations that work to bring clean drinking water to everyone.

POSSIBLE MISCONCEPTIONS
Identify: Students may not understand that vomiting and diarrhea can be protective to human health.
Clarify: Explain that vomiting and diarrhea can flush toxins and microorganisms out of the digestive system.
Ask What They Think Now: At the end of this discussion, ask, Why do you think we have developed this response to infection or poisoning? (It helps get harmful substances out of the body).
• Ask, Why do doctors recommend that people drink a lot of fluids when they are experiencing vomiting or diarrhea? (Vomiting and diarrhea remove a lot of fluids from the body and cause dehydration and the loss of electrolytes, which can be very harmful or fatal if untreated.)
• Lead students in creating a two-column chart about the underlying causes of food poisoning described in the section. In the first column, ask students to list the source of the bacterial infection. (Sample answer: water or food contaminated by feces). In the second column, have them list possible ways to prevent the infection. (Sample answers: thoroughly washing and cooking food, inspections of facilities where food is processed or prepared)
• Have students complete Research This: Diarrhea as Cause of Death.

EXPLORE AND EXPLAIN
• Explain to students that vomiting and diarrhea are symptoms of an underlying disease or disorder. Ask, Why do you think we have developed this response to infection or poisoning? (It helps get harmful substances out of the body).
• Ask, Why do doctors recommend that people drink a lot of fluids when they are experiencing vomiting or diarrhea? (Vomiting and diarrhea remove a lot of fluids from the body and cause dehydration and the loss of electrolytes, which can be very harmful or fatal if untreated.)
• Lead students in creating a two-column chart about the underlying causes of food poisoning described in the section. In the first column, ask students to list the source of the bacterial infection. (Sample answer: water or food contaminated by feces). In the second column, have them list possible ways to prevent the infection. (Sample answers: thoroughly washing and cooking food, inspections of facilities where food is processed or prepared)
• Have students complete Research This: Diarrhea as Cause of Death.

RESEARCH THIS: DIARRHEA AS CAUSE OF DEATH
Skills: Researching, Evaluating
Purpose: Students will research how diarrhea threatens health, how rates of diarrhea related deaths vary worldwide, and some reasons for the persistent threat of deaths caused by diarrhea.
Notes
• Students can work individually on this assignment.

EXTEND AND ASSESS
• Divide students into small groups and assign each group a microorganism that causes food poisoning. Have them create a poster about the microorganism including pictures of the microorganism, the disease it causes, symptoms of infection, foods linked to outbreaks of the disease, how the disease is treated, and any outbreaks of the disease that have occurred in Canada. Once completed students should present their findings to the class.
• Extend the Research This: Diarrhea as Cause of Death activity by discussing how access to clean water can reduce diarrheal deaths worldwide. Introduce students to the work of Canadian organizations such as WaterCan, OK Clean Water Project, and global organizations such as UNICEF and Sanitation and Water for All.
• Have students complete the Questions on page xxx of the Student Book.

DIFFERENTIATED INSTRUCTION
• Have students create newscasts reporting the events surrounding the Walkerton, Ontario E. coli outbreak. Allow students to work in multi-modal groups and contribute according to their personal strengths. For
example, kinesthetic and auditory learners could act out the newscast, visual learners could create charts or other visual aids, and auditory learners could write the script.

ENGLISH LANGUAGE LEARNERS
• Many of the terms used in this section have complicated spellings and/or pronunciations, such as diarrhea, Salmonella, Campylobacter, and Listeria monocytogenes. Provide phonetic spellings and pronunciation guides for such terms.

9.7 Biology Journal: Scientific Detective Work

OVERALL EXPECTATIONS: A1; E1; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9; A1.11
Relating Science to Technology, Society, and the Environment: E1.1; E1.2
Understanding Basic Concepts: E3.4

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website, www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

TEACHING NOTES
• Lead the class in listing the living conditions in London that may have contributed to the outbreak and spread of cholera. As an extension, students can research the living conditions of areas where Cholera is currently a health risk. This is a major problem in developing countries, especially following natural disasters such as the earthquake and torrential rains in Haiti, and flooding in Pakistan in 2010.
• Have students work in groups to discuss the reasoning behind each of the pieces of evidence listed for Snow’s theory.

DIFFERENTIATED INSTRUCTION
• As a multi-modal activity, have students conduct research and then participate in a debate on the theories of how cholera spread. Have students get into character, including Snow, Pacini, Koch, Londoners, and politicians in order to enhance their understanding and internalization of the situation.

ENGLISH LANGUAGE LEARNERS
• Provide struggling readers and English language learners with the reading assignment one or two days before the lesson so that they have time to read ahead on their own and make any necessary translations and prepare questions about the text.

9.5.1 Controlled Experiment: Factors Affecting the Digestion of Starch

OVERALL EXPECTATIONS: A1

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.2; A1.4; A1.5; A1.6; A1.8; A1.10; A1.11; A1.12

The full Overall and Specific Expectations are listed on pages xx–xx.

SKILLS
Hypothesizing Observing
Predicting Analyzing
Controlling Variables Evaluating
Performing Communicating

EQUIPMENT AND MATERIALS
per student:
• apron
• chemical safety goggles
per group:
• masking tape
• pen or permanent marker
• 8 test tubes
• test tube rack
• test tube tongs
• ice water bath (0ºC)
• room-temperature-waterbath
• warm-water bath (37ºC)
• hot water bath (90ºC)
• boiling-water bath

STUDENT SAFETY
• Remind students to follow all safety procedures.
• Remind students to wear eye protection and an apron for the entire investigation.
• Remind students to be careful with hot surfaces.
• Warn students that NaOH and HCl are both corrosive and can cause severe burns.

ASSESSMENT RESOURCES
Assessment Rubric 5: Investigation
Assessment Summary 5: Investigation
Self-Assessment Checklist 1: Investigation

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• develop a testable hypothesis about the effects of temperature and pH on amylase activity
• perform an experiment testing their hypothesis
• collect and interpret data
• formulate a conclusion about how temperature and pH affect the activity of amylase

SCIENCE BACKGROUND
• Enzymes are organic catalysts that speed up reactions without being affected by the reaction. Every enzyme is substrate specific; the quaternary structure of the protein regulates how it binds to its target. The enzyme and substrate fit together like a lock and key.
• Enzyme activity is affected by a few factors. Temperature, pH, and concentration are all factors that influence the activity of an enzyme. Most enzymes in the human body catalyze reactions optimally at 37 ºC which is normal body temperature. The optimal pH varies depending on the organ in which the enzymes are acting. Enzymes in the stomach function in an acidic pH while enzymes in the small intestine work best in a basic solution. The set of conditions that allow an enzyme to function most efficiently is referred to as the enzyme’s functional range.

TEACHING NOTES
TESTABLE QUESTION
• Discuss the Testable Question as a class. Ask, How can we design an experiment to answer the testable question? (We can set up test tubes with starch and amylase in them and vary the temperature or pH in each test tube.).

HYPOTHESIS/PREDICTION
• Make sure the hypothesis is a prediction written as a statement, along with a reason for the prediction. Sample hypothesis/prediction:
  • If human body temperature is 37ºC, then the test tube heated to 37ºC should have the greatest amylase activity. It should have the highest amount of sugar and turn orange-red when Benedict’s solution is added.
  • If the pH of the human small intestine is alkaline then the test tube with a pH of 8 should have the greatest amylase activity. It should have the highest amount of sugar and turn orange-red when Benedict’s solution is added.

VARIABLES
• Ask, What factors are we testing when we set up this experiment? (temperature, pH)
• Ask, What outcome do we expect to observe at the end of the procedure? (a color change in the test tubes)
• Explain to students that temperature and pH are the independent variables and the amount of starch digestion is the dependent variable.

EXPERIMENTAL DESIGN
• Discuss the results that students are expecting to observe. Ask, Why is it necessary to test temperature and pH separately? (If temperature and pH are varied in the same tube, then it is not possible to determine if the results obtained are due to the pH or the temperature.)

EQUIPMENT AND MATERIALS
• Test tubes with sugar in them instead of starch can be set up ahead of time to demonstrate the color changes observed with Benedict’s solution.
• Students can set up control test tubes without starch inside.

PROCEDURE
• If time is limited you may wish to set up part of this experiment as a demonstration. It is also possible to assign each student group a single temperature or pH and then pool the results once each group has completed their experiment.

OBSERVATIONS
• Student can create a chart in their lab books to record their observations.

DIFFERENTIATED INSTRUCTION
• Allow students to work in groups and to contribute according to their personal learning styles. For example, visual learners can describe observations, verbal learners can record the results, and logical learners can analyze and interpret the results. Each student should be encouraged to enhance their findings in their lab report in a manner of their choice. Visual learners may wish to include additional diagrams and auditory learners may wish to include an oral presentation or podcast.

ENGLISH LANGUAGE LEARNERS
• To help English language learners understand the procedure, have the class read through the procedures together, pantomiming each step before beginning the investigation.

RELATED RESOURCES

SUMMARY QUESTIONS
• Have students review the key concepts and starting points on page XX of the student book. Revisit the K-W-L charts the students wrote at the beginning of the chapter. Ask, What have you learned about digestion and nutrition? Instruct students to fill in the third column of the chart. Discuss the charts as a class.
• Ask, Why is it important to have a healthy diet? How can you ensure you are getting all the nutrients you need? Why is physical activity part of a healthy lifestyle? (Sample answer: It is important to eat a healthy diet so that our bodies have all the raw materials needed for growth, repair, and maintenance. We must eat a variety of foods and avoid processed, refined, and fast foods. Physical activity is important because it strengthens the body and helps to increase the metabolic rate.)
• Ask, What are the main and accessory organs of digestion? How does digestion happen in each of these organs? (The main organs of digestion are the mouth, esophagus, stomach, small intestine, and large intestine. The accessory organs are the pancreas, liver, and gallbladder. Physical and chemical digestion occurs in the mouth, chemical digestion occurs in the stomach, chemical digestion and absorption of nutrients happens in the small intestine, absorption of water, concentration of waste and production of vitamins occur in the large intestine.)
• Ask, What are some disorders and diseases of the digestive system? What is one tool doctors can use to study the digestive system? (Nausea, vomiting, diarrhea, ulcers, acid reflux, gastroenteritis, colon cancer, and stomach cancer are all disorders or diseases of the digestive system. Doctors can use an endoscope to study the inside of the digestive system non-invasively.)
• Have students select a non-western culture or region and research the diet of the people in that area. Students should evaluate the similarities and differences between their diet and the diet they are investigating. Students should consider whether the diet they are studying has any nutritional deficiencies or if the diet is healthier than their own. Students should present their findings to the class and decide if the diets of some cultures are healthier than others.
• Ask, What are the risks of undernutrition and overnutrition? (Undernutrition can result in low body weight and vitamin and mineral deficiencies while overnutrition can lead to obesity and vitamin and mineral overdoses).
• Discuss as a class what constitutes an appropriate diet for someone their age. In order to consolidate all learning students should write a persuasive essay explaining what they consider an appropriate diet. Remind students to use specific examples to support their opinions.

CAREER PATHWAYS
• Explain to students that many careers are available to someone with a degree in Biology. Have students look at the concept map on page XX of the student book. Poll the class to determine who would be interested in the careers shown on the map. Have students choose one career and research the daily responsibilities of someone with that career.

DIFFERENTIATED INSTRUCTION
• To engage all learners, conduct a trivia-style review session. In addition to the teachers questions, have students develop questions of their own. The review session should allow students to answer the questions in a variety of ways, including drawing pictures to explain their answers or pointing to models or posters in the classroom.
• Students should be allowed to work in small groups to review the chapter material using their learning styles. Visual learners could create graphic organizers to share with others, auditory learners could create sample questions and answers, and kinesthetic learners could create hands on activities to review concepts.

ENGLISH LANGUAGE LEARNERS
• Have English language learners revisit the vocabulary cards they have been creating throughout the chapter.
**MINI INVESTIGATION: MODELLING BREATHING IN A SINGLE LUNG**

**Skills:** Performing, Observing, Analyzing, Evaluating, Communicating

**Purpose:** Students will build, analyze, and evaluate a model that demonstrates how the diaphragm changes lung volume during inhalation and exhalation.

**Equipment and Materials (per group):** 2 L clear pop bottle with bottom cut off; balloon; glass or vinyl tubing; one-hole rubber stopper; a tied balloon with the top cut off; rubber band (or masking tape)

**Notes**
- You can build a sample before this activity so that students can see an example of the final product.
- To prevent student injury, you may choose to assemble the portion containing the glass or vinyl tubing in advance.

**DIFFERENTIATED INSTRUCTION**

- Have students create a presentation that uses their lung models to explain the role of the diaphragm to an audience of younger students. Have students develop their lessons to include a visual, auditory, and kinesthetic portion to engage their young learners.
- You may want to have students who are interested in computers set up a class blog, wiki, or website for posting reports, lab results, presentations, images, videos, links, and other forms of information.

**ENGLISH LANGUAGE LEARNERS**

- Have students create flashcards for all of the vocabulary terms they encounter throughout the chapter. Each card should include the term, its description or definition, and the word translated into the student’s native language.
The Need for a Respiratory System

OVERALL EXPECTATIONS: A1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.11
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.1

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
• aerobic cellular respiration
• phosphorylation
• gas exchange
• ventilation

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Summary 1: Knowledge and Understanding

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• explain that all plants and animals require oxygen during cellular respiration in order to release the energy stored in food
• explain that carbon dioxide and water are the waste products of cellular respiration
• explain that ventilation brings a continuous supply of air to the lungs
• explain that gas exchange occurs in the lungs as well as in the body cells

SCIENCE BACKGROUND
• The purpose of aerobic cellular respiration is to break down fuel molecules (primarily glucose) through a series of chemical reactions in order to harvest stored energy.

Cellular respiration is typically discussed in conjunction with glycolysis, during which a glucose molecule is split into smaller molecules called pyruvate. In aerobic respiration, those molecules move to the mitochondrial matrix where they enter the Krebs Cycle. During the Krebs Cycle, the pyruvates undergo further reactions that yield energy (in the form of ATP) and carbon dioxide. Electrons released during the reactions of both glycolysis and the Krebs Cycle are carried to the mitochondrial membrane, where they pass through the electron transport chain. As electrons progress along the electron transport chain, they release energy that is captured and stored in the form of ATP. Although ATP is also produced during glycolysis and the Krebs Cycle, the vast majority of ATP is produced during the electron transport chain.

POSSIBLE MISCONCEPTIONS
Identify: Students might not understand that plants use cellular respiration to obtain energy from glucose.
Clarify: Emphasize that plants make food that they use for cellular respiration through the process of photosynthesis.
Ask What They Think Now: At the end of this discussion, ask, How do plants obtain the food needed for cellular respiration? (They make their own food through photosynthesis and use that food for cellular respiration.)

TEACHING NOTES
ENGAGE
• Challenge students to lean against the wall with their knees bent at a 90° angle as though they were sitting in a chair. Hold a contest to see who can hold the position for the longest period of time. Ask, How do your legs feel? (Sample answers: tired, sore, weak) Explain to students that muscle cells use oxygen to obtain energy from food, and during this activity their muscles were not getting enough oxygen to keep up with the demand from the cells. As a result, their muscles felt weak and sore.

EXPLORE AND EXPLAIN
• Write the equation for cellular respiration on the board. Instruct students to work in groups to write a description that describes the process of cellular respiration.
• Ask, How does a cell store the energy yielded during respiration? (It stores the energy in the bonds of ATP, which it creates through phosphorylation.)
• Ask, Why do multicellular organisms have special respiratory organs such as lungs? (Multicellular organisms have special organs such as lungs because many of their cells do not come in contact with air or water and must have the oxygen brought to them.)
• Ask, Where does gas exchange occur in mammals? (Gas exchange occurs in both the lungs and the body cells. In the lungs, oxygen diffuses from the air into the blood...
stream, and carbon dioxide diffuses from the bloodstream into the air. Cells also exchange gases in the same way, except that there is tissue fluid between the bloodstream and the cells, so gases must also diffuse through the tissue fluid.

**EXTEND AND ASSESS**

- Have students research anaerobic respiration and fermentation. Compare and contrast them with aerobic respiration.
- Have students complete the Questions on page xxx of the Student Book.

**DIFFERENTIATED INSTRUCTION**

- To appeal to visual and kinesthetic learners, have the class work in groups to build ball-and-stick models of the reactants and products of cellular respiration. Have students disassemble the reactants and use the “atoms” to assemble the products of the reaction. Have students record their reactions using both words and graphics.
- Have auditory learners orally describe the difference between anaerobic and aerobic respiration.

**ENGLISH LANGUAGE LEARNERS**

- English language learners may struggle with written or verbal descriptions of a complex process such as cellular respiration. Refer often to the formula for respiration, as well as molecular models of the reactants and products, in order to reinforce the concepts non-verbally.

**OVERALL EXPECTATIONS**: A1; E1; E2; E3

**SPECIFIC EXPECTATIONS**

- Scientific Investigation Skills: A1.1
- Relating Science to Technology, Society, and the Environment: E1.1
- Developing Skills of Investigation and Communication: E2.1
- Understanding Basic Concepts: E3.1

*The full Overall and Specific Expectations are listed on pages xx–xx.*

**VOCABULARY**

- diaphragm
- external intercostal muscles
- internal intercostal muscles
- pleural membrane
- pneumothorax
- total lung capacity
- tidal volume
- inspiratory reserve volume
- expiratory reserve volume
- residual volume
- vital capacity
- VO_2
- VO_2 max

**ASSESSMENT RESOURCES**

- Assessment Rubric 1: Knowledge and Understanding
- Assessment Summary 1: Knowledge and Understanding

**PROGRAM RESOURCES**

- BLM XXX Concept Map
- BLM XX Two-Column Table
- BLM XX Compare and Contrast Chart
- BLM 10.2-1 Respiratory Structures and Processes
- Biology 11 ExamView® Test Bank
- Biology 11 Online Teacher’s Centre
- Biology 11 website
  - www.nelson.com/onseniorscience/Biology11u

**RELATED RESOURCES**

- DVD. *Bill Nye, the Science Guy: Respiration.* Disney, 2009.

**EVIDENCE OF LEARNING**

- Look for evidence that students can:
  - explain that the respiratory and circulatory systems deliver oxygen to the body’s cells and remove carbon dioxide from the body’s cells
  - explain how volume and pressure changes in the chest result in air either entering or exiting the lungs
  - explain that tidal volume is the volume of air used during normal breathing
  - explain that VO_2 is the rate at which oxygen is used by the body and that it can be measured directly and indirectly
  - explain that fish and other aquatic organisms use gills to extract oxygen from water

**SCIENCE BACKGROUND**

- The organs of the respiratory system either conduct air in and out of the body or facilitate gas exchange. The nose, mouth, pharynx, trachea, bronchi, and bronchioles are part of the conducting zone. These organs are passages for air to enter and exit the body. Gas exchange only occurs at the alveoli within the lungs.
There are a number of ways to quantify the amount of air in the lungs. Total lung capacity is the maximum amount of air in the lungs after an inhalation. Total lung capacity (TLC) is about 6 L for males and about 5 L for females.

Some forms of lung capacity can be measured while others are calculated. Tidal volume, residual volume, inspiratory reserve volume, and expiratory reserve volume can all be measured through the use of a spirometer. A spirometer is a machine that can measure and record various data when a patient breathes into the attached mouthpiece. Total lung capacity and vital capacity are calculated from measurements of lung volume. Total lung capacity is the sum of vital capacity and residual volume; vital capacity is the sum of inspiratory reserve volume, tidal volume, and expiratory reserve volume. However, performing these calculations is rarely necessary because spirometers can calculate these values from the measurements taken.

All of the air inhaled is not available for gas exchange. About 350 mL of a tidal inhalation reach the alveoli. The remaining 150 mL stays in the airways.

A variety of gas exchange mechanisms have evolved in animals. Fish obtain oxygen through gills and countercurrent exchange, amphibians conduct gas exchange across their moist skin, insects obtain oxygen through tracheal tubes in their exoskeletons, and mammals inhale and exhale with lungs.

TEACHING NOTES

ENGAGE
- Engage students’ interest by discussing the sport of freediving. Encourage students to find pictures and videos of freedivers. If possible, show video footage of someone freediving. Explain that freedivers are able to hold their breath for several minutes, often because they hyperventilate before diving. This practice rids the lungs of carbon dioxide and eliminates the physical urge to rush to the surface for a breath of air. Emphasize that such a practice can easily cause a person to black out and drown, or can starve the brain of oxygen and cause permanent brain damage.

EXPLORE AND EXPLAIN
- As a class, have students use BLM XXX Concept Map to summarize the location and function of each respiratory organ.
- Ask, What characteristics of the alveoli make them ideal for gas exchange? (The cells of the alveoli are moist, they have a thin membrane, and they have a rich blood supply.) Why are these characteristics necessary? (These characteristics are necessary because oxygen cannot diffuse across the respiratory membrane if it is not dissolved in a liquid. A high blood supply allows for a good exchange of gases.)

- Have students press their hands firmly on their ribs as they try to inhale. Ask, How did it feel to inhale this way? (Sample answer: It was difficult to inhale when my hands were pressing on my ribs.) Discuss as a class the role of the ribs and diaphragm in ventilation.
- Distribute copies of BLM XX Two-Column Table and have students use it to summarize the information on lung volumes. The first column should be labeled “Lung volumes” and the second column “Description and Percent of Total Lung Capacity.”
- Ask, What are VO2 and VO2max? (VO2 is the amount of oxygen delivered to the body in a given time and VO2max is the maximum amount of oxygen a person can use during sustained activity.) Explain to students that after completing Investigation 10.2.2: The Relationship Between Long-Term Exercise and Vital Capacity, they will be able to evaluate their own VO2.
- Have students look at Figures 9 and 10 on page XX of the Student Book. As a class, develop a definition for the term countercurrent. Use BLM XX Compare and Contrast Chart to compare and contrast gas exchange in fish and humans.

EXTEND AND ASSESS
- Have students select and do research on an organism that is not covered in the chapter. They should then explain to the class how gas exchange occurs in that organism.
- Distribute copies of BLM 10.2-1 Respiratory Structures and Processes. Have students complete the activity.
- Have students complete the Questions on page xxx of the Student Book.

UNIT TASK BOOKMARK
Remind students that what they have learned about lung capacity and gas exchange in this section will be useful when they complete the Unit Task.

DIFFERENTIATED INSTRUCTION
- Have students work individually or in groups to model the concept of countercurrent. Encourage students to select their modelling methods according to their strengths. Visual learners may prefer a written or graphic description, while a kinesthetic learner may prefer a two- or three-dimensional visual aid or pantomime.

ENGLISH LANGUAGE LEARNERS
- Due to the large amount of vocabulary terms associated with this section, suggest that English language learners read the section a day or two before class in order to identify terms or concepts that are particularly confusing. Encourage students to write down and submit questions before class so that you can address the issues during lecture or class discussions.
10.3 Transport and Diffusion of Gases

OVERALL EXPECTATIONS: A1; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9
Relating Science to Technology, Society, and the Environment: E1.2
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.1

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
• partial pressure
• plasma
• hemoglobin

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

PROGRAM RESOURCES
BLM 10.3-1 Gas Exchange and The Effects of Altitude on Respiration
BLM XX Compare and Contrast Chart
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• explain that the atmosphere is 20.9% oxygen and 0.04% carbon dioxide
• explain that gases diffuse in the body from areas of higher partial pressure to areas of lower partial pressure
• explain how oxygen and carbon dioxide are transported in the blood
• explain how carbon dioxide transport regulates blood pH
• explain how the respiratory centre of the brain and the concentration of carbon dioxide in the blood affect breathing rate and depth

SCIENCE BACKGROUND
• Hemoglobin is composed of four protein chains (globins) and four heme groups. In the center of the heme group is an iron molecule which binds up to four oxygen molecules. When oxyhemoglobin releases its oxygen it is called deoxyhemoglobin. Reserved oxygen in the blood meets the increased need for oxygen during exercise. It can also provide oxygen for 4 to 5 minutes if breathing is stopped or if the heart stops pumping blood.
• Hypoxia is a chronic shortage of oxygen to the body’s cells. When a person rapidly travels from low to high elevation they may experience hypoxia. Mild hypoxia can begin at an altitude of about 1,600 meters. Symptoms include shortness of breath, headaches, fatigue, dizziness, confusion, vomiting, and a lack of coordination. The most serious effects of hypoxia are blood clots, coma, and death. Moving to lower elevation is the most effective way to treat hypoxia. People born at higher elevations can develop lifelong adaptations such as greater lung capacity, a larger left ventricle of the heart, a higher red blood cell count, and an increased number of capillaries. Some athletes choose to live at high altitude in order to develop some of these adaptations, however they are not permanent and will disappear after a few weeks or months at a lower elevation.

POSSIBLE MISCONCEPTIONS
Identify: Students might not understand that the partial pressure of oxygen, not the actual proportion of oxygen in the air, changes at high altitudes.
Clarify: Emphasize that the concentration of oxygen is the same in all levels of the atmosphere. Explain that the decrease in atmospheric pressure at high altitudes results in less available oxygen for respiration.
Ask What They Think Now: At the end of the discussion ask, Why is it difficult to breathe at high altitudes? (It is difficult to breathe at high altitudes because air pressure is lower. This decreases the amount of available oxygen to the body.)

TEACHING NOTES
ENGAGE
• Engage students’ interest with an activity. Have students sit quietly while observing their breathing. Encourage students to consider how deeply they are breathing, how much air they are inhaling, and how far their chest expands when they inhale. Ask, Did your breathing change when you thought about it? (Sample answer: My breathing became slower and fuller when I thought about it.) Explain that breathing is an involuntary action controlled by the brain, but that we have some degree of voluntary control over how fast and deep we breathe.
• Invite students who have visited areas at relatively high or low altitudes to discuss how the change in elevation affected their breathing.

• Draw students’ attention to Figure 2 on page XX of the Student Book. Ask, *Are there bubbles in an unopened can of pop? Why not?* (When the pop is sealed in a can, air pressure keeps the gas dissolved. Opening the can exposes the pop to air, which has a different partial pressure than the gas in the pop, so the dissolved gas rises to make the pressure in the pop equal to the pressure in the air above it.)

• Divide the class into small groups and have each group prepare a poster that depicts gas exchange in the lungs and the body cells. The posters should include the direction that oxygen and carbon dioxide diffuse, the way they are transported (plasma, hemoglobin, carbonic acid), and the pressure gradients present in the lungs and body cells.

• Challenge students to use Figure 1 on page XX of the Student Book to determine the partial pressure of oxygen at the top Mt. Logan (20.9% of 53kPa = 11 kPa is the partial pressure of oxygen at 6000m).

• Distribute copies of *BLM 10.3-1 Gas Exchange and The Effects of Altitude on Respiration*. Have students complete the activity.

• Ask, *Can you die from holding your breath?* (No, breathing is an involuntary action. You can only override the brain for a short period of time.)

• Distribute copies of *BLM XX Compare and Contrast Chart*. Use the graphic organizer to compare and contrast how carbon dioxide and oxygen levels are maintained in the human body.

**EXTEND AND ASSESS**

• Challenge students to conduct research and write a brief explanation of why passengers on commercial jets are able to breathe normally at high altitudes.

• Have students complete the *Questions* on page xxx of the Student Book.

**UNIT TASK BOOKMARK**

Remind students that what they have learned about how the body regulates oxygen and carbon dioxide levels in this section will be useful when they complete the *Unit Task*.

**DIFFERENTIATED INSTRUCTION**

• Provide, or have students create and manipulate visual, tactile, or computer-generated representations of the different forms of hemoglobin. Provide oxygen molecules and encourage students to describe and record in their preferred method how oxygen molecules bind to hemoglobin.

• Visual learners can create a visual representation of the partial pressure of gases using different coloured Styrofoam balls.

**ENGLISH LANGUAGE LEARNERS**

• Have students work in pairs to read the material in this section. After each subtopic, have the class summarize and discuss what they have read. Write important points on the board or chart paper so that students understand what information is important, and can focus on comprehending those points.

**10.4 Interference with Gas Exchange**

**OVERALL EXPECTATIONS:** A1; A2; E1; E2; E3

**SPECIFIC EXPECTATIONS**

Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9

Career Exploration: A2.1

Relating Science to Technology, Society, and the Environment: E1.1; E1.2

Developing Skills of Investigation and Communication: E2.1

Understanding Basic Concepts: E3.1; E3.4

The full Overall and Specific Expectations are listed on pages xx–xx.

**VOCABULARY**

• asthma
• chronic obstructive pulmonary disease (COPD)
• tuberculosis (TB)
• pneumonia

**ASSESSMENT RESOURCES**

Assessment Rubric 1: Knowledge and Understanding

Assessment Rubric 4: Application

Assessment Summary 1: Knowledge and Understanding

Assessment Summary 4: Application

**PROGRAM RESOURCES**


*Biology 11 ExamView® Test Bank*

*Biology 11 Online Teacher’s Centre*

*Biology 11 website*

www.nelson.com/onseniorscience/Biology11u

**RELATED RESOURCES**


**EVIDENCE OF LEARNING**

Look for evidence that students can
• explain that respiratory diseases or disorders can affect either the amount of airflow into the lungs, the process of gas exchange, or both
• describe how asthma, COPD, infectious diseases, cystic fibrosis, and cigarette smoking affect ventilation and gas exchange

SCIENCE BACKGROUND
• According to Lung Cancer Canada, 45,000 Canadians die of smoking-related causes each year. Besides numerous cancers, smoking can cause lung diseases such as asthma and COPD. A recent report from the Canadian Thoracic Society revealed that COPD is the leading cause of hospital admissions due to chronic conditions, and that COPD-related hospital admissions cost more than $1.5 billion each year. Furthermore, COPD is currently the only chronic disease with an increasing mortality rate.
• Quitting smoking does lead to a reduction in the risk of developing many smoking-related diseases. 10 to 15 years after quitting, the life-expectancy of ex-smokers is the same as non-smokers. The risks for laryngeal, oral, and esophageal cancer also return to normal after 10-15 years. The heart recovers even faster; a year after quitting, the risk of heart disease drops dramatically.
• There are two types of lung cancer: small cell and non-small cell. Small cell lung cancer (SCLC) is the most aggressive form and accounts for about 20% of all lung cancer cases. Smoking is almost always the cause of SCLC; about 99% of SCLC cases are in smokers. Non-small cell lung cancer (NSCLC) accounts for 80% of lung cancer diagnoses and can be caused by smoking as well as other factors.

POSSIBLE MISCONCEPTIONS
Identify: Students might not understand that smoking causes other health problems besides lung cancer.
Clarify: Emphasize that smoking can also cause COPD, bronchitis, emphysema, and asthma, and can contribute to other conditions such as coronary artery disease.
Ask What They Think Now: At the end of the discussion ask, What are the harmful effects of smoking? (Smoking can cause lung cancer, COPD, bronchitis, emphysema and asthma.)

TEACHING NOTES
ENGAGE
• Ask for volunteers to share any experiences they have had with asthma or other respiratory illnesses. Explain that asthma attacks are often described as feeling as though one is breathing through a small straw. Distribute drinking straws and have students breathe through the straws for 15 to 20 seconds, then have them pair with a partner to discuss how difficult it was to breathe through a straw. Warn students that if they begin to feel dizzy or lightheaded, they should stop the activity immediately.

EXPLORE AND EXPLAIN
• Divide the class into 6 groups. Assign each group one of the disorders discussed in this section and have them research it further. Tell the students that they are physicians who specialize in the disorder and that they will teach their classmates about the disorder. Have students prepare a presentation that describes the causes, symptoms, and treatments of the disorder. Students should explain how the disorder interferes with gas exchange and how the patient is affected by the disorder.
• Write the names of all of the organ systems on the board. As a class research how smoking negatively affects every organ system in the body. Post the list of effects in the classroom.

EXTEND AND ASSESS
• Have students research occupations that pose a risk to respiratory health. Discuss measures workers can take to protect their lungs.
• Have students complete the Questions on page xxx of the Student Book.

UNIT TASK BOOKMARK
Remind students that what they have learned about how respiratory diseases affect lung function in this section will be useful when they complete the Unit Task.

DIFFERENTIATED INSTRUCTION
• Kinesthetic and auditory learners can develop their reports into formats that include public service announcements, commercials, or skits, while visual learners can create pamphlets, posters, or blog postings.
• Auditory and visual learners would benefit from guest speakers with knowledge of a respiratory disease such as a local doctor or health-care provider.

ENGLISH LANGUAGE LEARNERS
• Prior to the lesson, visit a local clinic or health department and request some pamphlets that are written in other languages in order to aid English language learners in their research. There are also online resources you may recommend. For example, the Canadian Lung Association has information about TB in several languages on their website, and the entire website is available in French.

OVERALL EXPECTATIONS: A1; A2; E1; E2; E3
SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9
Career Exploration: A2.1
Relating Science to Technology, Society, and the Environment: E1.1; E1.2
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.1; E3.4

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
• FLAP inhibitors
• bronchial thermoplasty
• lung transplant

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• describe how new techniques such as FLAP inhibitors, bronchial thermoplasty, and artificial external lungs have improved the quality of life for people with respiratory disorders
• explain how a lung transplant is performed as well as the risks and benefits of a lung transplant

SCIENCE BACKGROUND
• Transplanted tissue is detected by the immune system as foreign. Cells that are transplanted do not carry the same major histocompatibility complex (MHC) markers that a person’s own cells have. Whenever foreign MHC markers are detected, an immune response begins. Cytotoxic T-cells attack transplanted cells. Tissue and organ rejection is prevented through the use of immune-suppressing drugs and antibiotics. A 75% MHC marker match between donor and recipient usually results in a successful transplant.

TEACHING NOTES
ENGAGE
• Engage students’ interest by showing images of an iron lung and

EXPLORE AND EXPLAIN
• Have students create a three-way Venn diagram to compare and contrast traditional asthma treatments with the use of FLAP inhibitors and bronchial thermoplasty.
• Ask, How does the iLA Membrane Ventilator mimic gas exchange in the lungs? (Sample answer: It provides an artificial membrane that allows carbon dioxide to pass into empty tubes, and oxygen to pass from the tubes into the blood.)
• Show the class documentary video footage of a lung transplant. (An excellent video is available on the website run by the Columbia University Department of Surgery.) Lead students in creating a list of the major steps involved in the procedure and the possible risks and complications. Be sure to warn students if the video is particularly graphic.

EXTEND AND ASSESS
• Have students research the quality of life of a lung transplant recipient. Students should identify the medications taken by transplant recipients as well as the signs of organ rejection.
• Show students news articles or documentary footage of the Toronto XVIVO Lung Perfusion System that was pioneered at Toronto General Hospital. This technique makes it possible for doctors to sustain and repair damaged donated lungs that would otherwise be unusable for transplantation.
• Have students complete the Questions on page xxx of the Student Book.

DIFFERENTIATED INSTRUCTION
• Have students research and create a commercial advertisement or public service announcement promoting a treatment or preventive measure for a respiratory disease. They may promote their treatment in any way they choose—for example posters for visual learners, radio advertisements for auditory learners, and a skit for kinesthetic learners. Promotions should include the nature of the condition, the treatment, and the risks and benefits of the treatment.

ENGLISH LANGUAGE LEARNERS
• Use the Internet, medical texts, or other resources to obtain visual aids for the conditions and technologies described in this section.
OVERALL EXPECTATIONS: A1; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9, A1.10, A1.11
Relating Science to Technology, Society, and the Environment: E1.2
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.4

The full Overall and Specific Expectations are listed on pages xx–x.

SKILLS
Researching Communicating
Analyzing the Issue Evaluating
Defending a Decision

ASSESSMENT RESOURCES
Assessment Rubric 6: Explore an Issue
Assessment Summary 6: Explore an Issue
Self-Assessment Checklist 2: Explore an Issue

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• explain the issues surrounding access to health care for individuals who develop smoking-related diseases
• assess the values of various stakeholders such as smokers, non-smokers, physicians, and the federal government
• develop solutions to the issue
• communicate their opinions and solutions

SCIENCE BACKGROUND
• In 2009, Ontario became the third Canadian province to sue tobacco companies on behalf of its taxpayers. Their reasoning, like those of plaintiffs in previous cases, is that the tobacco industry knew about the risks associated with smoking for decades and did not inform the public. As a result, some believe they are now responsible for the medical bills of long-term smokers. The Ontario lawsuit is seeking 50 billion dollars from various tobacco companies. Defendants, however, have countered that Canadian plaintiffs have no right to sue for such damages, as they are already receiving funds for medical treatment from the taxes used to support universal healthcare.

TEACHING NOTES

THE ISSUE
• As a class, write a statement that identifies the issue. For example, Is it ethical to withhold medical treatment from smokers who continue to smoke? Ask, Who has a stake in this issue? (Sample answers: smokers, their families, physicians, non-smokers, taxpayers, and hospital administrators) Discuss how each stakeholder is affected by this issue.

GOAL
• To help students anticipate the influences that would determine each committee member’s stance, lead the class in brainstorming the likely motives and priorities of each member. For example, a doctor would be concerned with helping each patient that needs treatment, but an economist would likely focus on the financial burden placed on the healthcare system.

RESEARCH
• Write the names of all of the committee members on the board. Write the point of view of each committee member on the board next to their names. Discuss the point of view of each committee member. Ask, Do any of the committee members’ points of view coincide with your own? (Sample answer: I tend to feel the same way as the economist; I worry that all of the extra medical costs are going to be too much for the healthcare system to bear.)
• In the Student Book, students are told to work in groups of five or six, with each member researching the role of one committee member. Consider assigning roles to each student rather than allowing them to choose roles within their groups. This will allow you to ensure that as many different positions as possible are covered by the class.
• Give the groups time to draft a statement that supports their solution. Remind students that their statements should be written from the point of view of the committee member they represent and should be supported by evidence. This will help them to direct their research efforts towards supporting their position.

IDENTIFY SOLUTIONS
• Have students choose a solution from those listed in the student text or come up with an alternative solution. List all of the solutions on the board.

MAKE A DECISION
• Poll the class about which solution they think is the most appropriate.

**COMMUNICATE**
• Reconvene and have each team present their solution to the class.
• Debate each team’s proposal and then vote again. Ask, *How has your opinion changed as a result of this activity?* (Sample answer: I now feel sympathetic towards smokers as I now see smoking addiction as a medical condition that requires treatment.)

**PLAN FOR ACTION**
• Use the result of the class vote to draft a set of recommendations to send to Health Canada.

**DIFFERENTIATED INSTRUCTION**
• Visual learners can gather or develop smoking-related statistics and post graphical representations of health care costs and other data related to smoking to post in the class.
• Kinaesthetic and auditory learners could carry out a survey to determine public opinion concerning healthcare costs and smoking.

**ENGLISH LANGUAGE LEARNERS**
• Try to assign English language learners to groups that have one or more members who are particularly strong readers or speakers. Encourage students to help one another conduct their research and write and present their proposals. Provide plenty of time for students to practice their speaking parts before making their presentations.

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**Investigations**

**10.2.1 Observational Study:**
**Determining Lung Volume and Oxygen Consumption**

**OVERALL EXPECTATIONS:** A1; E1; E2; E3

**SPECIFIC EXPECTATIONS**

*Scientific Investigation Skills: A1.1; A1.2; A1.4; A1.5; A1.6; A1.8; A1.10; A1.11; A1.12; A1.13*

*Relating Science to Technology, Society, and the Environment: E1.1*

*Developing Skills of Investigation and Communication: E2.1; E2.3*

*Understanding Basic Concepts: E3.1*

The full Overall and Specific Expectations are listed on pages xx–xx.

**SKILLS**

Planning | Analyzing
Performing | Evaluating
Observing | Communicating

**EQUIPMENT AND MATERIALS**

per student:
• spirometer
• disposable mouthpiece
• stopwatch
• bathroom scale
• measured racetrack or GPS

**ASSESSMENT RESOURCES**

Assessment Rubric 5: Investigation
Assessment Summary 5: Investigation
Self-Assessment Checklist 1: Investigation

**PROGRAM RESOURCES**

*Biology 11 ExamView® Test Bank*
*Biology 11 Online Teacher’s Centre*
*Biology 11 website*
www.nelson.com/onseniorscience/Biology11u

**RELATED RESOURCES**


**EVIDENCE OF LEARNING**

Look for evidence that students can
• use a spirometer to measure their lung capacity at rest
• calculate the rate at which oxygen is used in their bodies (VO₂)
• calculate the maximum amount of oxygen that their bodies can use during sustained, intense physical activity (VO₂max)

**SCIENCE BACKGROUND**

• Pulmonary function tests can be used to diagnose lung diseases such as asthma, bronchitis and emphysema. These tests also assess lung function after an exposure to contaminants. Spirometry is useful for diagnosing lung diseases because it measures airflow. Emphysema and chronic bronchitis cause too much air to be contained in the lungs while scarring caused by asbestosis makes the lungs smaller leading to too little air in the lungs. These differences in lung volume can be measured with a spirometer.
• VO₂ measures the rate at which oxygen is consumed in the body when at rest. VO₂max is the maximum oxygen consumption and it measures the maximum rate at which oxygen can be used by the body. VO₂max is used as an
indicator of cardiovascular fitness. VO\textsubscript{2}max can be obtained directly by measuring gas consumption or calculated from other measurements.

- Athletes train to increase their VO\textsubscript{2}max so that more oxygen can be delivered to their tissues. Genetics, age, gender, and cardiovascular fitness all influence VO\textsubscript{2}max. Among athletes, cross-country skiers, cyclists, and runners have the highest VO\textsubscript{2} max. The record for males is 96.0 ml/kg/min and the record for females is 78.6 ml/kg/min.

**TEACHING NOTES**

**PURPOSE**
- The purpose of Part A is to measure lung capacity using a spirometer. The purpose of Part B and Part C is to assess cardiovascular fitness by calculating VO\textsubscript{2} and VO\textsubscript{2}max.

**EQUIPMENT AND MATERIALS**
- Provide students with access to a computer spreadsheet program to analyze and present their data.

**PROCEDURE**
- Remind students to pinch their nose shut and exhale through their mouths into the spirometer.
- Remind students that they should not be sharing mouthpieces. They should each use their own disposable mouthpiece.
- If students feel dizzy at any time while using the spirometer, they should stop immediately.

**OBSERVATIONS**
- The average tidal volume is about 500 mL for males and 390 mL for females. The average vital capacity for males is 4.6 L and 3.6 L for females. Forced exhalation volume is about 80% of vital capacity.

**DIFFERENTIATED INSTRUCTION**
- Demonstrate the use of a spirometer for visual learners. Make sure students can see exactly how you are using the spirometer. Narrate your demonstration to support auditory learners.

**ENGLISH LANGUAGE LEARNERS**
- Explain to students that the term VO\textsubscript{2}max is pronounced *vee-oh-too-max*, rather than *voh-too-max* or *vee-oh-too-em-ay eks*.

**10.2.2 Correlational Study: The Relationship between Long-Term Exercise and Vital Capacity**

**OVERALL EXPECTATIONS:** A1; E2; E3

**SPECIFIC EXPECTATIONS**

**Scientific Investigation Skills:** A1.5; A1.6; A1.8; A1.10; A1.11; A1.12; A1.13

**Developing Skills of Investigation and Communication:** E2.1

**Understanding Basic Concepts:** E3.1

*The full Overall and Specific Expectations are listed on pages xx–xx.*

**SKILLS**
- Hypothesizing
- Observing
- Predicting
- Analyzing
- Planning
- Evaluating
- Controlling Variables
- Communicating
- Performing

**EQUIPMENT AND MATERIALS**
- per group:
  - raw data
  - computer with a spreadsheet program

**ASSESSMENT RESOURCES**
- Assessment Rubric 5: Investigation
- Assessment Summary 5: Investigation
- Self-Assessment Checklist 1: Investigation

**PROGRAM RESOURCES**
- Biology 11 ExamView® Test Bank
- Biology 11 Online Teacher’s Centre
- Biology 11 website
  - www.nelson.com/onseniorscience/Biology11u

**RELATED RESOURCES**

**EVIDENCE OF LEARNING**
- Look for evidence that students can
  - assess the factors that affect vital capacity and predict the relationship between regular exercise and vital capacity and gender and vital capacity
  - use spreadsheet software to determine whether a correlation exists between two sets of raw data

**SCIENCE BACKGROUND**
- Vital capacity (VC) is determined by adding the sum of an individual’s tidal volume, inspiratory reserve volume, and expiratory reserve volume. It represents the total amount of air exchanged by the lung, and should amount to at least 80 percent of an individual’s total lung capacity. The average VC for a young, healthy male is
4800 ml, and is 3100 ml for a young, healthy female. Some of the factors besides lifestyle that influence VC are chest cavity volume and age. It is estimated that, after the age of 20, an individual’s VC declines by 5 to 20 percent every 10 years. VC is sometimes used in predicting life expectancy.

TEACHING NOTES

PURPOSE
• To help students understand the purpose of their investigation, ask, *How might showing a correlation between lifestyle and vital lung capacity be useful?* (Sample answer: Doctors could use it to convince patients that there are clear benefits to exercising regularly.)

VARIABLES
• Emphasize to students that they are testing only one of the factors that can affect an individual’s vital capacity. Ask, *Why would we want to avoid testing more than one factor at once?* (We would not be able to determine which factor was responsible for any changes in vital capacity.)

STUDY DESIGN
• Before groups begin analyzing their data, guide the class in reviewing the raw data to identify apparent trends that may be confirmed by their analyses.

EQUIPMENT AND MATERIALS
• Many software programs have tutorials or help features. Familiarize yourself with the program your students will be using so that you can direct them to these resources.

PROCEDURE
• Consider creating spreadsheet templates for students so that they do not have to decide how to organize their data, and can simply enter their raw data in a pre-determined format.

OBSERVATIONS
• Ask groups or individuals to provide a brief lab report that summarizes their group’s data and conclusions.

DIFFERENTIATED INSTRUCTION
• In addition to providing students will written instructions for determining the correlation between the variables, deliver the instructions orally by reading the procedure aloud. You should also demonstrate how to use the software by analyzing your own set of theoretical data.

ENGLISH LANGUAGE LEARNERS
• To ensure that English language learners understand the purpose of the investigation as well as their groups’ results, encourage them to try explaining each in their own words.
ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Summary 1: Knowledge and Understanding

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/Biology11u

RELATED RESOURCES
LaFontaine, Tom. “Knowing your maximal oxygen consumption is good for your health.” Running & FitNews, 2007

SUMMARY QUESTIONS
• Have students review the Key Concepts and Starting Points on page XX of the student book. Review the K-W-L charts the students wrote at the beginning of the chapter. Ask, What have you learned about gas exchange? Have students fill in the third column of the chart. Ask, Have you answered any of the questions that you wrote in the second column? Discuss the charts as a class.
• Ask, Which parts of the respiratory system bring oxygen to the lungs? (The nose, pharynx, trachea, bronchi and bronchioles carry oxygen to the alveoli.) Ask, Where does gas exchange occur? (Gas exchange occurs at the alveoli and also across the membranes of body cells.)
• Ask, What are the structural features that allow the respiratory system to function properly? (The features that allow the respiratory to function properly are a thin permeable membrane, a large surface area for gas exchange, a system for bringing oxygen to the respiratory membrane, and a good blood supply.
• Ask, What are the factors that affect lung volume? (Gender, body type, and lifestyle are all factors that affect lung volume.)
• Ask, How can you increase your lung capacity? (Exercise increases lung capacity.)
• Ask, What is one disease that decreases gas exchange? (Sample answer: Asthma decreases gas exchange by preventing oxygen from reaching the alveoli.)
• Ask, How can people with asthma benefit from new treatments. (New treatments such as FLAP inhibitors suppress inflammation without the use of corticosteroids.)
• Ask, How are non-smokers affected by cigarette smoking? (Smoking related illnesses add to the cost of health care and weaken the economy through loss of productivity. Second hand smoke also causes many health problems in non-smokers.)

CAREER PATHWAYS
• Careers that relate to the respiratory system include: respiratory therapist, pulmonologist, allergist and thoracic surgeon.

DIFFERENTIATED INSTRUCTION
• To engage all learning types, hold a review session in the format of a game show, with the class divided into competing groups. Allow students to answer in a variety of formats, including orally, in writing, using pantomime, or drawing diagrams.
• Students should create study notes employing their learning style, and share them with peers with similar styles.

ENGLISH LANGUAGE LEARNERS
• Have students revisit the vocabulary flash cards they have been making for the chapter. Suggest that they practice using each of the terms in a sentence.
The Circulatory System

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u/

TEACHING NOTES
• Have students examine the Chapter Opener photograph. Ask, What are these students doing? (learning to use EADs and administer CPR)
• Ask if any students have participated in such a training course. Have them describe situations in which they may need to use such knowledge.

ENGAGE THE LEARNER

CHAPTER INTRODUCTION
• To preview the major ideas that will be explored in the chapter, review the Key Concepts. Ask a student volunteer to read each Key Concept aloud before it is discussed. Ask prompting questions to assess students’ prior knowledge and to engage students in the topics. Examples are given:
  1. What is the function of the circulatory system? (It carries oxygen, nutrients, and other substances to and from the cells of organisms.)
  2. What are the main organs and tissues that make up the circulatory system? (blood, blood vessels, heart)
  3. How do oxygen and the other substances we need move through our bodies? (They are carried with the blood, which is pumped by the heart through the network of vessels.)
  4. How does exercise affect heart rate? (It increases it.) Why? (Muscles need more oxygen, so the heart pumps faster to supply them with extra oxygen.)
  5. What conditions can interfere with the functions of the circulatory system? (hypertension, some infections, diabetes, arteriosclerosis)
  6. How do we diagnose and treat diseases of the circulatory system? (track symptoms, blood tests, CT, PET, and MRI scans)
  7. What can people do to ensure the healthy functioning of their own circulatory system? (stop smoking, eat right, exercise)
• Collect and keep student responses to revisit during the Chapter Summary exercises.
• Ask students to think about scenes from television shows or movies and the manner in which heart attack victims are portrayed. Facilitate a group a discussion of the popular beliefs surrounding heart disease and its treatment.
• Explain to students that CPR training is conducted by certified professionals and is available for minimal cost through agencies such as the Canadian Red Cross. Obtain a training mannequin similar to that in the photograph, and let students examine it. Ask their opinions about the look and feel of the model, and their feelings about conducting CPR on a human being.
• Have students complete the Starting Points questions. Collect their answers and keep them to reference at the end of the chapter.
• Obtain an automated external defibrillator (AED) and demonstrate its use for the class. Discuss with students the places where the devices are typically found, their appropriate use, and the dangers of misuse.
• Have students complete Mini Investigation: Under Pressure!

MINI INVESTIGATION: UNDER PRESSURE!
Skills: Performing, Observing, Analyzing.
Purpose: Students will learn to use common tools to measure blood pressure.
Equipment and Materials (per pair): sphygmomanometer; stethoscope
Student Safety
• Remind students to simply turn the valve and release pressure if their partner feels the blood pressure cuff is uncomfortably tight.
Notes
• Make sure students understand that arm placement during the test is important. They should relax the arm and rest it on a table.
• If students do not have experience with a stethoscope, have them practice listening to their own heartbeat before conducting the investigation.

DIFFERENTIATED INSTRUCTION
• Have students work in groups to create a presentation informing the public of the symptoms of a heart attack and what to do if someone has a heart attack. To engage different learning styles provide a variety of options for the format of the presentation, such as a skit, public service announcement, or illustrated pamphlet.
• You may want to have students who are interested in computers set up a class blog, wiki, or website for posting reports, lab results, presentations, images, videos, links, and other forms of information.

ENGLISH LANGUAGE LEARNERS
• As students read through the chapter, have them create flashcards that they can use to review the vocabulary words and any other terms they find challenging. Cards should include the term, a definition, and a phonetic pronunciation guide or translation when necessary.
11.1 The Need for a Circulatory System

OVERALL EXPECTATIONS: A1; C2; C3; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9; A1.11
Developing Skills of Investigation and Communication: C2.1; C2.2; E2.1
Understanding Basic Concepts: C3.2; E3.3

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
- hemolymph
- atrium
- ventricle
- septum
- pulmonary circuit
- systemic circuit

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Summary 1: Knowledge and Understanding

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
  www.nelson.com/on seniorscience/biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
  • discuss the functions of the circulatory system
  • list the three main features of any circulatory system
  • describe the two types of circulatory systems
  • explain the basic structure of the closed, four-chamber, two-circuit system

SCIENCE BACKGROUND
• For an organism to function properly, its health must be ensured at the cellular level. Circulatory systems are the mechanism by which nutrients are carried to all cells in the body, even those in the innermost locations. Through osmosis and diffusion, these systems also remove by-products and other harmful waste from the cells. In organisms such as the sponge, where all cells are readily in contact with nutrients in the environment, no transport system is required. In some organisms, an open circulatory system provides sufficient transport of nutrients and waste because all cells come in contact with the transport medium, or hemolymph. In more complex organisms, body structure would inhibit the flow of hemolymph to some points. Specialized tissue that provides transport directly to and from every cell in the body has evolved, allowing osmosis and diffusion to occur just as they do in single-celled organisms.

POSSIBLE MISCONCEPTIONS
Identify: Organisms with open circulatory systems do not have blood.
Clarify: In these organisms, blood and lymph are combined and known as hemolymph, which circulates throughout the body cavity and bathes all the internal organs. The appearance of hemolymph is different than blood; it may be pink or green, and often has a thicker consistency. But the basic function of blood in the hemolymph is the same as blood confined to vessels in a closed system: to carry nutrients and waste to and from the cells as necessary.
Ask What They Think Now: Ask, How do organisms with open circulatory systems supply oxygen and nutrients to their body cells? (Oxygen and nutrients are transported in the hemolymph which is a combination of blood and lymph.)

TEACHING NOTES
ENGAGE
• Display live specimens, models, or photographs of various invertebrates, insects, and other creatures. Invite students to share what they know about the physiological structure of these organisms. Suggest that they consider the animals’ skeletal structure, etc. Challenge students to guess which organisms have circulatory systems that are most like that of humans. List their ideas on the board to revisit later.

EXPLORE AND EXPLAIN
• After students have read the section, direct their attention to Figure 1 on page xx of the Student Book. Ask, What major environmental factor enables the sponge to survive without a circulatory system? (Water, because it is in contact with all of the body cells and enables osmosis and diffusion, which are necessary for cell function.)
• Draw students’ attention to Figures 2, 3, 4, and 5 on pages xx–xx of the Student Book. Ask them to draw a column chart listing the different types of circulatory systems. Have them compare and contrast the different types.
(Student charts should include open and closed types of systems and should list all four ventricle configurations as subsets of the closed type.

- Read Two-Circuit Circulatory System aloud. Draw students’ attention to Figure 6 on page xx of the Student Book. Ask, What will happen if there is an interruption in blood flow somewhere along the circuits? (If the flow is blocked, blood will not be able to move properly and the system will not work.)

**EXTEND AND ASSESS**

- Have students work in pairs to draw their own sketches of the pulmonary and systemic blood-flow circuits. Walk through the classroom to ensure that they label the parts of the system and the directions of blood flow correctly.
- Have students complete the Questions on page xxx of the Student Book.

**DIFFERENTIATED INSTRUCTION**

- Allow students to depict the flow of blood through blood-flow circuits in various formats. Kinesthetic learners can develop three-dimensional models or be given models to manipulate in order to demonstrate their understanding of the different types of circulatory systems. Auditory learners can describe the flow of blood orally, while visual learners may prefer to use a diagram or flowchart.
- Students should explain the different ways materials are circulated in a simple multicellular organism, a fish, and a larger mammals using a variety of formats. Visual learners could compare systems using a graphic organizer, Auditory learners could explain it to other students.

**ENGLISH LANGUAGE LEARNERS**

- Point out that the term circuit is also used when discussing electricity. Show students a simple circuit diagram, and ask them to describe how the electrical and biological circuits compare in appearance and function.

**11.2 Blood: A Fluid Tissue**

**OVERALL EXPECTATIONS:** A1; E1; E2; E3

**SPECIFIC EXPECTATIONS**

- **Scientific Investigation Skills:** A1.1; A1.3; A1.7; A1.9, A1.11
- **Relating Science to Technology, Society, and the Environment:** E1.1; E1.2
- **Developing Skills of Investigation and Communication:** E2.1
- **Understanding Basic Concepts:** E3.3; E3.4

**The full Overall and Specific Expectations are listed on pages xx–x.**

**VOCABULARY**

- plasma
- serum
- erythrocyte
- leukocyte
- pus
- platelet
- anemia

**ASSESSMENT RESOURCES**

Assessment Rubric 1: Knowledge and Understanding
Assessment Summary 1: Knowledge and Understanding

**PROGRAM RESOURCES**

- Biology 11 ExamView® Test Bank
- Biology 11 Online Teacher’s Centre
- Biology 11 website www.nelson.com/onseniorscience/biology11u

**RELATED RESOURCES**


**EVIDENCE OF LEARNING**

Look for evidence that students can

- describe the components of blood
- describe the components and functions of plasma
- explain the functions of red blood cells, white blood cells, and platelets
- discuss the importance of blood type and Rh factor

**SCIENCE BACKGROUND**

- As scientists have learned more about blood and its components, techniques for blood donation have become safer and more efficient. Technology now allows for donated blood to be separated via aphaeresis. In this procedure, one component of blood (platelets or plasma) is separated from whole blood and collected; the remaining components are returned to the donor’s body. Aphaeresis allows for donations to be made more frequently without harmful effects to the donor.
- The impact of the Rh factor was not fully understood until this century. When a mother and fetus have incompatible blood types, the newborn’s immune system reacts and haemolytic disease of the newborn develops. Until a treatment was developed in the 1940s, this usually resulted in the infant’s death. Now, pregnant women are tested early in their pregnancy and, when necessary, given shots of Rho(D) Immune Globulin to prevent the disease.

The Circulatory System 3
TEACHING NOTES

ENGAGE
• Ask students to think about a time that they were injured and lost blood. Ask, *What did the blood look like?* (Answers will vary.) Have students share their ideas about what blood is made of and why it has the characteristics that it does. Record their thoughts on the board.
• Remind students that scientists have been conducting research about blood for thousands of years yet still have many unanswered questions. Have them consider the questions very early researchers might have asked. Direct students to choose partners, and spend a few minutes listing questions they have about blood.

EXPLORE AND EXPLAIN
• After students have read Section 11.2, direct their attention to Figures 1, 2, and 3 on pages xx-xx of the Student Book. Point out that the dark, bottom part of the bag shown in Figure 1 contains all of the blood’s red and white cells.
• Ask, *What is the relationship between a high-sodium diet and hypertension?* (Excess salt causes more water to enter the bloodstream via osmosis. The volume of blood increases but the vessels do not.)
• Ask, *What differences are there between red and white blood cells?* (presence of nuclei, shape, color, function, location)
• Ask, *While platelets are important to help protect us from infection or loss of blood, they can also be dangerous. Why?* (Clots can block blood vessels and cause strokes or other damage.)
• Draw students’ attention to Figure 6 on page xx of the Student Book. Ask them to examine the information regarding relative quantities of the different components of blood. Ask, *Why is information about these relative amounts important?* (differences from the normal range could indicate medical issues)
• Poll the group about their blood types and compare the results to those of the general population. Students might not know their own blood type; discuss the importance of knowing this information in emergency situations.
• Explain that the “positive” or “negative” label on blood types refers to the Rhesus factor and is very important; the immune system of a patient with Rh-negative blood may reject blood that is positive for the Rh protein Tally the number of students with positive and negative blood types, and correlate the results with general trends. (Overall, 85% of people are Rh-positive and 15% are Rh-negative.)
• Ask, *Why have scientists been unable to create an effective blood substitute?* (Blood is very complex, and scientists have not been able to recreate all of the specific components of blood.)

EXTEND AND ASSESS
• Divide students into pairs. Have them quiz each other on the vocabulary words from Section 11.2.
• Have students complete the *Questions* on page xxx of the Student Book.

DIFFERENTIATED INSTRUCTION
• Ask students to work in groups to think of an analogy to illustrate the composition of blood. For example, if the human body were a concert venue, the air would be plasma, the security staff would be white blood cells, and the wait staff would be the red blood cells. Have students present their analogies to the class. Visual learners may want to draw a sketch of their analogy, auditory learners may prefer an oral presentation, and kinaesthetic learners may prefer to do a skit for the class.

ENGLISH LANGUAGE LEARNERS
• Point out to students that many of the vocabulary words in the section have roots in other languages. For example, *leuko-* and *erythro-* and *–cyte* are derived from the Greek words *leukós* (white), *erythrós* (red), and *kutos* (container, body), respectively.

11.3 Blood Vessels

OVERALL EXPECTATIONS: A1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.5; A1.6; A1.7; A1.8; A1.9; A1.10
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.3; E3.4

The full Overall and Specific Expectations are listed on pages xx–x.

VOCABULARY
• aorta
• arteriole
• vasodilation
• vasoconstriction
• venule
• systolic pressure
• diastolic pressure
• hypertension
• lymph
• lymph node
• spleen
• thymus
SKILLS
Performing  Analyzing
Observing

EQUIPMENT AND MATERIALS
per pair:
• stopwatch

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

PROGRAM RESOURCES
BLM 11.3-X Optional Research This: Blood Vessel Disorders
BLM 11.3-X Vessels and their Vocabulary
Skills Handbook 1. Safe Science
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• discuss the different types of blood vessels, including their structures and functions
• explain the value of pulse and blood pressure measurements
• understand the condition of hypertension
• describe the role of the lymphatic system and its interrelationship with the circulatory system

SCIENCE BACKGROUND
• Scientists have studied the heart and the circulatory system for hundreds of years, and had identified that arteries were distinct from veins by the 6th century BCE. (This is because blood pools in the veins after death, but not the arteries. In fact, for many centuries it was thought that the arteries carried air.) By the 2nd century AD, the differences between venous and arterial blood had been identified. In 1628, William Harvey published his theory that there must be a connection between the veins and arteries existing somewhere in the extremities. His work helped lead to the discovery of the capillary system in 1661 by Marcello Malpighi.
• The veins we see through our skin appear blue. In the past, people thought the blood in veins actually was blue because it was deoxygenated. They believed the blood turned red instantly when it left the body and reacted with oxygen. During surgery, doctors see that blood in arteries is brighter red and blood in veins is a darker, maroon color. Veins appear blue through the skin because only the higher energy blue wavelengths of the visible spectrum can penetrate through the skin and fat covering the vein. The other lower energy wavelengths are absorbed. The reflection of the blue wavelengths gives veins their characteristic blue or purplish colour.

POSSIBLE MISCONCEPTIONS
Identify: Students might believe that blood in the arteries is red while blood in the veins is blue.
Clarify: While traditionally arteries are illustrated in red and veins in blue, all blood is red. Veins do appear blue through the skin. This is because when light shines on the body, blue wavelengths penetrate and are reflected off the veins but the other wavelengths are absorbed.
Ask What They Think Now: Ask, What color is the blood in veins? (All human blood is red; blood in the veins is a darker red than blood in the arteries.)

TEACHING NOTES
ENGAGE
• Display a map of Canada. Draw students’ attention to the first paragraph of Section 11.3. Have a student point to St. John’s, Newfoundland, on the map, and then point to Victoria, British Columbia. Discuss the distance between these two cities, and the time it takes to travel between them.

EXPLORE AND EXPLAIN
• Draw students’ attention to Figure 1 on page xx of the Student Book. Ask them to try and identify the structures they see in the diagram. At the end of the lesson, you can repeat the exercise, incorporating new information they’ve learned.
• Have students complete Mini Investigation: Taking a Pulse

MINI INVESTIGATION: TAKING A PULSE
Skills: Performing, Observing, Analyzing
Purpose: Students will observe, record, and compare pulses taken at several different points on the body.
Equipment and Materials (per pair): stopwatch
Notes
• Direct students’ attention to Figure 3 on page xx of the Student Book for clarification on where the pulse points lie.
• Tell students to work quietly and not disturb others when they are counting.
• Have students take a moment to find their pulse at each point before they start their timers.
• Remind students to relax and breathe normally while taking their pulses.
• Ask, Why does a person’s skin turn red when they are exercising? (To cool itself, the body sends nerve impulses to the arterioles, which expand or dilate, moving more blood and body heat to the outside of the body.)

• Have students refer to Figures 5, 6, and 7 on page xx of the Student Book. Have them create a list of characteristics that are unique to capillaries. (single-cell layer for wall, no smooth muscles, pre-capillary sphincters, very small size)

• Ask, Are capillaries a type of artery? (No. They are not a vein, either. They are a separate type of blood vessel.)

• Draw students’ attention to Figures 8, 9, and 10 on page xx of the Student Book. Ask, How do venules and veins differ from arterioles and arteries? (They return blood to the heart, have thinner walls with less elasticity, have larger capacity, rely on surrounding muscle contractions to move blood through them, and contain valves that keep blood from flowing backward through them.)

• Remind students of the Mini Investigation they conducted as part of the Chapter Opener. Ask, Why is it important to measure both diastolic and systolic pressures? (We must make sure the circulatory system is functioning correctly both during the heart’s contractions and between them.)

• Ask, How is table salt related to hypertension? (Increased sodium in the blood causes excess water to move into the vessels by osmosis, increasing the pressure on vessel walls.)

• Draw students’ attention to Figure 13 on page xx of the Student Book. Ask, How is the lymph system related to the circulatory system? (It collects excess fluid from body tissue and moves it back into the circulatory system to help maintain a consistent volume of blood. It also helps filter out harmful microorganisms and other waste.)

• Have students complete BLM 11.3-X Optional Research This: Blood Vessel Disorders. Provide students with time to use library and internet resources to complete their research and then prepare and share their presentations.

EXTEND AND ASSESS
• Have students complete BLM 11.3-X Vessels and their Vocabulary.

• Divide students into small groups and create trivia questions regarding the important details covered in this section. Have them create and play a quiz game to review these facts.

• Have students complete the Questions on page xxx of the Student Book.

UNIT TASK BOOKMARK
Remind students that what they have learned about blood vessels in this section will be useful when they complete the Unit Task.

DIFFERENTIATED INSTRUCTION
• Divide students into small multi-modal groups or pairs, and assign each pair one of the vocabulary terms from the chapter. Have students create a brief review of the meaning and use of their term to present to the class. Encourage students to use various presentation modes, such as illustrations for visual learners, verbal descriptions for auditory learners, and demonstrations for kinaesthetic learners.

• New terms should be clearly displayed in the classroom for visual learners, and if possible sound files should be made available to auditory learners to help with pronunciation.

ENGLISH LANGUAGE LEARNERS
• Have students act out the roles of blood cells moving through sections of the circulatory system, designating areas in the classroom as locations in the human body. They can start at the heart; some students can follow the pulmonary circuit and some the systemic circuit. Have others recreate the actions of cells through the arteries, capillaries, and veins.

11.4 The Cardiac Cycle and Circulation

OVERALL EXPECTATIONS: A1; A2; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.5; A1.6; A1.7; A1.9; A1.10; A1.12
Career Exploration: A2.2
Relating Science to Technology, Society, and the Environment: E1.1; E1.2
Developing Skills of Investigation and Communication: E2.1; E2.3
Understanding Basic Concepts: E3.3; E3.4

The full Overall and Specific Expectations are listed on pages xx–xx.

VOCABULARY
• pericardium
• coronary blood vessel
• semilunar valve
• atrioventricular valve
• chordae tendineae
• cardiac cycle
• diastole
• systole
• myogenic muscle
• sinoatrial (SA) node
• atrioventricular (AV) node
The Circulatory System

SKILLS
Observing  Communicating  Analyzing

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Rubric 3: Communication
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation
Assessment Summary 3: Communication

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES
Barron’s Educational Series, 2005.

EVIDENCE OF LEARNING
Look for evidence that students can
• describe the basic structure of the heart
• trace the routes of both the pulmonary and systemic circuits
• summarize the events that take place during a cardiac cycle
• explain the importance of the stethoscope and electrocardiograph as diagnostic tools

SCIENCE BACKGROUND
• The stethoscope was invented in 1816, and was very similar to the common ear trumpet used to assist those with hearing loss. This first generation instrument was simply a wooden tube that physicians would hold against a patient’s chest to amplify heart and lung sounds. In the 1850’s, a binaural stethoscope was developed that used two earpieces. No significant changes were made to the design until 1940, when Maurice Rappaport and Howard Sprague patented a two-sided design for separate cardiac and pulmonary applications. Their fundamental design is still used today, though refinements have been made that improve sound quality and reduce interfering noise.

POSSIBLE MISCONCEPTIONS
Identify: Students may believe the heart is on the left side of the chest.
Clarify: The heart sits in the middle of the chest. The left ventricle of the heart, however, is usually the largest chamber of the heart because it pumps blood through the entire body. Because of this, the heartbeat is sometimes felt more on the left side of the chest.

Ask What They Think Now: Ask, Where does the heart sit in relation to the lungs? (centered directly in front of them)

TEACHING NOTES

ENGAGE
• Have students read the Learning Tip at the bottom of page xxx. Direct them to use one hand to find their own pulse at the carotid artery, and to clench and unclench the fist of the other hand at the same rate as their heartbeat. Have them try to keep up this clenching action as they read the section, noting at what point their hand grows tired of keeping the beat.

EXPLORE AND EXPLAIN
• After students have finished reading, discuss the results of the hand-clenching exercise above.
• Draw students’ attention to Figure 1 on page xx of the Student Book. Ask students to think back to Section 11.1. Ask, Which features are not found in the hearts of some organisms? (four distinct chambers, full septum, two circuits)
• Solicit volunteers to read Circulation aloud. As each sentence of the second paragraph is read, have students indicate the location of the action described in Figure 2 on page xx of the Student Book. Circulate through the room to ensure students understand the circuit routes.
• Have students give examples of valves that are used in everyday life. (tire valves, water faucets) Show an example of a flap-type valve similar to those found in the heart.
• Have a student volunteer read The Cardiac Cycle aloud. Direct students to follow each step in Figure 3 on page xx of the Student Book as it is read.
• Ask, What is the primary heart sound detected via a stethoscope? (closing of valves)
• Have students complete Mini Investigation: Listening to Heart Sounds

MINI INVESTIGATION: LISTENING TO HEART SOUNDS
Skills: Observing, Analyzing, Communicating
Purpose: Students will observe their own heart sounds as well as recorded normal and abnormal samples.
Equipment and Materials: stethoscope; alcohol towelette; recordings of heart sounds; mp3 or wav player; computer with speakers
Notes
• Instruct students that they are to listen only to their own heartbeats.
• Have students who are exercising move away from those who are listening through stethoscopes or to samples so no one’s work is disrupted.
• Care should be taken when cleaning stethoscopes. The earpieces should be cleaned with alcohol wipes between users, but the plastic tube should not come into contact with solvents or cleaners. These can damage the tube material.
• Draw students’ attention to Figure 4 on page xx of the Student Book. Ask, What characteristics distinguish the heart muscle from other muscles of the body? (its fibres are woven and give it extra strength, and its contractions are stimulated by internal electrical impulses instead of nerve impulses from the brain)
• Ask, How does the heart’s unique abilities help us measure its health? (The heart’s electrical impulses can be detected through sensors on the skin, then recorded and analyzed for abnormalities.)

EXTEND AND ASSESS
• Remind students of the components of a good summary. Have them write a summary of The Structure of the Heart and Circulation sections, including all vocabulary and major points.
• Have students complete the Questions on page xxx of the Student Book.

UNIT TASK BOOKMARK
Remind students that what they have learned about the cardiac cycle and circulation in this section will be useful when they complete the Unit Task.

DIFFERENTIATED INSTRUCTION
• Students should be encourage to redraw Figure 2, with auditory learners describing the path of blood through the heart and visual learners drawing the path of blood through the heart. Kinesthetic learners may wish to act out this pathway with their peers.
• To aid visual and kinesthetic learners, a model of the heart with removable labels could be displayed in class to assist with terminology.

ENGLISH LANGUAGE LEARNERS
• To help students learn the various anatomical terms associated with this section, have them create index cards for each term that include a description of the structure’s function. Then, have them use the cards to label a diagram of the circulatory system.

OVERALL EXPECTATIONS: A1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9; A1.10; A1.11
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.3; E3.4

VOCABULARY
• arteriosclerosis
• plaque
• atherosclerosis
• coronary artery disease (CAD)
• angina
• myocardial infarction
• angioplasty
• bypass surgery

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 4: Application
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 4: Application

PROGRAM RESOURCES
Biology 11 ExamView ® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES
Silverstein A., Silverstein V. Heart Disease (Gr. 7-12). Lerner Publishing Group, 2006.

EVIDENCE OF LEARNING
Look for evidence that students can
• describe the process of atherosclerosis and its impact on the circulatory system
• describe the symptoms of coronary artery disease and myocardial infarction
• discuss the methods for treating blockages to the coronary arteries
• list the lifestyle factors that can improve cardiac health

SCIENCE BACKGROUND
• Since the 1960’s, cardiac bypass surgery has become increasingly common. In cases where the blockage in a vessel cannot be removed, a new vessel is attached to allow blood flow around the clot. A double-, triple-, or quadruple-bypass may be performed, referring to the number of blocked vessels that are circumvented. Most often, the heart of a patient undergoing bypass surgery must be stopped. A heart-lung machine is then used to support the patient during the procedure.

POSSIBLE MISCONCEPTIONS
Identify: Students might believe that the term heart attack refers to a condition where the heart stops beating.
Clarify: A heart attack occurs when blood flow to the heart is slowed or stopped. The part of the heart muscle that is deprived of blood (and oxygen) is damaged, which can cause pain or other symptoms. If the blockage is not removed, the heart will indeed go into cardiac arrest and stop beating.

Ask What They Think Now: Ask, What is the difference between a heart attack and cardiac arrest? (A heart attack is caused when part of the heart muscle dies because it is deprived of oxygen; cardiac arrest means the heart has stopped altogether.)

TEACHING NOTES

ENGAGE
- Have students think about what they have learned regarding the functioning of the heart and the circulatory system. Guide a group discussion about things that could go wrong in the system. (vessel blockages, valve malfunctions, inconsistent electrical impulses) List students’ ideas on the board.

EXPLORE AND EXPLAIN
- Draw students’ attention to Figure 1 on page xx of the Student Book. Ask, Does this picture illustrate arteriosclerosis, atherosclerosis, or both? (Both; atherosclerosis is one type of arteriosclerosis and is caused by plaque build-up.)
- Ask, What are the risk factors for coronary artery disease? (high blood pressure, high cholesterol, diabetes, being overweight or obese, smoking, physical inactivity, gender, genetics, and age)
- Ask, What are the symptoms of CAD? (Often there are no symptoms, but sometimes angina is present.)
- Ask, Why is it important to minimize a person’s risk for CAD? (CAD can lead to a heart attack.)
- Ask, How are heart attacks treated, and why do these treatments work? (Angioplasty clears the blockage; bypass surgery creates a pathway around it; lifestyle changes help clear plaque from vessel walls.)
- Guide students in a discussion regarding steps they can take to minimize their own risk factors. Remind students to be sensitive when discussing these; some risk factors such as genetics are out of our control, while others are more difficult to manage than might be expected.
- Have students work in groups to research the effect of smoking on the heart and the factors that make quitting a challenge for some. Groups can research methods for quitting and prepare a presentation that might help a friend or family member.

EXTEND AND ASSESS
- Have students briefly research other diseases related to the heart and the circulatory system (such as peripheral artery disease, clotting disorders, aneurisms, etc.) then choose one to explore further and report on for the class.

Reports should include an explanation of how the disease affects functioning, as well as common symptoms and treatments.
- Have students complete the Questions on page xxx of the Student Book.

UNIT TASK BOOKMARK
Remind students that what they have learned about coronary artery disease in this section will be useful when they complete the Unit Task.

DIFFERENTIATED INSTRUCTION
- To engage interpersonal and verbal learners, have students play the role of either a heart patient or a cardiologist. Have students act out a scenario in which a patient describes their medical history (atherosclerosis, coronary artery disease, or myocardial infarction) and the doctor describes their treatment options and prognosis.

ENGLISH LANGUAGE LEARNERS
- Contact a local health clinic or the Canadian Red Cross to obtain informational pamphlets in other languages that are designed to educate the public about issues related to coronary diseases. Make the pamphlets available to students so that they can supplement the lesson with materials in their own language.
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 4: Application

PROGRAM RESOURCES
Skills Handbook 1. Safe Science
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• discuss the difference between invasive and non-invasive diagnostic tests
• explain the procedures and the positive and negative factors associated with common diagnostic imaging techniques

SCIENCE BACKGROUND
• Medical practitioners rely on many different kinds of medical imaging. Most forms of medical imaging are considered non-invasive, though the radiation to which the body is subjected during some testing can be dangerous. The x-ray is still the most commonly used type of image; it provides pictures of hard and soft tissue that enable doctors to spot medical abnormalities. Fluoroscopy involves taking x-ray pictures over time. Since this is most often used to examine soft-tissue organs, it requires the ingestion of a contrast medium. Angiography is required for the study of the blood vessels. Arteriograms (to show arteries) and venograms (to show veins) both require the introduction of an iodine compound that makes the vessels opaque. Computer tomography (CT) scans are also referred to as computed axial tomography (CAT) scans. They involve cross-sectional x-ray images that are combined using computer technology to create a two-dimensional image of the body. All of these procedures require the use of radiation, and can damage the body if overused.
• Magnetic resonance imaging (MRI) relies on high-power magnets and seems to be safe for patients. The strong magnetic fields polarize and excite the nuclei (each a single proton) of hydrogen molecules in the body. These molecules then emit a charge that can be mapped to create an image of the body. MRI scans show all types of tissue and provide valuable diagnostic information, but their use is limited by the high cost of the machines.

TEACHING NOTES
ENGAGE

• Obtain and display samples of CT, PET, or MRI films. Have students examine the images. Challenge them to identify the parts of the circulatory system they have studied in this chapter.

EXPLORE AND EXPLAIN
• Ask students to list some medical procedures they can think of that are invasive and some that are non-invasive. Ask, Why are diagnostic procedures usually non-invasive? (It might be very harmful to a patient to cut into their body if the doctor does not know what is wrong with the patient.)
• Draw students’ attention to Figure 1 on page xx of the Student Book. Ask students to point to the spot on the angiogram where they believe the blockage is located.
• Have students refer to Figures 2 and 3 on page xx of the Student Book. Ask, What are the pros and cons of CT scans? (In CT scans, high quality images are produced via a non-invasive method. However, the patient is exposed to higher levels of radiation, and the procedure is expensive.)
• Have students examine Figure 4 on page xx of the Student Book. Ask, What is the advantage of combining information from CT and PET scans? (It provides a clearer, more detailed image.)
• Point out that MRI equipment is very expensive to obtain and use. The equipment can cost a million dollars or more, and requires a large space, specialized staff, and regular maintenance. These factors limit the number of machines that are available in most communities, which drives up the cost of the procedure.
• Have students complete Research This: Doppler Ultrasound.

RESEARCH THIS: DOPPLER ULTRASOUND
Skills: Researching, Identifying Alternatives, Communicating, Evaluating
Purpose: Students will research the technology behind Doppler ultrasound, including associated risks, benefits, and costs.
Notes
• Have students work in pairs to collect the information needed for their research.
• Suggest that students create an outline to organize their research.
• Let students choose how they will communicate their findings. Examples could include newspaper articles, brochures, or posters.

EXTEND AND ASSESS
• Have students play the role of sales representatives for medical equipment companies. Instruct them to create a brochure or sales presentation for one of the technologies discussed in this section. They should discuss the benefits of the technology and the relative costs of procurement and operation of the equipment.
• Have students complete the Questions on page xxx of the Student Book.
DIFFERENTIATED INSTRUCTION
• To support visual and kinesthetic learners, as well as other students, provide a series of medical images and guide students through interpreting the two-dimensional images to assess a three-dimensional object. Auditory learners should be encouraged to discuss the images with other students.
• Student could explore the career of medical technician and create a poster, presentation or skit to describe their day, and their impact on a patient.

ENGLISH LANGUAGE LEARNERS
• Explain to students that CT scan can be pronounced see-tee skan or kat skan.

OVERALL EXPECTATIONS: A1; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.3; A1.7; A1.9; A1.10; A1.11
Relating Science to Technology, Society, and the Environment: E1.1; E1.2
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.3; E3.4

The full Overall and Specific Expectations are listed on pages xx–x.

SKILLS
Researching  Evaluating
Identifying Alternatives  Communicating
Analyzing

ASSESSMENT RESOURCES
Assessment Rubric 7: Explore an Application
Assessment Summary 7: Explore an Application
Self-Assessment Checklist 3: Explore an Application

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/on seniorscience/biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• describe the role of glucose and insulin in the body
• summarize the current and the emerging technologies for glucose monitoring and insulin delivery

SCIENCE BACKGROUND
• Diabetes was first identified in ancient times. When conducting a diagnosis, early physicians routinely tasted a patient’s urine to detect abnormalities. They noted the sweet taste of the urine of diabetic patients, and associated the disorder with a sedentary lifestyle. It was not until 1889, however, that the role of the pancreas was suggested and insulin was identified. In 1922, the first treatment using insulin injections was administered by researchers at the University of Toronto. Two of them, Frederick Banting and John Macleod, received the Nobel Prize for Physiology or Medicine in 1923. The patent for insulin was made available without charge, allowing for its use to spread worldwide very quickly. Despite the success of this treatment, the occurrence of diabetes is increasing and is a serious economic concern.

POSSIBLE MISCONCEPTIONS
Identify: Students might believe that diabetes is primarily an unpreventable disease found in older people.
Clarify: The disease affects people of all ages, and there are several forms of it. Type 1 diabetes is an autoimmune disorder that is not preventable. Gestational diabetes occurs during pregnancy. Type 2 diabetes, however, occurs primarily in patients who are inactive and do not have healthy diets. This type of diabetes is preventable and can be managed with healthy lifestyle choices, but it is becoming increasing common.
Ask What They Think Now: Ask, What can you do to prevent yourself from developing diabetes? (exercise and eat right)

TEACHING NOTES
THE APPLICATION
• Have students work in groups. Direct them to read the passage and discuss the issue it describes. Suggest that they include information about their own experiences with friends or family members who have diabetes.

GOAL
• Instruct students to outline a plan for their study. This might require that they assign specific topics to each
member, or develop another method of coordinating their efforts.

RESEARCH
- Allow students time to complete their research. Make online and print resources available. Students might interview parent volunteers from the medical research, pharmaceutical, or other industries.

SUMMARIZE
- Review each group’s outline to be sure it addresses the questions listed in the Research section.

COMMUNICATE
- Have the groups present their technology updates to the entire class. Review each final product for its applicability to the target audience selected by the student group.

PLAN FOR ACTION
- Ask, Do glucose and insulin affect the functioning of people without diabetes? (yes)
- After students have completed the research task, guide them in a discussion about the role of diet and exercise in diabetes management. Challenge them to identify parallels with the healthy habits suggested for all people.
- Once student diet and activity logs are complete, lead a group discussion about their plans.

UNIT TASK BOOKMARK
Remind students that what they have learned about diabetes in this section will be useful when they complete the Unit Task.

DIFFERENTIATED INSTRUCTION
- Encourage each student to contribute to his or her group’s research efforts according to their personal strengths. For example, interpersonal learners may conduct interviews of health professionals. Auditory learners may read relevant books or listen to podcasts or first-person testimonial on the Internet, and visual learners may watch documentaries.

ENGLISH LANGUAGE LEARNERS
- Allow English language learners to conduct research using sources in their native languages. Provide ample time for students to practice their presentations, particularly if English language learners will have speaking parts.
11.1.1 Observational Study: Fetal Pig Dissection

OVERALL EXPECTATIONS: A1; E1; E2; E3

SPECIFIC EXPECTATIONS

Scientific Investigation Skills: A1.1; A1.2; A1.3; A1.4; A1.5; A1.6; A1.7; A1.9; A1.10; A1.11; A1.12
Relating Science to Technology, Society, and the Environment: E1.2
Developing Skills of Investigation and Communication: E2.1; E2.2
Understanding Basic Concepts: E3.1; E3.2; E3.3; E3.4

The full Overall and Specific Expectations are listed on pages xx–xx.

SKILLS
Performing Evaluating
Observing Communicating
Analyzing

EQUIPMENT AND MATERIALS

per student:
• eye protection
• apron
• dissecting gloves

per group:
• probe
• dissecting pins
• preserved fetal pig
• scalpel
• dissection tray
• forceps
• string
• hand lens
• scissors
• ruler

ASSESSMENT RESOURCES

Assessment Rubric 5: Investigation
Assessment Summary 5: Investigation
Self-Assessment Checklist 1: Investigation

PROGRAM RESOURCES

Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES


EVIDENCE OF LEARNING

Look for evidence that students can
• record detailed observations of a specimen
• use observation notes to prepare a written report

SCIENCE BACKGROUND

• Pigs and humans are both mammals, and share many structural and functional characteristics such as hair, mammary glands, and basic body form. Fetal pigs are ideal for dissection because their organs are relatively large and fully developed, yet the specimens are easily examined because the bones are soft cartilage. Fetal pigs are not raised specifically for research purposes; they are harvested from pregnant sows slaughtered for meat. If they were not sold to schools and research facilities, they would be used as fertilizer or thrown away.

TEACHING NOTES

STUDENT SAFETY

Remind students of the following safety procedures.
• Wear eye protection, gloves, and an apron for the entire investigation.
• Do not inhale preservative. Work in a well-ventilated area, and avoid leaning over specimen.
• Keep preservative off clothes, skin, and eyes.
• If preservative gets on clothes, remove them immediately.
• If preservative gets on skin, wash thoroughly.
• If preservative gets in eyes, wash thoroughly for 15 minutes.
• Use care with scissors and scalpels. Never cut toward yourself or another person.
• If you feel uncomfortable at any time, tell your teacher right away.
• After completing your observations, clean your work area and your hands thoroughly. Dispose of the specimen as directed by your teacher.

PURPOSE

• The word dissect does not mean to cut up, as is commonly believed. It means to analyze or examine in detail. Explain to students that their task is not to cut up the pig; it is to observe the internal organs that they have been learning and talking about. This will give all students, and particularly visual learners, an opportunity to take their understanding to a new level.

EQUIPMENT AND MATERIALS

• The preservatives used on the fetal pig specimens are not toxic, but can be irritating to the skin and eyes. Remind students not to touch their faces, especially their eyes and mouths, while completing the investigation.
• Remind students that they should use the scalpels sparingly, and that careful use of the pins, probe, and forceps will prove more precise and helpful.
PROCEDURE
• Instruct students to take notes during the procedure, writing down short descriptions and simple sketches of what they see. Suggest that they include details about size, shape, color, texture, location, and interesting details.

Part A: Preparation for Dissection
• Draw students’ attention to Figures 1 and 2 on pages xx-xx of the Student Book. Point out to students that the labels on these figures are Latin terms that have been used by physicians for centuries, and that they apply to any type of specimen being observed.

Part B: The Oral Cavity
• The digestive and respiratory systems both start in the mouth. The epiglottis and trachea, respectively, carry food and air into the body. Inside the larynx are the vocal chords, across which air moves to create vocal sounds.

Part C: The Abdominal Cavity
• The connective tissues that lie under the skin hide the internal organs. In addition, organs in individual specimens may not lie exactly where expected. It is important to consider the relative locations of organs and systems, rather than counting on their appearance in a specific location.

Part D: The Thoracic Cavity
• The thoracic organs are protected by the ribs, a thick layer of muscle (the diaphragm), and other connective tissue.
• The trachea connects to the lungs. The lungs in a fetal pig have not been inflated, so their texture is not as spongy as lung texture in another type of specimen might be.

OBSERVATIONS
• Have students look back through their notes and sketches and make sure they are clear and organized, while the observations are still fresh in their minds. Explain that they will be using the notes to prepare a report on their observations.

DIFFERENTIATED INSTRUCTION
• Students may wish to avoid participating in the dissection for any number of reasons and additional resources may be needed to complete this task. All learners should be encouraged to participate in a virtual dissection that contains audio, video, and interactive content.
• Auditory learners should be encouraged to discuss what they see during the dissection and how systems appear to be connected.

ENGLISH LANGUAGE LEARNERS
• Dissect a fetal pig prior to class. Display the pig for students to use as reference, and use dissecting pins with tags to label various structures.
• To familiarize students with the anatomical terms featured in Figures 1 and 2, lead the class in an exercise. Have students stand at their desks or in an open area. Tell students that as you call out various terms, they must point to an appropriate location on their bodies. For example, if the term is dorsal, students would point to their backs.

11.3.1 Controlled Experiment: The Effect of Exercise on Heart Rate and Blood Pressure

OVERALL EXPECTATIONS: A1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.2; A1.3; A1.4; A1.5; A1.6; A1.7; A1.8; A1.9; A1.10; A1.11; A1.12; A1.13

Developing Skills of Investigation and Communication: E2.1; E2.3

Understanding Basic Concepts: E3.3

The full Overall and Specific Expectations are listed on pages xx-xx.

SKILLS
Researching Controlling Variables Evaluating
Hypothesizing Performing Communicating
Predicting Observing Planning Analyzing

EQUIPMENT AND MATERIALS
per group:
• sphygmomanometer
• stethoscope
• stopwatch

ASSESSMENT RESOURCES
Assessment Rubric 5: Investigation
Assessment Summary 5: Investigation
Self-Assessment Checklist 1: Investigation

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• apply knowledge regarding the heart and the circulatory system
• formulate and test a hypothesis

SCIENCE BACKGROUND
• Over time, regular exercise strengthens the heart muscle and enables it to pump more blood through the body with less effort. This helps lower a person’s blood pressure and heart rate at rest. To maintain this effect, regular exercise is required or the heart muscle will begin to weaken again.
• During exertion, the muscles require more oxygen than normal. The heart pumps harder to meet that need, and blood pressure temporarily increases. Normally, the blood pressure returns to lower levels once exertion stops and the body cools down.

TEACHING NOTES

PURPOSE
• Students are to use the knowledge they have gained about the circulatory system to formulate and test a hypothesis about the relationship between exercise, heart rate, and blood pressure.

TESTABLE QUESTION
• Ask, What are some reasons that it is important to know how exercise affects heart rate and blood pressure? (Sample answer: People beginning an exercise routine should know what benefits to expect, and they should know if a certain amount of exercise is dangerous for them based on their medical history.)

HYPOTHESIS/PREDICTION
• Sample hypothesis: Exercise will increase heart rate and blood pressure, because the body will need more oxygen, so the heart will have to pump harder and faster to deliver more oxygenated blood to the muscles.

VARIABLES
• Heart rate and blood pressure are the dependent variables, and physical activity is the independent variable. The controlled variables are the type of exercise done, the intensity of the exercise, and the duration of exercise.

EXPERIMENTAL DESIGN
• Lead the class in brainstorming a list of ways they could measure heart rate and blood pressure.

EQUIPMENT AND MATERIALS
• Students are to create their own lists of materials they will use for the investigation. Have appropriate equipment available. This might include sphygmomanometers, stethoscopes, and stopwatches.

PROCEDURE
Student Sample Procedure
1. Use a sphygmomanometer to measure and record the person’s blood pressure.

2. Use a stopwatch and a stethoscope to count the number of times the person’s heart beats in 20 seconds, then multiply that number by 3 to get the beats per minute. Record the beats per minute.
3. Use a stopwatch to time the person as he or she runs in place for 1 minute.
4. Repeat Steps 1 and 2 and compare the results to the initial readings.

OBSERVATIONS
• As students are performing their investigations, circulate around the room and make sure they are using equipment properly and recording measurements accurately and consistently. If time permits, suggest that groups repeat their experiments several times and calculate averages in order to make their results as reliable as possible.

DIFFERENTIATED INSTRUCTION
• Encourage students to contribute to their group’s lab report according to their personal learning styles when possible. For example, intrapersonal or verbal learners could do the writing, logical learners could analyze the results and perform calculations, and visual learners could create graphs or other visual summaries of the results.

ENGLISH LANGUAGE LEARNERS
• Have students work in their groups to read and answer the Analyze and Evaluate and Apply and Extend questions. This will provide struggling students with the opportunity to ask questions and benefit from the strengths of their classmates.

11.4.1 Observational Study: Analyzing and Interpreting ECGs

OVERALL EXPECTATIONS: A1; E1; E2; E3

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.1; A1.2; A1.3; A1.6; A1.7; A1.8; A1.9; A1.10; A1.11; A1.12; A1.13
Relating Science to Technology, Society, and the Environment: E1.1
Developing Skills of Investigation and Communication: E2.1
Understanding Basic Concepts: E3.3; E3.4

The full Overall and Specific Expectations are listed on pages xx–xx.

SKILLS
Researching  Evaluating
Observing  Communicating
Analyzing
EQUIPMENT AND MATERIALS
per group:
• ECGs of normal and abnormal heart rhythms

ASSESSMENT RESOURCES
Assessment Rubric 5: Investigation
Assessment Summary 5: Investigation
Self-Assessment Checklist 1: Investigation

PROGRAM RESOURCES
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES

EVIDENCE OF LEARNING
Look for evidence that students can
• use an ECG to determine heart rate
• identify abnormal patterns in an ECG

SCIENCE BACKGROUND
• ECGs can be taken with the patient at rest or under stress. Stress can be chemically induced through the use of carefully monitored medications which affect the body in predictable ways. At other times, the test is given while the patient exercises by walking on a treadmill. During a stress test, the patient must be watched carefully for signs of dysfunction in the cardiovascular system. These tests are conducted in a hospital or doctor’s office to ensure help is available if necessary.

TEACHING NOTES
PURPOSE
• Explain to students that they are going to use the knowledge they have gained about the cardiac cycle to interpret ECGs. Emphasize that professional cardiologists and ECG technicians study extensively before they do this work in the real world, but that students can try their hand at identifying ECGs that illustrate abnormal heart patterns. These abnormalities can be caused by a number of factors, the determination of which is beyond the scope of this lesson.

EQUIPMENT AND MATERIALS
• Obtain ECGs from online sources or from a local lab. Be sure no patient names or other information appear on the printouts.
• Ensure that the sample rhythm strips provided for students to calculate the heart rate have the vertical lines representing 0.2 s intervals (as referred to in Part A, Step 2). The actual ECG rhythm strip has mm intervals that represent 0.04 s.

PROCEDURE
Part A: Analyzing Normal ECGs
• Draw students’ attention back to Figure 3 in Section 11.4 (page xx of the Student Book). Demonstrate the identification of a normal cardiac cycle for the entire class.

Part B: Analyzing Abnormal ECGs
• Check students’ progress in indentifying cardiac cycles and abnormalities before handing out the unidentified ECG samples.

OBSERVATIONS
• You may wish to ask groups to provide a brief lab report that summarizes their data and their conclusions.

DIFFERENTIATED INSTRUCTION
• Non-visual learners may have difficulty identifying normal and abnormal patterns by observing ECGs. To help students identify patterns in another way, encourage a member of each group to use a clock or stopwatch to gently pound their desktop at appropriate times to represent the start of each cycle. Auditory learners can listen to audio recordings of different rhythms while observing the associated ECGs.

ENGLISH LANGUAGE LEARNERS
• Suggest that English language learners or struggling students reread Section 11.4 in advance to better prepare for this investigation. This will give them the opportunity to revisit concepts such as the cardiac cycle and ECGs at their own pace.
CHAPTER 11 Summary

ASSESSMENT RESOURCES
Assessment Rubric 1: Knowledge and Understanding
Assessment Rubric 2: Thinking and Investigation
Assessment Summary 1: Knowledge and Understanding
Assessment Summary 2: Thinking and Investigation

PROGRAM RESOURCES
BLM 11.Q Chapter 11 Quiz
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES

SUMMARY QUESTIONS
• To help students synthesize the information in the chapter and construct their concept maps, lead the class in making a list of each of the components of the circulatory system. Then, have students assign terms from the list of vocabulary words to each component. Ask students to briefly explain their choices.
• Distribute students’ original responses to the questions asked regarding the Key Concepts. Have students identify information about which their knowledge has improved.
• Ask one or two questions that will prompt students’ recall of each Key Concept. Have students explain and support their responses. Examples are given:
  1. Why can cardiac arrest cause brain damage? (If the heart is not beating, the circulatory system cannot deliver oxygen to the body’s organs, including the brain.)
  2. How does the circulatory system contribute to the immune response? (Leukocytes are blood cells that serve to identify and attack pathogens.)
  3. What is the main difference between a vein and an artery? (An artery carries blood away from the heart, and a vein carries blood back to the heart.)
  4. When you studied the effect of exercise on blood pressure and heart rate, why was it important to take readings before the person began to exercise? (There are variations in blood pressure and heart rate among individuals, and we needed to be able to compare the post-exercise results to the original readings for each individual in order to see how they changed.)
  5. Why does coronary artery disease increase a person’s risk of having a heart attack? (CAD can restrict or block blood flow to the heart muscle tissue. If the heart is deprived of oxygen, the tissue will die.)
  6. How do cardiologists use ECGs to assess a person’s health? (They can look at the patterns on the ECG and detect irregular heart rhythms, which can indicate a number of heart conditions.)
  7. Why is it important to avoid a diet that is high in LDL? (Bad cholesterol can build up in the arteries and cause atherosclerosis.)

CAREER PATHWAYS
• Lead a group discussion regarding the types of careers that require knowledge of the circulatory system. List students’ ideas on the board.
• Group student responses according to industry (care providers, research, business, technology development). Suggest that students choose careers from two different industries as the focus of their research.
• Suggest that students visit the website of a local hospital or medical care facility and find the employment listings. Have them examine job listings for the education requirements.
• Help students identify local institutions that offer training or degree programs related to the careers they are researching. Have them check program catalogs for admission requirements and course prerequisites.
• Have a doctor, researcher, or other professional in a field related to cardiac care visit the class and answer students’ questions.
• Instruct students to create a job description for their chosen careers. This should include responsibilities and requirements of the position.
• Have students share their reports with the class.

DIFFERENTIATED INSTRUCTION
• Encourage students to present their career reports in creative ways such as through a skit, poem, advertisement, or website.

ENGLISH LANGUAGE LEARNERS
• Have students revisit the vocabulary cards they have been making throughout the chapter. Challenge them to practice using each term in a sentence as part of their review of the chapter material.
OVERALL EXPECTATIONS: A1; A2; E1; E2

SPECIFIC EXPECTATIONS
Scientific Investigation Skills: A1.3; A1.7; A1.9; A1.11
Career Exploration: A2.1
Relating Science to Technology, Society, and the Environment: E1.2
Developing Skills of Investigation and Communication: E2.1; E2.3

The full Overall and Specific Expectations are listed on pages xx-x.

SKILLS
The Unit Task provides an opportunity for students to demonstrate their understanding of and their ability to apply the key ideas in this unit, as well as the skills and process of Planning, Researching, Analyzing, Evaluating, and Communicating.

EQUIPMENT AND MATERIALS
per class:
• scale
• meter sticks
• stethoscopes
• sphygmomanometers

ASSESSMENT RESOURCES
Assessment Rubric 6: Perform an Activity
Assessment Summary 6: Perform an Activity
Self-Assessment Checklist 2: Perform an Activity

PROGRAM RESOURCES
Skills Handbook 1. Safe Science
Skills Handbook 2. Scientific Tools and Equipment
Biology 11 ExamView® Test Bank
Biology 11 Online Teacher’s Centre
Biology 11 website
www.nelson.com/onseniorscience/biology11u

RELATED RESOURCES


• The Unit Task is a culminating task that provides students with an opportunity to demonstrate that they understand the concepts and can apply the skills developed in this unit. The Unit Task is also a means for students to show that they understand and appreciate how the science addressed in this unit influences their society and the environment.

• The challenge in this Unit Task is to create a health profile for a real or fictional individual, then set achievable goals for the individual and develop a plan to achieve them.

EVIDENCE OF LEARNING
Look for evidence that students can
• explain the difference between health and fitness
• create a health and fitness profile of an individual
• identify areas that need improvement and set achievable goals
• create a plan or program for achieving the goals

SCIENCE BACKGROUND
• Fitness has always been an important element in human survival. This fact was appreciated even by early civilizations. Confucius, a Chinese philosopher who lived between 551 and 479 BCE, taught that people should engage in regular physical activity. The ancient Greeks placed high importance upon fitness of both mind and body. This was encouraged by ancient medical pioneers such as Hippocrates and Galen. A common saying of the time encouraged, “exercise for the body and music for the soul.”

• The first modern fitness movement can be traced back to the late eighteenth century. Writers and educators in Germany, Sweden, and Denmark began to advocate for formal gymnastics education in schools. The German educator Johann Guts Muths is often referred to as the “Grandfather of German Gymnastics.” He developed numerous exercise programs and invented several types of exercise equipment. In 1793, he published a book titled “Gymnastics for Youth: or a Practical Guide to Healthful and Amusing Exercises for the Use of Schools.” It was translated into several languages, including English, and quickly became a standard text for physical education.
TEACHING NOTES

- Initiate a discussion with the students about the difference between the terms health and fitness.
- Provide examples of health and fitness profiles to the students to guide their planning.
- Remind students of the appropriate level of detail required for their health profile. Particularly ambitious students may try to do more than is required and can become overwhelmed.
- Much of the information that goes into a health profile may be of a sensitive nature (e.g., body mass, percent body fat, diseases, etc.). Emphasize to students that they may develop a health profile for a fictional individual. If they prefer to complete their own profile, give them the option of not sharing it with the class.

THE TASK

Part A: Create a Health and Fitness Profile

- Discuss with students the pros and cons of developing a health profile for a real or fictitious individual, addressing issues such as access, sensitivity of information, etc. If they choose to focus on a fictitious individual, encourage them to choose a person with particular health and fitness requirements, such as an athlete or someone with a health condition like diabetes, high blood pressure, or sickle cell anemia.
- If students decide to create a profile for themselves or someone in the class, have them take their own measurements for height, weight, blood pressure, and pulse rate.
- Check in with students to see that they are taking accurate measurements. For factors that change rapidly, such as pulse and blood pressure, encourage students to take multiple readings and calculate an average.

Part B: Identify Areas of Improvement and Set Goals

- Discuss with students what are and are not realistic goals. Point out that the time period involved affects this detail. Emphasize to students that the goals that they set should be reasonably achievable.

Part C: Create a Health and Fitness Plan

- Remind students that the goals of their health and fitness plan need to be measurable.
- Remind students that the plan should include a specific time frame. They may wish to break down the goals into several short time periods. For example, a student may plan to lose 2.5 kg the first week and 0.5 kg per week for each of the next 5 weeks.

APPLY AND EXTEND

- Some areas may have greater access to fitness coaches and counselors than others. If having students seek out individual coaches and counselors in their area is impractical, consider having coaches and counselors come in to school to address classes as a whole. If that is not possible, consider using distance learning resources such as teleconferencing to allow students to ask questions of the coaches.
- Have students look at advertisements for commercial weight loss and exercise plans. Have them discuss whether the goals that these plans advertise are realistic for most individuals.

RESEARCH AND PLANNING

- Caution students that much of the information they find about health and fitness in magazines and the internet may not be accurate. Encourage them to double check and cite their sources.

EQUIPMENT AND MATERIALS

- Much of the equipment needed for the students to take their measurements should be readily available in the school’s health suite or nurse’s office. If possible, have the students visit the health suite and ask questions of the health practitioners working there.

COMMUNICATING

- Students presenting their profiles and plans to the class can be given different options for the form of their presentation, including charts, graphs, posters, video, or PowerPoint presentations.

DIFFERENTIATED INSTRUCTION

- As an alternative to the Health and Fitness unit task, have the students research and compare one of the body systems discussed in the chapter (digestion, circulation, respiration). They can then compare and contrast that system in humans with the parallel system in other animals.

ENGLISH LANGUAGE LEARNERS

- Encourage English Language Learners to complete research in their native language. They could also create a final product that includes translations so that it could be used as a health-education tool for the student’s family members and speakers of both languages.