

Unit 4
Cells, Tissues, Organs and Systems
Suggested Time: 18 Hours

Unit Overview

Introduction

In previous explorations of living things, students have not encountered the cell as a basic building block and functional unit of life. At this level, these notions are explored in a rigorous fashion to ensure that students understand the cell's critical importance to all life. These new understandings allow students to study the human organism from a holistic perspective. Students will continue to study the different body systems but not in minute detail. From activities, students should start to appreciate a correlation between healthful living and healthy systems. This is the first time that students deal with systems as an integrated whole.

Focus and Context

The focus of this unit of study is on decision-making. Using the context of healthy/non-healthy lifestyle choices, and how these choices affect cells, tissues, organs and systems, students should appreciate their interconnections and use them to make informed choices when it comes to their health.

Science Curriculum Links

In primary students begin their study of living things by investigating the basic needs and characteristics of living things including growth and changes. In elementary, students investigate the basic structure and function of several organ systems.

In grade 9, students will investigate the process of cell division more closely within the context of sexual and asexual reproduction. They will also begin to learn about the cell's genetic information. In senior high school, students might choose a course in biology in which mitosis and meiosis are described in detail and the structure and function of the female and male human reproductive systems are analysed and described. Cell theory is also addressed at this level and major organelles visible with the light and electron microscope are described and cellular processes investigated.

Curriculum Outcomes

STSE	Skills	Knowledge
<p><i>Students will be expected to</i></p> <p>Nature of Science and Technology 109-5 describe how technologies develop as a systematic trial-and-error process that is constrained by the properties of materials and the laws of nature 109-13 explain the importance of choosing words that are scientifically or technologically appropriate 110-2 distinguish between ideas used in the past and theories used today to explain natural phenomena</p> <p>Relationships Between Science and Technology 111-1 provide examples of scientific knowledge that have resulted in the development of technologies 111-5 describe the science underlying particular technologies designed to explore natural phenomena, extend human capabilities, or solve practical problems</p> <p>Social and Environmental Contexts of Science and Technology 112-2 describe how a community's needs can lead to developments in science and technology 112-10 provide examples of science- and technology-based careers in their province or territory 113-8 make informed decisions about applications of science and technology, taking into account personal and social advantages and disadvantages 113-9 make informed decisions about applications of science and technology, taking into account environmental and social advantages and disadvantages 113-13 propose a course of action on social issues related to science and technology, taking into account human and environmental needs</p>	<p><i>Students will be expected to</i></p> <p>Initiating and Planning 208-1 rephrase questions in a testable form and clearly define practical problems 208-5 state a prediction and a hypothesis based on background information or an observed pattern of events 208-6 design an experiment and identify major variables</p> <p>Performing and Recording 209-1 carry out procedures controlling the major variables 209-2 estimate measurements 209-3 use instruments effectively and accurately for collecting data 209-4 organize data using a format that is appropriate to the task or experiment 209-6 use tools and apparatus safely</p> <p>Analyzing and Interpreting 210-2 compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs, and scatter plots 210-7 identify, and suggest explanations for, discrepancies in data</p> <p>Communication and Teamwork 211-3 work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise 211-4 evaluate individual and group processes used in planning, problem solving, decision making, and completing a task</p>	<p><i>Students will be expected to</i></p> <p>304-4 illustrate and explain that the cell is a living system that exhibits all the characteristics of life 304-5 distinguish between plant and animal cells 304-6 explain that growth and reproduction depend on cell division 304-7 explain structural and functional relationships between and among cells, tissues, organs, and systems in the human body 304-8 relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole 304-9 describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous systems 304-10 describe examples of the interdependence of various systems of the human body</p>

Cells and Living Things

Outcomes

Students will be expected to

- discuss how early scientists differentiated between living and non-living things and compare this with modern cell theory (110-2)

- illustrate and explain that the cell is a living system that exhibits the four characteristics of life (304-4)
 - define cell
 - state the cell theory

- describe four characteristics common to living things.

Include:

 - (i) growth
 - (ii) movement
 - (iii) response to stimuli
 - (iv) reproduction

Elaborations—Strategies for Learning and Teaching

This unit is intended to introduce students to the basic concepts of cells, tissues, organs and systems. It is important to note that these topics are covered in significantly greater detail in the high school biology.

Teachers could start this unit by creating a “Word Wall”. Choose a wall in the classroom that can be used throughout the entire unit. As new concepts are taught, new words are introduced; they are written on a card and added to the wall (choose colored paper, colored print and ensure it is large enough for students to read from all areas of the classroom). At the end of the unit, all of the key terms should be on the wall (do not include the definitions). This would help students recognize, become familiar with, and spell the key terms.

Teachers could have students begin a Mind Map (see Appendix B) for this topic with “cells” at the center. Students would add detail to this mind map as per mind mapping guidelines (see Appendix B). A more complete definition of cell will arise as later outcomes are addressed.

This is intended as a basic introduction to cell theory. Concepts such as abiogenesis and biogenesis and the development of the cell theory are dealt with in Biology 2201 and do not need to be addressed here.

While other characteristics of life can be discussed at this time, teachers should limit discussion to growth, movement, stimulus/response and reproduction. Teachers should clarify that movement refers to a change in place and/or position. For example, a plant demonstrates movement as it grows.

Teachers could provide a list of various living things and have students brainstorm the characteristics that they all have in common. In this discussion, students may discover other characteristics common to living things including gas exchange and elimination of waste.

Teachers could have students use samples of paramecium and amoeba to explore and investigate movement in cells. Use of the flex camera/microscope will facilitate whole group observation of cells. To illustrate the characteristic of stimulus/response, teachers could vary the amount of light to observe the organism’s response to the presence of light.

Cells and Living Things

Suggested Assessment Strategies

Journal

- Explain why early peoples may have thought that we were made up of the basic materials such as air, water and fire. (110-2)
- Cells are the basic units of structure and function of all living things. Explain what this means to you. (110-2)

Paper and Pencil

- Why do you think ancient people had different theories and explanations regarding the make-up of our bodies than we have today? (110-2)
- Why do you think ancient people had different theories and explanations regarding the make-up of our bodies than we have today. (110-2)

Performance

- Write a poem and /or song about cells and how they exhibit characteristics of life. (110-2, 304-4)
- Create a cartoon or a series of cartoons/ sketches that illustrate the basic characteristics of life. (110-2, 304-4)
- Survey people in your community to determine why they think ancient people had different theories and explanations regarding the make-up of our bodies than we have today.
- Create a cartoon that illustrates the evolution of the cell theory. (110-2)

Conventions used in Resources Column

ST = Student Text

TR = Teacher Resource

TR AC = Assessment Checklist

TR PS = Process Skills Rubric

TR AR = Assessment Rubric

BLM = Black Line Master

BLM 8 Activity # = Additional BLMs for each grade level

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 391, 406

ST p. 391

BLM 4-6

BLM 8 Activity 12

The Microscope

Outcomes

Students will be expected to

- recognize that optical technologies have developed through systematic trial and error processes constrained by the optical properties of the materials (109-5)

- identify the major parts of the compound microscope.
 - (i) eyepiece
 - (ii) objective lenses
 - (iii) stage
 - (iv) coarse adjustment knob
 - (v) fine adjustment knob
 - (vi) light source/lamp
 - (vii) iris diaphragm
 - (viii) base
 - (ix) barrel (or tube)
 - (x) arm
 - (xi) revolving nosepiece

Elaborations—Strategies for Learning and Teaching

Teachers should ensure that students are taught the skills necessary to maintain and use the light microscope safely and effectively. The microscope is arguably the most important tool in the biological sciences. For those students who may not be taking biology courses in high school, this may be the only opportunity to get an in-depth experience in the use of the microscope.

Teachers could include a brief discussion of the nature of science when introducing the microscope. This is a good place to emphasize that science is a dynamic, not a static, process. For example, with the invention of new technologies come new discoveries in science. As the quality and sophistication of our tools (e.g. microscopes) improve, so does the quality of the observations, measurements, etc., that we can make. This leads to the collection of new information. The information is then used to create new theories or modify existing ones.

Teachers could have students follow the historical development of the microscope from Leeuwenhoek's single lens microscope to the scanning electron microscope. Teachers could have students create a foldable outlining the history of the microscope, its use, and a picture of what an object looks like through its lenses.

Students should be able to label and identify the major parts of the compound microscope giving the main function of each part.

Teachers should limit their treatment of this delineation to the safe and efficient use of the compound microscope in conjunction with Core Lab 10-1A.

A detailed diagram, as well as the function of each of the parts of the microscope, is available in the Skills section of the textbook.

Teachers could prepare cards with the names of the parts of the microscope and their functions and have students engage in a Quiz-Quiz-Trade activity (see Appendix B) to review and reinforce this topics.

Teachers could have students create a foldable containing a labeled diagram of the microscope. This foldable could be created with lift flaps which provide a brief description of the functions of the parts of the microscope.

The Microscope

Suggested Assessment Strategies

Interview

- Interview a lab technician. In preparation for this task formulate 5 questions. These questions must relate to the use and the benefit of the microscope technology which allows them to do their job. (109-5)

Paper and Pencil

- Use diagrams to predict what epithelial cells, or other types of cells, will look like under different types of microscopes. (109-5)
- Using a picture of a microscope, label and identify the functions of each part. (209-3)

Performance

- Create a brochure to sell a microscope based on how easy it is to use. Be sure to give step-by-step instructions on its use. (209-3)
- Using the format of “Pin-the-tail-on-the-donkey” game, label the parts of the microscope (209-3).
- Create a foldable with a labelled diagram of the microscope and lift flaps to describe the function of each part. (209-3).

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 133-134, 398-399

ST pp. 392-393

BLM 4-3, 4-7, 4-8

ST pp. 478 (Science Skills)

The Microscope (continued)

Outcomes

Students will be expected to

- use a light microscope to produce a clear image of cells (209-3)
- estimate measurements of cells viewed with a microscope (209-2)
- demonstrate proper care in the use and storage of the compound microscope (209-6)
 - examine the field of view under low and medium power

- prepare and observe a wet mount slide

Elaborations—Strategies for Learning and Teaching

Core Laboratory Activity: Setting up and Using a Microscope.

The laboratory outcomes 209-2, 209-3 and, in part ,304-5 are addressed by completing CORE LAB 10-1A “Setting up and Using a Microscope”.

Students require practice using microscopes. This should include observing prepared slides and preparing and observing wet mounts.

Teachers should review the proper handling and care of the microscope prior to beginning the core lab. Teachers should demonstrate the correct method of focusing on an object, using low and medium powers. This could be done using the school’s digital flex camera. An ability to use the high power lens is not a required outcome, however teachers may wish to demonstrate the use of the high power lens. The digital flex camera would be useful for this purpose. Students should not use the high power lens unless they can demonstrate effective use as inappropriate use of this lens can damage the microscope.

Teachers should ensure that students are able to estimate the approximate size of cells viewed with the microscope. Students do not need to calculate the size using ratios. The explanation for determining the field of view and estimating the size of cells is found in Part 2 of the Core lab,

Teachers should demonstrate the proper technique of preparing a wet mount slide. Students could refer to Science Skill 4 as they develop this skill. Teachers could use the flex camera to illustrate the steps necessary to focus, and observe, the slide under low and medium power.

Teachers could have students engage in a Two-Minute Review (see Appendix B) in which students summarize the proper methods of using and handling a microscope.

The Microscope (continued)

Suggested Assessment Strategies

Performance

- Locate the cell wall of a plant cell when viewed through a light microscope. (209-3, 304-5)
- Given the field of view, estimate the size of the plant or animal cell viewed with your microscope. Use the measurement function on the flex camera to verify your estimation. (209-2, 209-3).
- Make drawings/ sketches of the various cells observed when using a light microscope. Label the parts you can identify. (109-13, 209-3)
- Create a brochure to sell a microscope based on how easy it is to use. Be sure to give step by step instructions on its use and care. (209-3)
- Create a poster or slide show that shows the proper use and care of the microscope. (209-3)
- Create a video clip to demonstrate the proper technique to prepare a wet mount. (209-3)

Paper and Pencil

- Predict what the change will be in the difference of the field of view using a low power and a medium power lens. (209-3)

Presentation

- Using digital pictures create a labeled poster to demonstrate the proper technique to prepare a wet mount. Describe your poster to the class. (209-3)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

Core Lab #7: Setting up and Using a Microscope, p. 394

ST pp. 478-480 (Science Skills)

BLM 4-9, 4-10, 4-11

TR pp. 4.6-4.7

ST pp. 476-477 (Science Skills)

TR AC 7

TR AR 3, 4

BLM 8 Activity 12

Cells and Cell Structure

Outcomes

Students will be expected to

- use proper terms when comparing plant and animal cells (109-13)

- examine and explain the role of the following organelles:
 - (i) cell wall
 - (i) cell membrane
 - (ii) chloroplast
 - (iii) cytoplasm
 - (iv) nucleus
 - (v) vacuole
 - (vii) mitochondria

- label organelles on diagrams of typical plant and animal cells

- work cooperatively with team members to develop and construct models of cells (211-3)
- evaluate individual and group processes used in constructing models of cells (211-4)

Elaborations—Strategies for Learning and Teaching

Teachers should be aware of an error in the student textbook (p. 405). In the diagram of the plant cell; Label A refers to the cell wall and Label C refers to the cell membrane. Students should relabel these two organelles in their textbooks so the table that follows will be accurate.

A study of these organelles is adequate at this level. Other cell organelles will be studied in more detail in Biology 2201.

Teachers could have students engage in a Quiz-Quiz-Trade activity (see Appendix B) to review and reinforce these terms.

Teachers could have students prepare a memory game with the words on one set of cards and the roles on another set of cards. The object is to match the organelle with its function.

Teachers could have students create a foldable illustrating the plant and animal cells and their parts.

Teachers should use the three-dimensional cell models to assist students with the development and understanding of this concept. Students often believe that cells are two-dimensional as they sometimes appear under the microscope. Three-dimensional drawings or models will help to correct this misconception.

Teachers could have students model the three dimensional nature of animal cells by filling a plastic bag (cell membrane) with gelatin, and putting in various fruit, vegetables or candy for cell parts when the gelatin is partially set. This plastic bag could then be put inside a transparent sandwich container which represents the cell wall. The models could be stacked to show the differences between plant and animal tissue. The different groups of containers could be stacked to model organs.

Teachers could have students use modeling clay, dioramas, or paper maché to model their cells. Prior to the construction of models, teachers could involve students in the creation of a rubric to evaluate their models.

Cells and Cell Structure

Suggested Assessment Strategies

Performance

- Using teacher prepared cards (with organelles and definitions), find the partner who has the match to your card. You and your partner will then find the appropriate picture for your organelle from the variety of pictures which the teacher has posted around the room. (109-13)
- Create a skit whereby the classroom walls become cell walls. Take on the role of an organelle and explain your function in the cell. (109-13, 211-3)
- Create a 3-D model of a plant & animal cell using gelatin and candies to illustrate the organelles and differences between the types of cells. (211-3, 304-5)
- Create a skit whereby the classroom walls become cell walls and they must take on the role of an organelle explaining what their functions are in the cell. (109-13, 211-3)
- Create a 3-D model of an animal and/or a plant cell illustrating the cell wall, cell membrane, nucleus, cytoplasm, vacuoles, chloroplasts and mitochondria. (109 -13, 211-4, 211-3)
- Produce a travel brochure, wall mural, a poster or a series of foldables that describes a plant or animal cell as if it were an amusement park. (211-3)
- Use a class generated checklist to evaluate individual and group processes used in the construction of the cell models. (211-4)

Presentation

- Prepare a play with group members playing the various parts of a particular cell and explain their function. (109-13)
- Create a poem, song or rap that explains the roles of various organelles. (109-13)
- Create a mnemonic device to remember the parts of the cell. Share this with the class. (109-13)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 404-409

ST pp. 404-405

BLM 4-13, 4-14, 4-15

BLM 8 Activity 15

ST p. 405

BLM 4-3, 4-16, 4-17

ST p. 407

BLM 4-19

TR p. 4.13

TR AC 6, 21, 22

TR AR 3

Plant and Animal Cells -- Characteristics

Outcomes

Students will be expected to

- distinguish between typical plant and animal cells (304-5)
- produce labeled drawings of each type of cell
- list three differences between plant and animal cells. Include:
 - (i) plant cells have chloroplasts
 - (ii) plant cells have cell walls, therefore they have a regular shape
 - (iii) plant cells have fewer, and larger, vacuoles

Elaborations—Strategies for Learning and Teaching

Teachers could have students create a K-W-L chart prior to beginning this topic. Students could share their charts with others and a class K-W-L (see Appendix B) could be created and revisited after this topic has been covered.

Students should be able to create labeled graphic representations of representative animal and plant cells. This could be achieved using pencil and paper or electronically using various software.

Teachers should ensure that students are able to (i) identify and differentiate between cell walls and cell membranes, and (ii) identify the nucleus in the given samples. Teachers could use commercially prepared animal slides to compare and contrast with plant cells. Thin layers of onion or lettuce could be prepared to observe cell structures.

Teachers should ensure that students follow appropriate safety guidelines when working with living organisms. Teachers should be aware that students should not harvest live human cells in this activity (eg. Cheek scraping).

Teachers should also ensure that students develop the skills necessary to maintain and use the light microscope effectively and safely.

Teachers could give students a large sheet of paper to construct a VENN diagram to compare plant and animal cells. See Science Skills 10, p. 497. In groups of 3 or 4, students could then place the names of the organelles into the appropriate space on their diagram.

Teachers could use a Think-Pair Share (see Appendix B) strategy in which students divide a piece of paper down the center, writing the word “Compare” on one side and “Contrast” on the other. Under the “Compare” column, they would write how the cells are the same and under the “Contrast” column, they would write how the cells are different. Teachers could then have students explain/describe their diagram/chart with their partner, correcting and adding information as necessary. As a summary, the teacher could lead the class in creating “Compare” and “Contrast” diagram/chart using the class results.

Plant and Animal Cells -- Characteristics

Suggested Assessment Strategies

Performance

- Make drawings/ sketches of the various cells observed when using a light microscope. Label the parts they can identify. (109-13, 209-3)
- Using the format of “Pin-the-tail-on-the-donkey” game, label the parts of the cell (109-13).
- Draw pictures or make models of plant and animal cells. (304-5)
- Locate the cell wall of a plant cell when viewed through a light microscope. (209-3, 304-5)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 405-409

BLM 4-18, 4-20

TR AC 24

ST pp. 408-409

TR AC 7

TR AR 4

ST pp. 476-477 (Science Skills)

ST pp. 405, 408-409

TR AC 15

ST p. 497 (Science Skills)

BLM 8 Activity 14

Plant and Animal Cells -- Characteristics (continued)

Outcomes

Students will be expected to

- explain that growth and reproduction depend on cell division (304-6)
- recognize that mitosis is the process by which cells divide to produce more, identical cells

Elaborations—Strategies for Learning and Teaching

Teachers should not provide students with a detailed study of the stages of mitosis at this level. This topic will be dealt with in greater detail in Grade 9 Science.

Teachers should provide students with an example of cell division for growth (e.g., skin cells divide to produce more skin cells to heal a cut or injury) as well as an example that illustrates cell division for reproduction (eg. a bacteria cell divides to become two cells).

Teachers should ensure students not develop the misconception that all cell division occurs by mitosis. Teachers could mention that there is a special type of cell division that occurs in the sex organs (ovaries and testes) to produce sex cells (egg and sperm). Mitosis occurs only in body (somatic) cells. A more complete treatment of how sex cells are produced is addressed in grade 9 science.

Teachers could use commercial slides or models to illustrate the process of cell division. Teachers could also access computer simulations of this process.

Plant and Animal Cells -- Characteristics (continued)

Suggested Assessment Strategies

Pencil and Paper

- If one cell divides into two new cells every four to five hours, approximately how many cells would one expect to find in 3 days? (304-6)
- How would you explain the growth of an organism? (304-6, 304-7)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 410-412

Cells, Tissues, Organs and Organ Systems

Outcomes

Students will be expected to

- explain structural and functional relationships between and among cells, tissues, organs, and systems in the human body (304-7)
- describe the levels of organization found in living things. Include:
 - (i) cells
 - (ii) tissues
 - (iii) organs
 - (iv) organ systems
 - (v) organisms

- relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole (304-8)
- recognize that cells and organisms require the same basic necessities of life. Include:
 - (i) oxygen
 - (ii) nutrients
 - (iii) waste removal

Elaborations—Strategies for Learning and Teaching

Teachers could have students create a class K-W-L chart (see Appendix B) before starting this topic.

Teachers could show a variety of prepared cells or cell images to illustrate the variety of cells in a person. The shape and function of a variety of cells could be highlighted. A prepared cross-section of muscle tissue could illustrate how striated muscle cells work in unison to form a voluntary muscle. Muscles or organs, such as the heart, could be observed and studied through software or videos. Students could investigate organ systems such as those that make up the digestive system or the circulatory system to show how they work in unison. Model cells made in the previous section could be stacked to form tissues and organs in order to demonstrate how they are related.

Teachers could use a “building analogy” to represent these levels of organization. For example, in a multi-level house, the bricks could represent the cells, walls of brick represent the tissues, rooms represent the organs, the levels (floors) represent the systems while the house/building represents the organism.

Students should be able to diagram the relationships between cells, tissues, organs, organ systems and organisms using a graphic organizer such as a flow chart.

Teachers should help students develop an understanding and appreciation of the interdependence and interconnectedness of cells, tissues, organs, and organ systems.

Tissues, organs, organ systems, and organisms are all made up of cells. Cells require nutrients and oxygen and produce wastes which must be removed. If cells die because they can not get sufficient nutrient and oxygen, or because they can not get rid of wastes, the tissues they make up will be damaged and may also die. Eventually the entire organism could die because of negative effects to the cells. Tissues and organ systems provide the mechanisms by which nutrients are obtained and wastes are removed. The energy for cellular activity originates in the food eaten and digested by the human organism. Cellular processes create waste material that must be removed by the organism. This concept will be developed more fully later in this unit.

Teachers could demonstrate the results of cellular respiration using yeast and sugared water to illustrate the production of heat and CO₂. This could be related to humans having a constant body temperature and the need to get rid of the CO₂ produced during cellular respiration as well as requiring food (sugar) and air (oxygen) to allow cellular respiration to take place.

Cells, Tissues, Organs and Organ Systems

Suggested Assessment Strategies

Paper and Pencil

- Explain how the needs of a cell are related to the functions of major body process as a whole. (304-8)
- How would you explain the growth of an organism? (304-6, 304-7)
- Create an analogy to describe the levels of organization found in living things. (304-7)
- Create a concept map to demonstrate your knowledge of cellular organization. (304-7)

Performance

- Create a song or a poem about the different levels of cellular organization using the terms cells, tissues, organs, organ systems and organisms. (304-7)
- Create a poster display to describe the levels of organization in living things. (304-7)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 420-423

BLM 4-23, 4-26, 4-27

BLM 8 Activity 9

ST pp. 413

BLM 4-21, 4-29, 4-30

Cells, Tissues, Organs and Systems (continued)

Outcomes

Students will be expected to

- relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole (304-8)

(continued)

- identify the main function of the following organ systems in keeping organisms alive:
 - circulatory
 - respiratory
 - digestive
 - excretory
 - nervous
 - muscular

Elaborations—Strategies for Learning and Teaching

Teachers could have students work together to research the main organ systems and present their findings to the class. Students could share their findings in a presentation (Power Point, wiki, play, song, etc.) to communicate the role of the organ system and the main organs involved.

Teachers should note that this is not intended to be a detailed study of the various body systems. It is important to address this section holistically and not dwell on terminology and the memorization of anatomical details.

Teachers should limit their instruction to the function of the system and be able to list the main organs involved as outlined below. The function of each organ is not required. For example:

- Circulatory system consists of the heart, arteries, veins and capillaries. The function of the circulatory system is to transport blood, nutrients, gases and wastes.
- Respiratory system consists of the nasal cavity, trachea, and lungs. The function of the respiratory system is to control breathing, and exchange gases in lungs and tissues.
- Digestive system consists of the mouth, esophagus, stomach, small intestine, large intestine, liver, gall bladder, and pancreas. The function of the digestive system is to take in and break down food, absorb nutrients, and eliminate solid waste.
- Excretory system consists of the kidneys and urinary bladder. The function of the excretory system is to remove liquid and gas wastes from the body. Lungs are sometimes considered as part of the excretory system because they excrete CO₂.
- Nervous system consists of the brain, spinal cord, nerves, and sense organs. The function of the nervous system is to detect changes in the environment and signals these changes to the body which then carries out a response.
- Muscular system consists of muscles attached to bones throughout the body. The function of the muscular system is to work with the bones to move body parts.

Teachers should not elaborate too much on the individual parts of these systems because they are covered in depth in Biology 2201 and Biology 3201. Students are not required to label diagrams representing the organs of various systems.

Teachers could use the “Numbered Heads Together” strategy (see appendix B) to review this topic.

Cells, Tissues, Organs and Systems (continued)

Suggested Assessment Strategies

Paper and Pencil

- Design a rubric, with teacher guidance, to assess a presentation about organ systems. (211-4)

Presentation

- In groups, explore one organ system using a teacher created Webquest. Each group will present their research as a Powerpoint presentation. (211-4)

Performance

- Create a poem, song, or rap that describes the main functions of an organ system. (211-4, 304-8)
- Create a collage to describe the main functions of an organ system. (211-4)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 426-430

TR AC 21, 22

TR AR 3, 10

BLM 4-24, 4-25, 4-32

BLM 8 Activity 12

Maintaining Healthy Organ Systems

Outcomes

Students will be expected to

- describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, muscular, digestive, excretory, and nervous systems (304-9)
- explain the roles that diet, nutrition, exercise and stress have on the systems listed above
- discuss lifestyle choices such as diet choices, smoking, drinking alcohol, or sedentary lifestyle and their effects on body systems

Elaborations—Strategies for Learning and Teaching

Teachers could use the K-W-L strategy or an Anticipation/Reaction Guide (see appendix B) to identify misconceptions that students may have on the effects of diet, nutrition, exercise and stress on the human systems.

Teachers should give students the opportunity to explore positive and negative factors, such as nutrition, exercise and other lifestyles, that affect the function and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous systems. Teachers should encourage students to explore and learn what practices or lifestyles contribute to healthy and unhealthy systems.

Teachers could have students work in pairs or small groups to investigate and explore how certain lifestyles positively or negatively affect body systems. For example, students could investigate how certain foods and/or diets affect the function and performance of several body systems. Students could communicate their findings in the form of a presentation, a multi-media report or a written report.

By providing a variety of learning experiences designed to highlight positive and negative factors affecting the systems of our bodies, teachers could lead students toward an appreciation of the personal and social consequences involving their overall health. Representatives from the Canadian Lung Association or the Canadian Cancer Society could be invited to class to give a presentation about their organization and their cause.

Teachers could have students create a journal entry related to this topic using the “What? So What? Now What?” format (see Appendix B).

Maintaining Healthy Organ Systems

Suggested Assessment Strategies

Paper and Pencil

- In a report, describe how one of the following factors affects the various systems of the body: (304-9)
 - nutrition
 - exercise
 - stress

Presentation

- Prepare a short presentation to describe how one of the following factors affects the various systems of the body: (304-9)
 - nutrition
 - exercise
 - stress

Performance

- Using newspapers and magazines, create a collage that promotes healthy body systems. (304-9)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 436-441

TR AC 24

ST pp. 444, 446-449

ST pp. 449-545

BLM 4-33, 4-34, 4-35, 4-36,
4-37, 4-38

Unhealthy Organ Systems -- Assistive Technology

Outcomes

Students will be expected to

- describe the science underlying various technologies used to assist or replace unhealthy organs or systems (111-5) Include:
 - (i) insulin pump
 - (ii) artificial heart
- provide examples of scientific knowledge that have resulted in the development of technologies (111-1)
- describe how a community's needs can lead to developments in science and technology (112-2)
- make informed decisions about applications of science and technology, taking into account environmental and social advantages and disadvantages (113-9)
- propose a course of action on social issues related to science and technology, taking into account human and environmental needs (113-13)

Elaborations—Strategies for Learning and Teaching

Students should be aware of some technologies that have been designed to assist damaged organs and/or systems. Examples to investigate include the insulin pump that regulates insulin levels in the blood and artificial hearts that pump blood throughout the body. Cochlear implants, artificial limbs controlled by electrical impulses from nerves, artificial heart valves, respirators, dialysis machine, and pace makers are other examples that could be explored and discussed.

The **CORE STSE** component of this unit incorporates a broad range of Grade 8 science outcomes. More specifically, it targets 111-1, 111-5, 112-2, 113-9 and 113-13). The STSE component, “Artificial Organs” can be found in Appendix A.

Unhealthy Organ Systems -- Assistive Technology

Suggested Assessment Strategies

Performance

- Create a collage of technologies involved in assisting damaged organs or body systems. (111-5)

Presentation

- Working in small groups, gather and organize information on an aspect related to the technological advancements used to treat various organ/system problems. Share your knowledge with the class in the form of a prepared report, poster, brochure, power-point presentation, etc. (111-5)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST p. 450

Core STSE: “Artificial Organs”, Appendix A

ST pp. 493-495 (Science Skills)

Organ Systems -- Interdependence

Outcomes

Students will be expected to

- describe three examples of the interdependence of various systems of the human body. (304-10) Include:
 - (i) circulatory/respiratory
 - (ii) digestive/circulatory
 - (iii) nervous/muscular

Elaborations—Strategies for Learning and Teaching

Teachers should provide students with the opportunity to investigate and learn about the interdependence and interactions of several body systems. Teachers could also have students investigate circulatory/muscular, digestive/excretory or nervous/circulatory pairs.

This is intended to be a brief introduction to this topic. A more complete treatment of this topic will be addressed in high school biology.

Teachers should limit the discussion of the interdependence of these systems to the following:

- (i) **circulatory/respiratory:** we take in oxygen-rich air through our nose, windpipe, and into our lungs (i.e., through the respiratory system). The inner surface of our lungs contain blood vessels. Oxygen from the air we breathe in is transferred to the blood and is transported throughout the body, by the circulatory system, to the cells that need the oxygen. As the blood passes by the cells, it delivers the oxygen and picks up carbon dioxide (a waste product). The carbon dioxide is then transported to the lungs. At the lungs, the carbon dioxide is transferred from the blood vessels into the air that we breathe out (exhale).
- (ii) **digestive/circulatory:** when we chew and swallow food, it passes to the stomach and then to the small intestine where it is digested. The walls of the small intestine contain many blood vessels. When it is digested, the food is broken down into very small particles called nutrients. These nutrients (molecules) pass through the intestine lining into the blood. Once in the blood, these nutrients are transported to the body cells, where it is used to provide the cell with the materials and energy to carry out its life processes.
- (iii) **nervous/muscular:** our nervous system picks up signals (stimuli) from both outside and inside our bodies. Depending on the type of signal, our nervous system may cause our bodies to react in a particular way. Often, the reaction or change that occurs, involves the muscular system. For example, when it is cold, our nervous system causes our muscles to contract and relax rapidly. We experience this as shivering. When it is too hot, the nervous system causes the muscles around the blood vessels in our skin to relax, bringing the warm blood closer to the surface where it can be cooled by the air (e.g., the skin is flushed).

Organ Systems -- Interdependence

Suggested Assessment Strategies

Paper and Pencil

- Students will create a flow chart or use a mind map to show the interdependence of these body systems. (304-10)
- Imagine that you are a drop of blood in a human body. Describe your adventures using the circulatory and respiratory systems. (304-10)
- Imagine that you are a slice of pizza at a Birthday party. Describe your journey through the digestive and circulatory system. (304-10)
- Imagine that you have just stepped on a nail. Describe the journey of a nerve impulse using the nervous and muscular systems. (304-10)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST pp. 438-441

BLM 4-31

BLM 8 Activity 4

Organ Systems -- Interdependence (continued)

Outcomes

Students will be expected to

- design and carry out an experiment to compare and contrast heart rate and breathing rate in an individual during various levels of activity, and identify and control the major variables (208-6, 209-1)
- rephrase questions into testable form about the factors that affect physical fitness and health (208-1)
- state a hypothesis based on background information or an observed pattern of events (208-5)
- carry out procedures controlling the major variables (209-1)
- compile and display data using tables and graphs (210-2)
- suggest explanations for variations in the heart rate and the breathing rate of an individual during various levels of activity when the experiment is repeated (210-7)
- organize data using a format that is appropriate to the task or experiment (209-4)

Elaborations—Strategies for Learning and Teaching

Core Laboratory Activity : The Effect of Activity on Heart Rate and Breathing Rate.

The laboratory outcomes 208-1, 208-5, 208-6, 209-1, 209-4, 210-2, 210-7 and, in part, 304-10 are addressed by completing CORE LAB 12-1B “The Effect of Exercise on Heart Rate and Breathing Rate”.

Teachers should relate the results and observations of this experiment to the hierarchy of cells, tissues, organs, systems, organisms and the interconnectedness of each.

Teachers could lead students to discuss such questions as “Does lifestyle have an effect on physical fitness?” or “How does an athlete’s heart rate compare to that of a non-athlete?” Teachers could have students collect additional data from members of their families indicating those who are smokers, overweight, etc. The class data could then be used to stimulate further discussion. NOTE: if such data is collected, teachers should ensure that anonymity and privacy concerns are respected.

If available, teachers could have students use computer-interface equipment to measure heart rate and breathing rate.

Teachers could have students repeat their experiment at another time or day. In this way, the data can be compared and any variations in this data can be discussed and explained by the students.

Opportunities for cross-curricular planning and integration are available here with physical education and/or health curricula.

Organ Systems -- Interdependence (continued)

Suggested Assessment Strategies

Performance

- Create a storybook for primary students showing the interdependence of one of the following pairs of body systems:
 - i) circulatory / respiratory
 - ii) digestive / circulatory
 - iii) nervous / muscular

A further extension of this activity could involve students reading these books to primary students. This activity could also be used as a cross-curricular activity with Language Arts, Art and Health. (304-10)

- Compare individual and class data measurements using data tables, graphs, spreadsheets, etc. (209-4)

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

Core Lab #8: The effect of Activity on Heart Rate and Breathing Rate, p. 442

ST pp. 469-473, 483-487
(Science Skills)

TR AC 3, 18, 19

TR AR 3, 5, 6

TR PS 2, 10

BLM 8 Activity 3

Organ Systems -- Associated Careers and Technology

Outcomes

Students will be expected to

- provide examples of careers that are associated with the health of body systems (112-10)
- make informed decisions about applications of science and technology that are associated with human body systems taking into account personal and social advantages and disadvantages (113-8)

Elaborations—Strategies for Learning and Teaching

Teachers should encourage students to provide examples of careers that deal directly or indirectly with the health of body systems such as lab and x-ray technicians, physiotherapists, nutritionists, coaches, doctors, and public health nurses. People in these careers could be invited to class to share what they do and how it involves the body systems investigated in this unit of study.

Teachers could address this outcome using a decision-making model, such as that found in the grade 9 health curriculum. Developments in science and technology, related to our health and the health of various body systems, could be addressed by asking students to imagine life without sports and fitness equipment. “Which body systems would be affected?” and “What would be the consequences?” are questions that could lead to discussions regarding developments related to health issues.

Discussion and reflection regarding what we know about various lifestyles and their effects on body systems (such as deciding to exercise or stop smoking based on scientific research) would provide a better opportunity for students to make informed personal decisions regarding their own health. Teachers could have students investigate risk analysis models used by insurance companies and advertisements for various fitness machines. Other possibilities for research and discussion could be the use of sunscreen, food additives, steroids, as well as health-related issues that arise in newspapers and magazines.

Organ Systems -- Associated Careers and Technology

Suggested Assessment Strategies

Performance

- Create a poster depicting a career in the health field. Their poster should include: (112-10)
 - Educational requirements
 - Salary
 - Job description
 - Visuals
- Research and debate one of the following topics: (113-8)
 - The Dept. of Education's nutrition policy
 - Increasing Physical Education classes in schools
 - The graduation requirement of two Phys. Ed credits
 - Banning the sale of energy drinks to those under 18 years of age
 - Should adults be allowed to smoke in the presence of children?

Resources

<http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html>

ST. p. 456

ST pp. 446-453

ST pp. 493-495 (Science Skills)

TR AC 5

BLM 8 Activity 5

BLM 8 Activity 11

