Unit 1 Tissues, Organs, and Systems of Living Things

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BIG IDEAS

- Developments in medicine and medical technology can have social and ethical implications.
- Plants and animals, including humans, are made of specialized cells, tissues, and organs that are organized into systems.

Overall Expectations

- **B1** evaluate the importance of medical and other technological developments related to systems biology, and analyse their societal and ethical implications;
- **B2** investigate cell division, cell specialization, organs, and systems in animals and plants, using research and inquiry skills, including various laboratory techniques;
- **B3** demonstrate an understanding of the hierarchical organization of cells, from tissues, to organs, to systems in animals and plants.

Materials

Please see page TR-31 for a list of the materials required for this unit and other units.

In this unit, students learn about concepts in biology and the interrelationships between biology, technology, and society. Students learn about the structure and function of cells, tissues, organs, and systems in animals and plants. They also explore how develops in medicine and technology can have social and ethical implications.

Using the Unit Opener (Student textbook page 1)

- Read the opener with the class. Encourage students to comment openly. Ask students the following questions: Where and when have you heard or seen transplant information? What do you know about transplants? What diseases and disorders might require a transplant? What do you know about wait times on transplant lists?
- Have students brainstorm and begin a list of social and ethical issues related to human organ transplants. This list can be expanded as students work through the unit.
- Check what students know and believe already about tissues, organs, and systems of living things using **BLM 1-1 Unit 1 Anticipation Guide.** Then, when they have completed the unit, have students reflect on how and why their understandings and attitudes may have changed.
- Reactivate learning by having students answer the Get Ready questions on pages 2 and 3 of the student textbook. **BLM 1-2 Get Ready** can be used for students who would benefit from remediation.

Assessment OF Learning		
Tool	**Evidence of Student Understanding**	**Supporting Learners**
Inquiry Project	Students design an investigation to determine the relative amount of time each phase of mitosis takes in onion root tip cells. Students display their data graphically and summarize the patterns they observe in the graph.	Provide students with **BLM G-14 Using a Microscope.** Have students review the procedure they followed for Inquiry Investigation 1-B on pages 48 and 49 of the student textbook. Refer students to Math Skills Toolkit 3 Organizing and Communicating Scientific Results with Graphs on pages 556 and 557 of the student textbook.
Issue Analysis Project	Students make a recommendation related to a medical technology that would be useful in supporting patients in need of a new organ. They base their recommendation on the risks and benefits from a variety of perspectives.	Have students visit **www.scienceontario.ca** to find relevant information. Provide students with **BLM G-18 How to Do a Research-Based Project, BLM G-20 Research Worksheet,** and **BLM G-4 Analyzing Issues–Science, Technology, Society, and the Environment.**

Get Ready (Student textbook pages 2 and 3)

Prerequisite Learning

Students would benefit from understanding

- cell theory (question 1)
- the main structures and organelles in plant and animal cells (question 2)
- the basics of microscopy (question 3)
- diffusion (question 4)
- the main characteristics of unicellular and multicellular organisms (question 5, 6, and 8)
- exponents and exponential growth (question 7)

Prerequisite Skills

Students need to be able to

- use appropriate science and technology vocabulary (questions 2, 3, 4, and 8)
- use a variety of forms to communicate with different audiences and for a variety of purposes (questions 1, 2, 4, 5, 6, 7, and 8)
- interpret a variety of literary, graphic, and informational text (questions 3, 4, 6, and 7)
- use their inquiry, numeracy, and literacy skills from multiple areas of previous curricula (questions 5, 6, 7, and 8)

Assessment FOR Learning		
Tool	**Evidence of Student Understanding**	**Supporting Learners**
Concept Check	Students recall and understand that the cell is the basic unit of life, and recall the structure and function of cell organelles. They have had some experience with microscopes and recall the skills of careful handling and use. Students recall the differences between unicellular and multicellular organisms.	Provide worksheets or text from the previous curriculum to help students. Guide students through a cell model in class, identifying organelles and their functions. Provide students with some pre-practice using microscopes or microviewers.
Inquiry Check	Students list characteristics of unicellular and multicellular organisms. They identify organisms in photographs based on these characteristics.	Provide worksheets or text from the previous curriculum to help students. Have students brainstorm answers to question 5 and list characteristics at the front of the class.
Numeracy and Literacy Check	Students calculate the exponential growth of bacterial cells to determine how many bacterial cells will exist after a given time. Students explain how multicellular organisms are structured using key terms from systems biology.	Refer students to Science Skills Toolkit 11 The GRASP Problem Solving Method to help them organize what is given and required in question 7. Have a class discussion about other types of exponential growth students may be familiar with from other fields.

Answers

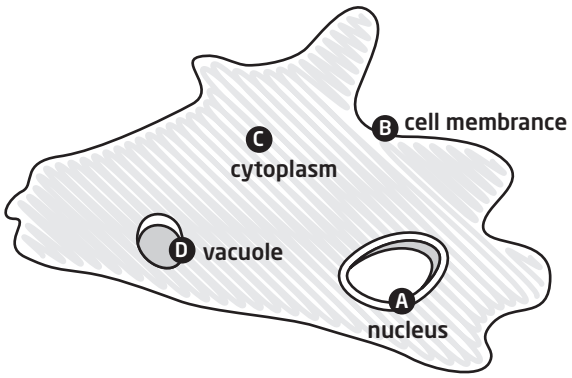
Concept Check

1. a. T

b. T

c. F; All living things are made of one or more cells.

2.



3. a. iv

b. iii

c. i

d. ii

4. In the first diagram (A) there is a high concentration of solute inside the cell and a low concentration of solute outside the cell. The membrane is selectively permeable and in the second diagram (B) solute particles are moving by diffusion from the high concentration inside to the low concentration outside. The concentration of solute in the third diagram (C) is almost equal in the inside and outside.

Inquiry Check

5. unicellular organisms: single-celled; single cell performs all functions; examples include amoeba, paramecium

multicellular organisms: many-celled; cells are specialized for different functions; examples include humans, plants

6.

Organism	Plant, Animal, or Protist?	Unicellular or Multicellular?	Observations
A	Protist	Unicellular	Amoeba, single cell
B	Animal	Multicellular	Snail, different tissues made of different kinds of cells
C	Plant	Multicellular	Plant, different tissues made of different types of cells

7. a. 64

b. 200 min

Numeracy and Literacy Check

8. Multicellular organisms are made up of organ systems. Organ systems are groups of organs that work together. Organs are made up of tissues, which are made up of groups of cells.

Introducing the Unit 1 Projects (Student textbook pages 126 and 127)

The Unit 1 projects provide students with an open-ended, inquiry and/or research approach to furthering their skills and understanding of cells and systems. In the Inquiry Project students are provided with an opportunity to broaden their understanding of the cell cycle and the length of phases, as well as to develop skills of inference (using the number of cells in each phase to infer the length of time of each phase), technical microscopy skills (making their own stained microslides), and personal data collection and analysis. This is a critical age where students are willing and capable of independently seeking an answer to a question in a laboratory setting.

To prepare, have students review Section 1.3 for the knowledge background required. They should pay particular attention to pages 34 and 35. Inquiry Investigation 1-B precedes this project. In this investigation, students examined prepared microslides of cells in phases of mitosis from whitefish embryos and onion root tips. This investigation ensures that students understand what they are viewing in the microscope in terms of cell size, stain colouration, and general make-up of a tissue.

In An Issue to Analyze, students are introduced to the great need in Canada for organ donations, and the lack of organ donors to keep up with the growing population. They are invited to investigate medical technologies that sustain life while a person waits on the organ donor recipient list. They are guided through the research portion of this project in order to prepare a recommendation to the Ministry of Health, suggesting which medical technology would be most useful in continued support for development and use. Through such research and evaluation, students practise their skills including planning, performing, recording, and analysis.

To prepare, students should return to the unit opener on page 1, the Chapter 1 opener on page 4, and Section 3.2 for an overview of organs and medical technologies.

English language learners may find the Inquiry Project more appealing in terms of achieving goals and learning new skills. Encourage these students to practise and develop their language skills in the Communicate Your Findings portion of the An Issue to Analyze project. Bodily-kinesthetic learners may also prefer the hands-on component of the Inquiry Project. For differentiated assessment and student choice, the An Issue to Analyze project may be particularly engaging for logical-mathematical and linguistic learners.

Using Making a Difference (Student textbook pages 44, 68, 113)

The Making a Difference features in this unit demonstrate how people can use their understanding of biology to make a difference. Ted Paranjothy, Isdin Oke, and Jerri Clout each began with an interest in biological systems and how they work. Students can find motivation from these three exemplary individuals. These features provide opportunities for student engagement as they illustrate that high school students are able to expand on what they learn in class and make connections to questions and issues in their lives. Ted, Isdin, and Jerri blended personal experience, academic knowledge, inquisitive natures, and a passionate enthusiasm to make a difference in research or human health.

The features are excellent examples of how enthusiastic students can engage in higher level investigations, perhaps partner with a university, be proud of their accomplishments, and meaningfully contribute to working scientific knowledge in a specific area. Students can be encouraged to take what they learn from the features and do further research in these areas. They may also choose another concept from the unit that they find particularly interesting, and do further work or research to find out how they might become involved in an issue in biology.

Using Science at Work (Student textbook page 124)

Tedros Bezabeh performs his research for the National Research Council of Canada (NRC). The NRC has been active since 1916 and has an expansive mandate. It is involved in many ongoing research investigations that study human tissue or fluids. The highest ethical considerations, including informed consent, must be used for these investigations. Discuss informed consent with students by asking them what they think is involved, and if they think informed consent promotes or inhibits test subjects to participate. Ask students what they think it means to be an ethical scientist.

Tedros Bezabeh uses magnetic resonance spectroscopy to compare stool samples from healthy individuals and those with colorectal cancer. Magnetic resonance spectroscopy has potential in many fields of disease diagnosis. Introduce this feature by having students brainstorm types of medical diagnostic procedures. Ask them to then group these under invasive or non-invasive, rapid or slow, and affordable or expensive. Students may not be able to categorize all of the procedures they come up with.

Extend this feature's information by having students practise a case study where they are a doctor trying to diagnose a disease, and are required to collect samples from a patient. Have them consider what a doctor would say to practise informed consent. How much explanation is needed? How can a doctor make sure a patient understands everything, without over-complicating the issue? How important is patient-doctor communication? Are there courses or ways to practise this? What other medical professionals require excellent patient communication skills?

Using the Case Studies

The suggestions below provide opportunities for students of multiple learning styles to engage in and explore issues. The strategies chosen support bodily-kinesthetic, spatial, and interpersonal learning styles. The strategies also serve as pre-reading strategies and scaffolds for English language learners.

Chapter 1 (Student textbook page 24 and 25)

- Before reading the Case Study, ask students what they know about Dolly, genetic engineering, and cloning. Ask students how they became familiar with these topics. Ask them about their pre-conceived attitudes towards these topics.
- Conduct a class survey on the issue of eating "cloned" meat. Ask students the following statements:
  1. I would eat cloned meat because I have no objections to eating meat in general.
  2. I would eat cloned meat because it is of higher quality.
  3. I would not eat cloned meat because I don't eat meat in general.
  4. I would not eat cloned meat because it is fattier and of lower quality.
- Students can also present their evaluations as group oral reports, debates, docudramas, posters, a scrapbook of print resources on the topic, or pamphlets.

Chapter 2 (Student textbook pages 66 and 67)

- Before reading the feature, orally assess students' knowledge of plant diseases by helping them make connections to animal diseases. Ask students the following questions:
  1. Can you think of some diseases that affect animals?
  2. What organisms cause those diseases? (bacteria, viruses, fungi)
  3. What are some diseases that affect plants?
  4. What kinds of organisms are the causes of those plant diseases?
- Students can also present independently written newspaper articles, questionnaires, letters to editors, play scripts, docudramas, television media reports, scrapbooks of print resources on the topic, or pamphlets.

Chapter 3 (Student textbook page 110 and 111)

- Before reading the Case Study, have students discuss their prior knowledge and experiences with vaccinations. Ask students:
  1. Have you ever had a vaccination?
  2. Do you recall what your last experience was like?
  3. Do you know how often Ontarians expect to receive vaccinations?
  4. What are vaccinations?
  5. Can you name any vaccine-treated diseases?
- Prior to researching some common vaccines in Canada, students can use **BLM G-48 K-W-L Chart** to ask themselves what they know, want to know, and have learned about vaccines.
- Have English language learners search for common word parts in the names of vaccines. Draw pictures to describe what those word parts mean (*coccal* means round). They can draw images or perform a presentation instead creating a pamphlet, if they are more comfortable with their oral communication than their written communication.
- Enrichment—Have students explore the historical development of vaccines. By making connections to microscopy, biotechnology, and medical technologies, students can gain context and understanding about the tremendous efforts that have gone into vaccine development over the years.