Chapter 3 Animals: From Cells to Systems

Materials

Please see the teaching notes for each activity for a list of the materials required. Please see page TR-31 for a summary of the materials required in this chapter and other chapters.

Advance Preparation

- Ensure microscopes or microviewers are in working order. Ideally, there should be one microscope per student or group of students as required.
- Order or ensure availability of prepared slides of various tissues from the human body for Activity 3-2. Ideally, there should be a slide for each tissue type described in Table 3.1 on page 88 of the student textbook.
- Ensure there are timers available for Activity 3-3 or have students bring in timers or watches on the day of the activity.
- Order or ensure availability of preserved frogs for Inquiry Investigation 3-B. Ideally, there should be one frog per student or group of students as required.
- Ensure that complete dissection kits (tray, pins, scissors, forceps, scalpel, and probe) are available for each student or group of students for Investigation 3-B.
- Ensure the availability of safety materials for Inquiry Investigation 3-B, including laboratory gloves, goggles and aprons. Before beginning the investigation, make sure there are enough paper towels handy for clean-up and any spills that may occur.
- Students can review the Key Terms in Chapter 3 using **BLM 3-1 Chapter 3 Key Terms.**

In this chapter, students will learn about cell specialization and the different types of tissues in animals. They will explore stem cells and the ethical questions raised by stem cell research. Students will develop an understanding of hierarchical organization and function of cells, tissues, organs, and systems. They will also explore the use of medical technologies in diagnostics and treatments. Finally, students will learn about and investigate public health strategies.

Using the Chapter Opener (Student textbook pages 82 and 83)

- Before beginning the chapter, ask students what they think the largest organ in the body is (Answer: skin). After students read the Chapter Opener, ask them why they think skin is considered an organ. Ask them to brainstorm the functions they think skin performs. Revisit this list after students have completed Activity 3-1.
- Have students brainstorm new medical technologies they have heard of. Post this list on a bulletin board in the classroom. Have students add to the list as they work through the chapter. Add newspaper and magazine articles and photos related to medical technologies to the bulletin board as students progress through the chapter.
- Remind students of what they learned about cloning in Chapter 1. Ask students if their opinions of cloning have changed after reading the Chapter Opener.

Alternative Context

Ask students if they are familiar with recent news stories about successful face and hand transplants. In 2008, medical specialists in the United States replaced about 80 percent of a patient's face with tissue from a deceased donor. The case received widespread media coverage. The transplant included arteries, muscles, bone, nerves, and skin. The surgery was only the fourth face transplant ever performed and it was the most extensive one to date. Many people think that recipients of face transplants end up looking like their donors, and this idea has been reinforced by popular culture (e.g., in movies). This is not the case because the transplanted tissues generally take the shape of the patient's facial bone structure (the patient in the United States did have her nose reconstructed with some bone tissue from the donor). Face and hands transplants can be more controversial than organ transplants. Patients who undergo these transplants do not have them because they have life-threatening illnesses. The goal of the transplants is to improve the quality of life. For example, the American face transplant patient could not eat or speak and had to breathe through a hole in her trachea before she had the transplant. The surgeries do come with risks, however, including the possibility of tissue rejection. Patients need to take anti-rejection drugs for their entire lives and these drugs can result in other health problems, such as diabetes.

Activity 3-1 More Than a Covering (Student textbook page 83)

Pedagogical Purpose

In this activity, students form hypotheses about specialized skin cells, and analyze the use of cloning to replace natural skin. Students explore the significance of cell specialization, and both the benefits and limitations of a medical technology.

Planning	
Time	10 min

Background

Skin has a number of important functions. It acts as a protective covering for internal tissues and organs, protects the body against infection and fluid loss, helps regulate temperature and eliminate waste, and stores water and fat tissue. It holds receptors that provide other parts of the body with feedback information about touch, pressure, pain, and temperature. For example, receptors in the skin provide information that is sent to the hypothalamus for temperature regulation.

Although replacement skin cannot carry out all of these functions, it still plays a vital role in the treatment of people with severe burns. The need for suitable replacement tissue for burn victims is great but the supply can be limited.

Skin grafting involves transplanting healthy skin or replacement tissue on the site of a burn or other wound (e.g., skin ulcers caused by diabetes). When healthy skin from a patient's own body is used for grafting it is called an autograft. An allograft is a graft that comes from skin from a donor cadaver.

Using donated skin from cadavers carries a higher risk of tissue rejection and infection. A more successful treatment for burn patients has been the use of donated cells from the foreskins of circumcised infants. The donated cells are cultured on a synthetic mesh or scaffold, and are then used as a temporary cover on burn wounds. These cells can be grown to fit the specific size of a wound. Artificial skin created using shark cartilage tissue, collagen taken from cowhide, and a synthetic mesh made of silicon have also been developed by researchers for use as a temporary covering for severe burns.

Third-degree burns are also called full-thickness burns because of the potential loss or severe damage to both the epidermis and dermis. They often require some type of skin grafting. In comparison, first-degree burns, including most sunburns, involve only the epidermis. They can cause redness and minor pain. Second-degree burns involve some dermis and cause more substantial pain, which can depend on the damage to nervous tissues. Scalding from boiling water generally causes second-degree burns. Fourth-degree burns are the most severe of burns and cause damage below the skin, to muscle, tendon and ligaments. People who survive these types of burns always require some form of tissue grafting.

Activity Notes and Troubleshooting

- Students may need prompting to answer question 3. Remind students to think about the functions of skin that they brainstormed for the chapter opener.
- Ensure that students keep a record of their answers to question 4 so they can return to them when they have completed the chapter and expand their explanations with the details they have learned. Alternatively, you could have a class discussion about question 4 at the end of the activity and again at the end of the chapter. Keep a record of students' comments during the first discussion so they have evidence and can appreciate what they learned from the chapter.

Additional Support

- DI Have students answer the questions with a partner. Encourage peer tutoring by pairing spatial and linguistic learners with students who are experiencing difficulty.
- ELL This activity presents new terminology that some students may be unfamiliar with. Encourage English language learners to answer their questions in their own language first and then translate.
- Have a class discussion about students' hypotheses about the functions of the epidermis and dermis before students answer the activity questions. Ask students to support their hypotheses based on information in the diagram.

- Have students begin a journal, list, or chart of all the words from the chapter that are unfamiliar to them. Provide students with **BLM 3-2 Cells to Systems Word Tracker** for students to use to list new terms and their definitions and origins.
- Enrichment—Some students may be interested in carrying out independent research on an issue related to cloning skin cells or other tissues. Encourage these students to present their findings to the class in some form. Provide them with **BLM G-18 How to Do a Research-Based Project** and **BLM G-21 Internet Research Tips.**
- Use **Assessment BLM A-1 Making Observations and Inferences Checklist.**

Answers

1. The dermis includes specialized cells and tissues that help to perform some of the many functions of skin and include nerve endings, hair follicles, and oil and sweat glands.
2. The title "More Than a Covering" hints at the fact that skin acts as more than a covering or outer layer for the rest of the body. It is made up of many different kinds of specialized cells and tissues (e.g., nervous tissues, hair, sweat and oil glands) and as a result has many different functions.
3. Cloned skin still acts as a covering and barrier that can protect the rest of the body, for example, by preventing infection and loss of fluids.
4. Example: Cells divide and reproduce new cells, which replace the dead cells that are shed.

Study Toolkit

Strategy	Page Reference	Additional Support
Making Study Notes	Students can read the paragraphs related to the digestive system on pages 97 to 99. After reading, students can identify the most important information and make point-form study notes by following the model shown in the Study Toolkit on page 84. For example, students can change the heading "Digestive System" to "What does the digestive system do?" and follow the question with point-form notes.	Have students create study notes in a way and format that is meaningful to them. Some students, especially spatial learners, may want to create a diagram or flowchart showing the fate of a meal based on the study notes they made about the digestive system. Provide these students with **BLM G-43 Flowchart** or refer them to Study Toolkit 4 Organizing Your Learning: Using Graphic Organizers on pages 565 and 566 of the student textbook.
Asking Questions	Students can read the first paragraph under "Preventive Health Care" on page 109 and list at least four questions. (For example, students could ask: "What are public health strategies?"; "Why do public health strategies exist?"; "How are vaccinations related to public health strategies?"; "Who benefits from the use of vaccinations?")	Read the paragraph as a class. Ask students what questions they would like answered in the following section. Encourage students who have additional questions about or interest in the material presented in the textbook to conduct independent research and share their findings with the class. Provide students with **BLM G-20 Research Worksheet.**
Word Origins	Students can use a dictionary or other resource to determine the origins of the words used to describe the major organs systems on page 96. For example, the word "circulate", which is the basis for the term "circulatory system" comes from the Latin word *circulatus*, meaning "to form a circle". Students can explain how knowing the origin of a word helps them remember its meaning.	Provide students with **BLM G-40 Word Study.** Learning about word origins can help deepen students understanding of a word. Pair linguistic learners with students who are experiencing difficulty learning the new medical terminology in this chapter and encourage peer tutoring. Provide students with **BLM 3-3 Word Origins: Describing the Human Body and Medical Technology.** Students who are interested in learning more about the origins of medical terminology can be encouraged to perform additional research and share their findings with the class.