Chapter 3 Animals: From Cells to Systems

What You Will Learn

In this chapter, you will learn how to...

- **describe** how the cells of animals become specialized
- **explain** how unspecialized cells replace and repair damaged tissues
- **describe** how organs co-ordinate the actions of different tissues and work together in systems
- **assess** the impact of medical technologies and public health strategies on human health

Why It Matters

Over the years, human health has improved greatly due to advances in technologies that scientists use to study and understand the human body and how it functions.

Skills You Will Use

In this chapter, you will learn how to...

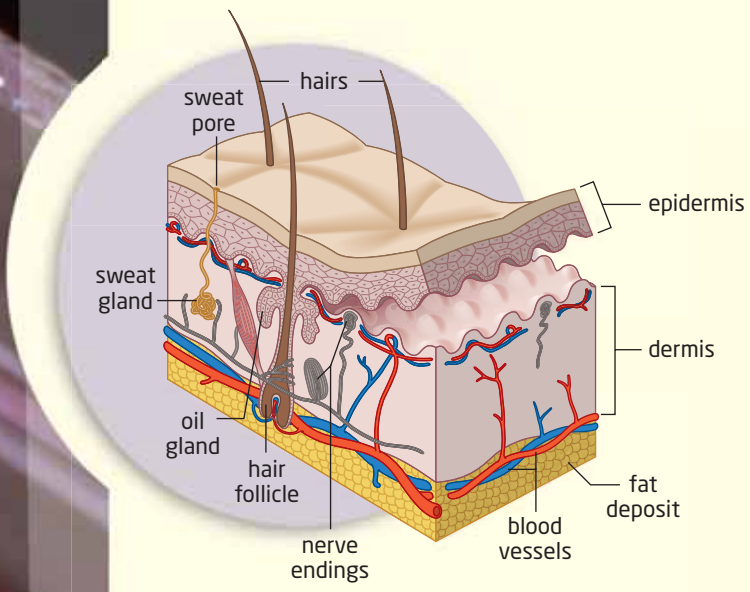
- **examine** and **draw** specialized animal tissues
- **investigate** a frog's body structure through dissection
- **research** the risk factors for heart disease

Skin is the largest organ in the human body. It is the body's first defence against infection and injury. In the past, people with severe burns had to have skin grafted from other parts of their body. However, if people were badly burned, they did not always have enough healthy skin left to graft. Such patients often died due to loss of fluids or infection. Medical specialists can clone new skin (shown here) from a tiny piece of the patient's unburned skin. This technique is one of many new medical technologies that are possible because of our understanding of how cells reproduce and form tissues and organs.

Activity 3-1

More Than a Covering

The diagram below shows a highly magnified section of both layers of human skin, the epidermis and the dermis. In severe, third-degree burns, both layers are damaged. How well does cloned skin replace natural skin?



Procedure

Study the diagram. Based on what you see, record two hypotheses: one about the main functions of the dermis and one about the main functions of the epidermis. How are the cells in these layers specialized? **Hint:** Observe both the appearance of the cells and the kinds of structures each skin layer contains.

Questions

1. Replacement skin created by cloning is not exactly the same as natural skin. Replacement skin lacks the specialized cells of the dermis. Why would this matter?
2. Explain the title of this activity.
3. Even though cloned skin cannot replace all of the abilities of human skin, why do you think using cloned skin to replace damaged skin is still valuable?
4. The epidermis is made of 25 to 30 layers of dead cells that are shed in the thousands every time you shower, shake hands, or scratch an itch. Explain how you think these cells are replaced by your body. After you have completed the chapter, improve your explanation with details you have learned.

Study Toolkit

These strategies will help you use this textbook to develop your understanding of science concepts and skills.
To find out more about these and other strategies, refer to the Study Toolkit Overview, which begins on page 560.

Organizing Your Learning

Making Study Notes

Making study notes on a section of text will help you identify main ideas and state them in your own words. One approach is to change each heading within a section into a question, and then list details that answer the question. Be sure to use the key terms in your notes. Notes about Section 3.3 might begin like this:

Section 3.3: How can humans maintain healthy body systems?

- Various cultures have traditional treatments and cures for disease.
  - **examples:** acupuncture, herbal remedies
- Today's technologies allow doctors to perform surgeries without having to open up the body. This prevents infections that can cause death.
  - **example:** Surgeons can use various forms of biophotonics, which are technologies using light. Includes endoscopy and surgical lasers

Use the Strategy

Read the first paragraph under the heading "Prenatal Care and Ultrasound" on page 109. After reading, follow the model above and make point-form study notes.

Reading Effectively

Asking Questions

While reading, stop to ask *who*, *what*, *when*, *where*, *why*, and *how* questions. Then continue reading to see if your questions are answered in the text.

When they are not, reread the text to see if you have misunderstood something or whether the answer to your question is not provided. This process helps you pay close attention to details in the text.

For example, questions you might ask while reading the "SARS" section on page 112 include the following:

- *What* is SARS?
- *How* is SARS treated?
- *Why* does SARS require a public health strategy?
- *Where* have SARS outbreaks occurred?

Use the Strategy

While reading the first two paragraphs on page 93, list at least four questions. As you read the rest of the section, record any answers you find. Follow up on unanswered questions with a partner.

Word Study

Word Origins

Some English words originated from words in ancient languages, such as Greek and Latin. Knowing the origin of a word may help you understand and remember it better. For example, the word *digestive* comes from the Latin *digerere*, meaning "to separate, divide, arrange." Knowing this might help you remember that the digestive system breaks food down into molecules that are either absorbed or eliminated.

Use the Strategy

The word *follicle* comes from the Latin word *folliculus*, meaning "little bag." Explain how knowing this word's origin can help you remember its current meaning.