SECTION 4

The Integumentary System

What part of your body has to be partly dead to keep you alive? Here are some clues: It comes in many colors, it is the largest organ in the body, and it is showing right now!

Did you guess your skin? If you did, you guessed correctly. Your skin, hair, and nails make up your **integumentary system** (in TEG yoo MEN tuhr ee SIS tuhm). The integumentary system covers your body and helps you maintain homeostasis.

What You Will Learn

- List four functions of skin.
- Describe the two layers of skin.
- Describe the structure and function of hair and nails.
- Describe two kinds of damage that can affect skin.

Vocabulary

integumentary system
epidermis
dermis

READING STRATEGY

Paired Summarizing Read this section silently. In pairs, take turns summarizing the material. Stop to discuss ideas that seem confusing.

Functions of Skin

Why do you need skin? Here are four good reasons:

- Skin protects you by keeping water in your body and foreign particles out of your body.
- Skin keeps you in touch with the outside world. Nerve endings in your skin let you feel things around you.
- Skin helps regulate your body temperature. Small organs in the skin called *sweat glands* make sweat. Sweat is a salty liquid that flows to the surface of the skin. As sweat evaporates, the skin cools.
- Skin helps get rid of wastes. Several kinds of waste chemicals can be removed in sweat.

As shown in **Figure 1,** skin comes in many colors. Skin color is determined by a chemical called *melanin*. If a lot of melanin is present, skin is very dark. If little melanin is present, skin is very light. Melanin absorbs ultraviolet light from the sun. So, melanin reduces damage that can lead to skin cancer. However, all skin, even dark skin, is vulnerable to cancer. Skin should be protected from sunlight whenever possible.

integumentary system the organ system that forms a protective covering on the outside of the body

Figure 1 *Variety in skin color is caused by the pigment melanin. The amount of melanin varies from person to person.*

Figure 2 **Structures of the Skin**

Beneath the surface, your skin is a complex organ made of blood vessels, nerves, glands, and muscles.

Blood vessels transport substances and help regulate body temperature.

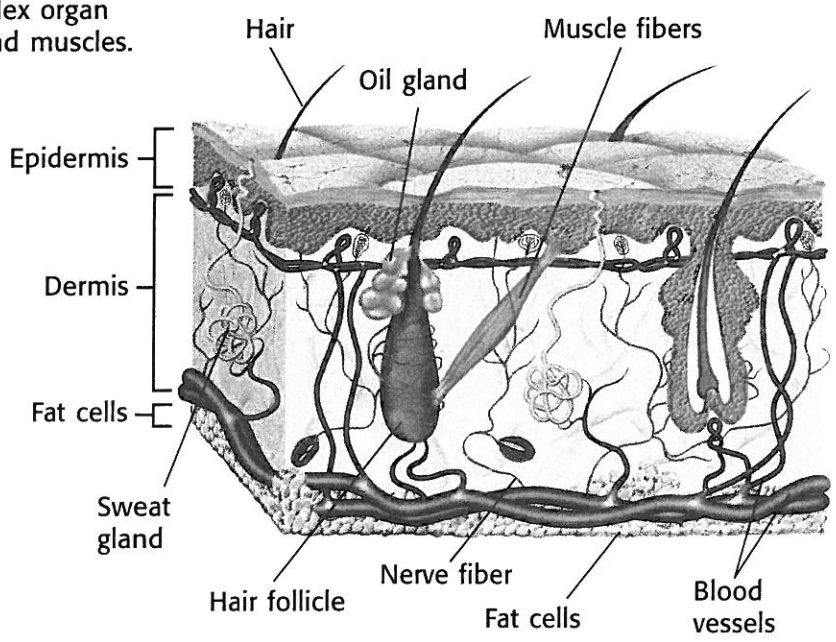
Nerve fibers carry messages to and from the brain.

Hair follicles in the dermis make hair.

Muscle fibers attached to a hair follicle can contract and cause the hair to stand up.

Oil glands release oil that keeps hair flexible and waterproofs the epidermis.

Sweat glands release sweat to cool the body. Sweating is also a way to remove waste materials from the body.



Layers of Skin

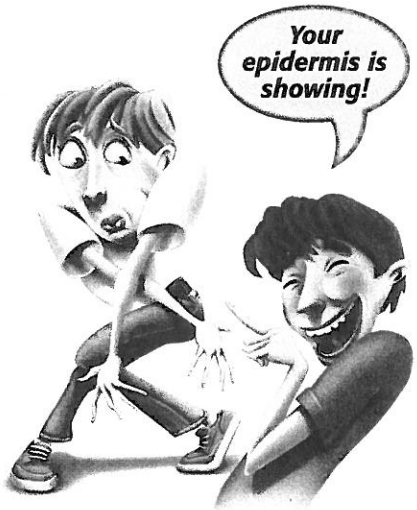
Skin is the largest organ of your body. In fact, the skin of an adult covers an area of about 2 m^2! However, there is more to skin than meets the eye. Skin has two main layers: the epidermis (EP uh DUHR mis) and the dermis. The **epidermis** is the outermost layer of skin. You see the epidermis when you look at your skin. The thicker layer of skin that lies beneath the epidermis is the **dermis.**

epidermis the surface layer of cells on a plant or animal

dermis the layer of skin below the epidermis

Epidermis

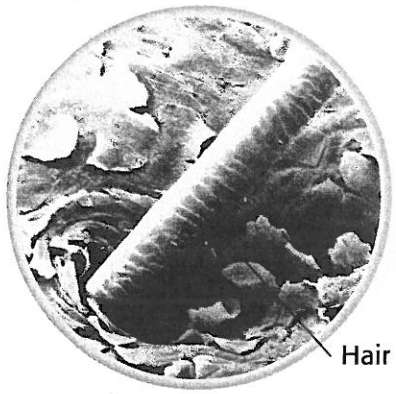
The epidermis is made of epithelial tissue. Even though the epidermis has many layers of cells, it is as thick as only two sheets of paper over most of the body. It is thicker on the palms of your hands and on the soles of your feet. Most cells in the epidermis are dead. These cells are filled with a protein called *keratin*. Keratin helps make the skin tough.



Dermis

The dermis lies beneath the epidermis. The dermis has many fibers made of a protein called *collagen*. These fibers provide strength. They also let skin bend without tearing. The dermis contains many small structures, as shown in **Figure 2.**

Reading Check **Describe the dermis. How does it differ from the epidermis?** (*See the Appendix for answers to Reading Checks.*)



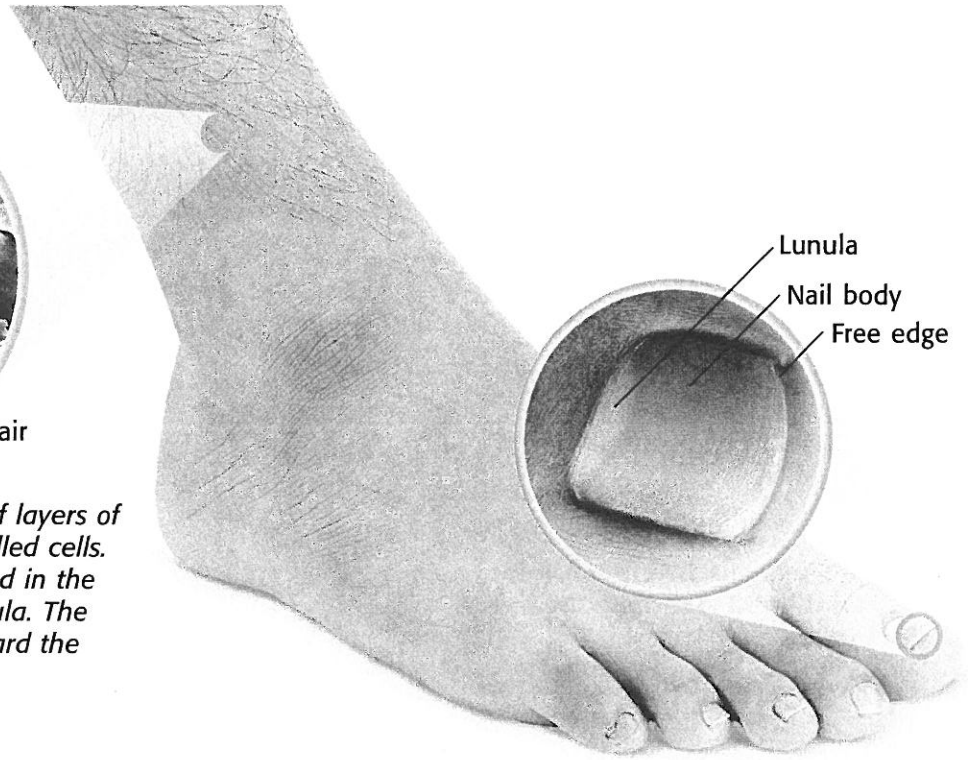


Figure 3 *A hair is made up of layers of dead, tightly packed, keratin-filled cells. In nails, new cells are produced in the nail root, just beneath the lunula. The new cells push older cells toward the outer edge of the nail.*

Hair and Nails

Hair and nails are important parts of the integumentary system. Like skin, hair and nails are made of living and dead cells. **Figure 3** shows hair and nails.

A hair forms at the bottom of a tiny sac called a *hair follicle*. The hair grows as new cells are added at the hair follicle. Older cells get pushed upward. The only living cells in a hair are in the hair follicle. Like skin, hair gets its color from melanin.

Hair helps protect skin from ultraviolet light. Hair also keeps particles, such as dust and insects, out of your eyes and nose. In most mammals, hair helps regulate body temperature. A tiny muscle attached to the hair follicle contracts. If the follicle contains a hair, the hair stands up. The lifted hairs work like a sweater. They trap warm air around the body.

A nail grows from living cells in the *nail root* at the base of the nail. As new cells form, the nail grows longer. Nails protect the tips of your fingers and toes. So, your fingers and toes can be soft and sensitive for a keen sense of touch.

Reading Check **Describe how nails grow.**

CONNECTION TO Social Studies

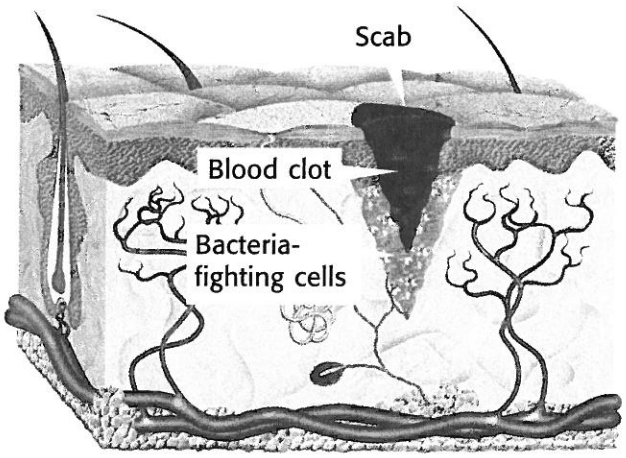
WRITING SKILL **Using Hair** Many traditional cultures use animal hair to make products, such as rugs and blankets. Identify a culture that uses animal hair. In your **science journal,** write a report describing how the culture uses animal hair.

Skin Injuries

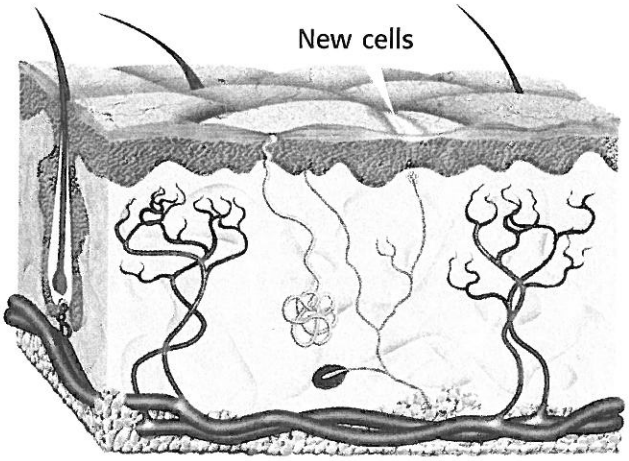
Skin is often damaged. Fortunately, your skin can repair itself, as shown in **Figure 4.** Some damage to skin is very serious. Damage to the genetic material in skin cells can cause skin cancer. Skin may also be affected by hormones that cause oil glands in skin to make too much oil. This oil combines with dead skin cells and bacteria to clog hair follicles. The result is acne. Proper cleansing can help but often cannot prevent this problem.

Figure 4 How Skin Heals

1. A blood clot forms over a cut to stop bleeding and to keep bacteria from entering the wound. Bacteria-fighting cells then come to the area to kill bacteria.



2. Damaged cells are replaced through cell division. Eventually, all that is left on the surface is a scar.



SECTION Review

Summary

- Skin keeps water in the body, keeps foreign particles out of the body, lets people feel things around them, regulates temperature, and removes wastes.
- The two layers of skin are the epidermis and the dermis.
- Hair grows from hair follicles. Nails grow from nail roots.
- Skin may develop skin cancer. Acne may develop if skin produces too much oil.

Using Key Terms

1. In your own words, write a definition for each of the following terms: *integumentary system*, *epidermis*, and *dermis*.

Understanding Key Ideas

2. Which of the following is NOT a function of skin?
   - **a.** to regulate body temperature
   - **b.** to keep water in the body
   - **c.** to move your body
   - **d.** to get rid of wastes
3. Describe the two layers of skin.
4. How do hair and nails develop?
5. Describe how a cut heals.

Math Skills

6. On average, hair grows 0.3 mm per day. How many millimeters does hair grow in 30 days? in a year?

Critical Thinking

7. **Making Inferences** Why do you feel pain when you pull on your hair or nails, but not when you cut them?
8. **Analyzing Ideas** The epidermis on the palms of your hands and on the soles of your feet is thicker than it is anywhere else on your body. Why might this skin need to be thicker?