**KEY CONCEPT**

The integumentary system shields the body.

**Sunshine State Standards**

**SC.F.1.3.1**: The student understands that living things are composed of major systems that function in reproduction, growth, maintenance, and regulation.

**SC.H.3.3.4**: The student knows that technological design should require taking into account constraints such as natural laws, the properties of the materials used, and economic, political, social, ethical, and aesthetic values.

**BEFORE, you learned**

- The body is defended from harmful materials
- Response structures fight disease
- The immune system responds in many ways to illness

**NOW, you will learn**

- About the functions of the skin
- How the skin helps protect the body
- How the skin grows and heals

**VOCABULARY**

- **Integumentary System** p. 649
- **Epidermis** p. 650
- **Dermis** p. 650

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**EXPLORE The Skin**

**What are the functions of skin?**

**PROCEDURE**

1. Using a vegetable peeler, remove the skin from an apple. Take notes on the characteristics of the apple's peeled surface. Include observations on its color, moisture level, and texture.
2. Place the apple on a dry surface. After fifteen minutes, note any changes in its characteristics.

**WHAT DO YOU THINK?**

- What is the function of an apple's skin? What does it prevent?
- What does this experiment suggest about how skin might function in the human body?

**MATERIALS**

- Vegetable peeler
- Apple

**Skin performs important functions.**

Just as an apple's skin protects the fruit inside, your skin protects the rest of your body. Made up of flat sheets of cells, your skin protects the inside of your body from harmful materials outside. The skin is part of your body's **integumentary system** (ihn-TEHG-yu-MEHNTUH-ree), which also includes your hair and nails.

Your skin fulfills several vital functions:

- Skin repels water.
- Skin guards against infection.
- Skin helps maintain homeostasis.
- Skin senses the environment.
The structure of skin is complex.

Have you ever looked closely at your skin? Your skin is more complex than it might at first seem. It does more than just cover your body. The skin is made up of many structures, which perform many different jobs.

Dermis and Epidermis

As you can see in the diagram above, human skin is composed of two layers: an outer layer, called the epidermis, and an inner layer, called the dermis. The cells of the epidermis contain many protein fibers that give the skin tough, protective qualities. These cells are formed in the deepest part of the epidermis. Skin cells move upward slowly as new cells form below them. Above new cells, older cells rub off. The surface cells in the epidermis are dead but form a thick, waterproof layer about 30 cells deep.

The dermis, the inner layer of skin, is made of tissue that is strong and elastic. The structure of the dermis allows it to change shape instead of tear when it moves against surfaces. The dermis is rich in blood vessels, which supply oxygen and nutrients to the skin’s living cells. Just beneath the dermis lies a layer of fatty tissue. This layer protects the body from extremes in temperature, and it stores energy for future use. Also in the dermis are structures that have special functions, including sweat and oil glands, hair, nails, and sensory receptors.
Sweat and Oil Glands

Deep within the dermis are structures that help maintain your body’s internal environment. Sweat glands help control body temperature, and oil glands protect the skin by keeping it moist. Both types of glands open to the surface through tiny openings in the skin called pores. Pores allow important substances to pass to the skin’s surface. Pores can become clogged with dirt and oil. Keeping the skin clean can prevent blockages.

Sweat glands, which are present almost everywhere on the body’s surface, help maintain homeostasis. When you become too warm, the sweat glands secrete sweat, a fluid that is 99% water. This fluid travels from the sweat glands, through the pores, and onto the skin’s surface. You probably know already about evaporation. Evaporation is the process by which a liquid becomes a gas. During evaporation, heat is released. Thus, sweating cools the skin’s surface and the body.

Like sweat glands, oil glands are present almost everywhere on the body. They secrete an oil that moistens skin and hair and keeps them from becoming dry. Skin oils add flexibility and provide part, but not all, of the skin’s waterproofing.

What are the functions of oil glands?

How does oil protect your skin?

PROCEDURE

1. Rub a cotton ball dampened with alcohol across one of your palms. Alcohol removes the oil from the surface of your skin.
2. Drip a couple of drops of water onto the palm with alcohol. Observe what happens. Record your observations.
3. Drip a couple of drops of water onto your other palm. Observe what happens. Record your observations.

WHAT DO YOU THINK?

• Compare the observations for each palm.
• What does this investigation suggest about the importance of oil and oil glands?

CHALLENGE Predict what might happen to your skin if you removed every trace of oil several times a day.
Hair and Nails

In addition to your skin, your integumentary system includes your hair and nails. Many cells in your hair and nails are actually dead but continue to perform important functions.

The hair on your head helps your body in many ways. When you are outside, it shields your head from the Sun. In cold weather, it traps heat close to your head to keep you warmer. Your body hair works the same way, but it is much less effective at protecting your skin and keeping you warm.

Fingernails and toenails protect the tips of the fingers and toes from injury. Both are made of epidermal cells that are thick and tough. They grow from the nail bed, which continues to manufacture cells as the cells that form the nail bond together and grow.

Sensory Receptors

How does your body know when you are touching something too hot or too cold? You get that information from sensory receptors attached to the nerves. These receptors are actually part of the nervous system, but they are located in your skin. Your skin contains receptors that sense heat, cold, pain, touch, and pressure. These sensors help protect the body. For example, temperature receptors sense when an object is hot. If it is too hot and you touch it, pain receptors send signals to your brain telling you that you have been burned.
The skin grows and heals.

As a person grows, skin also grows. As you have noticed if you have ever had a bruise or a cut, your skin is capable of healing. Skin can often repair itself after injury or illness.

Growth

As your bones grow, you get taller. As your muscles develop, your arms and legs become thicker. Through all your body’s growth and change, your skin has to grow, too.

Most of the growth of your skin occurs at the base of the epidermis, just above the dermis. The cells there grow and divide to form new cells, constantly replacing older epidermal cells as they die and are brushed off during daily activity. Cells are lost from the skin’s surface all the time: every 2 to 4 weeks, your skin surface is entirely new. In fact, a percentage of household dust is actually dead skin cells.

Injuries and Healing

You have probably experienced some injuries to your skin, such as blisters, burns, cuts, and bruises. Most such injuries result from the skin’s contact with the outside world, such as a concrete sidewalk. In simple injuries, the skin can usually repair itself.

Burns can be serious injuries. They can be caused by heat, electricity, radiation, or certain chemicals. In mild cases—those of first-degree burns—skin merely becomes red, and the burn heals in a day or two. In severe cases—those of second-degree and third-degree burns—the body loses fluids, and death can result from fluid loss, infection, and other complications.
Sunburns are usually minor first-degree burns, but that does not mean they cannot be serious. Rays from the Sun can burn and blister the skin much as a hot object can. Repeated burning can increase the chance of skin cancer. Specialized cells in the skin make a pigment that absorbs the Sun’s ultraviolet rays and helps prevent tissue damage. These cells produce more of the skin pigment melanin when exposed to the Sun. The amount of melanin in your skin determines how dark your skin is.

Severe cold can damage skin as well. Skin exposed to cold weather can get frostbite, a condition in which the cells are damaged by freezing. Mild frostbite often heals just as well as a minor cut. In extreme cases, frostbitten limbs become diseased and have to be amputated.

What types of weather can damage your skin?

Protection

Your skin is constantly losing old cells and gaining new cells. Although your skin is always changing, it is still important to take care of it.

- Good nutrition supplies materials the skin uses to maintain and repair itself. By drinking water, you help your body, and thus your skin, to remain moist and able to replace lost cells.
- Appropriate coverings, such as sunblock in summer and warm clothes in winter, can protect the skin from weather damage.
- Skin also needs to be kept clean. Many harmful bacteria cannot enter the body through healthy skin, but they should be washed off regularly. This prevents them from multiplying and then entering the body through small cuts or scrapes.