

## SELECTED KEY TERMS

The following terms and other boldface terms in the chapter are defined in the Glossary

**alopecia**  
**arrector pili**  
**cicatrix**  
**dermatitis**  
**dermis**  
**epidermis**  
**erythema**  
**exfoliation**  
**integument**  
**keloid**  
**keratin**  
**lesion**  
**melanin**  
**scar**  
**sebaceous**  
**sebum**  
**stratum**  
**subcutaneous**  
**sudoriferous**

## LEARNING OUTCOMES

After careful study of this chapter, you should be able to:

1. Name and describe the layers of the skin
2. Describe the subcutaneous tissue
3. Give the location and function of the accessory structures of the skin
4. List the main functions of the skin
5. Summarize the information to be gained by observation of the skin
6. List the main disorders of the skin
7. Show how word parts are used to build words related to the skin (see Word Anatomy at the end of the chapter)

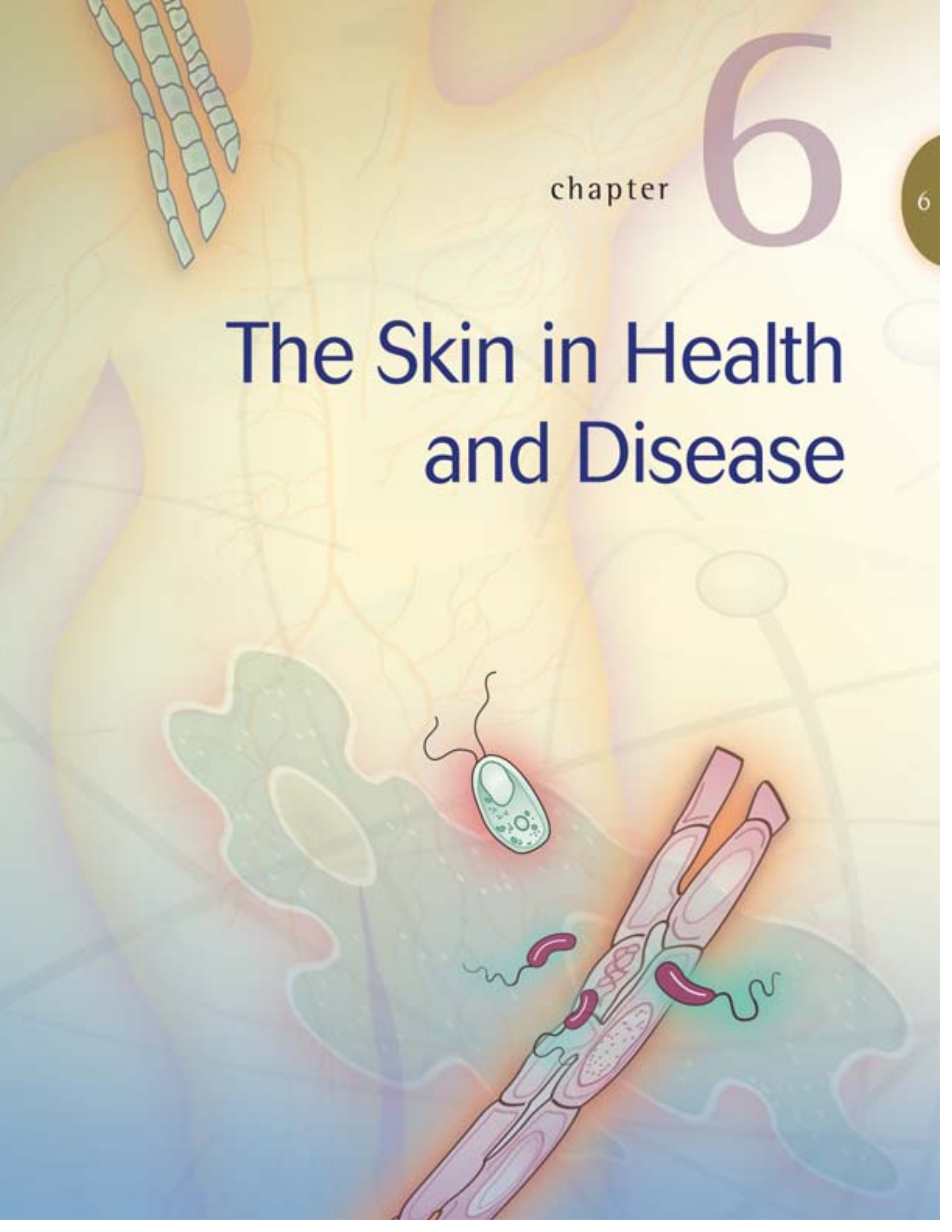


chapter

# 6

6

## The Skin in Health and Disease



The skin is the one system that can be inspected in its entirety without requiring surgery or special equipment. The skin not only gives clues to its own health but also reflects the health of other body systems. Although the skin may be viewed simply as a membrane enveloping the body, it is far more complex than the other epithelial membranes described in Chapter 4.

The skin is associated with accessory structures, also known as appendages, which include glands, hair, and nails. Together with blood vessels, nerves, and sensory organs, the skin and its associated structures form the **integumentary** (in-teg-u-MEN-tar-e) system. This name is from the word integument (in-TEG-u-ment), which means “covering.” The term cutaneous (ku-TA-ne-us) also refers to the skin. The functions of this system are discussed later in the chapter after a description of its structure.

## Structure of the Skin

The skin consists of two layers (Fig. 6-1):

- The **epidermis** (ep-ih-DER-mis), the outermost portion, which itself is subdivided into thin layers called **strata**

(STRA-tah) (sing. stratum). The epidermis is composed entirely of epithelial cells and contains no blood vessels.

- The **dermis**, or true skin, which has a framework of connective tissue and contains many blood vessels, nerve endings, and glands.

Figure 6-2 is a photograph of the skin as seen through a microscope showing the layers and some accessory structures.

## Epidermis

The epidermis is the surface portion of the skin, the outermost cells of which are constantly lost through wear and tear. Because there are no blood vessels in the epidermis, the cells must be nourished by capillaries in the underlying dermis. New epidermal cells are produced in the deepest layer, which is closest to the dermis. The cells in this layer, the **stratum basale** (bas-A-le), or **stratum germinativum** (jer-min-a-TI-vum), are constantly dividing and producing daughter cells, which are then pushed upward toward the surface of the skin. As the epidermal cells die from the gradual loss of nourishment, they undergo changes. Mainly, their cytoplasm is replaced by

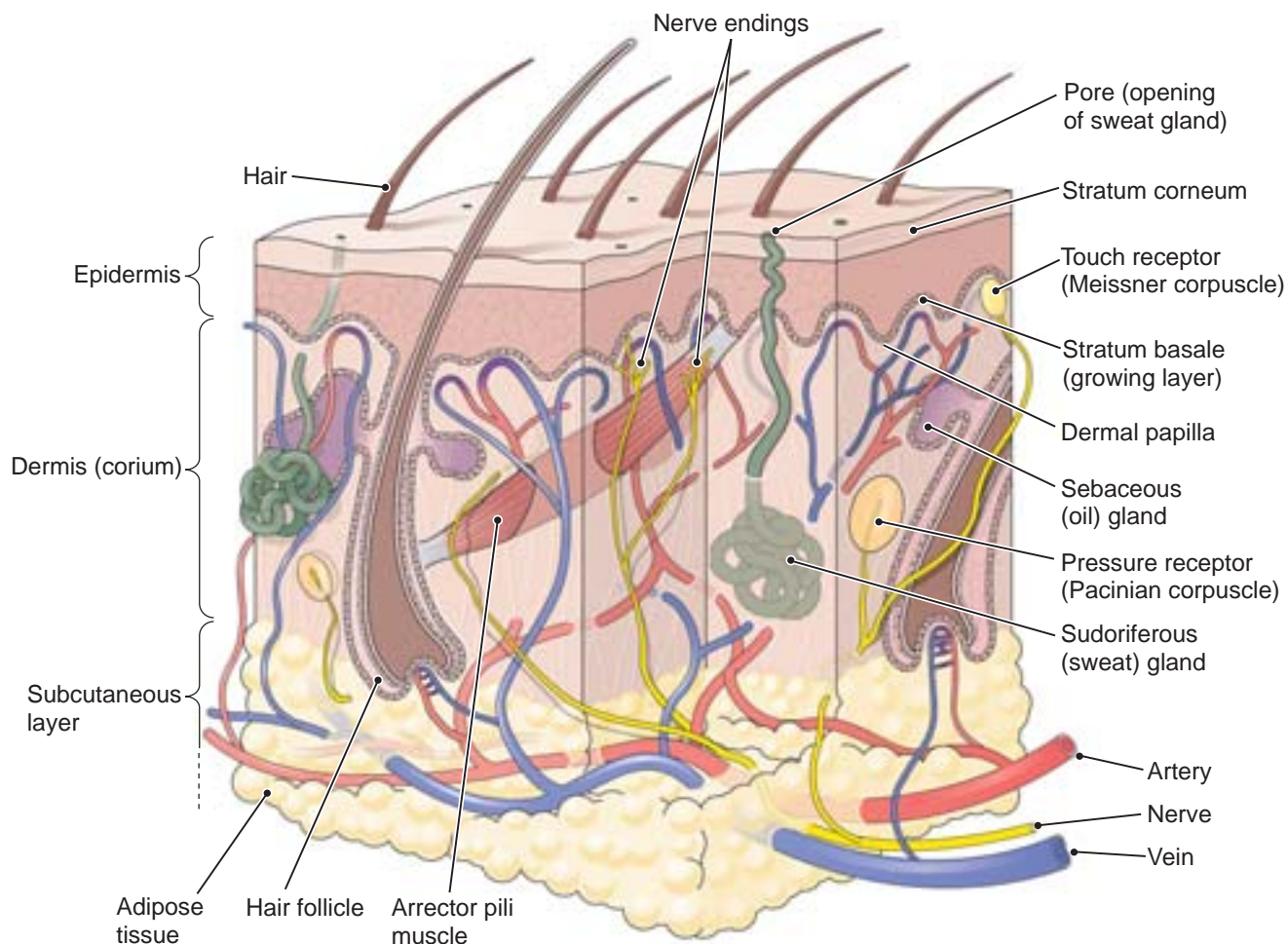
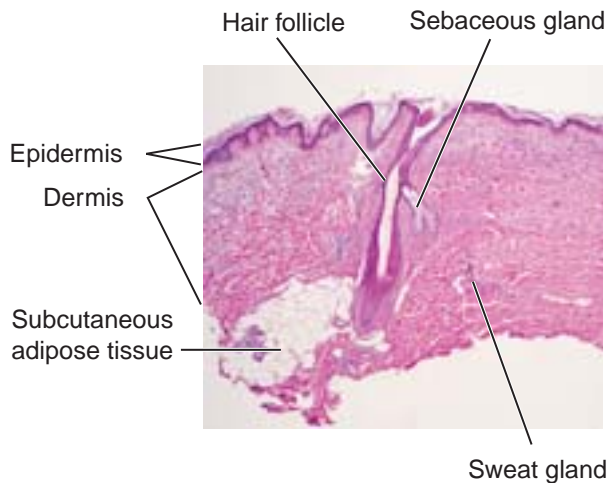


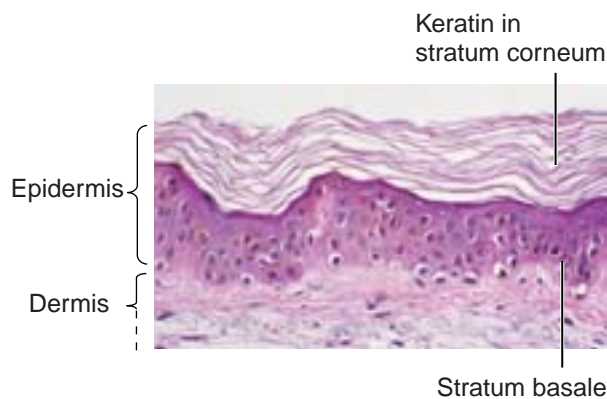
Figure 6-1 Cross-section of the skin.



**Figure 6-2 Microscopic view of thin skin.** Tissue layers and some accessory structures are labeled. (Reprinted with permission from Cormack DH. *Essential Histology*. 2<sup>nd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2001.)

large amounts of a protein called **keratin** (KER-ah-tin), which serves to thicken and protect the skin (Fig. 6-3).

By the time epidermal cells approach the surface, they have become flat, filled with keratin, and horny, forming the uppermost layer of the epidermis, the **stratum corneum** (KOR-ne-um). The stratum corneum is a protective layer and is deeper in thick skin than in thin skin. Cells at the surface are constantly being lost and replaced from below, especially in areas of the skin that are subject to wear and tear, as on the scalp, face, soles of the feet, and palms of the hands. Although this process of **exfoliation** (eks-fo-le-A-shun) occurs naturally at all times, many cosmetics companies sell products to promote exfoliation, presumably to “enliven” and “refresh” the skin.



**Figure 6-3 Upper portion of the skin.** Layers of keratin in the stratum corneum are visible at the surface. Below are layers of stratified squamous epithelium making up the remainder of the epidermis. (Reprinted with permission from Cormack DH. *Essential Histology*. 2<sup>nd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2001.)

Between the stratum basale and the stratum corneum there are additional layers of stratified epithelium that vary in number and quantity depending on the thickness of the skin.

Cells in the deepest layer of the epidermis produce **melanin** (MEL-ah-nin), a dark pigment that colors the skin and protects it from the harmful rays of sunlight. The cells that produce this pigment are the **melanocytes** (MEL-ah-no-sites). Irregular patches of melanin are called freckles.

## Dermis

The **dermis**, the so-called “true skin,” has a framework of elastic connective tissue and is well supplied with blood vessels and nerves. Because of its elasticity, the skin can stretch, even dramatically as in pregnancy, with little damage. Most of the accessory structures of the skin, including the sweat glands, the oil glands, and the hair, are located in the dermis and may extend into the subcutaneous layer under the skin.

The thickness of the dermis also varies in different areas. Some places, such as the soles of the feet and the palms of the hands, are covered with very thick layers of skin, whereas others, such as the eyelids, are covered with very thin and delicate layers. (See Box 6-1, Thick and Thin Skin: Getting a Grip on Their Differences.)

Portions of the dermis extend upward into the epidermis, allowing blood vessels to get closer to the surface cells (see Figs. 6-1 and 6-2). These extensions, or **dermal papillae**, can be seen on the surface of thick skin, such as at the tips of the fingers and toes. Here they form a distinct pattern of ridges that help to prevent slipping, such as when grasping an object. The unchanging patterns of the ridges are determined by heredity. Because they are unique to each person, fingerprints and footprints can be used for identification.

**Checkpoint 6-1** The skin and all its associated structures comprise a body system. What is the name of this system?

**Checkpoint 6-2** The skin itself is composed of two layers. Moving from the superficial to the deeper layer, what are the names of these two layers?

## Subcutaneous Layer

The dermis rests on the **subcutaneous** (sub-ku-TA-ne-us) layer, sometimes referred to as the hypodermis or the superficial fascia (see Fig. 6-1). This layer connects the skin to the surface muscles. It consists of loose connective tissue and large amounts of adipose (fat) tissue. The fat serves as insulation and as a reserve supply for energy. Continuous bundles of elastic fibers connect the subcutaneous tissue with the dermis, so there is no clear boundary between the two.

## Box 6-1 A Closer Look

## Thick and Thin Skin: Getting a Grip on Their Differences

The skin is the largest organ in the body, weighing about 4 kg. Though it appears uniform in structure and function, its thickness in fact varies, from less than 1 mm covering the eyelids to more than 5 mm on the upper back. Many of the functional differences between skin regions reflect the thickness of the epidermis and not the skin's overall thickness. Based on epidermal thickness, skin can be categorized as **thick** (about 1 mm deep) or **thin** (about 0.1 mm deep).

Areas of the body exposed to significant wear and tear (the palms, fingertips, and bottoms of the feet and toes) are covered with thick skin. It is composed of a thick stratum corneum and an extra layer not found in thin skin, the stratum lucidum, both of which make thick skin resistant to abrasion. Thick skin is also characterized by epidermal ridges (e.g., fingerprints) and numerous sweat glands, but lacks hair and

sebaceous (oil) glands. These adaptations make the thick skin covering the hands and feet effective for grasping or gripping. Thick skin's dermis also contains many sensory receptors, giving the hands and feet a superior sense of touch.

Thin skin covers areas of the body not exposed to much wear and tear. It has a very thin stratum corneum and lacks a distinct stratum lucidum. Though thin skin lacks epidermal ridges and has fewer sensory receptors than thick skin, it has several specializations that thick skin does not. Thin skin is covered with hair, which may help prevent heat loss from the body. In fact, hair is most densely distributed in skin that covers regions of great heat loss—the head, axillae (armpits), and groin. Thin skin also contains numerous sebaceous glands, making it supple and free of cracks that may let infectious organisms enter.

The blood vessels that supply the skin with nutrients and oxygen and help to regulate body temperature run through the subcutaneous layer. This tissue is also rich in nerves and nerve endings, including those that supply nerve impulses to and from the dermis and epidermis. The thickness of the subcutaneous layer varies in different parts of the body; it is thinnest on the eyelids and thickest on the abdomen.

**Checkpoint 6-3** What is the composition of the subcutaneous layer?

## Accessory Structures of the Skin

The integumentary system includes some structures associated with the skin—glands, hair, and nails—that not only protect the skin itself but have some more generalized functions as well.

### Sebaceous (Oil) Glands

The **sebaceous** (se-BA-shus) glands are saclike in structure, and their oily secretion, **sebum** (SE-bum), lubricates the skin and hair and prevents drying. The ducts of the sebaceous glands open into the hair follicles (Fig. 6-4 A).

Babies are born with a covering produced by these glands that resembles cream cheese; this secretion is called the **vernix caseosa** (VER-niks ka-se-O-sah), which literally means “cheesy varnish.” Modified sebaceous glands, **meibomian** (mi-BO-me-an) glands, are associated with the eyelashes and produce a secretion that lubricates the eyes.

Blackheads consist of a mixture of dried sebum and keratin that may collect at the openings of the sebaceous glands. If these glands become infected, pimples result. If a sebaceous gland becomes blocked, a sac of accumulated sebum may form and gradually increase in size. Such a

sac is referred to as a **sebaceous cyst**. Usually, it is not difficult to remove such tumorlike cysts by surgery.

### Sudoriferous (Sweat) Glands

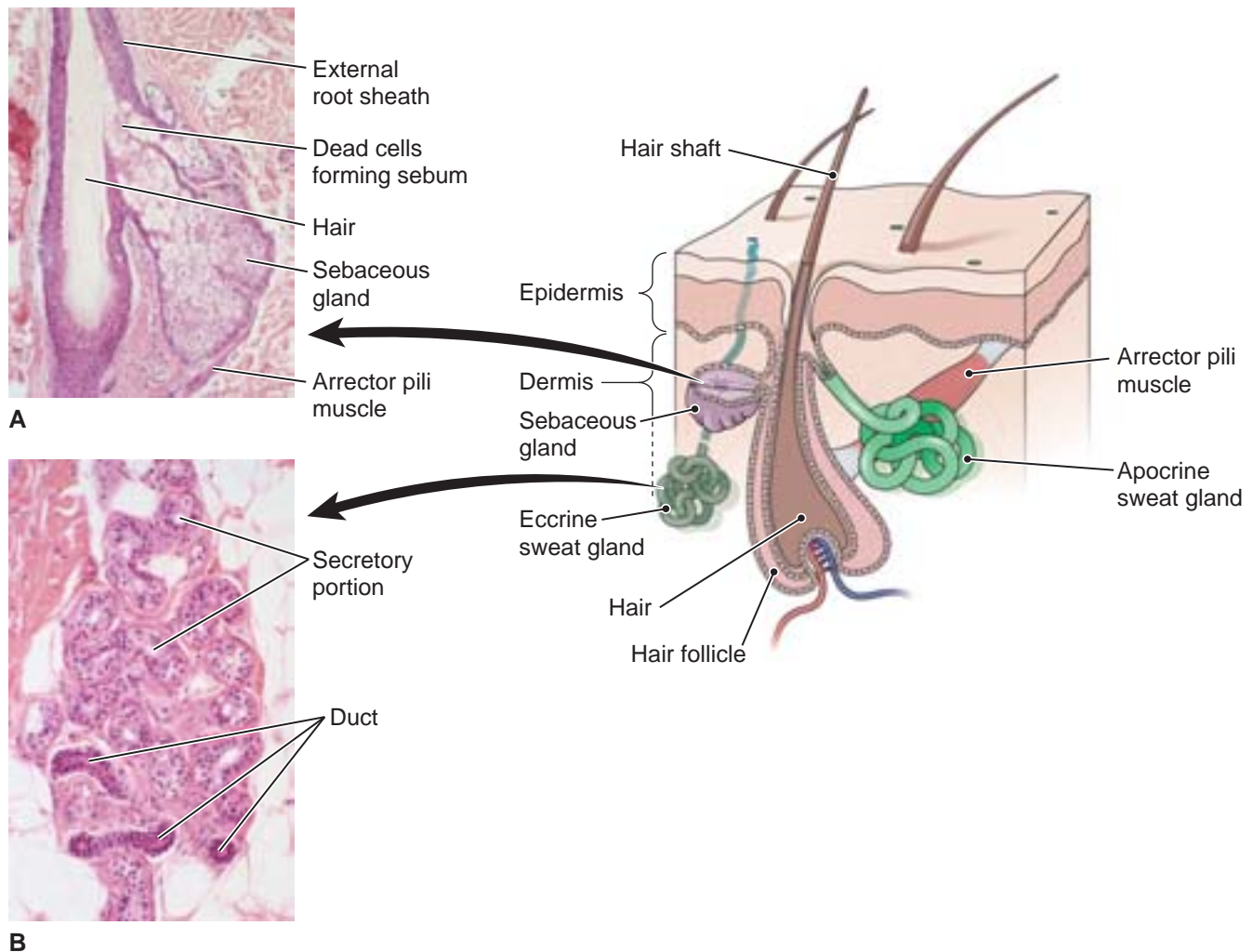
The **sudoriferous** (su-do-RIF-er-us) glands, or sweat glands, are coiled, tubelike structures located in the dermis and the subcutaneous tissue (see Fig. 6-4 B). Most of the sudoriferous glands function to cool the body. They release sweat, or perspiration, that draws heat from the skin as the moisture evaporates at the surface. These **eccrine** (EK-rin) type sweat glands are distributed throughout the skin. Each gland has a secretory portion and an excretory tube that extends directly to the surface and opens at a pore (see also Fig. 6-1). Because sweat contains small amounts of dissolved salts and other wastes in addition to water, these glands also serve a minor excretory function.

Present in smaller number, the **apocrine** (AP-o-krin) sweat glands are located mainly in the armpits (axillae) and groin area. These glands become active at puberty and release their secretions through the hair follicles in response to emotional stress and sexual stimulation. The apocrine glands release some cellular material in their secretions. Body odor develops from the action of bacteria in breaking down these organic cellular materials.

Several types of glands associated with the skin are modified sweat glands. These are the **ceruminous** (seh-RU-min-us) glands in the ear canal that produce ear wax, or **cerumen**; the **ciliary** (SIL-e-er-e) glands at the edges of the eyelids; and the **mammary glands**.

**Checkpoint 6-4** Some skin glands produce an oily secretion called sebum. What is the name of these glands?

**Checkpoint 6-5** What is the scientific name for the sweat glands?



**Figure 6-4** Portion of skin showing associated glands and hair. (A) A sebaceous (oil) gland and its associated hair follicle. (B) An eccrine (temperature-regulating) sweat gland. (A and B, Reprinted with permission from Cormack DH. *Essential Histology*. 2<sup>nd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2001.) **ZOOMING IN** ♦ How do the sebaceous glands and apocrine sweat glands secrete to the outside? What kind of epithelium makes up the sweat glands?

## Hair

Almost all of the body is covered with hair, which in most areas is soft and fine. Hairless regions are the palms of the hands, soles of the feet, lips, nipples, and parts of the external genital areas. Hair is composed mainly of keratin and is not living. Each hair develops, however, from living cells located in a bulb at the base of the **hair follicle**, a sheath of epithelial and connective tissue that encloses the hair (see Fig. 6-4). Melanocytes in this growth region add pigment to the developing hair. Different shades of melanin produce the various hair colors we see in the population. The part of the hair that projects above the skin is the **shaft**; the portion below the skin is the **root** of the hair.

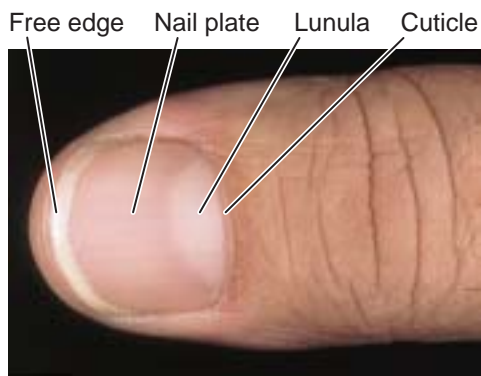
Attached to most hair follicles is a thin band of involuntary muscle (see Fig. 6-1). When this muscle contracts, the hair is raised, forming “goose bumps” on the skin.

The name of this muscle is **arrector pili** (ah-REK-tor PI-li), which literally means “hair raiser.” This response is of no importance to humans but helps animals with furry coats to conserve heat. As the arrector pili contracts, it presses on the sebaceous gland associated with the hair follicle, causing the release of sebum to lubricate the skin.

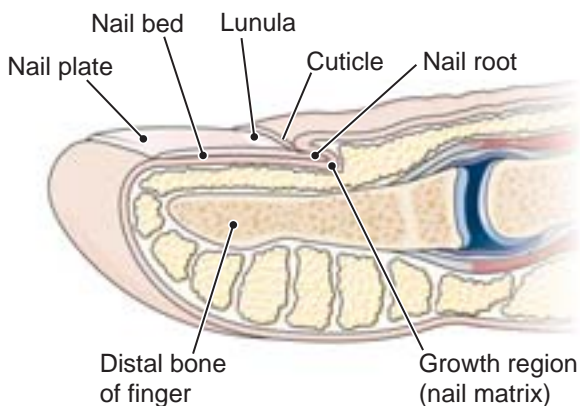
**Checkpoint 6-6** Each hair develops within a sheath. What is this sheath called?

## Nails

Nails protect the fingers and toes and also help in grasping small objects with the hands. They are made of hard keratin produced by cells that originate in the outer layer of the epidermis (stratum corneum) (Fig. 6-5). New cells form continuously in a growth region (nail matrix) located under the proximal end of the nail, a portion called



A



B

**Figure 6-5 Nail structure.** (A) Photograph of a nail, superior view. (B) Midsagittal section of a fingertip. (A, Reprinted with permission from Bickley L.S. Bates' Guide to Physical Examination and History Taking, 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003.)

the **nail root**. The remainder of the **nail plate** rests on a **nail bed** of epithelial tissue. The color of the dermis below the nail bed can be seen through the clear nail. The pale **lunula** (LU-nu-lah), literally “little moon,” at the proximal end of the nail appears lighter because it lies over the thicker growing region of the nail. The **cuticle**, an extension of the stratum corneum, seals the space between the nail plate and the skin above the root.

Nails of both the toes and the fingers are affected by general health. Changes in nails, including abnormal color, thickness, shape, or texture (e.g., grooves or splitting), occur in chronic diseases such as heart disease, peripheral vascular disease, malnutrition, and anemia.

## ► Functions of the Skin

Although the skin has many functions, the following are its four major functions:

- Protection against infection
- Protection against dehydration (drying)

- Regulation of body temperature
- Collection of sensory information

## Protection Against Infection

Intact skin forms a primary barrier against invasion of pathogens. The cells of the stratum corneum form a tight interlocking pattern that is resistant to penetration. The surface cells are constantly being shed, causing the mechanical removal of pathogens. Rupture of this barrier, as in cases of wounds or burns, invites infection of deep tissues. The skin also protects against bacterial toxins (poisons) and some harmful chemicals in the environment.

## Protection Against Dehydration

Both keratin in the epidermis and the oily sebum released to the surface of the skin from the sebaceous glands help to waterproof the skin and prevent water loss by evaporation from the surface.

## Regulation of Body Temperature

Both the loss of excess heat and protection from cold are important functions of the skin. Indeed, most of the blood supply to the skin is concerned with temperature regulation. In cold conditions, vessels in the skin constrict (become narrower) to reduce the flow of blood to the surface and diminish heat loss. The skin may become visibly pale under these conditions. Special vessels that directly connect arteries and veins in the skin of the ears, nose, and other exposed locations provide the volume of blood flow needed to prevent freezing.

To cool the body, the skin forms a large surface for radiating body heat to the surrounding air. When the blood vessels dilate (widen), more blood is brought to the surface so that heat can be dissipated.

The other mechanism for cooling the body involves the sweat glands, as noted above. The evaporation of perspiration draws heat from the skin. A person feels uncomfortable on a hot and humid day because water does not evaporate as readily from the skin into the surrounding air. A dehumidifier makes one more comfortable even when the temperature remains high.

As is the case with so many body functions, temperature regulation is complex and involves several parts of the body, including certain centers in the brain.

## Collection of Sensory Information

Because of its many nerve endings and other special receptors, the skin may be regarded as one of the chief sensory organs of the body. Free nerve endings detect pain and moderate changes in temperature. Other types of sensory receptors in the skin respond to light touch and deep pressure. [Figure 6-1](#) shows some free nerve endings, a touch receptor (Meissner corpuscle), and a deep pressure receptor (Pacinian corpuscle) in a section of skin.



Many of the reflexes that make it possible for humans to adjust themselves to the environment begin as sensory impulses from the skin. As elsewhere in the body, the skin works with the brain and the spinal cord to accomplish these important functions.

## Other Activities of the Skin

Substances can be absorbed through the skin in limited amounts. Some drugs, for example, estrogens, other steroids, anesthetics, and medications to control motion sickness, can be absorbed from patches placed on the skin. (See Box 6-2, Medication Patches: No Bitter Pill to Swallow.) Most medicated ointments used on the skin, however, are for the treatment of local conditions only. Even medication injected into the subcutaneous tissues is absorbed very slowly.

There is also a minimal amount of excretion through the skin. Water and electrolytes (salts) are excreted in sweat (perspiration). Some nitrogen-containing wastes are eliminated through the skin, but even in disease, the amount of waste products excreted by the skin is small.

Vitamin D needed for the development and maintenance of bone tissue is manufactured in the skin under the effects of ultraviolet radiation in sunlight.

Note that the human skin does not “breathe.” The pores of the epidermis serve only as outlets for perspiration from the sweat glands and sebum (oil) from the sebaceous glands. They are not used for exchange of gases.

**Checkpoint 6-7** What two mechanisms are used to regulate temperature through the skin?

## Observation of the Skin

What can the skin tell you? What do its color, texture, and other attributes indicate? Is there any damage? Much can be learned by an astute observer. In fact, the first indication of a serious systemic disease (such as syphilis) may be a skin disorder.

### Color

The color of the skin depends on a number of factors, including the following:

- ▶ Amount of pigment in the epidermis
- ▶ Quantity of blood circulating in the surface blood vessels
- ▶ Composition of the circulating blood, including:
  - ▶ Quantity of oxygen
  - ▶ Concentration of hemoglobin
  - ▶ Presence of bile, silver compounds, or other chemicals

**Pigment** The main pigment of the skin, as we have noted, is called **melanin**. This pigment is also found in the hair, the middle coat of the eyeball, the iris of the eye, and certain tumors. Melanin is common to all races, but darker people have a much larger quantity in their tissues. The melanin in the skin helps to protect against damaging ultraviolet radiation from the sun. Thus, skin that is exposed to the sun shows a normal increase in this pigment, a response we call tanning.

Sometimes, there are abnormal increases in the quantity of melanin, which may occur either in localized areas or over the entire body surface. For example, diffuse spots of pigmentation may be characteristic of some en-

### Box 6-2 Clinical Perspectives

## Medication Patches: No Bitter Pill to Swallow

For most people, pills are a convenient way to take medication, but for others, they have drawbacks. Pills must be taken at regular intervals to ensure consistent dosing, and they must be digested and absorbed into the bloodstream before they can begin to work. For those who have difficulty swallowing or digesting pills, **transdermal (TD) patches** offer an effective alternative to oral medications.

TD patches deliver a consistent dose of medication that diffuses at a constant rate through the skin into the bloodstream. There is no daily schedule to follow, nothing to swallow, and no stomach upset. TD patches can also deliver medication to unconscious patients, who would otherwise require intravenous drug delivery. TD patches are used in hormone replacement therapy, to treat heart disease, to manage pain, and to suppress motion sickness. Nicotine patches are also used as part of programs to quit smoking.

TD patches must be used carefully. Drug diffusion

through the skin takes time, so it is important to know how long the patch must be in place before it is effective. It is also important to know how long the medication's effects take to disappear after the patch is removed. Because the body continues to absorb what has already diffused into the skin, removing the patch does not entirely remove the medicine.

A recent advance in TD drug delivery is **iontophoresis**. Based on the principle that like charges repel each other, this method uses a mild electrical current to move ionic drugs through the skin. A small electrical device attached to the patch uses positive current to “push” positively charged drug molecules through the skin, and a negative current to push negatively charged ones. Even though very low levels of electricity are used, people with pacemakers should not use iontophoretic patches. Another disadvantage is that they can move only ionic drugs through the skin.

doctrine disorders. In **albinism** (AL-bih-nizm), a hereditary disorder that affects melanin production, there is lack of pigment in the skin, hair, and eyes.

Another pigment that imparts color to the skin is carotene, a pigment obtained from carrots and other orange and yellow vegetables. Carotene is stored in fatty tissue and skin. Also visible is hemoglobin, the pigment that gives blood its color, which can be seen through the vessels in the dermis.

**Discoloration** **Pallor** (PAL-or) is paleness of the skin, often caused by reduced blood flow or by reduction in hemoglobin, as occurs in cases of anemia. Pallor is most easily noted in the lips, nail beds, and mucous membranes. **Flushing** is redness of the skin, often related to fever. Signs of flushing are most noticeable in the face and neck.

When there is not enough oxygen in circulating blood, the skin may take on a bluish discoloration termed **cyanosis** (si-ah-NO-sis) (Fig. 6-6 A). This is a symptom of heart failure and of breathing problems, such as asthma or respiratory obstruction.

A yellowish discoloration of the skin may be due to the presence of excessive amounts of bile pigments, mainly bilirubin (BIL-ih-ru-bin), in the blood (Fig. 6-6 B). (Bile is a substance produced by the liver that aids in the digestion of fats; see Chapter 19.) This condition, called **jaundice** (JAWN-dis) (from the French word for “yellow”), may be a symptom of a number of disorders, such as the following:

- ▶ A tumor pressing on the common bile duct or a stone within the duct, either of which would obstruct the flow of bile into the small intestine
- ▶ Inflammation of the liver (hepatitis), commonly caused by a virus
- ▶ Certain diseases of the blood in which red blood cells are rapidly destroyed (hemolyzed)
- ▶ Immaturity of the liver. Neonatal (newborn) jaundice occurs when the liver is not yet capable of processing bilirubin (bile pigment). Most such cases correct themselves without treatment in about a week, but this form of jaundice may be treated by exposure to special fluorescent light that helps the body to get rid of the bilirubin.



A

Another possible cause of a yellowish discoloration of the skin is the excessive intake of carrots and other deeply colored vegetables. This condition is known as **carotene-mia** (kar-o-te-NE-me-ah).

Certain types of chronic poisoning may cause gray or brown discoloration of the skin. A peculiar bronze cast is present in Addison disease (malfunction of the adrenal gland). Many other disorders cause discoloration of the skin, but their discussion is beyond the scope of this chapter.

**Checkpoint 6-8** What are some pigments that impart color to the skin?

## Lesions

A **lesion** (LE-zhun) is any wound or local damage to tissue. In examining the skin for lesions, it is important to make note of their type, arrangement, and location. Lesions may be flat or raised or may extend below the surface of the skin.

**Surface Lesions** A surface lesion is often called a **rash** or, if raised, an **eruption** (e-RUP-shun). Skin rashes may be localized, as in diaper rash, or generalized, as in measles and other systemic infections. Often, these lesions are accompanied by **erythema** (er-eh-THE-mah), or redness of the skin. The following are some terms used to describe surface skin lesions:

- ▶ **Macule** (MAK-ule). A macule is a spot that is neither raised nor depressed. Macules are typical of measles and descriptive of freckles (Fig. 6-7 A).
- ▶ **Papule** (PAP-ule). A papule is a firm, raised area, as in some stages of chickenpox and in the second stage of syphilis (see Fig. 6-7 B). A pimple is a papule. A large firm papule is called a **nodule** (NOD-ule).
- ▶ **Vesicle** (VES-ih-kl). A vesicle is a blister or small sac that is full of fluid, such as may be found in some of the eruptions of chickenpox or shingles (see Fig. 6-7 C). Another term for a vesicle is a **bulla** (BUL-ah).
- ▶ **Pustule** (PUS-tule). A pustule is a vesicle filled with pus. Pustules may develop if vesicles become infected (see Fig. 6-7 D).

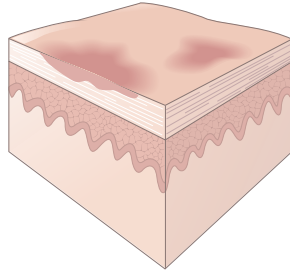


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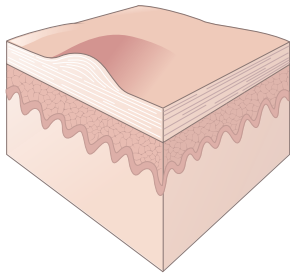
**Figure 6-6** **Discoloration of the skin.** (A) Cyanosis is a bluish discoloration due to lack of oxygen. (B) Jaundice is a yellowish discoloration due to bile pigments in the blood. (Reprinted with permission from Bickley LS. Bates' Guide to Physical Examination and History Taking, 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003.) **ZOOMING IN** ♦ What color is associated with cyanosis? What color is associated with jaundice?



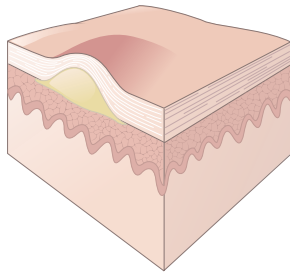
A Macule



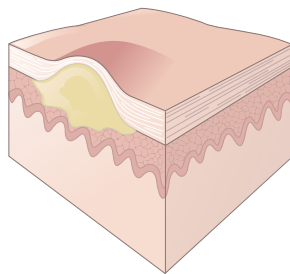
B Papule



C Vesicle



D Pustule



**Figure 6-7 Surface lesions.** (A) Macules on the dorsal surface of the hand, wrist, and forearm. (B) Papules on the knee. (C) Vesicles on the chin. (D) Pustules on the palm. (Photographs reprinted with permission from Bickley LS. *Bates' Guide to Physical Examination and History Taking*. 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003. Line drawings reprinted with permission from Cohen BJ. *Medical Terminology*. 4<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2004.)

**Deeper Lesions** A deeper lesion of the skin may develop from a surface lesion or may be caused by **trauma** (TRAW-mah), that is, a wound or injury. Because such breaks may be followed by infection, wounds should be cared for to prevent the entrance of pathogens and toxins into deeper tissues and body fluids. Deeper injuries to the skin include the following:

- ▶ **Excoriation** (eks-ko-re-A-shun), which is a scratch into the skin
- ▶ **Laceration** (las-er-A-shun), which is a rough, jagged wound made by tearing of the skin
- ▶ **Ulcer** (UL-ser), which is a sore associated with disintegration and death of tissue (Fig. 6-8 A)
- ▶ **Fissure** (FISH-ure), which is a crack in the skin. Athlete's foot, for example, can produce fissures. Tongue fissures may be normal variations in the tongue's surface (see Fig. 6-8 B), but may also appear on the lips or tongue as a result of injury or disease.

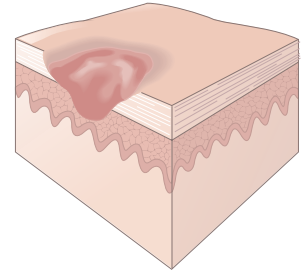
**Checkpoint 6-9** What is a lesion?

## Burns

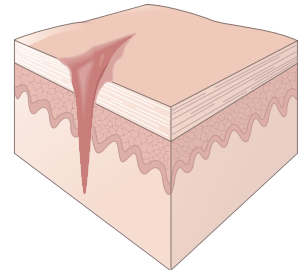
Most burns are caused by contact with hot objects, explosions, or scalding with hot liquids. They may also be caused



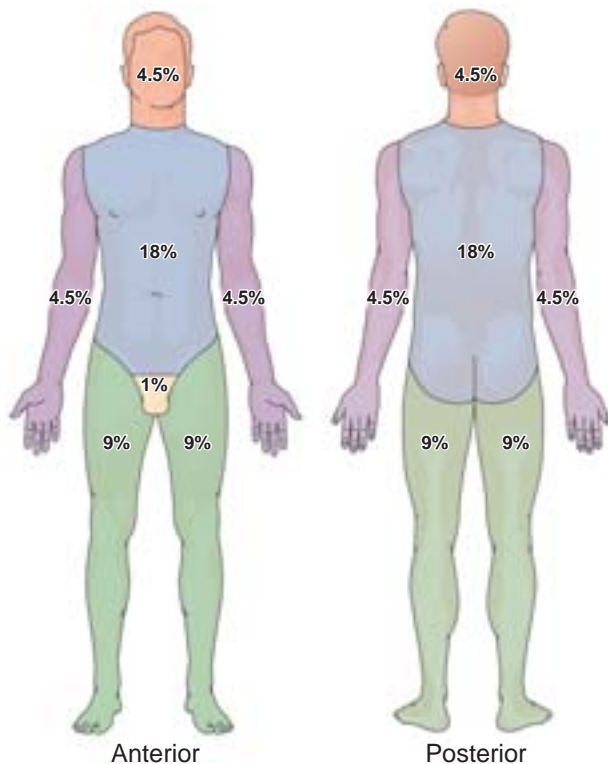
A Ulcer



B Fissures



**Figure 6-8 Deeper lesions.** (A) Tongue ulcer. (B) Tongue fissures. (Photographs reprinted with permission from Langlais RP, Miller CS. *Color Atlas of Common Oral Diseases*. 3<sup>rd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2002. Line drawings reprinted with permission from Cohen BJ. *Medical Terminology*. 4<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2004.)



**Figure 6-9 The rule of nines.** This method is used to estimate percentages of body surface area (BSA) in treatment of burns.

by electrical injuries, contact with harmful chemicals, or abrasion. Burns are assessed in terms of the depth of damage and the percentage of body surface area (BSA) involved. Depth of tissue destruction is categorized as follows:

- ▶ **Superficial partial-thickness**, which involves the epidermis and perhaps a portion of the dermis. The tissue is reddened and may blister, as in cases of sunburn.

- ▶ **Deep partial-thickness**, which involves the epidermis and portions of the dermis. The tissue is blistered and broken, with a weeping surface. Causes include scalding and exposure to flame.
- ▶ **Full-thickness**, which involves the full skin and sometimes subcutaneous tissue and underlying tissues as well. The tissue is broken, dry and pale, or charred. These injuries may require skin grafting and may result in loss of digits or limbs.

The above classification replaces an older system of ranking burns as first-, second-, and third-degree according to the depth of tissue damage.

The amount of body surface area involved in a burn may be estimated by using the **rule of nines**, in which areas of body surface are assigned percentages in multiples of nine (Fig. 6-9). The more accurate Lund and Browder method divides the body into small areas and estimates the proportion of BSA that each contributes.

Infection is a common complication of burns, because the skin, a major defense against invasion of microorganisms, is damaged. Respiratory complications may be caused by inhalation of smoke and toxic chemicals, and circulatory problems may result from loss of fluids and electrolytes. Treatment of burns includes respiratory care, administration of fluids, wound care, and pain control. Patients must be monitored for circulatory complications, infections, and signs of posttraumatic stress.

**Sunburn** Sunlight can cause chemical and biologic changes in the skin. On exposure, the skin first becomes reddened (erythematous) and then may become swollen and blistered. (See Box 6-3, *The Dark Side of the Sun*.) Sunlight can cause severe burns that result in serious illness. Continued excessive exposure to the sun is a risk factor in skin cancer. Tanning requires the skin to protect it-

### Box 6-3 • Health Maintenance

## The Dark Side of the Sun

The three most common forms of skin cancer—basal cell carcinoma, squamous cell carcinoma, and malignant melanoma—share a common risk factor: excessive exposure to the ultraviolet radiation (UV) found in sunlight. UV rays also cause premature aging of the skin, including wrinkling, discoloration (“age spots” or “liver spots”), and a change in texture most often referred to as “leathery skin.” Excessive sun exposure is also a risk factor for cataracts and other eye problems.

The damaging radiation found in sunlight occurs in two different forms, ultraviolet-A (UVA) and ultraviolet-B (UVB). UVA damages the skin’s deeper layers, resulting in a loss of elasticity and a general decrease in blood flow to the skin. UVB damages the skin’s outermost layers, causing the erythema (redness), inflammation, and peeling common to the average “sunburn.” Excessive UV exposure causes genetic mutations in skin cells that make them unable to repair them-

selves and possibly cancerous. Tanning booths also produce UVA and UVB rays and are no safer than sun tanning.

You can reduce the damage caused by UVA and UVB by the following:

- ▶ Limit exposure during midday when the level of UV radiation is highest.
- ▶ Cover up with a hat, long pants, and a long-sleeved shirt when outdoors.
- ▶ Wear sunglasses that block UV rays.
- ▶ Apply a sunscreen with an SPF (sun protection factor) of 15 or higher 30 minutes before going outdoors. Reapply during exposure, especially after swimming.
- ▶ Stay in the shade, where exposure to UVA and UVB is significantly decreased.
- ▶ Avoid tanning booths.

self by producing considerably more than usual amounts of melanin. This increase in pigmentation may reduce the body's ability to profit from smaller amounts of sun available during some parts of the year.

## ► Tissue Repair

True tissue regeneration after injury can occur only in areas that have actively dividing cells or cells that can be triggered to divide by injury. Specifically, these tissues are the epithelial and connective tissues. Even among the connective tissues, repair occurs more slowly in tissues that are not very active metabolically, in cartilage for example. Muscle tissue and nervous tissue, which stop dividing early in life, generally do not restore themselves, although some types can carry out minimal regeneration. When muscle and nervous tissues are injured, they are generally replaced by connective tissue.

Repair of a skin wound or lesion begins after blood has clotted and a scab has formed at the surface to protect underlying tissue. From damaged capillaries, new vessels branch and grow into the injured tissue. Fibroblasts (cells that produce fibers) manufacture collagen to close the gap made by the wound. A large wound requires extensive growth of new connective tissue, which develops from within the wound. This new tissue forms a **scar**, also called a **cicatrix** (SIK-ah-triks).

After the upper layer of epithelium has regenerated, the scab is released. The underlying scar tissue may then continue to show at the surface as a white line. Scar tissue is strong but is not as flexible as normal tissue and does not function like the tissue it replaces. Suturing (sewing) the edges of a clean wound together, as is done in the case of operative wounds, decreases the amount of connective tissue needed for repair and thus reduces the size of the resulting scar.

Excess production of collagen in the formation of a scar may result in the development of **keloids** (KE-loids), tumorlike masses or sharply raised areas on the surface of the skin. These are not dangerous but may be removed for the sake of appearance.

Wound healing is affected by:

- **Nutrition**—A complete and balanced diet will provide the nutrients needed for cell regeneration. All required vitamins and minerals are important, but especially vitamins A and C, which are needed for collagen.
- **Blood supply**—The blood brings oxygen and nutrients to the tissues and also carries away waste materials and toxins (poisons) that might form during the healing process. White blood cells attack invading bacteria at the site of the injury. Poor circulation, as occurs in cases of diabetes, for example, will delay wound healing.
- **Infection**—Contamination prolongs inflammation and interferes with the formation of materials needed for wound repair.

- **Age**—Healing is generally slower among the elderly due to a slower rate of cell replacement. The elderly also may have a lowered immune response to infection.

**Checkpoint 6-10** What two categories of tissues repair themselves most easily?

## ► Effects of Aging on the Integumentary System

As people age, wrinkles, or crow's feet, develop around the eyes and mouth owing to the loss of fat and collagen in the underlying tissues. The dermis becomes thinner, and the skin may become transparent and lose its elasticity, the effect of which is sometimes called "parchment skin." The formation of pigment decreases with age. However, there may be localized areas of extra pigmentation in the skin with the formation of brown spots ("liver spots"), especially on areas exposed to the sun (e.g., the back of the hands). Circulation to the dermis decreases, so white skin looks paler.

The hair does not replace itself as rapidly as before and thus becomes thinner on the scalp and elsewhere on the body. Decreased melanin production leads to gray or white hair. The texture of the hair changes as the hair shaft becomes less dense, and hair, like the skin, becomes drier with a decrease in sebum production.

The sweat glands decrease in number, so there is less output of perspiration and lowered ability to withstand heat. The elderly are also more sensitive to cold because of less fat in the skin and poor circulation. The fingernails may flake, become brittle, or develop ridges, and toenails may become discolored or abnormally thickened.

## ► Care of the Skin

The most important factors in caring for the skin are those that ensure good general health. Proper nutrition and adequate circulation are vital to the maintenance of the skin. Regular cleansing removes dirt and dead skin debris and sustains the slightly acid environment that inhibits bacterial growth on the skin. Careful hand washing with soap and water, with attention to the under-nail areas, is a simple measure that reduces the spread of disease.

The skin needs protection from continued exposure to sunlight to prevent premature aging and cancerous changes. Appropriate applications of sunscreens before and during time spent in the sun can prevent skin damage.

## ► Skin Disorders

Skin disorders range from simple superficial nuisances, such as acne and rashes, to more deep-seated problems that may lead to systemic disease.

## Dermatitis

**Dermatosis** (der-mah-TO-sis) is a general term referring to any skin disease. Inflammation of the skin is called **dermatitis** (der-mah-TI-tis). It may be due to many kinds of irritants, such as the oil of poison oak or poison ivy plants, detergents, and strong acids, alkalis, or other chemicals. Prompt removal of the irritant is the most effective method of prevention and treatment. A thorough cleansing as soon as possible after contact with plant oils may prevent the development of itching eruptions.

**Atopic Dermatitis** Atopic dermatitis (ah-TOP-ik der-mah-TI-tis) or eczema (EK-ze-mah) is characterized by intense itching and skin inflammation (Fig. 6-10). The affected areas show redness (erythema), blisters (vesicles), pimplelike lesions (papules), and scaling and crusting of the skin surface. Scratching (excoriation) of the skin can lead to a secondary bacterial infection. Atopic dermatitis commonly first occurs in early childhood, with the recurrence of acute episodes throughout life. The skin may be excessively sensitive to many soaps, detergents, rough fabrics, or perspiration. The person with atopic dermatitis may also be subject to allergic disorders, such as hay fever, asthma, and food allergies.

## Psoriasis

Psoriasis (so-RI-ah-sis) is a chronic overgrowth of the epidermis leading to large, sharply outlined, red (erythema-



**Figure 6-10 Atopic dermatitis (eczema).** Scratches (excoriation) are visible in the photo. (Reprinted with permission from Bickley LS. Bates' Guide to Physical Examination and History Taking, 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003.)



**Figure 6-11 Psoriasis.** Silvery surface scales are visible. (Reprinted with permission from Bickley LS. Bates' Guide to Physical Examination and History Taking, 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003.)

ous), flat areas (plaques) covered with silvery scales (Fig. 6-11). The cause of this chronic, recurrent skin disease is unknown, but there is sometimes a hereditary pattern, and an immune disorder may be involved. Psoriasis is treated with topical corticosteroids and exposure to ultraviolet (UV) light.

**Checkpoint 6-11** What is the difference between dermatosis and dermatitis?

## Cancer

Skin cancer is the most common form of cancer in the United States. Exposure to sunlight predisposes to development of skin cancer, which, in the United States, is most common among people who have fair skin and who live in the Southwest, where exposure to the sun is consistent and may be intense.

Basal cell and squamous cell carcinomas arise in the epidermis and generally appear on the face, neck, and hands (Fig. 6-12 A, B). Early detection and treatment in these cases usually results in cure, although squamous cell carcinoma is the more likely to metastasize.

**Melanoma** (mel-ah-NO-mah) is a malignant tumor of melanocytes (melanin-forming cells). This type of cancer originates in a **nevus** (NE-vus), a mole or birthmark, anywhere in the body (see Fig. 6-12 C). Unlike a normal mole, which has an evenly round shape and well-defined border, a melanoma may show irregularity in shape. Other signs of melanoma are a change in color or uneven color and increase in size of a mole. A predisposing factor for melanoma is severe, blistering sunburn, although these cancers can appear in areas not sun-exposed, such as the soles of the feet, between fingers and toes, and in mucous membranes.

**Checkpoint 6-12** What is the name for a cancer of the skin's pigment-producing cells?



**Figure 6-12 Skin cancer.** (A) Basal cell carcinoma. (B) Squamous cell carcinoma. (C) Malignant melanoma. (A, Reprinted with permission from Goodheart HP. *Goodheart's Photoguide of Common Skin Disorders; Diagnosis and Management*. 2<sup>nd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003. B, Reprinted with permission from Bickley LS. *Bates' Guide to Physical Examination and History Taking*. 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2003. C, Reprinted with permission from Rubin E, Farber JL. *Pathology*. 3<sup>rd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 1999.)

## Acne and Other Skin Infections

**Acne** (AK-ne) is a disease of the sebaceous (oil) glands connected with the hair follicles. The common type, called **acne vulgaris** (vul-GA-ris), is found most often in people between the ages of 14 and 25 years. The infection of the oil glands takes the form of pimples, which generally surround blackheads. Acne is usually most severe at adolescence, when certain endocrine glands that control sebaceous secretions are particularly active.

**Impetigo** *Impetigo* (im-peh-TI-go) is an acute contagious disease of staphylococcal or streptococcal origin that may be serious enough to cause death in newborn infants. It takes the form of blisterlike lesions that become filled with pus and contain millions of virulent bacteria. It is found most frequently among poor and undernourished children. Affected people may reinfect themselves or infect others.

**Viral Infections** One virus that involves the skin is **herpes** (HER-peze) **simplex virus**, which causes the formation of watery vesicles (cold sores, fever blisters) on the skin and mucous membranes. Type I herpes causes lesions around the nose and mouth; type II is responsible for genital infections (see Table 2 in Appendix 5).

**Shingles** (herpes zoster) is seen in adults and is caused by the same virus that causes chickenpox (varicella). Infection follows nerve pathways, producing small lesions on the skin. Vesicular lesions may be noted along the course of a nerve. Pain, increased sensitivity, and itching are common symptoms that usually last longer than a year. Prompt treatment with antiviral drugs decreases the severity of this disease.

A **wart**, or **verruca** (veh-RU-kah), is a small tumor caused by a virus of the human papillomavirus (HPV) group. Warts may appear anywhere on the body, including the genital region and the soles of the feet (plantar wart). They can be removed by chemical treatment or

surgery. Usually benign, warts have been associated with cancer, especially in the case of genital warts and cancer of the cervix (neck of the uterus).

**Fungal Infections** Fungi are non-green, plantlike microorganisms that may cause surface infections of the skin. These superficial mycotic (fungal) infections, commonly known as **tinea** or ringworm, may appear on the face, body, scalp, hands, or feet (Fig. 6-13). When on the foot, the condition is usually called **athlete's foot**, as fungal growth is promoted by the dampness caused by perspiration. Fungal infections of the nails commonly result from wearing false nails or acrylic nails, as fungal growth is promoted by the moisture that accumulates under the artificial nails.

Fungal infections are difficult to treat. Topical antifungal agents are used, but it is often necessary to take the drugs orally.

**Checkpoint 6-13** What are some viruses that affect the skin?



**Figure 6-13 Tinea (ringworm) of the body.** (Reprinted with permission from Hall JC. *Sauer's Manual of Skin Diseases*. 8<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 1999.)

**Checkpoint 6-14** What causes tinea or ringworm infections?

## Alopecia (Baldness)

**Alopecia** (al-o-PE-she-ah), or baldness, may be due to a number of factors. The most common type, known as male pattern baldness, is an expression of heredity and aging; it is influenced by male sex hormones. Topical applications of the drug minoxidil (used as an oral medication to control blood pressure) have produced growth of hair in this type of baldness. Alopecia may be the result of a systemic disease, such as uncontrolled diabetes, thyroid disease, or malnutrition. In such cases, control of the disease results in regrowth of hair. A growing list of drugs has been linked with baldness, including the chemotherapeutic drugs used in treating neoplasms.

## Allergy and Other Immune Disorders

**Allergy**, also known as hypersensitivity, is an unfavorable immune response to a substance that is normally harmless to most people (see Chapter 17). Foods, drugs, cosmetics, and a variety of industrial substances can provoke allergic responses in some people. Often the skin is involved in such responses, showing inflammation, rashes, vesicles, or other forms of eruptions, usually accompanied by severe **pruritus** (pru-RI-tus), or itching.

**Urticaria** (ur-tih-KA-re-ah), or hives, is an allergic reaction characterized by the temporary appearance of elevated red patches known as *wheals*.

**Autoimmune Disorders** An autoimmune disease results from an immune reaction to one's own tissues. The following diseases that involve the skin are believed to be caused, at least in part, by autoimmune reactions.

**Pemphigus** (PEM-fi-gus) is characterized by the formation of blisters, or bullae (BUL-e) in the skin and mucous membranes caused by a separation of epidermal cells from underlying layers. Rupture of these lesions leaves deeper areas of the skin unprotected from infection and fluid loss, much as in cases of burns. Pemphigus is fatal unless treated by methods to suppress the immune system.

**Lupus erythematosus** (LU-pus er-ih-the-mah-TO-sus) (LE) is a chronic, inflammatory, autoimmune dis-

ease of connective tissue. The more widespread form of the disease, systemic lupus erythematosus (SLE), involves the skin and other organs. The discoid form (DLE) involves only the skin. It is seen as rough, raised, violet-tinted papules, usually limited to the face and scalp. There may also be a butterfly-shaped rash across the nose and cheeks, described as a malar (cheekbone) rash. The skin lesions of lupus are worsened by exposure to the ultraviolet radiation in sunlight. SLE is more prevalent in women than in men and has a higher incidence among Asians and blacks than in other populations.

**Scleroderma** is a disease of unknown cause that involves overproduction of collagen with thickening and tightening of the skin. Sweat glands and hair follicles are also involved. A very early sign of scleroderma is numbness, pain, and tingling on exposure to cold caused by constriction of blood vessels in the fingers and toes. Skin symptoms first appear on the forearms and around the mouth. Internal organs become involved in a diffuse form of scleroderma called progressive systemic sclerosis (PSS).

## Pressure Ulcers

**Pressure ulcers** are skin lesions that appear where the body rests on skin that covers bony projections, such as the spine, heel, elbow, or hip. The pressure interrupts circulation leading to ulceration and death of tissue. Poor general health, malnutrition, age, obesity, and infection contribute to the development of pressure ulcers.

Lesions first appear as redness of the skin. If ignored, they may penetrate the skin and underlying muscle, extending even to bone and requiring months to heal.

Pads or mattresses to relieve pressure, regular cleansing and drying of the skin, frequent change in position, and good nutrition help to prevent pressure ulcers. Prevention of pressure ulcer by these methods is far easier than treatment of an established ulcer.

Other terms for pressure ulcers are *decubitus ulcer* and *bedsore*. Both of these terms refer to lying down, although pressure ulcers may appear in anyone with limited movement, not only those who are confined to bed.

**Checkpoint 6-15** What are several autoimmune disorders that involve the skin?



## Word Anatomy

Medical terms are built from standardized word parts (prefixes, roots, and suffixes). Learning the meanings of these parts can help you remember words and interpret unfamiliar terms.

WORD PART	MEANING	EXAMPLE
<b>Structure of the Skin</b>		
derm/o	skin	The <i>epidermis</i> is the outermost layer of the skin.
corne/o	horny	The stratum <i>corneum</i> is the outermost thickened, horny layer of the skin.
melan/o	dark, black	A <i>melanocyte</i> is a cell that produces the dark pigment melanin.
sub-	under, below	The <i>subcutaneous</i> layer is under the skin.
<b>Accessory Structures of the Skin</b>		
ap/o-	separation from, derivation from	The <i>apocrine</i> sweat glands release some cellular material in their secretions.
pil/o	hair	The arrector <i>pili</i> muscle raises the hair to produce “goose bumps.”
<b>Observation of the Skin</b>		
alb/i	white	<i>Albinism</i> is a condition associated with a lack of pigment, so the skin appears white.
-ism	state of	See preceding example.
cyan/o	blue	<i>Cyanosis</i> is a bluish discoloration of the skin due to lack of oxygen.
-sis	condition, process	See preceding example.
bili	bile	<i>Bilirubin</i> is a pigment found in bile.
-emia	condition of blood	In <i>carotenemia</i> , vegetable pigments, as from carrots, appear in the blood and give color to the skin.
eryth	red	<i>Erythema</i> is redness of the skin.
<b>Skin Disorders</b>		
dermat/o	skin	<i>Dermatosis</i> is any skin disease.
scler/o	hard	<i>Scleroderma</i> is associated with a hardening of the skin.

## Summary

### I. Structure of the skin

- A. Epidermis—surface layer of the skin
  1. Stratum basale (stratum germinativum)
    - a. Produces new cells
    - b. Melanocytes produce melanin—dark pigment
  2. Stratum corneum
    - a. Surface layer of dead cells
    - b. Contain keratin
- B. Dermis (true skin)
  1. Deeper layer of the skin
  2. Has blood vessels and accessory structures
- C. Subcutaneous layer
  1. Under the skin
  2. Made of connective tissue and adipose (fat) tissue

### II. Accessory structures of the skin

- A. Sebaceous (oil) glands
  1. Release sebum—lubricates skin and hair
- B. Sudoriferous (sweat) glands
  1. Eccrine type
    - a. Control body temperature
    - b. Widely distributed
    - c. Vent directly to surface

- 2. Apocrine type
  - a. Respond to stress
  - b. In armpit and groin
  - c. Excrete through hair follicle
- C. Hair
  1. Develop in hair follicle (sheath)
  2. Active cells at base of follicle
- D. Nails
  1. Grow from nail matrix at proximal end

### III. Functions of the skin

- A. Protection against infection—barrier
- B. Protection against dehydration—keratin and sebum water-proof skin
- C. Regulation of body temperature—blood supply and sweat glands
- D. Collection of sensory information—receptors in skin
- E. Other activities of the skin—absorption, excretion, manufacture of vitamin D

### IV. Observation of the skin

- A. Color
  1. Pigment—mainly melanin, also carotene, hemoglobin
  2. Discoloration—pallor, flushing, cyanosis, jaundice, poisoning

- B.** Lesions—wound or local damage
1. Surface lesions (rash, eruption)
    - a. Macule (spot), papule (firm, raised), vesicle (blister), pustule (pus-filled)
  2. Deeper lesions
    - a. excoriation (scratch), laceration (tear), ulcer (sore), fissure (crack)
- C.** Burns
1. Evaluated by depth of damage and amount body surface area (BSA) involved
  2. Sunburn—risk factor in skin cancer

### V. Tissue repair

1. Requires actively dividing cells
2. Easiest in epithelial and connective tissue
3. Fibrous material forms scar (cicatrix)
4. Influenced by nutrition, blood supply, infection, age

### VI. Effects of aging on the integumentary system

### VII. Care of the skin—good nutrition, cleansing, sun protection

### VIII. Skin disorders

- A.** Dermatitis—inflammation
1. Atopic dermatitis (eczema)
- B.** Psoriasis
- C.** Cancer
1. Basal cell carcinoma
  2. Squamous cell carcinoma
  3. Melanoma—cancer of melanocytes
- D.** Acne and other skin infections
1. Acne—disease of sebaceous glands related to increased endocrine secretions
  2. Impetigo—infectious disease of infants and children
  3. Viral infections—herpes viruses, shingles, human papilloma virus
  4. Fungal (mycotic) infections—tinea (ringworm)
- E.** Alopecia—baldness
- F.** Allergy and other immune disorders
1. Allergy—hypersensitivity
    - a. Urticaria (hives)
  2. Autoimmune disorders—pemphigus, lupus erythematosus, scleroderma
- G.** Pressure ulcers (decubitus ulcer, bedsore)
1. Caused by pressure on skin over bone

## Questions for Study and Review

### Building Understanding

#### Fill in the blanks

1. Cells of the stratum corneum contain large amounts of a protein called \_\_\_\_\_.
2. Sweat glands located in the axillae and groin are called \_\_\_\_\_ sweat glands.
3. The name of the muscle that raises the hair is \_\_\_\_\_.
4. A dark-colored pigment that protects the skin from ultraviolet light is called \_\_\_\_\_.
5. A medical term that means “scar” is \_\_\_\_\_.

#### Matching

Match each numbered item with the most closely related lettered item.

- |   |              |
|---|--------------|
| ___ 6. Skin sensitivity characterized by intense itching and inflammation                           | a. urticaria |
| ___ 7. A viral infection that follows nerve pathways, producing small lesions on the overlying skin | b. pruritis  |
| ___ 8. Severe itching of the skin   | c. shingles  |
| ___ 9. Allergic reaction characterized by the appearance of wheals                                  | d. psoriasis |
| ___ 10. Chronic skin disease characterized by red flat areas covered with silvery scales            | e. eczema    |

#### Multiple choice

- |   |  |
|---|--|
| ___ 11. The epidermis is _____ to the dermis. | c. verruca   |
| a. superficial                                | d. dermatitis  |
| b. deep                                       | ___ 14. Accumulation of bile pigments in the blood causes      |
| c. lateral                                    | a. pallor  |
| d. medial                                     | b. cyanosis  |
| ___ 12. Acne is an infection of a             | c. jaundice  |
| a. sudoriferous gland                         | d. carotenemia   |
| b. sebaceous gland                            | ___ 15. Basal cell and squamous cell carcinomas are cancers of |
| c. ceruminous gland                           | a. epidermal cells   |
| d. meibomian gland                            | b. dermal cells  |
| ___ 13. The medical term for baldness is      | c. melanocytes   |
| a. alopecia                                   | d. subcutaneous fat  |
| b. pemphigus                                  |  |

**Understanding Concepts**

16. Compare and contrast the epidermis, dermis, and hypodermis. How are the outermost cells of the epidermis replaced?
17. What are the four most important functions of the skin?
18. Describe the location and function of the two types of skin glands.
19. Describe the events associated with skin wound healing.
20. What changes may occur in the skin with age?
21. What is the difference between the terms *dermatosis* and *dermatitis*? List examples of irritants that can cause dermatitis.

22. Discuss some ways to prevent and control athlete's foot.
23. What is a decubitus ulcer? List the two best measures for preventing decubitus ulcer.

**Conceptual Thinking**

24. Skin is the largest organ in your body. Explain why it is an organ.
25. Remember Mr. Baker from last chapter? He sustained full-thickness burns to his legs while lighting a fire with gasoline. After Mr. Baker is informed that he will require skin grafting, he asks you why his own skin won't heal by itself. How would you answer his question? Using the rule of nines, estimate Mr. Baker's percentage body surface area burned.