

# Skin

An anatomical illustration of a cross-section of human skin. The top layer is the epidermis, showing a wavy surface with several hair follicles extending upwards. Below the epidermis is the dermis, which contains a network of purple-colored blood vessels and collagen fibers. The bottom layer is the hypodermis, composed of yellowish adipose tissue. The entire illustration is set against a dark background with a vertical orange gradient on the left side.

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## INTRODUCTION

The skin and its accessory structures (hair, nails, and glands) make up the **integumentary system** of the body. Integument means covering, and the skin (weighing 8 to 10 pounds and extending over an area of 22 square feet in an average adult) is the outer covering for the body. It is, however, more than a simple body covering. This complex system of specialized tissues contains glands that secrete several types of fluids, nerves that carry impulses, and blood vessels that aid in the regulation of the body temperature.

The skin has many important functions:

First, as a protective membrane over the entire body, the skin guards the deeper tissues of the body against excessive loss of water, salts, and heat and against invasion of pathogens and their toxins. Secretions from the skin are slightly acidic in nature, which contributes to the skin's ability to prevent bacterial invasion. Specialized cells (Langerhans cells) react to the presence of antigens and have an immune function.

Second, the skin contains two types of glands that produce important secretions. These glands in the skin are the **sebaceous glands** and the **sweat glands**. Sebaceous glands produce **sebum**, an oily secretion, and sweat glands produce **sweat**, a watery secretion. Sebum and sweat pass to the outer edges of the skin through ducts and leave the skin through openings, or pores. Sebum lubricates the surface of the skin, and sweat cools the body as it evaporates from the skin surface.

Third, nerve fibers under the skin are receptors for sensations such as pain, temperature, pressure, and touch. Thus, the body's adjustment to the environment depends on sensory messages relayed to the brain and spinal cord by sensitive nerve endings in the skin.

Fourth, different tissues in the skin maintain body temperature (thermoregulation). Nerve fibers coordinate thermoregulation by carrying messages to the skin from heat centers in the brain that are sensitive to increases and decreases in body temperature. Impulses from these fibers cause blood vessels to dilate to bring blood to the surface and cause sweat glands to produce the watery secretion that carries heat away.

## ANATOMY OF THE SKIN

Figure 16-1A shows three layers of the skin. Label them from the outer surface inward:

**Epidermis** [1]—a thin, cellular membrane layer; containing keratin

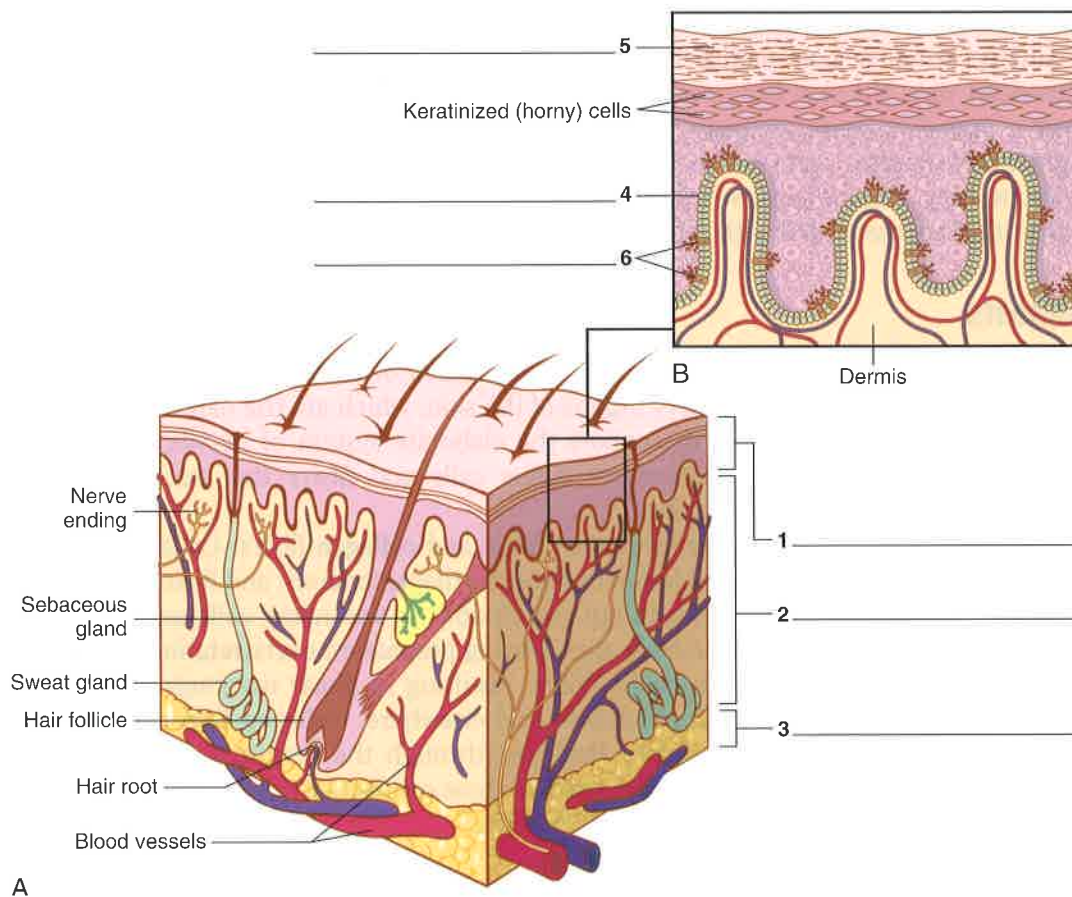
**Dermis** [2]—dense, fibrous, connective tissue layer; containing collagen

**Subcutaneous layer** [3]—thick, fat-containing tissue

### EPIDERMIS

The epidermis is the outermost, totally cellular layer of the skin. It is composed of **squamous epithelium**. Epithelium is the covering of both the internal and the external surfaces of the body. Squamous epithelial cells are flat and scale-like. In the outer layer of the skin, these cells are arranged in several layers (**strata**) to form **stratified squamous epithelium**.

The epidermis lacks blood vessels, lymphatic vessels, and connective tissue (elastic fibers, cartilage, fat) and is therefore dependent on the deeper dermis layer and its rich network of capillaries for nourishment. In fact, oxygen and nutrients seep out of the capillaries in the dermis, pass through tissue fluid, and supply nourishment to the lower layers of the epidermis.



**FIGURE 16-1** The skin. (A) Three layers of the skin. (B) Epidermis.

Figure 16-1B illustrates the multilayered cells of the epidermis. The deepest layer is called the **basal layer** [4]. The cells in the basal layer are constantly growing and multiplying and are the source of all the other cells in the epidermis. As the basal layer cells divide, they are pushed upward and away from the blood supply of the dermal layer by a steady stream of younger cells. In their movement toward the most superficial layer of the epidermis, called the **stratum corneum** [5], the cells flatten, shrink, lose their nuclei, and die, becoming filled with a hard protein material called **keratin**. The cells are then called keratinocytes, reflecting their composition of keratin. Finally, within 3 to 4 weeks after beginning as a basal cell in the deepest part of the epidermis, the keratinized cell is sloughed off from the surface of the skin. The epidermis is thus constantly renewing itself, with cells dying at the same rate at which they are replaced.

The basal layer of the epidermis contains special cells called **melanocytes** [6]. Melanocytes form and contain a brown-black pigment called **melanin** that is transferred to other epidermal cells and gives color to the skin. The number of melanocytes in all human races is the same, but the amount of melanin within each cell accounts for the color differences among the races. Individuals with darker skin possess more melanin within the melanocytes, not a greater number of melanocytes. The presence of melanin in the epidermis is vital for protection against the harmful effects of ultraviolet radiation, which can manifest themselves as skin cancer. Individuals who are incapable of forming melanin are called **albino**. Skin and hair are white. Their pupils (circular opening in the eye) are red because in the absence of pigment in the retina, the tiny blood vessels are visible in the iris (normally pigmented portion) of the eye.

Melanin production increases with exposure to strong ultraviolet light, and this creates a suntan, which is a protective response. When the melanin cannot absorb all of the ultraviolet rays, the skin becomes sunburned and inflamed (redness, swelling, and pain). Over a period of years, excessive exposure to sun tends to cause wrinkles, permanent pigmentary changes, and even cancer of the skin. Because dark-skinned people have more melanin, they acquire fewer wrinkles and they are less likely to develop the types of skin cancer that are associated with ultraviolet light exposure.

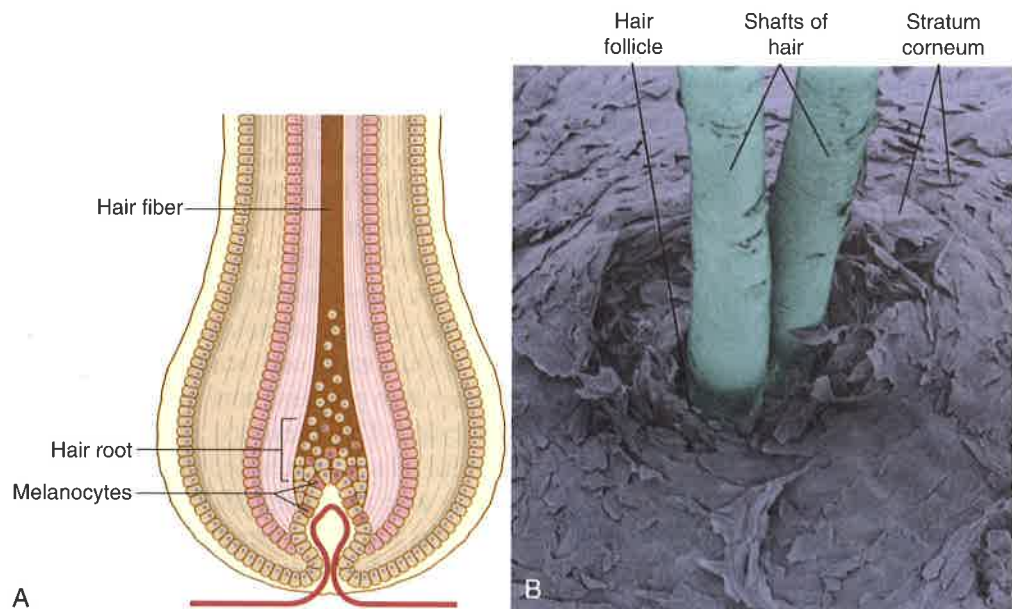
## DERMIS

The dermis, directly below the epidermis, is composed of blood and lymph vessels and nerve fibers, as well as the accessory organs of the skin, which are the hair follicles, sweat glands, and sebaceous glands. To support the elaborate system of nerves, vessels, and glands, the dermis contains connective tissue cells and fibers that account for the extensibility and elasticity of the skin.

The dermis is composed of interwoven elastic and **collagen** fibers. Collagen (**coll**a = glue) is a fibrous protein material found in bone, cartilage, tendons, and ligaments, as well as in the skin. It is tough and resistant but also flexible. In the infant, collagen is loose and delicate; it becomes harder as the body ages. During pregnancy, overstretching of the skin with weight gain may break the elastic fibers, resulting in linear markings called **striae** (“stretch marks”) on the woman’s abdomen and elsewhere. Collagen fibers support and protect the blood and nerve networks that pass through the dermis. Collagen diseases affect connective tissues of the body. Examples of these connective tissue collagen disorders are systemic lupus erythematosus and scleroderma.

## SUBCUTANEOUS LAYER

The subcutaneous layer (epidermis and dermis are the cutaneous layers) specializes in the formation of fat. **Adipocytes** (fat cells) are predominant in the subcutaneous layer, and they manufacture and store large quantities of fat. Obviously, areas of the body and individual people vary so far as fat deposition is concerned. Functionally, this layer of the skin is



**FIGURE 16-2** (A) Enlargement of a **hair follicle**. (B) Scanning electron micrograph of **hair shafts** (visible parts of hair) extending from their hair follicles. (B, From Thibodeau GA, Patton KT: *Anatomy & Physiology*, 6th ed., St. Louis, Mosby, 2007, p. 212.)

important in protection of the deeper tissues of the body, as a heat insulator, and for energy storage.

## ACCESSORY STRUCTURES OF THE SKIN

### HAIR

A hair fiber is composed of a tightly fused meshwork of cells filled with the hard protein called **keratin**. Hair growth is similar to the growth of the epidermal layer of the skin. Deep-lying cells in the hair root (Figure 16-2) produce keratinized cells that move upward through **hair follicles** (sacs within which each hair fiber grows). Melanocytes (see Figure 16-2) are located at the root of the hair follicle, and they donate the melanin pigment to the cells of the hair fiber. A type of melanin containing iron is responsible for red hair. Hair turns gray when with advancing age the melanocytes stop producing melanin.

Of the 5 million hairs on the body, about 100,000 are on the head. They grow about  $\frac{1}{2}$  inch (1.3 cm) per month. Cutting the hair has no effect on its rate of growth.

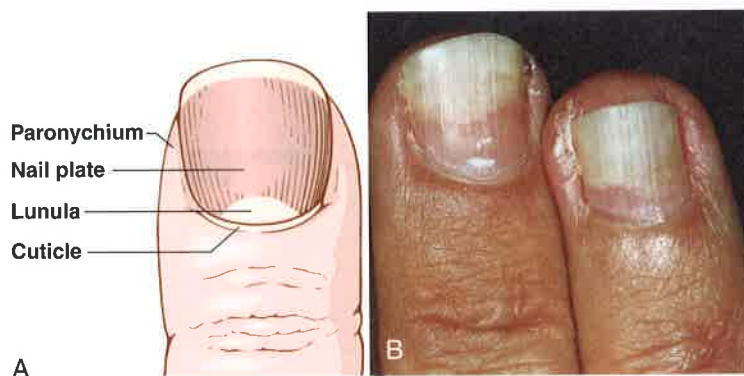
### NAILS

Nails are hard keratin plates covering the dorsal surface of the last bone of each toe and finger. They are composed of keratinocytes that are cemented together tightly and can extend indefinitely unless cut or broken. A nail grows in thickness and length as a result of division of cells in the region of the nail matrix, which is at the base (proximal portion) of the nail plate.

Fingernails grow about 1 mm per week, which means that they can regrow in 3 to 5 months. Toenails grow more slowly than fingernails; it takes 12 to 18 months for toenails to be replaced completely.

The **lunula** is a semilunar (half-moon-shaped) whitish region at the base of the nail plate. It generally can be seen in the thumbnail of most people and is evident to varying degrees in other fingers. Air mixed in with keratin and cells rich in nuclei give the lunula its whitish color. The **cuticle**, a narrow band of epidermis (layer of keratin), is at the base and sides of the nail plate. The **paronychium** is the soft tissue surrounding the nail border. Figure 16-3A illustrates the anatomic structure of a nail.

Nail growth and appearance commonly alter during systemic disease. For example, grooves in nails may occur with high fevers and serious illness, and spoon nails (flattening of the nail plate) occur in iron deficiency anemia. **Onycholysis** (**onych/o** = nail) is the loosening of the nail plate with separation from the nail bed. It may occur with infection of the nail (Figure 16-3B).



**FIGURE 16-3** (A) Anatomic structure of a nail. (B) Onycholysis. Infection or trauma to the nail may be the cause of the detachment of the nail plate from the nail bed. (B, From Seidel HM: Mosby's Guide to Physical Examination, 5th ed., St. Louis, Mosby, 2003, p. 214.)

## GLANDS

### Sebaceous Glands

Sebaceous glands are located in the dermal layer of the skin over the entire body, with the exception of the palms (hands), soles (feet), and lips. They secrete an oily substance called **sebum**. Sebum, containing lipids, lubricates the skin and minimizes water loss. Sebaceous glands are closely associated with hair follicles, and their ducts open into the hair follicle through which the sebum is released. Figure 16-4 shows the relationship of the sebaceous gland to the hair follicle. The sebaceous glands are influenced by sex hormones, which cause them to hypertrophy at puberty and atrophy in old age. Overproduction of sebum during puberty contributes to blackhead (comedo) formation and acne in some people.

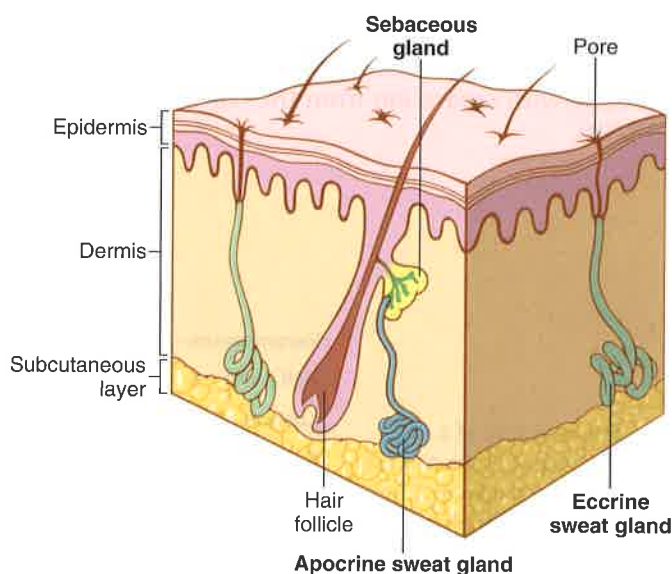
### Sweat Glands

Sweat glands (the most common type are **eccrine sweat glands**) are tiny, coiled glands found on almost all body surfaces (about 2 million in the body). They are most numerous in the palm of the hand (3000 glands per square inch) and in the sole of the foot. As illustrated in Figure 16-4, the coiled eccrine sweat gland originates deep in the dermis and straightens out to extend up through the epidermis. The tiny opening on the surface is a **pore**.

Sweat, or perspiration, is almost pure water, with dissolved materials such as salt making up less than 1% of the total composition. It is colorless and odorless. The odor produced when sweat accumulates on the skin is caused by the action of bacteria on the sweat.

Sweat cools the body as it evaporates into the air. Perspiration is controlled by the sympathetic nervous system, whose nerve fibers are activated by the heart regulatory center in the hypothalamic region of the brain, which stimulates sweating.

A special variety of sweat gland, active only from puberty onward and larger than the ordinary kind, is concentrated in a few areas of the body near the reproductive organs and in the armpits. These glands (**apocrine sweat glands**) secrete an odorless sweat, containing substances easily broken down by bacteria on the skin. The bacterial waste products produce a characteristic human body odor. The milk-producing mammary gland is another type of apocrine gland; it secretes milk after the birth of a child.



**FIGURE 16-4** Sebaceous gland, eccrine sweat gland, and apocrine sweat gland.



## VOCABULARY

This list reviews many of the new terms introduced in the text. Short definitions reinforce your understanding of the terms. Refer to the Pronunciation of Terms on page 686 for help with unfamiliar or difficult words.

<b>adipocyte</b>	Fat cell.
<b>albino</b>	Person with skin deficient in pigment (melanin).
<b>apocrine sweat gland</b>	One of the large dermal exocrine glands located in the axilla and genital areas. It secretes sweat that, in action with bacteria, is responsible for human body odor.
<b>basal layer</b>	Deepest region of the epidermis; it gives rise to all the epidermal cells.
<b>collagen</b>	Structural protein found in the skin and connective tissue.
<b>cuticle</b>	Band of epidermis at the base and sides of the nail plate.
<b>dermis</b>	Middle layer of the skin.
<b>eccrine sweat gland</b>	Most numerous sweat-producing exocrine gland in the skin.
<b>epidermis</b>	Outermost layer of the skin.
<b>epithelium</b>	Layer of skin cells forming the outer and inner surfaces of the body.
<b>hair follicle</b>	Sac within which each hair grows.
<b>integumentary system</b>	The skin and its accessory structures such as hair and nails.
<b>keratin</b>	Hard protein material found in the epidermis, hair, and nails. Keratin means horn and commonly is found in the horns of animals.
<b>lunula</b>	The half-moon-shaped, whitish area at the base of a nail.
<b>melanin</b>	Major skin pigment. It is formed by melanocytes in the epidermis.
<b>paronychium</b>	Soft tissue surrounding the nail border.
<b>pore</b>	Tiny opening on the surface of the skin.
<b>sebaceous gland</b>	Oil-secreting gland in the dermis that is associated with hair follicles.
<b>sebum</b>	Oily substance secreted by sebaceous glands.
<b>squamous epithelium</b>	Flat, scale-like cells composing the epidermis.
<b>stratified</b>	Arranged in layers.
<b>stratum (plural: strata)</b>	A layer (of cells).
<b>stratum corneum</b>	Outermost layer of the epidermis, which consists of flattened, keratinized cells.
<b>subcutaneous layer</b>	Innermost layer of the skin, containing fat tissue.



## TERMINOLOGY

Write the meanings of the medical terms in the spaces provided.

### COMBINING FORMS

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COMBINING FORM	MEANING	TERMINOLOGY	MEANING
<b>adip/o</b>	fat (see <b>lip/o</b> and <b>steat/o</b> )	<u>adipose</u> _____	
<b>albin/o</b>	white	<u>albinism</u> _____	<i>Table 16-1 lists combining forms for colors and examples of terms using those combining forms.</i>
<b>caus/o</b>	burn, burning	<u>causalgia</u> _____	<i>Intensely unpleasant burning sensation in skin and muscles when there is damage to nerves.</i>
<b>cauter/o</b>	heat, burn	<u>electrocautery</u> _____	<i>An instrument containing a needle or blade used during surgery to burn through tissue by means of an electrical current. Electrocauterization is very effective in minimizing blood loss.</i>
<b>cutane/o</b>	skin (see <b>derm/o</b> )	<u>subcutaneous</u> _____	<i>Epidermis and dermis are the cutaneous layers of the skin.</i>

**TABLE 16-1** Colors

Combining Form	Meaning	Terminology
albin/o	white	<u>albinism</u>
anthrac/o	black (as coal)	<u>anthracosis</u>
chlor/o	green	<u>chlorophyll</u>
cirr/h/o	tawny yellow	<u>cirrhosis</u>
cyan/o	blue	<u>cyanosis</u>
eosin/o	rosy	<u>eosinophil</u>
erythr/o	red	<u>erythrocyte</u>
jaund/o	yellow	<u>jaundice</u>
leuk/o	white	<u>leukoderma</u>
lute/o	yellow	corpus <u>luteum</u>
melan/o	black	<u>melanocyte</u>
poli/o	gray	<u>poliomyelitis</u>
xanth/o	yellow	<u>xanthoma</u>

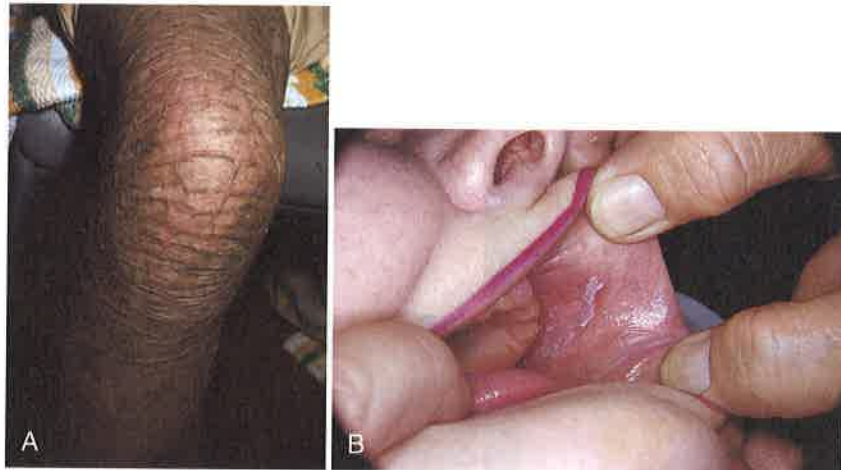


COMBINING FORM	MEANING	TERMINOLOGY	MEANING
derm/o, dermat/o	skin	epidermis _____	
		dermatitis _____	<i>Atopic dermatitis is marked by intense itching leading to excoriations of the skin (from scratching). Atopic means pertaining to a genetic tendency to experience an allergic reaction (Figure 16-5A).</i>
		dermatoplasty _____	<i>Skin is transplanted to a body surface damaged by disease or injury.</i>
		dermatologist _____	
		dermabrasion _____	<i>Abrasion means a scraping away. Dermabrasion using a sandpaper-like material removes acne scars and fine wrinkles.</i>
		epidermolysis _____	<i>Loosening of the epidermis with the development of large blisters; occurs after injury, or with blister-producing diseases.</i>
diaphor/o	profuse sweating (see hidr/o)	diaphoresis _____	<i>Commonly called sweating.</i>
erythem/o, erythemat/o	redness	erythema _____	<i>Flushing; widespread redness of the skin. Erythema infectiosum (fifth disease) is a viral illness, mainly of children. It is marked by fever and an erythematous rash that manifests with a “slapped cheek” appearance on the face and later the arms, buttocks, and trunk. It is caused by a parvovirus (Figure 16-5B).</i>



**FIGURE 16-5** (A) Atopic dermatitis (eczema) in an infant. Greater than 70% of patients have a family history of other atopic conditions such as allergic rhinitis, hay fever, and asthma. (B) Erythema infectiosum. (A, From Zitelli BJ, Davis HW: Atlas of Pediatric Physical Diagnosis, 4th ed., St. Louis, Mosby, 2002; B, from Callen JP et al: Color Atlas of Dermatology, 2nd ed., Philadelphia, Saunders, 2000.)

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
hidr/o	sweat	anhidrosis _____ Do not confuse hidr/o with hydr/o (water)!	
ichthy/o	dry, scaly (fish-like)	ichthyosis _____ This is usually a hereditary condition in which the skin is dry, rough, and scaly (resembling fish scales) because of a defect in keratinization. Ichthyosis also can be acquired, appearing with malignancies such as lymphomas and multiple myeloma. Greek ichthys means fish (Figure 16-6A).	
kerat/o	hard	keratosis _____ See page 670.	
leuk/o	white	leukoplakia _____ The suffix -plakia means plaques (Figure 16-6B).	
lip/o	fat	lipoma _____ liposuction _____ Removal of subcutaneous fat tissue through a tube that is introduced into the fatty area via a small incision. The fat is aspirated (suctioned) out.	
melan/o	black	melanocyte _____ melanoma _____ This is a malignant skin tumor. See page 671.	




**FIGURE 16-6** (A) Ichthyosis. (B) Leukoplakia. (A, From Kanski JJ: Systemic Diseases and the Eye, St. Louis, Mosby, 2001; B, from Callen JP et al: Color Atlas of Dermatology, 2nd ed., Philadelphia, Saunders, 2000.)



**FIGURE 16-7** (A) Mycosis; tinea pedis, or “athlete’s foot.” (B) Acute paronychia most commonly occurs from nail biting, finger sucking, aggressive manicuring, or penetrating trauma. The most common infecting organism is *Staphylococcus aureus*. (A, From Zitelli BJ, Davis HW: Atlas of Pediatric Physical Diagnosis, 4th ed., St. Louis, Mosby, 2002; B, from Callen JP et al: Color Atlas of Dermatology, 2nd ed., Philadelphia, Saunders, 2000.)

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
<b>myc/o</b>	fungus (fungi include yeasts, molds, and mushrooms)	<u>mycosis</u> _____ <i>An example of a mycosis (fungal infection) is tinea pedis, commonly called “athlete’s foot” (Figure 16-7A). Another fungal infection is tinea corporis (ringworm). See page 668.</i>	
<b>onych/o</b>	nail (see <b>ungu/o</b> )	<u>onycholysis</u> _____ <i>Separation of the nail plate from the nail bed in fungal infections or after trauma.</i>	
		<u>onychomycosis</u> _____ <i>Fungal infection of the nails, which become white, opaque, thick, and brittle.</i>	
		<u>paronychia</u> _____ <i>Par- means near or beside. Paronychia is the inflammation and swelling of the soft tissue around the nail and is associated with torn cuticles or ingrown nails (Figure 16-7B).</i>	
<b>phyt/o</b>	plant	<u>dermatophytosis</u> _____ <i>Examples are fungal infections (mycoses) (see Figure 16-7A).</i>	
<b>pil/o</b>	hair (see <b>trich/o</b> ), hair follicle	<u>pilosebaceous</u> _____ <i>Sebace/o indicates a gland that secretes sebum.</i>	

COMBINING FORM	MEANING	TERMINOLOGY	MEANING
py/o	pus	pyoderma _____	<i>Pus is within the skin (-derma). <b>Impetigo</b> is a purulent (pus-containing) skin disease caused by bacterial infection (Figure 16-8A). Also see page 667.</i>
rhytid/o	wrinkle	rhytidectomy _____	<i>Reconstructive plastic surgery to remove wrinkles and signs of aging skin; also called rhytidoplasty or face lift. Laser treatments, <b>Botox Cosmetic</b> (purified botulinum toxin) injections, and injectable fillers are used to soften facial lines and wrinkles. </i>
seb/o	sebum (oily secretion from sebaceous glands)	seborrhea _____	<i>Excessive secretion from sebaceous glands. <b>Seborrheic dermatitis</b> commonly is known as <b>dandruff</b>.</i>
squam/o	scale-like	squamous epithelium _____	<i>Cells are flat and scale-like; pavement epithelium.</i>
steat/o	fat	steatoma _____	<i>A cystic collection of sebum (fatty material) that forms in a sebaceous gland and can become infected; <b>sebaceous cyst</b>.</i>
trich/o	hair	trichomycosis _____	
ungu/o	nail	subungual _____	
xanth/o	yellow	xanthoma _____	<i>Nodules develop under the skin owing to excess lipid deposits and can be associated with a high cholesterol level. Plaques that appear on the eyelids are <b>xanthelasma</b> (-elasma = a flat plate) (Figure 16-8B).</i>
xer/o	dry	xeroderma _____	<i>The suffix -derma means skin. This is very dry skin.</i>



### Is Botox Cosmetic Safe?

Botox Cosmetic (purified botulinum toxin) has been FDA approved since 2002, for cosmetic use to the brow and facial frown lines. Over a million patients have been treated with Botox Cosmetic, and there have been no reported fatal or permanent adverse effects related to its use. Botox Cosmetic works by blocking the connection between nerves and muscles. Muscles do not contract, thus preventing lines and wrinkles in the skin. When injected in small doses directly into the muscle, Botox Cosmetic can reduce specific facial lines for up to 8 months.

The FDA has also approved dermal fillers for deep facial wrinkles and folds. These include Restylane, Juvederm, Evolence, and Radiesse.



**FIGURE 16-8** (A) Impetigo. (B) Xanthelasma. (A, From Phipps WJ et al: *Medical-Surgical Nursing*, 7th ed., St. Louis, Mosby, 2003, p. 1951; B, from Seidel HM et al: *Mosby's Guide to Physical Examination*, 5th ed., St. Louis, Mosby, 2003.)

## PATHOLOGY

### CUTANEOUS LESIONS

A **lesion** is an area of abnormal tissue anywhere on or in the body. It may be caused by disease or trauma (external forces). The following terms describe common skin lesions, which are illustrated in Figure 16-9A to L.

- 16**
- A. crust**                      **Collection of dried serum and cellular debris.**  
A scab is a crust. It forms from the drying of a body exudate, as in eczema, impetigo, and seborrhea.
- B. cyst**                        **Thick-walled, closed sac or pouch containing fluid or semisolid material.**  
Examples of cysts are the **pilonidal cyst**, which is found over the sacral area of the back in the midline and contains hairs (**pil/o** = hair, **nid/o** = nest); and a **sebaceous cyst**, a collection of yellowish, cheesy sebum commonly found on the scalp, vulva, and scrotum.
- C. erosion**                    **Wearing away or loss of epidermis.**  
Erosions do not penetrate below the dermoepidermal junction. They occur as a result of inflammation or injury and heal without scarring.
- D. fissure**                    **Groove or crack-like sore.**  
An anal fissure is a break in the skin lining of the anal canal.
- E. macule**                    **Flat lesion measuring less than 1 cm in diameter.**  
Freckles, tattoo marks, and flat moles are examples.
- F. nodule**                    **Solid, round or oval elevated lesion 1 cm or more in diameter.**  
An enlarged lymph node and solid growths are examples.
- G. papule**                    **Small (less than 1 cm in diameter), solid elevation of the skin.**  
**Pimples** are examples of papules. Papules may become confluent (run together) and form **plaques**, which are elevated flat lesions.
- H. polyp**                    **Growth extending from the surface of mucous membrane.**  
Polyps (a type of papule) commonly are found in the nose and sinuses, colon, urinary bladder, and uterus.
- I. pustule**                    **Papule containing pus.**  
A pustule is a small **abscess** (collection of pus) on the skin.
- J. ulcer**                      **Open sore on the skin or mucous membranes (deeper than an erosion).**  
**Decubitus ulcers** (bedsores) are caused by pressure that results from lying in one position (Latin *decubitus* means lying down). Pressure ulcers usually involve loss of tissue substance and **pus** or **exudate** formation.
- K. vesicle**                    **Small collection (papule) of clear fluid (serum); blister.**  
Vesicles form in burns, allergies, and dermatitis. A **bulla** (*plural*: bullae) is a large vesicle.
- L. wheal**                    **Smooth, edematous (swollen) papule or plaque that is redder or paler than the surrounding skin.**  
Wheals may be papular, as in a mosquito bite, or may involve a wide area, as in allergic reactions. Wheals often are accompanied by itching and are seen in hives, anaphylaxis, and insect bites.



**FIGURE 16-9** Cutaneous lesions. **A**, Crust—scab. **B**, Cyst—pilonidal cyst. **C**, Erosion—in varicella (chickenpox after rupture of blister). **D**, Fissures. **E**, Macule—freckles. **F**, Nodules. **G**, Papules. **H**, Polyp—nasal polyp. **I**, Pustules—acne. **J**, Ulcer—decubitus ulcer. **K**, Vesicle—bullae. **L**, Wheal—urticaria. (A, From Seidel HM et al: Mosby's Guide to Physical Examination, 5th ed., St. Louis, Mosby, 2003; B, from Zitelli BJ, Davis HW: Atlas of Pediatric Physical Diagnosis, 4th ed., St. Louis, Mosby, 2002; C, from Cohen BA: Atlas of Pediatric Dermatology, London, Wolfe, 1993; D, from Callen JP et al: Color Atlas of Dermatology, 2nd ed., Philadelphia, Saunders, 2000; E and I, from Weston WL et al: Color Textbook of Pediatric Dermatology, 3rd ed., St. Louis, 2002; F, from Habif TP: Clinical Dermatology, 4th ed., St. Louis, Mosby, 2004, p. 906; G, courtesy Dr. Bruce A. Chabner; H, from Frazier MS et al: Essentials of Human Diseases and Conditions, 3rd ed., Philadelphia, Saunders, 2004; J, from Gould BE: Pathophysiology for the Health Professions, 3rd ed., Philadelphia, Saunders, 2006; K, from White GM: Color Atlas of Regional Dermatology, London, Times-Mirror, 1994; L, from Farrar WE: Atlas of Infections of the Nervous System, London, Mosby-Wolfe, 1993.)

**SIGNS AND SYMPTOMS****alopecia****Absence of hair from areas where it normally grows.**

Alopecia, or baldness, may be hereditary (usual progressive loss of scalp hair in men) or it may be caused by disease, injury, or treatment (chemotherapy) or may occur in old age. **Alopecia areata** is an autoimmune disease in which hair falls out in patches without scarring or inflammation (Figure 16-10A).

**ecchymosis, ecchymoses****Bluish-purple mark (bruise) on the skin.**

Ecchymoses (**ec-** = out, **chym/o** = pour) are caused by hemorrhages into the skin from injury or spontaneous leaking of blood from vessels (Figure 16-10B).

**petechia, petechiae****Small, pinpoint hemorrhage.**

Petechiae are smaller versions of ecchymoses (Figure 16-10C). Both ecchymoses and petechiae are forms of **purpura** (bleeding into the skin).



**FIGURE 16-10** (A) Alopecia areata. (B) Ecchymosis. High-grade tear at the myotendinous junction at the right pectoralis major muscle. (C) Petechiae. (D) Urticaria. Erythematous, edematous, often circular plaques. (A, From Barkauskas VH et al: Health and Physical Assessment, 2nd ed., St. Louis, Mosby, 1998; B, courtesy Richard Tolman; C, from Mosby's Medical, Nursing and Allied Health Dictionary, 5th ed., St. Louis, Mosby, 1998; D, from Habif TP: Clinical Dermatology, 4th ed., St. Louis, Mosby, 2004, p. 130.)



**pruritus** **Itching.**

Pruritus is a symptom associated with most forms of dermatitis and with other conditions as well. It arises as a result of stimulation of nerves in the skin by substances released in allergic reactions or by irritation caused by substances in the blood or by foreign bodies. Be careful to spell *pruritus* correctly. It is a condition, not an inflammation (-itis).

**urticaria (hives)**

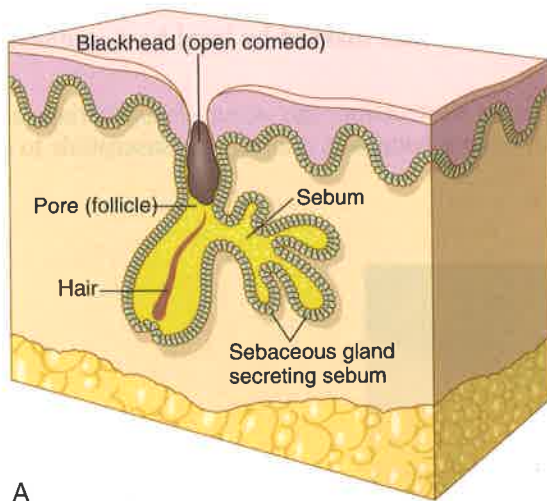
**Acute allergic reaction in which red, round wheals develop on the skin** (Figure 16-10D).

Pruritus may be intense, and the cause commonly allergy to foods (such as shellfish or strawberries). Localized edema (swelling) occurs as well.

**ABNORMAL CONDITIONS****acne**

**Chronic papular and pustular eruption of the skin with increased production of sebum.**

**Acne vulgaris** (Latin *vulgaris* means ordinary) is caused by the buildup of sebum and keratin in the pores of the skin. A **blackhead** or open **comedo** (*plural: comedones*) is a sebum plug partially blocking the pore (Figure 16-11). If the pore becomes completely blocked, a **whitehead** (closed comedo) forms. Bacteria in the skin break down the sebum, producing inflammation in the surrounding tissue. Papules, pustules, and cysts can thus form. Treatment consists of long-term antibiotic use and medications to decrease inflammation in the skin. Benzoyl peroxide and tretinoin (Retin-A) are medications used to prevent comedo formation; isotretinoin (Accutane) is used in severe cystic acne.



**FIGURE 16-11** (A) Formation of a **blackhead (open comedo)** in a dilated pore filled with oxidized sebum and bacteria. (B) **Acne vulgaris** on the face. (B, From Callen JP, Paller AS, Greer KE, Swinyer LJ: *Color Atlas of Dermatology*, 2nd ed., Philadelphia, Saunders, 2000, p. 151.)

**Pruritus**

Be sure to spell *pruritus* correctly. It is a condition, not an inflammation (-itis).



**FIGURE 16-12 Burns.** (A) **Second-degree burn.** Wound is painful and very sensitive to touch and air currents. (B) **Third-degree burn** showing variable color (deep-red, white, black, and brown). The wound itself is insensate (patient does not respond to pinprick). (A and B, From Black JM, Hawks JH, Keene AM: *Medical-Surgical Nursing: Clinical Management for Positive Outcomes*, 6th ed., Philadelphia, Saunders, 2001, pp. 1335-1336.)

### burns

#### **Injury to tissues caused by heat contact.**

Burns may be caused by dry heat (fire), moist heat (steam or liquid), chemicals, lightning, electricity, or radiation. Burns usually are classified as follows:

**first-degree burns**—superficial epidermal lesions, erythema, hyperesthesia, and no blisters.

**second-degree burns (partial-thickness burn injury)**—epidermal and dermal lesions, erythema, blisters, and hyperesthesia (Figure 16-12A).

**third-degree burns (full-thickness burn injury)**—epidermis and dermis are destroyed (necrosis of skin), and subcutaneous layer is damaged, leaving charred, white tissue (Figure 16-12B).

### cellulitis

#### **Diffuse, acute infection of the skin marked by local heat, redness, pain, and swelling.**

Abscess formation and tissue destruction can occur if appropriate antibiotic therapy is not given. Areas of poor lymphatic drainage are susceptible to this skin infection (Figure 16-13).



**FIGURE 16-13 Cellulitis.** Traveling on a safari in Botswana, a 63-year-old woman noticed swelling, redness, and pain in her lower leg. After a local physician prescribed oral antibiotics, she was advised to interrupt her trip to get IV antibiotics at a major hospital. Her cellulitis cleared in a week.

- eczema** **Inflammatory skin disease with erythematous, papulovesicular lesions.**  
This chronic or acute atopic dermatitis (rash occurs on face, neck, elbows, and knees) is accompanied by pruritus and tends to occur in patients with a family history of allergic conditions. Treatment depends on the cause but usually includes the use of corticosteroids.
- exanthematous viral diseases** **Rash (exanthem) of the skin due to a viral infection.**  
Examples are **rubella** (German measles), **rubeola** (measles), and **varicella** (chickenpox).
- gangrene** **Death of tissue associated with loss of blood supply.**  
In this condition, ischemia resulting from injury, inflammation, frostbite, diseases such as diabetes, or arteriosclerosis can lead to necrosis of tissue followed by bacterial invasion and putrefaction (proteins are decomposed by bacteria).
- impetigo** **Bacterial inflammatory skin disease characterized by vesicles, pustules, and crusted-over lesions.**  
This is a contagious **pyoderma** (**py/o** = pus) and usually is caused by staphylococci or streptococci. Systemic use of antibiotics combined with proper cleansing of lesions is effective treatment (see page 661).
- psoriasis** **Chronic, recurrent dermatosis marked by itchy, scaly, red plaques covered by silvery gray scales** (Figure 16-14).  
Psoriasis commonly involves the forearms, knees, legs, and scalp. It is neither infectious nor contagious but is caused by an increased rate of growth of the basal layer of the epidermis. It is an autoimmune disease that can run in families. Treatment is **palliative** (relieving but not curing) and includes topical lubricants, keratolytics, and steroids. Systemic treatments include psoralen–ultraviolet A (PUVA) light therapy and immunomodulators.
- scabies** **Contagious, parasitic infection of the skin with intense pruritus.**  
Scabies (from Latin *scabere*, to scratch) commonly affects areas such as the groin, nipples, and skin between the fingers. Treatment is topical medicated cream to destroy the scabies mites (tiny parasites).



**FIGURE 16-14 Psoriasis.** Thick red plaques have a sharply defined border and an adherent silvery scale. (From Habif TP et al: *Skin Disease: Diagnosis and Treatment*, St. Louis, Mosby, 2001.)

**scleroderma****Chronic progressive disease of the skin and internal organs with hardening and shrinking of connective tissue.**

Fibrous scar-like tissue forms in the skin, and the heart, lungs, kidneys, and esophagus may be affected as well. Skin is thick, hard, and rigid, and pigmented patches may occur. It is an autoimmune disease for which palliative treatment consists of immunosuppressive and anti-inflammatory agents and physical therapy.

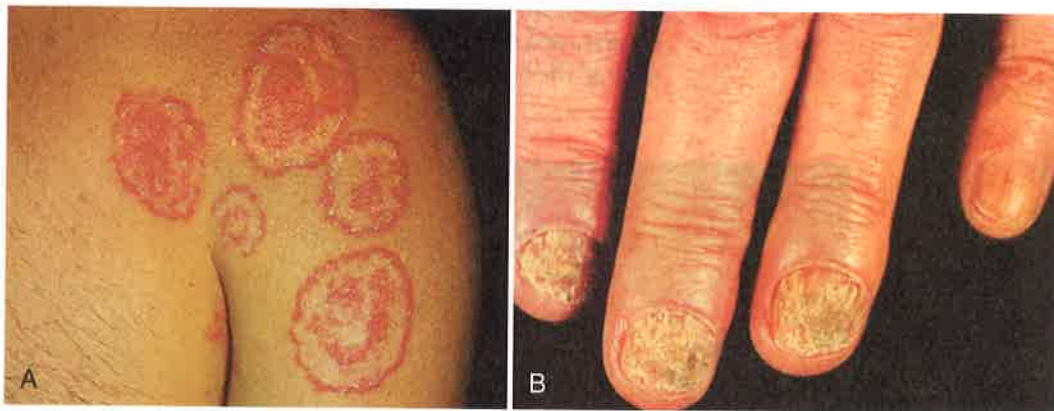
**systemic lupus erythematosus (SLE)****Chronic autoimmune inflammatory disease of collagen in skin, joints, and internal organs.**

Lupus, meaning wolf-like (the shape and color of the skin lesions resemble those in the bite of a wolf), produces a characteristic “butterfly” pattern of redness over the cheeks and nose. In more severe cases, the extent of erythema increases, and all exposed areas of the skin may be involved. Primarily a disease of females, lupus is an autoimmune disorder. High levels of certain antibodies are found in the patient’s blood. Corticosteroids and immunosuppressive drugs are used to control symptoms.

SLE should be differentiated from chronic **discoid lupus erythematosus (DLE)**, which is a photosensitive, scaling, plaque-like, superficial eruption of the skin confined to the face, scalp, ears, chest, arms, and back, which heals with scarring.

**tinea****Infection of the skin caused by a fungus.**

**Tinea corporis**, or ringworm, so called because the infection is in a ring-like pattern (Figure 16-15A), is highly contagious and causes severe pruritus. Other examples are **tinea pedis** (athlete’s foot), which affects the skin between the toes, **tinea capitis** (on the scalp), **tinea barbae**, affecting the skin under a beard), and **tinea unguium** (affecting the nails) (Figure 16-15B). Treatment is with antifungal agents. (Latin *tinea* means worm or moth—apparently the Romans thought that skin affected with tinea looked “moth-eaten.”)



**FIGURE 16-15** (A) **Tinea corporis (ringworm)**. (B) **Tinea unguium**. Fungal infection of the nail causes the distal nail plate to turn yellow or white. Hyperkeratotic debris accumulates, causing the nail to separate from the nail bed (onycholysis). (A, From Lewis SM, Heitkemper MM, Dirksen SR: *Medical-Surgical Nursing: Assessment and Management of Clinical Problems*, 6th ed., St. Louis, Mosby, 2004, p. 497; B, courtesy American Academy of Dermatology and Institute for Dermatologic Communication and Education, Evanston, Illinois. From Seidel HM: *Mosby's Guide to Physical Examination*, 5th ed., St. Louis, Mosby, 2003, p. 213.)



**FIGURE 16-16 Vitiligo** on the hand (from Latin *vitium*, blemish). Epidermal melanocytes are completely lost in depigmented areas through an autoimmune process. (From Jarvis C: *Physical Examination and Health Assessment*, 3rd ed., Philadelphia, Saunders, 2000, p. 223.)

### vitiligo

**Loss of pigment (depigmentation) in areas of the skin (milk-white patches).**

This is a form of **leukoderma** (Figure 16-16). The skin changes result from an autoimmune process, and there is an increased association of vitiligo with autoimmune disorders such as thyroiditis, hyperthyroidism, and diabetes mellitus.

## SKIN NEOPLASMS

### Benign Neoplasms

#### callus

**Increased growth of cells in the keratin layer of the epidermis caused by pressure or friction.**

The feet (Figure 16-17A) and the hands are common sites for callus formation. A **corn** is a type of callus that develops a hard core (a whitish, corn-like central kernel).

#### keloid

**Hypertrophied, thickened scar developing after trauma or surgical incision.**

Keloids (Figure 16-17B) result from excessive collagen formation in the skin during connective tissue repair. The term comes from the Greek *kelis*, meaning blemish. Surgical excision often is combined with intralesional steroid injections or ablative laser treatments.

A normal scar left by a healed wound is called a **cicatrix** (SĪK-ă-trĭks).



**FIGURE 16-17 (A) Callus** on the sole of the foot. **(B) Keloid.** (A, From Mosby's *Medical, Nursing, and Allied Health Dictionary*, 6th ed., St. Louis, Mosby, 2002, p. 265; B, from Ignatavicius DD, Workman ML: *Medical-Surgical Nursing: Critical Thinking for Collaborative Care*, 4th ed., Philadelphia, Saunders, 2002, p. 1544.)



**FIGURE 16-18** (A) Actinic (solar) keratosis. (B) Verruca vulgaris. A wart consists of multiple papules with rough, pebble-like surfaces. (A, From Ignatavicius DD, Workman ML: Medical-Surgical Nursing: Critical Thinking for Collaborative Care, 4th ed., Philadelphia, Saunders, 2002, p. 1502; B, from Cotran RS, Kumar V, Collins T: Robbins Pathologic Basis of Disease, 6th ed., Philadelphia, Saunders, 1999, p. 1208.)

### keratosis

**Thickened and rough lesion of the epidermis; associated with aging or skin damage.**

**Actinic keratosis** is caused by long-term ultraviolet light exposure and is a precancerous lesion (Figure 16-18A). **Seborrheic keratosis** results from overgrowth of the upper epidermis and is dark in color.

### leukoplakia

**White, thickened patches on mucous membrane tissue of the tongue or cheek.**

One type is a precancerous lesion that is common in smokers and may be caused by chronic inflammation.

### nevus, nevi

**Pigmented lesion of the skin.**

Nevi are commonly known as moles. Many are present at birth, but some are acquired.

**Dysplastic nevi** are moles that have atypical cells and may progress to form a type of skin cancer called melanoma (see **malignant melanoma**).

### verruca

**Epidermal growth (wart) caused by a virus.**

**Verruca vulgaris** (common wart) is the most frequent type of wart (Figure 16-18B). **Plantar warts** (verrucae) occur on the soles of the feet, juvenile warts occur on the hands and face of children, and venereal warts occur on the genitals and around the anus. Warts are removed with acids, electrocautery, or freezing with liquid nitrogen (cryosurgery). If the virus remains in the skin, the wart frequently regrows.

## Cancerous Lesions

### basal cell carcinoma

**Malignant tumor of the basal cell layer of the epidermis.**

This is the most frequent type of skin cancer. It is a slow-growing tumor that usually occurs on chronically sun-exposed skin, especially near or on the nose (Figure 16-19A). It almost never metastasizes.

**FIGURE 16–19** (A) Basal cell carcinoma. (B) Squamous cell carcinoma. Advanced lesions are often nodular and ulcerated. (A, From Mosby's Medical, Nursing, and Allied Health Dictionary, 6th ed., St. Louis, Mosby, 2002, p. 184; B, from Cotran RS, Kumar V, Collins T: Robbins Pathologic Basis of Disease, 6th ed., Philadelphia, Saunders, 1999, p. 1186.)



### squamous cell carcinoma

#### **Malignant tumor of the squamous epithelial cells in the epidermis.**

This tumor may grow in places other than the skin, wherever squamous epithelium is found (mouth, larynx, bladder, esophagus, lungs). **Actinic** (sun-related) **keratoses** are premalignant lesions in people with sun-damaged skin. Progression to squamous cell carcinoma (Figure 16-19B) may occur if lesions are not removed. Treatment is removal by surgical excision, cryotherapy, curettage and electrodesiccation, or radiotherapy.

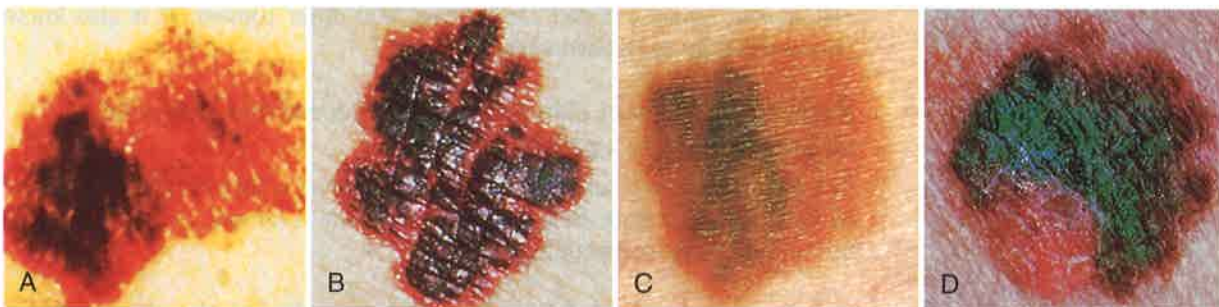
### malignant melanoma

#### **Cancerous growth composed of melanocytes.**

This malignancy is attributed to a genetic predisposition combined with exposure to ultraviolet light. Melanoma usually begins as a mottled, light brown to black macule with irregular borders (Figure 16-20). The lesion may turn shades of red, blue, and white and may crust on the surface and bleed. Melanomas often arise in preexisting moles (dysplastic nevi) and frequently appear on the upper back, lower legs, arms, head, and neck.

Biopsy is required to confirm the diagnosis of melanoma, and prognosis is best determined by measuring tumor thickness in millimeters.

Melanomas often metastasize to the lung, liver, bone, and brain. Treatment may include excision of the tumor, regional lymphadenectomy, chemotherapy/immunotherapy, or radiotherapy.



**FIGURE 16–20** The ABCDEs of melanoma:

**A**symmetry: one half unlike the other half

**B**order: irregular or poorly circumscribed border

**C**olor: varies from one area to another; shades of tan and brown, black, and sometimes white, red, or blue

**D**iameter: usually larger than 6 mm (diameter of a pencil eraser)

**E**volution: change in the lesion over time

(From Lewis SM, Heitkemper MM, Dirksen SR: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 6th ed., St. Louis, Mosby, 2004, p. 493.)

**Kaposi sarcoma**

**Malignant, vascular, neoplastic growth characterized by cutaneous nodules.**

Frequently arising on the lower extremities, nodules range in color from deep pink to dark blue and purple. One form of this condition is associated with acquired immunodeficiency syndrome (AIDS).

## LABORATORY TESTS AND CLINICAL PROCEDURES

16

### LABORATORY TESTS

**bacterial analyses**

**Samples of skin are examined for presence of microorganisms.**

**Purulent** (pus-filled) material or **exudate** (fluid that accumulates) often is taken for examination.

**fungal tests**

**Scrapings from skin lesions, hair specimens, or nail clippings are sent to a laboratory for culture and microscopic examination.**

The specimen also may be treated with a potassium hydroxide (KOH) preparation and examined microscopically. A positive result on a KOH test reveals elements that indicate the presence of a fungal infection.

### CLINICAL PROCEDURES

**cryosurgery**

**Use of subfreezing temperature via liquid nitrogen application to destroy tissue.**

**curettage**

**Use of a sharp dermal curette to scrape away a skin lesion.**

A curette is shaped like a spoon or scoop.

**electrodesiccation**

**Tissue is destroyed by burning with an electric spark.**

This procedure is used along with curettage to remove and destroy small cancerous lesions with well-defined borders.

**Mohs micrographic surgery**

**Thin layers of malignant tissue are removed, and each is examined under a microscope to check for adequate extent of the resection.**

Mohs micrographic surgery is a specialized form of excision to treat basal cell carcinomas, squamous cell carcinomas, and other tumors. It is also known as **microscopically controlled surgery**.

**skin biopsy**

**Suspected malignant skin lesions are removed and examined microscopically by a pathologist.**

In a **punch biopsy**, a surgical instrument removes a core of tissue by rotation of its sharp, circular edge. In a **shave biopsy**, tissue is excised using a cut parallel to the surface of the surrounding skin.

**skin test**

**Substances are injected intradermally or applied to the skin, and results are observed.**

Skin tests are used to diagnose allergies and disease. In the **patch test**, an allergen-treated piece of gauze or filter paper is applied to the skin. If the skin becomes red or swollen, the result is positive. In the **scratch test**, several scratches are made in the skin, and a very minute amount of test material is inserted into the scratches. The Schick test (for diphtheria) and the Mantoux and purified protein derivative (PPD) tests (for tuberculosis) are other skin tests.





## ABBREVIATIONS

<b>ABCDE</b>	asymmetry (of shape), border (irregularity), color (variation within one lesion), diameter (greater than 6 mm), evolution (change)—characteristics associated with melanoma	<b>DLE</b>	discoid lupus erythematosus
<b>Bx</b>	biopsy	<b>PPD</b>	purified protein derivative—used in skin test for tuberculosis
<b>Derm</b>	dermatology	<b>PUVA</b>	psoralen–ultraviolet A light therapy; treatment for psoriasis and other skin conditions
		<b>SLE</b>	systemic lupus erythematosus
		<b>SC</b>	subcutaneous



## PRACTICAL APPLICATIONS

This section contains disease descriptions, a medical report, and a case report using terms that you have studied in this and previous chapters. Explanations of more difficult terms are added in brackets. Answers to the questions are on page 685.

### DISEASE DESCRIPTIONS

- Candidiasis** (*Candida* is a yeast-like fungus): This fungus is normally found on mucous membranes, skin, and vaginal mucosa. Under certain circumstances (excessive warmth; administration of birth control pills, antibiotics, and corticosteroids; debilitated states; infancy), it can change to a pathogen and cause localized or generalized mucocutaneous disease. Examples are paronychia lesions, lesions in areas of the body where the rubbing of opposed surfaces is common (groin, perianal, axillary, inframammary, and interdigital), thrush (white plaques attached to oral or vaginal mucous membranes), and vulvovaginitis.
- Cellulitis**: This is a common nonsuppurative infection of connective tissue with severe inflammation of the dermal and subcutaneous layers of the skin. Cellulitis appears on an extremity as a reddish area of tender edematous skin. A surgical wound, puncture, insect bite, skin ulcer, or patch of dermatitis is the usual means of entry for bacteria (most cases are caused by streptococci). Therapy includes rest, elevation, hot wet packs, and antibiotics. Any cellulitis on the face should be given special attention because the infection may extend directly to the brain.
- Mycosis fungoides (cutaneous T cell lymphoma)**: This rare, chronic skin condition is caused by the infiltration of the skin by atypical lymphocytes. Contrary to its name (*myc/o* = fungus), it is not caused by a fungus but was formerly thought to be of fungal origin. It can manifest with generalized erythroderma or large, reddish, raised tumors that spread and ulcerate. In some cases, the malignant cells may involve lymph nodes and other organs. Treatment with cortisone ointments, topical nitrogen mustard, psoralen–ultraviolet light A (PUVA), and systemic retinoids or immunomodulators can be effective in controlling the disease.

### MEDICAL RECORD: FINDINGS ON DERMATOLOGIC EXAMINATION

A wide variety of lesions are seen on the face, shoulders, and back. The predominant lesions are pustules or papules. Many pustules are confluent [running together] over the chin and forehead. Comedones are present on the face, especially along the midface. Inflammatory papules are present on the lower cheeks and chin. Large abscesses and ulcerated cysts are present over the upper shoulder area. Numerous scars are present over the face and upper back.

**Questions about the Medical Record**

See page 673 for findings.

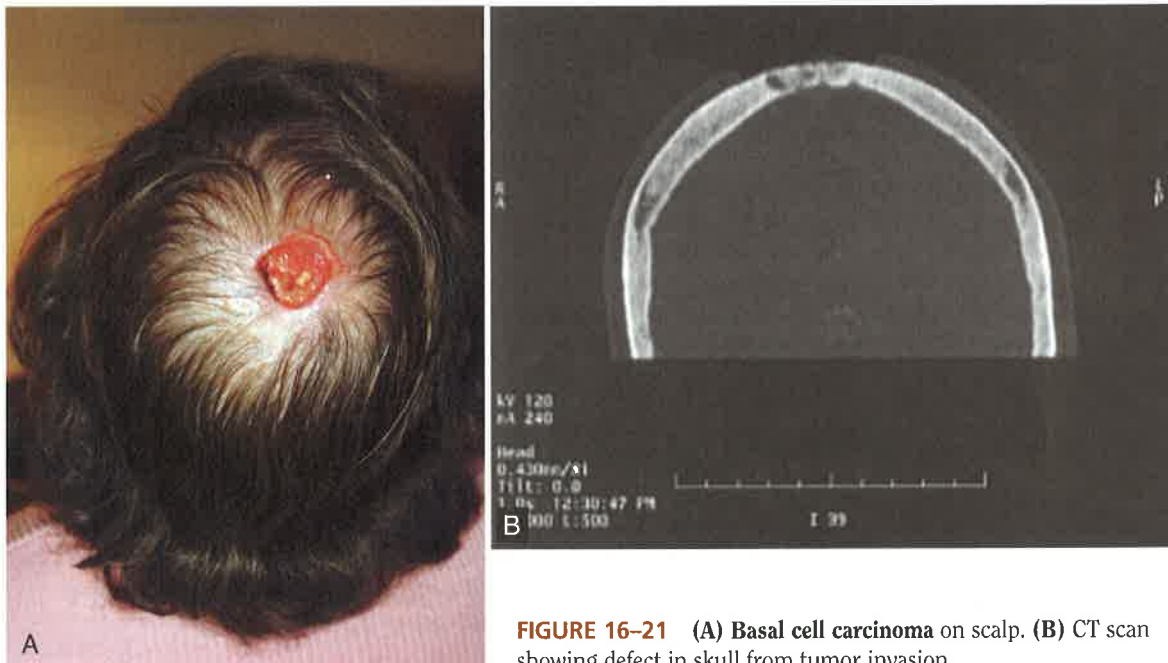
- In this skin condition, the primary lesions are
  - Discolored flat lesions
  - Grooves or crack-like sores
  - Small elevations containing pus
- Comedones are
  - Sebum plugs partially blocking skin pores
  - Contagious, infectious plugs of sebum
  - Small, pinpoint hemorrhages
- The papules described are known as
  - Purpura
  - Pimples
  - Freckles
- In the scapular region, lesions are
  - Large pigmented areas
  - Numerous collections of blisters
  - Large collections of sacs containing pus with erosion of skin
- What is your diagnosis of this skin condition, based on the physical examination?
  - Acne vulgaris
  - Leukoplakia
  - Scabies

**CASE REPORT: BASAL CELL CARCINOMA**

A 76-year-old woman noticed a 1-inch-diameter flaky patch on her scalp. Over a period of months, the lesion increased in size and became ulcerated, with the skull bone visible (Figure 16-21A). A biopsy was performed and pathologic examination revealed basal cell carcinoma. Mohs micrographic surgery was attempted but a CT study of the head/brain with contrast showed the likelihood of residual tumor extending into the skull (Figure 16-21B).

Major surgery was performed to resect residual malignant tissue. A large portion of skull was removed and replaced with titanium mesh on which muscle from her back and skin from her leg were grafted. The primary surgical area healed well. Pathologic examination confirmed the presence of tumor invading the skull and underlying dura at the surgical margin. The patient is now receiving radiation therapy for 6 weeks to treat the affected area.

**Commentary:** *Most basal cell carcinomas are small tumors that are easily removed by local surgery, such as Mohs. When treatment is delayed, however, they can become very large and require major surgical procedures with grafting. They can continue to grow locally and invade adjacent tissues, as occurred in this case.*



**FIGURE 16-21** (A) Basal cell carcinoma on scalp. (B) CT scan showing defect in skull from tumor invasion.