

# 5

## The Integumentary System

**FOCUS:** The integumentary system consists of the skin, hair, nails, and a variety of glands. The epidermis of the skin provides protection against abrasion, ultraviolet light, and water loss, and produces vitamin D. The dermis

provides structural strength and contains blood vessels involved in temperature regulation. The skin is attached to underlying tissue by the hypodermis, which is a major site of fat storage.

### CONTENT LEARNING ACTIVITY

#### Hypodermis

“*The hypodermis is not part of the integumentary system.*”

Match these terms with the correct statement or definition:

Fat  
Hypodermis

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Sometimes called subcutaneous tissue.
2. Loose connective tissue that attaches the skin to underlying bone or muscle.
3. Functions as padding and insulation.
4. Responsible for some of the structural differences between men and women.



The hypodermis contains about half the body's stored fat. Measuring the thickness of the hypodermis is a technique used to estimate total body fat.

## Dermis

“The dermis is dense connective tissue that forms the deep layer of the skin.”

Match these terms with the correct statement or definition:

Cleavage lines  
Dermal papillae

Striae

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Directions in which the skin is most resistant to stretch.
2. Lines visible through the epidermis produced by overstretching of the dermis.
3. Blood vessels in this structure exchange nutrients and waste products with the epidermis.
4. Projections from the dermis into the epidermis; produce fingerprints.

## Epidermis

“The epidermis is stratified squamous epithelium separated from the dermis by a basement membrane.”

A. Match these terms with the correct statement or definition:

Callus  
Corn  
Keratin  
Keratinization

Lipids  
Stratum basale  
Stratum corneum

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\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

\_\_\_\_\_

1. The process that changes the shape and chemical composition of epidermal cells.
2. The strata of the epidermis that produces new cells by mitosis.
3. The strata of the epidermis that contains dead, squamous cells.
4. Responsible for the structural strength of the stratum corneum.
5. Responsible for preventing fluid loss through the skin.
6. A thickened area of stratum corneum produced in response to friction.
7. Stratum corneum that thickens to form a cone-shaped structure over a bony prominence.



The epidermis forms a permeability barrier that is also resistant to abrasion.

B. Match these terms with the correct part labeled in figure 5.1:

- Dermis
- Epidermis
- Stratum basale
- Stratum corneum

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

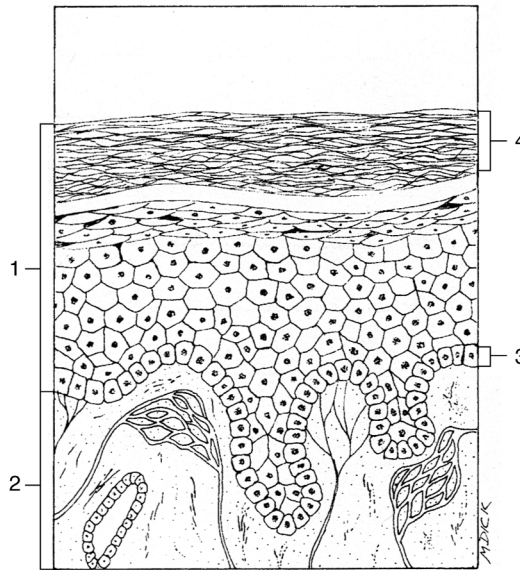


Figure 5.1

## Skin Color

“Skin color is determined by pigments in the skin, by blood circulation through the skin, and by the thickness of the stratum corneum.”

Using the terms provided, complete these statements:

- |            |             |
|------------|-------------|
| Albinism   | Melanin     |
| Birthmarks | Melanocytes |
| Blue color | Melanosomes |
| Carotene   | Red color   |
| Cyanosis   | Suntan      |

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_

(1) is the term used to describe a group of pigments responsible for skin, hair, and eye color. It is produced by (2) in the stratum basale, packaged into (3), and is distributed to other epidermal cells. Melanin production is determined by genetic factors, hormones, and exposure to light. A mutation that prevents the manufacture of melanin is called (4). Increased melanin production in response to ultraviolet light results in a (5). The (6) of tattoos, bruises, and some superficial blood vessels is due to the light-scattering effect of overlying tissues. (7) is a yellow pigment found in plants such as squash and carrots. When large amounts of this pigment are consumed, the excess accumulates in the stratum corneum and in fat cells of the dermis and hypodermis, causing the skin to develop a yellowish tint. Blood flowing through the skin produces a (8). When blood flow increases (e.g., blushing) this color intensifies. A decrease in the blood oxygen content of blood produces a bluish color called (9). Congenital disorders of blood vessels in the dermis produce (10).

# Hair

“The presence of hair is one of the characteristics common to all mammals.”

A. Match these terms with the correct statement or definition:

Arrector pili  
Cortex  
Cuticle  
Hair bulb

Hair follicle  
Hair root  
Hair shaft  
Medulla

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Portion of hair protruding above the surface of the skin.
2. Soft center of a hair.
3. Outer layer of a hair consisting of a single layer of overlapping cells that holds the hair in the hair follicle.
4. An extension of the epidermis into the dermis.
5. Smooth muscles cells that cause hair to "stand on end" and also produce "goose flesh."



Hair is produced in cycles that involve a growth stage alternating with a resting stage.

B. Match these terms with the correct part labeled in figure 5.2:

Arrector pili  
Cortex  
Cuticle  
Dermal papilla  
Hair bulb  
Hair follicle wall  
Hair root  
Hair shaft  
Medulla

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_

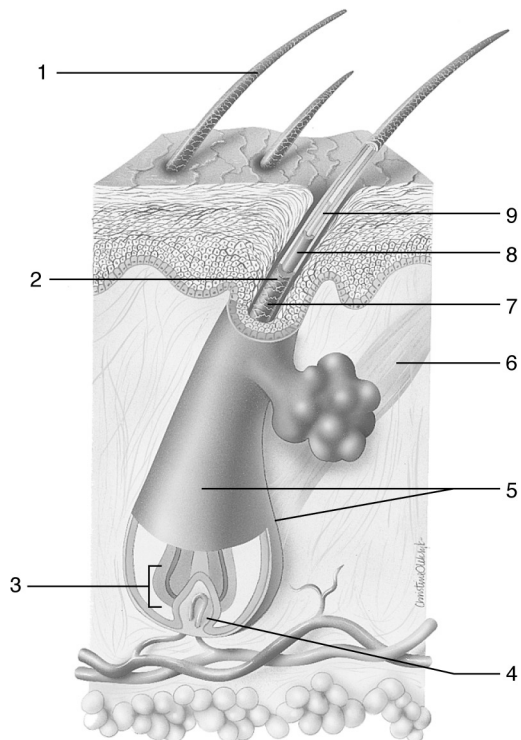


Figure 5.2

## Glands

“The major glands of the skin are the sebaceous glands and the sweat glands.”

A. Match these terms with the correct statement or definition:

Apocrine sweat gland  
Merocrine sweat gland

Sebaceous gland  
Sebum

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Oily, white substance rich in lipids; lubricates hair and the surface of the skin, prevents drying, and protects against some bacteria.
2. Produces sebum; opens into the hair follicle.
3. Produces a watery secretion (sweat); opens onto the surface of the skin.
4. Produces a thick, organic secretion that is broken down by bacteria to produce body odor; opens into the hair follicle.

B. Match these terms with the correct part labeled in figure 5.3:

Apocrine sweat gland  
Merocrine sweat gland  
Sebaceous gland

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

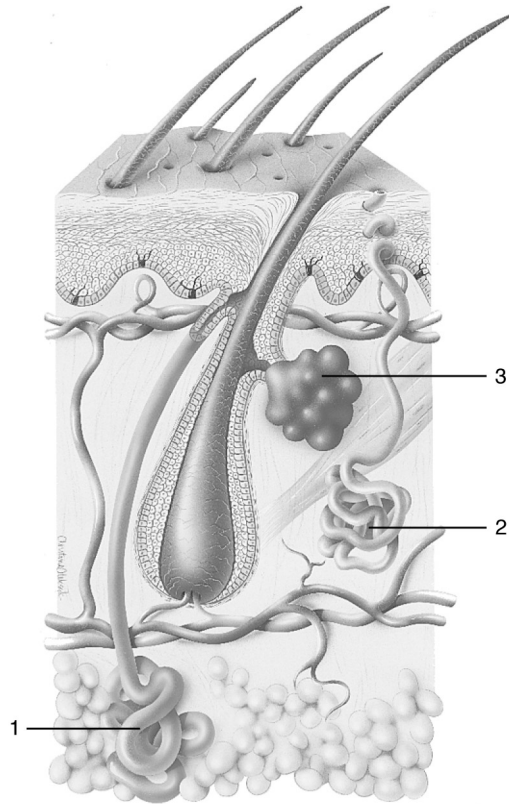


Figure 5.3

# Nails

“The distal ends of the digits of humans have nails.”

A. Match these terms with the correct statement or definition:

Eponychium  
Lunula  
Nail body

Nail matrix  
Nail root

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

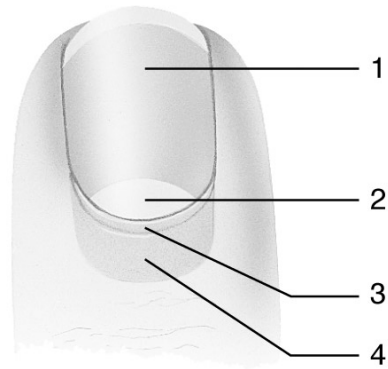
1. Visible part of the nail.
2. Cuticle; stratum corneum that extends onto the nail body.
3. Produces the nail.
4. Whitish, crescent-shaped area at the base of a nail; part of the nail matrix.



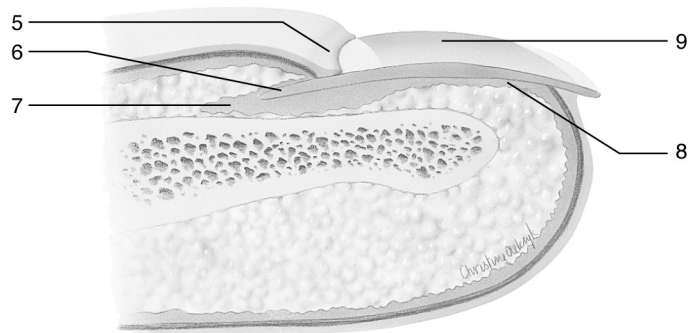
Unlike hair, nails grow continuously and do not have a resting stage.

B. Match these terms with the correct part labeled in figure 5.4:

Eponychium (cuticle)  
Lunula  
Nail bed  
Nail body  
Nail matrix  
Nail root



1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_



## Functions of the Integumentary System

“The integumentary system has many functions in the body.”

Match these terms with the correct statement or definition:

Excretion  
Protection  
Sensation

Temperature regulation  
Vitamin D production

- |       |   |
|-------|---|
| _____ | 1. The skin functions as a physical and permeability barrier.                                       |
| _____ | 2. Absorption of ultraviolet light by melanin.  |
| _____ | 3. Resists abrasion by sloughing cells from the epidermis.  |
| _____ | 4. Begins when a precursor molecule is exposed to ultraviolet light in the skin.                    |
| _____ | 5. Carried out by producing sweat and increasing or decreasing blood vessel diameter.               |
| _____ | 6. Occurs to a slight degree with sweat production when some urea, uric acid, and ammonia are lost. |

## The Effects of Aging on the Integumentary System

“As the body ages, many changes occur in the integumentary system.”

Using the terms provided, complete these statements:

Decreases

Increases

As the body ages blood flow to the skin (1), and the thickness of the skin (2). The skin is more easily damaged and repairs more slowly. The amount of elastic fibers in the skin (3), and the amount of fat in the hypodermis (4), causing the skin to wrinkle and sag. The activity of sweat and sebaceous glands (5), resulting in dry skin and poor ability to regulate body temperature. The number of functioning melanocytes (6), but in the hands and face, melanocytes increase to produce age spots. White or gray hair also results because melanin production (7).

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_

## The Integumentary System as a Diagnostic Aid

“The integumentary system is useful in diagnosis because it is observed easily.”

Match these terms with the correct statement or definition:

Cyanosis  
Jaundice

Rash

- |       |   |
|-------|---|
| _____ | 1. Indicates impaired circulatory or respiratory function.        |
| _____ | 2. Results from a buildup of bile pigments in the blood.          |
| _____ | 3. Can indicate an allergic reaction, for example, to penicillin. |

## Burns

“Burns are classified according to the depth of the burn.”

Match these terms with the correct statement or definition:

First degree burn  
Second degree burn  
Third degree burn

Full thickness burn  
Partial thickness burn

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\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Part of the stratum basale remains viable and regeneration of the epidermis occurs from within the burn area as well as from the edges of the burn; includes first and second degree burns.
2. Involves only the epidermis; red and painful.
3. Damages the epidermis and dermis; symptoms include redness, pain, edema, and blisters.
4. The epidermis and dermis are destroyed, and recovery occurs from the edges of the burn; also called a third degree burn.

## Skin Cancer

“Skin cancer is the most common type of cancer.”

Match these terms with the correct statement or definition:

Basal cell carcinoma  
Malignant melanoma

Squamous cell carcinoma

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. Begins in the stratum basale and extends into the dermis to produce an open ulcer; the most frequent type of skin cancer.
2. Develops from cells immediately superficial to the stratum basale; a nodular, keratinized tumor confined to the epidermis.
3. A rare form of skin cancer that arises from melanocytes, usually in a preexisting mole; unless diagnosed and treated early this cancer is often fatal.

## QUICK RECALL

1. List 5 functions of the integumentary system.
2. Name two strata of the epidermis and the process that changes the deepest stratum into the most superficial stratum.



3. Name two pigments involved in skin color.
  
4. Name the two stages in the hair growth cycle.
  
5. List the three types of glands found in the skin.
  
6. List four protective functions of the skin.
  
7. State two ways the integumentary system functions to regulate body temperature.
  
8. Name the three types of skin cancer.

## WORD PARTS

Give an example of a new vocabulary word that contains each word part.

| WORD PART | MEANING   | EXAMPLE  |
|-----------|-----------|----------|
| sub-      | below     | 1. _____ |
| derm-     | skin      | 2. _____ |
| kerat-    | horn      | 3. _____ |
| melan-    | black     | 4. _____ |
| cyan-     | dark blue | 5. _____ |
| papill-   | nipple    | 6. _____ |

## MASTERY LEARNING ACTIVITY

Place the letter corresponding to the correct answer in the space provided.

- \_\_\_\_\_ 1. The hypodermis
  - a. connects the dermis to underlying bone and muscle.
  - b. is the layer of skin where hair is produced.
  - c. is the layer of skin where nails are produced.
  - d. connects the dermis and the epidermis.
- \_\_\_\_\_ 2. The part of the skin where cells divide by mitosis in order to replace cells lost from the outermost surface of the skin?
  - a. hypodermis
  - b. dermis
  - c. stratum basale
  - d. stratum corneum
- \_\_\_\_\_ 3. The papillae of the dermis
  - a. are responsible for cleavage or tension lines in the skin.
  - b. contain large deposits of fat.
  - c. are responsible for fingerprints.
  - d. do not contain blood vessels.
- \_\_\_\_\_ 4. In what area of the body would you expect to find an especially thick stratum corneum?
  - a. back of the hand
  - b. heel of the foot
  - c. abdomen
  - d. over the shin
- \_\_\_\_\_ 5. The function of keratin in the skin is
  - a. lubrication of the skin.
  - b. to reduce water loss.
  - c. to provide protection from ultraviolet light.
  - d. to provide structural strength.
- \_\_\_\_\_ 6. Concerning skin color, which of the following statements is NOT correctly matched?
  - a. skin appears yellow - carotene present
  - b. no skin pigmentation (albinism) - genetic disorder
  - c. skin tans - increased melanin production
  - d. skin appears blue (cyanosis) - oxygenated blood
  - e. dark skinned person compared to a fair-skinned person - more melanin in the dark-skinned person
- \_\_\_\_\_ 7. Hair
  - a. slowly, but continually grows.
  - b. grows from the tip of the hair shaft.
  - c. consists of columns of dead keratinized epithelial cells.
  - d. all of the above
- \_\_\_\_\_ 8. A hair follicle
  - a. is an extension of the epidermis into the dermis.
  - b. receives a duct from a sebaceous gland.
  - c. receives a duct from an apocrine sweat gland.
  - d. all of the above
- \_\_\_\_\_ 9. Smooth muscles that produce "goose flesh" when they contract are the
  - a. papillae.
  - b. cuticle.
  - c. medulla.
  - d. arrector pili.
- \_\_\_\_\_ 10. Sebum
  - a. lubricates hair and skin, which prevents drying.
  - b. is produced by sweat glands.
  - c. consists of dead cells from hair follicles.
  - d. is responsible for body odor.

- \_\_\_\_\_ 11. If a person was born without any sweat glands, it would most likely affect the person's ability to
- secrete waste products.
  - control body temperature in warm environments.
  - flush out secretions that accumulate in hair follicles.
  - prevent some bacteria from growing on the skin.
- \_\_\_\_\_ 12. While building the patio deck to his house, an anatomy and physiology instructor hit his finger with a hammer. He responded by saying, "Gee, I hope I didn't irreversibly damage the \_\_\_\_\_, because if I did, my fingernail will never grow back."
- cuticle
  - nail body
  - nail matrix
  - nail root
- \_\_\_\_\_ 13. Skin aids in maintaining the calcium and phosphate levels of body by participating in the production of
- carotene.
  - keratin.
  - vitamin A.
  - vitamin D.
- \_\_\_\_\_ 14. On a sunny spring day a student decided to initiate her annual tanning ritual. However, she fell asleep while sunbathing. After awakening she noticed that the skin on her back was burned. She experienced redness, blisters, edema, and pain. The burn was nearly healed about 10 days later. The burn was best classified as
- first degree burn.
  - second degree burn.
  - third degree burn.
- \_\_\_\_\_ 15. A large, flat spreading lesion develops from a mole. A short time later the victim dies of cancer. The type of cancer most likely was a
- basal cell carcinoma.
  - squamous cell carcinoma.
  - malignant melanoma.



## FINAL CHALLENGES



Use a separate sheet of paper to complete this section.

- The rate of water loss from the skin of the hand was measured. Following the measurement the hand was soaked in alcohol for 15 minutes. After all the alcohol was removed from the hand, the rate of water loss was again measured. Compared to the rate of water loss before soaking the hand in alcohol, what difference, if any, would you expect in the rate of water loss after soaking the hand in alcohol.
- It has been several weeks since Goodboy Player has competed in a tennis match. After the match he discovers that a blister has formed beneath an old callus on his foot and the callus has fallen off. When he examines the callus he discovers that it appears yellow. Can you explain why?
- Why is it difficult to surgically remove a large tattoo without causing scar tissue to form? (hint: why do tattoos appear bluish in color?)
- Given what you know about the cause of body odor, propose some ways to prevent the condition.
- Dandy Chef has been burned on the arm. The doctor, using a forceps, pulls on a hair within the area that was burned. The hair easily pulls out. What degree of burn did the patient have and how do you know?