

# 7

## EXERCISE

# The Integumentary System



**Time Allotment:** 1½ hours.



**Multimedia Resources:** See Appendix B for Guide to Multimedia Resource Distributors.

*Practice Anatomy Lab™ 3.0 (PAL)* (PE: DVD, Website)

*The Senses: Skin Deep* (FHS: 26 minutes, DVD, 3-year streaming webcast)

*Skin* (FHS: 20 minutes, DVD, 3-year streaming webcast)

*The Skin* (NIMCO: 28 minutes, DVD)



**Solutions:**

*Lugol's Iodine (IKI)*

- 20 grams potassium iodide

- 4 grams iodine crystals

Dissolve potassium iodide in 1 liter distilled water. Add the iodine crystals and stir to dissolve. Store in dark bottles.

## Laboratory Materials

Ordering information is based on a lab size of 24 students, working in groups of 4. A list of supply house addresses appears in Appendix A.

24 compound microscopes, lens paper,  
lens cleaning solution

Model of the skin

24 slides of human scalp

24 slides of skin of palm or sole

1 sheet of 20# bond paper

Ruler

Adhesive tape

24 pairs of scissors

24 Betadine® swabs or 24 cotton

swabs and 6 dropper bottles of

Lugol's iodine

Data collection sheets

Disposable gloves

Porelon fingerprint pad or portable  
inking foils

Ink cleaning towelettes

Index cards (4 × 6)

24 magnifying glasses

## Advance Preparation

1. Set out models of the skin, prepared slides of human scalp with hair follicles and skin of palm or sole, lens paper, and lens cleaning solution. Have compound microscopes available.
2. Terminology for layers of the epidermis differs from text to text. Decide on the terminology to be used, and inform the students at the onset of the laboratory session if there is a discrepancy between the laboratory manual and the text.
3. Set out 20# bond paper ruled in 1-centimeter squares, scissors, Betadine swabs, or *Lugol's iodine* (Carolina, or see above), cotton swabs, and adhesive tape.
4. Prepare a data collection sheet for “palm” and “forearm” sweat gland data.
5. Set out 4 × 6 index cards, Porelon fingerprint pad or portable inking foils, ink cleaner towelettes, and magnifying glasses (all available from Sirchie®-Fingerprint & Forensic Supplies., 1-800-356-7311 or [www.sirchie.com](http://www.sirchie.com)).

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## Comments and Pitfalls

1. Students may have difficulty finding the arrector pili muscles and sweat glands. Some students will confuse the fibers of the dermis (dense fibrous irregular connective tissue) with smooth muscle.
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## Answers to Pre-Lab Quiz (p. 93)

- |                                   |                   |
|-----------------------------------|-------------------|
| 1. d, site of vitamin A synthesis | 6. c, melanocytes |
| 2. epidermis, dermis              | 7. true           |
| 3. d, stratum corneum             | 8. d, shaft       |
| 4. five                           | 9. sebaceous      |
| 5. b, Carotene                    | 10. Apocrine      |
- 

## Answers to Activity Questions

### Activity 3: Comparison of Hairy and Relatively Hair-Free Skin Microscopically (p. 98)

1. The stratified squamous epithelium of the skin consists of several cell layers, the outermost of which contains keratinized or dead cells. Hair follicles are also present.  
Both types of epithelia are protective, but the skin epithelium also protects against water loss to the external environment, UV damage, and chemical damage in addition to protecting against mechanical damage and bacterial invasion.
2. The thickness of the skin can be attributed to the presence of a fifth epithelial layer, the stratum lucidum, and a thicker stratum corneum and dermis. Thick skin lacks hair follicles, arrector pili muscles, and sebaceous glands that are present on thin skin of the scalp.

### Activity 4: Differentiating Sebaceous and Sweat Glands Microscopically (p. 100)

Eccrine sweat glands have long, straight, or undulating ducts with twisted coils at their base. In contrast, sebaceous glands have short ducts leading from a fan-shaped base. Sebaceous glands are usually associated with hair follicles.

### Activity 5: Plotting the Distribution of Sweat Glands (p. 100)

6. In most students, the palm has a greater density of sweat glands when compared to the forearm.

### Activity 6: Taking and Identifying Inked Fingerprints (pp. 101–102)

7. Sometimes it was easy to classify the prints; at other times it was difficult.  
This has to do with the clarity of the prints taken and the fact that more information on fingerprints is necessary to make accurate identifications.  
The same individual would probably affect the fingerprinting process in the same way each time.

# The Integumentary System

Name \_\_\_\_\_

Lab Time/Date \_\_\_\_\_

## Basic Structure of the Skin

1. Complete the following statements by writing the appropriate word or phrase on the correspondingly numbered blank:

The two basic tissues of which the skin is composed are dense irregular connective tissue, which makes up the dermis, and 1, which forms the epidermis. The tough water-repellent protein found in the epidermal cells is called 2. The pigments melanin and 3 contribute to skin color. A localized concentration of melanin is referred to as a 4.

1. stratified squamous epithelium
2. keratin
3. carotene
4. freckle

2. Four protective functions of the skin are

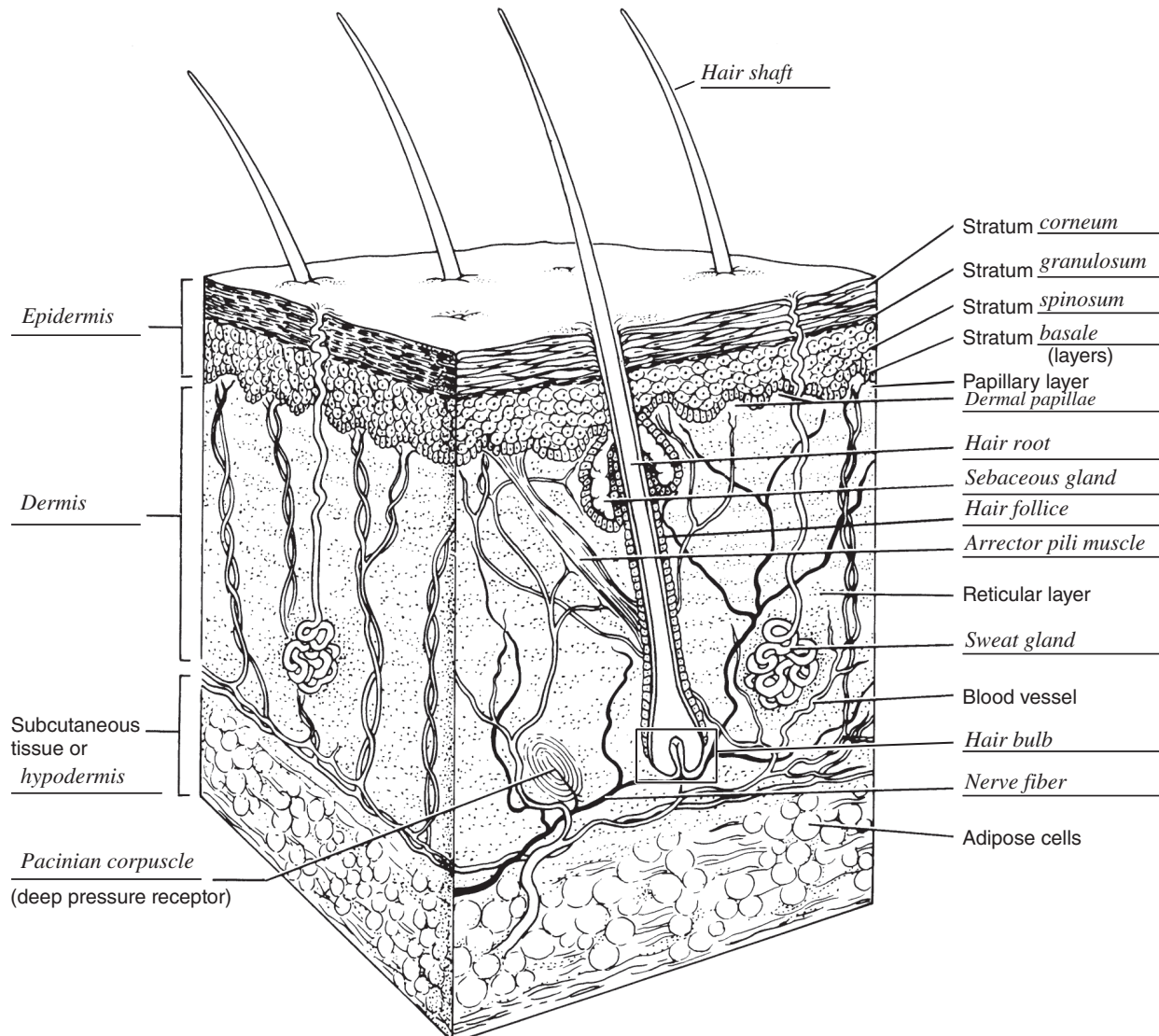
- |                                       |   |
|---------------------------------------|---|
| a. <u>Prevents desiccation</u>        | c. <u>Protects against thermal damage</u> |
| b. <u>Prevents bacterial invasion</u> | d. <u>Protects against UV radiation</u>   |

3. Using the key choices, choose all responses that apply to the following descriptions. Some terms are used more than once.

- |                        |                     |                         |
|------------------------|---------------------|-------------------------|
| Key: a. stratum basale | d. stratum lucidum  | g. reticular layer      |
| b. stratum corneum     | e. stratum spinosum | h. epidermis as a whole |
| c. stratum granulosum  | f. papillary layer  | i. dermis as a whole    |

- |  |  |
|--|--|
| <u>d; stratum lucidum</u>                | 1. layer of translucent cells in thick skin containing dead keratinocytes            |
| <u>b, d; stratum corneum and lucidum</u> | 2. two layers containing dead cells  |
| <u>f; papillary layer</u>                | 3. dermal layer responsible for fingerprints   |
| <u>i; dermis (or f, g)</u>               | 4. vascular region of the skin   |
| <u>h; epidermis</u>                      | 5. major skin area as a whole that produces derivatives (nails and hair)             |
| <u>a; stratum basale</u>                 | 6. epidermal layer exhibiting the most rapid cell division                           |
| <u>b; stratum corneum</u>                | 7. layer including scalelike dead cells, full of keratin, that constantly slough off |
| <u>e; stratum spinosum</u>               | 8. layer of mitotic cells filled with intermediate filaments                         |
| <u>i; dermis (or g)</u>                  | 9. has abundant elastic and collagenic fibers  |
| <u>a; stratum basale</u>                 | 10. location of melanocytes and tactile (Merkel) cells                               |
| <u>e; stratum spinosum</u>               | 11. area where weblike pre-keratin filaments first appear                            |
| <u>f; papillary layer</u>                | 12. layer of areolar connective tissue   |

4. Label the skin structures and areas indicated in the accompanying diagram of thin skin. Then, complete the statements that follow.



- Lamellar granules contain glycolipids that prevent water loss from the skin.
- Fibers in the dermis are produced by fibroblasts.
- Glands that respond to rising androgen levels are the sebaceous (and apocrine sweat) glands.
- Phagocytic cells that occupy the epidermis are called dendritic or Langerhans cells.
- A unique touch receptor formed from a stratum basale cell and a nerve fiber is a tactile or Merkel disc.
- What layer is present in thick skin but not in thin skin? Stratum lucidum
- What cell-to-cell structures hold the cells of the stratum spinosum tightly together? Desmosomes

5. What substance is manufactured in the skin and plays a role in calcium absorption elsewhere in the body?

Vitamin D

6. List the sensory receptors found in the dermis of the skin. Free nerve endings (for pain, temperature), tactile

corpuscles (for touch in hairless skin), lamellar corpuscles (for pressure)

7. A nurse tells a doctor that a patient is cyanotic. Define *cyanosis*. A blue cast to the skin

What does its presence imply? Inadequate oxygenation of the blood

8. What is a bedsore (decubitus ulcer)? Localized area of tissue necrosis and death

Why does it occur? Pressure areas (points of increased pressure over bony areas) restrict the blood supply to the area.

## Accessory Organs of the Skin

9. Match the key choices with the appropriate descriptions. Some terms are used more than once.

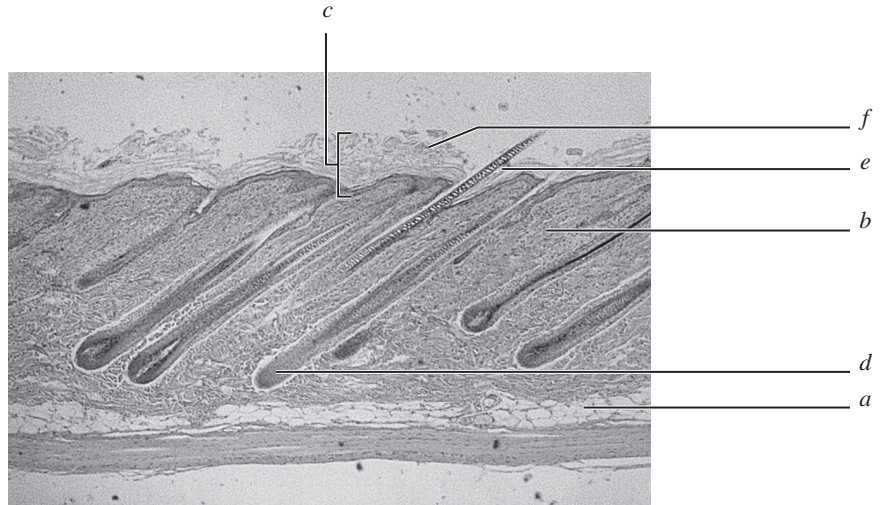
Key: a. arrector pili                      d. hair follicle                      g. sweat gland—apocrine  
b. cutaneous receptors              e. nail                                  h. sweat gland—eccrine  
c. hair                                      f. sebaceous glands

- f; sebaceous glands      1. produces an accumulation of oily material that is known as a blackhead
- a; arrector pili              2. tiny muscles, attached to hair follicles, that pull the hair upright during fright or cold
- h; sweat gland—eccrine      3. sweat glands with a role in temperature control
- d; hair follicle              4. sheath formed of both epithelial and connective tissues
- g; sweat gland—apocrine      5. less numerous type of sweat-producing gland; found mainly in the pubic and axillary regions  
d; hair follicle,  
f; sebaceous glands      6. found everywhere on the body except the palms of hands and soles of feet (two from key)
- c; hair; e; nail              7. primarily dead/keratinized cells (two from key)
- b; cutaneous receptors      8. specialized nerve endings that respond to temperature, touch, etc.
- f; sebaceous glands      9. secretes a lubricant for hair and skin
- e; nail                      10. “sports” a lunule and a cuticle

10. Describe two integumentary system mechanisms that help in regulating body temperature. (1) When capillary blood flow to the skin is enhanced (by nervous system controls), heat radiates from the skin surface; restriction of blood flow conserves body heat. (2) Activity of sweat glands, i.e., when perspiration evaporates from the skin surface, heat is lost.

11. Several structures or skin regions are listed below. Identify each by matching its letter with the appropriate area on the figure.

- a. adipose cells
- b. dermis
- c. epidermis
- d. hair follicle
- e. hair shaft
- f. sloughing stratum corneum cells



### Plotting the Distribution of Sweat Glands

12. With what substance in the bond paper does the iodine painted on the skin react? The starch

13. Based on class data, which skin area—the forearm or palm of hand—has more sweat glands? Palm

Was this an expected result? Yes Explain. For most people, hands sweat more than the forearm.

Which other body areas would, if tested, prove to have a high density of sweat glands? Face, axillae

14. What organ system controls the activity of the eccrine sweat glands? Nervous system (sympathetic division)

### Dermography: Fingerprinting

15. Why can fingerprints be used to identify individuals?

Everyone's fingerprints are genetically distinct.

16. Name the three common fingerprint patterns.

loops, arches, and whorls