

CHAPTER 6: INTEGUMENTARY SYSTEM

OBJECTIVES:

1. Explain why the skin is called the cutaneous membrane.
2. Name the layers of the skin, describe the structure (tissues) of each, and name a general function of each.
3. Discuss the four cell types present in the epidermis.
4. List the four/five layers of the epidermis and explain the process of keratinization.
5. Explain the protective role of keratin, and in turn, the epidermis.
6. Name the pigment responsible for skin and hair color, and explain how people of different races (i.e. and skin color) differ in regards to it, and the cell that produces it.
7. List some factors that promote the production of melanin (besides DNA).
8. Distinguish between the papillary layer and reticular layer of the dermis, and locate the appropriate sensory receptor in each of these layers.
9. Compare and contrast Meissner's and Pacinian Corpuscle's in terms of their structure, function, and location.
10. Describe the structure and function of the subcutaneous layer.
11. Explain what is meant by the term epidermal derivative, and list four examples.
12. Describe the general structure of a hair follicle and identify two other structures that are always associated with them.
13. Distinguish between merocrine (eccrine) and apocrine sweat glands in terms of structure, secretion content and odor, activation, and major body locations.
14. Name two modified apocrine glands of the skin.
15. Describe the structure, function, secretion, and location of sebaceous glands.

CHAPTER 6: INTEGUMENTARY SYSTEM

Objectives (continued)

16. Discuss the many functions of skin.
17. Describe some major homeostatic imbalances of the skin.
18. Sketch a typical layer of skin and label each layer and all structures. Then in complete sentences, discuss the function of each layer and structure.

CHAPTER 6: INTEGUMENTARY SYSTEM

I. INTRODUCTION

The integumentary system is the first body system we will study. Before we begin any study of a body system, we will first think about the organs/tissues that work together to perform the function(s) of that system.

The integumentary system consists of a major organ, skin, and many epidermal derivatives (accessory organs), which include hair follicles, sebaceous glands, sweat glands, and nails.

In addition, the organs of the integumentary **system** are composed of many different tissues that perform common functions. Look at Figure 6.2, page 162, and name as many different tissues as you can. These tissues include stratified squamous epithelium, glandular epithelium, dense irregular CT, smooth muscle tissue, blood vessels, adipose tissue, and nervous tissue. The functions that these tissues collectively perform are many. Functions of the skin include protection, excretion, regulation of body temperature, sensory reception, immunity, synthesis of Vitamin D, and blood reservoir.

II. SKIN (Cutaneous Membrane)

A. General Structure: See Fig 6.2, page 162.

1. Two distinct regions or layers compose the skin:

- a. **Epidermis** = outermost layer;
 - m keratinized stratified squamous ET.
- b. **Dermis** = inner layer;
 - m keratinized epithelium (hair follicles),
 - m glandular epithelium (sweat, sebaceous glands),
 - m dense irregular CT (collagen),
 - m smooth muscle tissue (arrector pili muscles),
 - m nervous tissue (Meissner's & Pacinian Corpuscles), and
 - m blood vessels.
- (c. **Subcutaneous layer** = adipose tissue; distinct layer beneath skin).

B. General Functions:

Each skin layer has its own unique function:

- 1. **Epidermis = protection;**
- 2. **Dermis = nourishment of epidermis;**
- 3. **Subcutaneous layer = insulation.**

CHAPTER 6: INTEGUMENTARY SYSTEM

II. SKIN (continued)

C. Epidermis:

1. Structure = **keratinized stratified squamous epithelium**;

See Fig 6.3, page 163 and table 6.1, page 164.

- a. **Five distinct layers** determined by the extent of keratinization in the epithelial cells:

1. **Stratum corneum** = outermost layer.

m composed of dead epithelial cells filled with the protein keratin;

2. **Stratum lucidum** = translucent layer cells separating s.corneum from s. granulosum.

o only in thick skin of soles & palms;

3. **Stratum granulosum** is composed of 3-5 layers of flattened granular cells (filled with keratin);

4. **Stratum spinosum** is composed of many layers of rounded cells with large nuclei;

5. **Stratum basale** = innermost layer;

m directly above basement membrane; ocomposed of a single row mitosing cuboidal epithelial cells and ocomposed of melanocytes.

- a. specialized cells that produce the pigment melanin.

See Figure 6.4 and Figure 6.5, page 165.

CHAPTER 6: INTEGUMENTARY SYSTEM

II. C. Epidermis of Skin (continued)

2. Function = **Protection** (keratin):

- a. moisture loss (waterproof);
- b. injury;
- c. microorganisms/chemicals.

3. Pigment = **Melanin**: See Fig 6.4 and 6.5, page 165.

- a. determines **skin color**:
- b. is produced by melanocytes in stratum basale;
- c. People of different races have essentially the same # of melanocytes, but the amount of melanin produced varies (determined by **DNA**);
- d. Other factors also affect melanin production:

- m UV rays,
- m chemicals,
- m drugs (antihistamines & antibiotics);

* Note that other factors may affect skin color (but not melanin production):

- m Carotene may accumulate in s. corneum = yellow;
- m Hemoglobin (Hb) in dermal blood vessels = pink;
- m Lack of Hb in dermal blood vessels = blue (cyanosis.)

D. Dermis: inner layer of skin;
binds epidermis to underlying tissues.

1. Structure (See Fig 6.2, page 162).

a. **two distinct layers:**

1. **papillary layer** (20%) is a below epidermis:

- m composed of loose areolar CT;
- m surface forms dermal papillae (finger-like projections into the epidermis) which house many
- m **Meissner's Corpuscles** (sensory receptor for light touch).

CHAPTER 6: INTEGUMENTARY SYSTEM

- II. D. 1. Structure of Dermal Layer of Skin (continued)
 - a. **two distinct layers**
 - 2. **reticular layer** (80%) = dense irregular CT;
 - m bundles of collagen fibers,
 - m elastic fibers, and
 - m reticular fibers which give skin its
 - m strength and resiliency.
 - b. The dermis houses epidermal derivatives or accessory organs (see below).
 - 2. Function = **nourishment** of epidermis.
- E. **Subcutaneous Layer** = beneath skin.
- 1. Structure = adipose tissue & blood vessels;
 - 2. Function = insulation.

III. ACCESSORY ORGANS (Epidermal Derivatives)

Consider these structures as extensions of the epidermis (i.e. they are epithelium), although they are located in the dermis.

- A. **Hair Follicles:** See Fig 6.6 and 6.7, page 169.
- 1. Structure:
 - a. root or base in deep dermis;
 - b. follicle throughout dermis;
 - c. hair shaft in epidermis.
 - 2. Keratinization
 - a. cells are epithelium;
 - b. cells in root = active mitosis;
 - c. cells in follicle = maturing & accumulating keratin;
 - d. cells in epidermis = dead epithelial cells; full of keratin = exposed hair or hair shaft.
 - 3. **Pigment = Melanin**
 - 4. **Arrector Pili Muscle** = a bundle of smooth muscle associated with every hair follicle.
 - a. causes hair to stand on end ("goose bumps") when frightened or cold.

CHAPTER 6: INTEGUMENTARY SYSTEM

III. Accessory Organs (continued)

B. Nails: See Fig 6.8, page 169.

1. Epithelium undergoing keratinization (active mitosis in lunula).
2. Functions:
 - m manipulation;
 - m protection of digit ends.

C. Sweat Glands (Sudoriferous Glands)

1. Two types (based on glandular secretion): See Fig 6.10 & 6.11, page 171.

a. Merocrine (Eccrine) Glands:

m Structure:

1. coil in deep dermis
2. duct in dermis
3. pore at surface

m Characteristics:

1. respond to elevated temperature / exercise
2. no odor in secretion
3. function throughout life
4. not associated with hair follicles
5. Location: forehead
neck
back

m Secretion (merocrine) = water plus

1. salts and
2. wastes (urea and uric acid)

b. Apocrine glands:

m Structure: ducts terminate into hair follicles

m Characteristics:

1. respond to stress / emotions
2. odor in secretion
3. begin to function at puberty & continue through life
4. associated with hair follicles
5. Location: armpits
groin

m Secretion (apocrine) = sweat above plus

1. oil and
2. cellular debris.

m Modified Apocrine Glands

1. **Ceruminous glands** = external ear; secretion = earwax;
2. **Mammary glands** = breasts; milk.

CHAPTER 6: INTEGUMENTARY SYSTEM

III. Accessory Organs (continued)

D. Sebaceous Glands: See Fig 6.9, page 171.

1. holocrine gland (simple cuboidal epithelium);
2. associated with every hair follicle;
3. Secretion (holocrine) = sebum (i.e. oil).
 - a. fat
 - b. cellular material
4. Sebum is secreted into hair follicle;
5. Function: Sebum keeps skin & hair soft, pliable and virtually waterproof!
6. Disorders:
 - a. acne (hypersecretion of sebum; ducts clog & inflame); See Clinical Application of page 172.
 - b. seborrhea (hyperproduction of sebum; oily scales).

CHAPTER 6: INTEGUMENTARY SYSTEM

IV. Skin Functions

A. Protection:

1. from water loss;
2. from injury;
3. from chemicals and microorganisms.

B. Excretion (minimal, most through kidneys!):

1. urea;
2. uric acid.

C. Regulation of body temperature:

Review negative-feedback mechanisms from Ch. 1 and see Figure 6.12, page 174.

D. Cutaneous Sensation:

1. Light touch detection = **Meissner's Corpuscle's**;
 - a. egg-shaped;
 - b. located in dermal papillae;
 - c. populate areas in the fingertips, palms, soles, eyelids, tip of tongue, nipples, clitoris, tip of penis.
2. Pressure detection = **Pacinian Corpuscle's**;
 - a. onion-shaped;
 - b. located in deep dermis and subcutaneous regions;
 - c. populate areas in the joints, tendons, muscles, mammary glands, and external genitalia.

E. Vitamin D Synthesis:

1. UV rays in sunlight activate its synthesis;
2. Vitamin D is required for bone homeostasis.
*See Clinical Application page 127.

F. Blood Reservoir:

The dermis houses about 10% of the body's blood vessels.

G. Immunity:

1. Langerhan cells (macrophages);
2. interact with T-helper cells in immune responses.

CHAPTER 6: INTEGUMENTARY SYSTEM

V. Homeostatic Imbalances of the Skin

Throughout the text of each chapter, your authors present selected imbalances, disorders, and diseases of each system. Although I may only discuss some major disorder in class, these disorders and diseases are very interesting to learn about. I strongly encourage you to study them.

- A. Burns (page 177-179)

 - B. Skin Cancer = carcinoma (Clinical Application 6.1, page 166-167)

 - 3. Stevens-Johnson Syndrome (page 161)

 - 4. Epidermolysis bullosa (page 162)

 - D. Psoriasis (page 163)

 - E. Contact dermatitis (page 164)

 - F. Pressure Ulcers (Page 164)

 - 7. Rashes (see Table 6.2, page 165.

 - 8. Hair loss (Clinical Application 6.2 page 170)

 - I. Acne (page 172)

 - I. Albinism (page 176)
- VI. Innerconnections between the Integumentary System and other organ systems: See page 180.