Chapter 6

The Integumentary System

Ch. 6 Study Guide

1. **Critically read Chapter 6–**
   - pp. 187-194 before "**Skin Color"** section
   - Skip Section 6.2 (Hair and Nails)
   - Critically read sections 6.3 (Cutaneous glands) and 6.4 (Skin Disorders) pp. 202-207 before "**Burns**" section
2. **Comprehend Terminology (those in bold in the textbook) within the reading scope above**
3. **Study**-- Figure questions, Think About It questions, and Before You Go On (section-ending) questions (within the reading scope above)
4. **Do end-of-chapter questions--**
   - Testing Your Recall— 1-4, 7-17, 20
   - True or False– All of them (1-10)
   - Testing Your Comprehension-- 1, 4, 5

§ Quotable Quotes (Skin)

- Some guys say beauty is only skin deep. But when you walk into a party, you don't see somebody's brain. The initial contact has to be the sniffing. (James Caan)
- Beauty may be skin deep, but ugly goes clear to the bone. (Redd Foxx)

I. Introduction

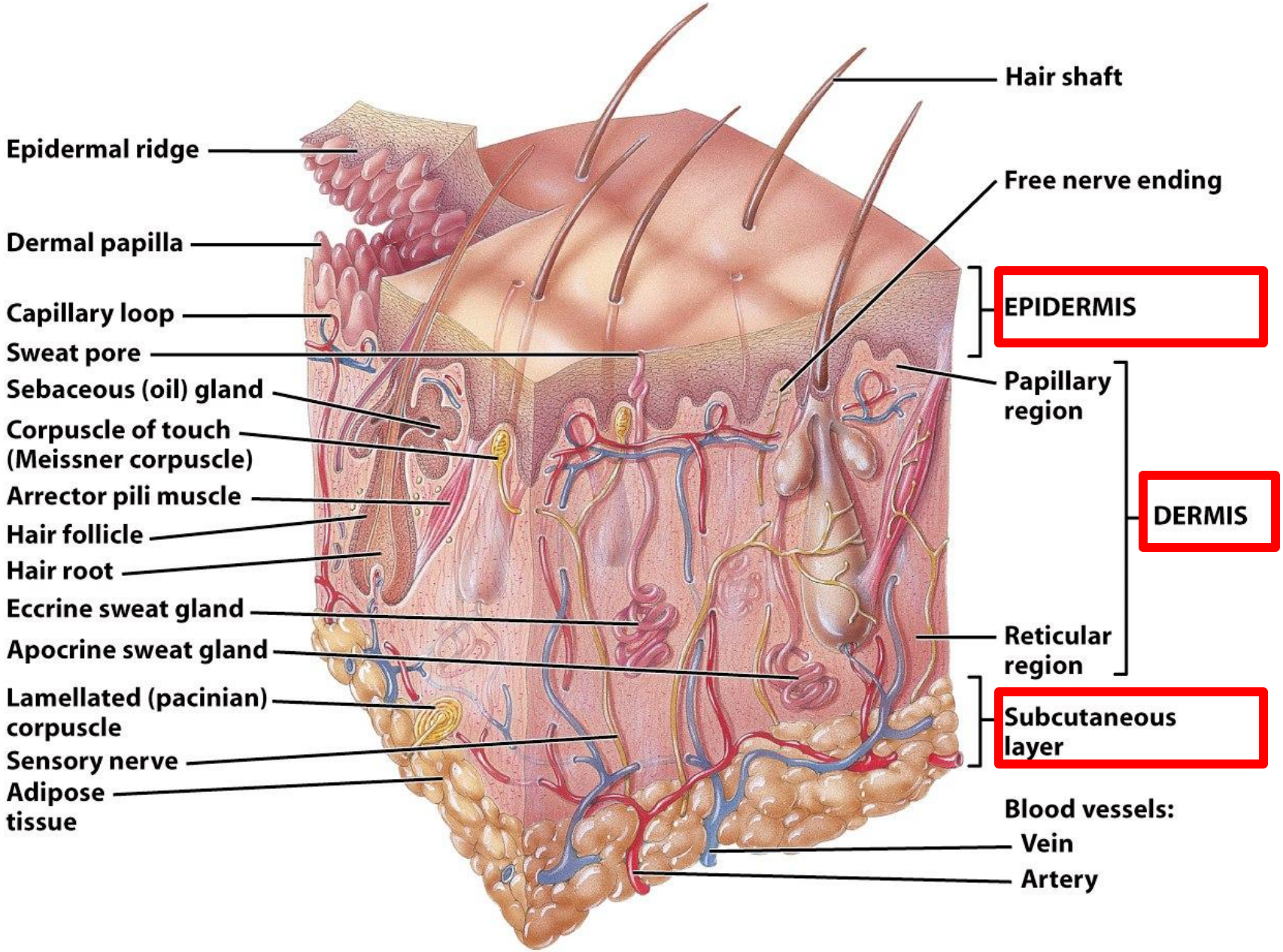
§ Overview (1)

- Dermatology– scientific study and medical treatment of this system
- Largest organ (skin) – covers about 2.0 meter square; 15% of the body weight
- Epidermis
  - stratified squamous epithelium
- Dermis
  - connective tissue layer
- Hypodermis (NOT part of the skin)– often what tissue predominates here?

§ Overview (2)

- Thickness variable, based on thickness of Epidermis, two categories--
- **Thick skin– .5 mm thick (epidermis)**
  - Locations?
  - stratum corneum layer increased
    - Sweat glands-- present
    - No hair follicles or sebaceous glands
- **Thin skin (.1 mm)–** The rest of the body
  - Has hair follicles, oil glands, and sweat glands

@Fig. 6.1



Sectional view of skin and subcutaneous layer

Figure 5-1a Principles of Anatomy and Physiology, 11/e
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§ Functions of the Skin

- **Resistance to trauma/infection**
  - Why? (Fig. 5.28)
  - acid mantle (pH 4-6)– acidic film (protection)
- **Barrier:** to water, UV light, some chemicals; transdermal patches . . can pass
- **Vitamin D synthesis** (first step)
- **Sensory receptors**– what? where?
- **Thermoreceptors**– in dermis: nerve endings to the brain, back to blood vessels (Fig. x)
- **Nonverbal communication**— move the skin etc. (Fig. 6.2)

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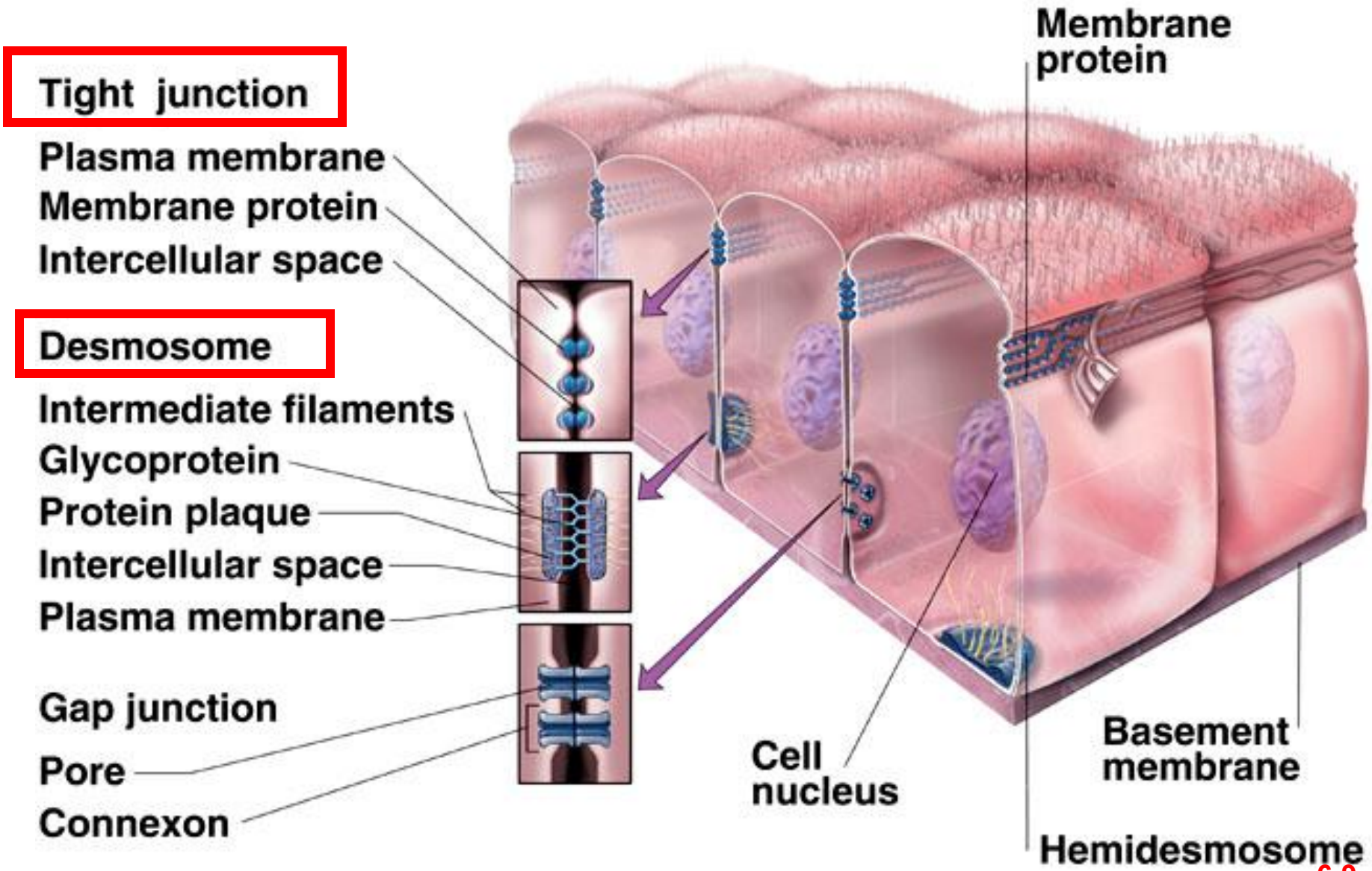

Thermoregulation

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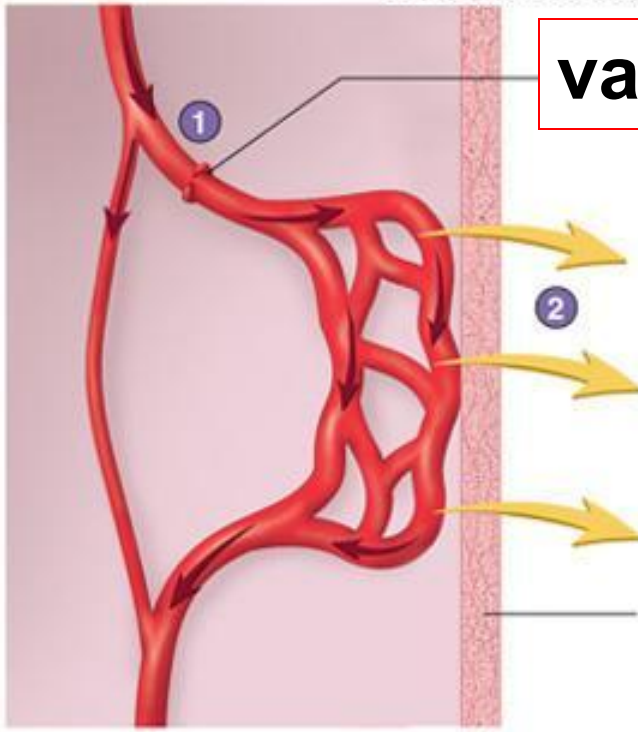
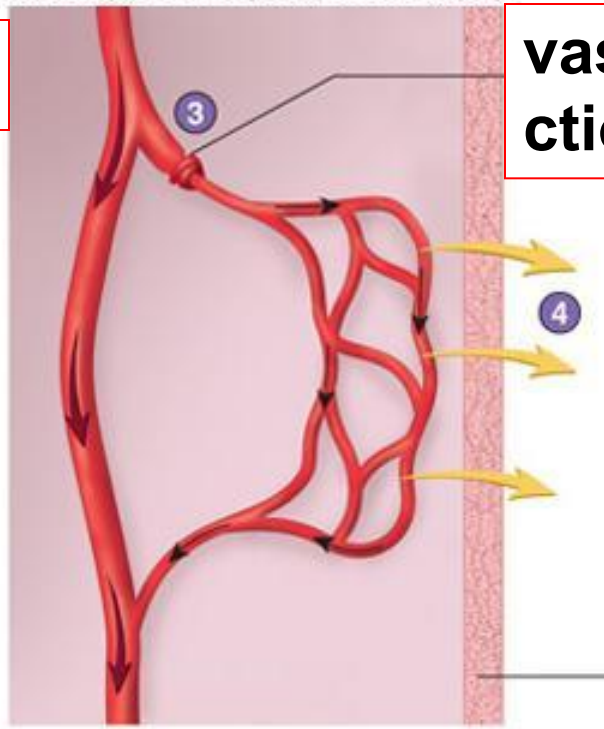


vasodilation

Heat loss



vasoconstriction

Less Heat loss

In hot environment

In cold environment

Social functions-- Figure 6.2

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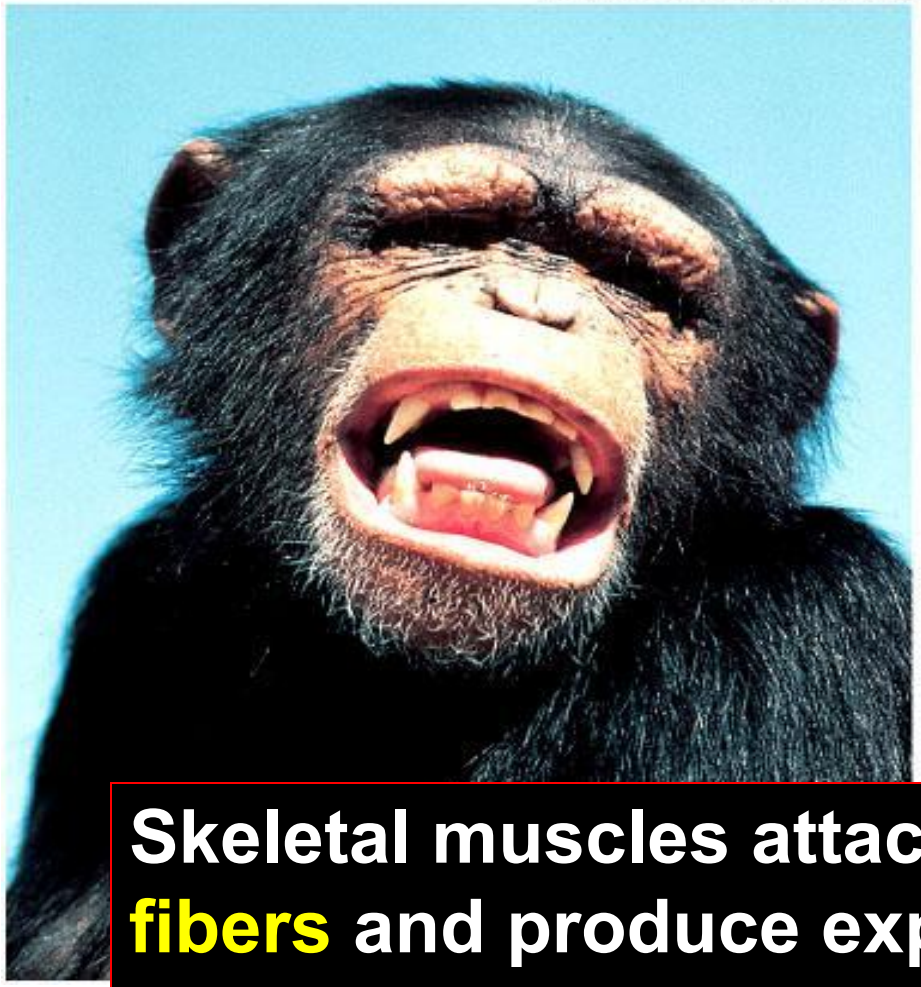
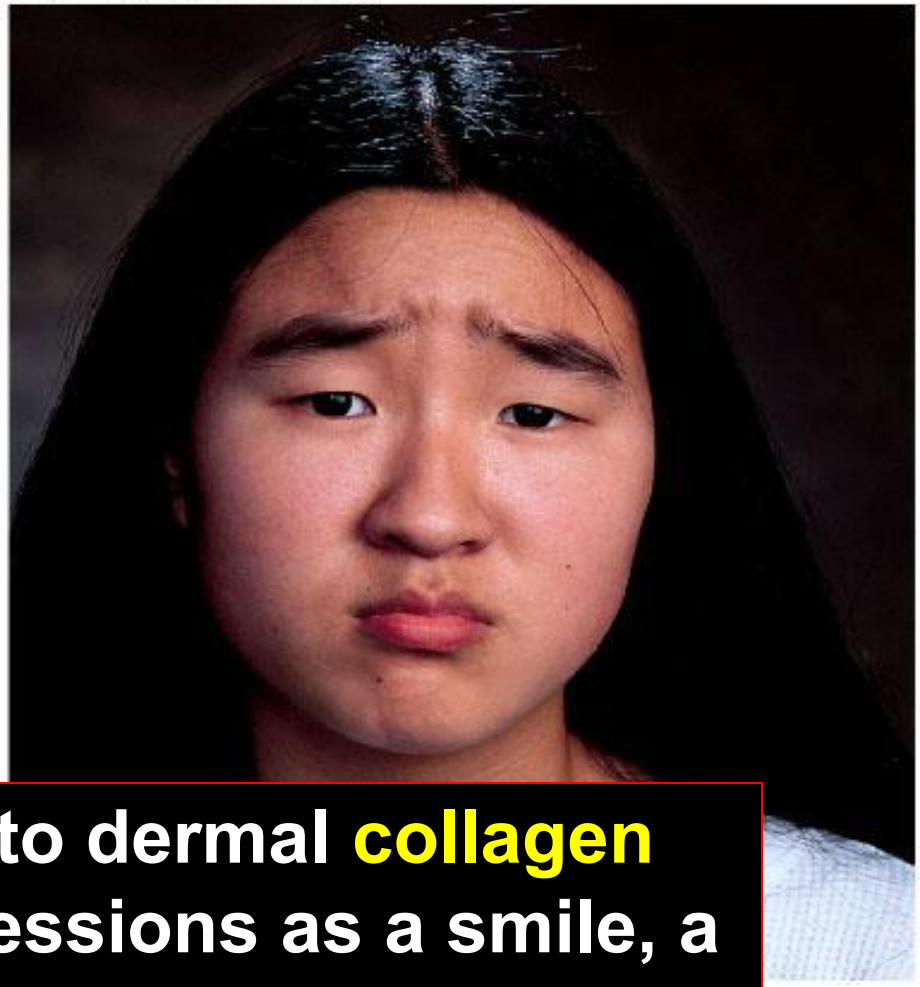




Skeletal muscles attach to dermal collagen fibers and produce expressions as a smile, a wrinkle of forehead, and lifting of an eyebrow

II. Epidermis

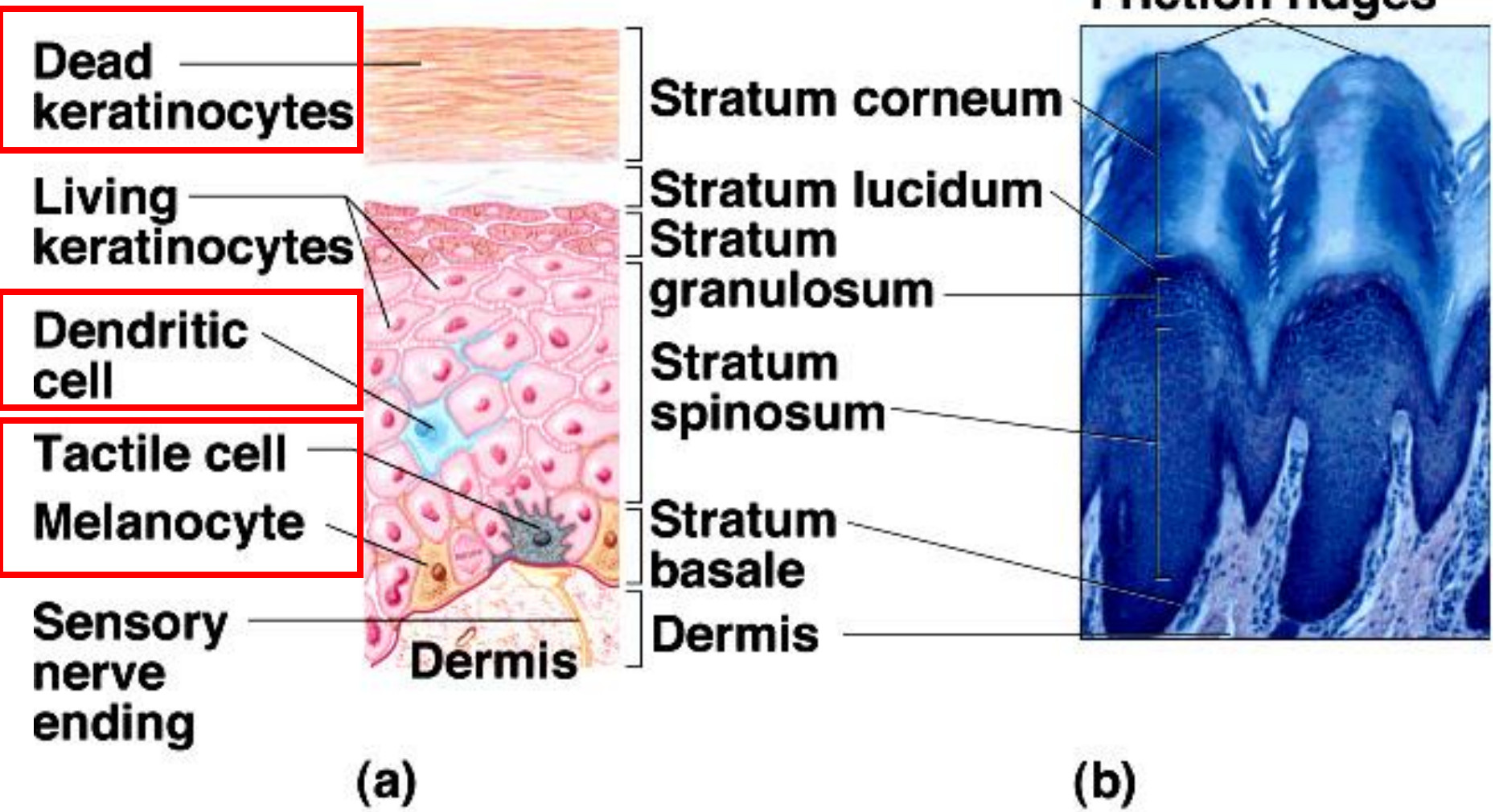
§ Cells of the Epidermis (1)

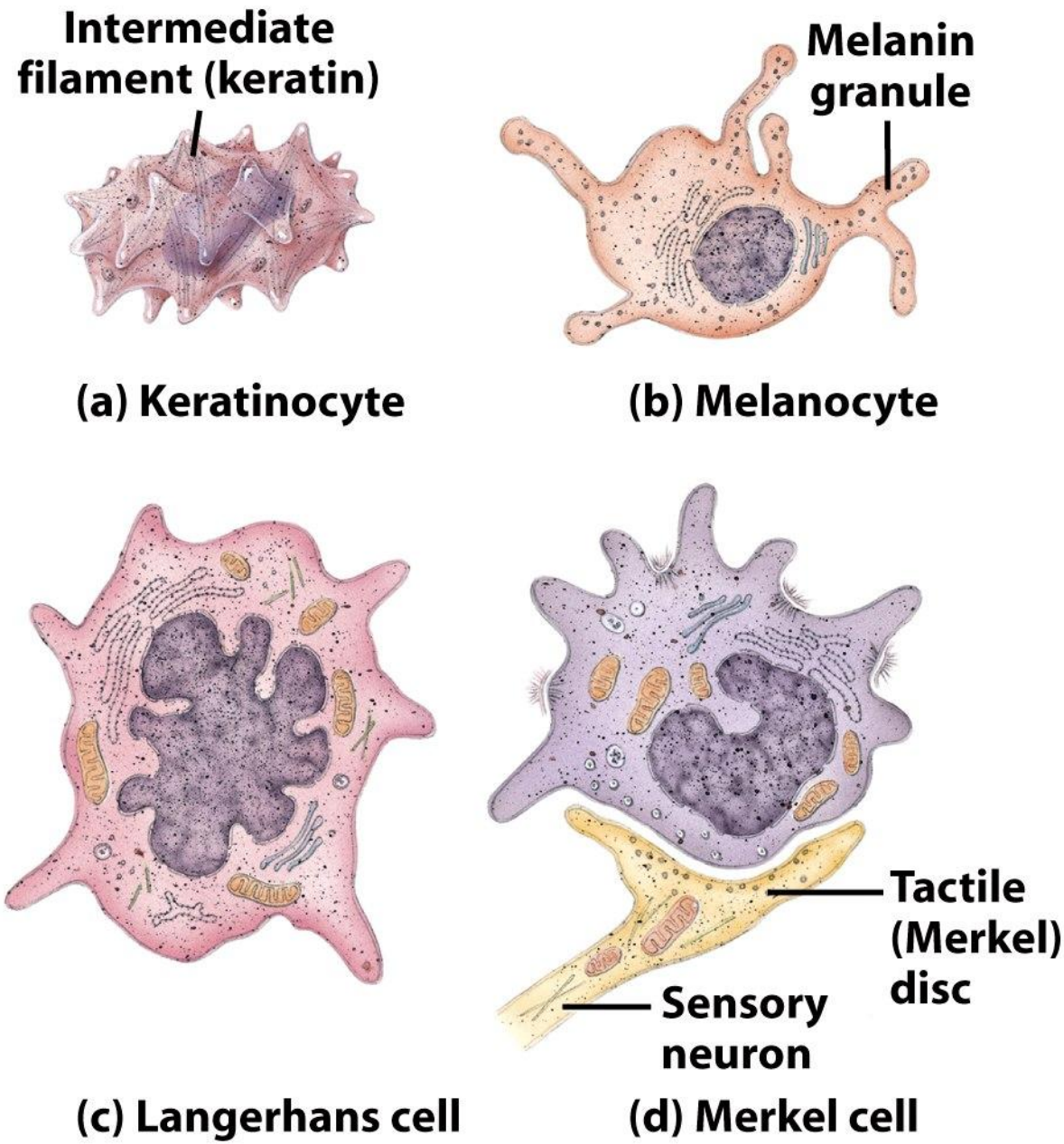
Five types of cells--

1. **Keratinocytes – most of the skin cells; Named b/c keratin synthesis**
2. **Dendritic (Langerhans) cells**
   - **MACROPHAGES guard against pathogens**
   - **Locations– the epidermis and epithelia of oral cavity, esophagus, and vagina**

Fig. 6.3 and X

The Epidermis— Fig. 6.2





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§ Cells of the Epidermis (2)

- Location of the following types of cells—stratum _____

3. Stem cells
   - undifferentiated cells for keratinocytes
4. Melanocytes
   - synthesize _____that shield UV rays
   - “sunny side” phenomenon (Fig. x)

5. Tactile (Merkel) cells (for touch)
   - receptor cells associated with nerve fibers
   - They are Meissner corpuscles

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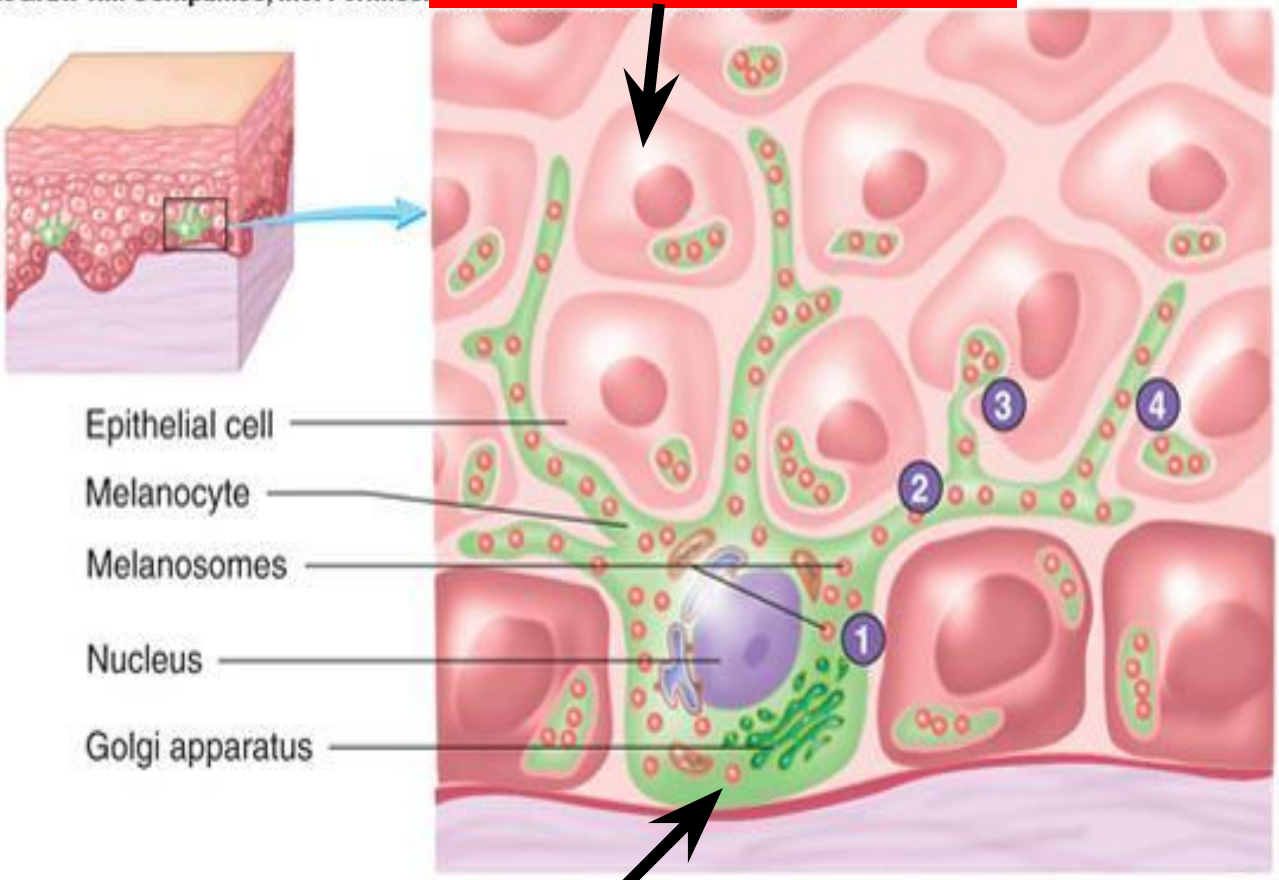
1. Melanosomes are produced by the Golgi apparatus of the melanocyte.
2. Melanosomes move into melanocyte cell processes.
3. Epithelial cells phagocytize the tips of the melanocyte cell processes.
4. The melanosomes, which were produced inside the melanocytes, have been transferred to epithelial cells and are now inside them.



§ Layers of the Epidermis—
Next five slides (1-5)
from deep to superficial and from youngest to oldest keratinocytes

1. Stratum Basale (deepest layer)

- Single layer cells on basement membrane (Fig. 6.3)
- Cell types in this layer (A review)
  - Stem cells and keratinocytes
    - undergo mitosis to replace epidermis
  - Melanocytes
    - distribute melanin through cell processes
    - melanin picked up by kerotinocytes
  - Merkel cells are touch receptors
    - form Merkel disc

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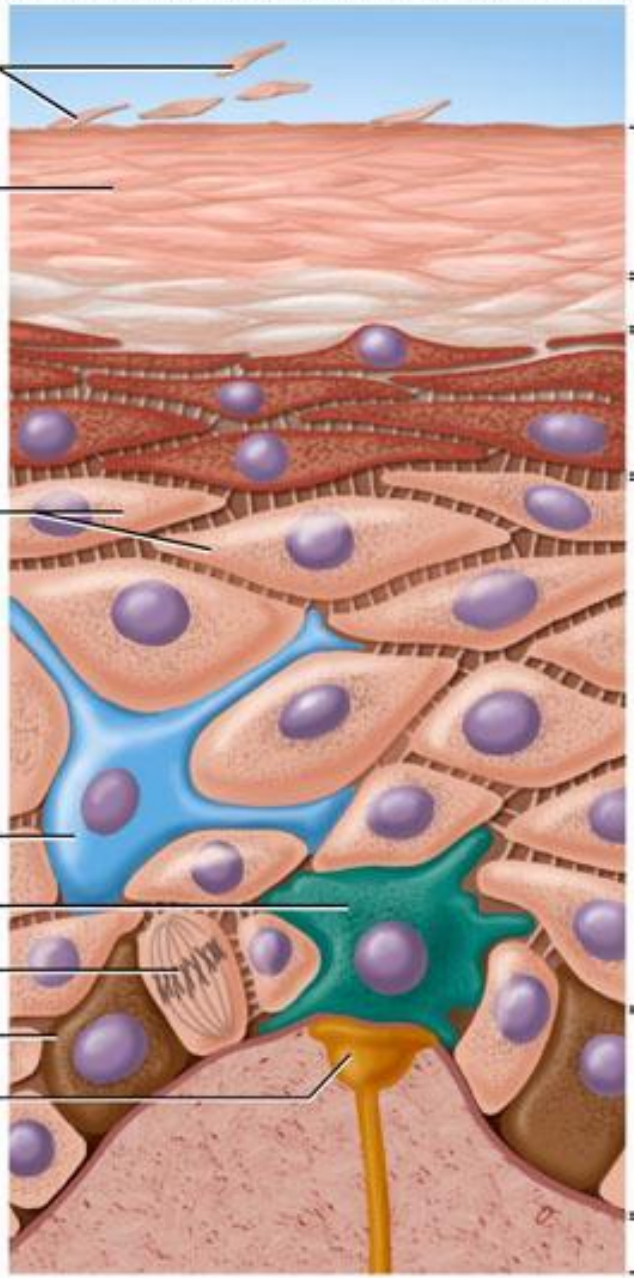


(a)

2. Stratum Spinosum– above stratum basale

- **Several layers of keratinocytes** (flattened as they cease dividing toward apical side; Why)
  - appear spiny due to shrinkage of keratinocytes (histological preparation)
  - What are these spiny structures?
  - **Thickest stratum in most skin except in _____**
- **Contains dendritic (Langerhans) cells**
  - macrophages from bone marrow that migrate to the epidermis
  - help protect body against pathogens by “presenting” them to the immune system

3. Stratum Granulosum

- 3 to 5 layers flat keratinocytes: three developments occur to them--

A. Contain keratohyalin granules (dark-stained)
   - Granules release a substance bonding with cytoskeleton and convert them to keratin

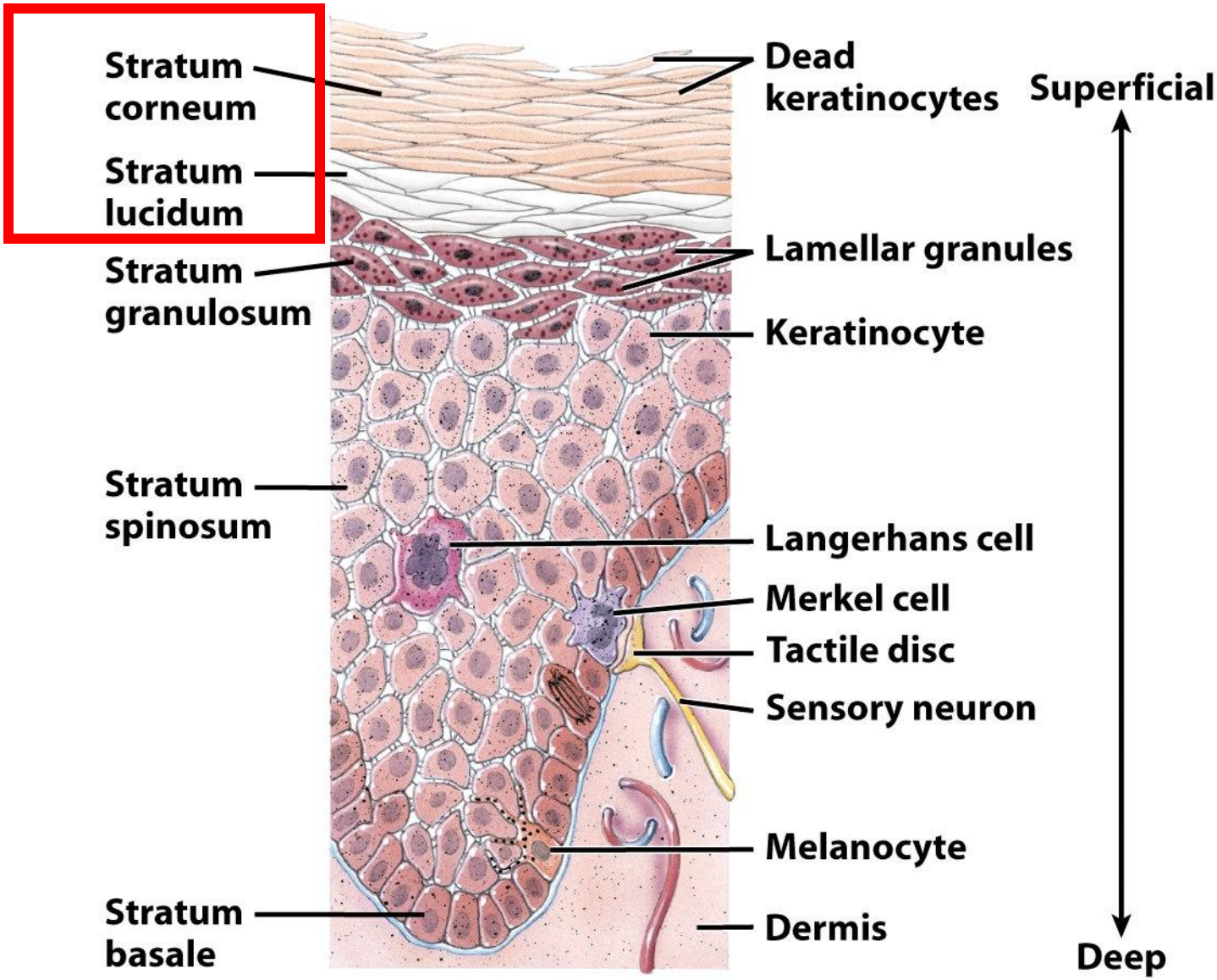
B. Granules release a glycolipid by exocytosis to waterproof the skin
   - called epidermal water barrier
   - Other structures contribute to this— TJs, proteins

C. Programmed cell death (apoptosis)—dander & dandruff

4. Stratum Lucidum— superficial to the stratum granulosum

- Thin translucent zone <u>seen only in thick skin</u>
- Keratinocytes are densely packed with eleidin, a precursor to keratin
  - Eleidin does not stain well (pale appearance)
    - In addition, cells (keratinocytes) here have no nucleus or organelles
  - Appearance– Pale and featureless

Fig. x



Four principal cell types in epidermis

Figure 5-3a Principles of Anatomy and Physiology, 11/e
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5. Stratum Corneum

- Up to 30 layers of dead, scaly, keratinized cells
  - surface cells flake off (exfoliate)
  - Especially in thick skin--palms, soles and corresponding fingers/toes

§ Life History of Keratinocytes

- Produced by stem cells in stratum basale
- New cells push others toward surface
  - cells grow flat and fill with vesicles (lipids)
- Cells filled with keratin
  - forms epidermal water barrier
- Cells die and exfoliate (relating to dust mites, “house dust allergy”--Fig. 6.4)

Fig. 6.4 The House Dust Mite, *Dermatophagoides*

- They are about 0.5 mm in length
- Feed on _____, edible flakes of keratin
- Esp. in pillows, mattresses, and upholstery
- We actually allergy to the **feces** of these mites

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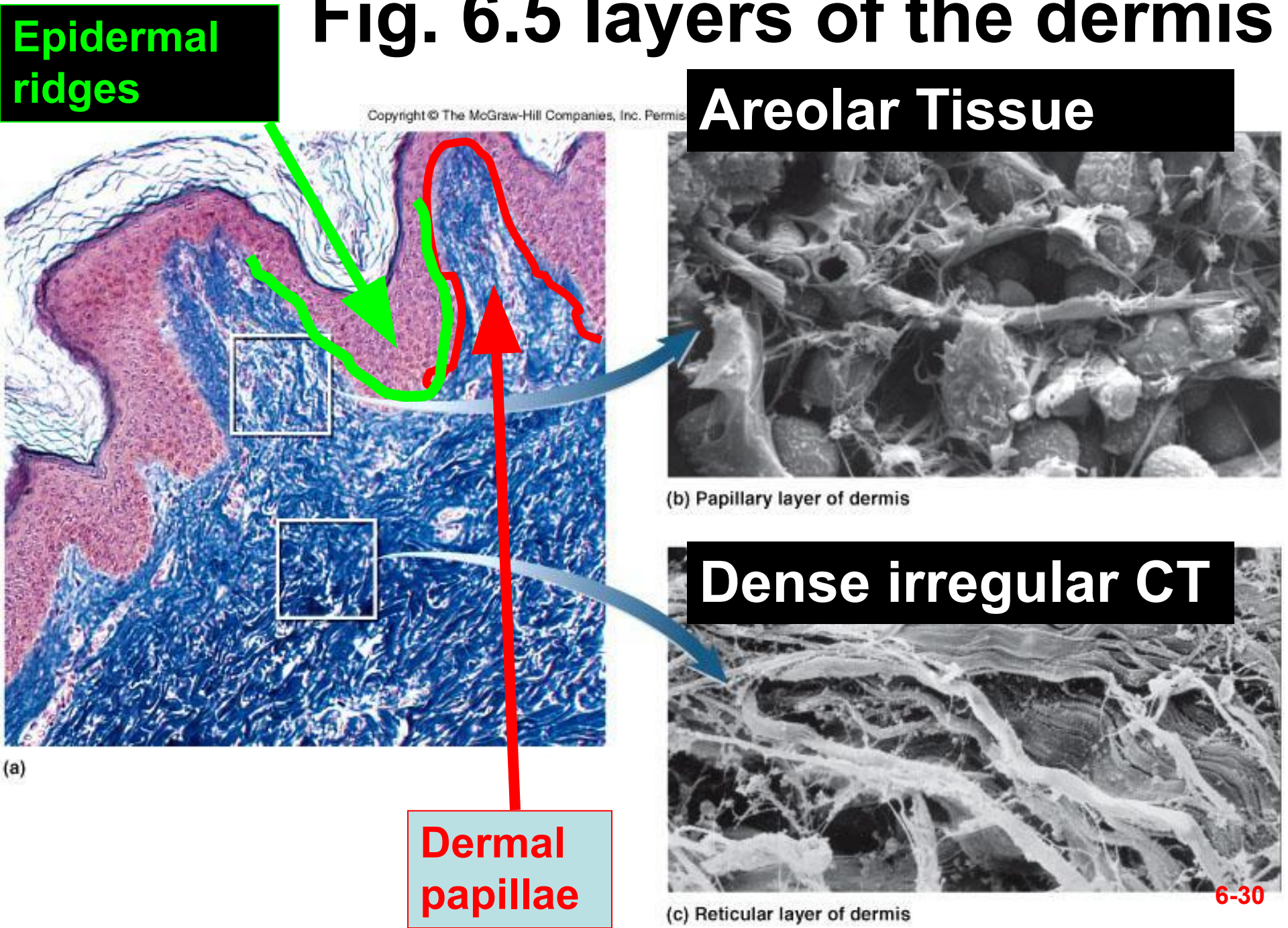
Questions (muddiest points)?

Next section–
III. Dermis & Hypodermis

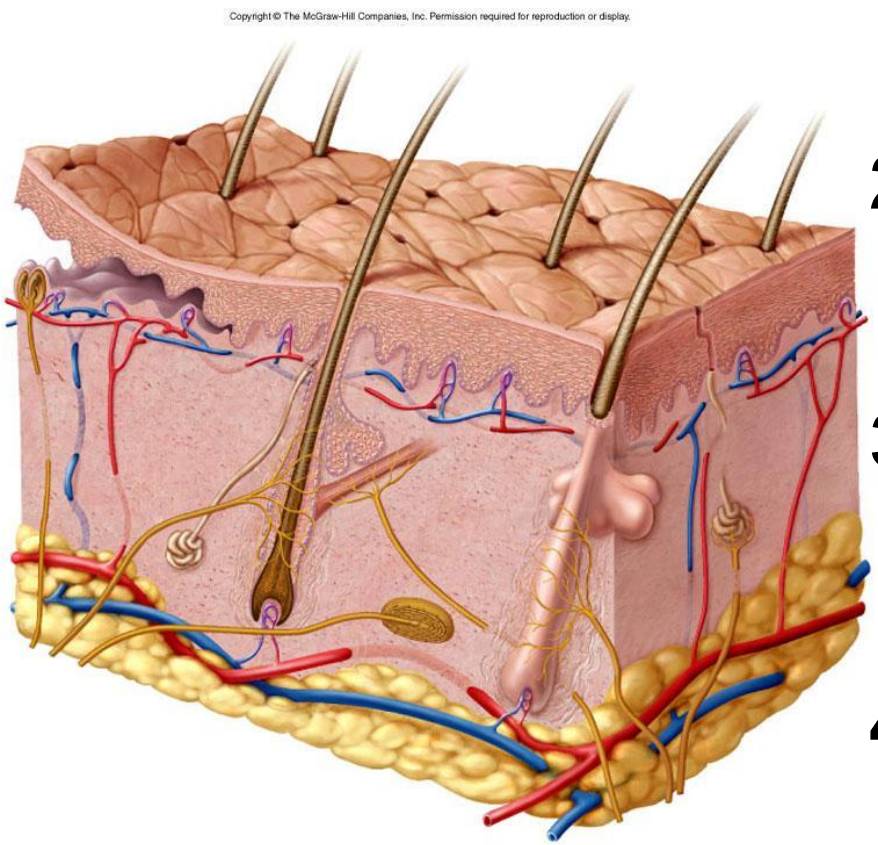
§ Dermis- a C.T. layer

- Thickness = 0.2 to 4.0 mm
- Composition
  - Collagen (mainly), elastic and reticular fibers,
  - Cells– fibroblast etc. --Blood supply (yes/no)
  - Sweat glands, sebaceous glands, nerve endings
- Dermal papillae – fingerlike extensions of the dermis into the epidermis
- Layers (fig. 6.5) in dermis:
  - papillary layer, thin and rich in capillaries, areolar tissue
  - reticular layer, deeper part, Dense irregular C.T.; striae— stretch marks (tearing of collagens)

Fig. 6.5 layers of the dermis



§ Hypodermis



1. Other names--Subcutaneous tissue; superficial fascia
2. Mostly adipose tissue; Uniformly distributed?; 8% thicker in women
3. Functions
   - energy reservoir
   - thermal insulation
4. Hypodermic injections (to subcutaneous tissue)
   - highly vascular; absorb drugs easily

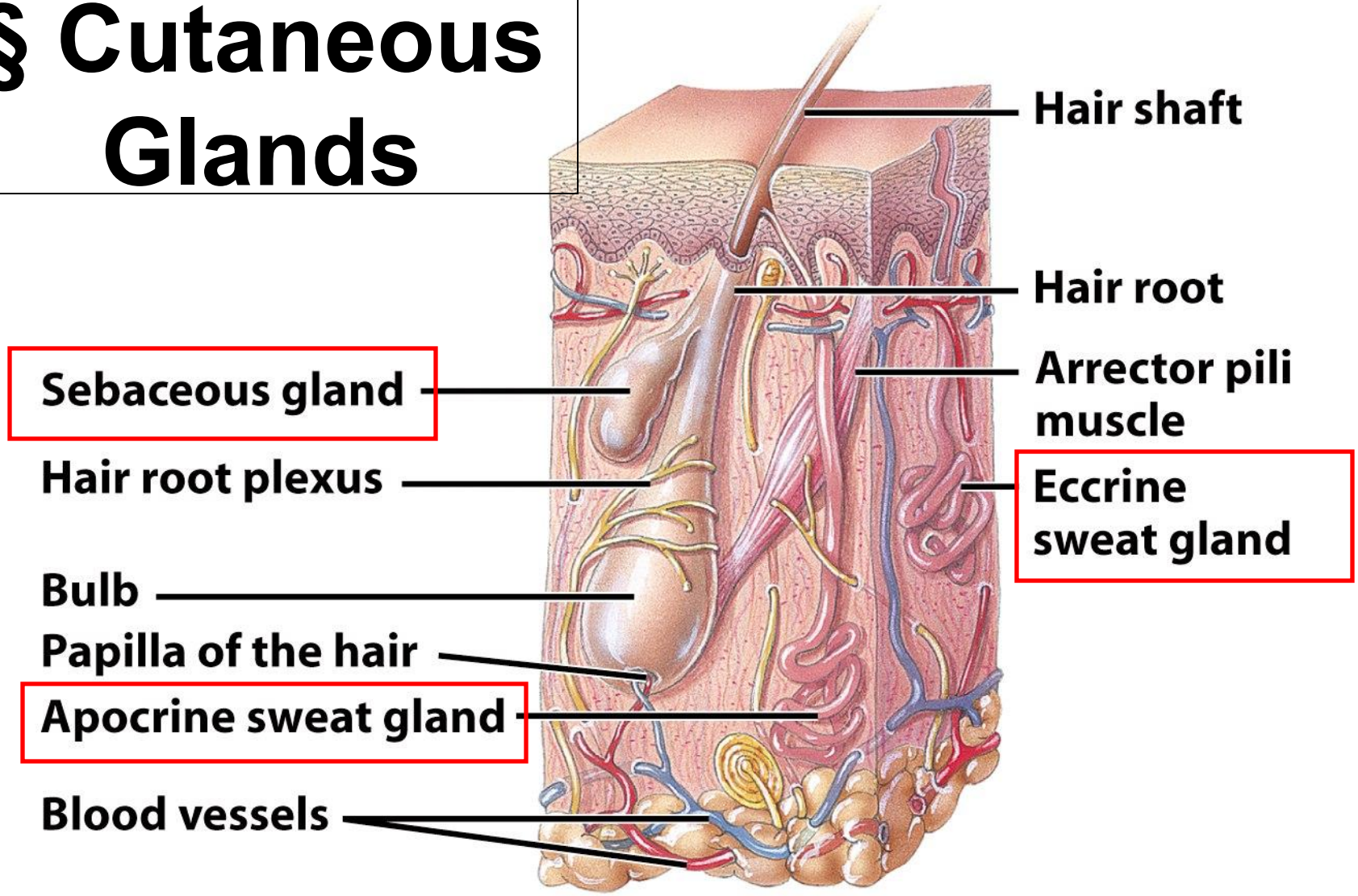
Questions?

Next section—
IV. Cutaneous Glands

Table 6.2— summary of cutaneous glands

1. Sweat glands
2. Oil glands
3. Ceruminous glands
4. Mammary glands

§ Cutaneous Glands



Hair and surrounding structures

Figure 5-4a Principles of Anatomy and Physiology, 11/e
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1. Two kinds of Sweat Glands

- Filtrate of plasma and some waste products
  - insensible perspiration; @ 500 ml a day
  - sweating with visible wetness is diaphoresis

A. Merocrine (eccrine) glands is simple tubular gland; what in the sweat?

B. Apocrine glands (larger lumen) produce sweat containing fatty acids; are scent glands—produce pheromones
  - Locations-- near hair follicles and respond to stress and sexual stimulation
  - brom*hidrosis* is disagreeable body odor produced by bacterial action on fatty acids; poor hygiene

Fig. 6.11

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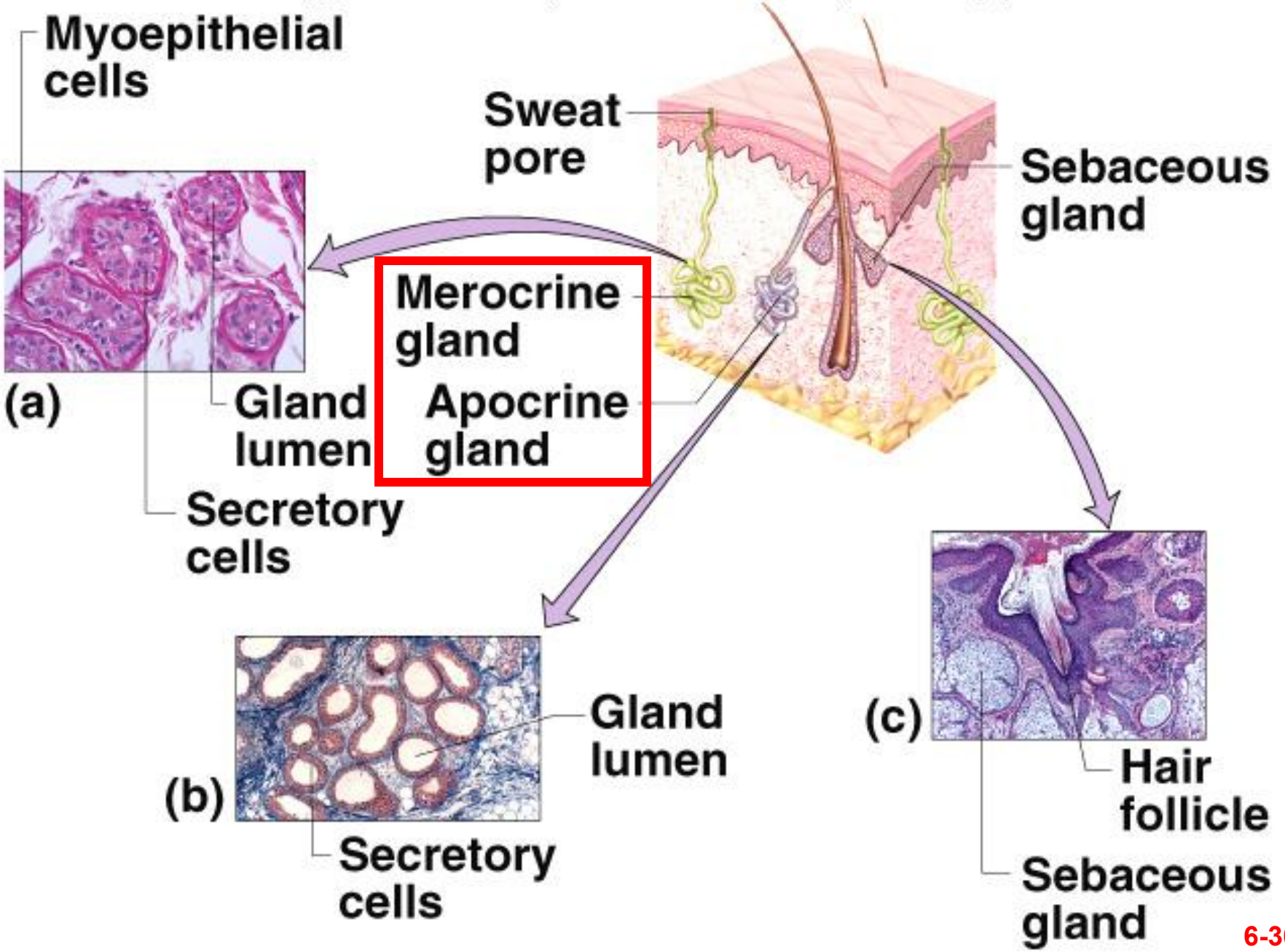
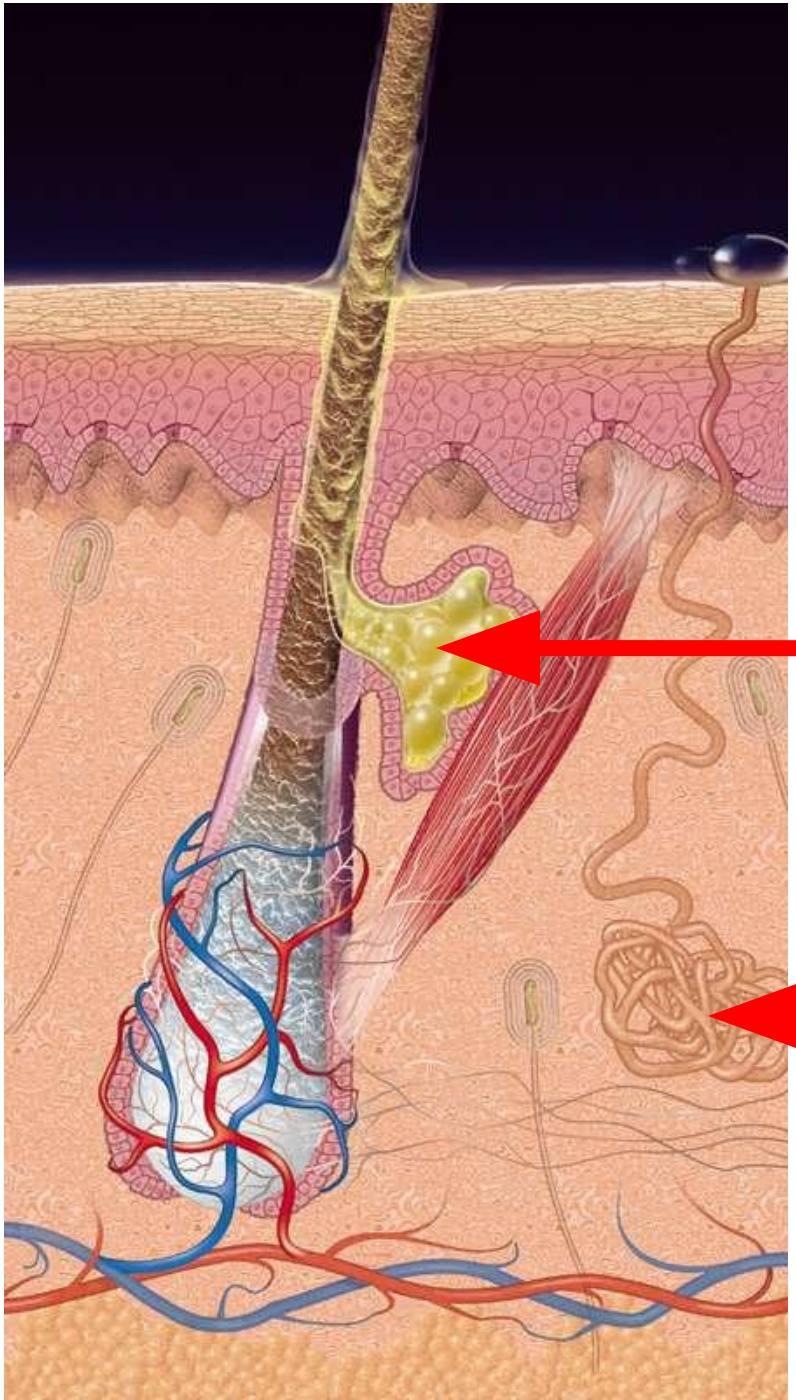


2. Sebaceous (Oil) Glands

- Oily secretion called sebum that contains broken-down cells
  - Due to mitosis replacement at the base of the gland
  - Sebum keeps the skin/hair from becoming dry
  - lanolin in skin creams is sheep sebum
- Flask-shaped glands with duct that opens into hair follicle

Fig. 6.11c



ID specific cutaneous glands (A & B).

A.

B.

Which specific kind?

3. Ceruminous Glands

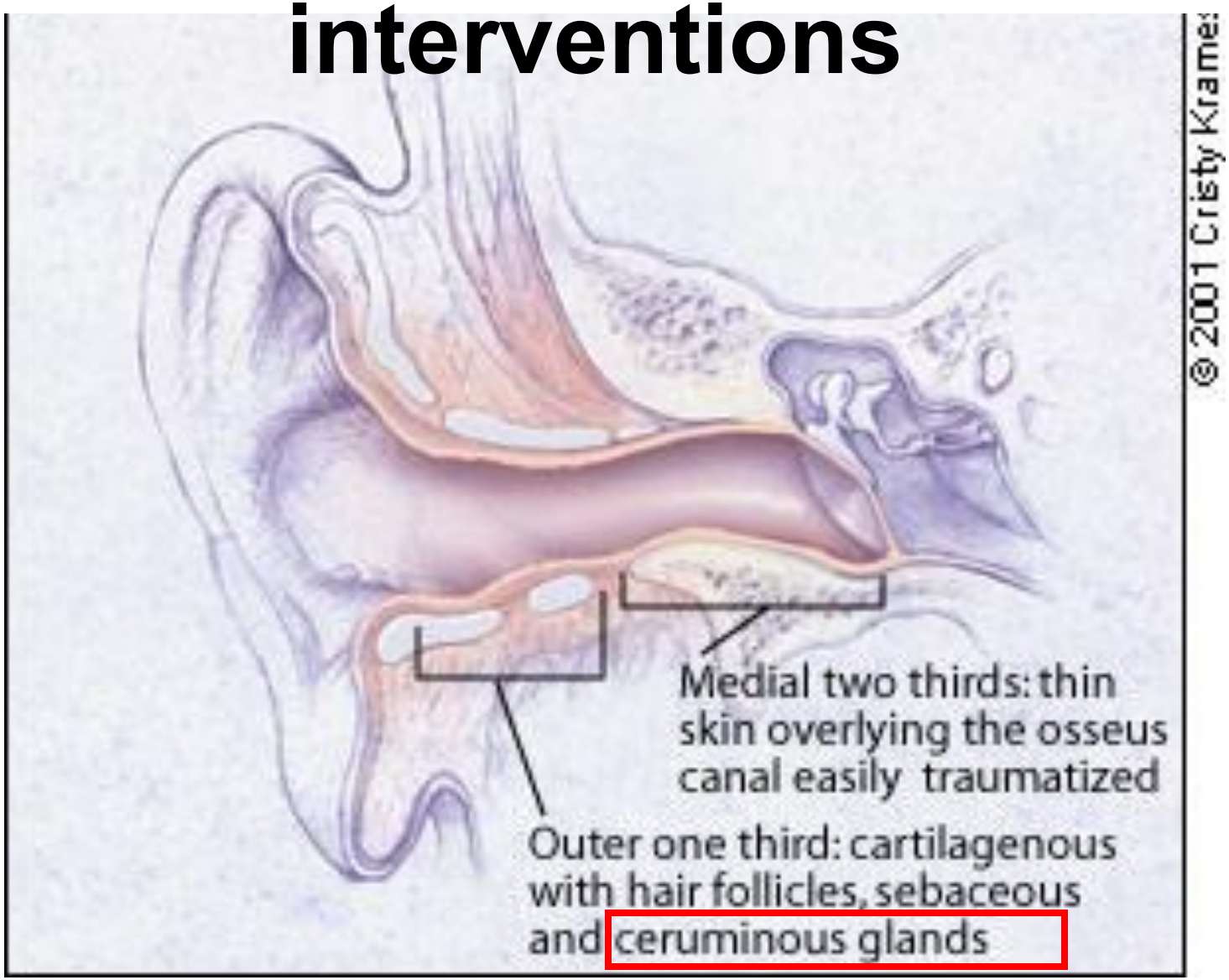
A. Found only in external ear canal

B. Their secretion combines with sebum to produce earwax (called cerumen)

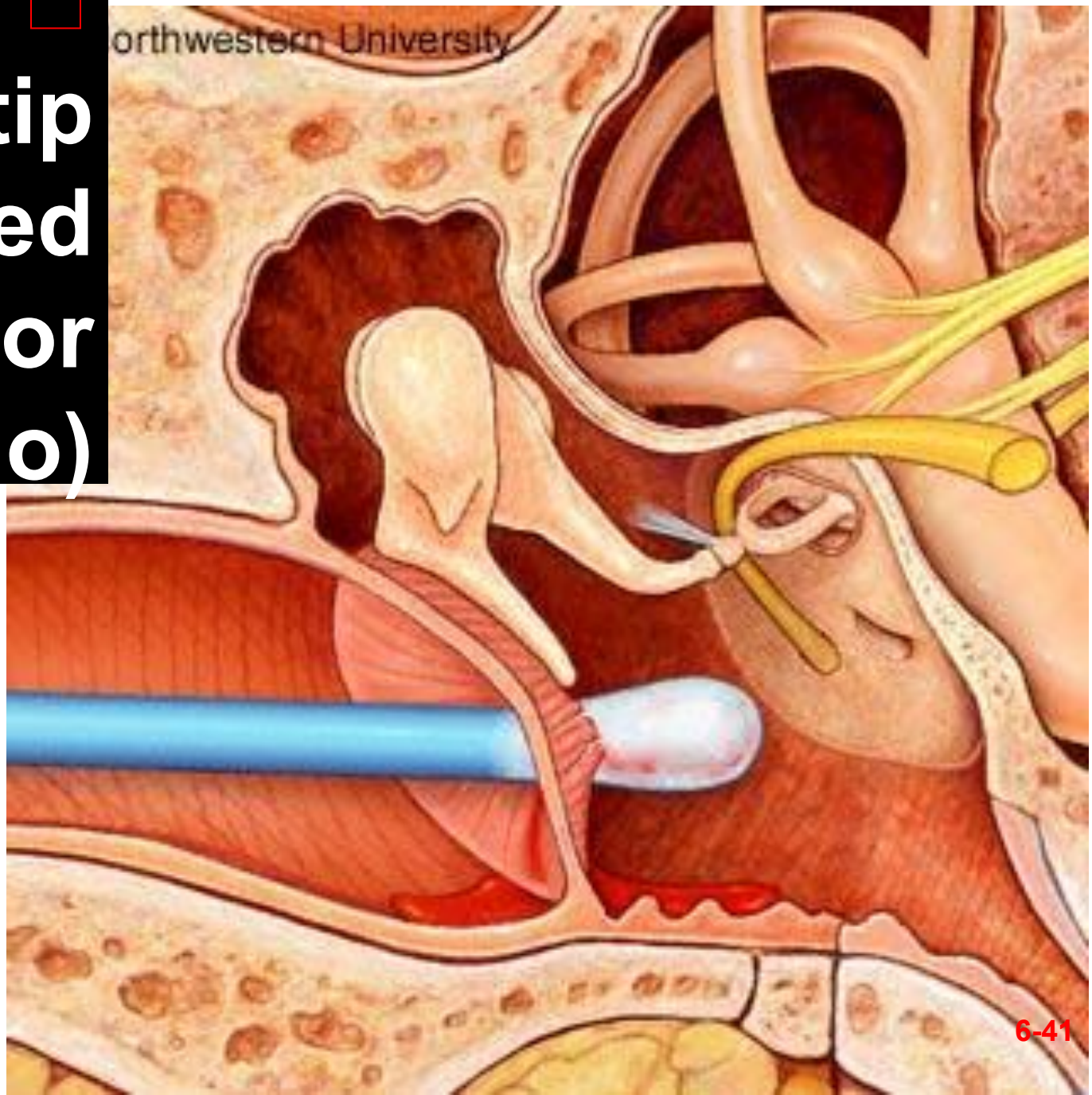
- Waterproofs the auditory canal
- Keeps eardrum flexible
- Bitterness repel mites and other pests
- Has a bactericidal effect

Fig. X

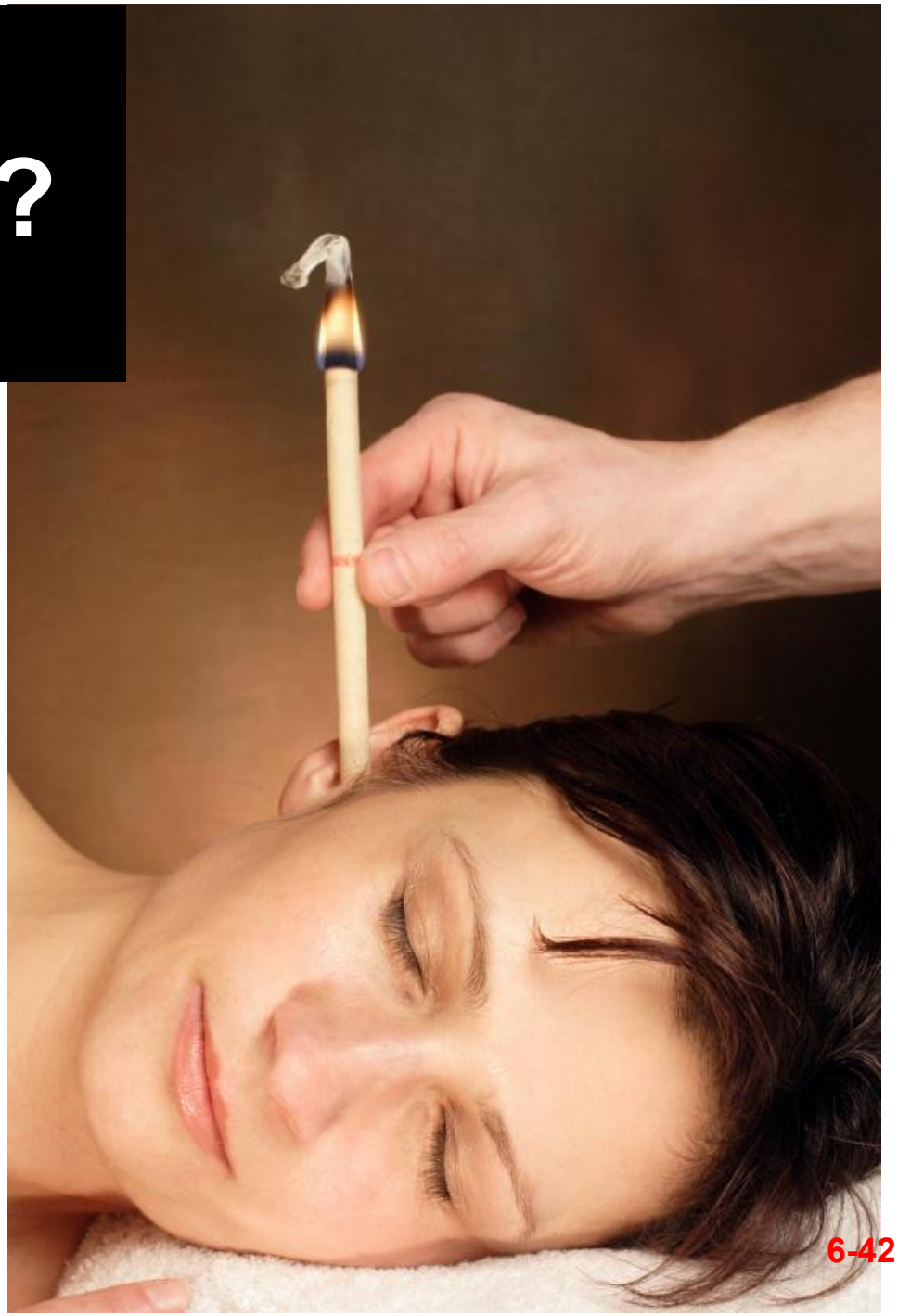
Ceruminous glands—inappropriate interventions



Cotton-tipped applicator (a no-no)



X Ear Candling!?



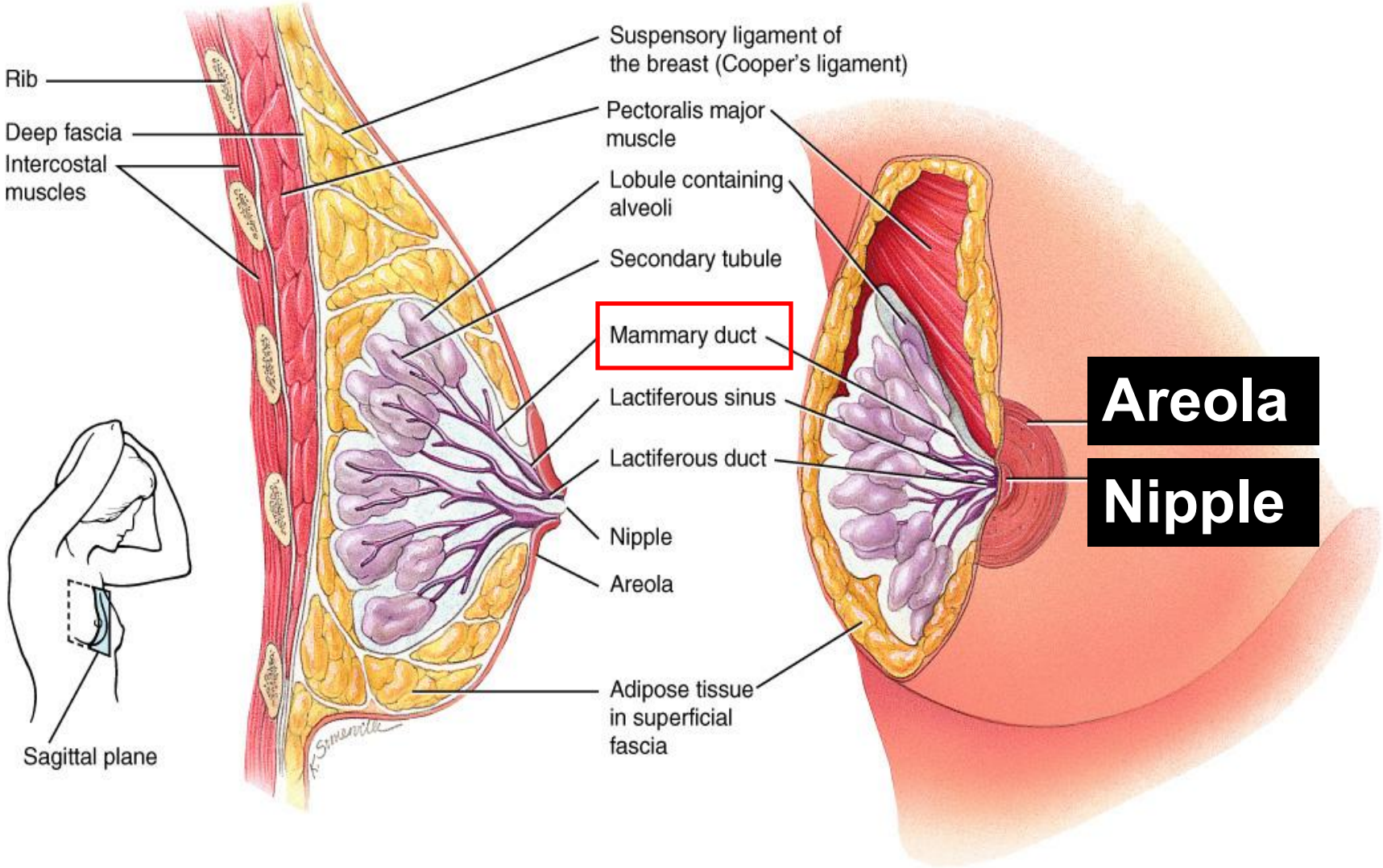
4. Mammary Glands

1. Breasts of both sexes rarely contain mammary glands
   - secondary sexual characteristic of females
2. Mammary glands (within female breast)
   - produce milk--during lactation and pregnancy

- Mammary ridges or milk lines
  - Mammals-- 2 rows of mammary glands
  - Primates-- kept only anteriormost glands
- Additional nipples (polythelia)
  - may develop along milk line

Fig. x

Mammary Glands



(a) Sagittal section

(b) Anterior view, partially sectioned

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Check Point Questions

1. (True/False) The three layers of the skin are the epidermis, dermis, and hypodermis.

2. How do merocrine and apocrine sweat glands differ in **structure and function**?

Questions (muddiest points)?

Next section—
V. Skin Disorders

§ Skin Cancer

1. **Cause–** the ultraviolet rays of the sun
   - There is no such thing as a healthy suntan
   - Controversial on suncreens (Read Insight 6.4)

2. **Types**– named for the epidermal cells they originate and the appearance of their **lesions** (zones of tissue injury):
   A. Basal cell carcinoma
   B. Squamous cell carcinoma
   C. Malignant melanoma

A. Basal cell carcinoma

1. Most common type and the least dangerous one
2. Origination- by cells of the stratum basale

Fig. 6.12a

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A. Basal cell carcinoma

(a)

B. Squamous cell carcinoma

1. Chance of recovery is good with early detection and surgical removal. But it can be lethal when metastasize
2. Origination- from the keratinocytes of the stratum spinosum (the layer right above the basale)

Fig. 6.12b

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B. Squamous cell carcinoma

(b)

C. Malignant melanoma

1. Most deadly skin cancer but accounts for only 5% of all cases
2. Origination- from the melanocytes of preexisting mole.
3. Distinguish a mole from this cancer (ABCD rule):
   - Asymmetry
   - Border irregularity
   - Color (mixture of brown, black, tan etc.)
   - Diameter (greater than 6 mm)

Fig. 6.12c

C. Malignant melanoma; which of the ABCD rules can you identify

(a) Normal nevus (mole)

(b) Malignant melanoma

Figure 5-8 Principles of Anatomy and Physiology, 11/e

Video watching

- **Preventing melanoma (1 min 30 sec), when available and time allows**