



ESSENTIALS OF
HUMAN ANATOMY
& PHYSIOLOGY

ELAINE N. MARIEB

Integumentary System : Skin & Body Coverings / Membranes

4

Body Membranes Function & Categories

Functions

- **1- Cover body surfaces**
- **2- Line body cavities**
- **3- Form protective sheets around organs**

Two Major Categories of Body Membranes are :

- **Epithelial (to cover)**
- **Connective (to connect)**

Classification of Body Membranes

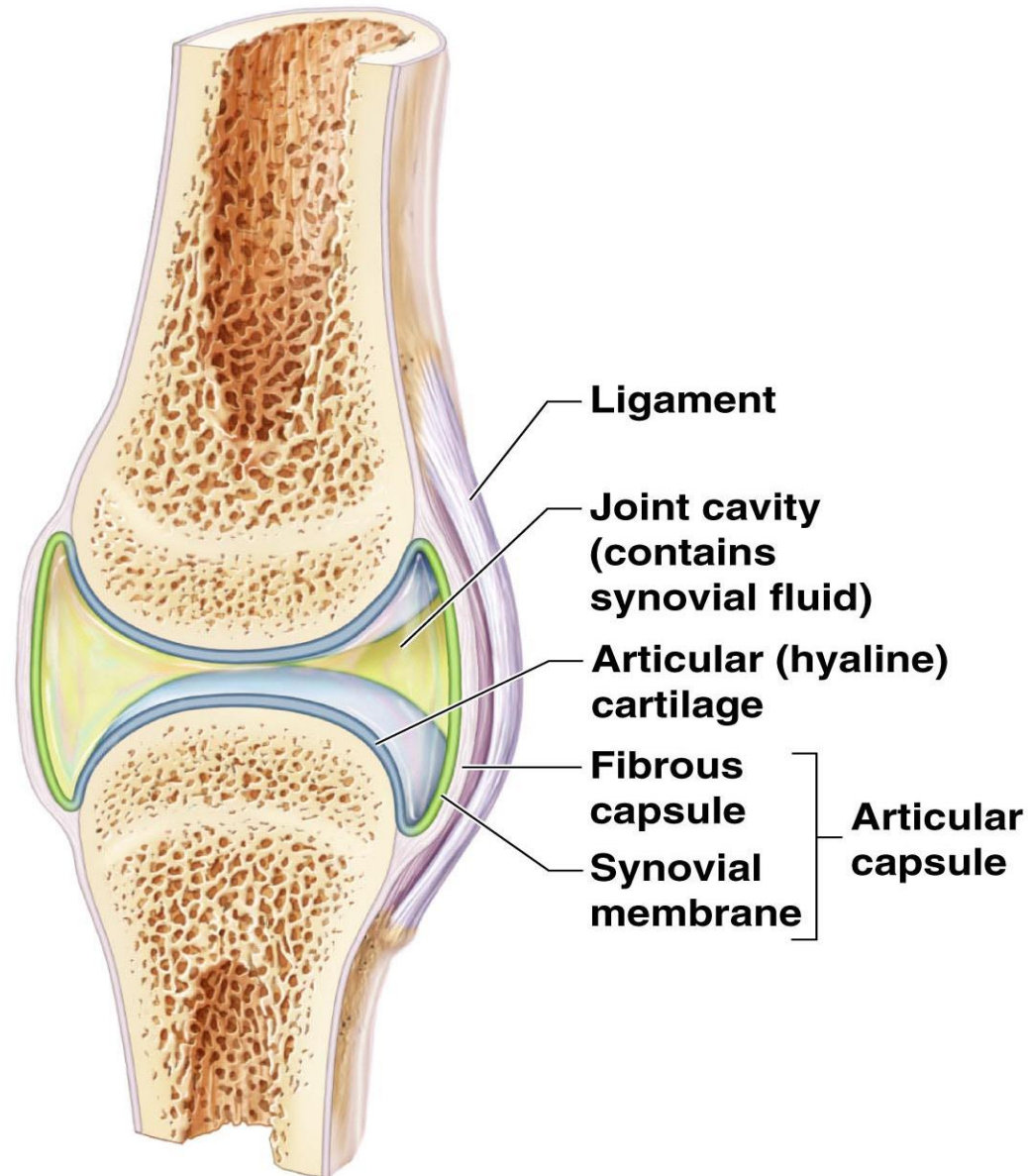
- **Types of Epithelial membranes**
 - **Cutaneous (skin) membranes**
 - **Mucous membranes**
 - **Serous membranes**
- **Connective tissue membranes**
 - **Synovial membranes**

Definition of Epithelial tissues types

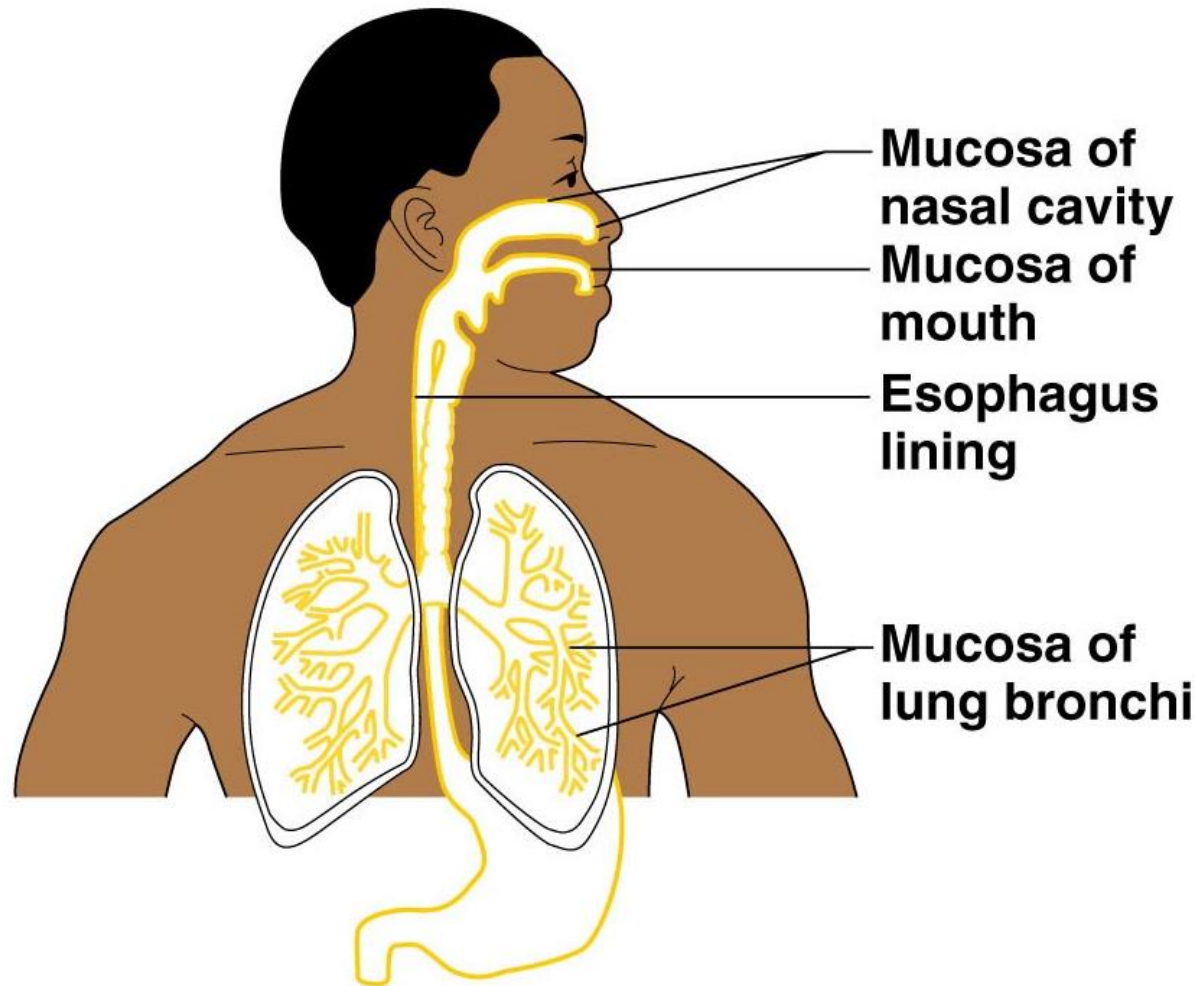
- 1 - **Cutaneous membrane** = skin
 - Dry membrane
 - Outermost protective boundary aided by tough protein called keratin
- 2- **Mucous Membranes**
 - Lines all body cavities that open to the exterior body surface
 - Adapted for absorption or secretion
- 3- **Serous Membranes**
 - covers the outside of the organ or body cavity

Connective Tissue Membrane

- 1- Synovial membrane -
 - **Lines fibrous capsules surrounding joints**
 - **Secretes a lubricating fluid**



Mucous Membranes



(b) Mucous membranes

Figure 4.1b

Serous Membranes

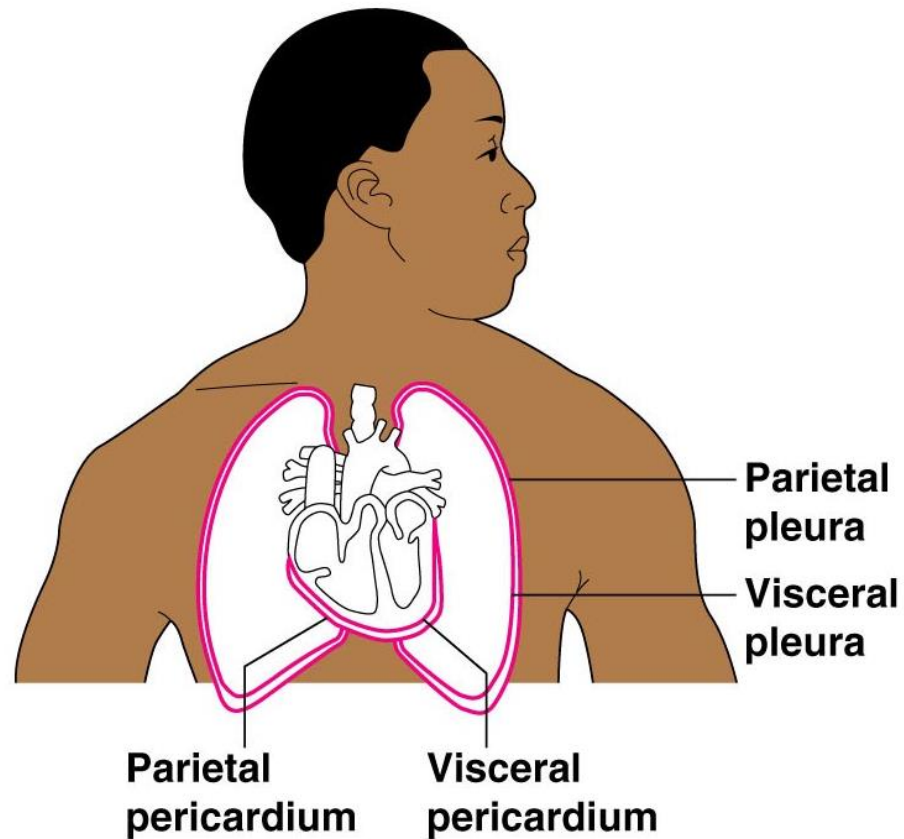


Figure 4.1d

Skin Functions & Properties

TABLE 4.1

Functions of the Integumentary System

Functions

How accomplished

Protects deeper tissues from

- Mechanical damage (bumps)

Physical barrier contains keratin, which toughens cells; fat cells to cushion blows; and pressure receptors, which alert the nervous system to possible damage.

- Chemical damage (acids and bases)

Has relatively impermeable keratinized cells; contains pain receptors, which alert the nervous system to possible damage.

- Bacterial damage

Has an unbroken surface and "acid mantle" (skin secretions are acidic, and thus inhibit bacteria). Phagocytes ingest foreign substances and pathogens, preventing them from penetrating into deeper body tissues.

- Ultraviolet radiation (damaging effects of sunlight)

Melanin produced by melanocytes offers protection from UV damage.

- Thermal (heat or cold) damage

Contains heat/cold/pain receptors.

- Desiccation (drying out)

Contains a waterproofing glycolipid and keratin.

Table 4.1 (1 of 2)

Skin Functions (con't)

TABLE 4.1

Functions of the Integumentary System

Functions

How accomplished

Aids in body heat loss or heat retention (controlled by the nervous system)

Heat loss: By activating sweat glands and by allowing blood to flush into skin capillary beds so that heat can radiate from the skin surface.
Heat retention: By not allowing blood to flush into skin capillary beds.

Aids in excretion of urea and uric acid

Contained in perspiration produced by sweat glands.

Synthesizes vitamin D

Modified cholesterol molecules in skin converted to vitamin D by sunlight.

Table 4.1 (2 of 2)

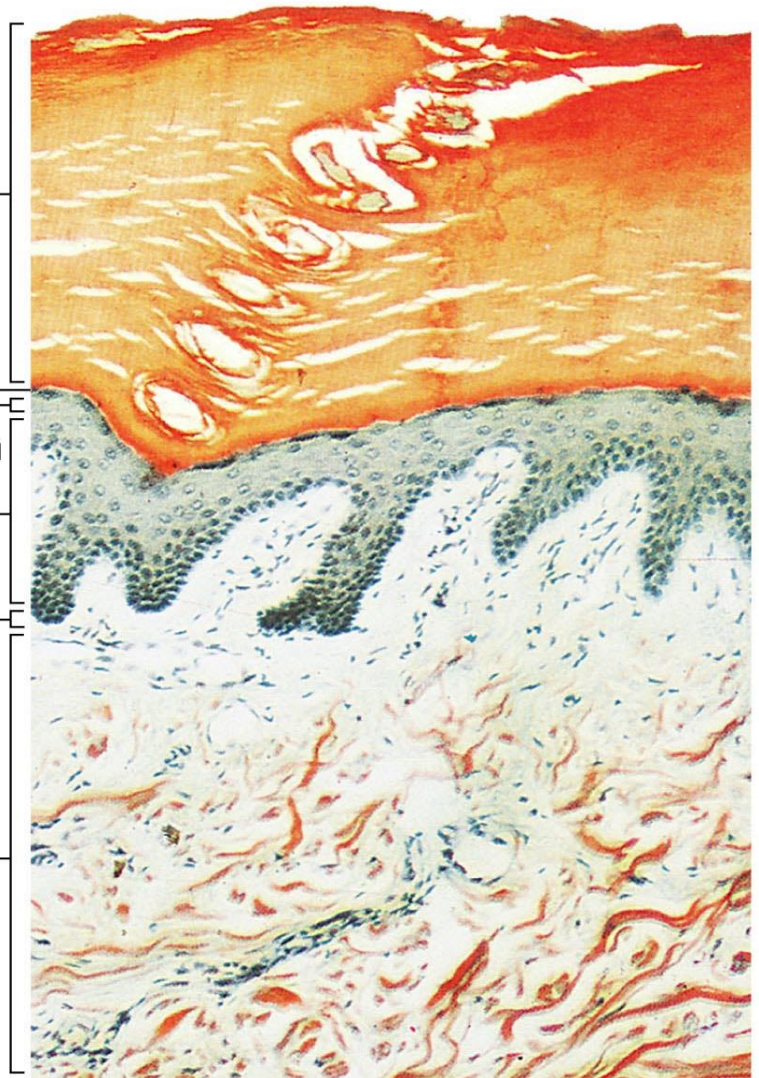
Skin Structure

- **Epidermis- outer layer**
- **Dermis- inner layer**

Epidermis

- Stratum corneum
- Stratum lucidum
- Stratum granulosum
- Stratum spinosum
- Stratum basale

Dermis



Skin Structure

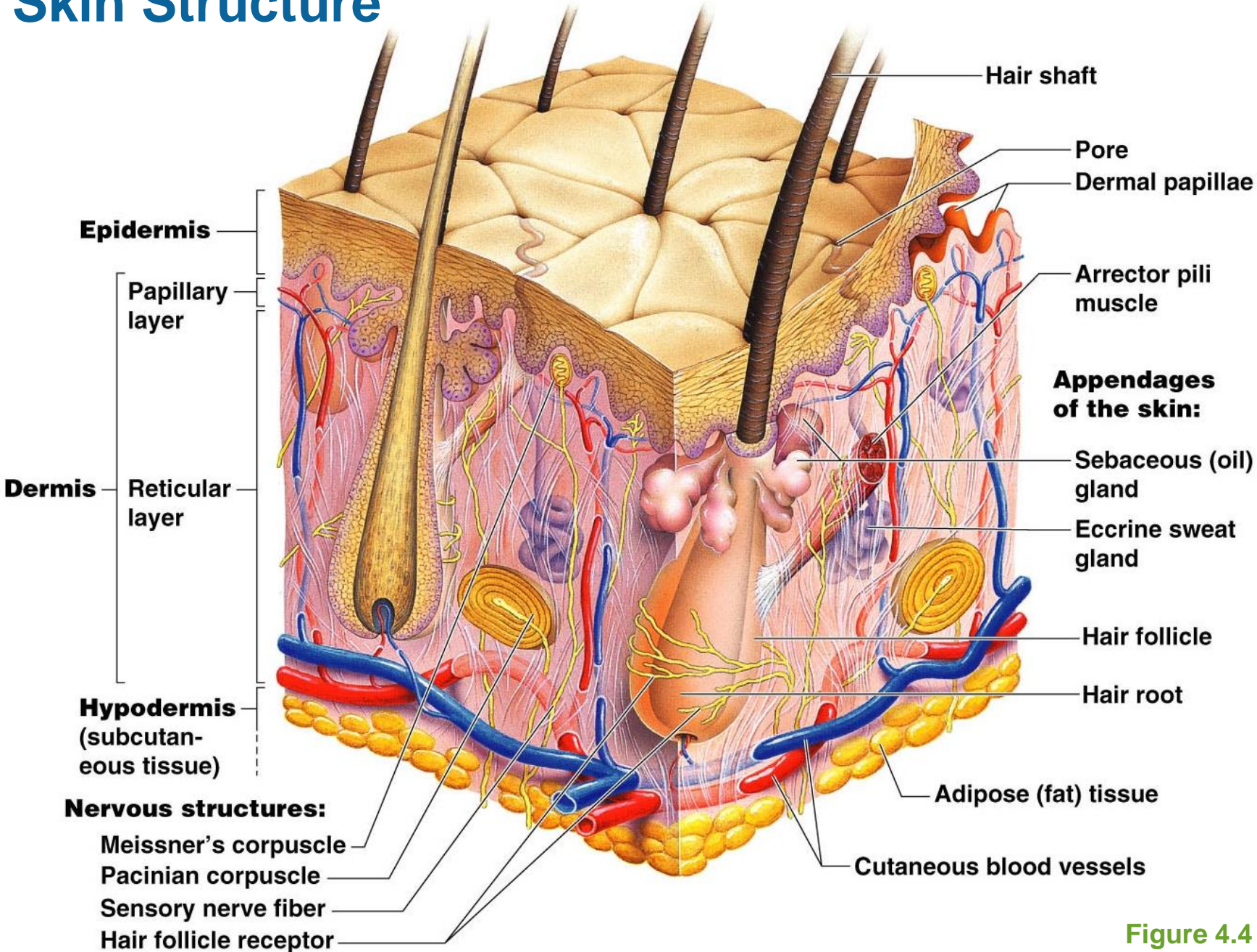


Figure 4.4

Skin Structure

Answer Key:

A = Dermis

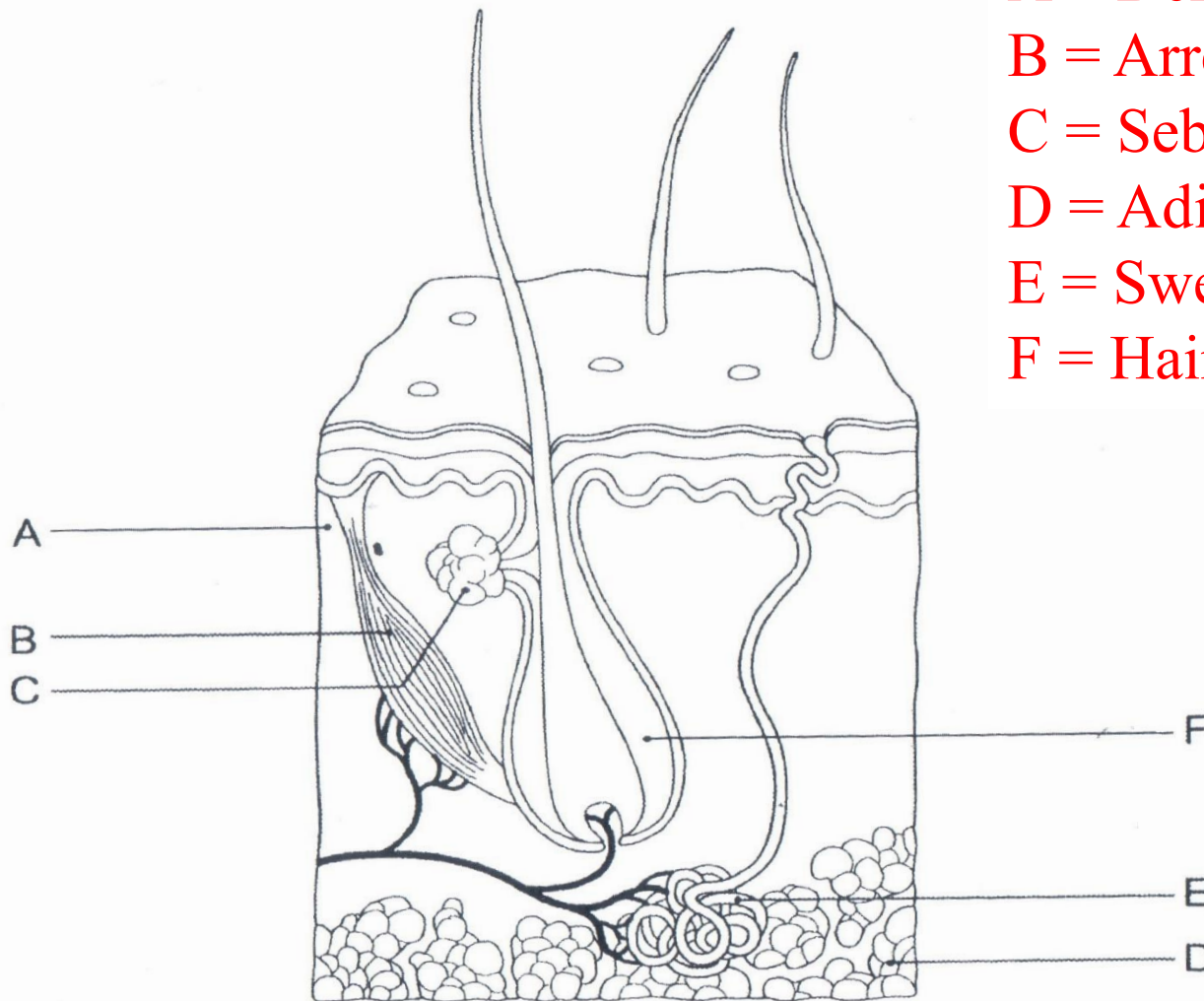
B = Arrector Pili Muscle

C = Sebaceous (oil) Gland

D = Adipose (fat)

E = Sweat gland

F = Hair follicle

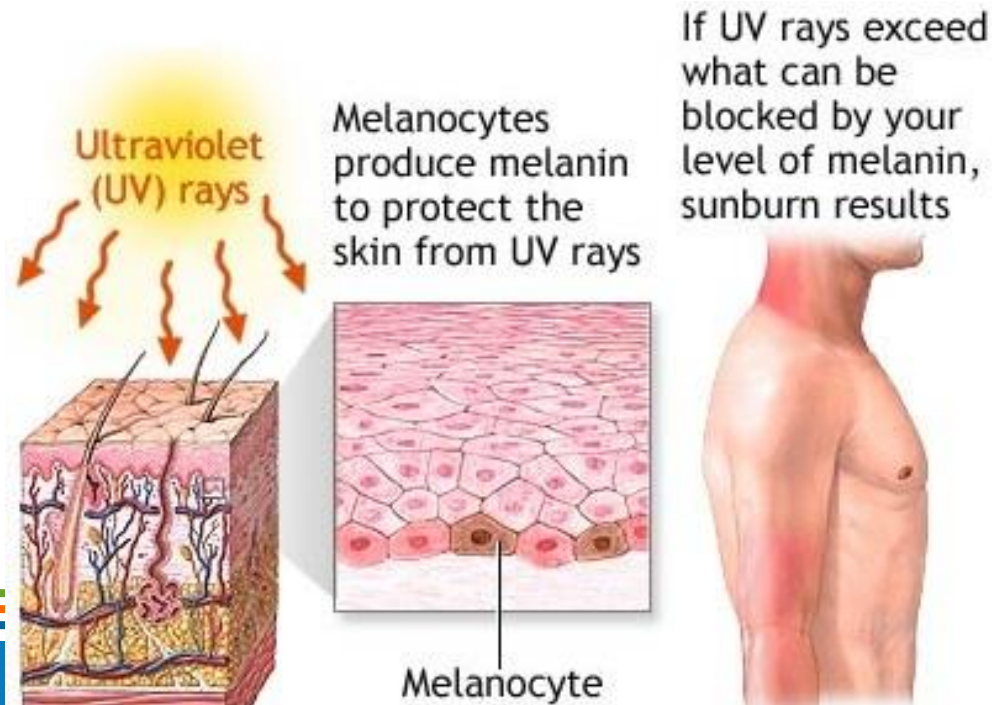


Dermis (deep layer of skin) contains:

- **Blood vessels** - play a role in body temperature regulation
- **Sweat and oil glands** - play a role in excretion
- **Collagen fibers** - give skin its toughness
- **Elastin fibers** – gives skin its elasticity
- **Deep pressure receptors** – nerve endings that receive signals for touch and pain

Melanin

- **Pigment** that gives skin its color
- Produced by **melanocytes** (cells in the epidermis)
- Amount produced depends upon **genetics** and **exposure to sunlight**
- Color is **yellow to brown to black**



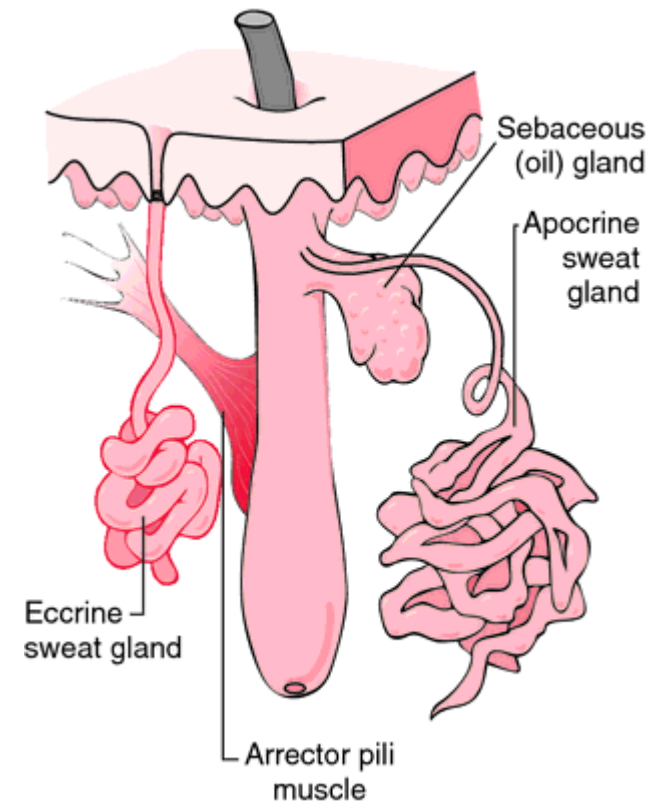
Skin Color Determinants

- **Melanin**
 - Yellow, brown, or black pigments
- **Carotene**
 - Orange-yellow pigment from some vegetables
- **Hemoglobin**
 - Red coloring from blood cells in dermal capillaries
 - Oxygen content determines the extent of red coloring



Skin Appendages

- Cutaneous exocrine glands
 - **Sebaceous glands**
 - **Sweat glands**
- **Hair**
- **Hair follicles**
- **Nails**



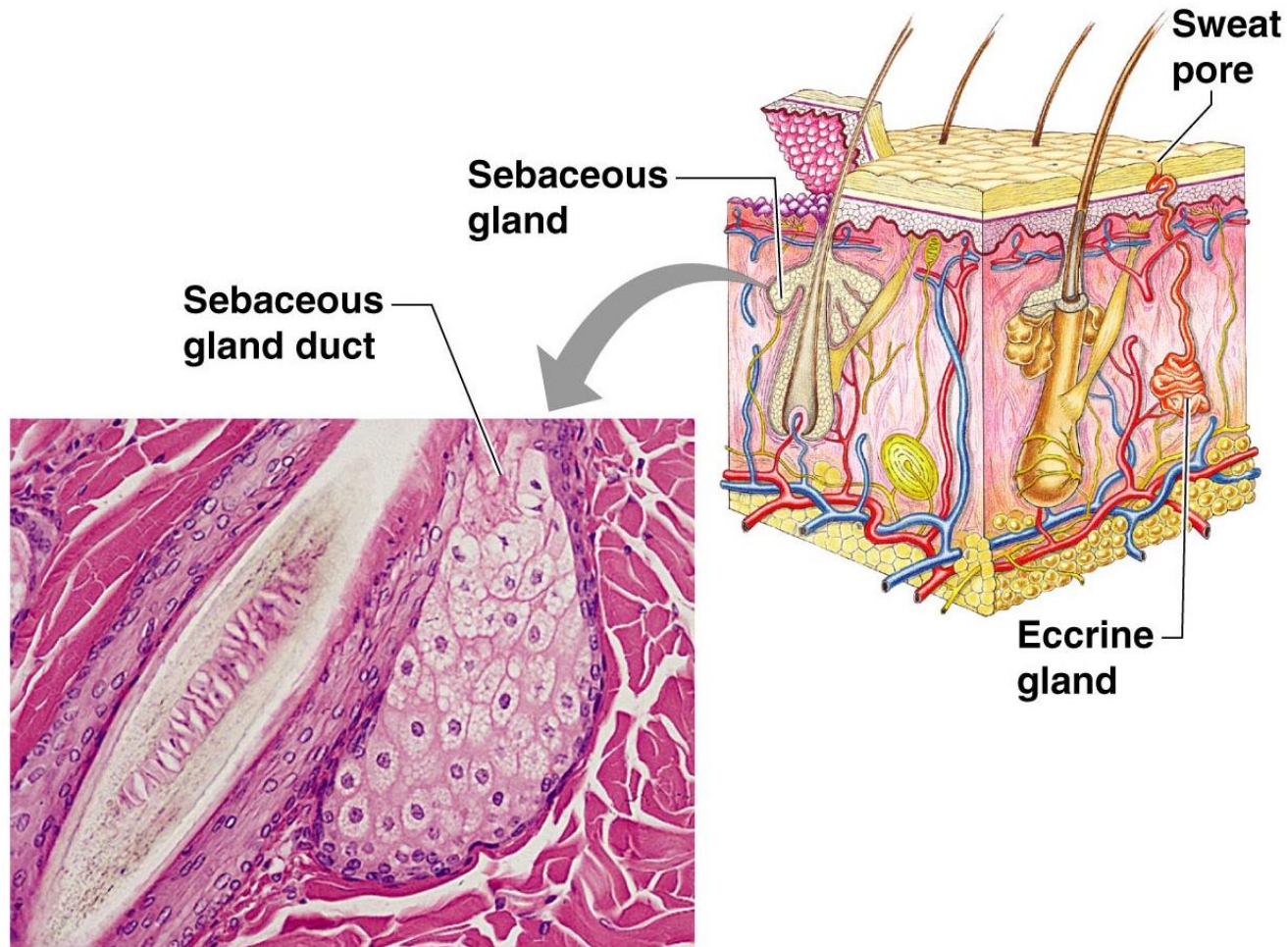
Appendages of the Skin

- Sebaceous glands
 - Produce **oil**
 - Lubricate skin
 - Prevents brittle hair
 - Kills bacteria
 - Most have ducts that empty into hair follicles; others open directly onto skin surface
 - Glands are activated at puberty



**Acne: clogged pores
due to excess sebum**

Appendages of the Skin (con't)

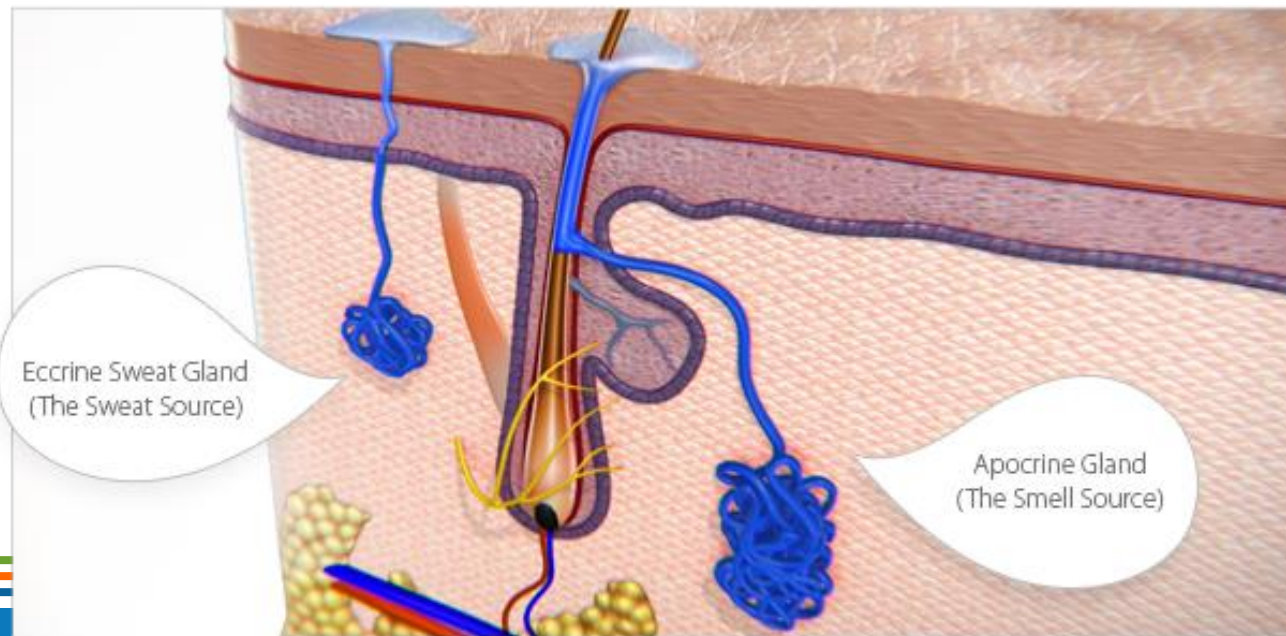


(a) Sectioned sebaceous gland (160x)

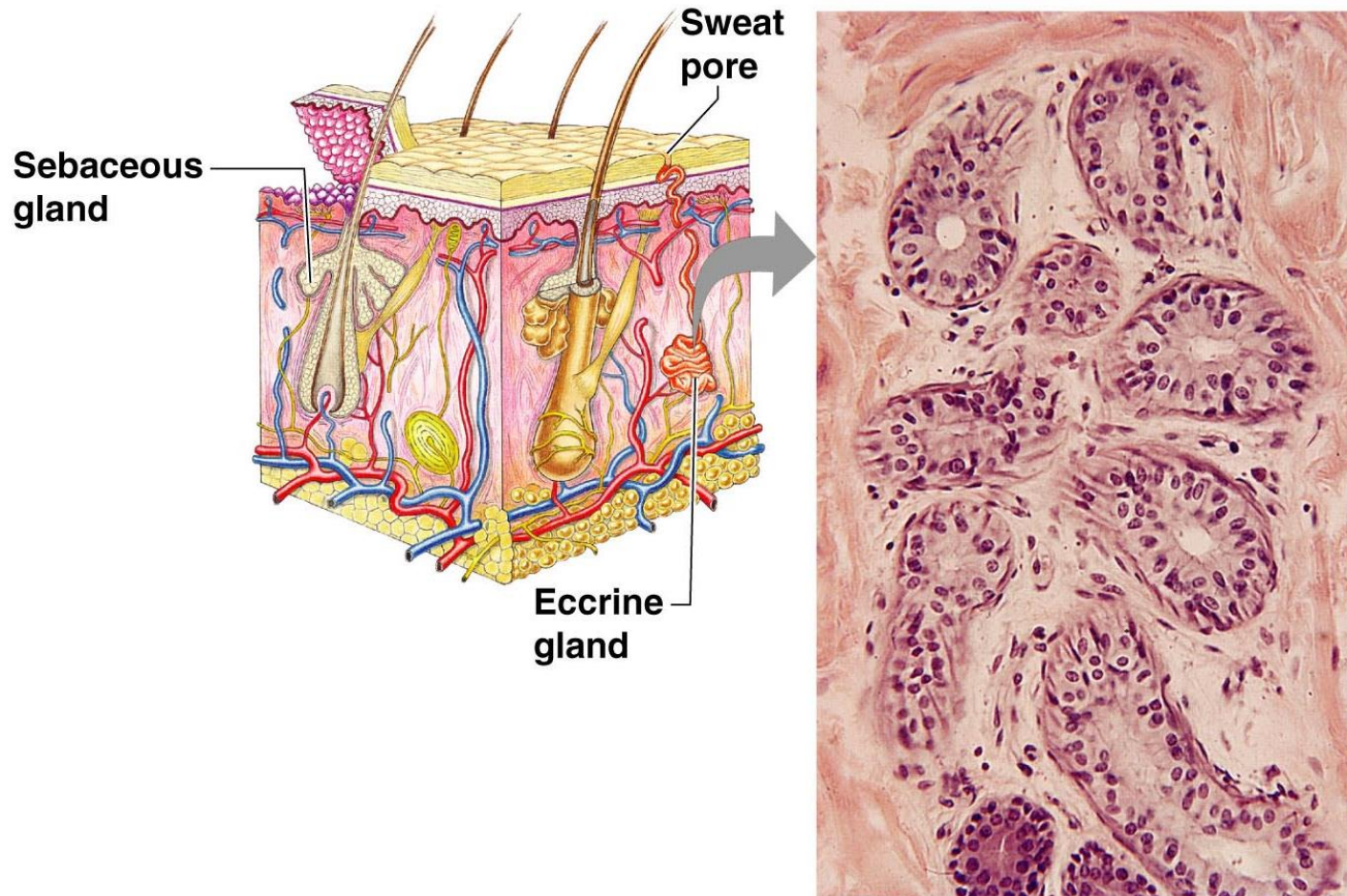
Figure 4.6a

Appendages of the Skin (con't)

- **Sweat glands**
 - Produce sweat & are widely distributed in skin
 - Two types
 - **Eccrine - Open via duct to pore on skin surface**
 - **Apocrine - Ducts empty into hair follicles**



Appendages of the Skin (con't)



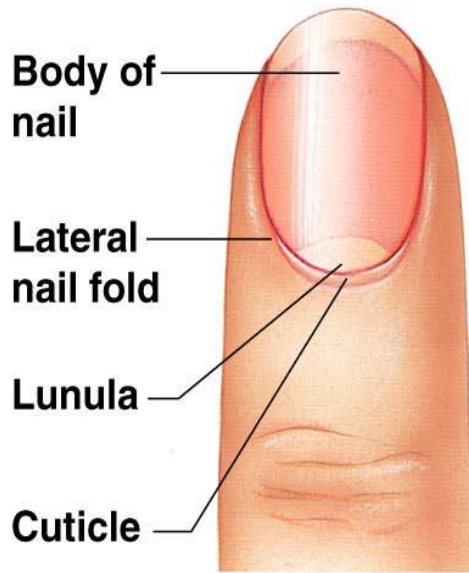
(b) Sectioned eccrine gland (250x)

Figure 4.6b

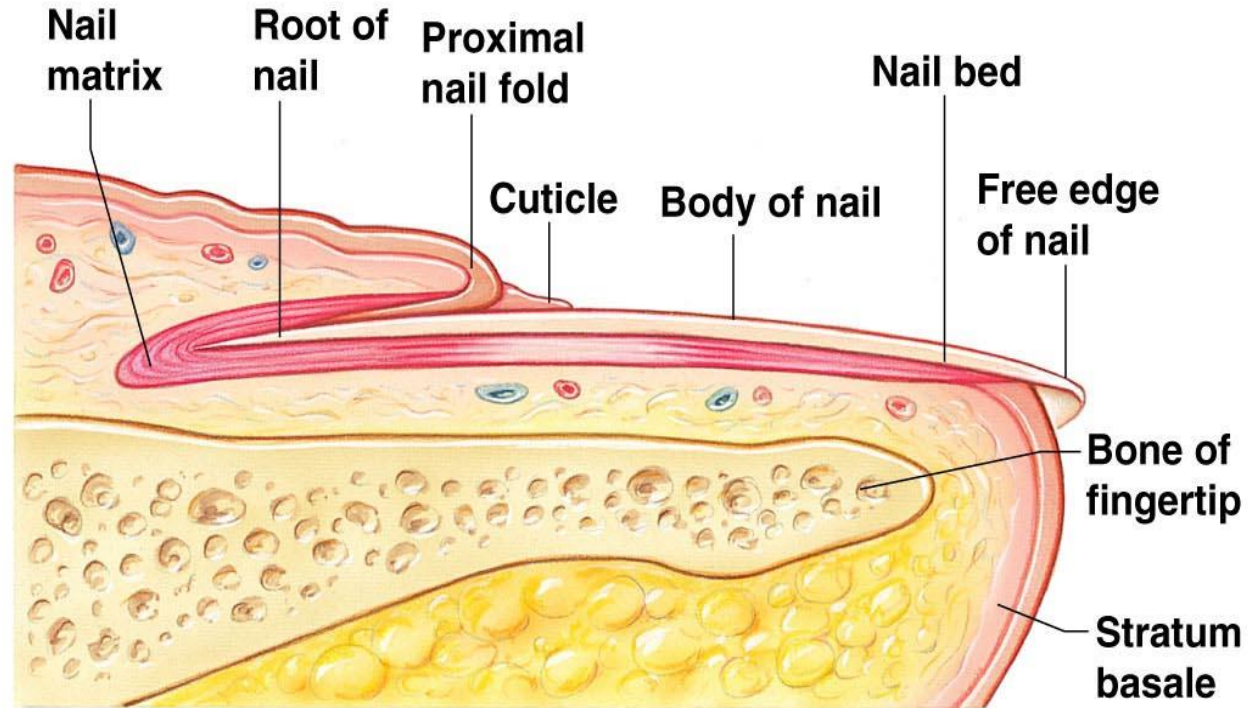
Sweat and Its Function

- **Composition**
 - Mostly **water**
 - Salts and vitamin C
 - Some metabolic waste (**urea**)
 - Fatty acids and proteins (apocrine only)
- **Function**
 - Helps dissipate excess heat
 - Excretes waste products
 - Acidic nature inhibits bacteria growth
- **Odor is from associated bacteria**

Appendages of the Skin



(a) Surface view



(b) Longitudinal section of the distal part of a finger

Figure 4.9

Skin Homeostatic Imbalances

- **Infections**
 - **Athlete's foot (tinea pedis)**
 - **Caused by fungal infection**
 - **Boils and carbuncles**
 - **Caused by bacterial infection**
 - **Cold sores (blisters)**
 - **Caused by herpes simplex virus**
 - **Impetigo (crusty skin & blisters)**
 - **Caused by bacterial infection**

Skin Homeostatic Imbalances

- **Contact dermatitis**
 - Exposures cause allergic reaction, redness
- **Psoriasis**
 - Dry silvery scales
 - Cause is unknown
 - Triggered by trauma, infection, stress

Skin Homeostatic Imbalances

Figure 4.10



(a) Cold sores



(b) Impetigo



(c) Psoriasis



(d) Boils



(e) Athlete's foot



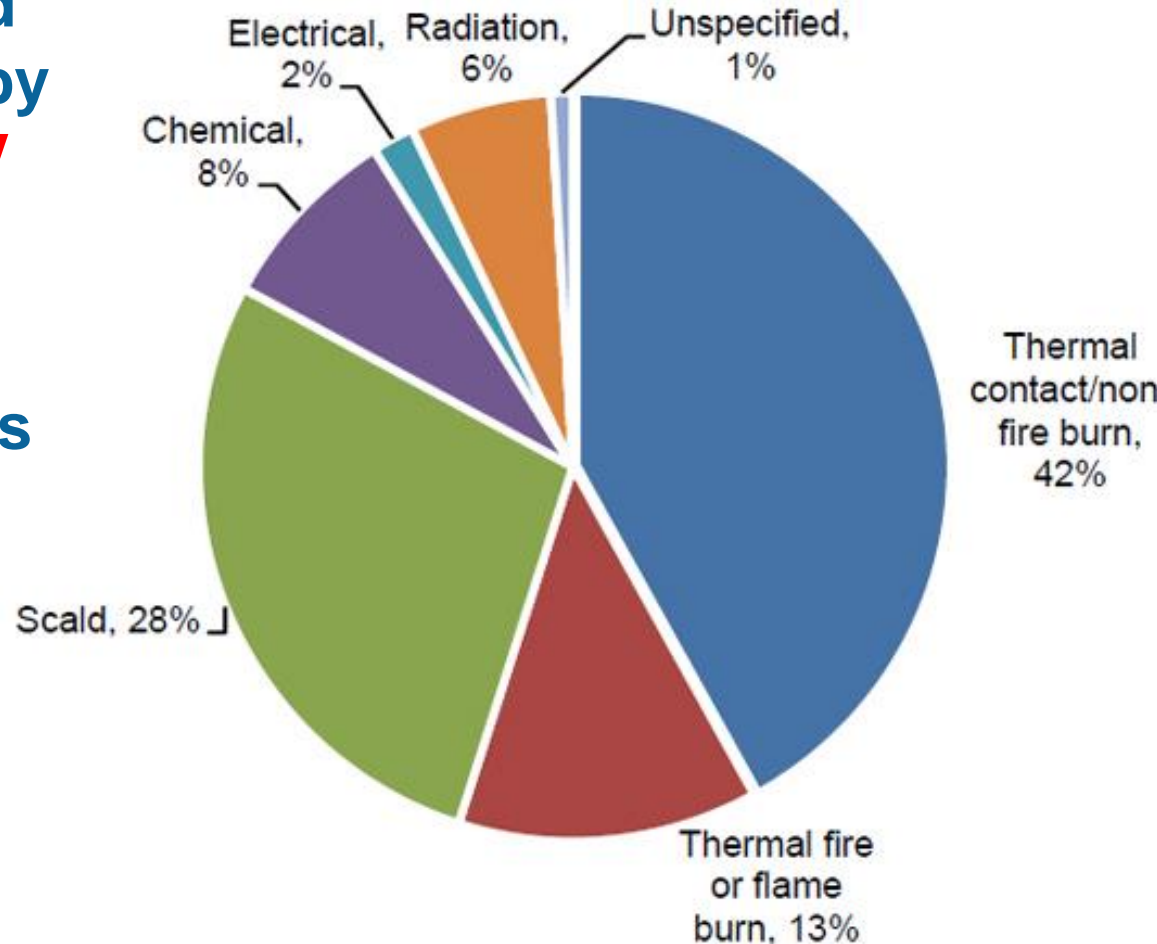
(f) Contact dermatitis

Skin Homeostatic Imbalances

■ Burns

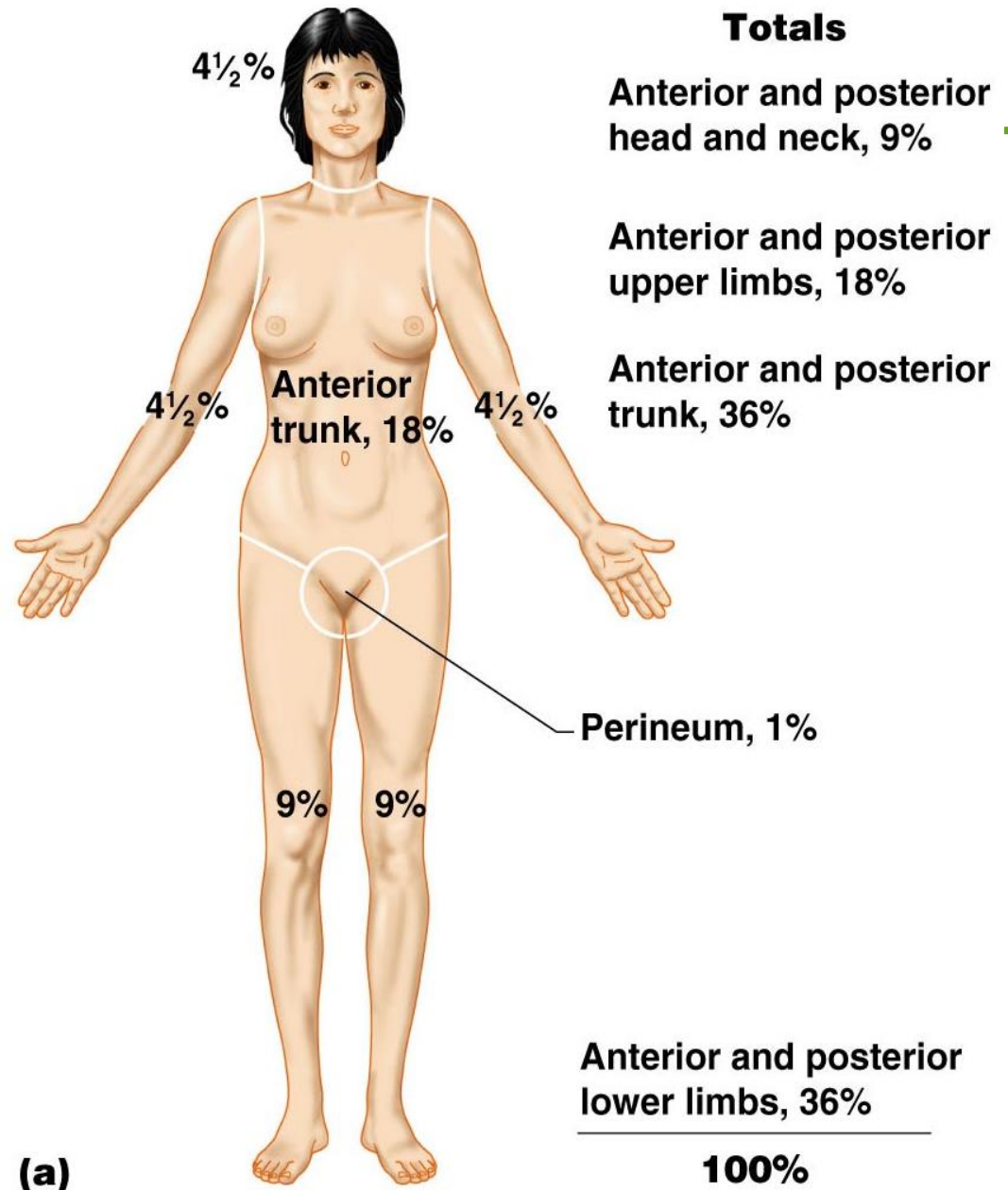
- Tissue damage and cell death caused by heat, electricity, UV radiation, or chemicals
- Associated dangers
 - Dehydration
 - Electrolyte imbalance
 - Circulatory shock

Figure 1. Hospital Emergency Room Visits in 2008 for Burns, by Type of Burn



Rule of Nines

- Way to determine the extent of burns
- Body is divided into 11 areas for quick estimation
- Each area represents about 9% of total body surface area



Severity of Burns

- **First-degree burns**

- Only **epidermis** is damaged
- **Skin is red and swollen**

- **Second-degree burns**

- **Epidermis and upper dermis** are damaged
- **Skin is red with blisters**

- **Third-degree burns**

- **Destroys entire skin layer**
- **Burn is gray-white or black**



Critical Burns

- Burns are considered critical if
 - **Over 25%** of body has second-degree burns
 - **Over 10%** of the body has third-degree burns
 - There are third-degree burns of the **face, hands, or feet**

Skin Cancer

- **Cancer—abnormal cell mass**
- **Skin cancer is the most common type of cancer**
- **Classified two ways**
 - **Benign**
 - **Does not spread (encapsulated)**
 - **Malignant**
 - **Moves (metastasizes) to other parts of the body**

Skin Cancer Types

- Basal cell carcinoma
 - Least malignant
 - Most common type
 - Arises from stratum basale (deepest epidermal layer)



(a) Basal cell carcinoma

Figure 4.12a

Skin Cancer Types

- Squamous cell carcinoma
 - Early removal allows a good chance of cure
 - Metastasizes to lymph nodes if not removed
 - Arises from stratum spinosum

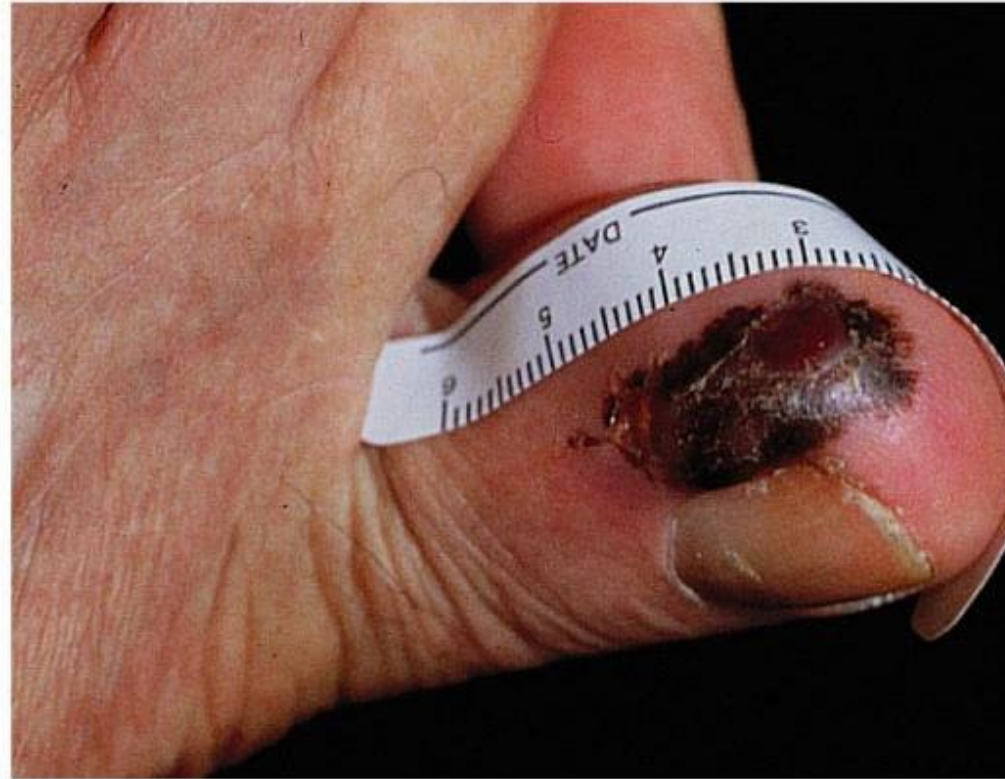


(b) Squamous cell carcinoma

Figure 4.12b

Skin Cancer Types

- **Malignant melanoma**
 - **Most deadly** of skin cancers
 - **Cancer of melanocytes**
 - **Metastasizes rapidly to lymph and blood vessels**
 - **Detection uses ABCD rule**

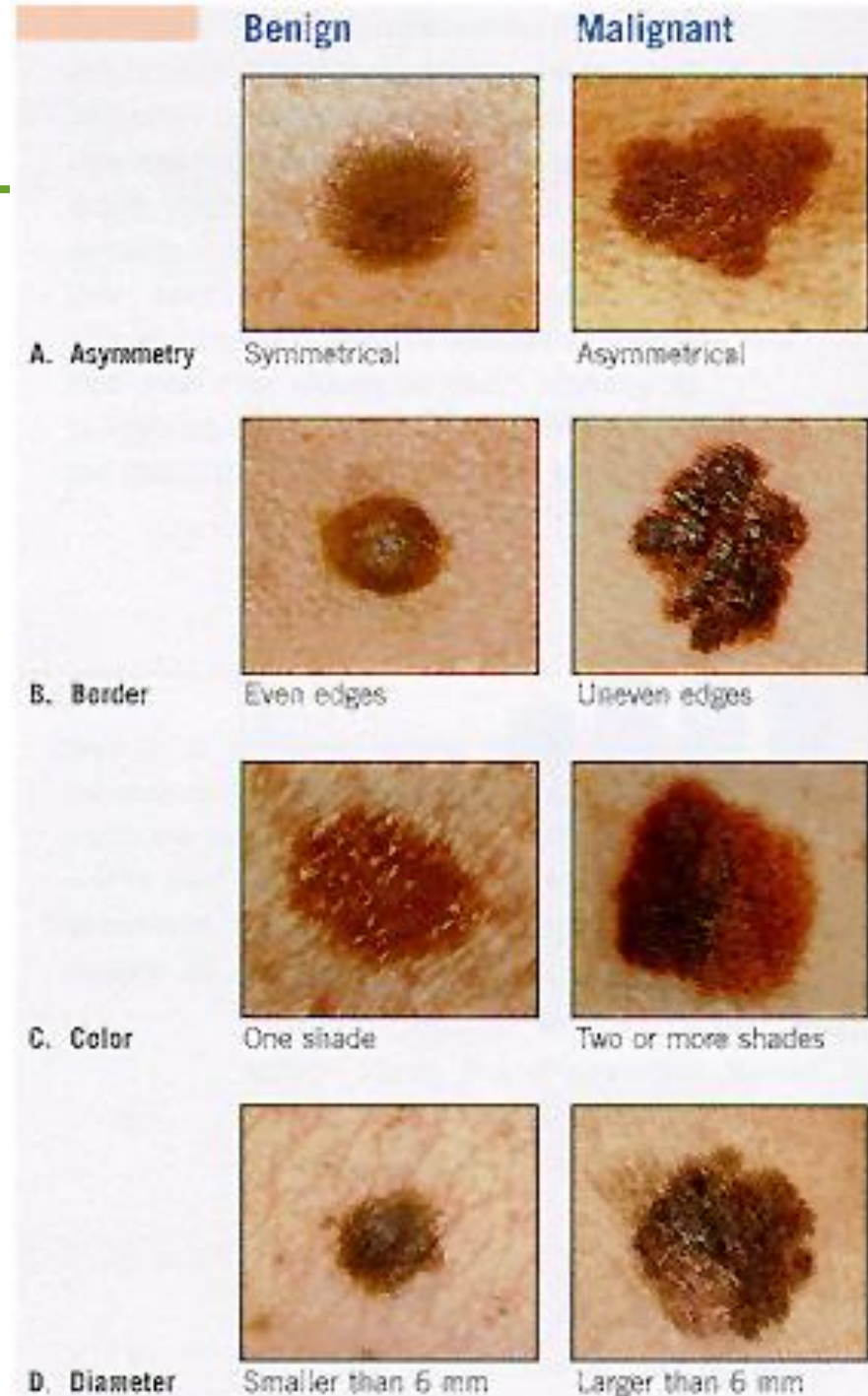


(c) Melanoma

Figure 4.12c

ABCD Rule

- **A = Asymmetry**
 - Two sides of pigmented mole do not match
- **B = Border irregularity**
 - Borders of mole are not smooth
- **C = Color**
 - Different colors in pigmented area
- **D = Diameter**
 - Spot is larger than 6 mm in diameter



ABCD Rule



Asymmetry



**Border
irregularity**



Color



**Diameter:
1/4 inch or
6mm**

Source: NCI Visuals Online. Skin Cancer Foundation. <http://visualsonline.cancer.gov/about.cfm>