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*Chapter 4*  
**Skin and Body  
Membranes**

*Slides 4.1 – 4.32*

Lecture Slides in PowerPoint by Jerry L. Cook

# Skin and Body Membranes

- Function of body membranes
  - Line or cover body surfaces
  - Protect body surfaces
  - Lubricate body surfaces

# Classification of Body Membranes

- Epithelial membranes
  - Cutaneous membrane
  - Mucous membrane
  - Serous membrane
- Connective tissue membranes

# Cutaneous Membrane

- Cutaneous membrane = skin
  - A dry membrane
  - Outermost protective boundary
- Superficial epidermis
  - Keratinized stratified squamous epithelium
- Underlying dermis
  - Mostly dense connective tissue

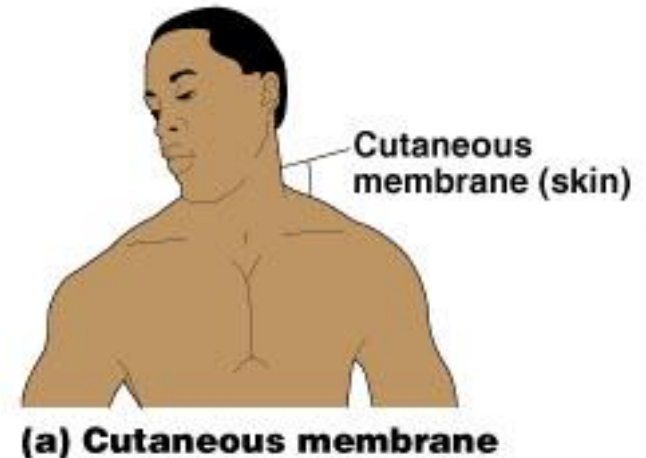


Figure 4.1a

# Mucous Membranes

- Surface epithelium
  - Type depends on site
- Underlying loose connective tissue (lamina propria)
- Lines all body cavities that open to the exterior body surface
- Often adapted for absorption or secretion

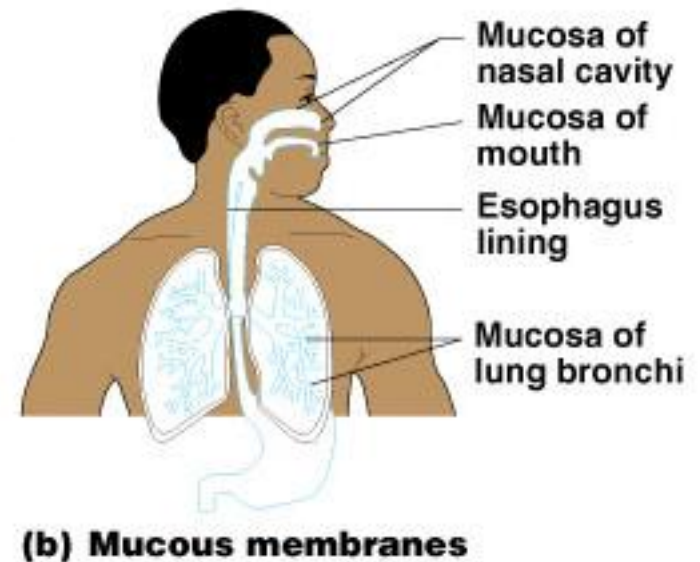


Figure 4.1b

# Serous Membranes

- Surface simple squamous epithelium
- Underlying areolar connective tissue
- Lines open body cavities that are closed to the exterior of the body
- Serous layers separated by serous fluid

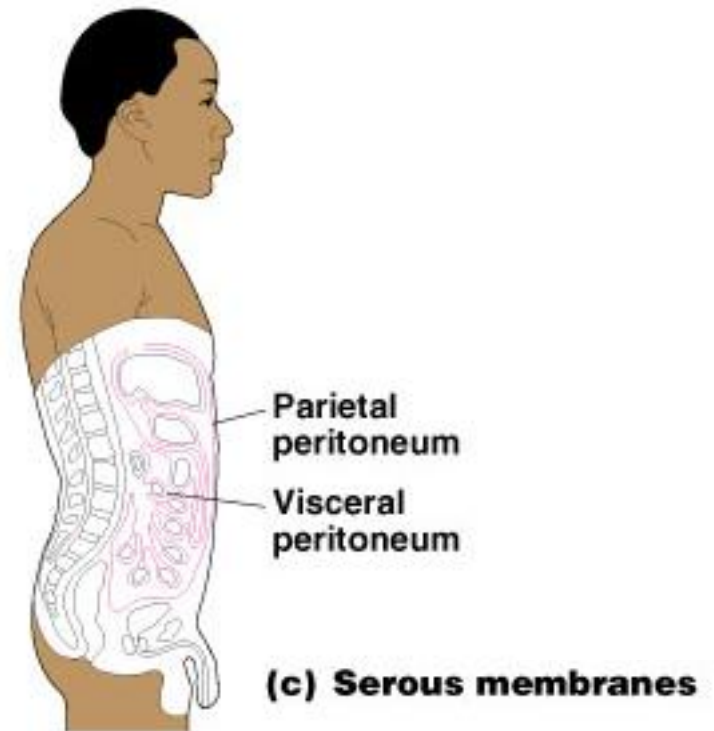


Figure 4.1c

# Serous Membranes

- Specific serous membranes
  - Peritoneum
    - Abdominal cavity
  - Pleura
    - Around the lungs
  - Pericardium
    - Around the heart

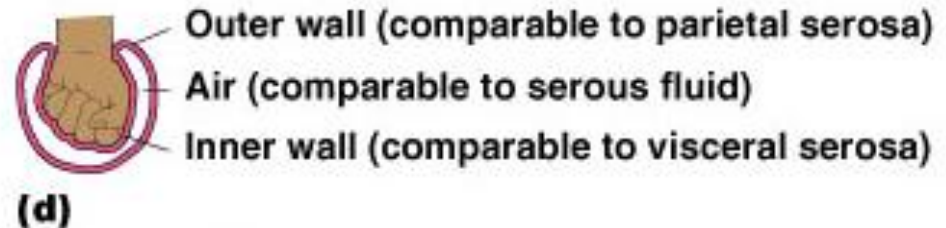


Figure 4.1d

# Connective Tissue Membrane

- Synovial membrane
  - Connective tissue only
  - Lines fibrous capsules surrounding joints

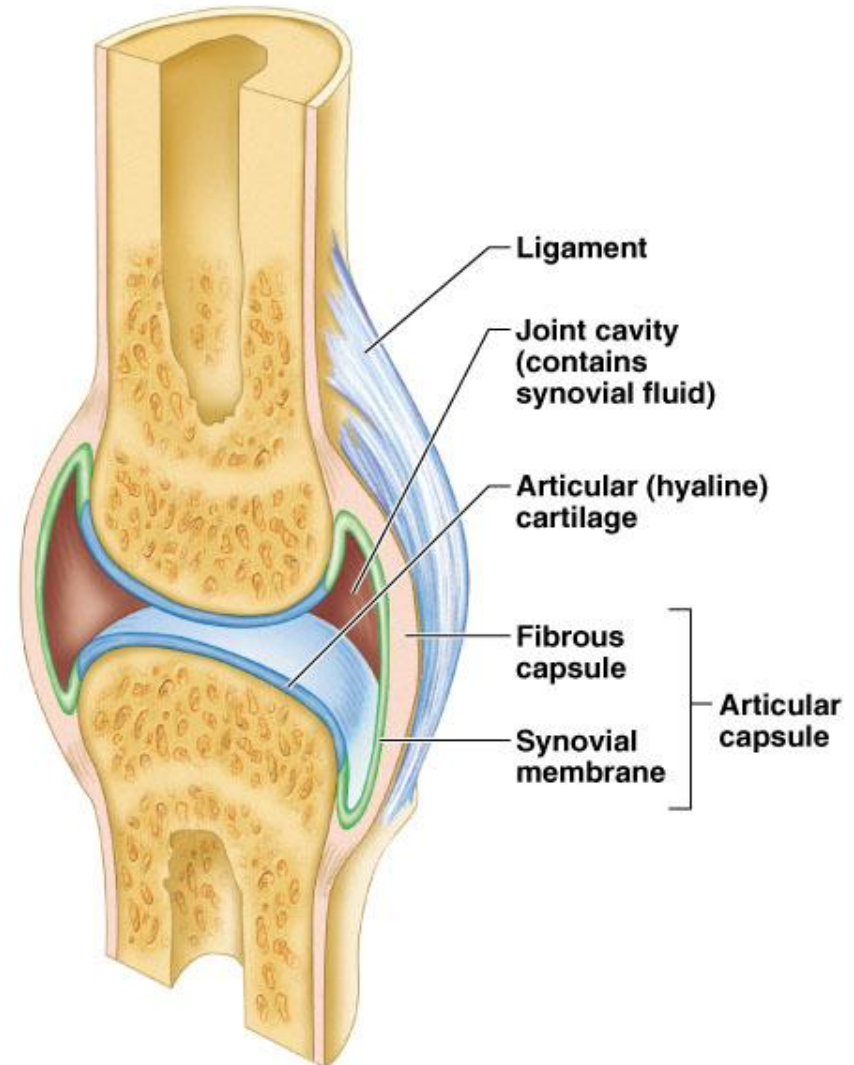


Figure 4.2



# Integumentary System

- Skin (cutaneous membrane)
- Skin derivatives
  - Sweat glands
  - Oil glands
  - Hairs
  - Nails

# Skin Functions

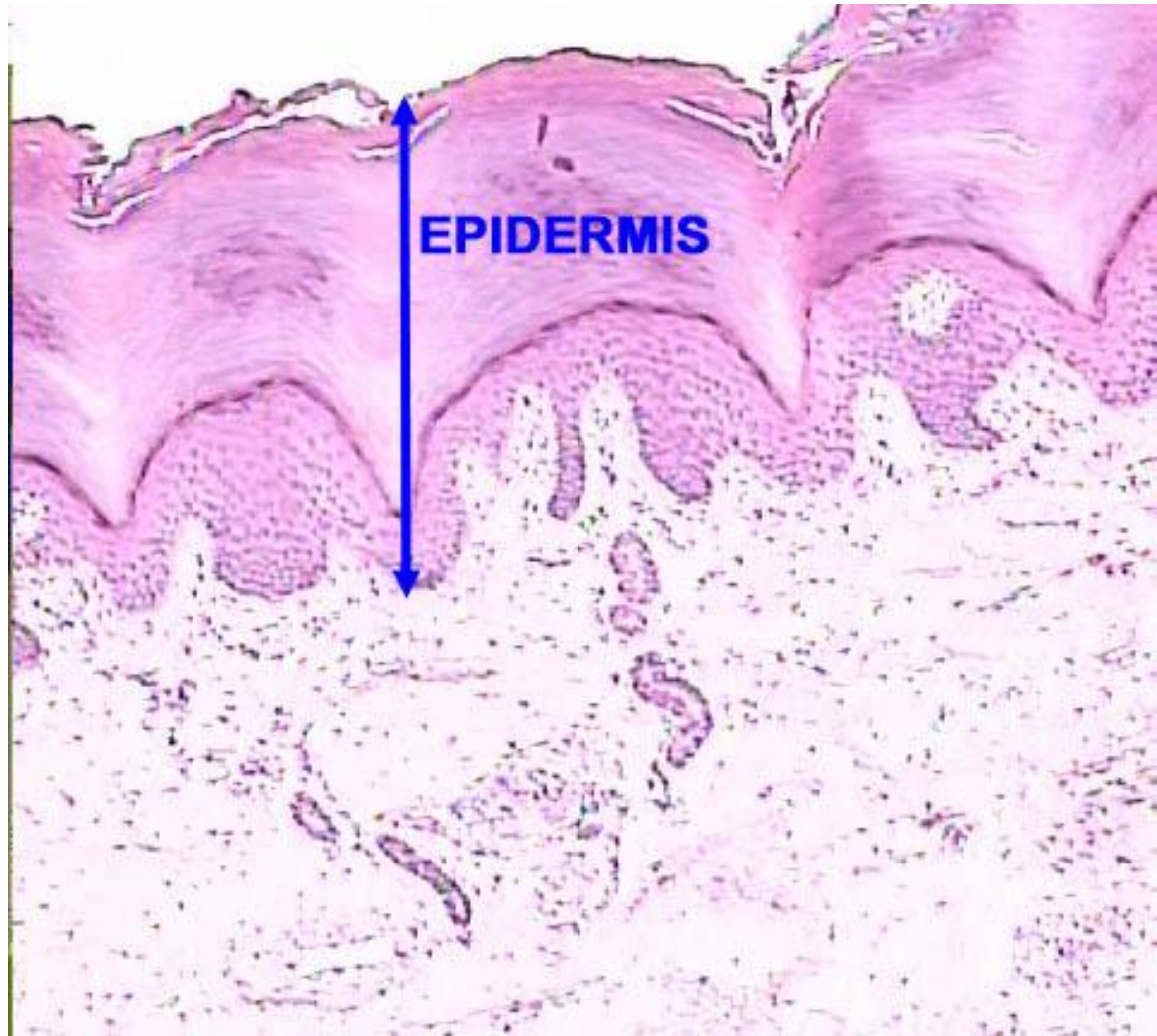
- Protects deeper tissues from:
  - Mechanical damage
  - Chemical damage
  - Bacterial damage
  - Thermal damage
  - Ultraviolet radiation
  - Desiccation

# Skin Functions

- Aids in heat regulation
- Aids in excretion of urea and uric acid
- Synthesizes vitamin D

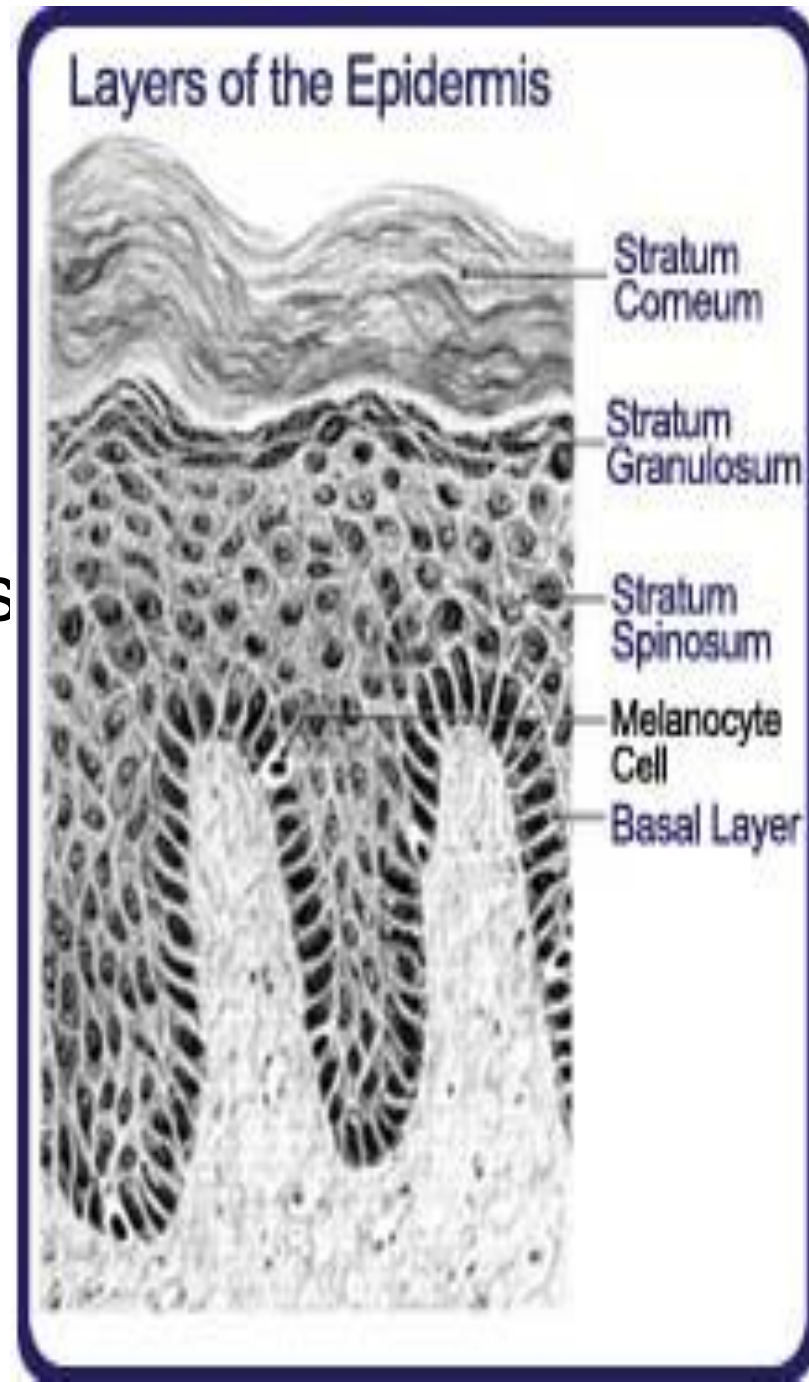
# Skin Structure

- Epidermis – outer layer
  - Stratified squamous epithelium
  - Often keratinized (hardened by keratin)



# Layer of Epidermis

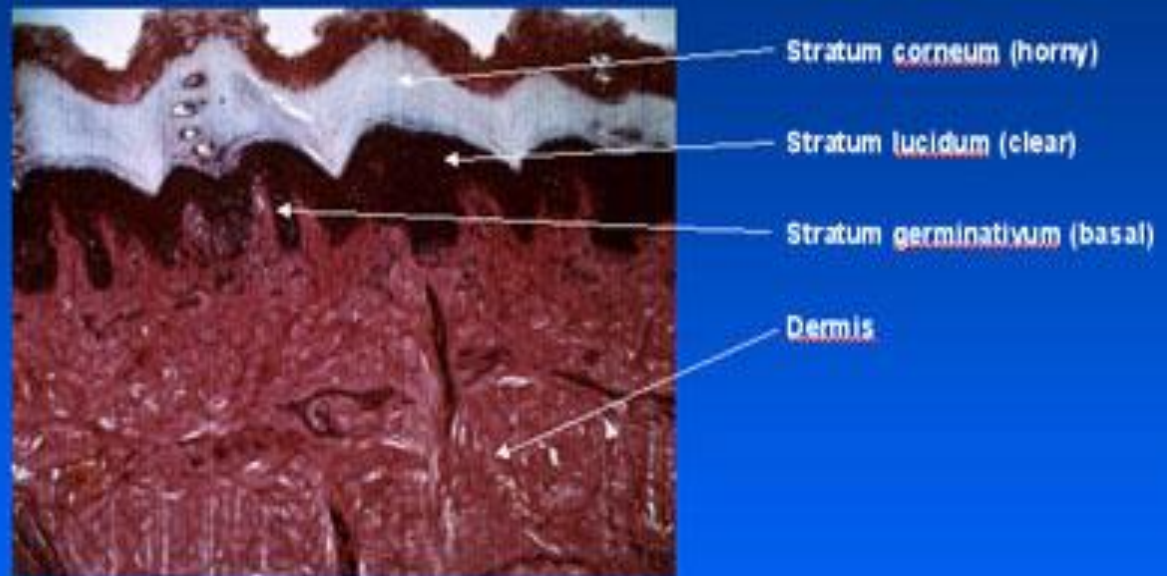
- Stratum basale
  - Cells undergoing mitosis
  - Lies next to dermis
- Stratum spinosum
- Stratum granulosum



# Layer of Epidermis

- Stratum lucidum
  - Occurs only in thick skin
- Stratum corneum
  - Shingle-like dead cells

Some of the layers of the epidermis in the fingertip



# Melanin

- Pigment (melanin) produced by melanocytes
- Color is yellow to brown to black
- Melanocytes are mostly in the stratum basale
- Amount of melanin produced depends upon genetic and exposure to sunlight



# Skin Color Determinants

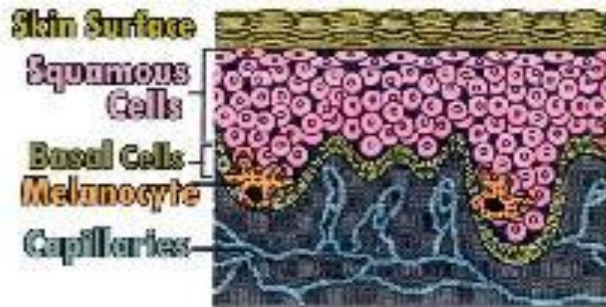
- Melanin
  - Yellow, brown or black pigments
- Carotene
  - Orange-yellow pigment from some vegetables
- Hemoglobin
  - Red coloring from blood cells in dermis capillaries
  - Oxygen content determines the extent of red coloring
  - Cyanosis - Low oxygen content creates a bluish appearance



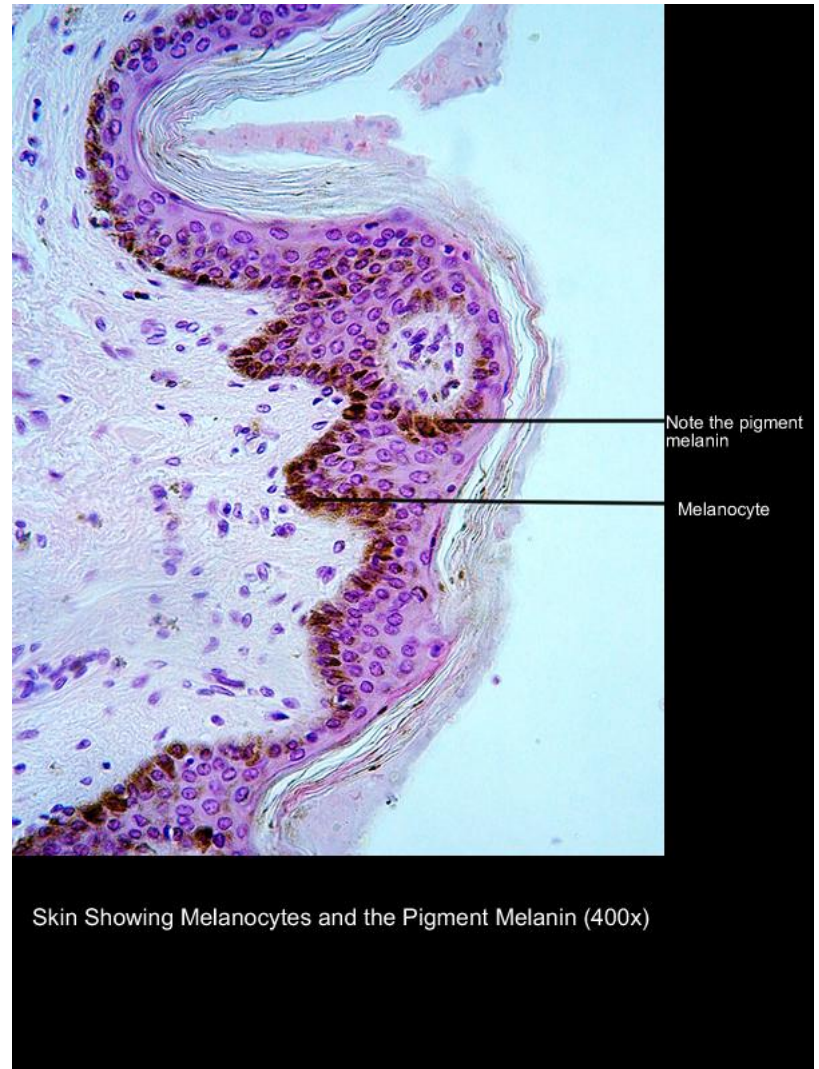
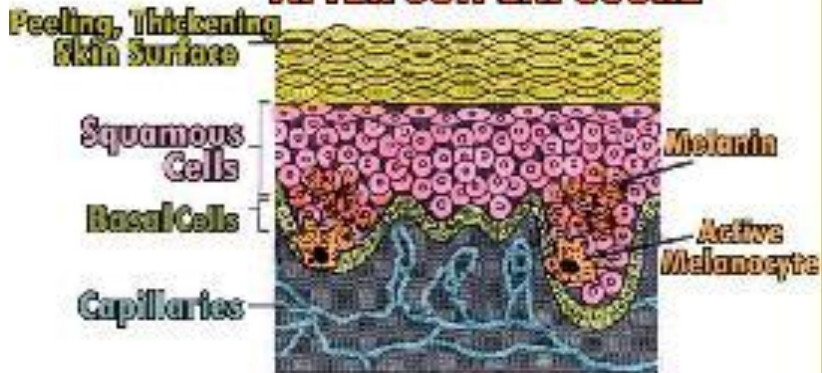
# MELANIN

## LAYERS OF SKIN

### BEFORE SUN EXPOSURE



### AFTER SUN EXPOSURE

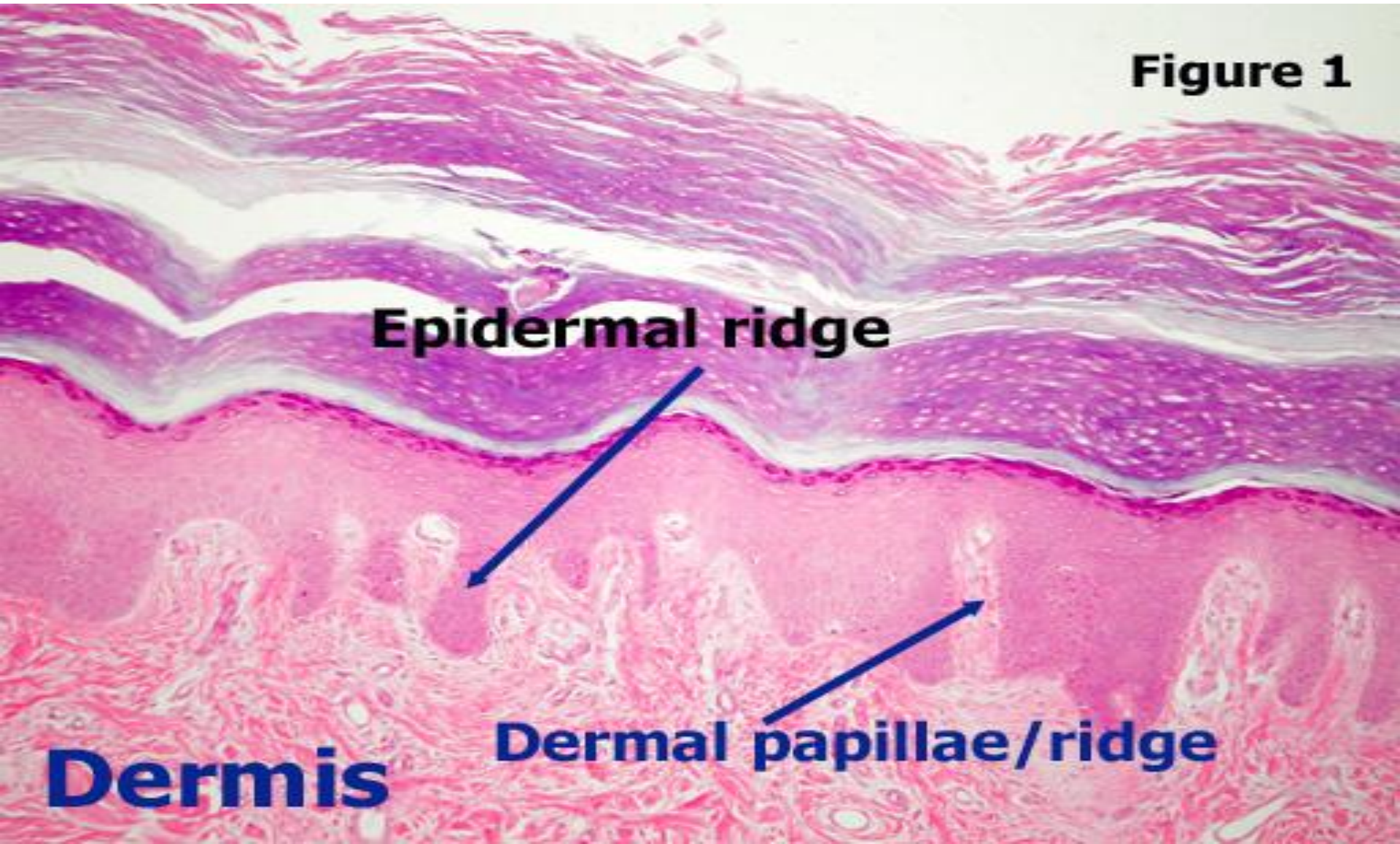


How Sun Effects Melanin



- Dermis

- Dense connective tissue



# Dermis

- Two layers

- Papillary layer

- Projections called dermal papillae

- Pain receptors

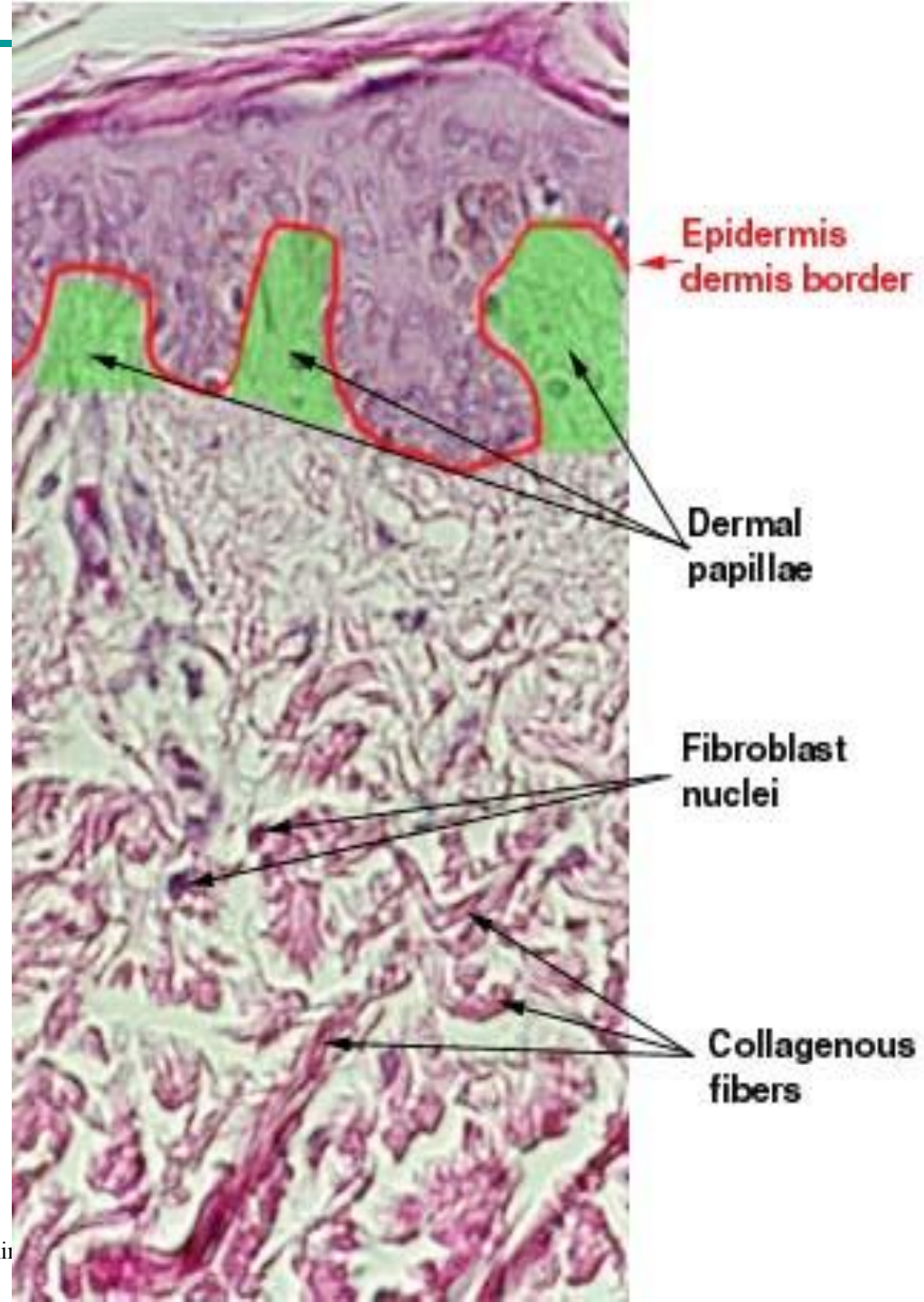
- Capillary loops

- Reticular layer

- Blood vessels

- Glands

- Nerve receptors





# FINGERPRINTS

Arise from the interaction of an individual's genes and the developmental environment in the uterus.

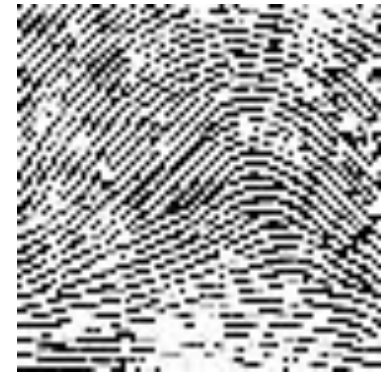
Genes determine general characteristics of patterns that are used for fingerprint classification.

As the skin on the fingertip differentiates, it expresses these general characteristics.



WHIRL

This skin is also in contact with the amniotic fluid in the uterus and other parts of the fetus and the uterus, and their position in relation to uterus and the fetal body changes as the fetus moves on its own and in response to positional changes of the mother.



ARCH

The area around growing cells on the fingertip is in flux, and is always slightly different from hand to hand and finger to finger.



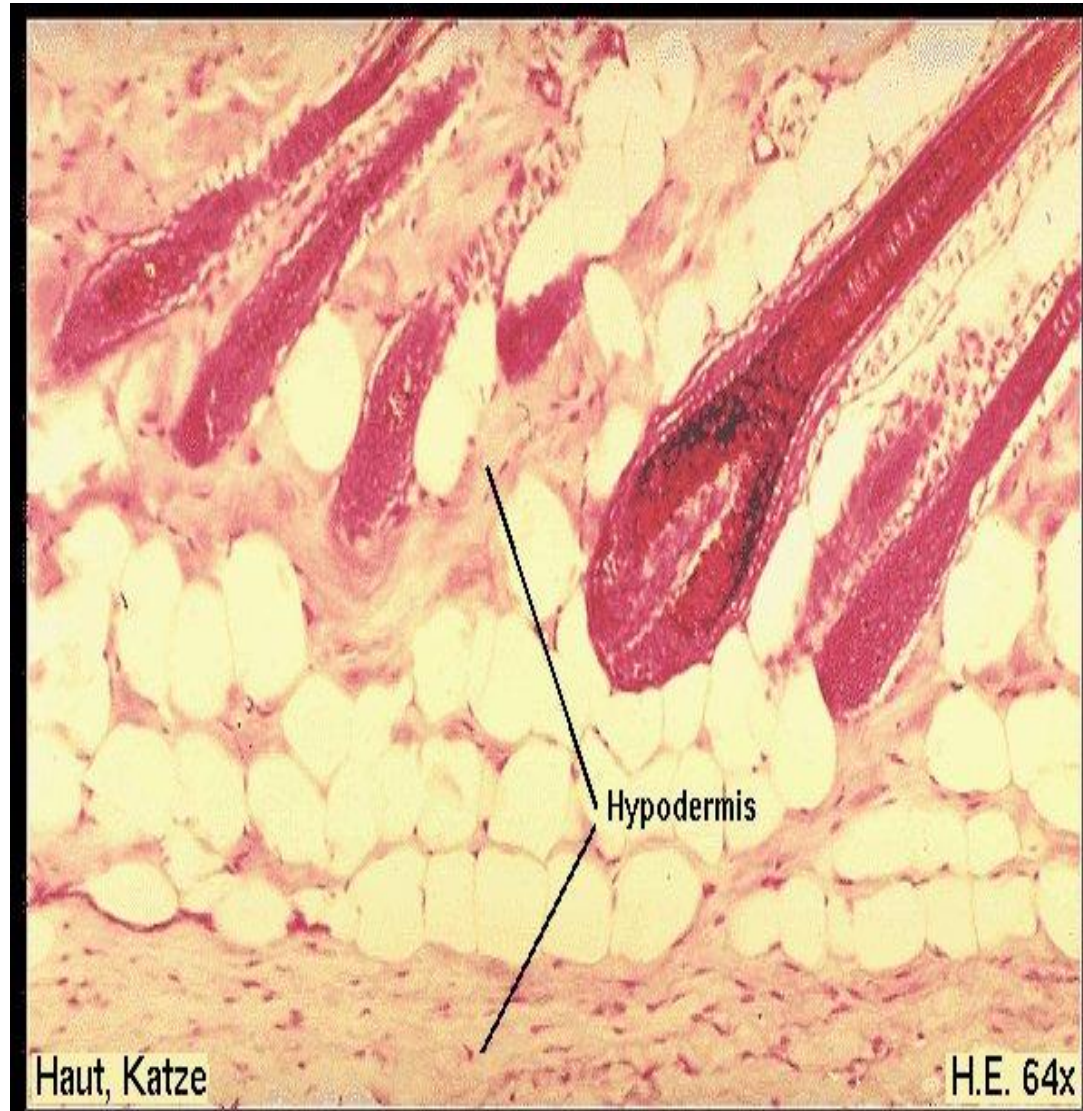
LOOP

Their effect is amplified by the differentiating cells and produces the larger differences that enable the fingerprints of even identical twins to be differentiated.

# Skin Structure

- Deep to dermis is the hypodermis

- Not part of the skin
- Anchors skin to underlying organs
- Composed mostly of adipose tissue





# Skin Structure

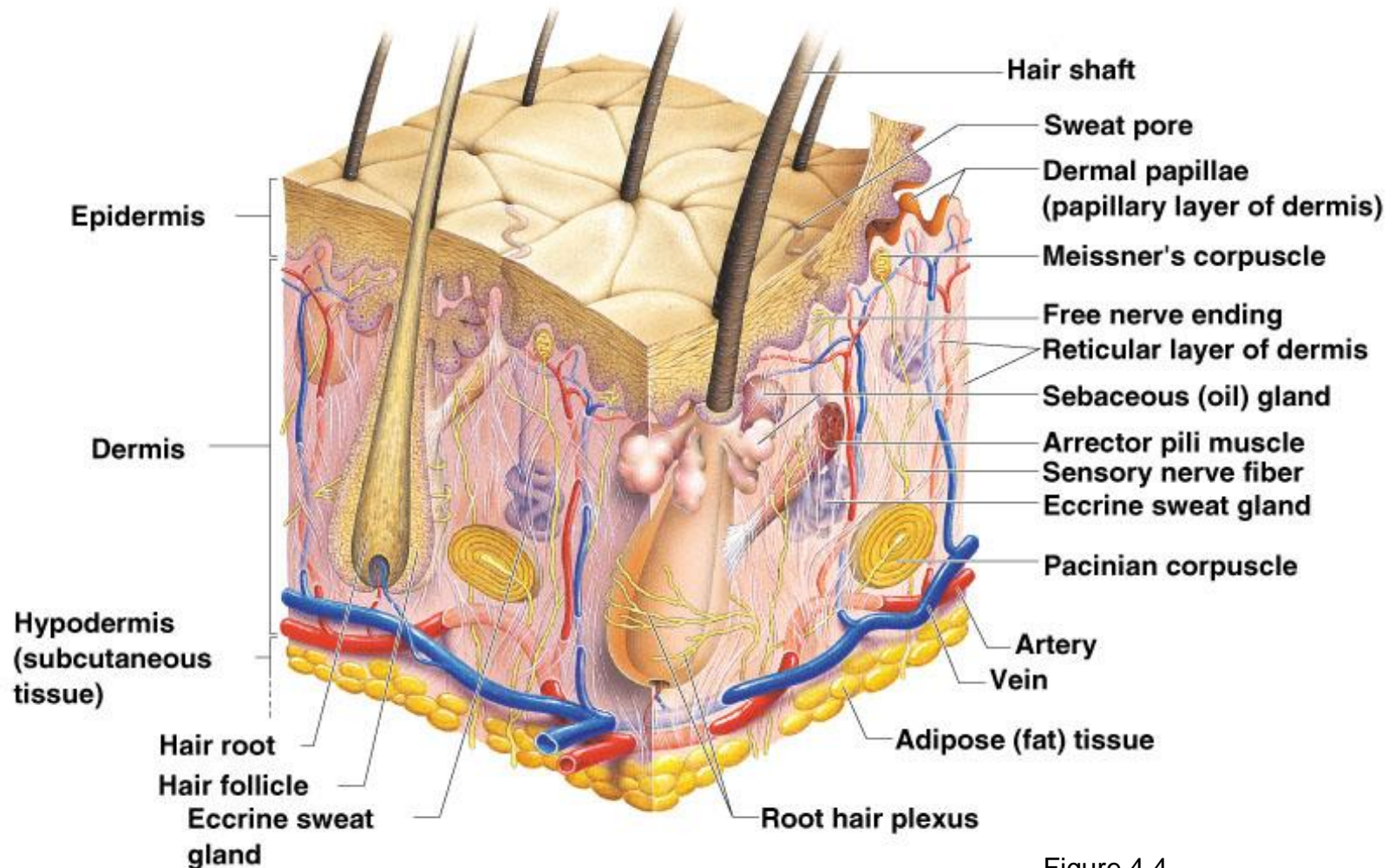
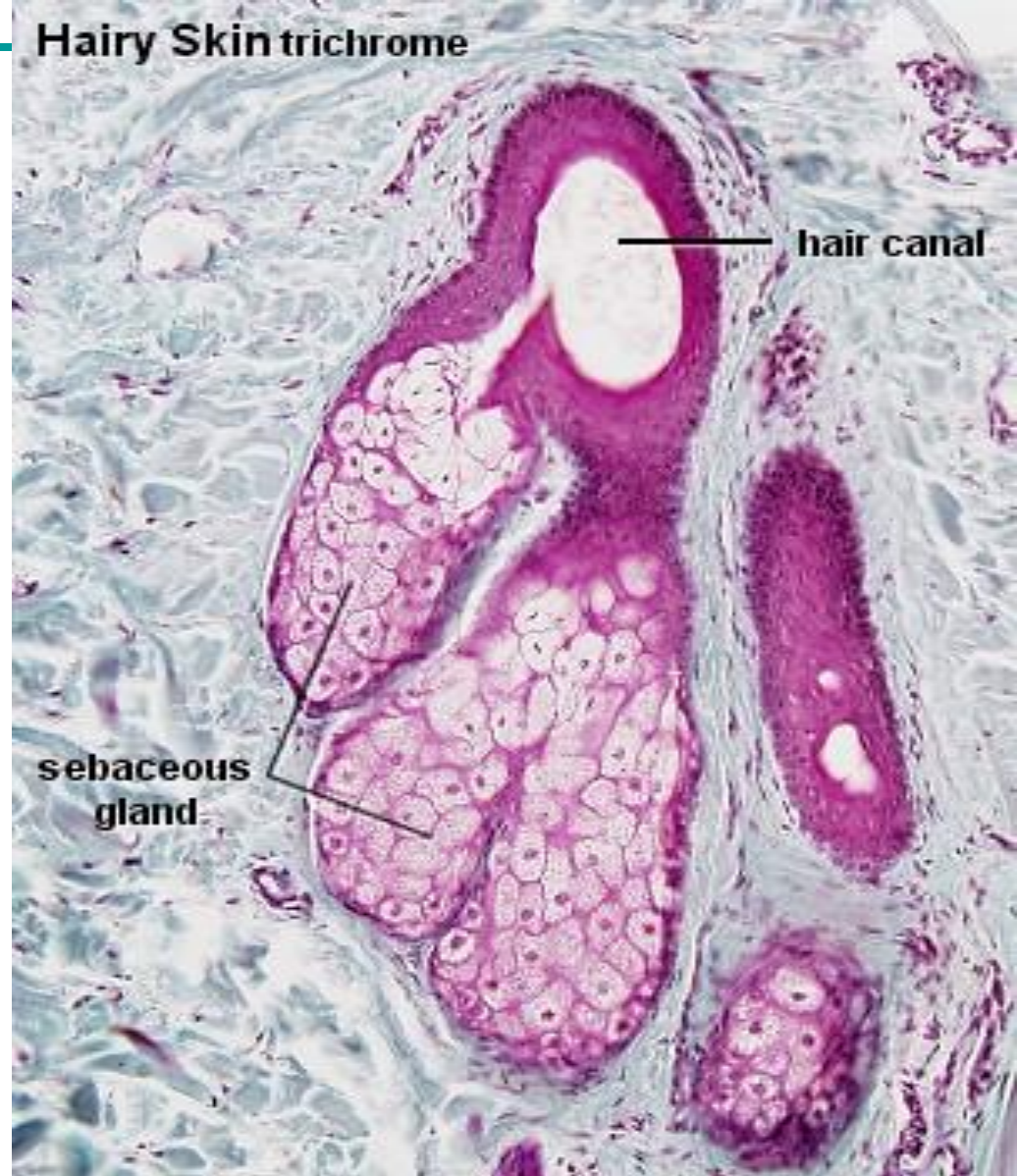


Figure 4.4

# Appendages of the Skin



- Sebaceous glands
  - Produce oil
    - Lubricant for skin
    - Kills bacteria
  - Most with ducts that empty into hair follicles
  - Glands are activated at puberty

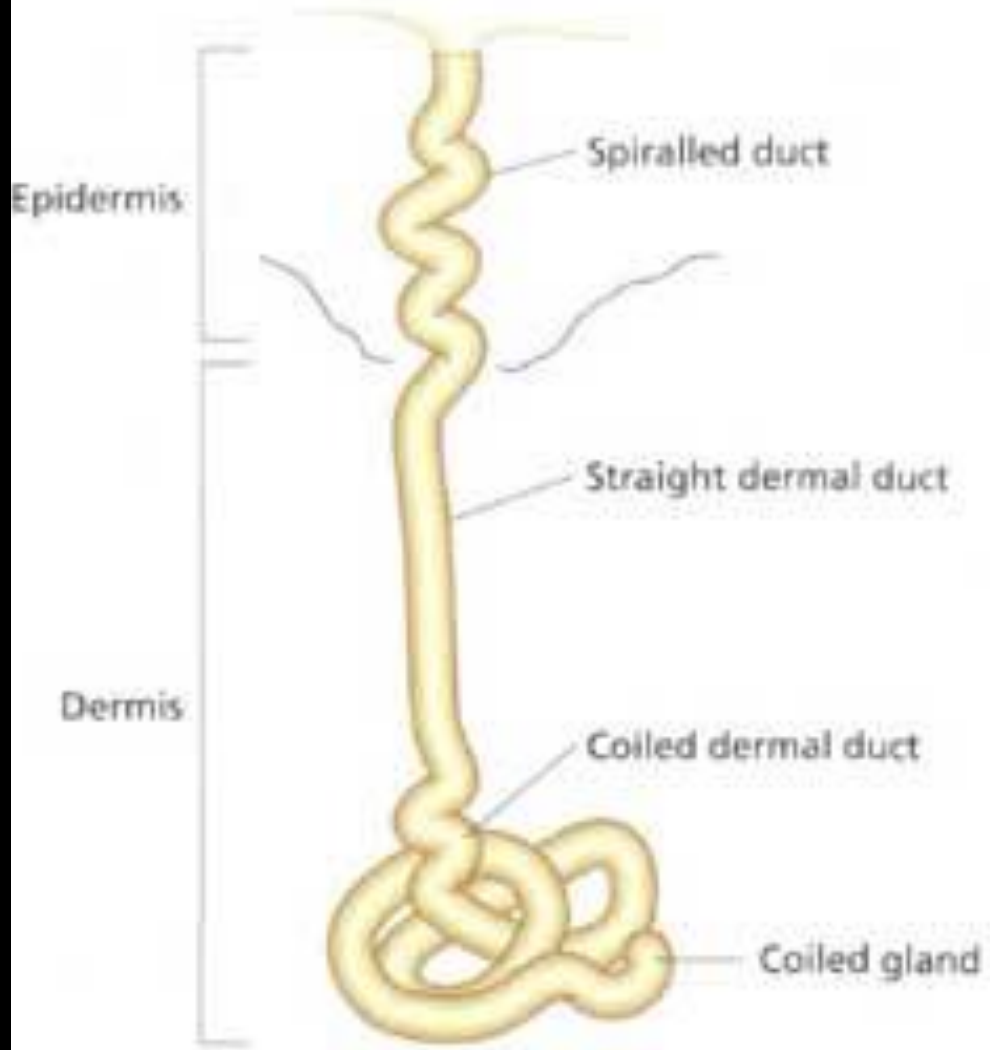
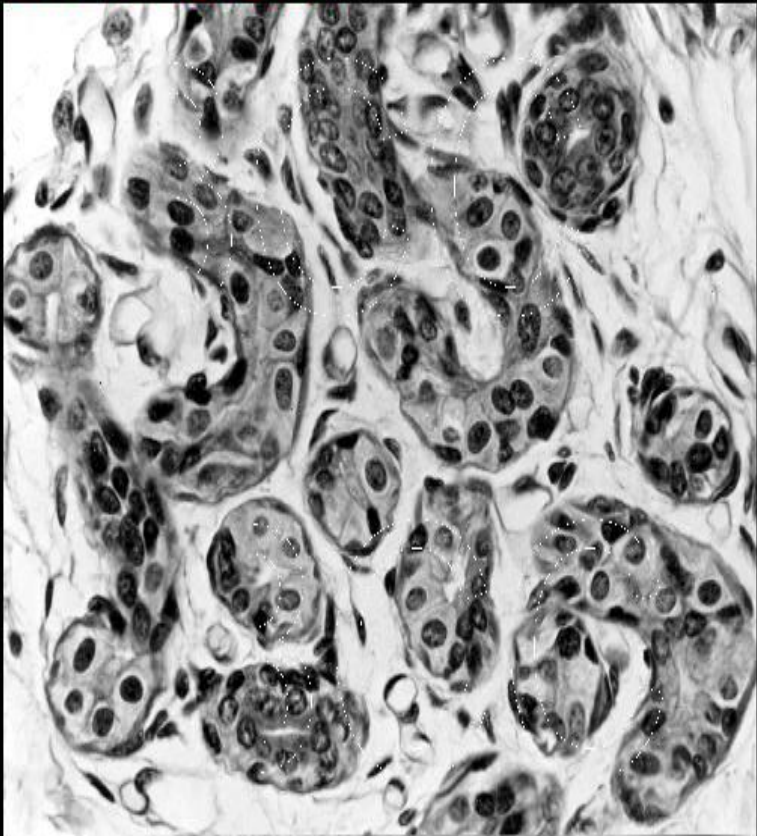
# Appendages of the Skin

- Sweat glands
  - Widely distributed in skin
  - Two types
    - Eccrine
    - Apocrine

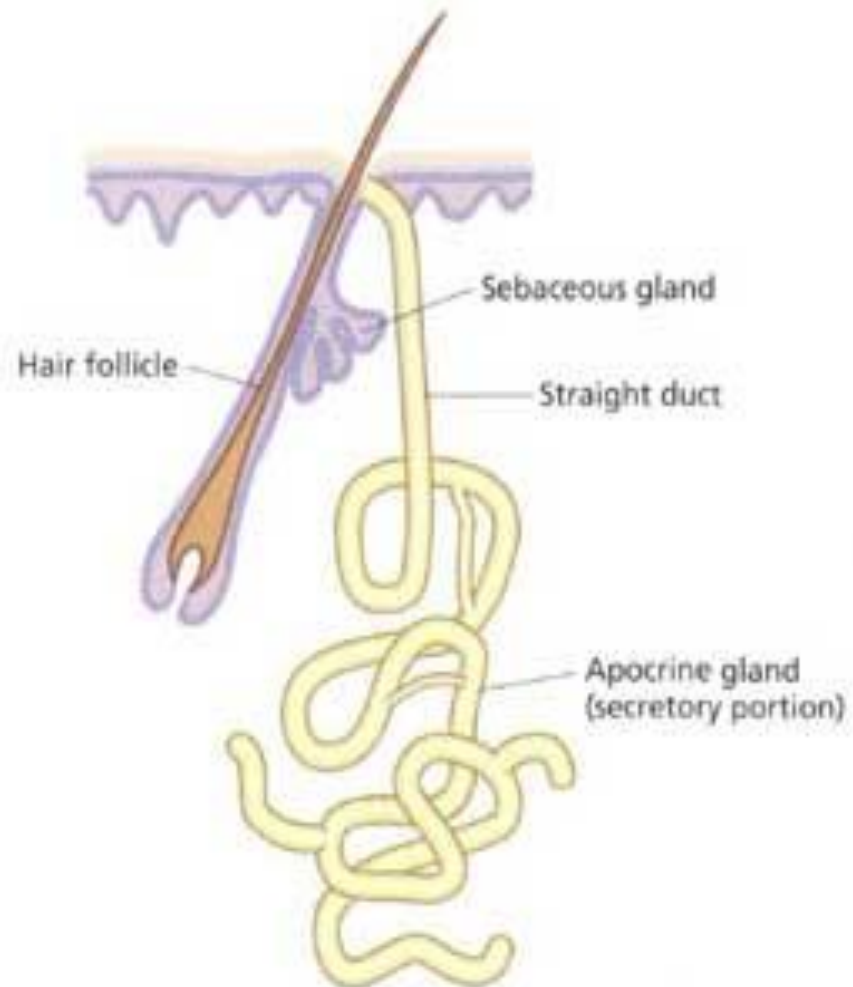


- Eccrine sweat gland
- Open via duct to pore on skin surface

*BCC Microimaging Inc.*



- Apocrine sweat gland
- Ducts empty into hair follicles



# Sweat and Its Function

- Composition
  - Mostly water
  - Some metabolic waste
  - 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

- Hair
  - Produced by hair bulb
  - Consists of hard keratinized epithelial cells
  - Melanocytes provide pigment for hair color

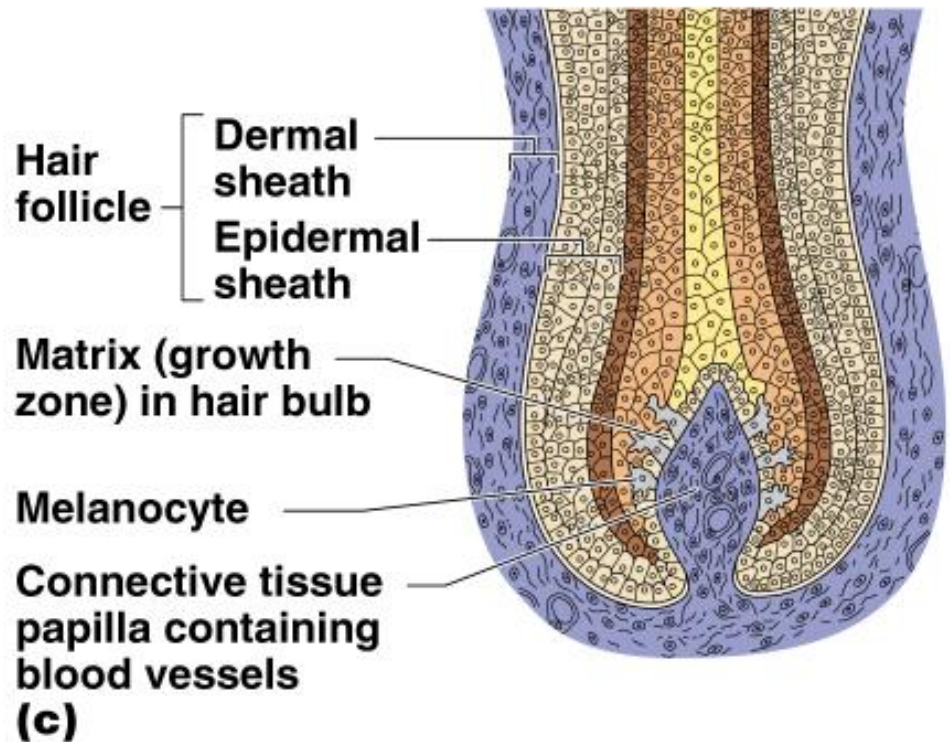
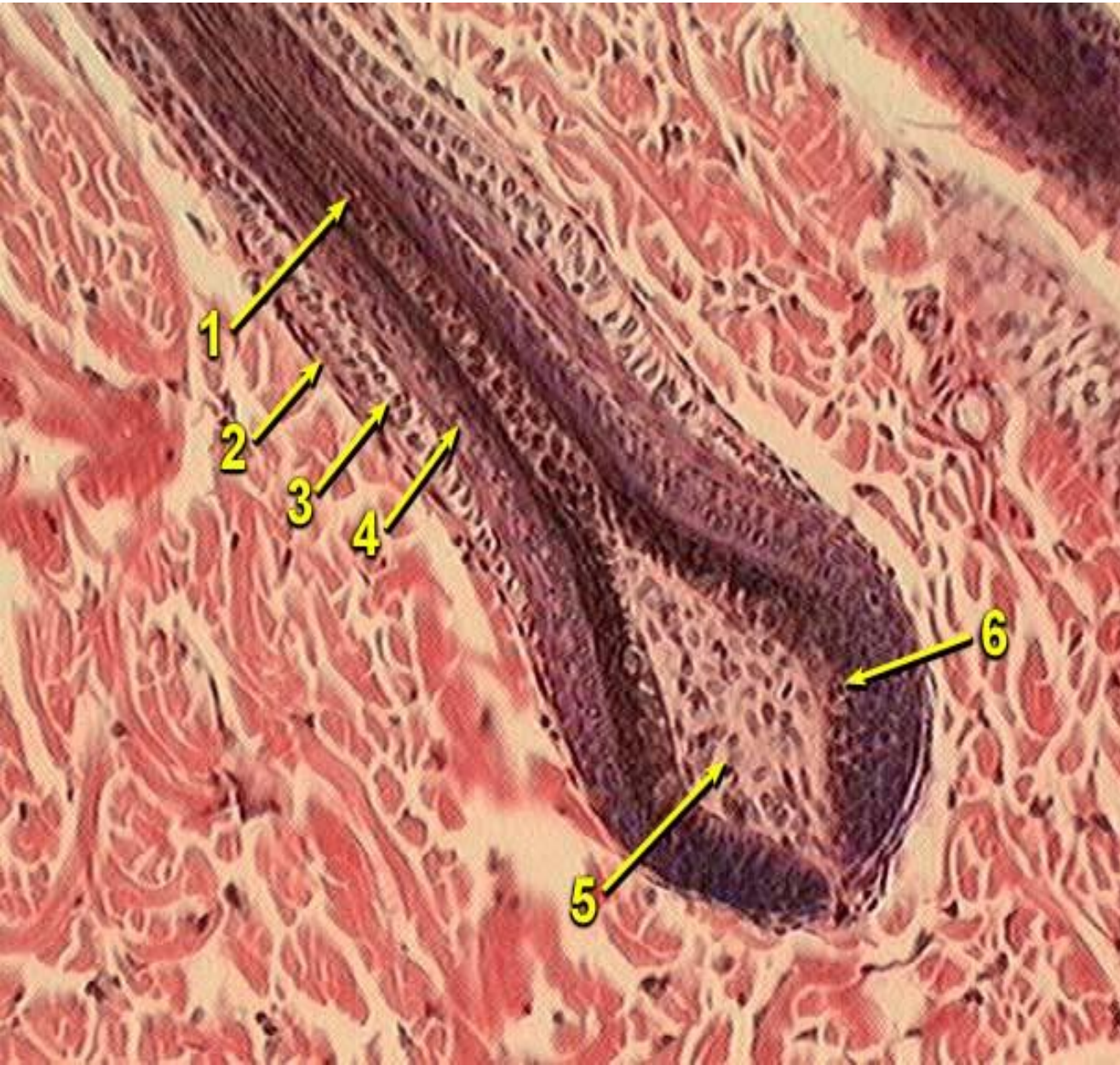


Figure 4.7c



# HAIR FOLLICLE



# Hair Anatomy

- Central medulla
- Cortex surrounds medulla
- Cuticle on outside of cortex
  - Most heavily keratinized

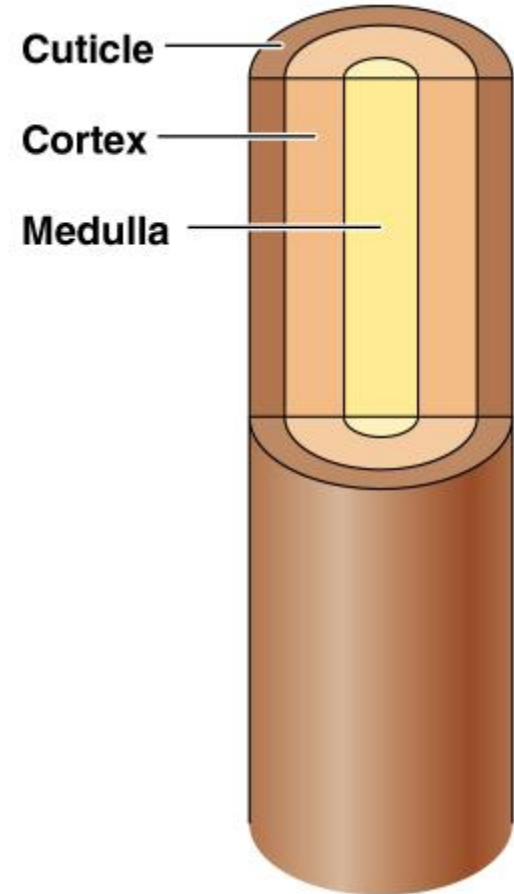
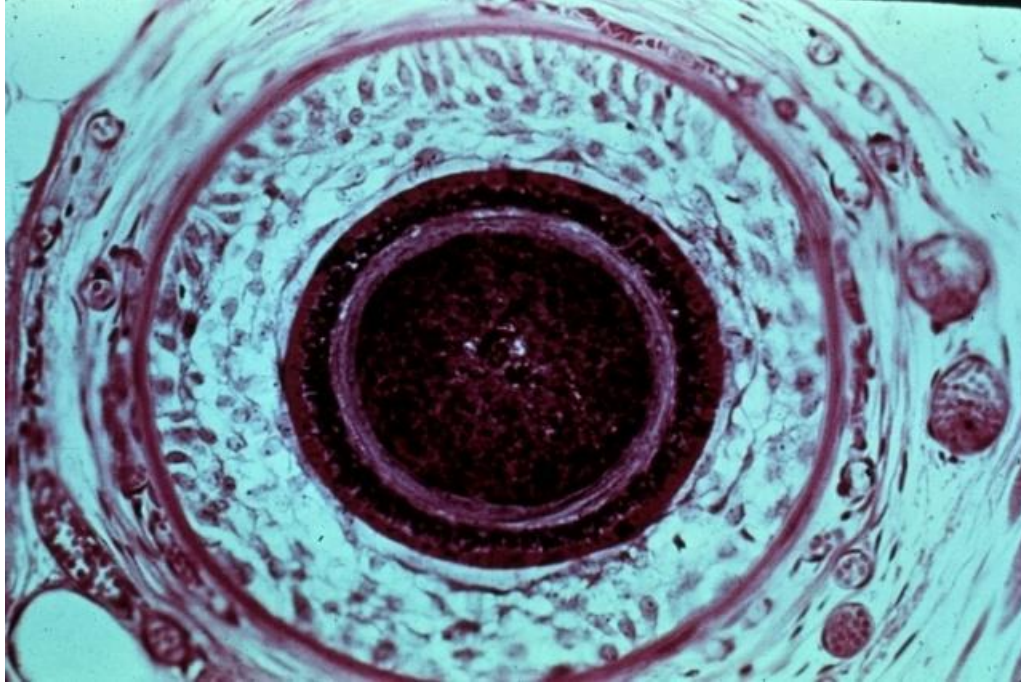


Figure 4.7b

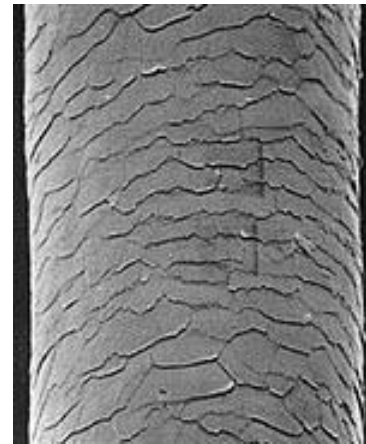
**(b) Hair**



**In this cross-section of a hair root, the dark cortex and medulla are surrounded by the interlocked cuticles, Huxley's and Henle's layers, the outer epithelial root sheath, a deeply stained basement membrane and, finally, the well-vascularized connective tissue sheath.**



Asian, Caucasian, African





# Associated Hair Structures

- Hair follicle
  - Dermal and epidermal sheath surround hair root
- Arrector pili
  - Smooth muscle
- Sebaceous gland
- Sweat gland

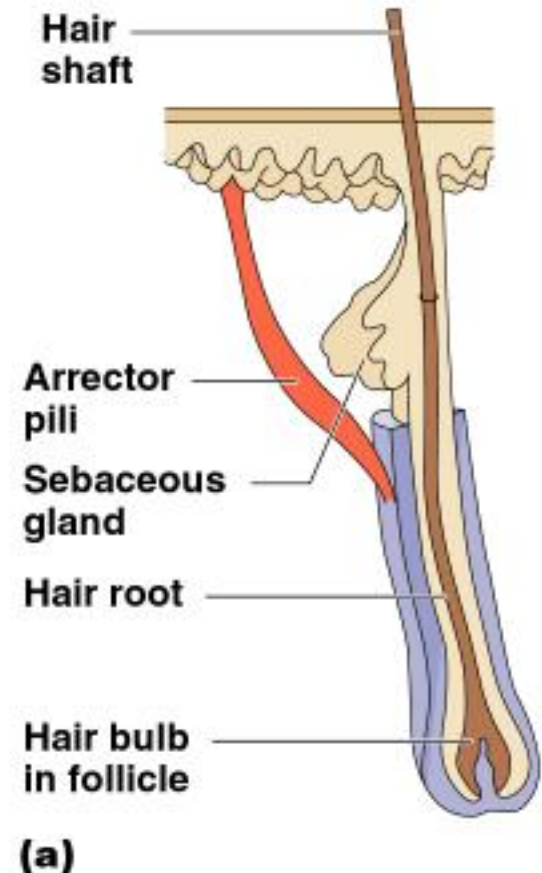


Figure 4.7a



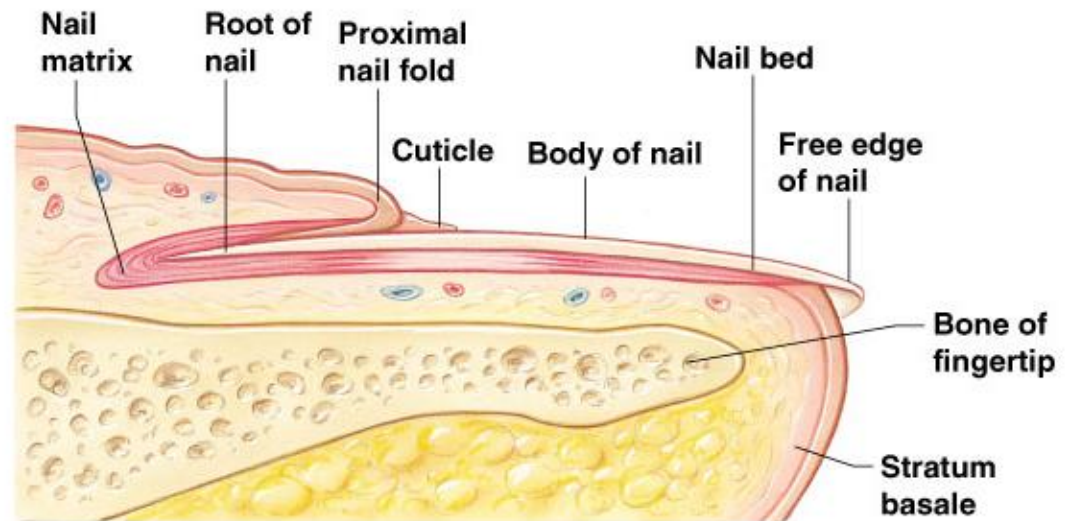
# Appendages of the Skin

- Nails
  - Scale-like modifications of the epidermis
    - Heavily keratinized
  - Stratum basale extends beneath the nail bed
    - Responsible for growth
  - Lack of pigment makes them colorless

# Nail Structures

- Free edge
- Body
- Root of nail
- Eponychium – proximal nail fold that projects onto the nail body

Figure 4.9



# Skin Homeostatic Imbalances

- Infections
  - Athletes foot
    - Caused by fungal infection
  - Boils and carbuncles
    - Caused by bacterial infection
  - Cold sores
    - Caused by virus

# Skin Homeostatic Imbalances

- Infections and allergies
  - Contact dermatitis
    - Exposures cause allergic reaction
  - Impetigo
    - Caused by bacterial infection
  - Psoriasis
    - Cause is unknown
    - Triggered by trauma, infection, stress

# Skin Homeostatic Imbalances

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

# Rules of Nines

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

# Severity of Burns

- First-degree burns

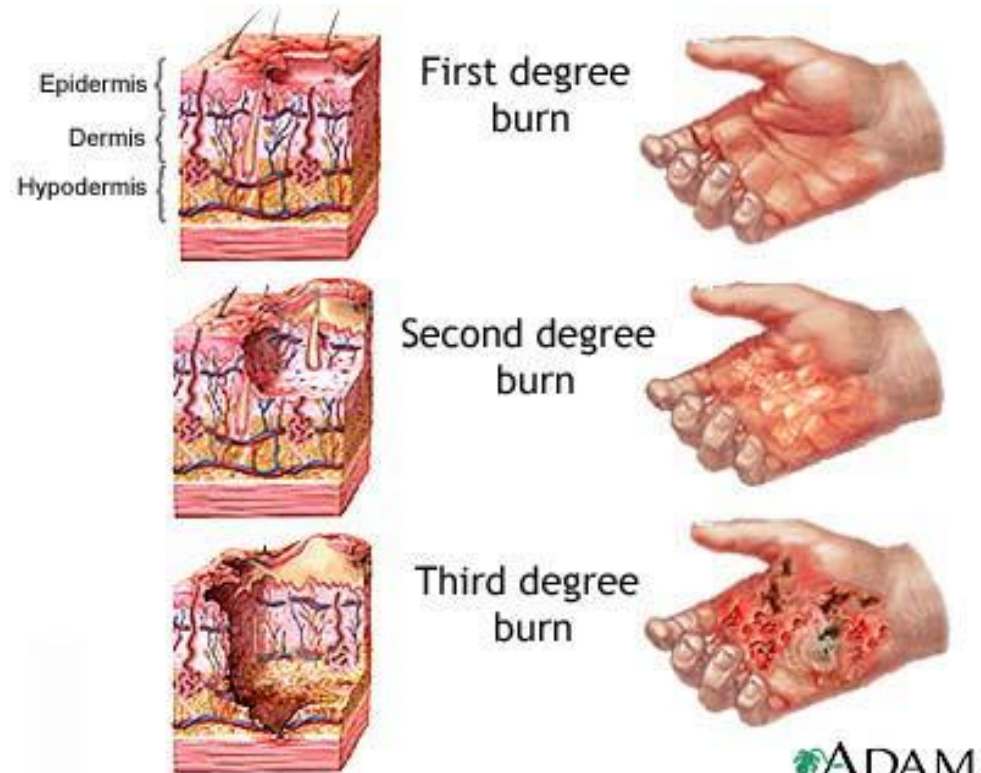
- Only epidermis is damaged
- Skin is red and swollen

- 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

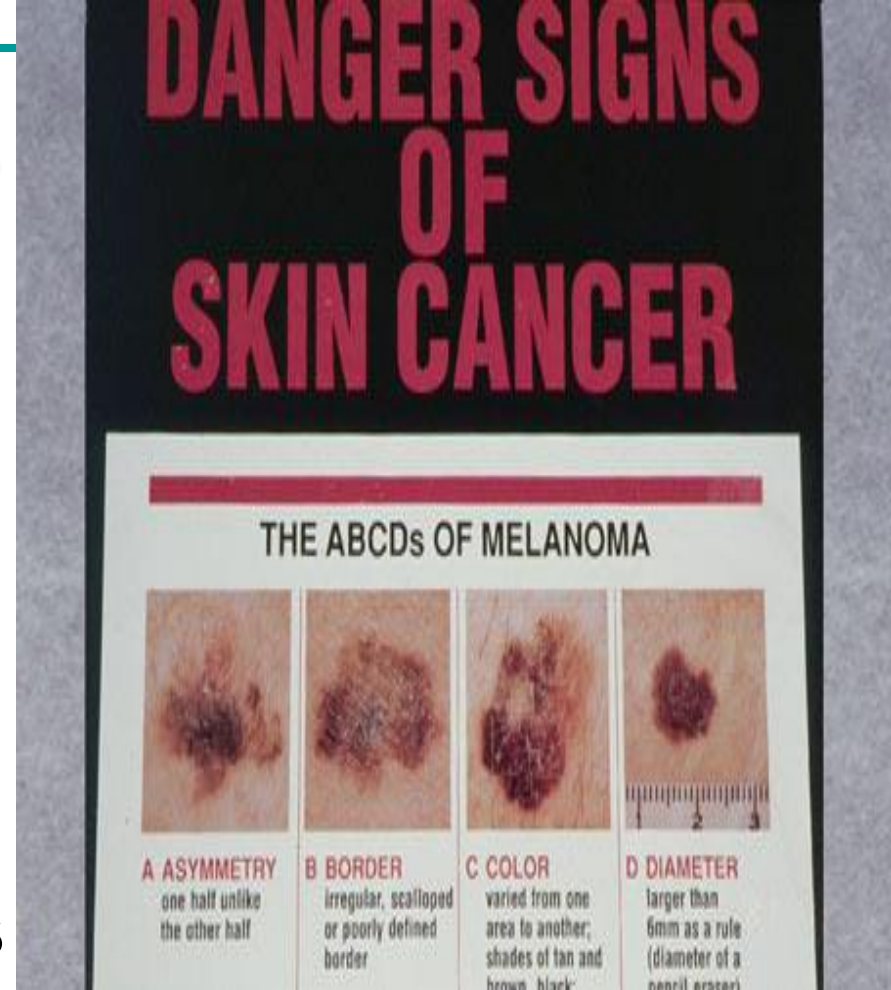
- Cancer – abnormal cell mass
- Two types
  - Benign
    - Does not spread (encapsulated)
  - Malignant
    - Metastasized (moves) to other parts of the body
- Skin cancer is the most common type of cancer

# Skin Cancer Types

- Basal cell carcinoma
  - Least malignant
  - Most common type
  - Arises from stratum basale
- Squamous cell carcinoma
  - Arises from stratum spinosum
  - Metastasizes to lymph nodes
  - Early removal allows a good chance of cure

# Skin Cancer Types

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



# 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

- <http://abcnews.go.com/Health/MedicalMysteries/story?id=5535375&page=1>
- <http://videos.howstuffworks.com/discovery/30742-one-step-beyond-hypertrichosis-video.htm>
- <http://videos.howstuffworks.com/discovery-health/39420-medical-mysteries-treeman-disease-video.htm>
- <http://videos.howstuffworks.com/discovery/30570-one-step-beyond-epidermolysis-bullosa-video.htm>