



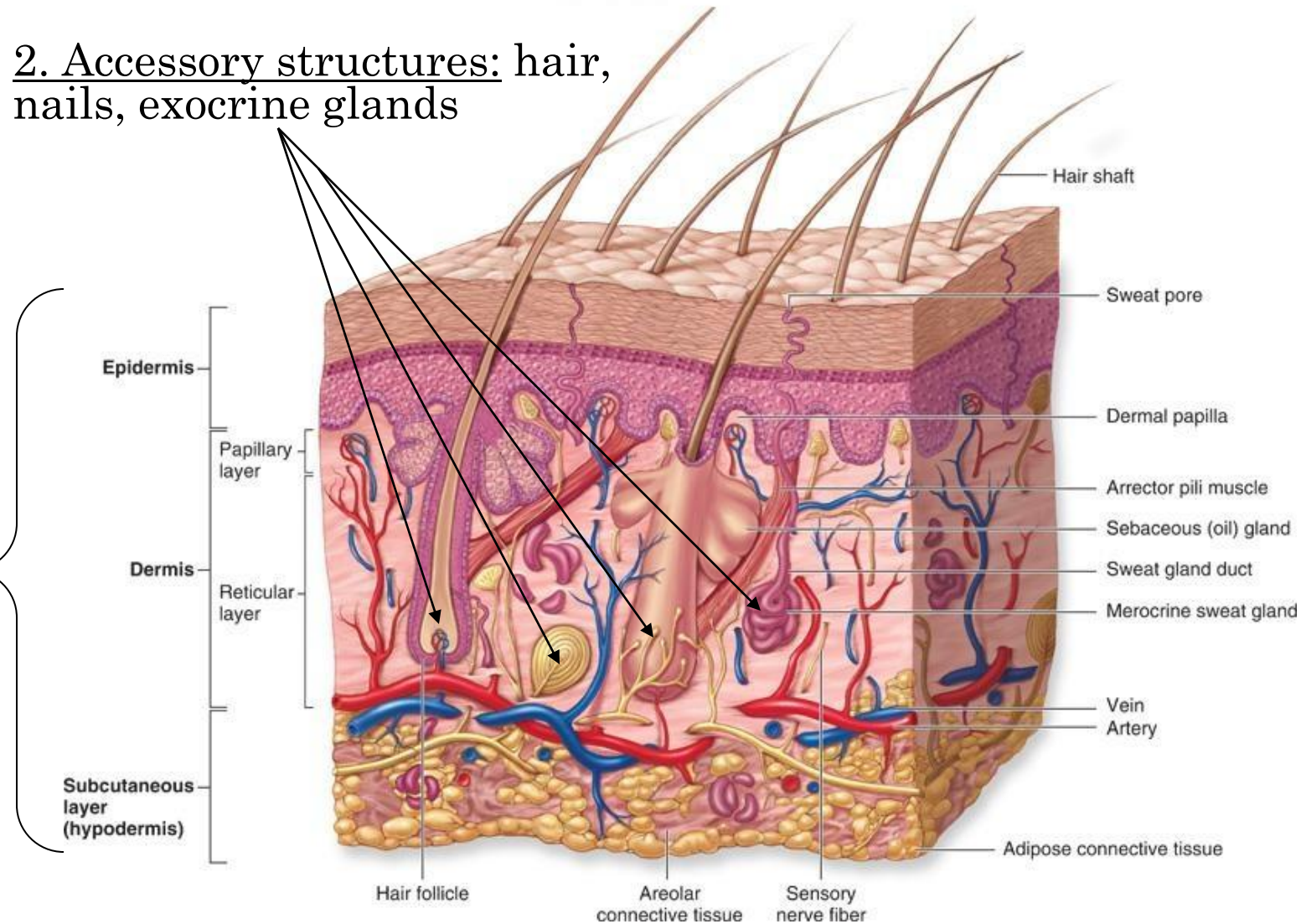
# The Integumentary System

The Skin & Its Parts

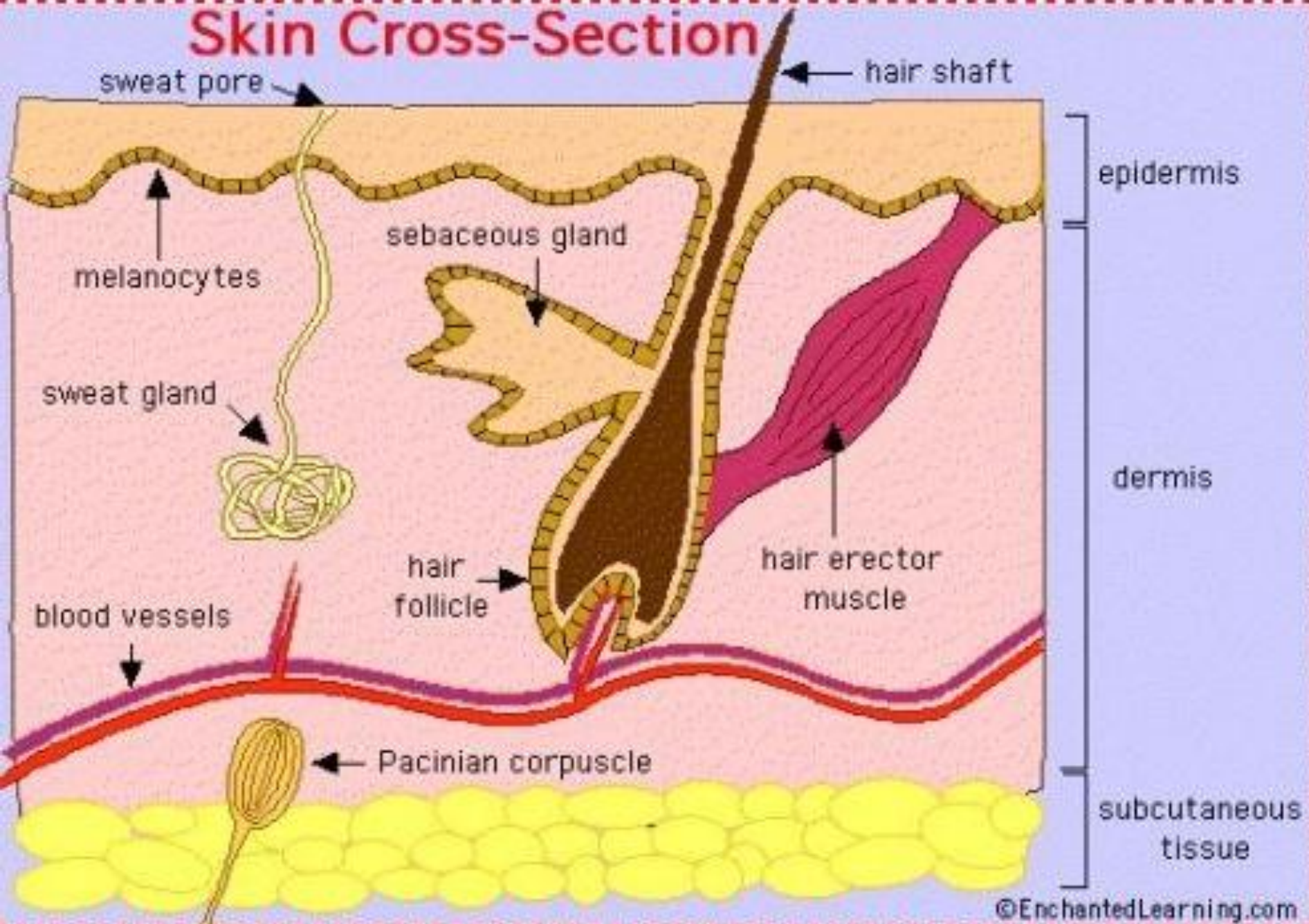
# General Structure

## 2. Accessory structures: hair, nails, exocrine glands

## 1. Cutaneous membrane: various layers



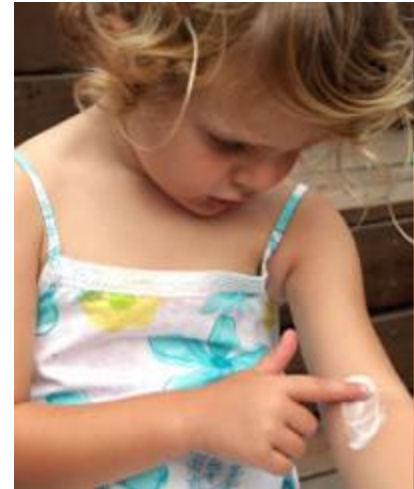
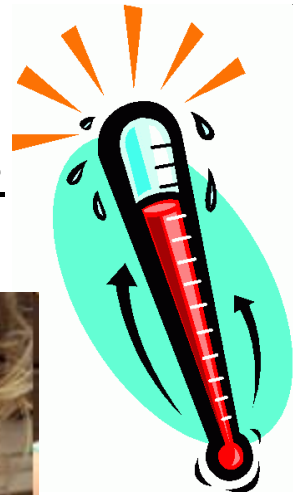
# Skin Cross-Section






# Major Functions

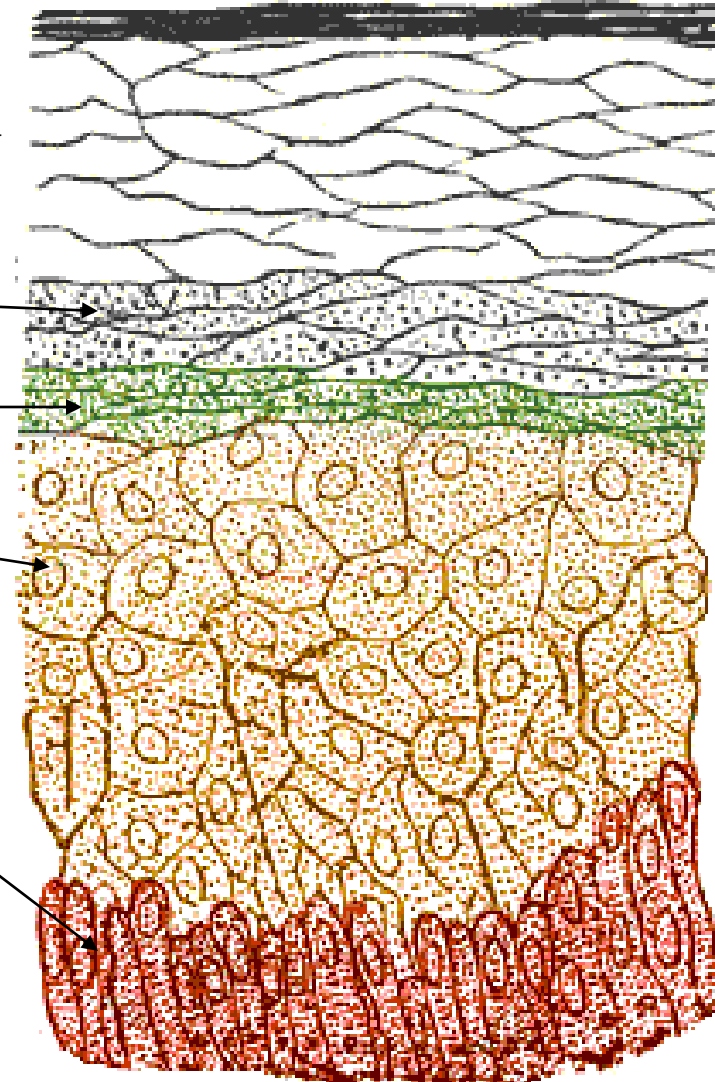
1. Protection
2. Temperature maintenance
3. Synthesis and storage of nutrients
4. Sensory reception
5. Excretion & secretion





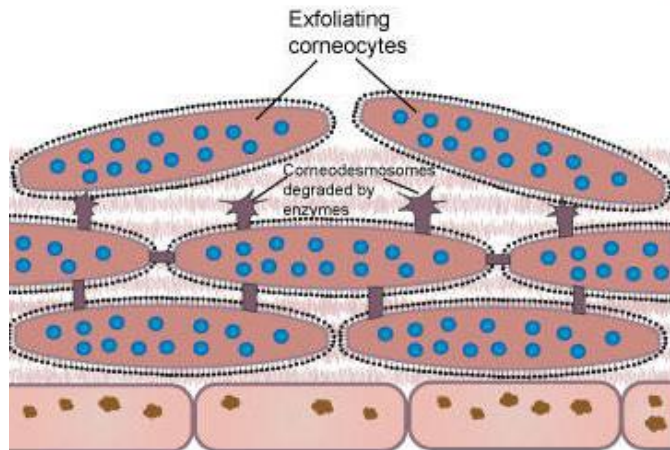
**Concept 1: The epidermis is composed of strata (layers) with various functions.**

- Stratum Corneum
- Stratum Lucidum
- Stratum Granulosum
- Stratum Spinosum
- Stratum Germinativum  
(stratum basale)



# Epidermis: Stratum Corneum

- Contains keratin which protects from heat damage, UV radiation, & water loss
- Composed mostly of dead skin cells
- Desquamation: shedding



# Epidermis: Stratum Lucidum

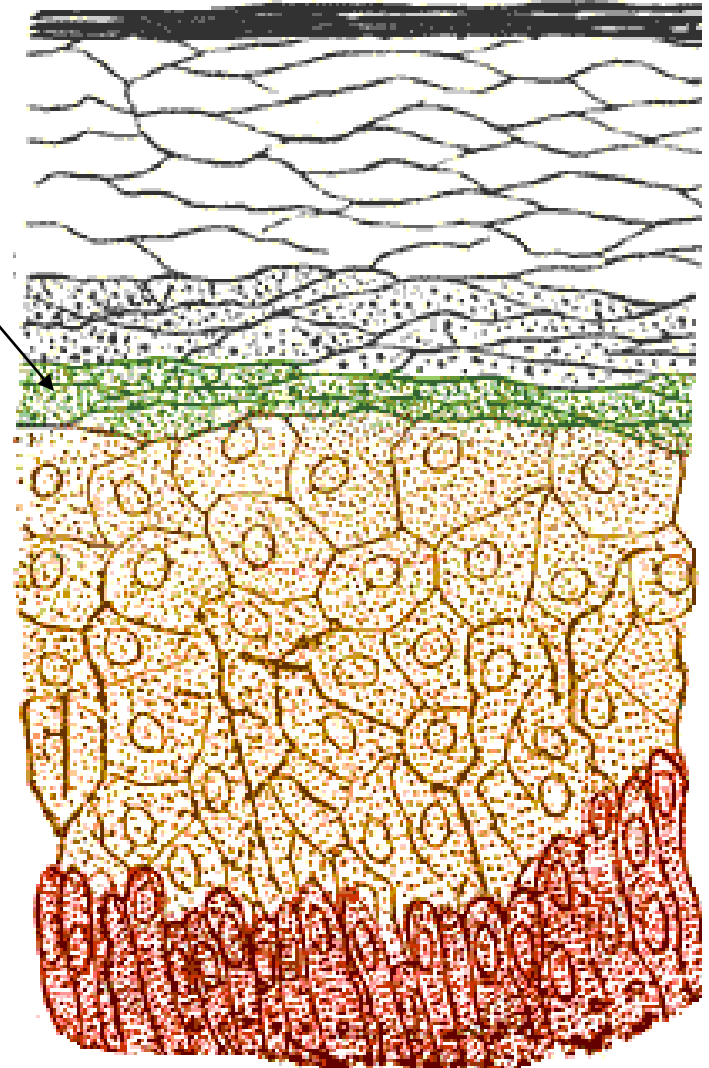
- Forms a breakable layer
  - reduces friction between the layer above & below it
- Found only in areas of thick skin
  - palms of hands, soles of feet





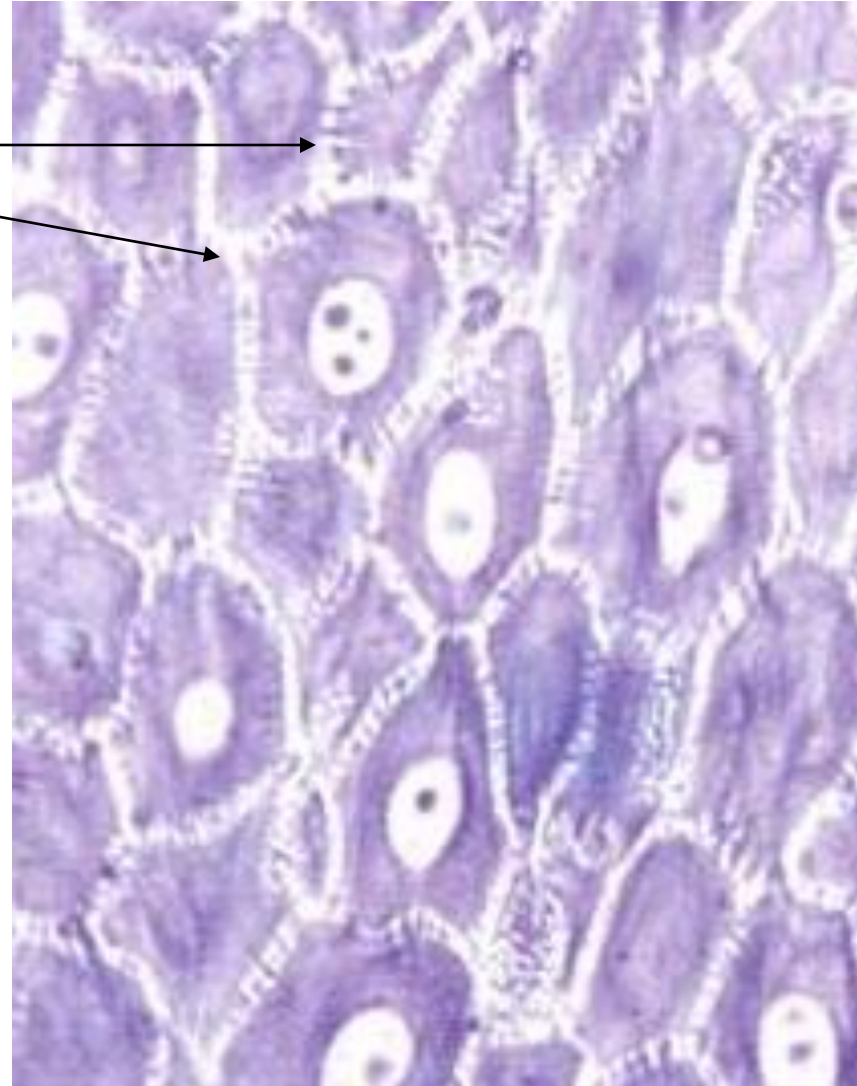
# Epidermis: Stratum Granulosum

- Middle layer of the *epidermis*
- Creates a waterproof barrier between outer and inner layers of the epidermis



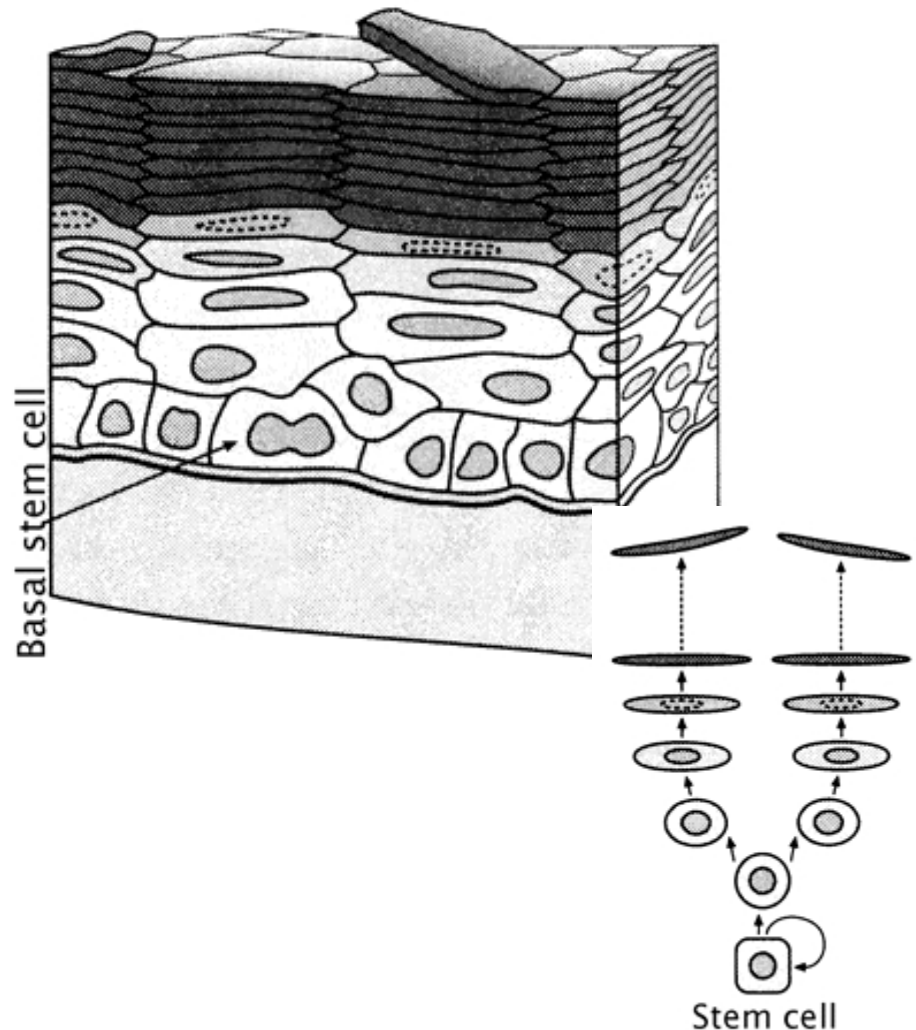
# Epidermis: Stratum Spinosum

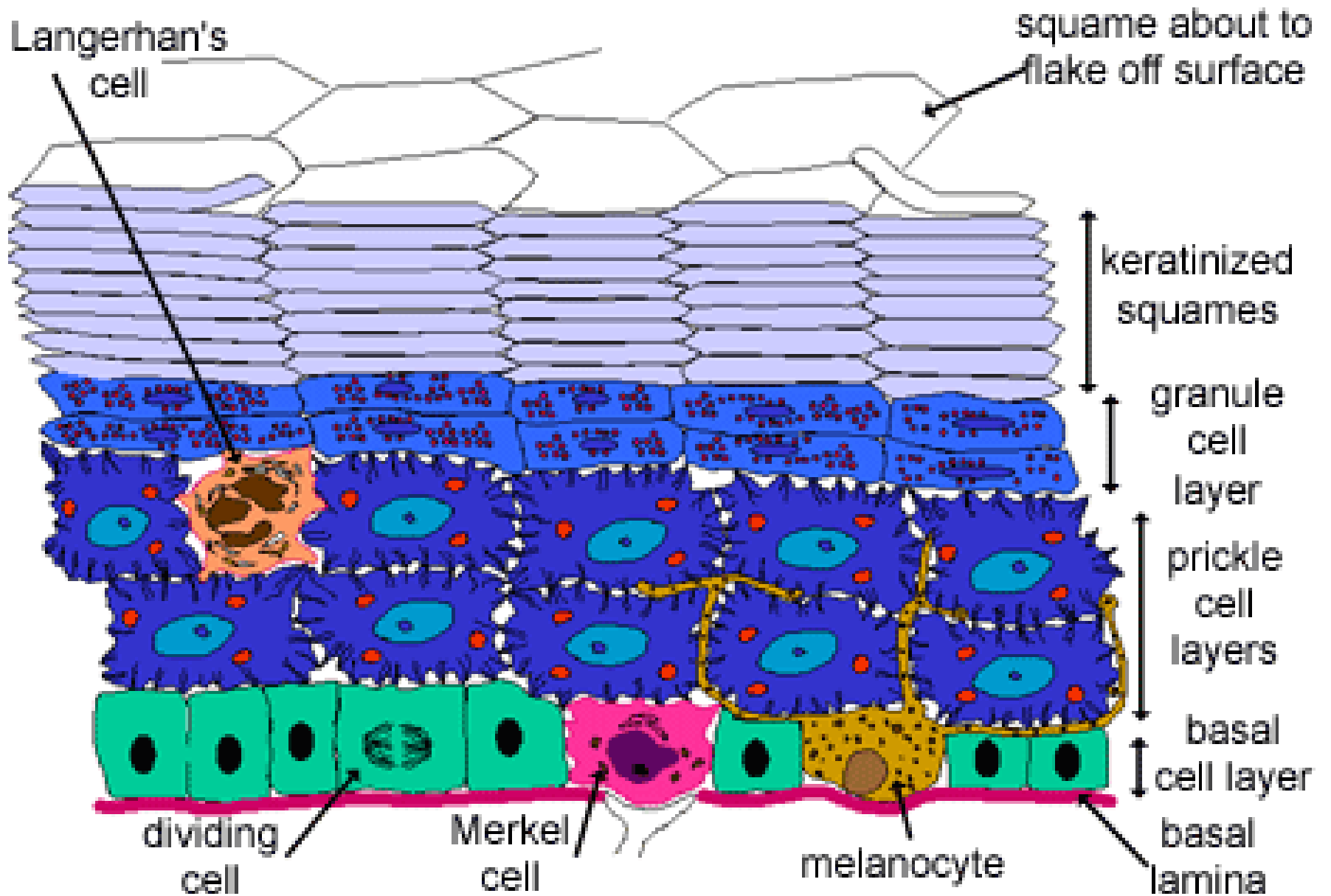
- “prickly layer” because of cell junctions
- where keratinization begins
- also contain Langerhans cells that help in fighting skin infections & healing



# Epidermis: Stratum Germinativum

- Also known as stratum basale
- Deepest layer of the epidermis
- Responsible for generating the layers above it. (cuboidal → squamous)





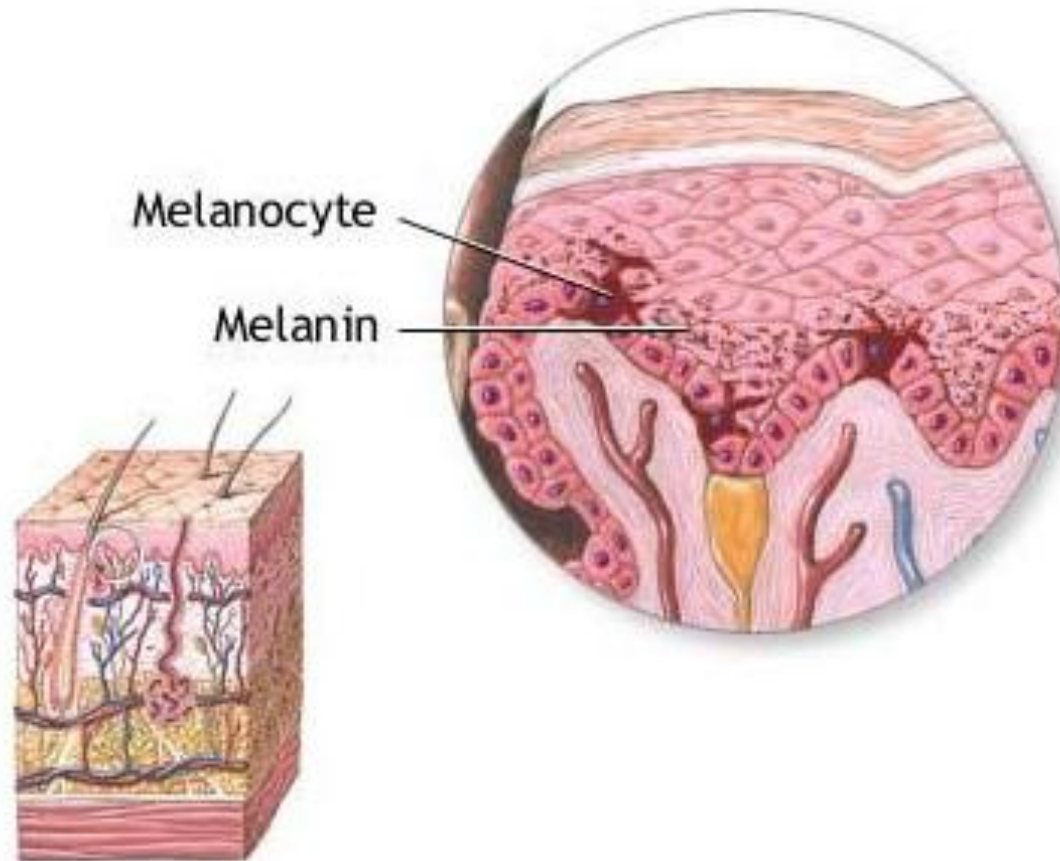


**Concept 2: Factors influencing  
skin color are epidermal  
pigmentation and dermal  
circulation**



# Pigmentation

- Epidermis contains 2 kinds of pigments



# Pigmentation

- Epidermis contains 2 kinds of pigments
  - Carotene: orange-yellow pigment
    - can be converted into vitamin A (necessary epithelial maintenance & making photoreceptor pigments in the eye)



# Pigmentation

- Epidermis contains 2 kinds of pigments
  - Melanin: brown, yellow-brown, or black
    - Produced by melanocytes
    - Prevents skin damage by absorbing UV radiation
  - Albinism is a genetic condition where the melanocytes do not produce melanin









**Why can our skin turn red?**

# Dermal Circulation

- Blood vessels in the dermis give the skin a reddish tint
  - If they become dilated (open up), the red tones are more apparent
  - For example, an increase in body temperature will open the blood vessels in order to lose heat





**Concept 3: Sunlight has  
detrimental and beneficial effects  
on the skin**

# Vitamin D<sub>3</sub>

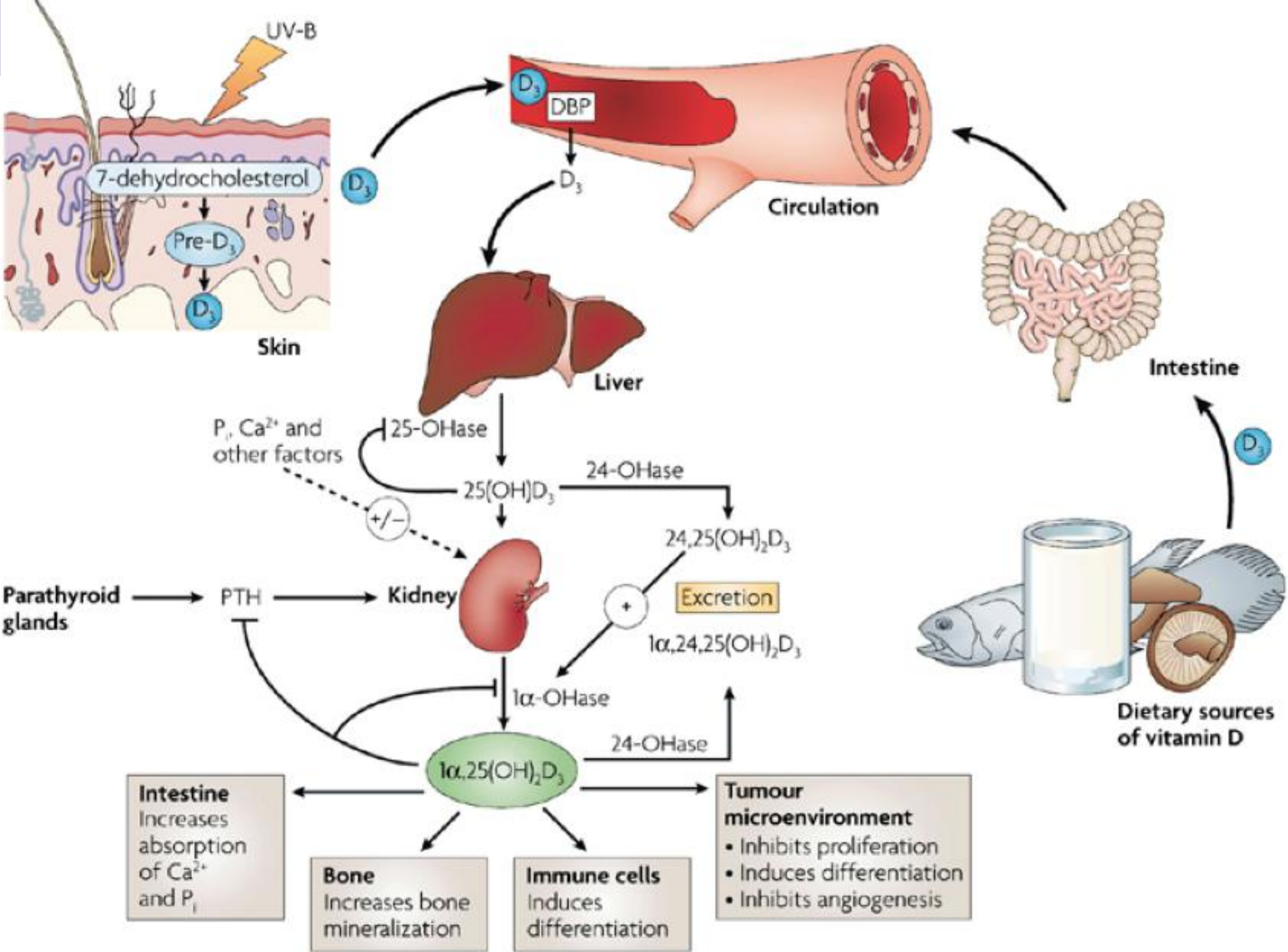
- When exposed to UV radiation, epidermal cells in the stratum spinosum and stratum germinativum convert a cholesterol-related steroid into vitamin D<sub>3</sub>.
- It is then absorbed, modified, and released by the liver

# Vitamin D<sub>3</sub>

- Converted into calcitrol by the kidneys
  - Calcitrol: hormone essential for calcium & phosphorous absorption in the small intestine
    - Inadequate supply of vitamin D<sub>3</sub> can lead to rickets (weak & flexible bones)







# Skin Cancers

- Too much sun exposure can lead to skin cancer!
- Benign: usually harmless; tumors can be surgically removed
  - Basal Cell Carcinoma: most common form of skin cancer
  - Squamous Cell Carcinoma: involves superficial layers

Basal cell carcinoma

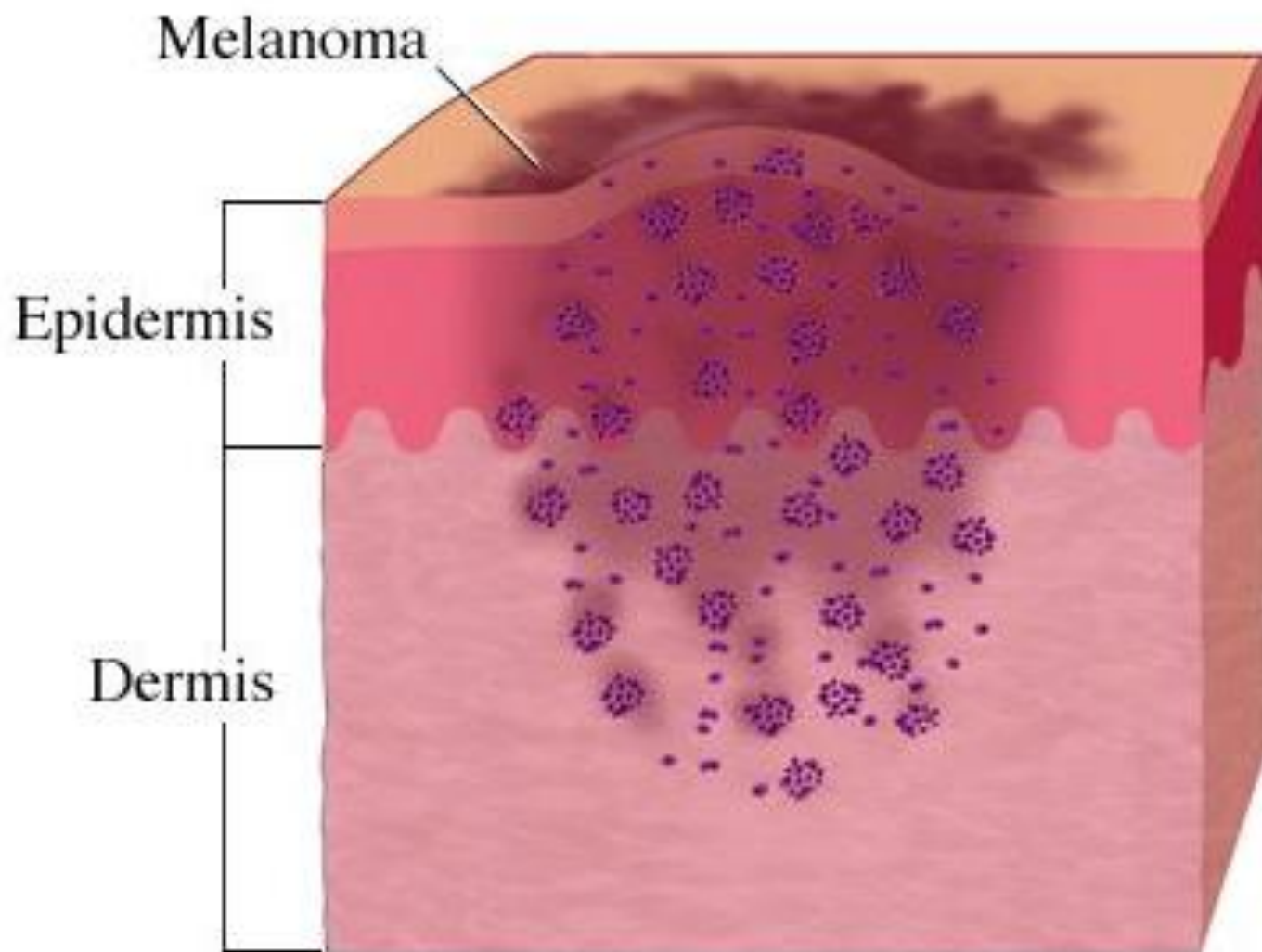


Squamous cell carcinoma



# Skin Cancers

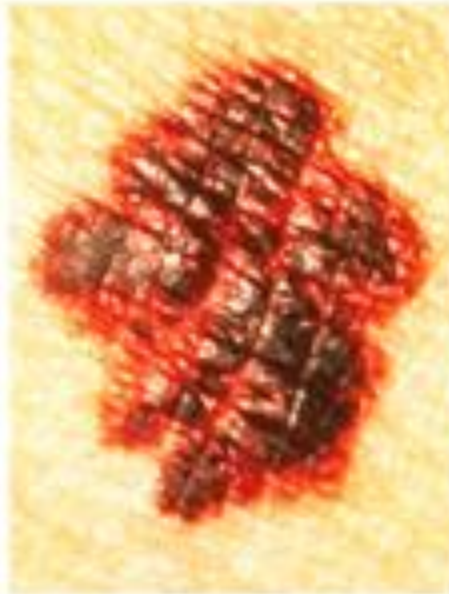
- Life-threatening
  - Malignant Melanoma: cancerous melanocytes grow rapidly and can invade other parts of the body
- Prevention: sunblock, less sun exposure during the middle of the day (10am-2pm)







Asymmetry



Border  
irregularity

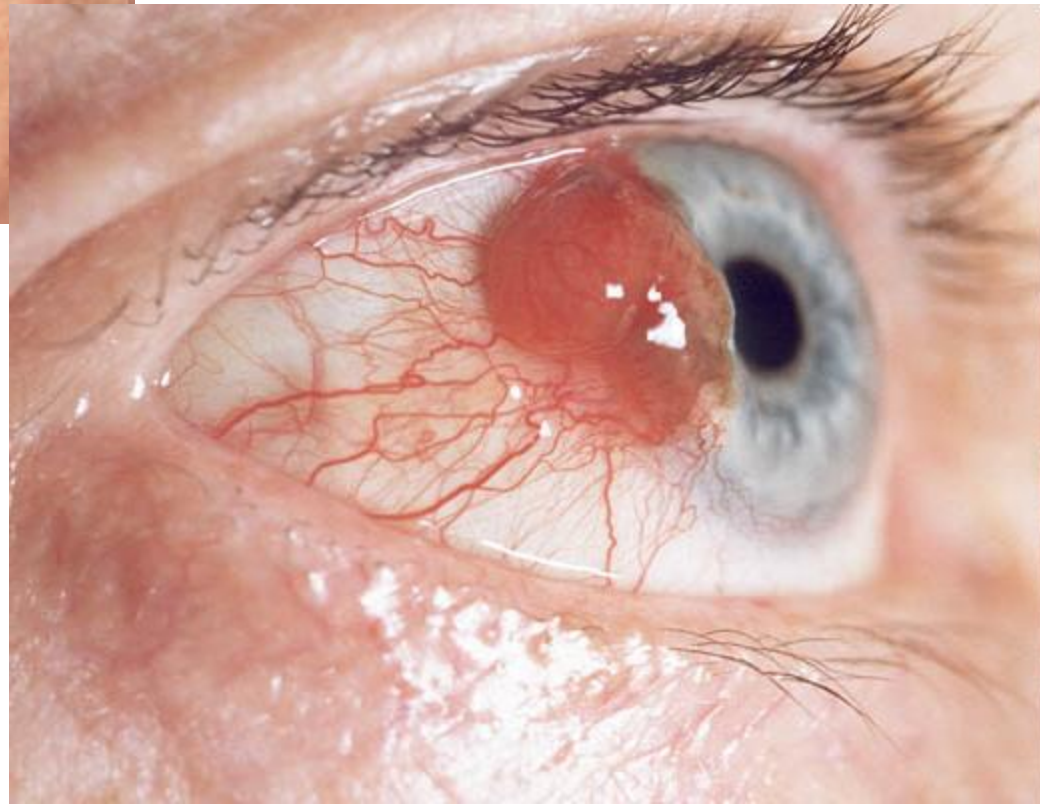


Color



Diameter:  
 $\frac{1}{4}$  inch or  
6mm














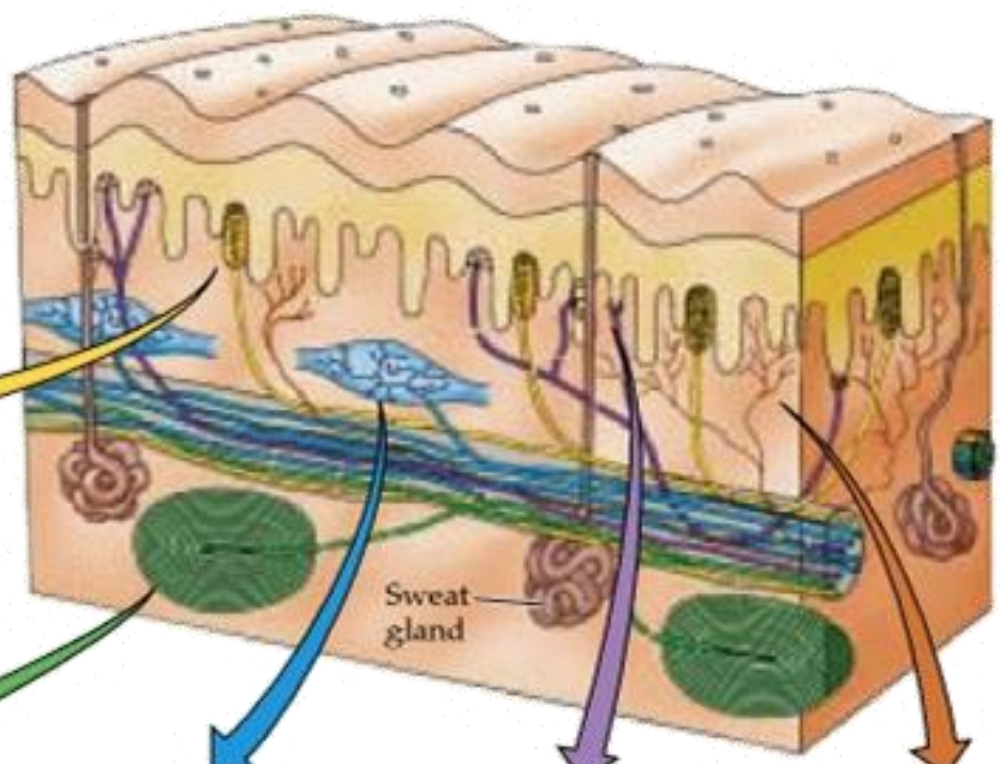
**Concept 4: The dermis is the tissue layer that supports the epidermis**

# Dermis

- Has two major components

- Papillary Layer

- consists of loose connective tissue
    - Contains the capillaries and nerves supplying the surface of the skin
    - Blood vessels: provide nutrients & oxygen and remove carbon dioxide and waste products
    - Nerve fibers: control blood flow, adjust gland secretion rates & sensory reception
      - Sensory provides info on touch, pain, pressure, and temperature

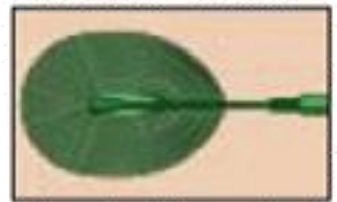


Epidermis

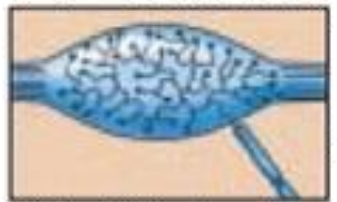
Dermis



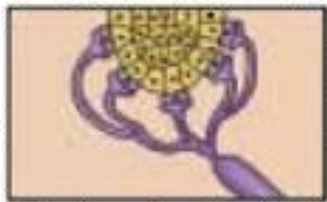
Meissner corpuscle



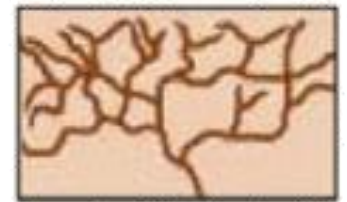
Pacinian corpuscle



Ruffini's corpuscles




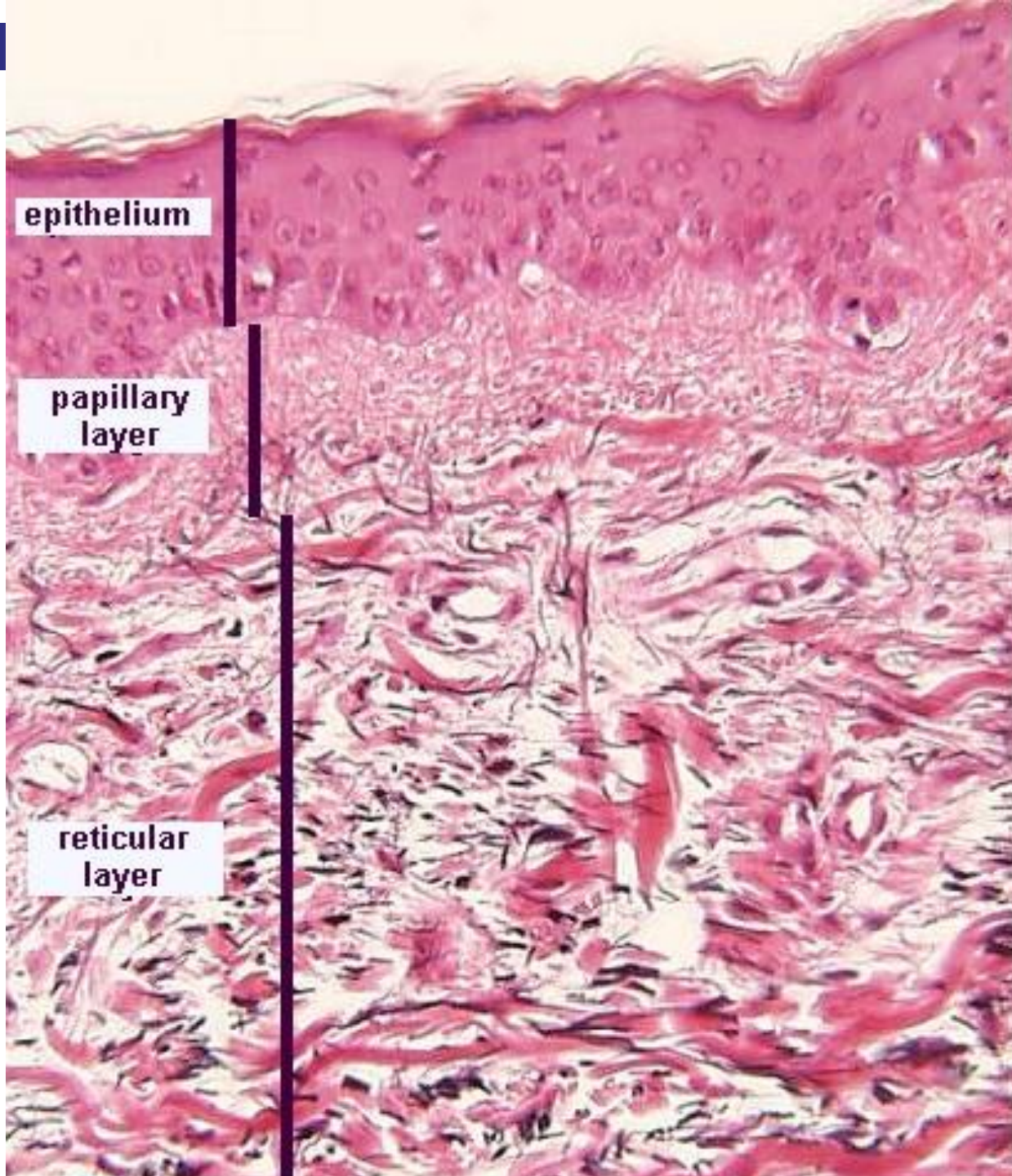
Merkel's disks



Free nerve endings



- 
- Nerve fibers: control blood flow, adjust gland secretion rates & sensory reception
    - Sensory provides info on touch, pain, pressure, and temperature
    - Pacinian corpuscle detects vibrations
    - Meissner's corpuscle detects light touch
    - Merkel disks detects deep pressure touch
    - Ruffini corpuscles detects stretching



epithelium

papillary  
layer

reticular  
layer

# Dermis

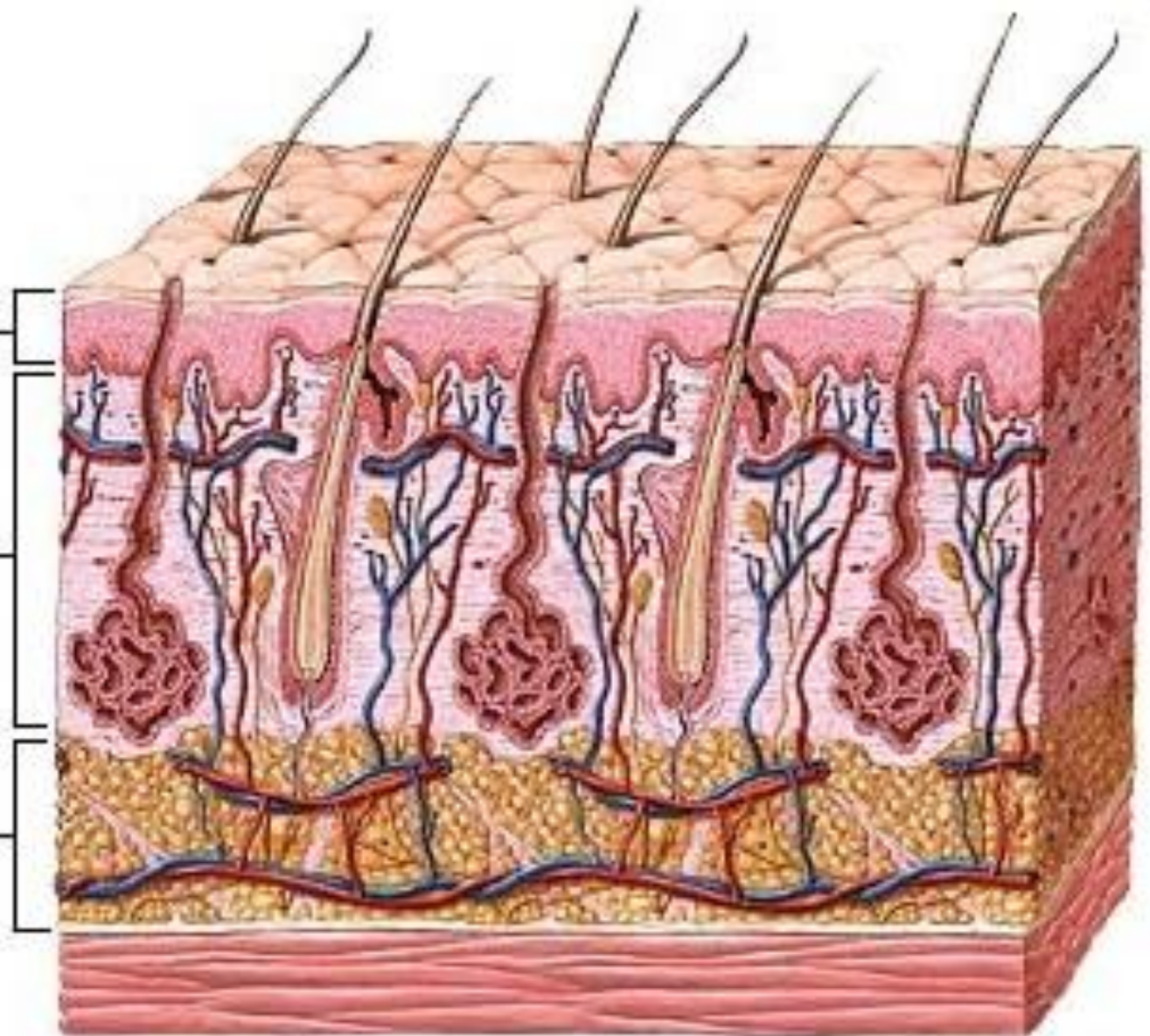
- Has two major components
  - Reticular Layer
    - Mixture of dense, irregular connective tissue
    - Contain elastic & collagen fibers
      - Elastic fibers provide flexibility, and the collagen fibers limit that flexibility to prevent damage to the tissue
    - Accessory organs like hair follicles, sweat glands and sebaceous glands are located here.



Epidermis

Dermis

Hypodermis

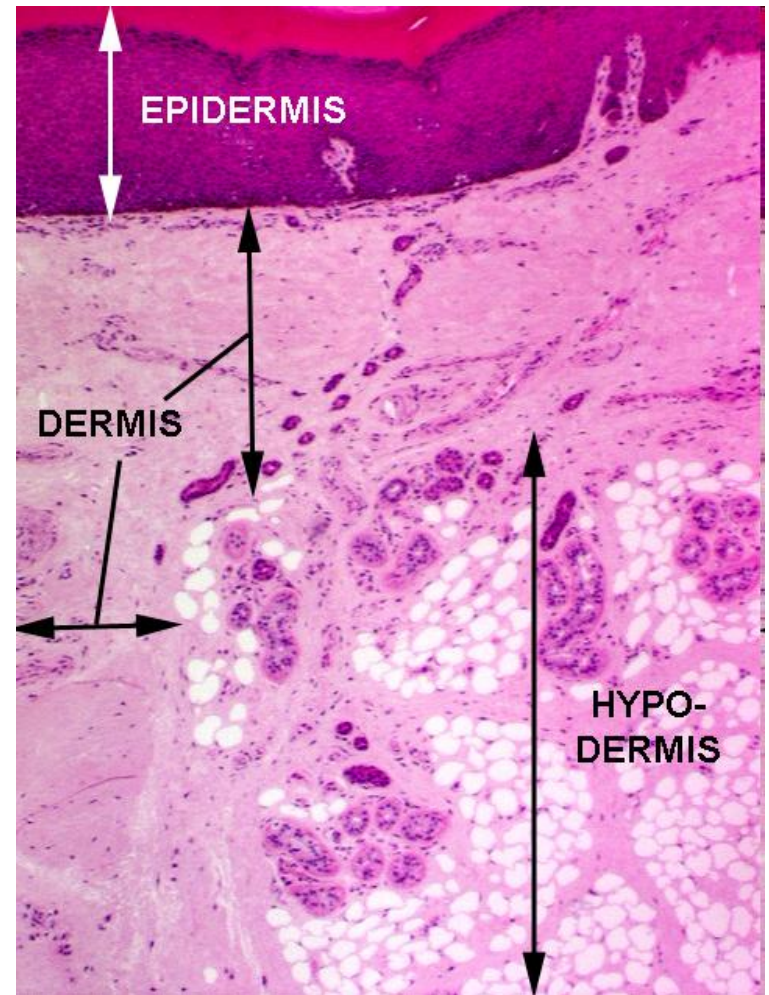




**Concept 5: The hypodermis is tissue that connects the dermis to underlying tissues**

# Hypodermis

- Function: stabilizes the position of the skin relative to skeletal muscles or other organs
- Consists of:
  - loose connective tissue





- Fat cells: energy reserve, shock absorber
  - Changes as we develop from infant to adult



- Lacks vital organs: this is why administering drugs with a hypodermic needle is useful!

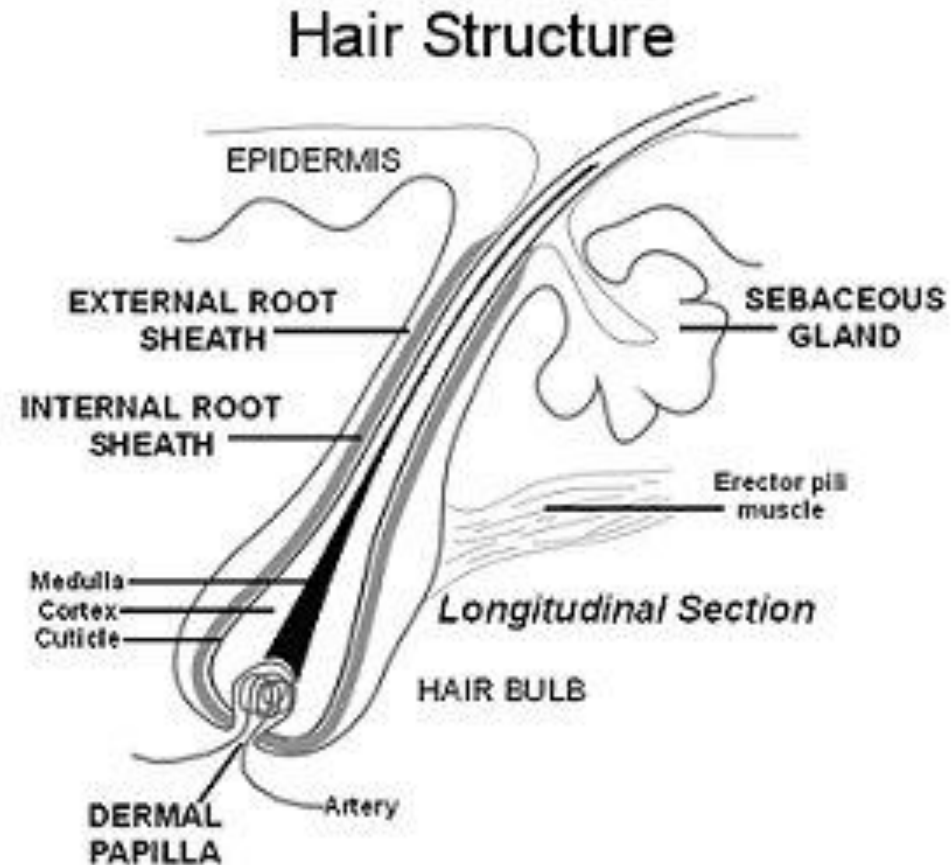




**Concept 6: Hair is composed of keratinized dead cells that have been pushed to the surface**

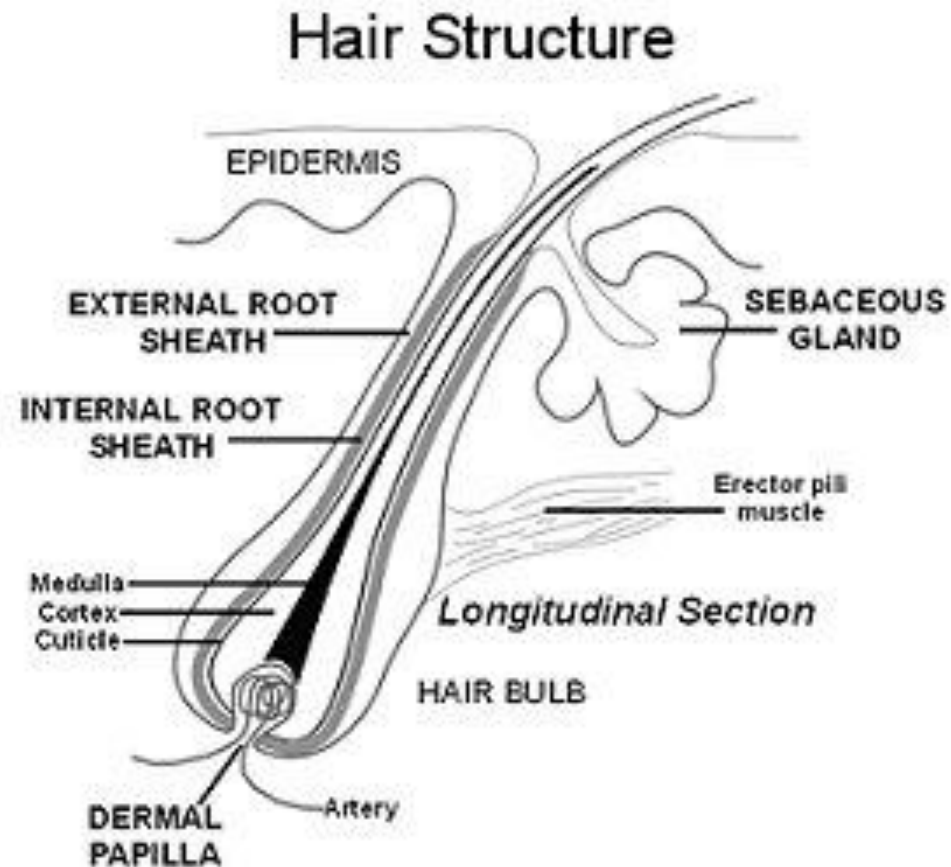
# Structure of Hair

- Hair is formed by mitosis; each new cell pushing the old ones up to the surface
- Hair/dermal papilla: a peg of connective tissue containing capillaries and nerves



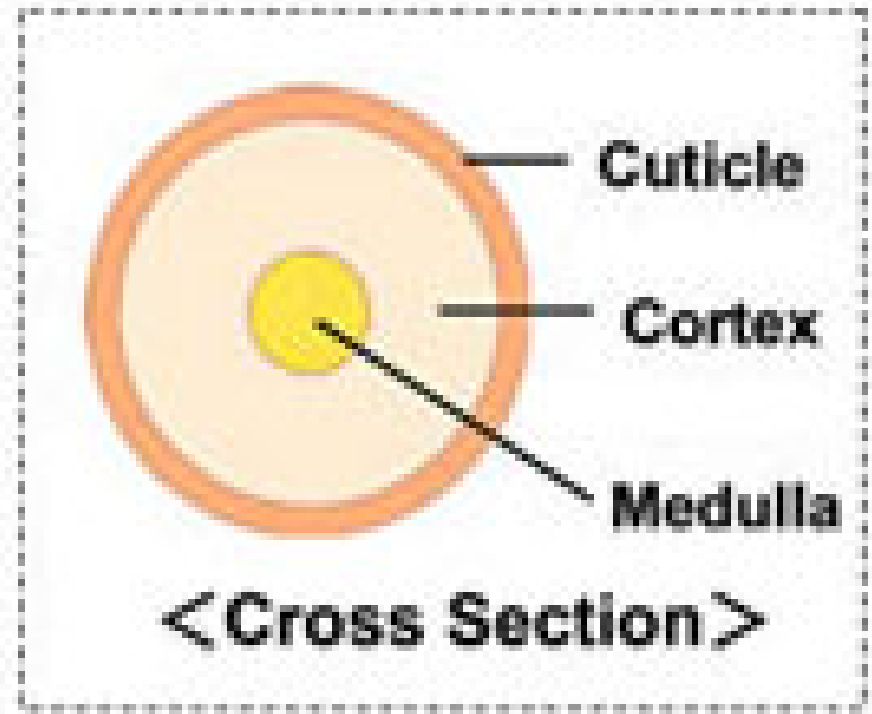
# Structure of Hair

- Hair Root: anchors the hair into the skin
- Hair shaft: the part we see on the surface of skin, and has 3 layers



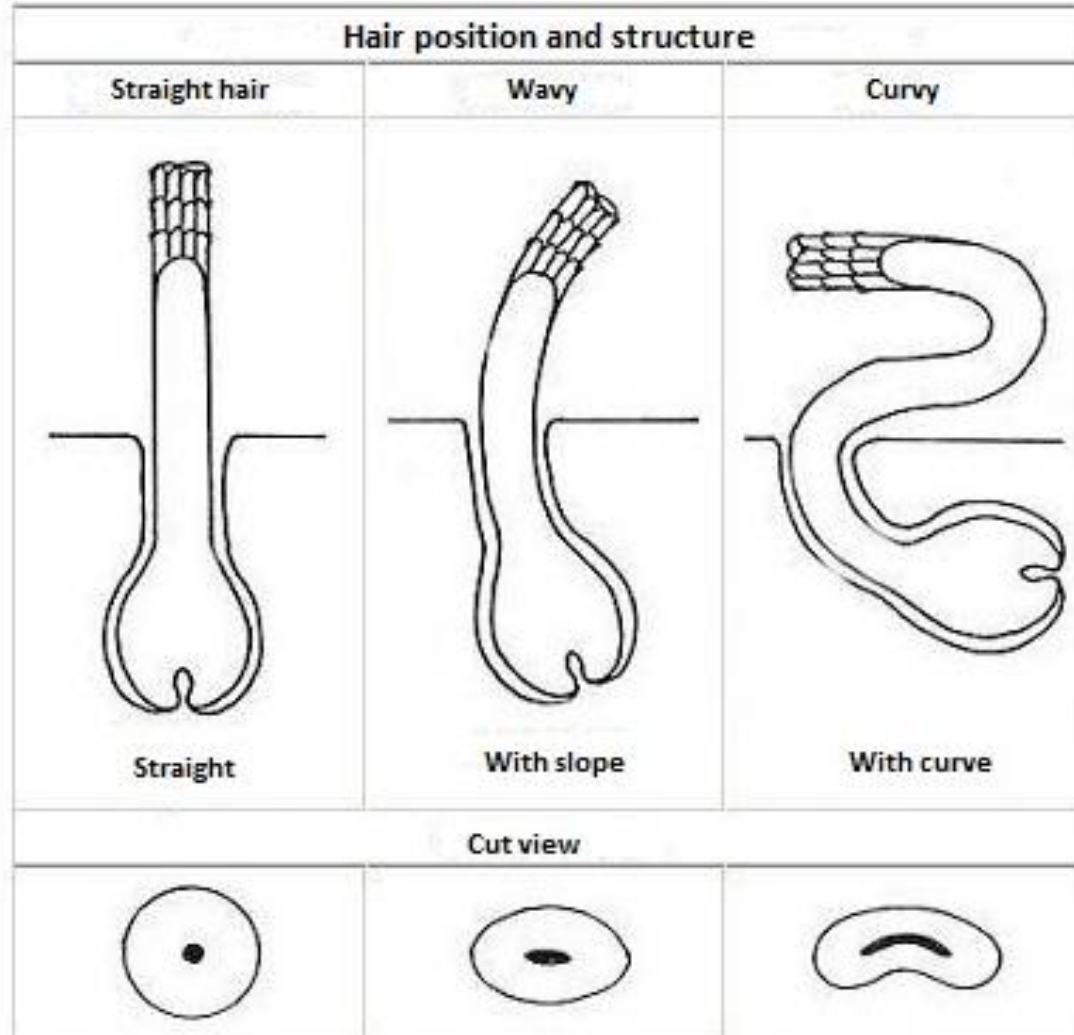
# Structure of Hair

- Hair shaft
  - Cuticle: surface layer; overlapping keratin cells
  - Cortex: contains pigment; retains moisture
  - Medulla: makes up the core; contains soft keratin





- Different hair textures depend on the position of the hair follicles



# Functions of Hair

Protect the head

- Protection from UV light
- Help cushion a light blow to the head
- Provide insulating benefits for the skull



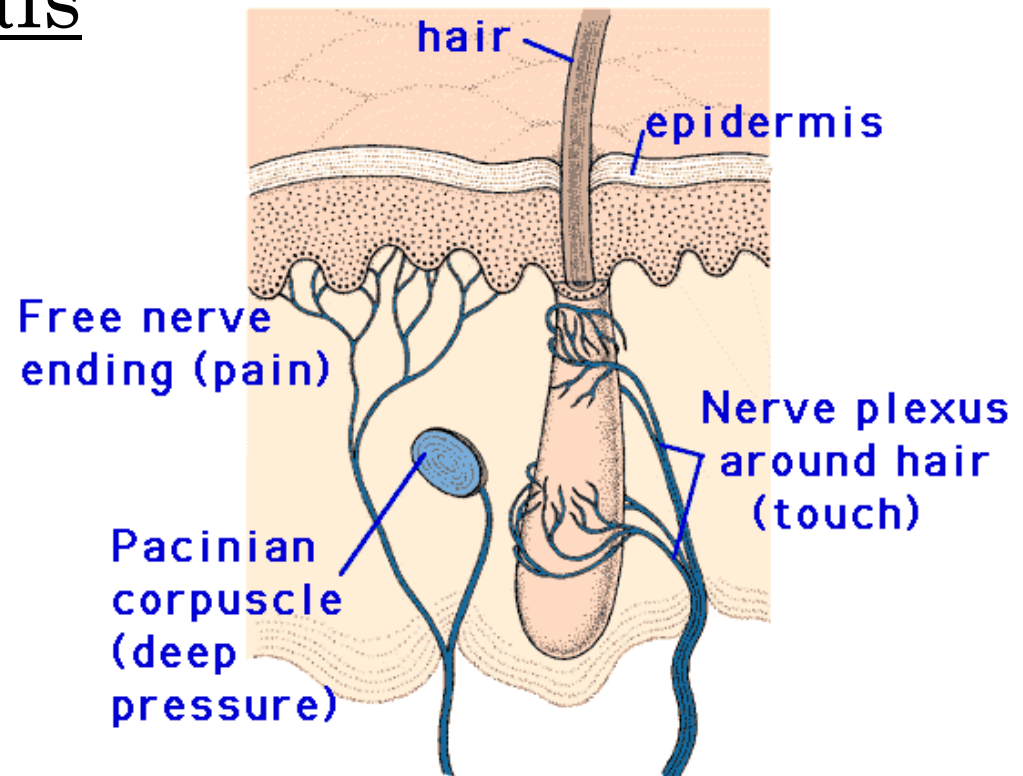
# Functions of Hair

- Prevent entry of foreign particles into the nose, ear, and eyes



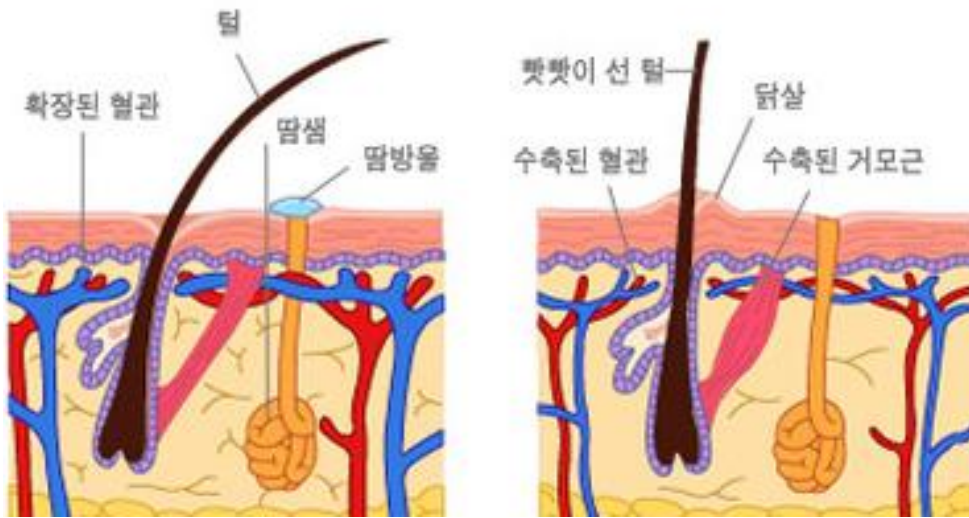
# Functions of Hair

- Attached to nerves that can provide warning signals




# Functions of Hair

- The arrector pili muscle pulls on the follicle, forcing the hair to stand up
  - can be caused by:
    - emotional states
    - response to cold → goosebumps



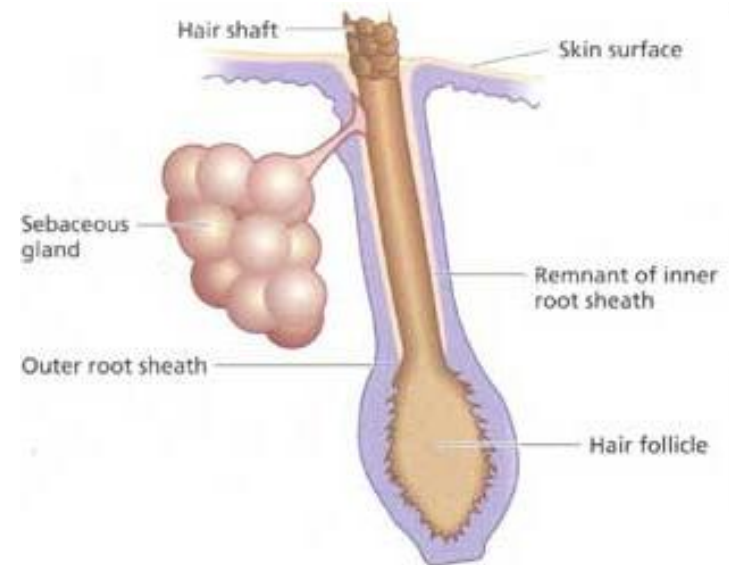




**Concept 7: Sebaceous glands and sweat glands are exocrine glands found in the skin**

# Sebaceous (oil) Glands

- Discharges an oily lipid secretion called sebum into hair follicles, or onto the skin sometimes
  - lubricates the hair and skin and inhibits the growth of bacteria

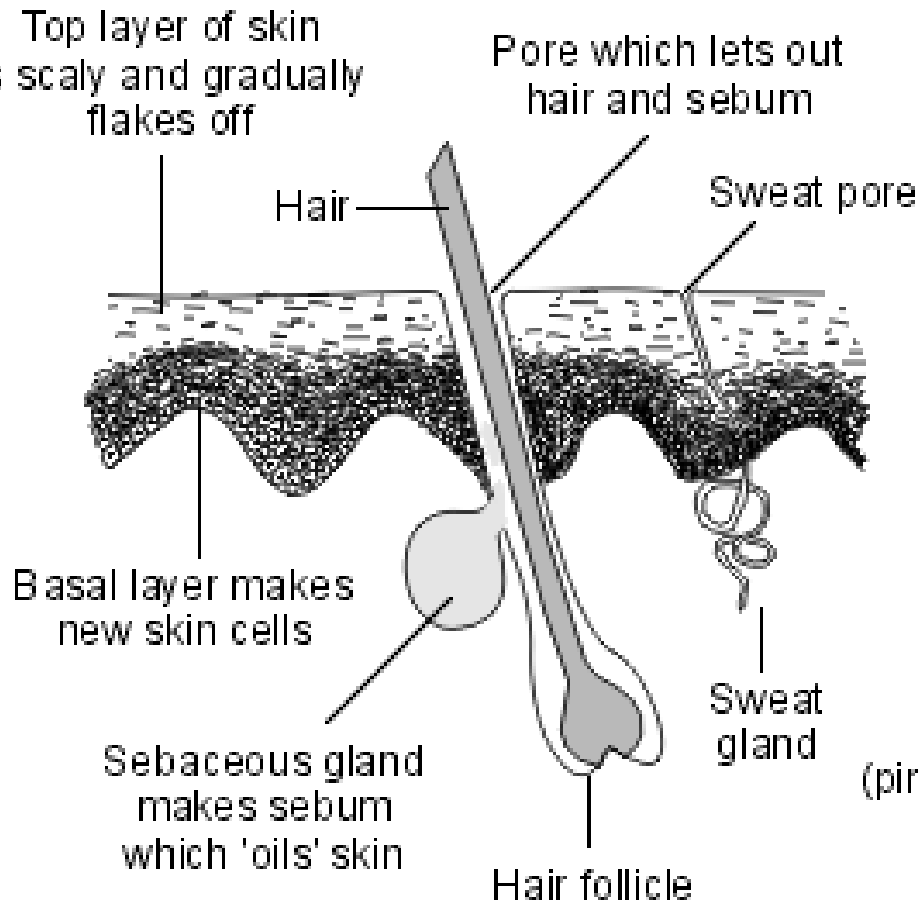


# Sebaceous (oil) Glands

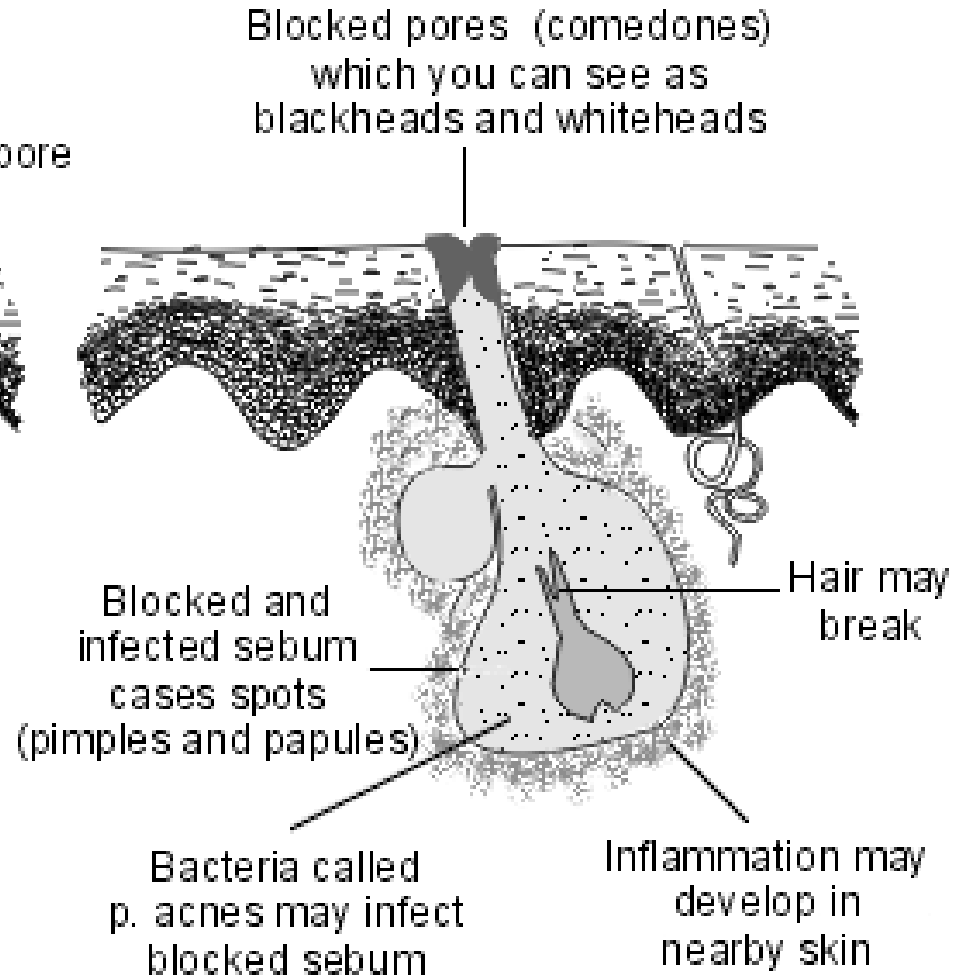
- Sensitive to changes in the concentration of sex hormones
  - increased activity during puberty → acne!



## Normal skin - cross section



## Skin with acne



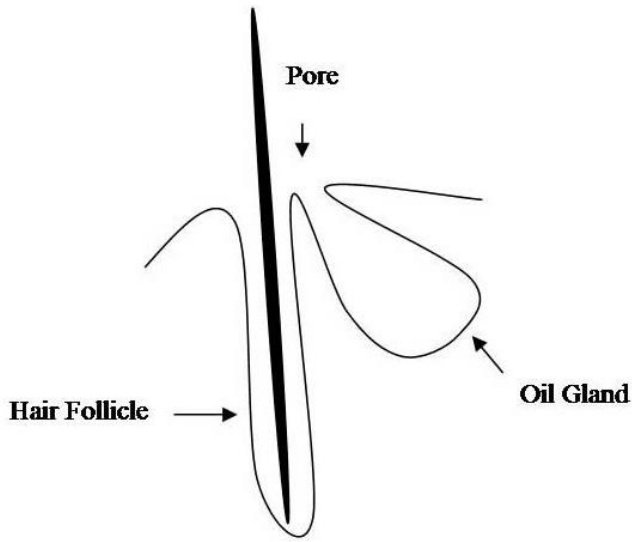
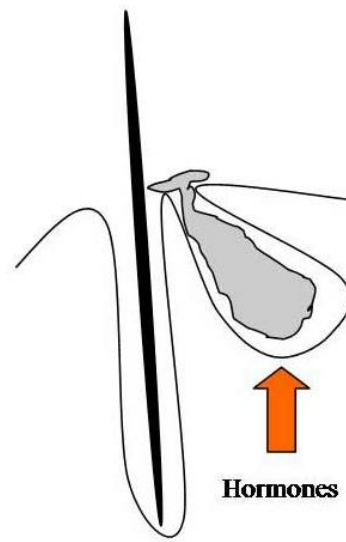
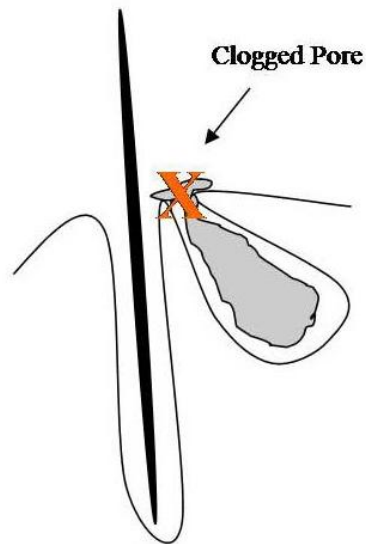


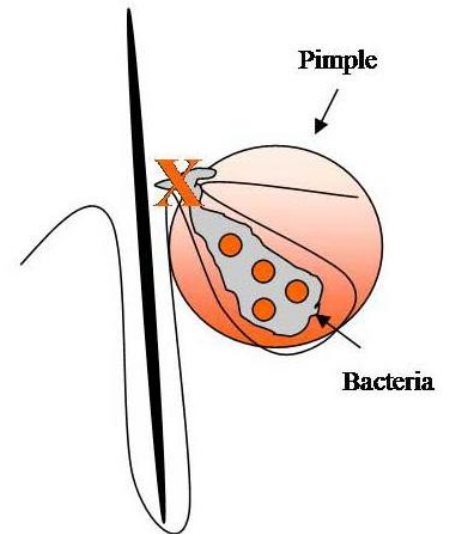
Diagram of a normal pore.



Hormones stimulate oil gland to produce sebum.



Oil gland becomes clogged forming a blackhead or whitehead.



Bacteria grow in clogged pore causing a pimple to form.



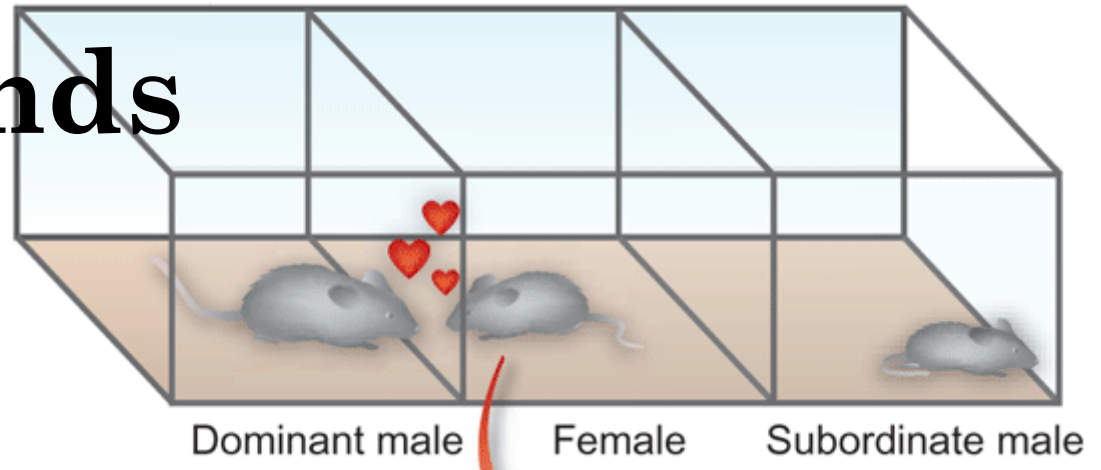


# Sweat Glands

- Two types:

- Apocrine

- Secrete a sticky, cloudy, and potentially odorous secretion called pheromones.
      - Plays some role in courtship and social behaviors
    - Can have a smelly affect when bacteria feed on the secretions



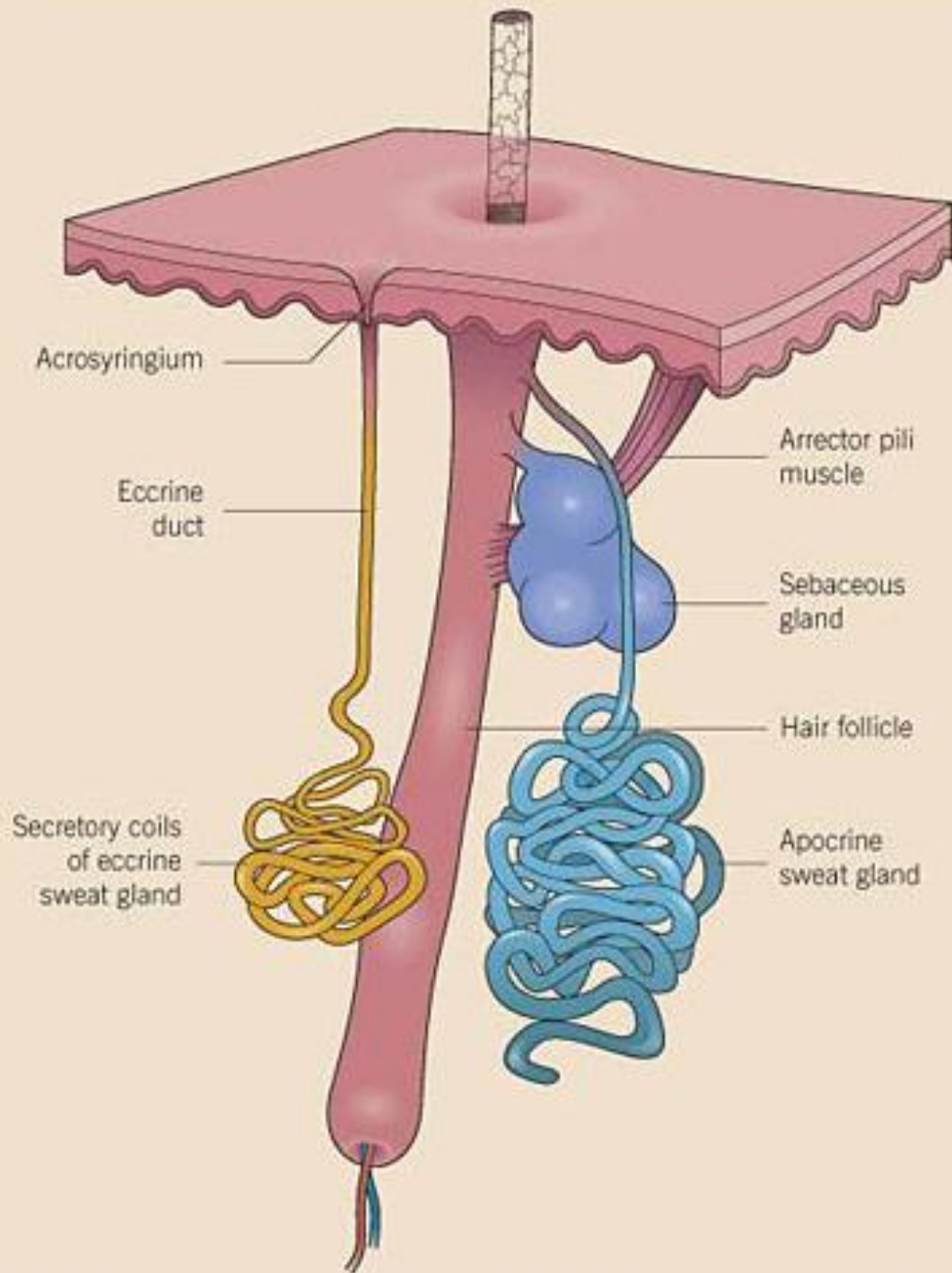
# Sweat Glands

- Two types:
  - Merocrine (or eccrine)
    - More numerous and widely distributed than apocrine glands
    - Major function is to excrete sweat and cool the body off




# Sweat Glands

- Two types:
  - Merocrine (or eccrine)
    - Also dilutes chemicals in contact with skin and contains dermicidin (antibiotic) to flush out unwanted bacteria on the skin







**Concept 8: Nails are keratinized epidermal cells that protect the tips of fingers and toes**

# Nails

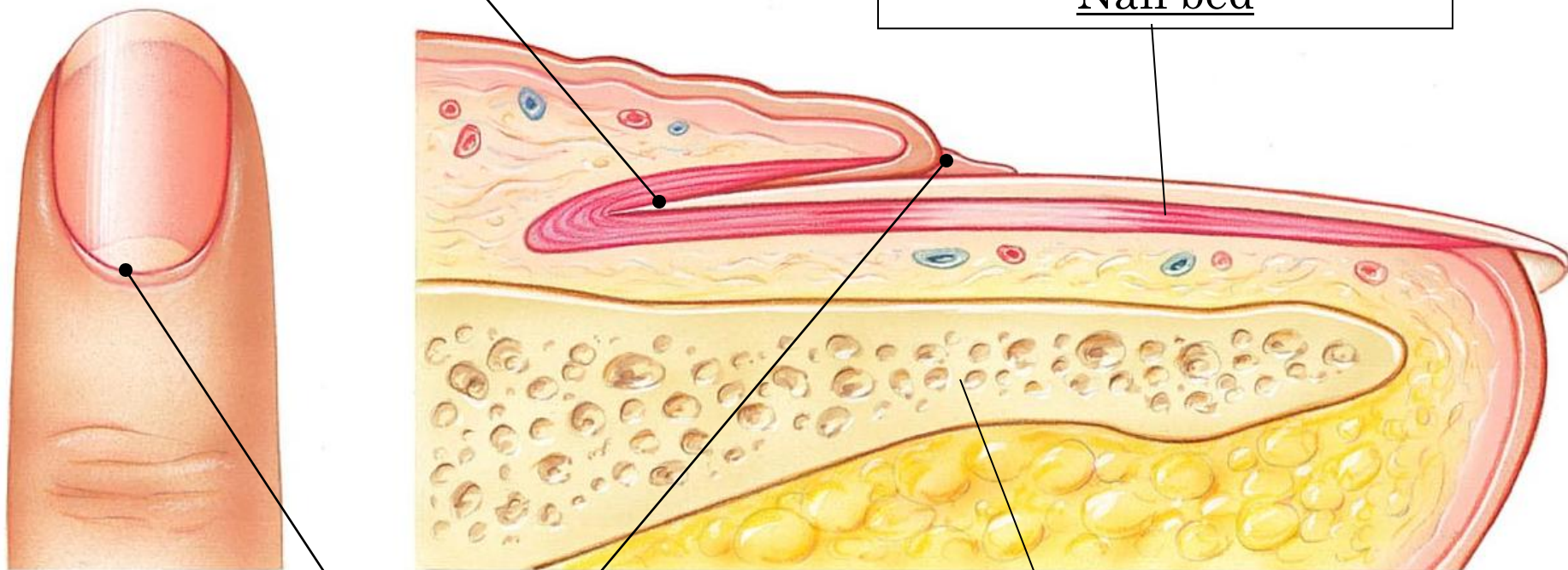
- Form on the dorsal side of fingers and toes
- Help limit distortion when put under stresses like grasping or running

Nail root (site of growth)

Nail bed

Cuticle (eponychium)

Bone of fingertip





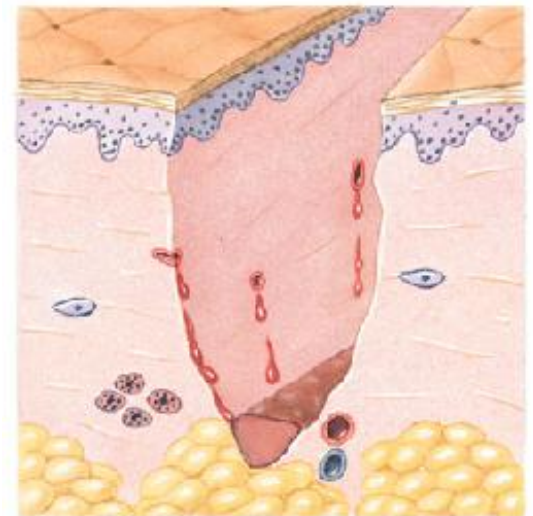
**Concept 9: Several steps are involved in repairing the integument following an injury**

# Repair of Skin Injuries

## ■ Step 1

□ Bleeding occurs at the site of injury immediately after the injury, and an inflammatory response is triggered

- Inflammatory response increases white blood cell to the cut area to fight infection



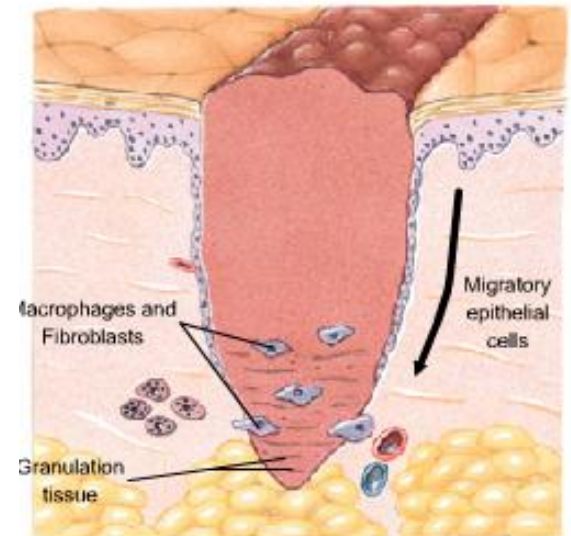


# Repair of Skin Injuries

## ■ Step 2

### □ Scab forms after several hours

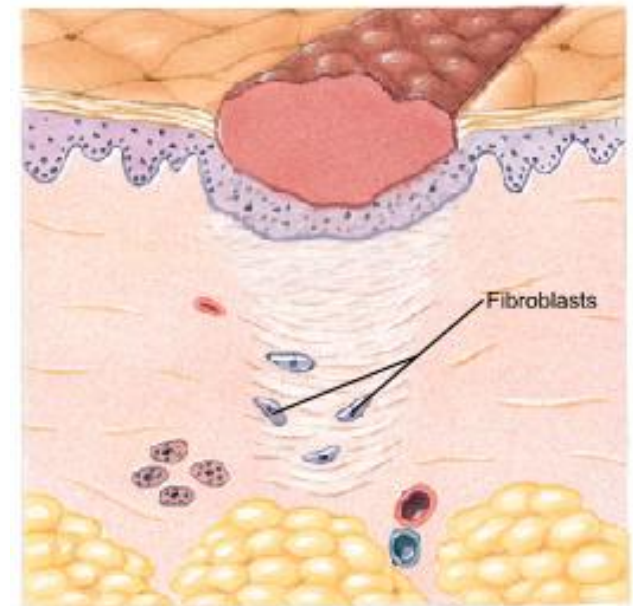
- Temporarily restores integrity of the epidermis
- Restricts entry of additional pathogens



# Repair of Skin Injuries

## ■ Step 3

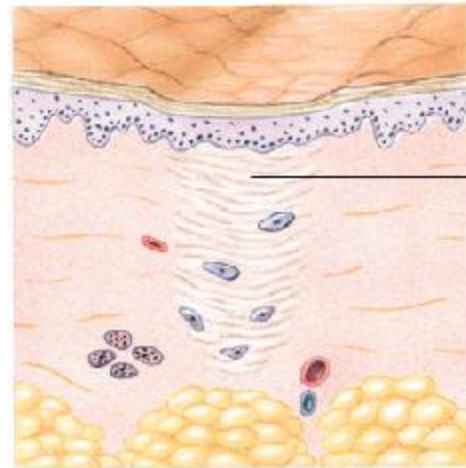
- Specialized cells, called fibroblasts, forms a meshwork of collagen fibers in the dermis



# Repair of Skin Injuries

## ■ Step 4

- Scab has been shed and epidermis is complete
- Shallow depression is left behind, but the tissue will gradually elevate the underlying epidermis
  - Thick scar tissue = keloid



Scar tissue



# Effects of Burns



Superficial  
(first degree)  
burn







# Effects of Burns



Partial thickness  
(second degree)  
burn





# Effects of Burns

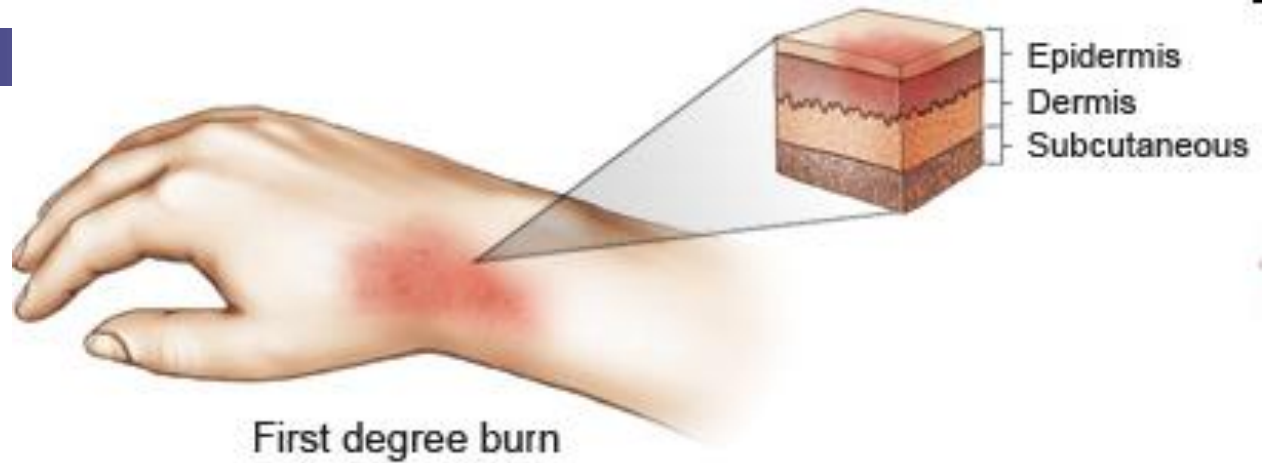


Full thickness  
(third degree)  
burn










*Mc Alexander*  
07



**Concept 10: Effects of aging  
include dermal thinning,  
wrinkling, and reduced  
melanocyte activity**





ADAM.

