

Tissues and Integumentary System



Tissues and Integumentary System

TISSUES

Tissues

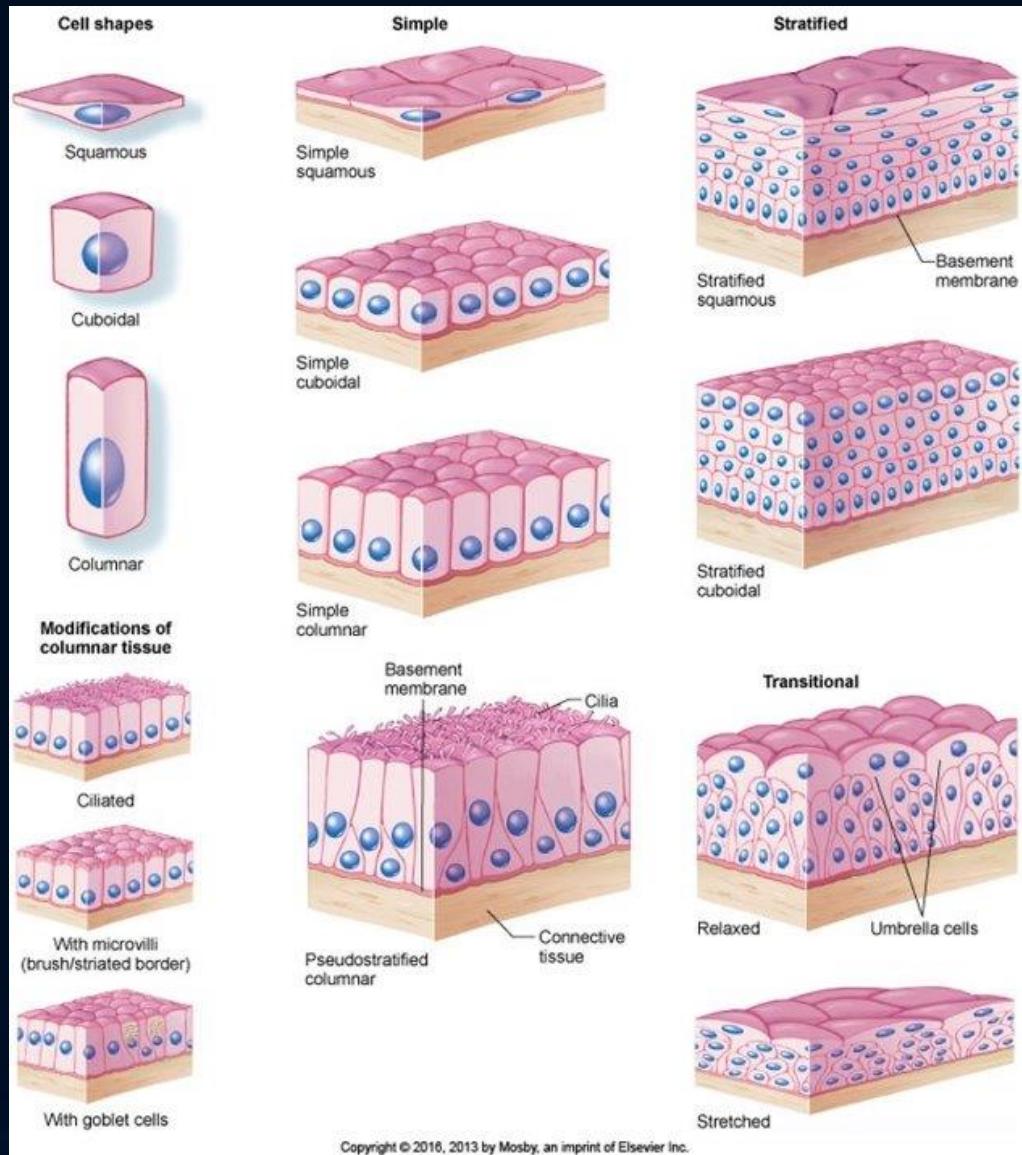
- Tissues
 - Epithelial
 - Connective
 - Nervous
 - Muscular

Epithelial

- Location – large sheets on outer surface of body – consider internal vs external environment
- Description – large sheets, poorly vascularized
- Function
 - Protection – intact tissue means no portal of entry, role of cilia & mucosa
 - Transportation across membranes / selectively permeable
 - Absorption / filtration / secretion
 - Sensation / nerve endings

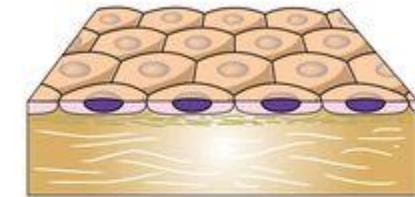
Classification

- Layers
 - Simple – one layer
 - Stratified – more than one layer
 - Pseudostratified – single layer but looks like multiple
 - Transitional – varies with stretch
- Shape
 - Squamous – flat
 - Cuboidal
 - Columnar

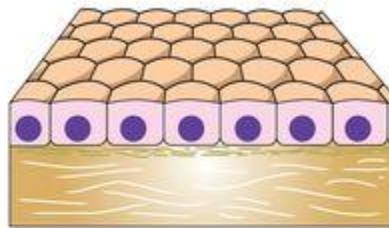


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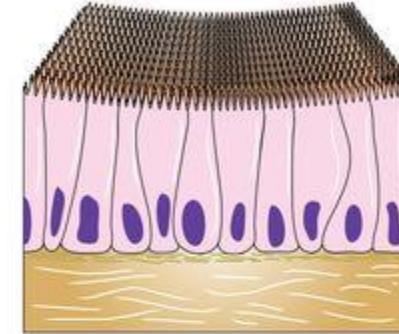
Epithelial Tissues



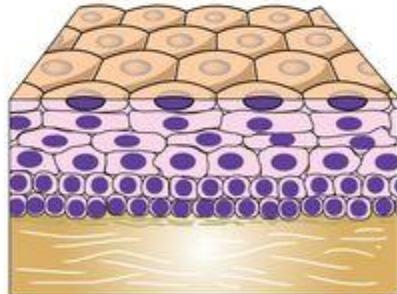
Simple squamous



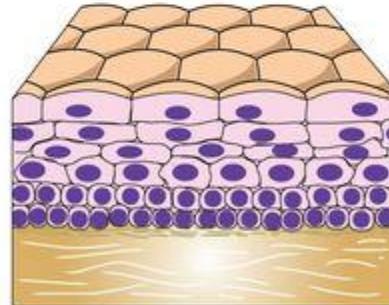
Simple cuboidal



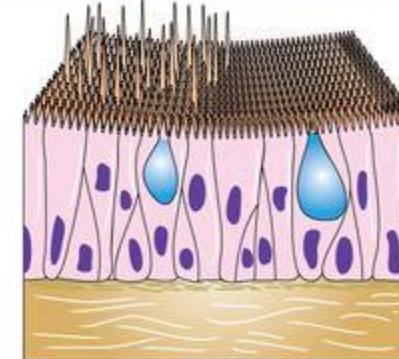
Simple columnar with microvilli



Stratified squamous



Transitional



Pseudostratified columnar with
cilia and microvilli

Glandular Epithelial

- Endocrine (no ducts)
 - Directly into blood
- Exocrine (ducts)
 - Mucous
 - Sweat
 - Saliva
 - Digestive enzymes

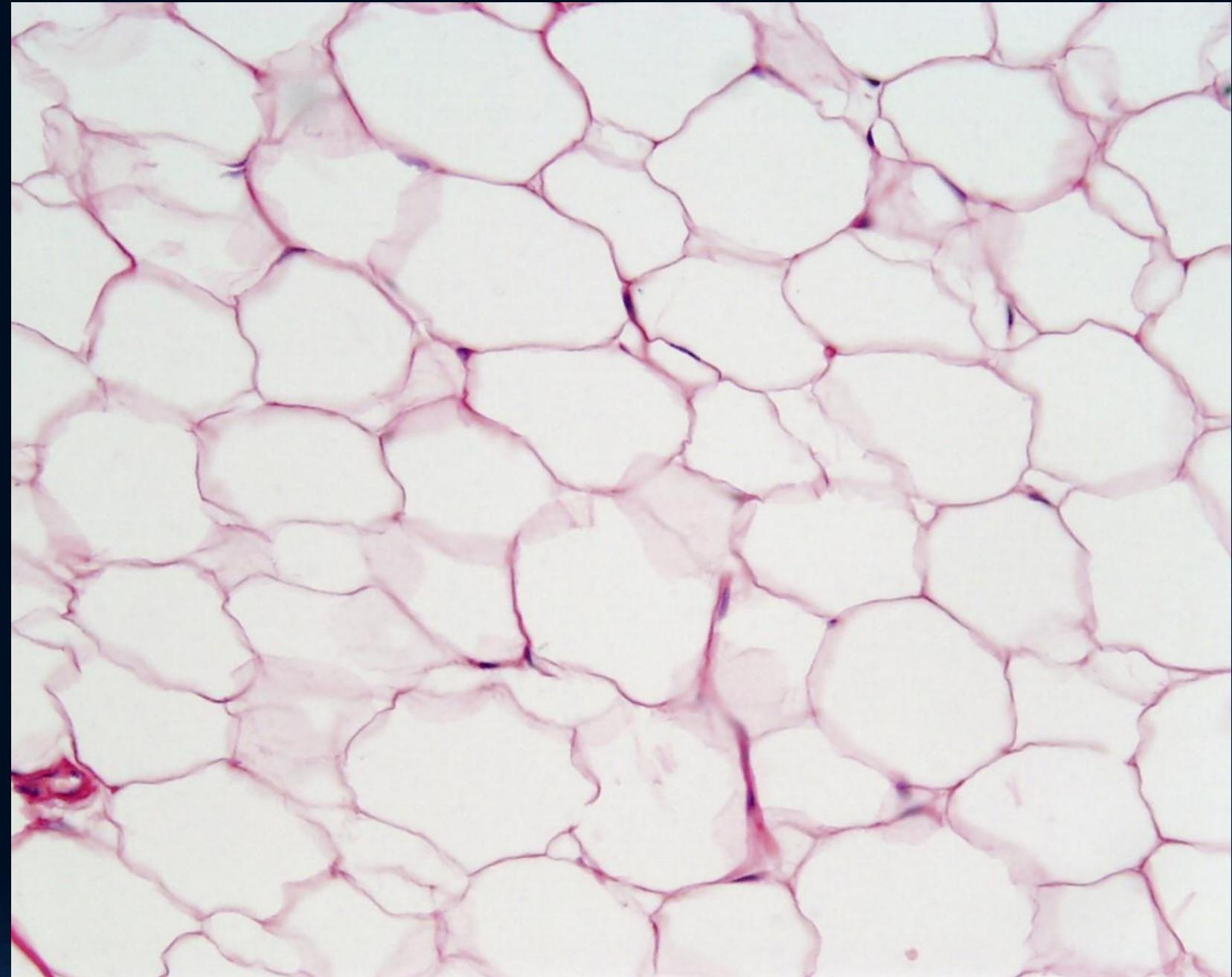
Connective Tissue

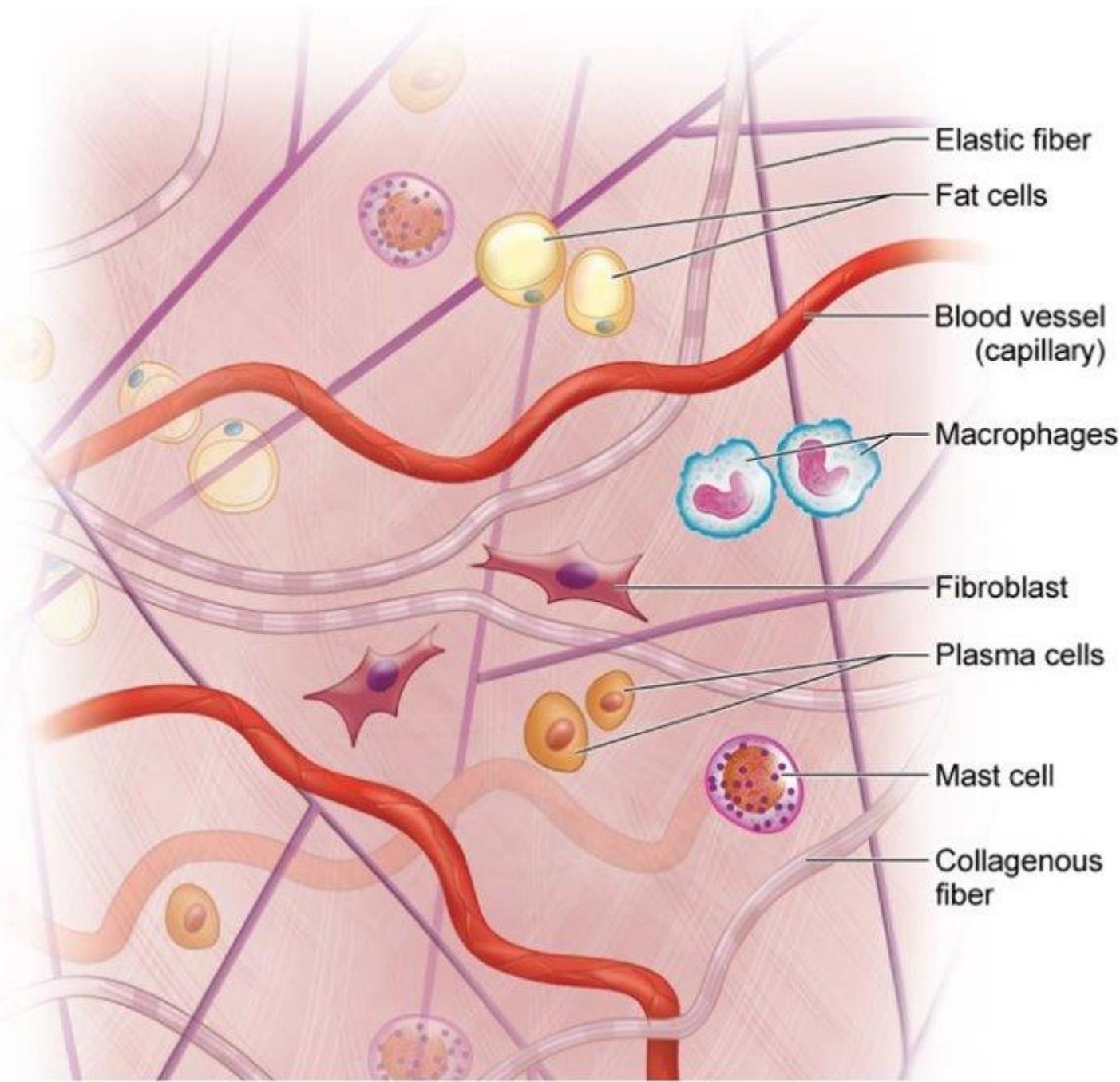
- Loose vs Dense
- Characteristics
 - Highly vascular
- Matrix
 - Cells exist in a matrix (liquid / gel / solid)
 - Secreted by “blast cells”
 - Composed of fibrous protein + ground material
 - Fibrous protein – usually collagen (rigid) and elastin (stretchy)

Loose Connective

- Areolar
 - Collagen plus Elastin in a gel matrix
 - Connect tissues to basement membrane
- Adipose
 - Very little matrix, cells that store fat
 - Functions – Energy storage, protection, cushion, insulation
- Reticular
 - Fine collagen fibers, found in lymph, spleen

Adipose Tissue



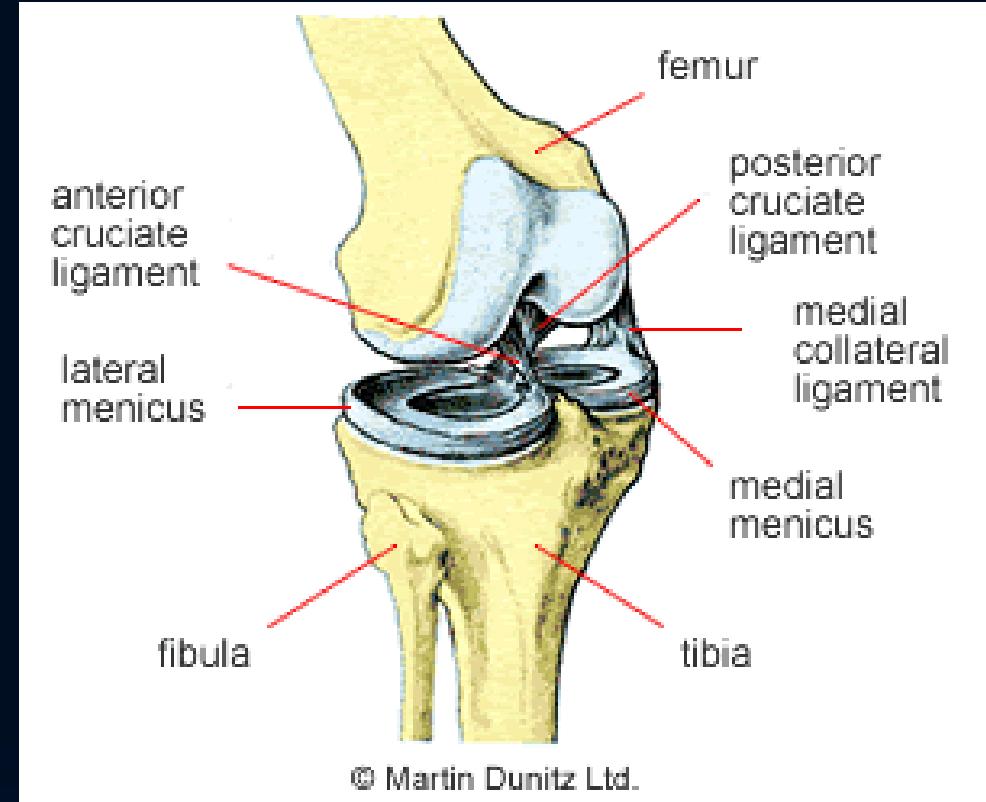


Dense Connective Tissue

- Tendons – muscle to bone
 - collagen
- Ligaments – bone to bone
 - Collagen + elastin
- Fascia
 - Covers, supports and anchors
- Blood
 - Immunity
 - Transportation of O₂ and CO₂

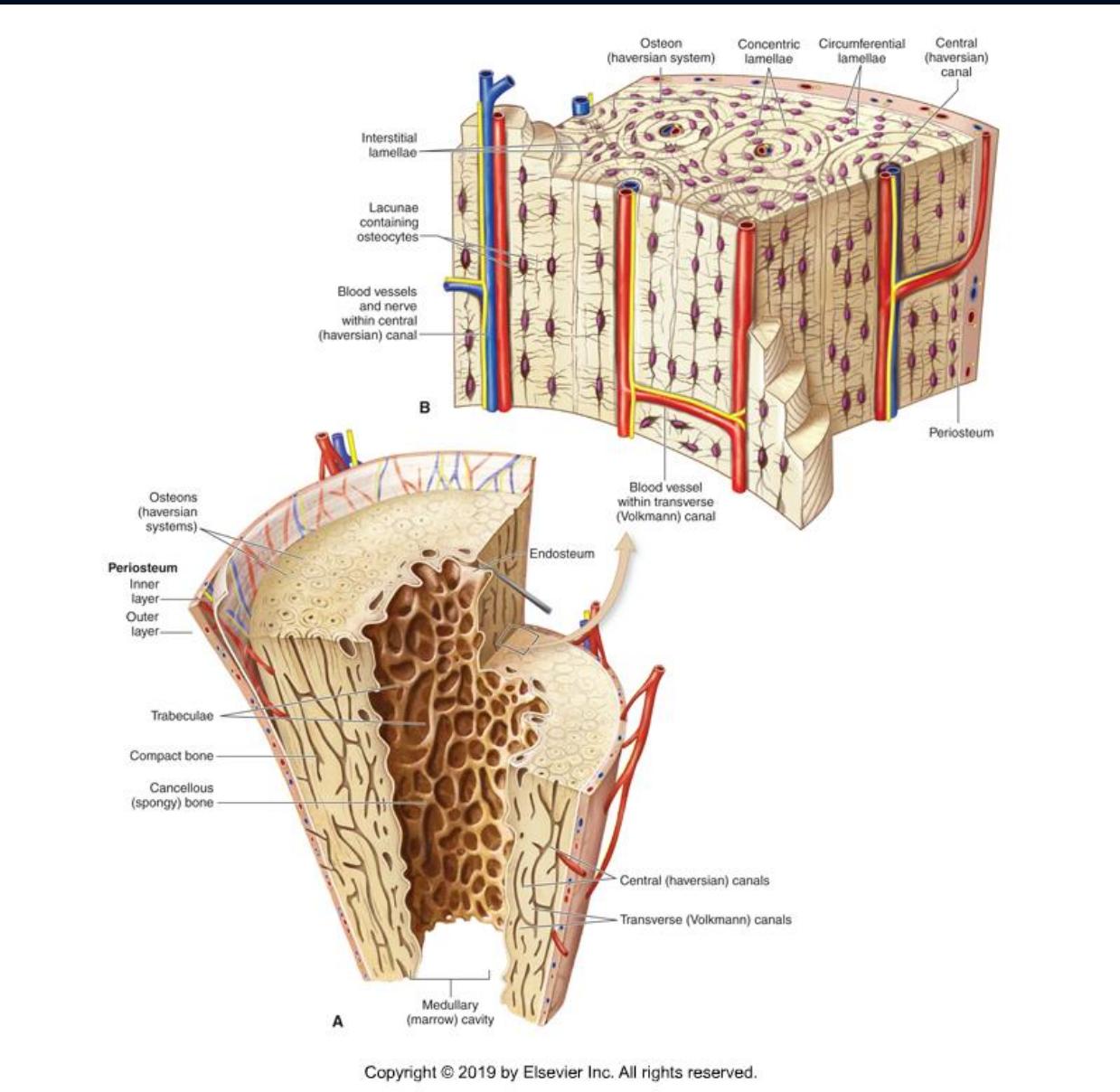
Dense Connective Tissue - Cartilage

- Chondroblasts vs chondrocytes
- Matrix
 - Hyaline – larynx, end of longbones, nose, fetal skeleton
 - Fibrocartilage – intervertebral discs, meniscus
 - Elastic – ear, larynx



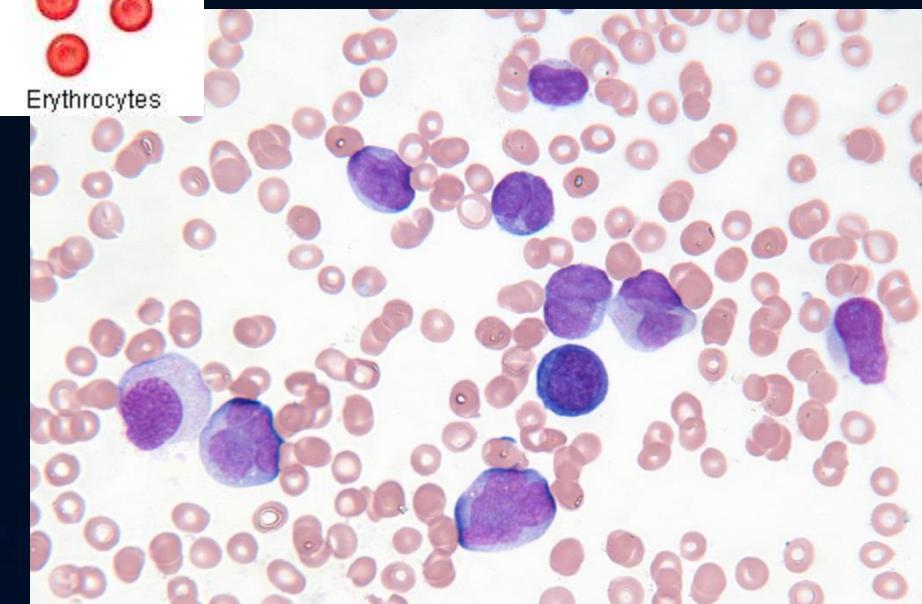
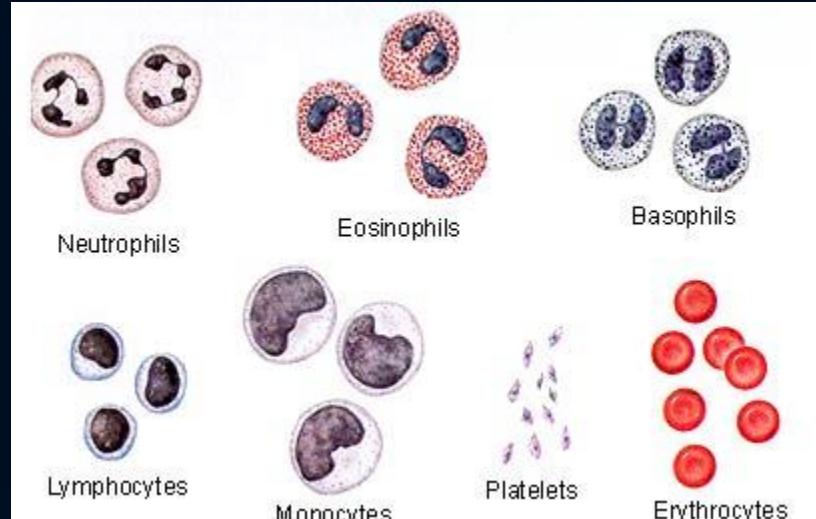
Dense Connective Tissue – Bones

- Osteoblasts vs osteoclasts vs osteocytes
- Matrix – collagen + Ca^{+2} + phosphate
- Matrix growth influenced by:
 - Hormones – HGH, E, T
 - Menopause
 - Osteoporosis
- Function
 - Protection
 - Mineral storage
 - Posture (with skeletal muscles)



Dense Connective Tissue – Blood

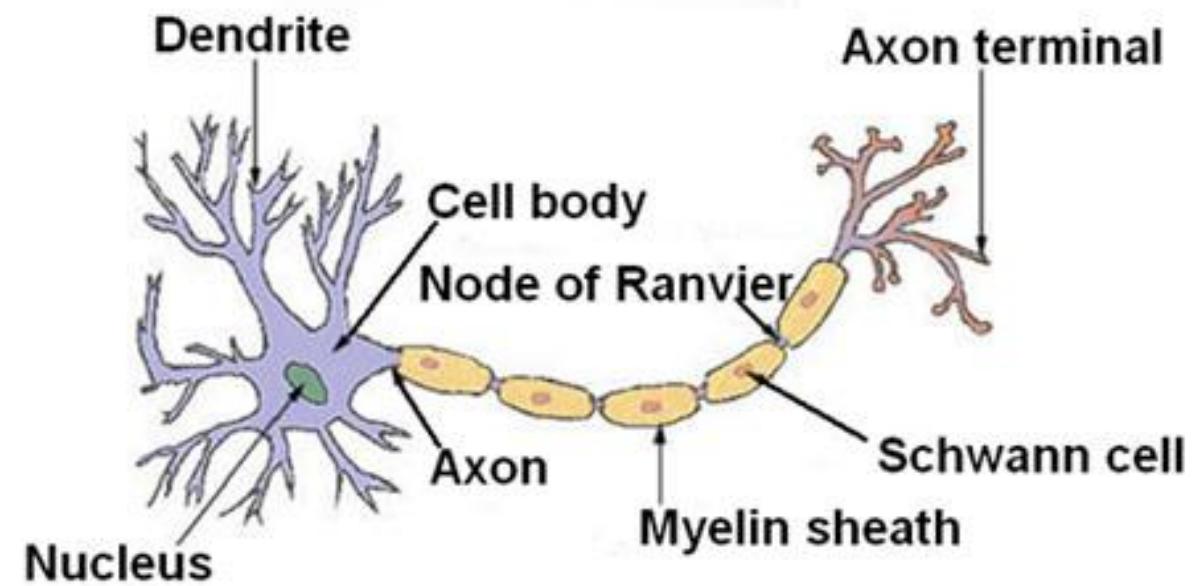
- Function
 - Immune system
 - Transportation
 - Clotting
- Cells
 - RBC – transport O₂ and CO₂
 - WBC – immunity
 - Platelets – clotting
- Matrix
 - Plasma
 - lymph fluid



Nervous Tissue

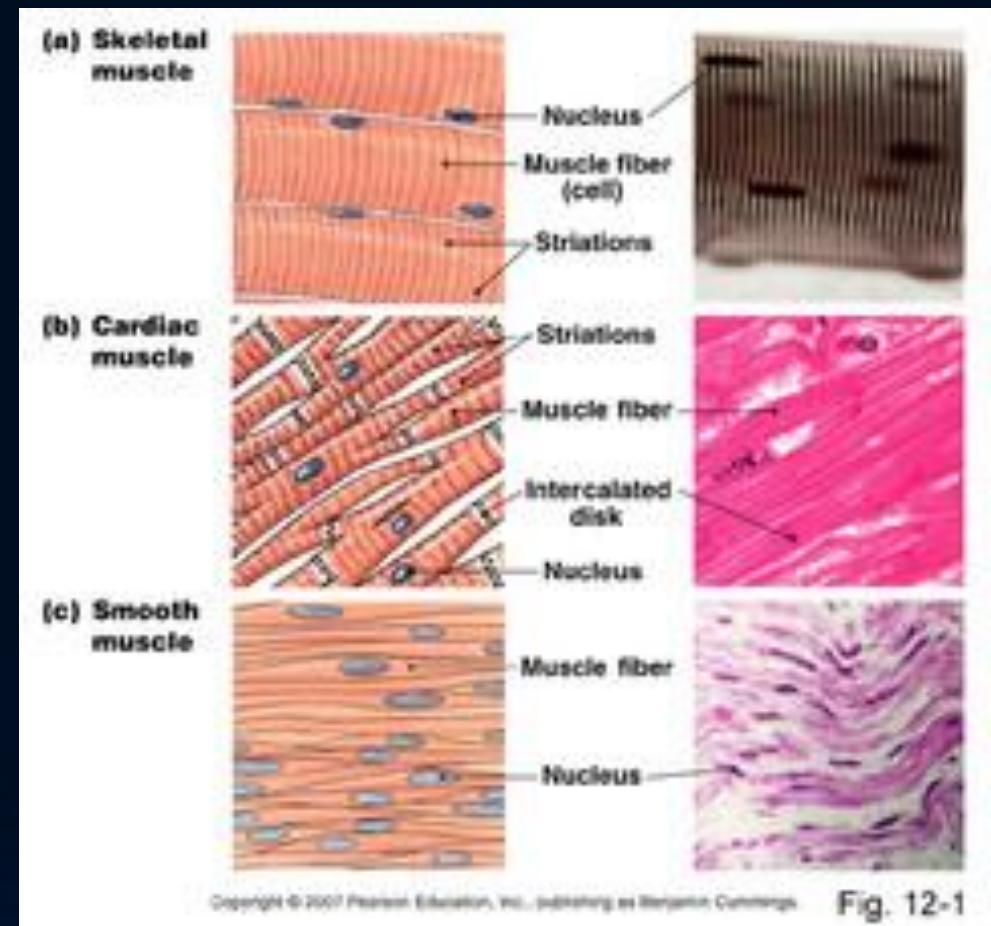
- Neurons
- Neuroglia – support cells
 - Astrocytes – BBB
 - Ependymal cells – CSF
 - Microglia – immune cells
 - Schwann cells – myelin sheath in peripheral nervous system
 - Oligodendrocytes – myelin sheath in CNS

Structure of a Typical Neuron



Muscle Tissue – Fibers not Cells

- Skeletal
 - Striated
 - voluntary
- Smooth
 - Non-striated
 - involuntary
- Cardiac
 - Branched
 - Involuntary
 - Syncytium, electrical conduction



Tissues and Integumentary System

INTEGUMENTARY SYSTEM

Functions

- Protection
- Mechanical and Chemical barrier
- Sensation (touch, pressure, pain, temp)
- Endocrine (Vit D synthesis)
- Exocrine
- Immune system
- Temperature regulation

Shingles present a band halfway around your body, never crossing the midline, as it originates from your nerves that innerviate that half of the body

Jaundice is excess bilirubin generated by high RBC breakdown levels which the liver can't digest.

Babies have higher RBC count (to absorb oxygen from mother), meaning they often get jaundice. Putting them under UV light breaks down the bilirubin.

Alcoholics are also higher risk due to liver damage.

Scleral Icterus refers to yellow eyes.

Dependant edema = edema in gravity affected areas (legs in walker, back in nonmobile people). Don't shift these people down on the stretcher, as this fluid will shift into their lungs and cause pulmonary edema.

CPAP pushes the fluid out, nitro dilates vessels allowing fluid to move and heart to pump easier.

Skin colours:

Black - necrosis
blue - breathing/oxygen
yellow - liver
red - flushed, inf, rash, burn

poor perfusion - cap refill, mottling, pale

Ascites = abdominal fluid build up due to organ failure, like liver (will be big hard swelling).

3 causes for edema:

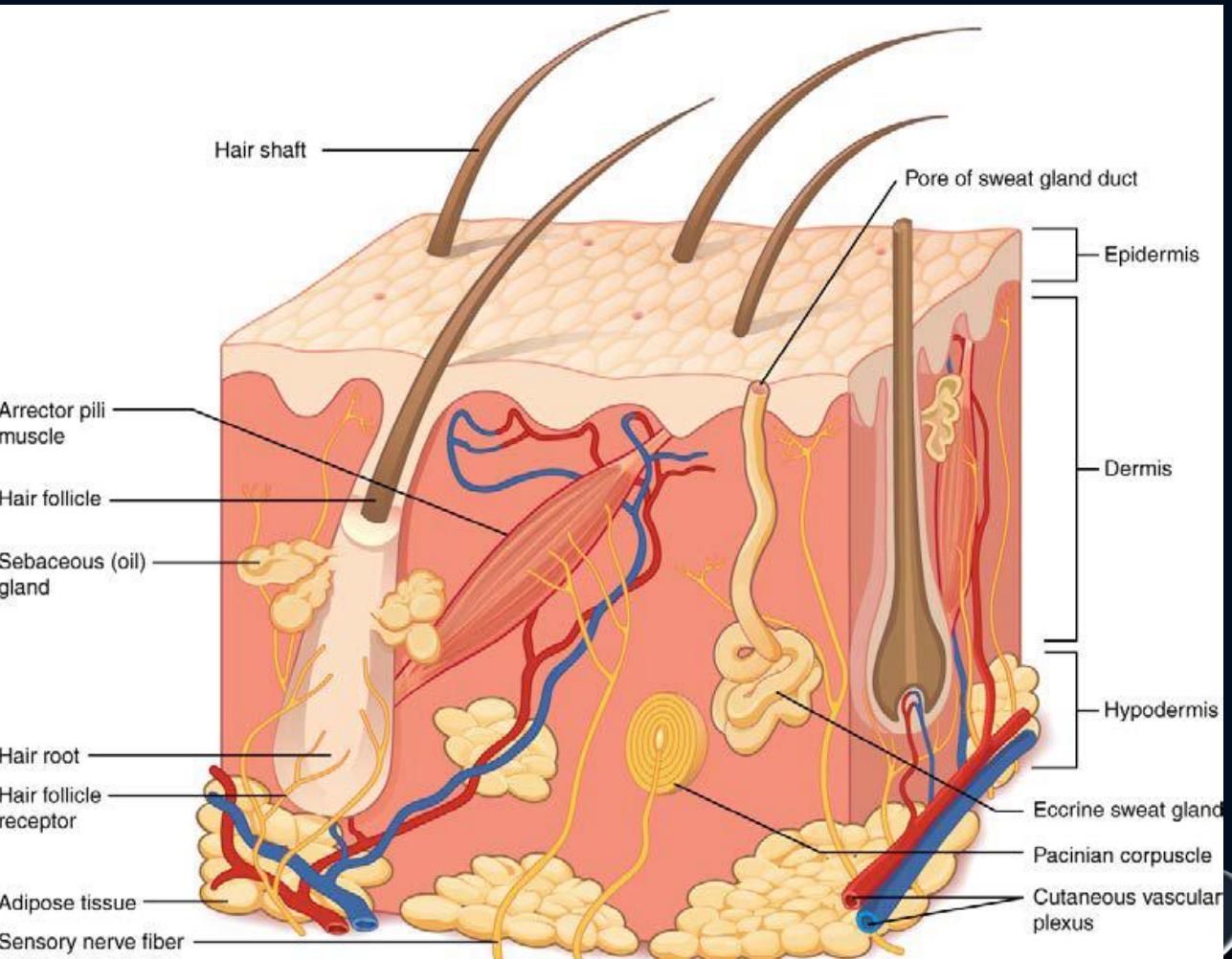
1. Increased Vascular permeability and dilation. Histamine and other factors increase this. Epinephrine really only helps this.

2. Osmotic gradient. Liver failure patients don't have enough albumin to generate an osmotic gradient for fluid reabsorption from interstitial fluid to vessels.

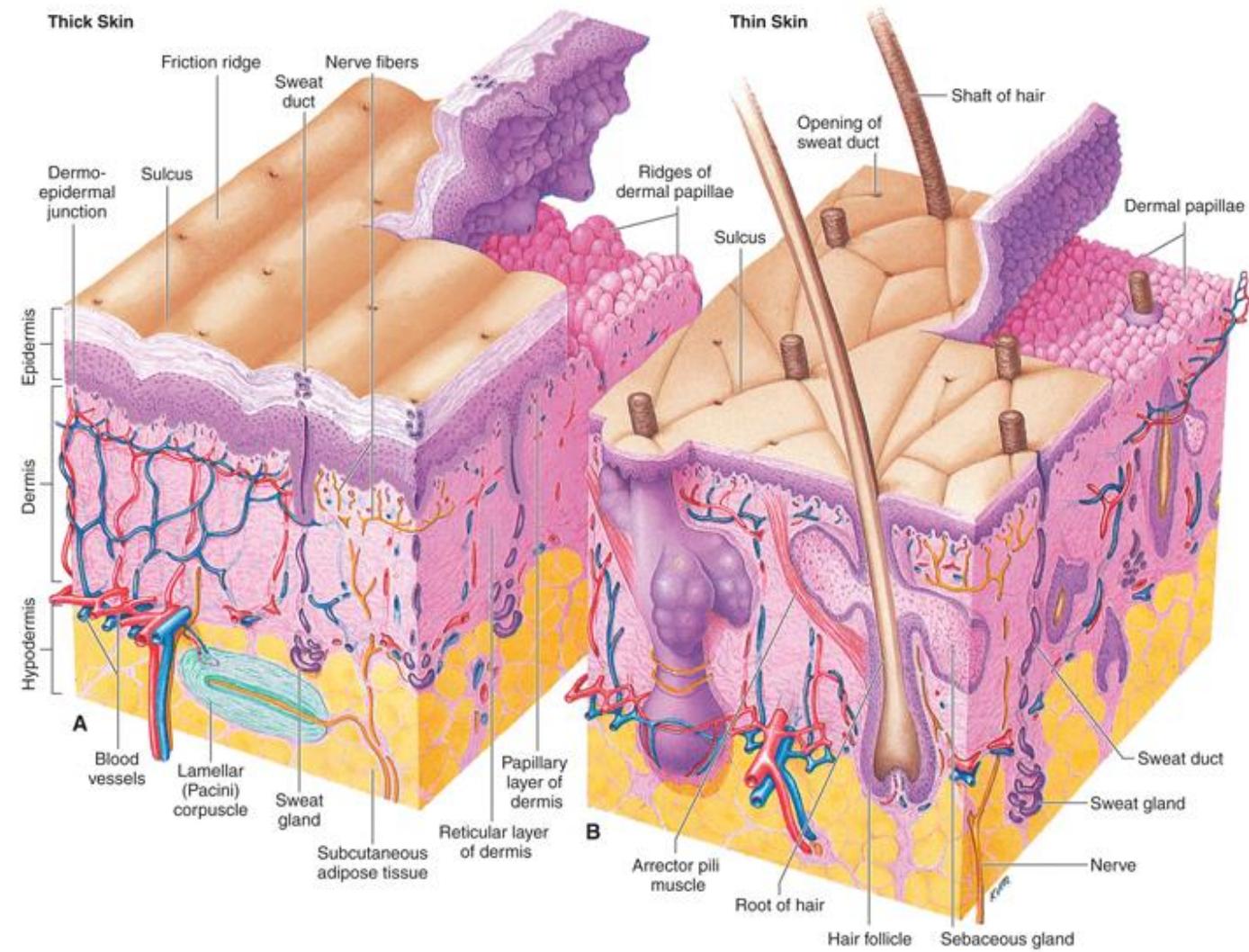
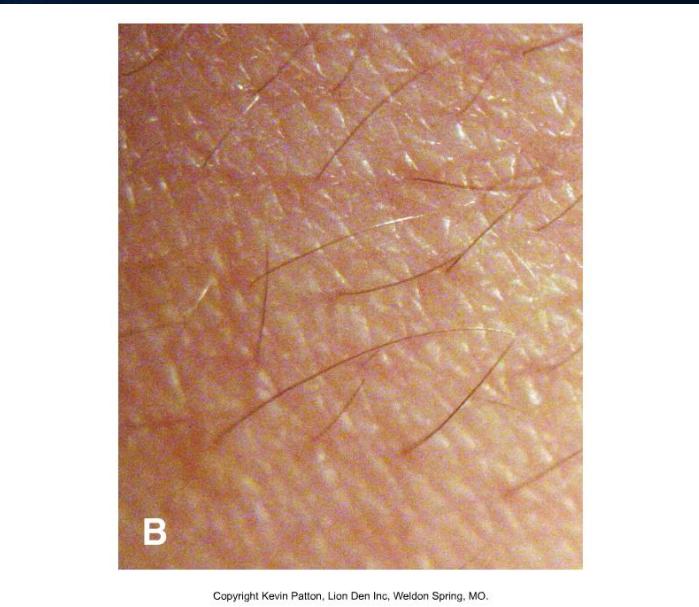
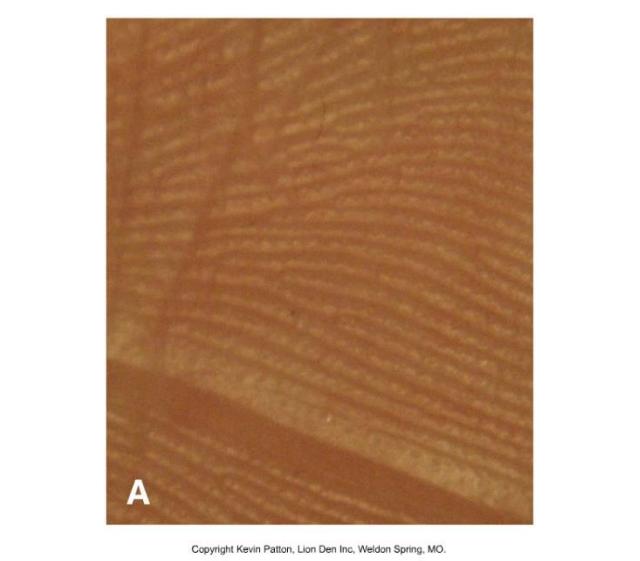
3. Increased hydrostatic pressure

Layers of the skin

- Largest body organ!
- Not as complex as other organs
- Covers entire body surface, area of 1.5 to 2.0 m² and 7-8% body weight
- Thickness ranges from 1.5 to 4mm
- 3 distinct layers
 - Epidermis* - Stratified squamous epithelium
 - Dermis* - Dense irregular connective tissue
 - Subcutaneous layer* (or *hypodermis*) - areolar and adipose connective tissue *not part of integumentary system

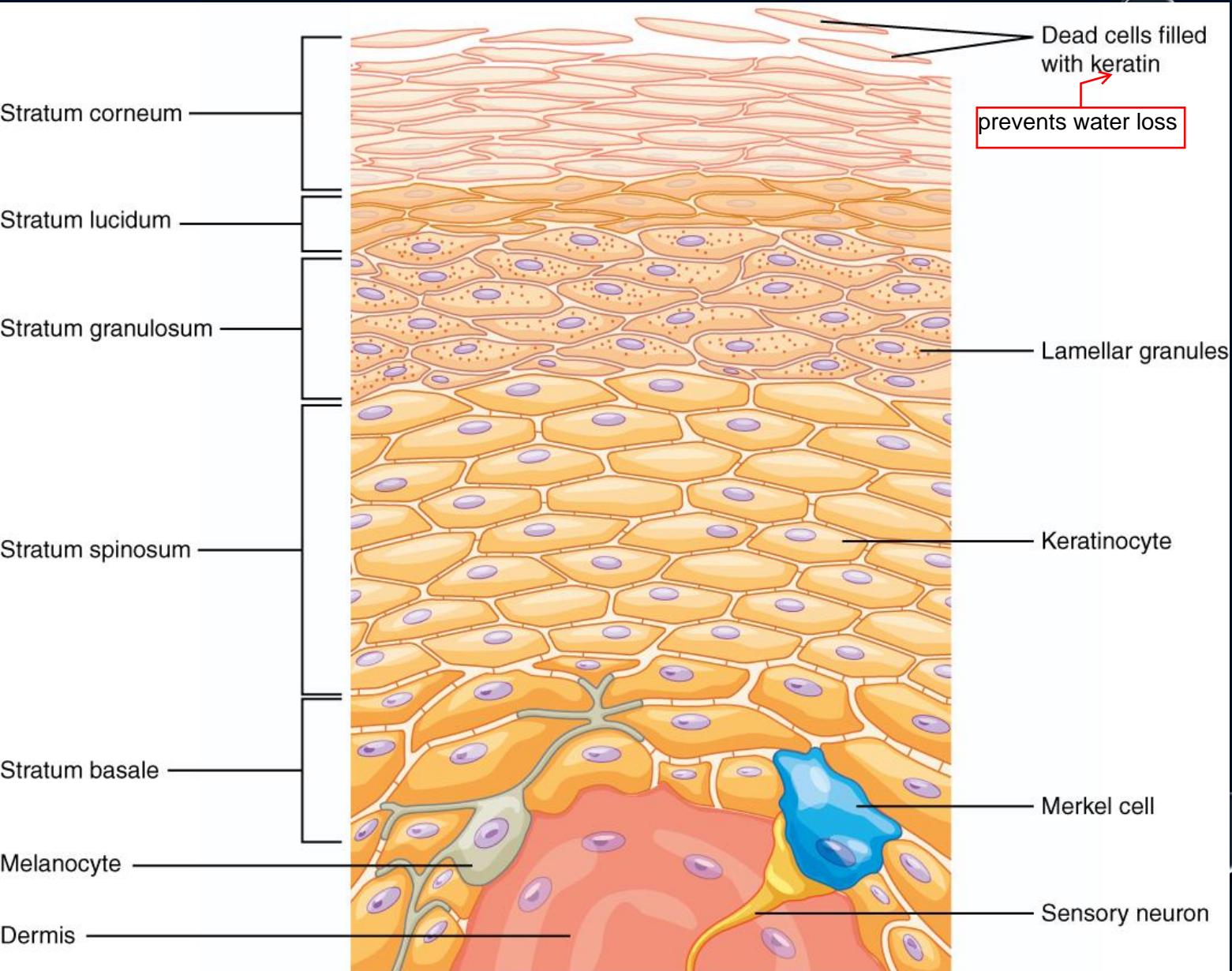


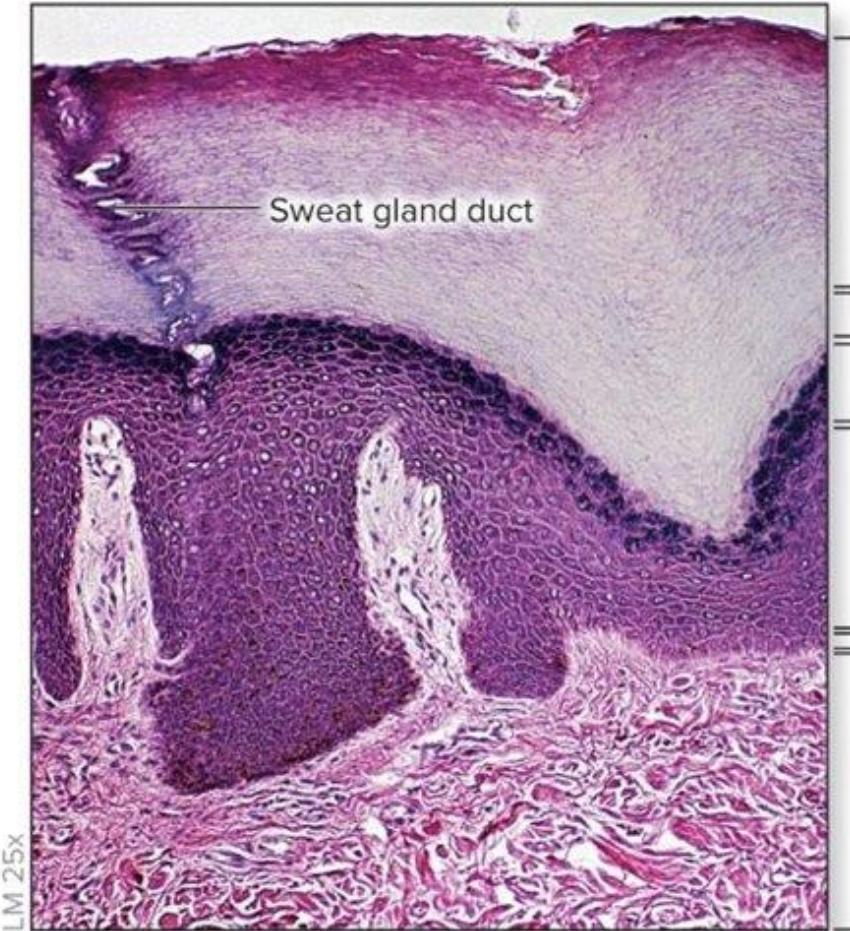
Thick vs thin skin



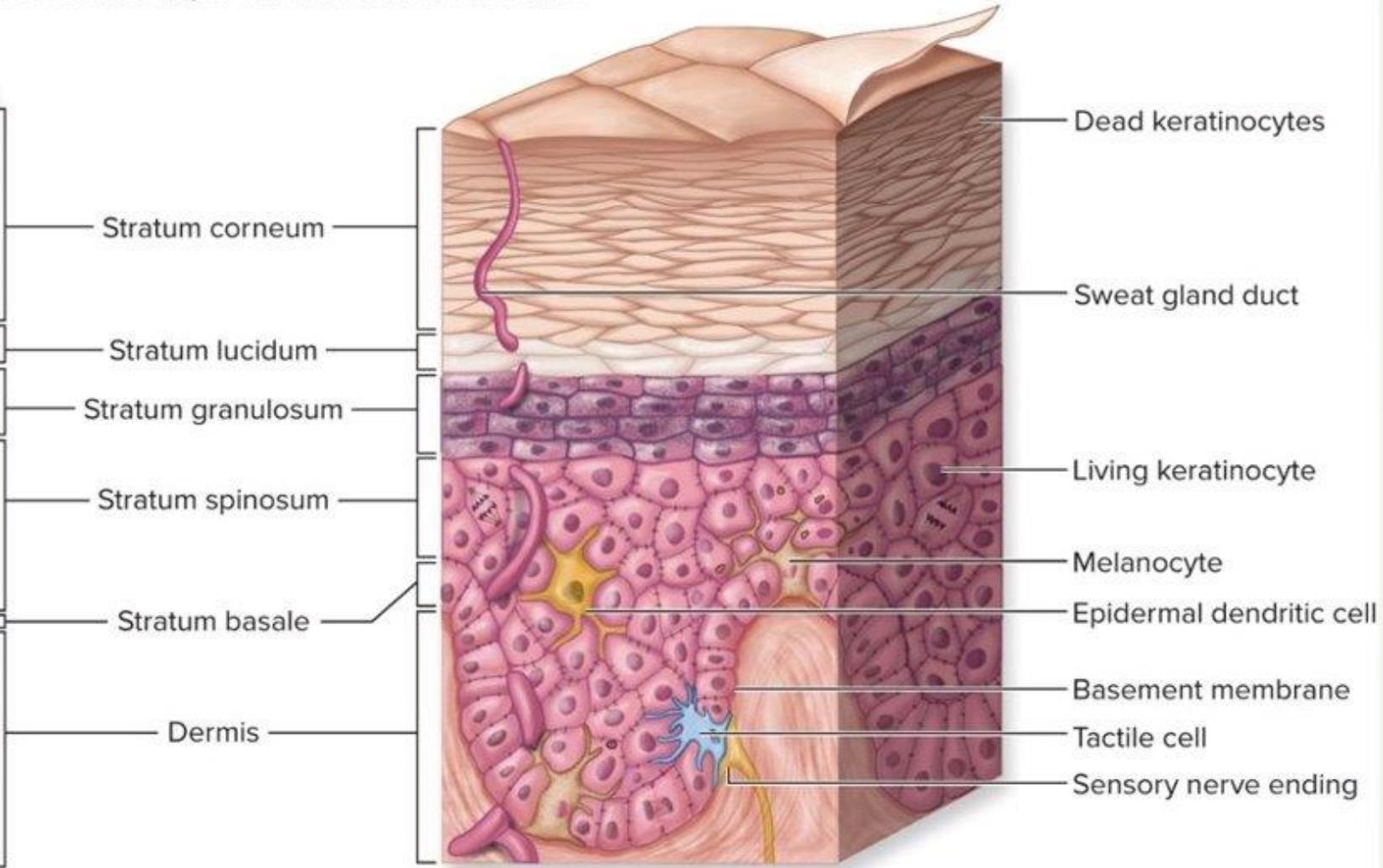
Layers of the epidermis

- Keratinized stratified squamous epithelium
- Avascular
- Organized into strata
 - *Stratum basale* (deepest layer)
 - *Stratum spinosum*
 - *Stratum granulosum*
 - *Stratum lucidum*
 - *Stratum corneum*





(a)

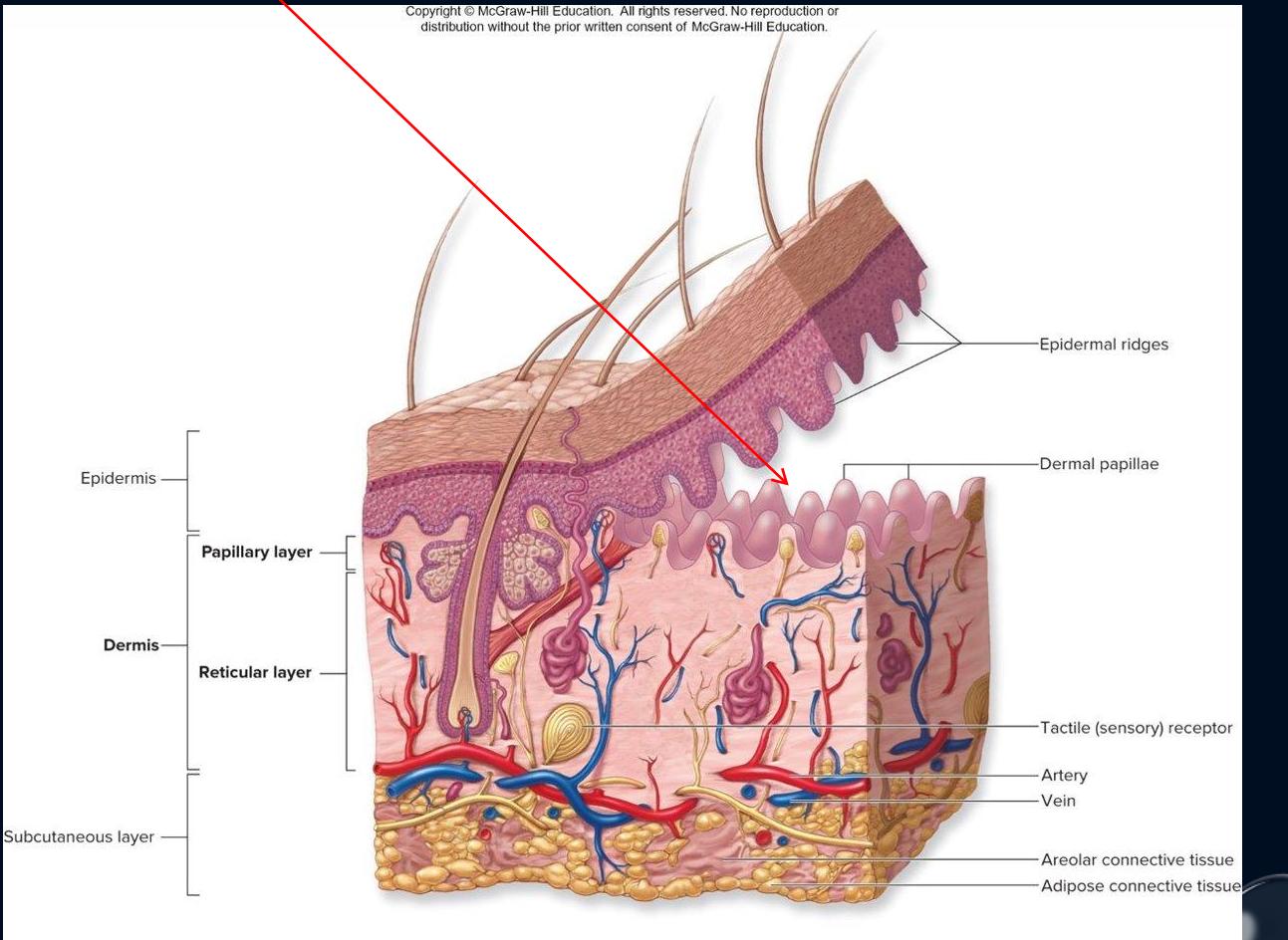


(b)

Dermis Layer

- Lies deep to epidermis
- 0.5 to 3.0mm thick
- Composed mostly of connective tissue (mainly collagen fibres, although both elastic and reticular fibres as well)
- Also contains blood vessels, sweat glands, sebaceous glands, hair follicles, nail roots, sensory nerve endings, smooth muscle tissue
- Two major layers: superficial papillary layer, deeper reticular layer

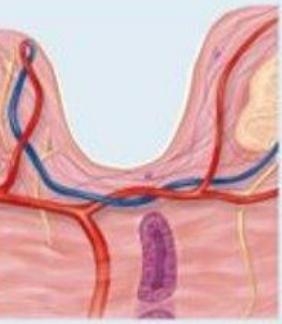
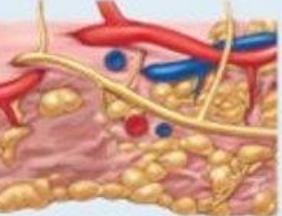
papillae prevent
layers from shifting
(anchors),
increases surface



Subcutaneous Tissue (Hypodermis)

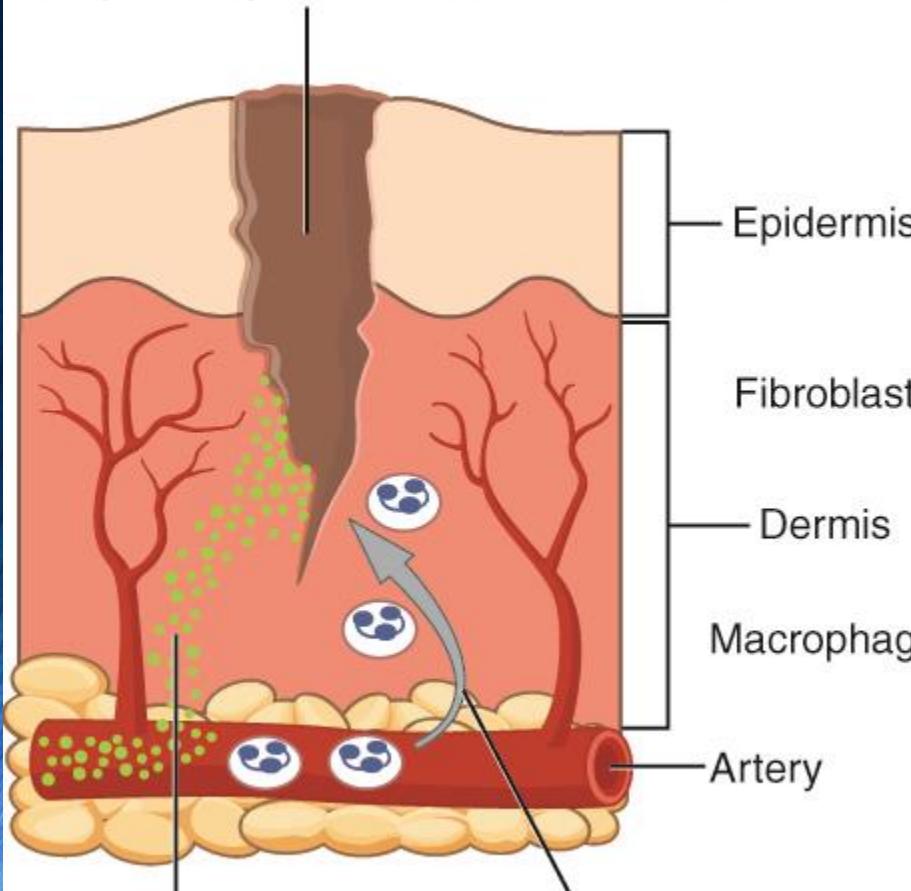
- Flexible connection between skin and underlying muscles and bones
- Loose connective tissue and adipose tissue
- Two main roles
- *Helps insulate the body (storage for fat)*
- *Anchors skin to underlying structure*
- Common site of medication administration (subcutaneous injections) because of vascular network that promotes rapid absorption

Table 6.1 Integument Layers and the Subcutaneous Layer **AP|R**

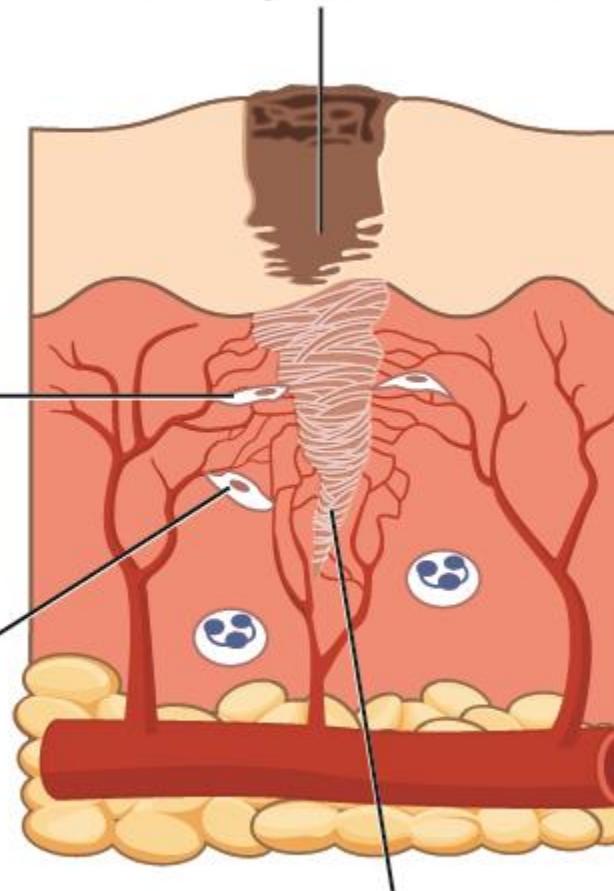
Layer	Specific Layer	Description
INTEGUMENT: EPIDERMIS		
	Stratum corneum	Most superficial layer of epidermis; 20–30 layers of dead, flattened, anucleate, keratin-filled keratinocytes
	Stratum lucidum	2–3 layers of anucleate, dead keratinocytes; seen only in thick skin (i.e., palms of hands, soles of feet)
	Stratum granulosum	3–5 layers of keratinocytes with distinct granules in cytoplasm; keratinization begins in this layer
	Stratum spinosum	Several layers of keratinocytes attached to neighbors by desmosomes; epidermal dendritic cells present
	Stratum basale	Deepest, single layer of cuboidal to low columnar keratinocytes in contact with basement membrane; cell division occurs here; also contains melanocytes and tactile cells
INTEGUMENT: DERMIS		
	Papillary layer	Superficial layer of dermis; composed of areolar connective tissue; forms dermal papillae; houses capillaries and tactile receptors
	Reticular layer	Deeper layer of dermis; composed of dense irregular connective tissue surrounding and supporting hair follicles, sebaceous glands and sweat glands, nerves, and blood vessels
SUBCUTANEOUS LAYER		
	No specific layers	Not considered part of the integument; deep to dermis; composed of areolar and adipose connective tissue

Tissue Repair

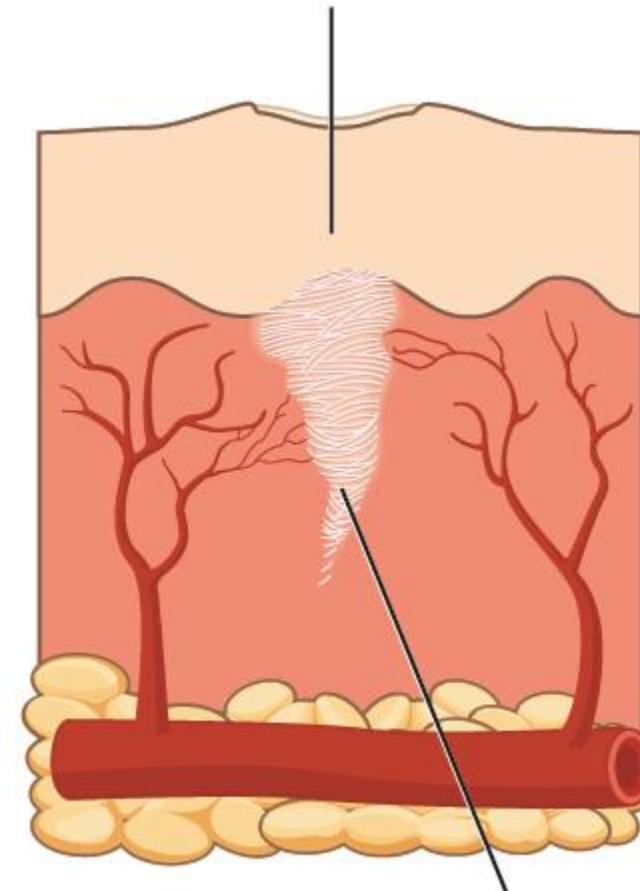
Clotting occurs, caused by clotting proteins and plasma proteins, and a scab is formed



Epithelial cells multiply and fill in over the granulation tissue



Restored epithelium thickens; the area matures and contracts



Wounds and Wound Healing

- 3 Stages
- *Inflammation*
- *Proliferation*
- *Maturation*

3 things happen first when you get a cut

1. Vasoconstriction (reduces blood flow, and slower blood clots)
2. Platelets (ASA prevents aggregation, resolving coronary cerebral issues)
- 3.

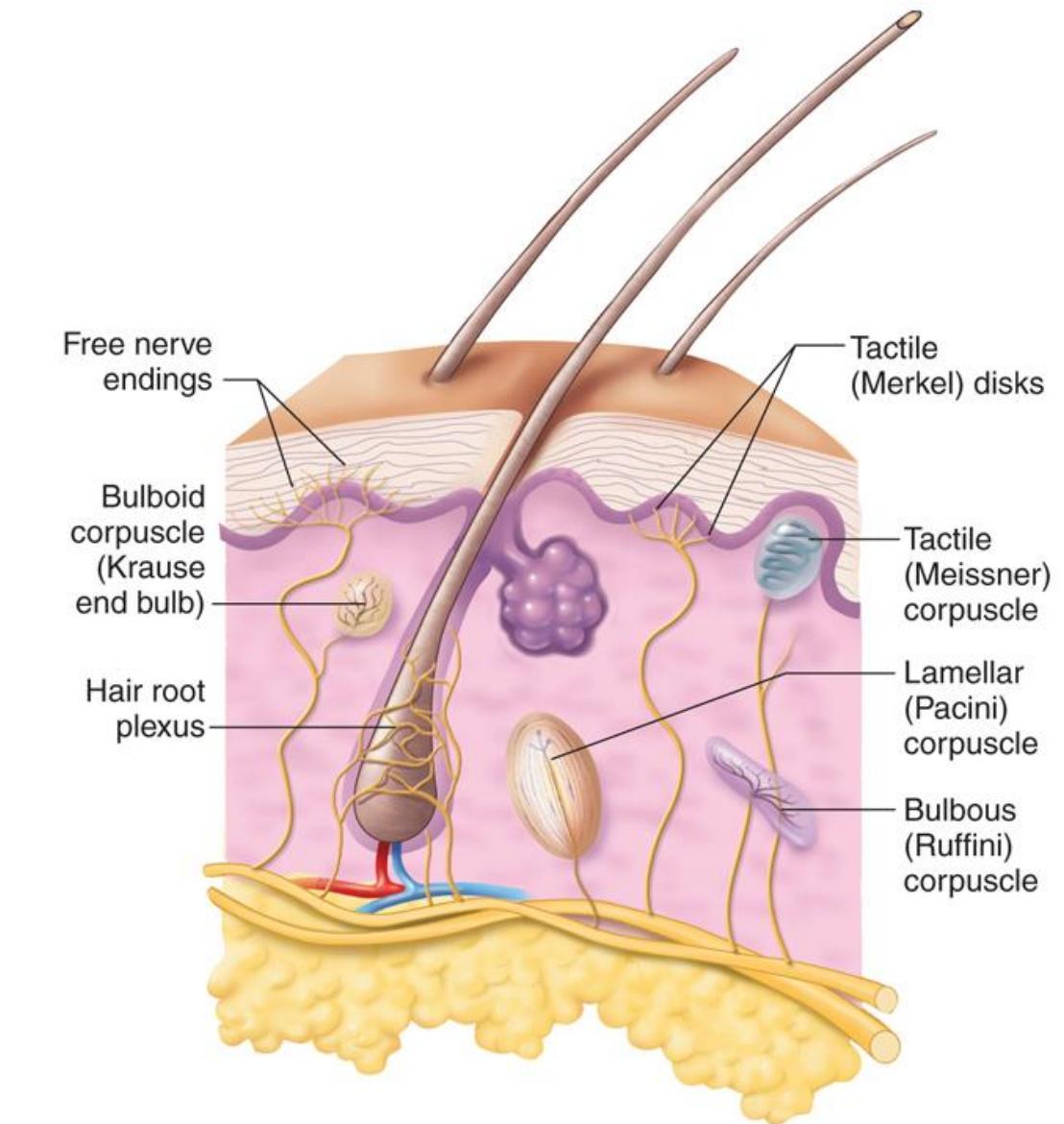
Wounds and Wound Healing

- Inflammation Stage
- *First stage*
- *Body's natural response to trauma*
- *After wound is inflicted, homeostasis begins*
- *Blood vessels constrict, seal themselves off, platelets form a clot and halt bleeding*
- *There is then dilation of blood vessels resulting in increased delivery of nutrients, white blood cells, antibodies, enzymes, and other beneficial substances*
- *Promotes wound healing*

Wounds and Wound Healing

- **Proliferation Stage**
- Second stage
- *Wound begins to “heal” as it is rebuilt with new granulation tissue*
- *Requires sufficient blood supply*
- *Tissue is made up of extracellular matrix, and collagen*
- Allows for development of new network of blood vessels to replace damaged ones (angiogenesis)
- *Damaged cells are transformed into fibroblasts*
- **Maturation Stage**
- *Third and final stage*
- Occurs after wound has closed up, can take up to two years depending on size of wound
- Dermal tissues are overhauled, non-functional fibroblasts are turned into functional fibroblasts, cellular activity declines, blood vessels recede

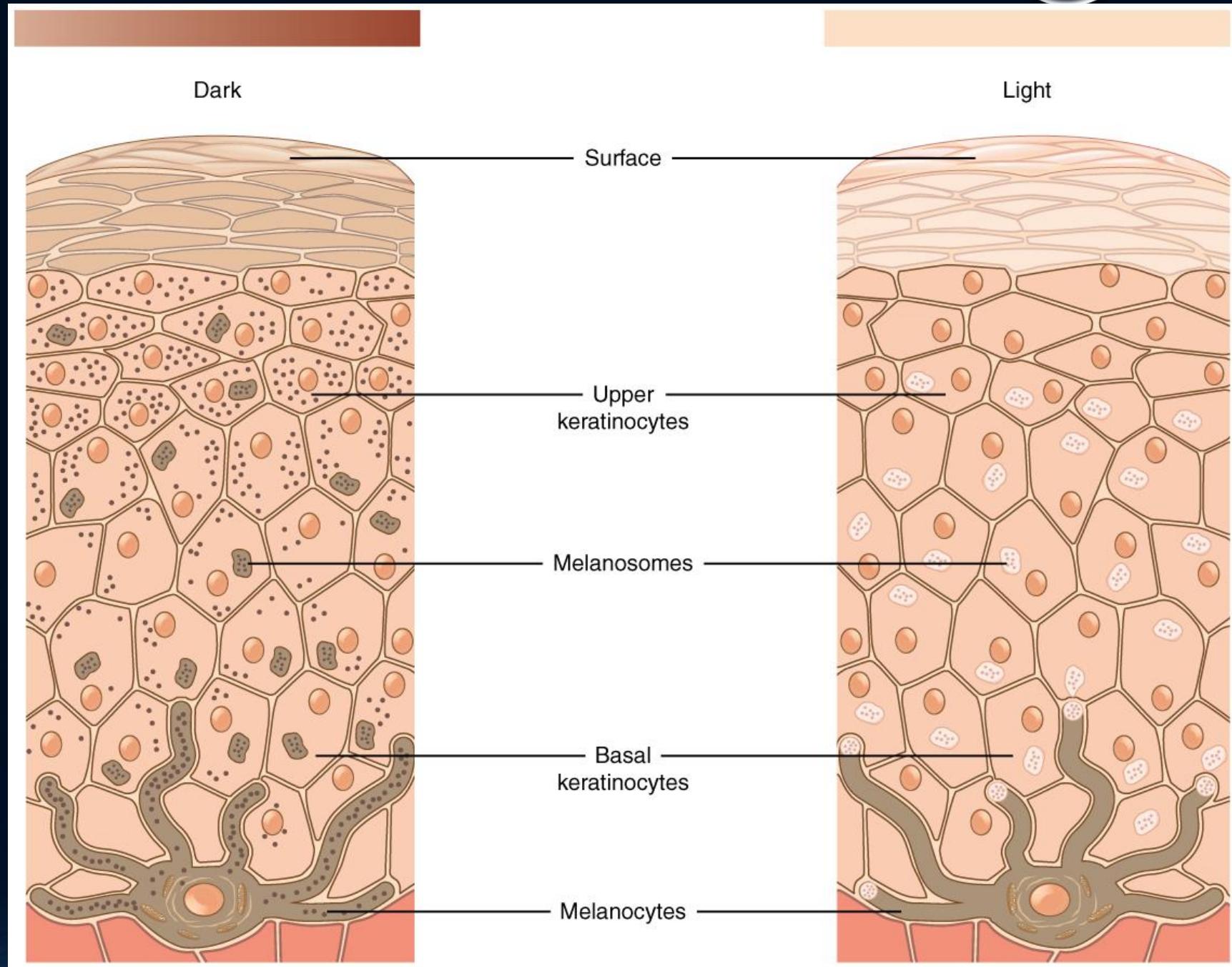
Skin sensory receptors



Somatosensory receptors

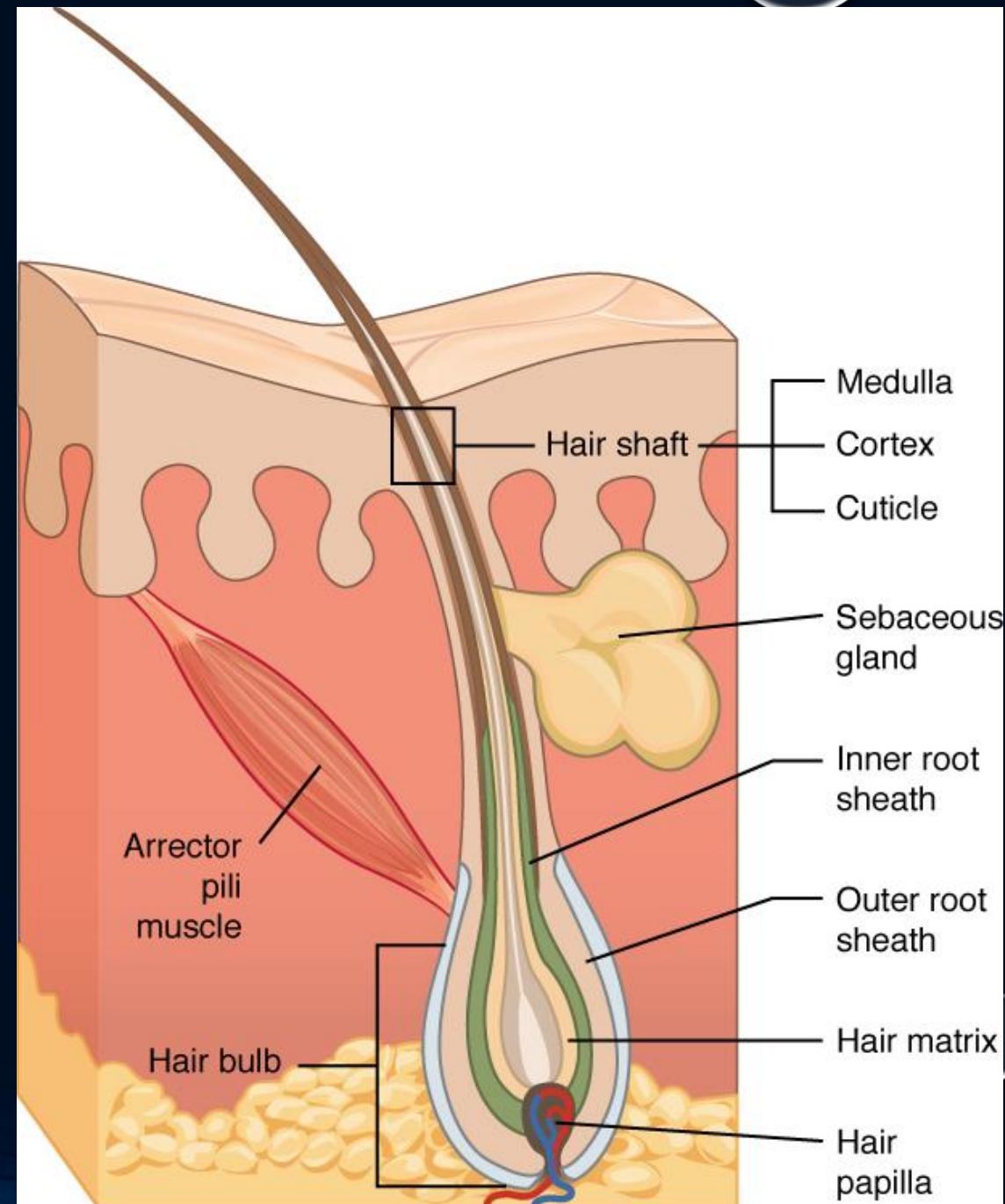
- Free nerve endings
 - Nociceptor (pain)
 - Merkel disc (light pressure)
 - Root hair plexus (hair movement)
- Touch / pressure receptors
 - Pacini corpuscles (high frequency vibration)
 - Meissner corpuscle (low frequency vibration)
 - Ruffini corpuscle (crude, persistent touch)
 - Krause corpuscle (texture, low frequency vibration)
- Thermoreceptors
- Proprioception
 - Spindle fibers (stretch of muscle)
 - Golgi tendon organs (tension on the tendon / tendon stretch)

Melanin



• Hair Follicle

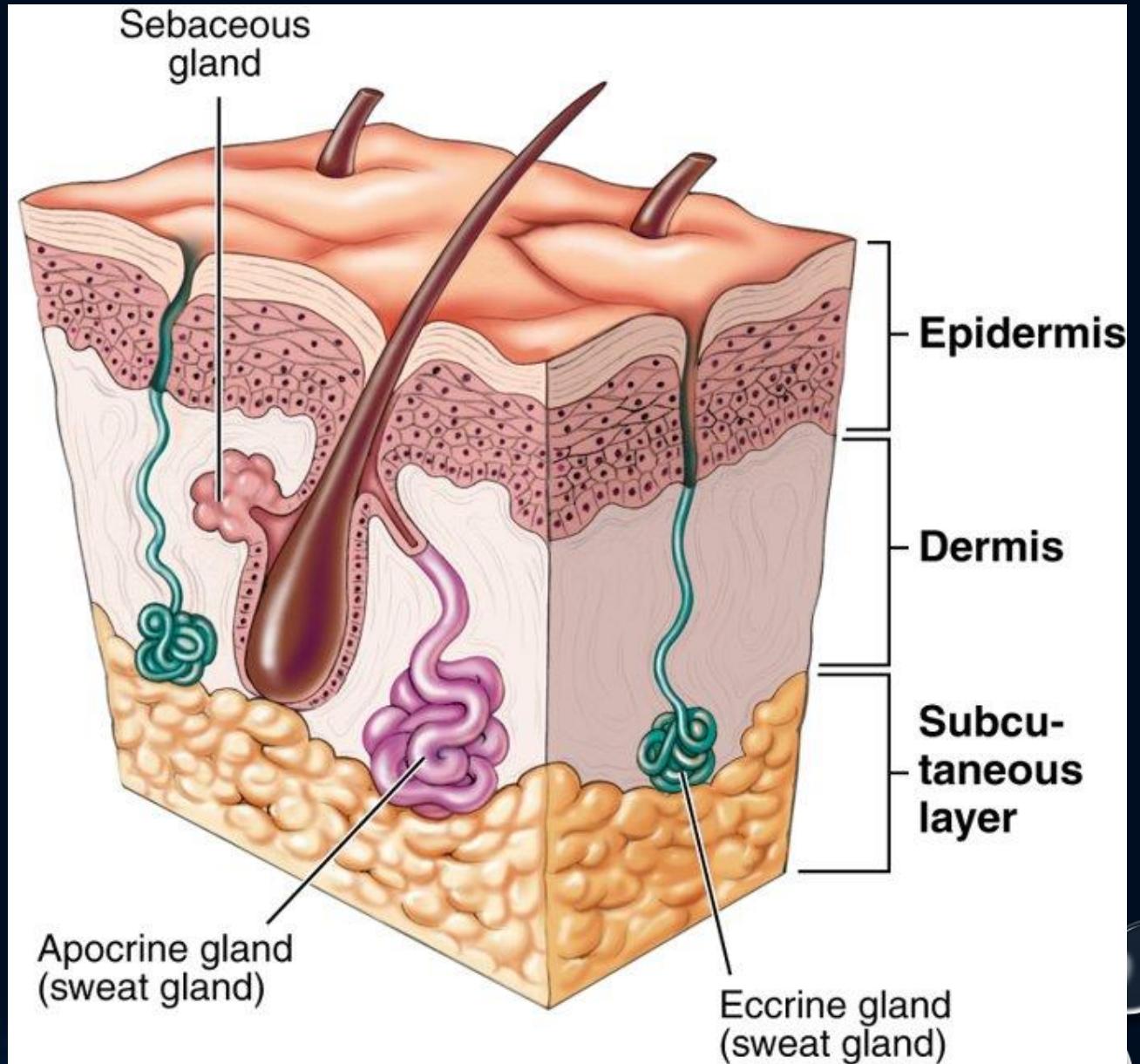
- Three zones along hair
 - *Hair bulb* – epithelial cells. Is a swelling at the base where hair originates in the dermis.
 - *Root* – hair within the follicle internal to the skin surface
 - *Shaft* – portion of hair that extends beyond skin surface
- Root and shaft are dead epithelial cells, bulb is living epithelial cells



Glands

- Sebaceous glands
- Discharge oily waxy secretion (sebum) usually into hair follicles
- Lubricant to keep skin and hair from becoming dry, brittle, cracked
- Responsible for vernix in newborns

Upon kidney failure, nitrogen will exit through sweat instead. Called uremic frost (white coating on skin).



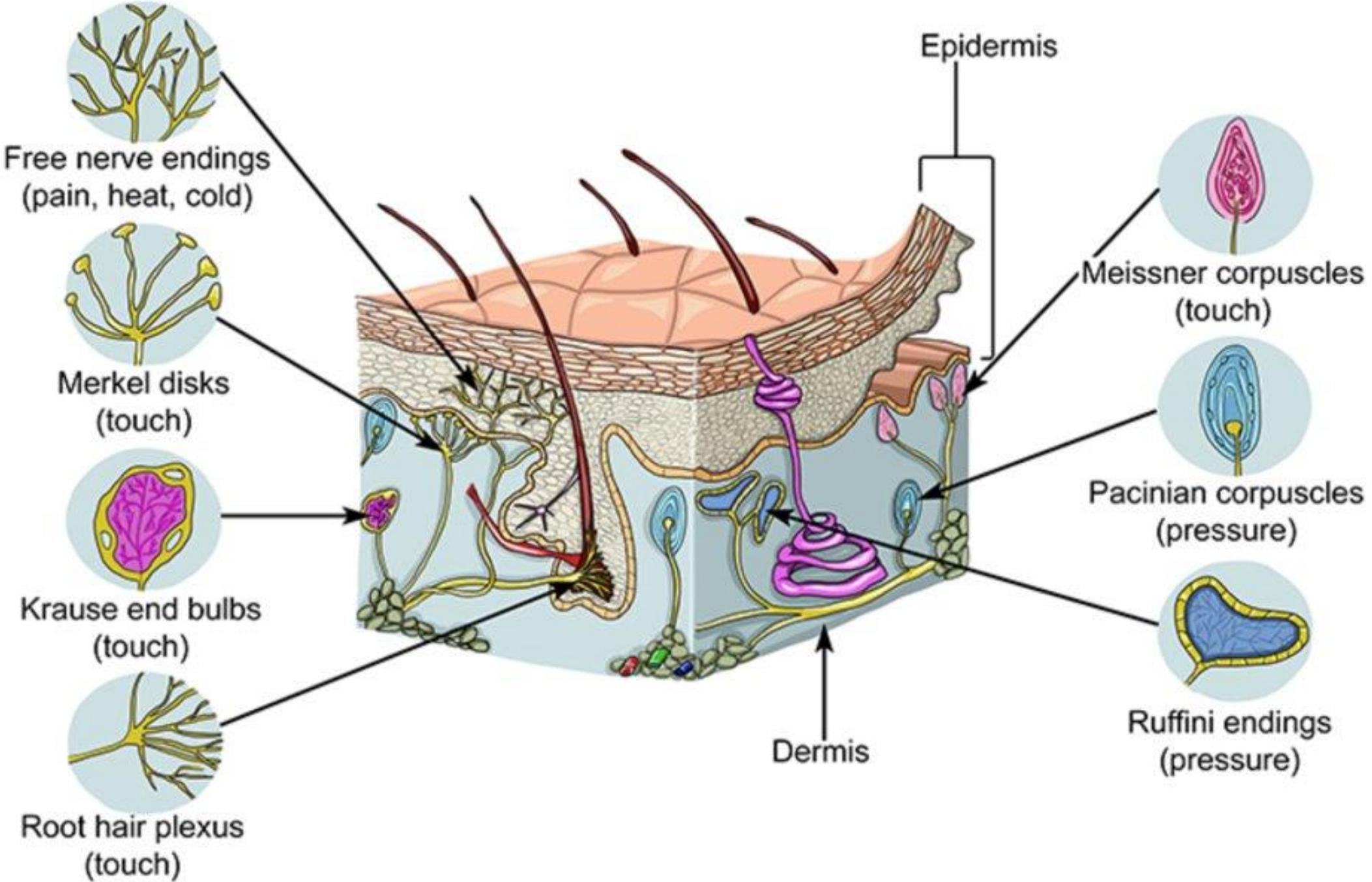
Glands

- Two types of exocrine glands
 - *Sweat (sudoriferous) glands*
 - *Sebaceous glands*
- Sweat glands produce watery solution. Located in reticular layer of dermis
- *Merocrine sweat glands: axillary, anal, areolar, pubic region*
- *Apocrine sweat glands: distributed throughout rest of body*

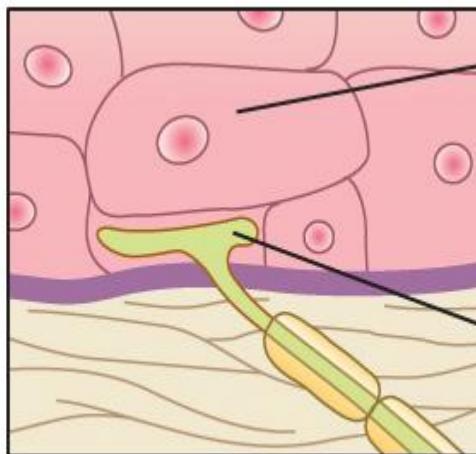
These two are mostly same. Only remember apocrine vs eccrine
- Coiled tubular secretory portion located in reticular layer of dermis or subcutaneous layer
- Sweat gland duct carries secretions to surface of epidermis (merocrine) or to hair follicle (apocrine)
- Opening of duct on the surface is the sweat pore
- myoepithelial cells

Receptors

- Classified according to the stimulus they perceive (modality of stimulus)
- ***Chemoreceptors*** – detect chemicals (e.g. taste buds)
- ***Thermoreceptors*** – respond to changes in temperature
- ***Photoreceptors*** – detect changes in light intensity, colour, movement (located in eye)
- ***Mechanoreceptors*** – respond to touch, pressure, vibration, stretch (located in skin)
- ***Baroreceptors*** - detect changes or pressure in body structures. (located in organ walls)
- ***Nociceptors*** – respond to pain caused by internal or external stimuli



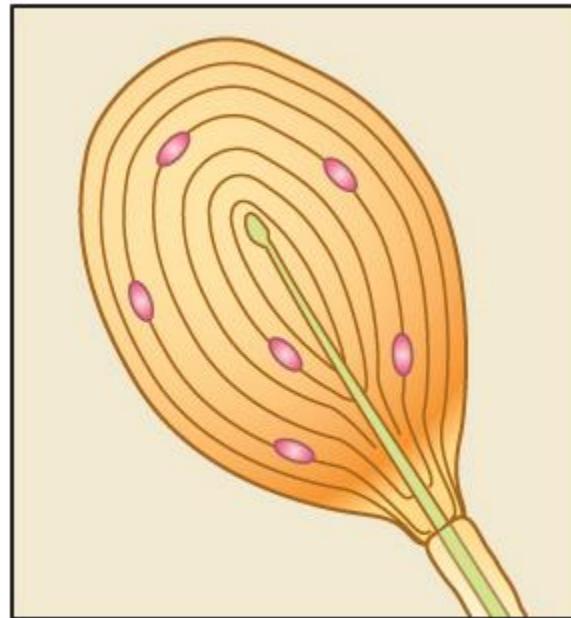
Merkel Discs & Pacinian Corpuscles



Tactile
epithelial
cell

Tactile
disk

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