Skin Histology

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Integumentary system

Prof. Dr.
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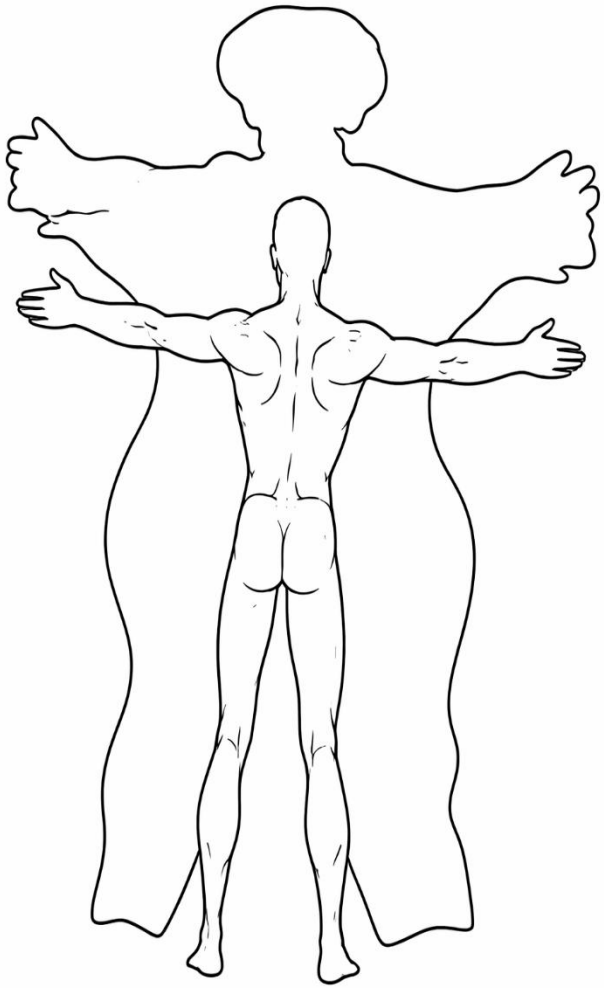
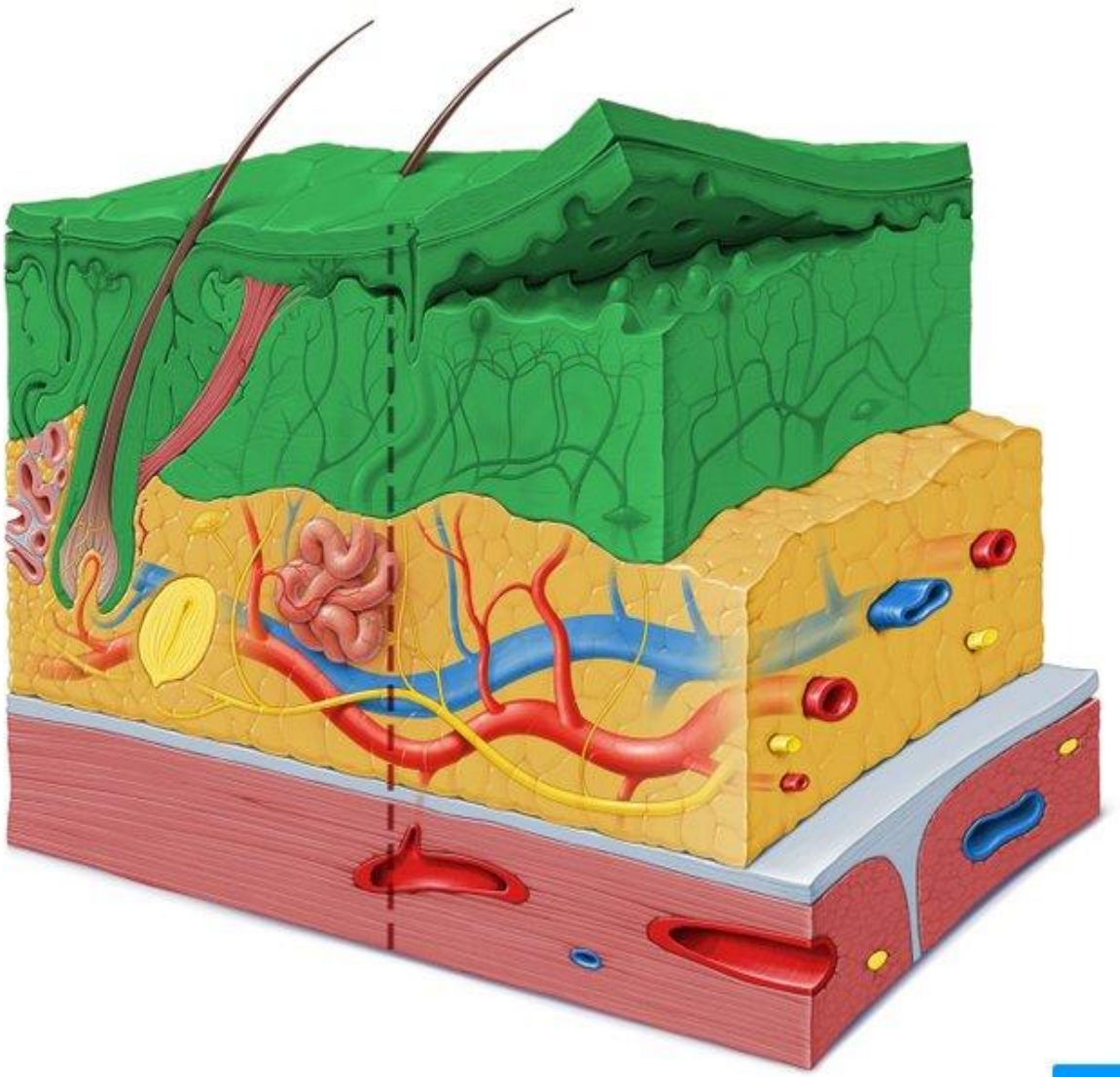
The skin is considered the largest organ of the body





Basic Skin Histology

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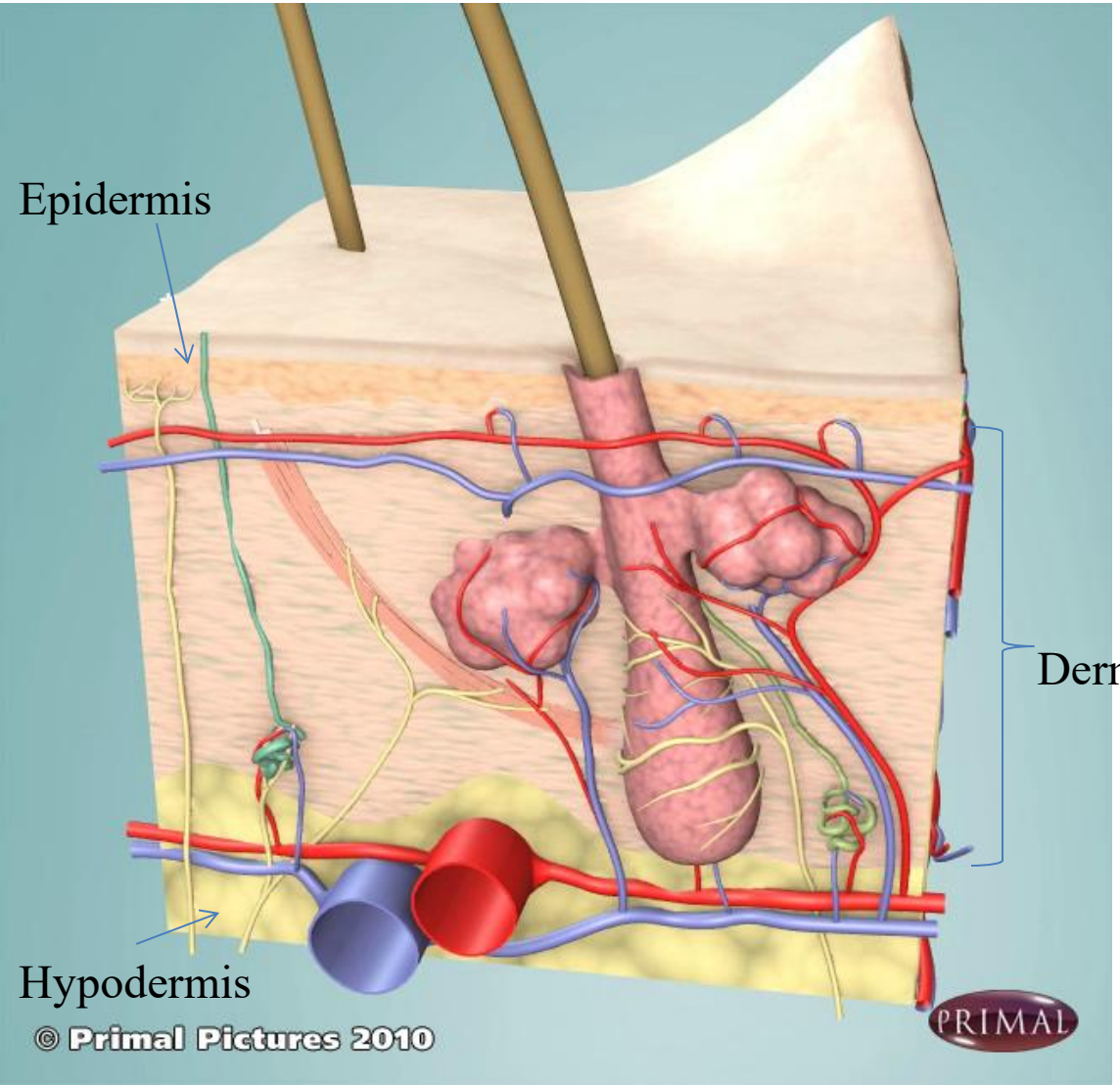
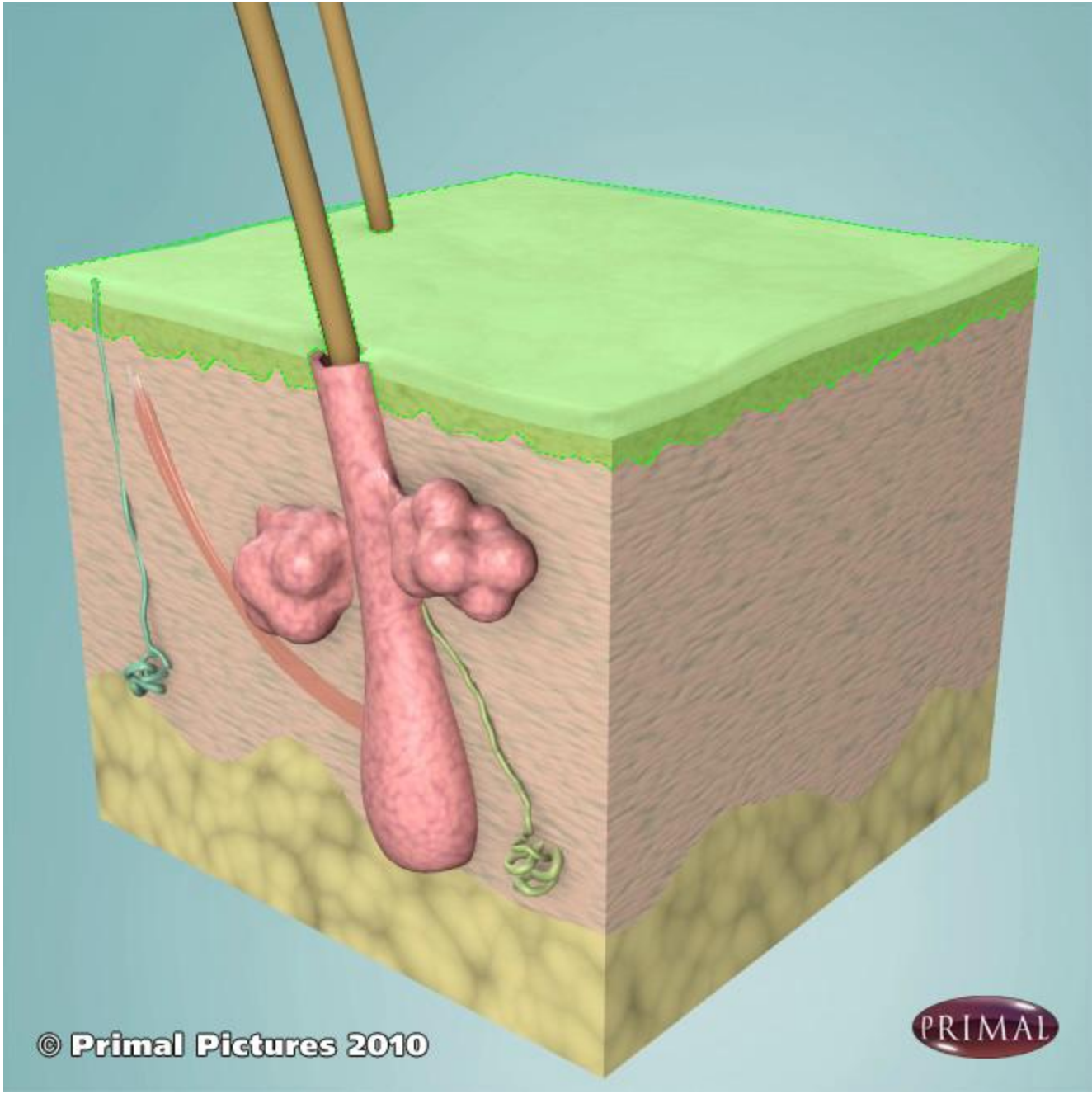
The skin is composed of two layers: the outer epidermis and the deeper dermis
Rests on the hypodermis.



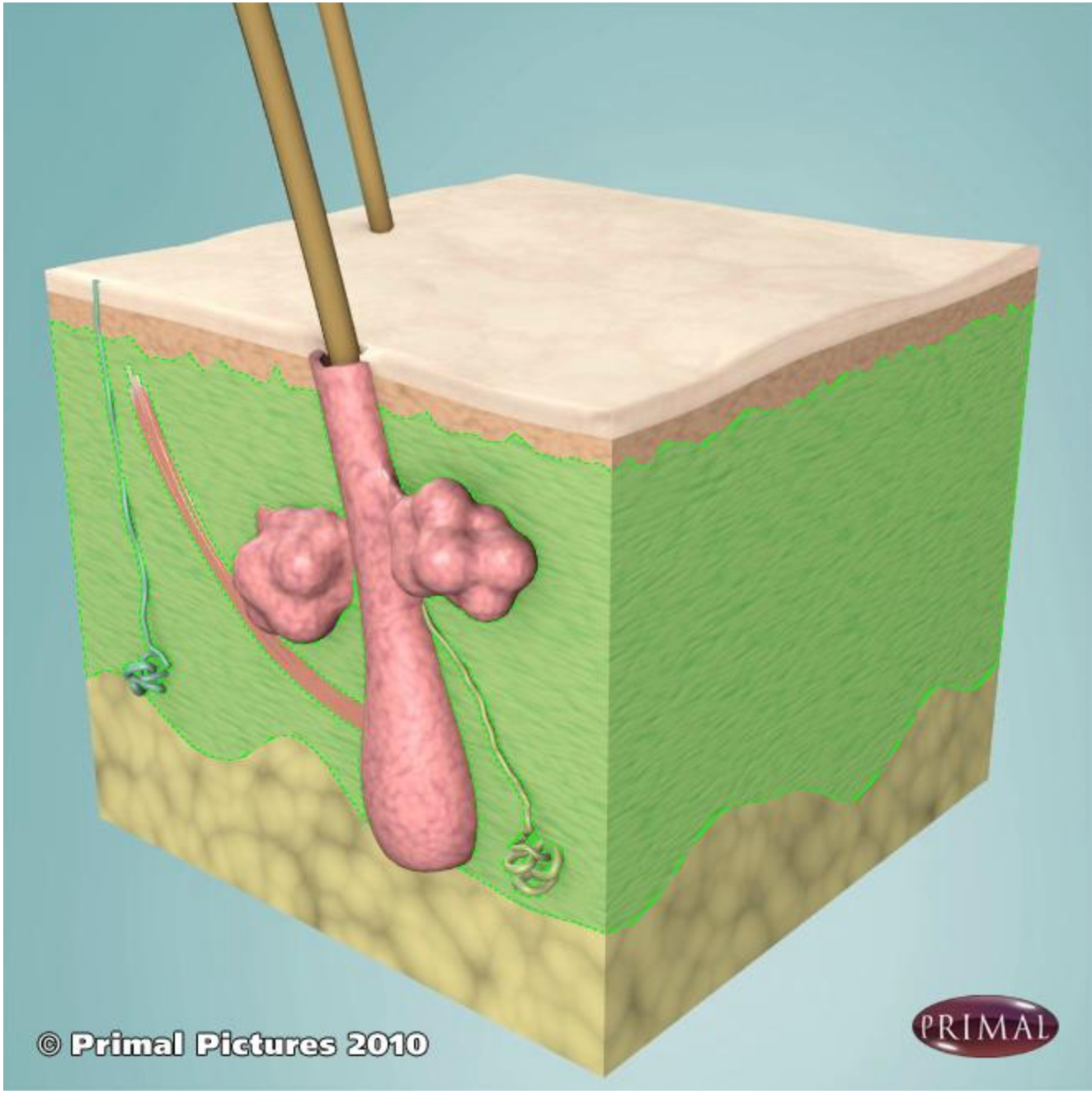
Skin histology is clinically relevant across all medical specialties.

Major Skin Functions
- Protection
- Sensory Perception
- Temperature Regulation
- Excretion
- Formation of Vitamin D

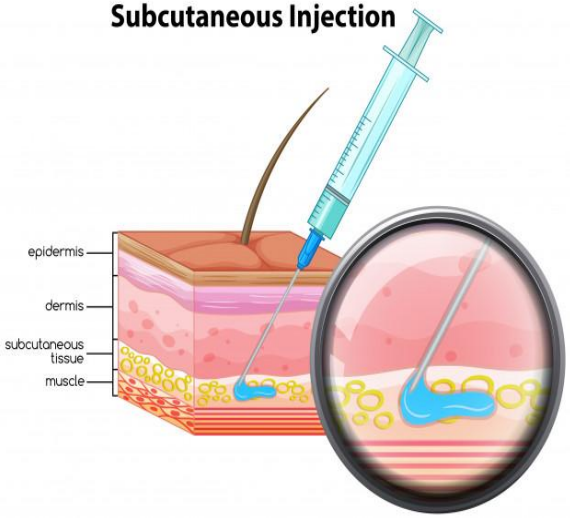
Epidermis

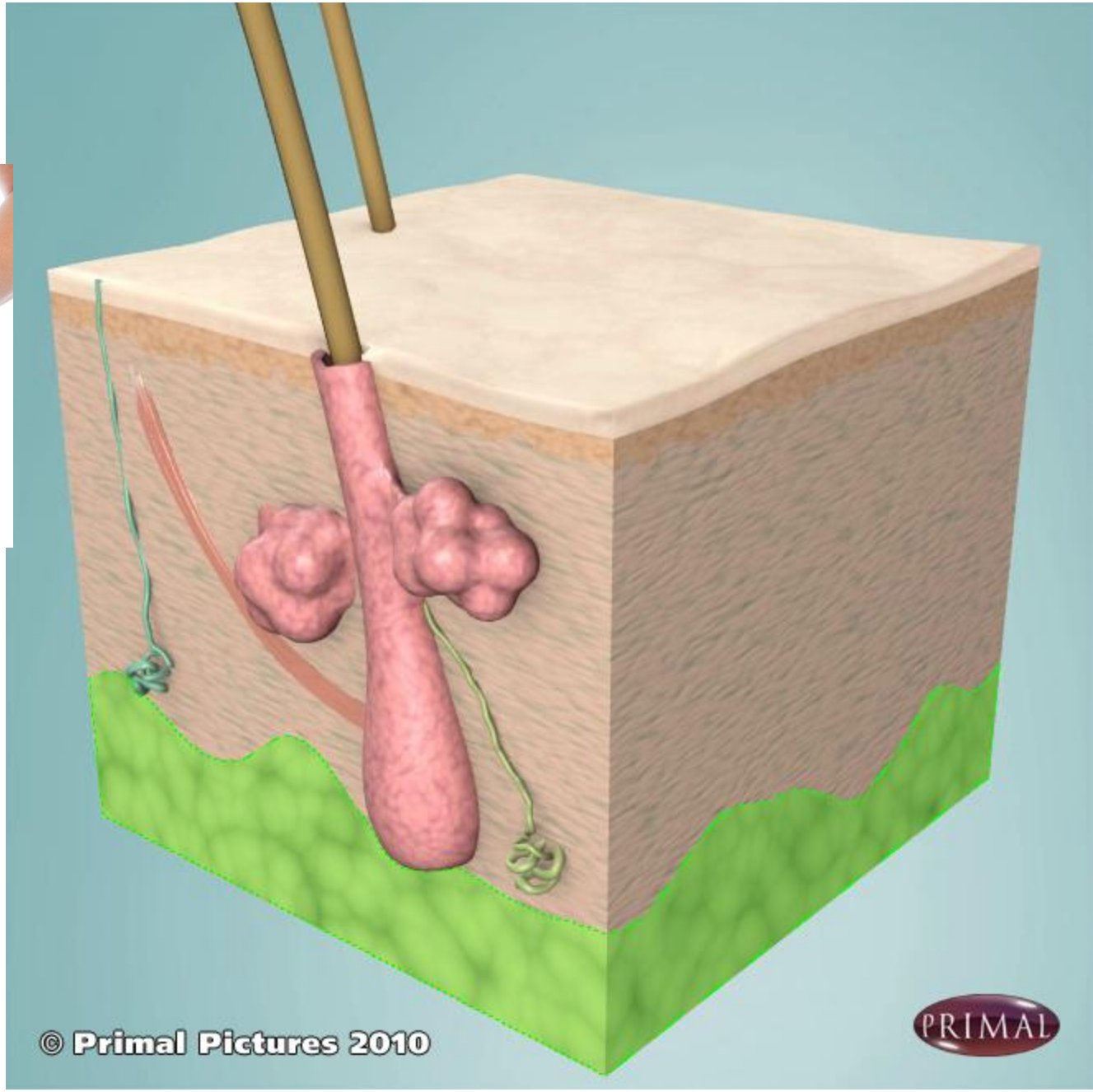


Dermis



Hypodermis
Superficial fascia
Subcutanous tissue
Subdermal fat





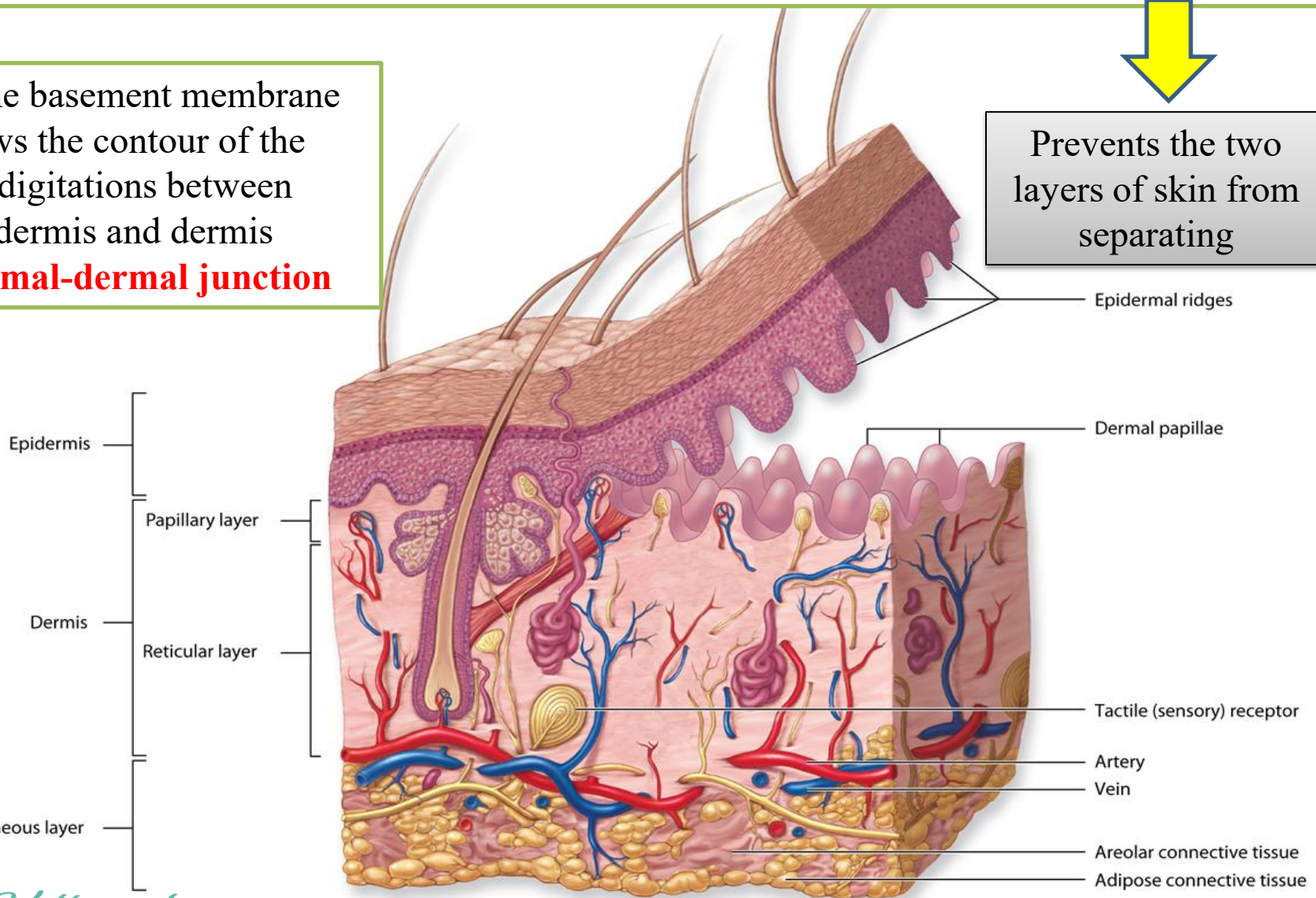
The **dermal papillae** are nipple-like extensions of the dermis into the epidermis

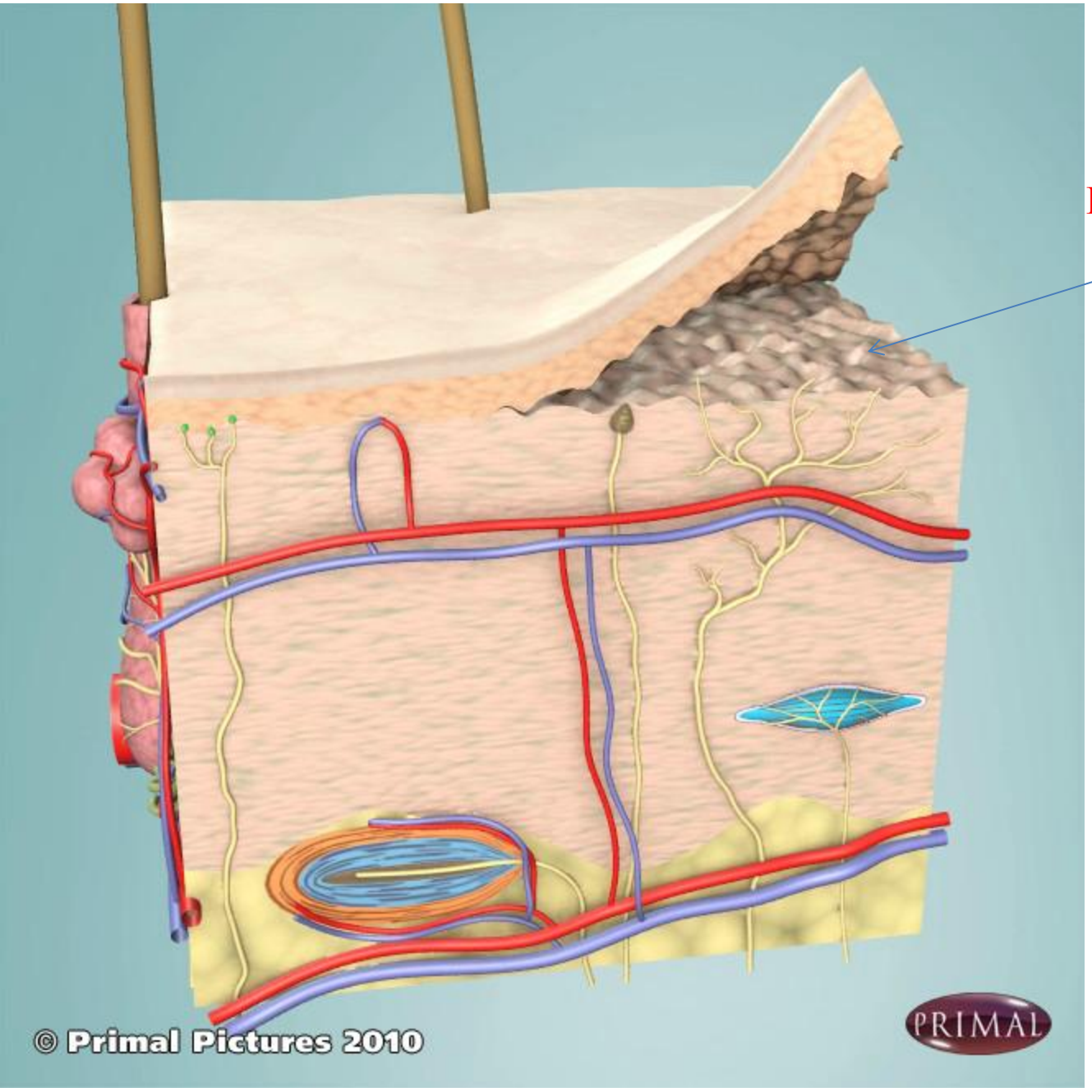
The epidermis conforms to the contours of the underlying dermal papillae forming **epidermal ridges**

Note: the basement membrane follows the contour of the interdigitations between epidermis and dermis

Epidermal-dermal junction

Prevents the two layers of skin from separating





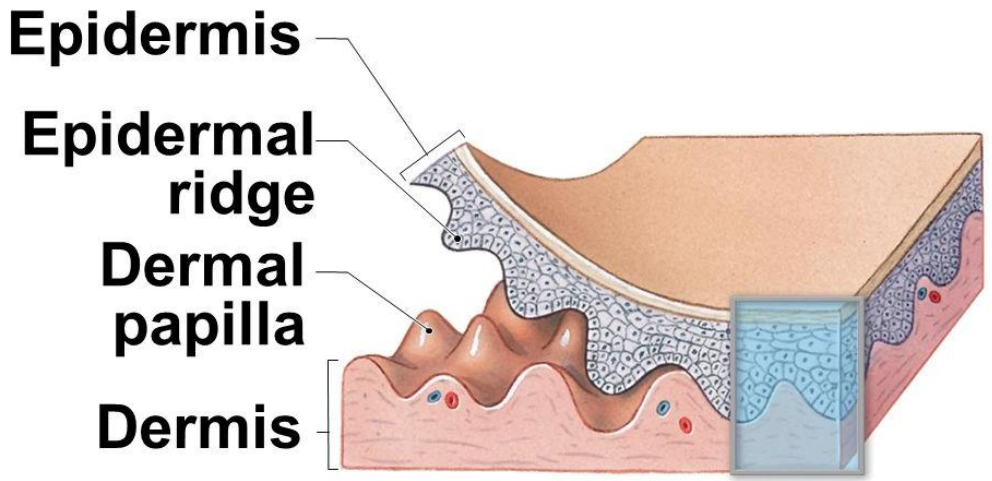
Epidermal-dermal junction

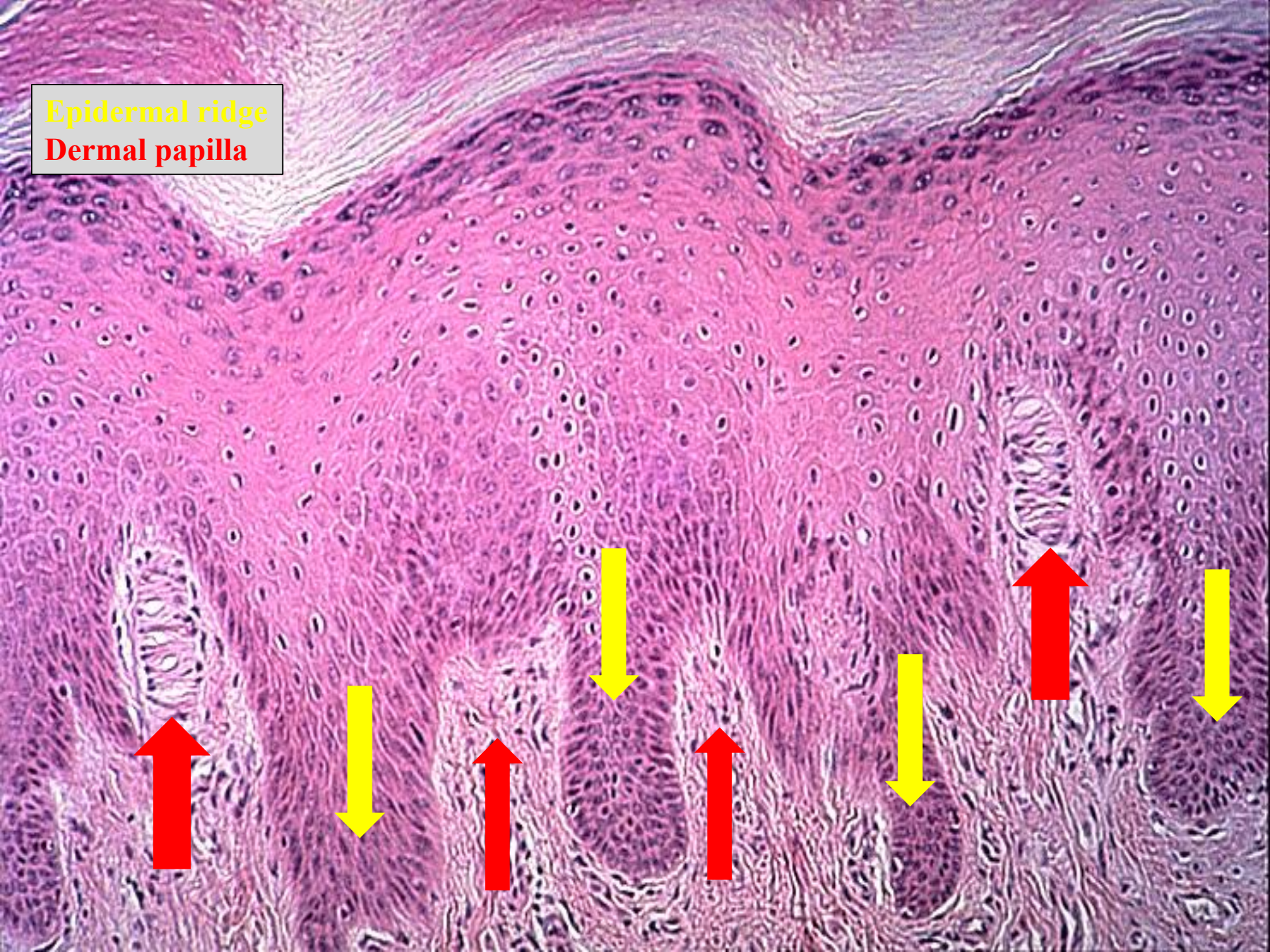
More prominent in palms and soles

These interdigitations form distinctive patterns unique for each individual (fingerprints and footprints)

Blisters

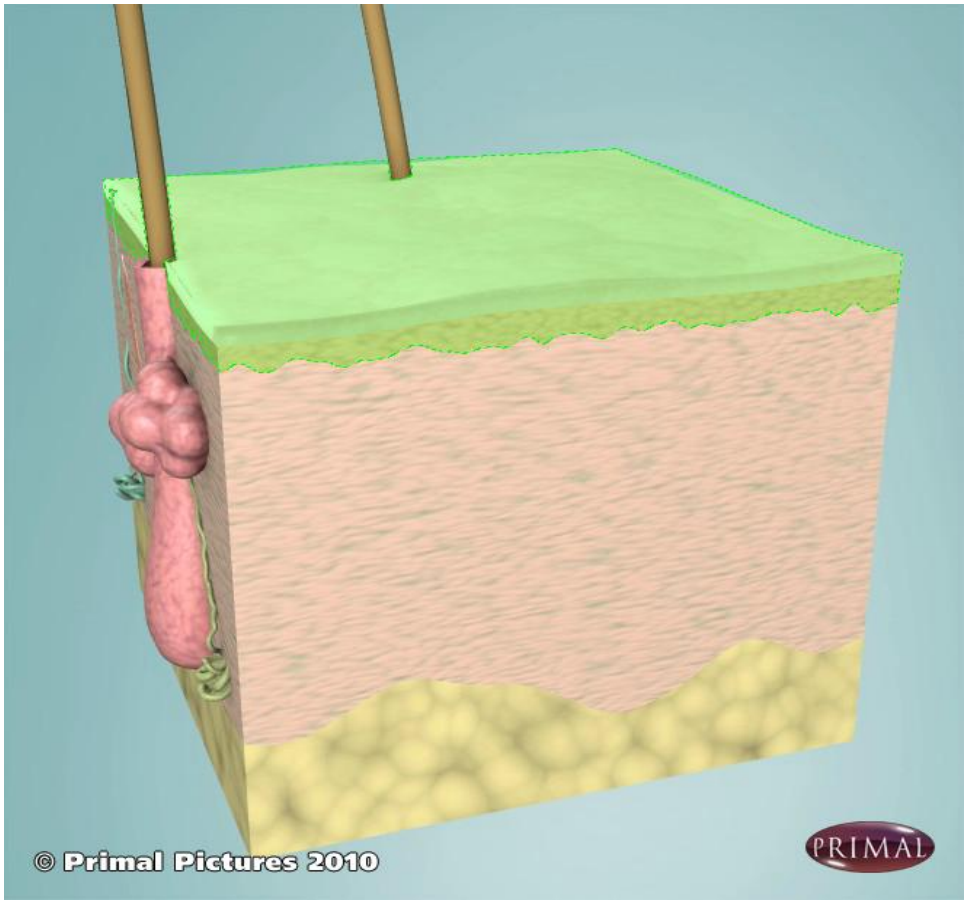
These interdigitations are called **friction ridges**
For grasping with our hands
And for walking barefoot




Epidermal ridge
Dermal papilla

Epidermis

- Is the outermost layer of the skin
- It is composed of four or five layers, depending on the type of skin.
- It is rich in a tough protein called keratin
- Contains four different cell types:
  - **Keratinocytes**
  - **Melanocytes**
  - **Langerhans cells**
  - **Merkel cells**
- Avascular
- The epidermis forms a waterproof barrier between the body and the external environment, which resists friction and microbial invasion and prevents water loss
- Is derived from ectoderm



Keratinized stratified squamous epithelium

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(1) Stratum basale

- Is the deepest layer in the epidermis.
- Consists of a single layer of basophilic columnar to cuboidal cells that rest on a basement membrane
- The cells are attached to one another by desmosomes, and to the underlying basement membrane by hemidesmosomes.
- Cells are characterized by intense mitotic activity

As cells of the outer surface of the epidermis are continually being sloughed off, some cells in the stratum basale divide continuously, replenishing the epidermis.

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(2)Stratum spinosum

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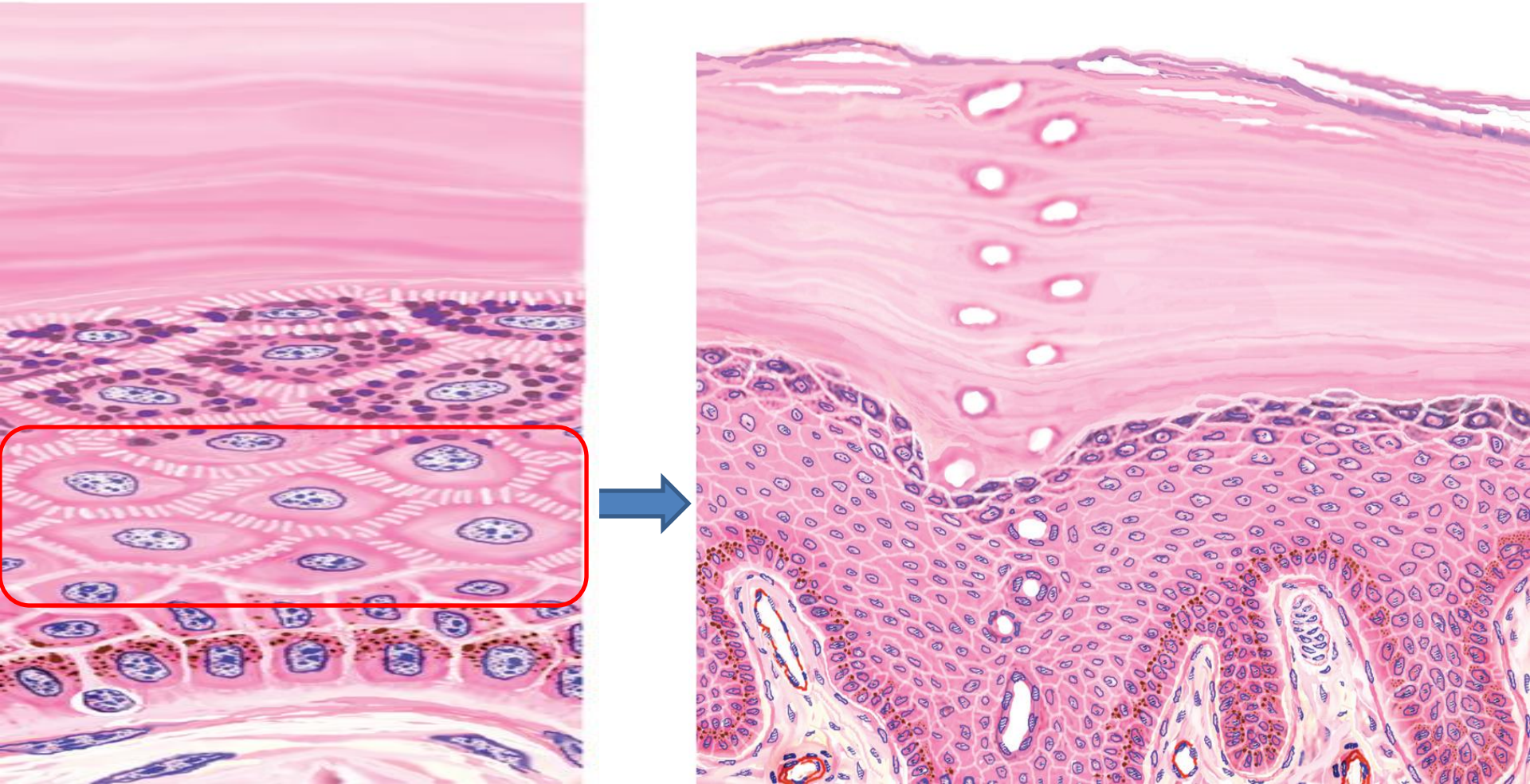
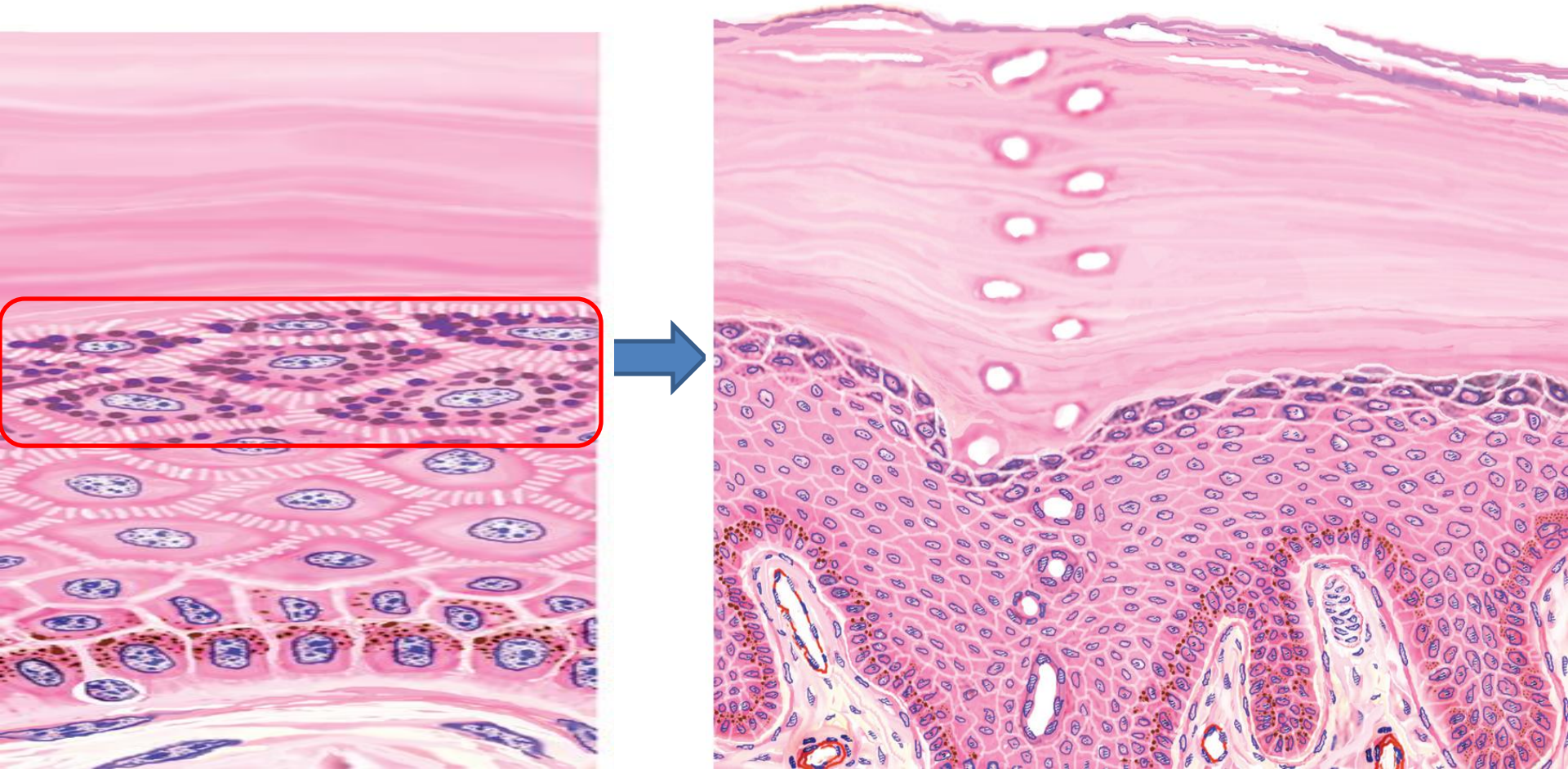
- Is the layer above the stratum basale
- Consists of 8-10 rows of cells
- Cells synthesize keratin filaments that become assembled into tonofilaments
- During histologic preparation, cells shrink and intercellular spaces appear as spines
- Spines represent sites of desmosome attachments to keratin tonofibrils



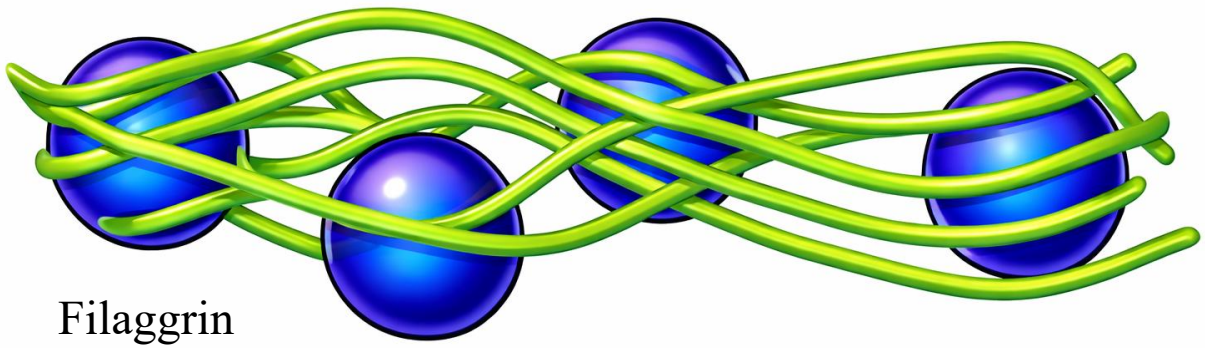
Stratum basale along with the deepest part of stratum spinosum is called
Stratum germinativum

(3)Stratum granulosum

- Cells above the stratum spinosum
- Consists of 3-5 cell layers of flattened cells
- Cells filled with dense basophilic keratohyalin granules and membrane- bound lamellar granules



Keratohyalin granules are intensely basophilic, non membranous bound masses of filaggrin cross-links with keratin tonofibrils

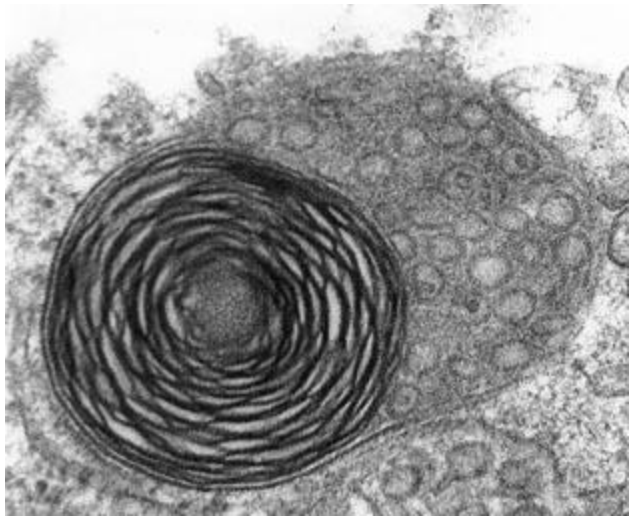


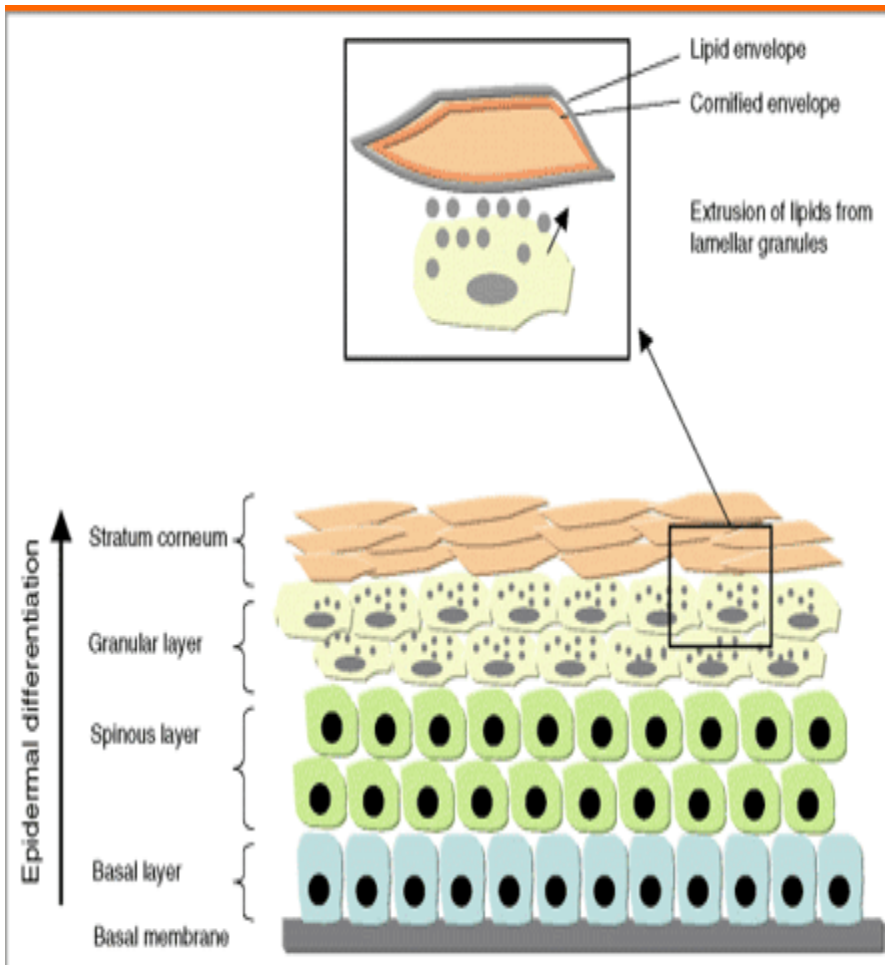
Tonofibrils

Intermediate filaments= keratin

Tonofilaments

Lamellar granules discharge lipid material between cells and waterproof the skin





(4)Stratum Lucidum

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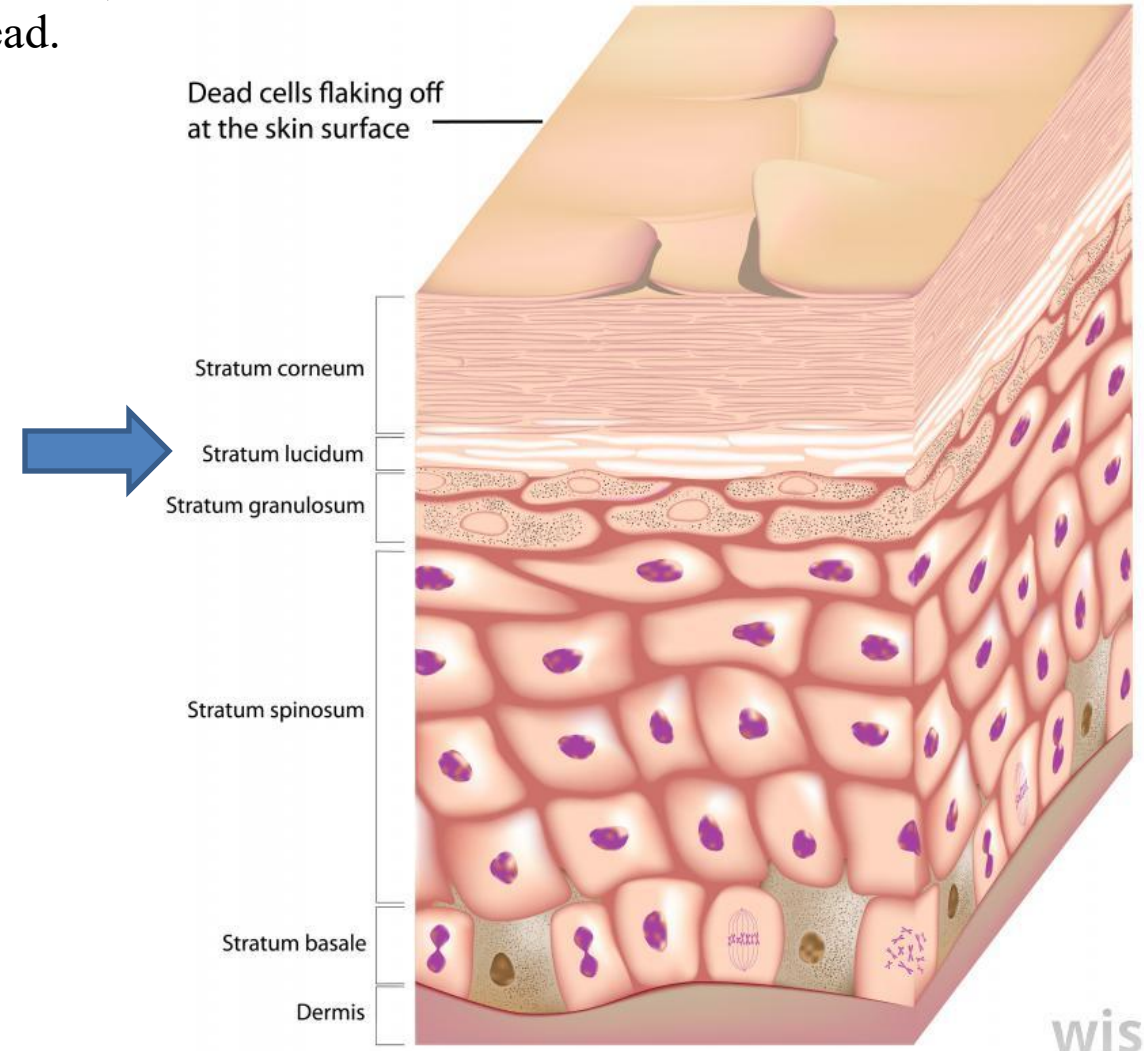
- In thick skin only
- Is translucent and barely visible
- The tightly packed cells (desmosomes) lack nuclei or organelles and are dead.



(5)Stratum corneum

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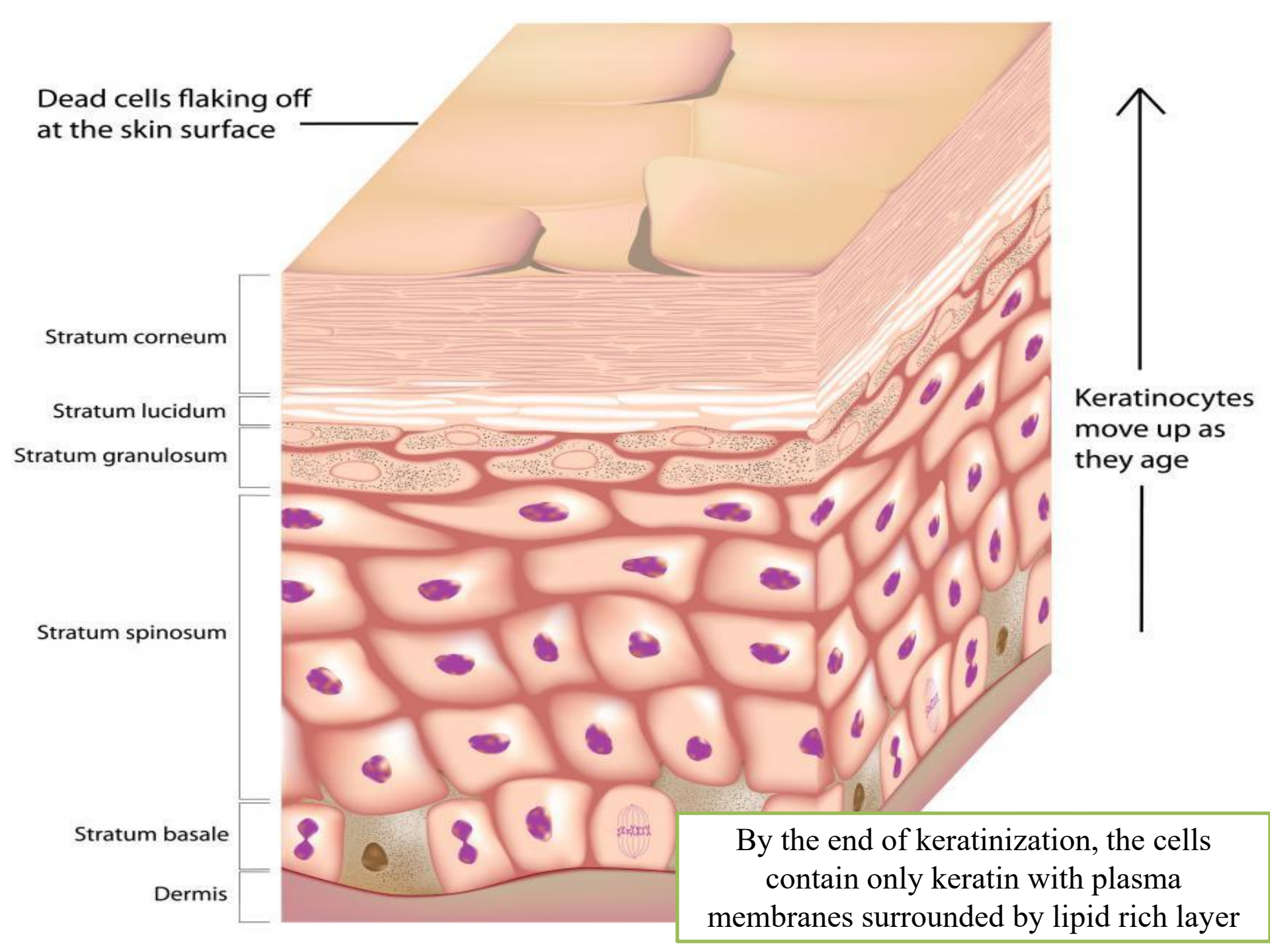
- Most superficial layer of the skin.
- Consists of dead, flattened cells with no nuclei and cell organelles
- The dead cells contain much keratin filaments with plasma membranes surrounded by lipid-rich layer
- The cells from this layer are continually shed, or desquamated, and are replaced by new cells arising from the deep stratum basale.
- During the keratinization process, the hydrolytic enzymes disrupt the nucleus and all cytoplasmic organelles, which disappear as the cells fill with keratin.

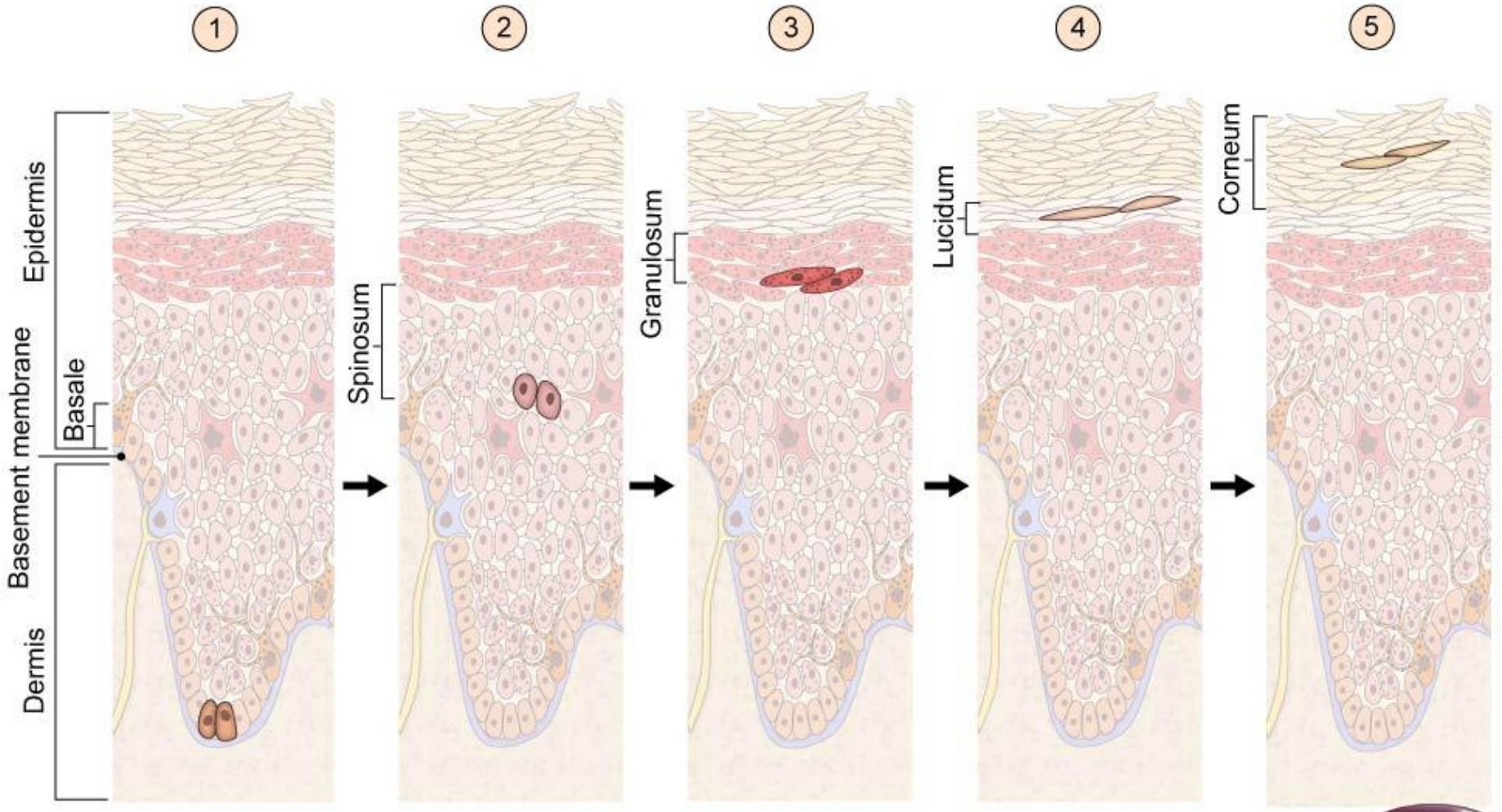
This layer acts to waterproof the skin surface

Keratin is a tough and fibrous protein that serves to protect the skin.

Calluses and corns



By the end of keratinization, the cells contain only keratin with plasma membranes surrounded by lipid rich layer



Psoriasis taht noitidnoc niks nommoc a si sesuac tI .sllec niks fo elcyc efil eht pu sdeeps eht fo ecafrus eht no yldipar pu dliub ot sllec der dna selacs mrof sllec niks artxe ehT .niks .lufniap semitemos dna yhcti era taht sehctap

Psoriasis is characterized by accelerated keratinocyte proliferation and incomplete keratinization, resulting in thickened epidermis (acanthosis), parakeratosis, and scaling.

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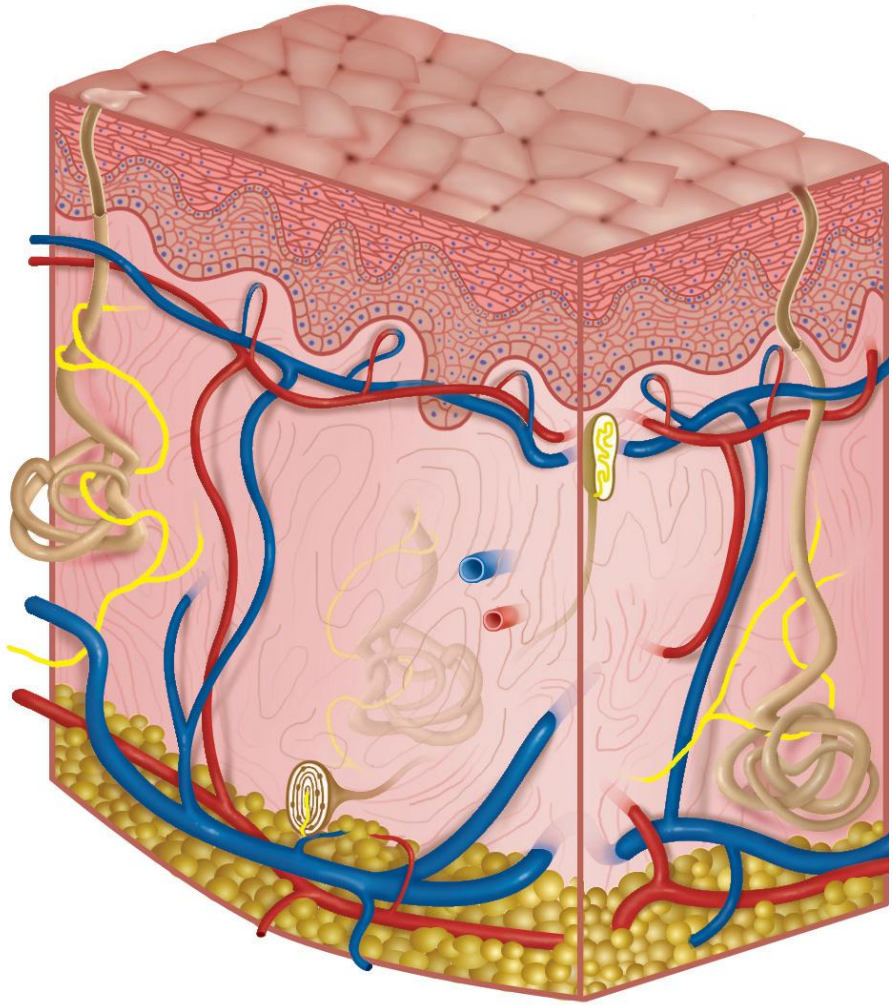
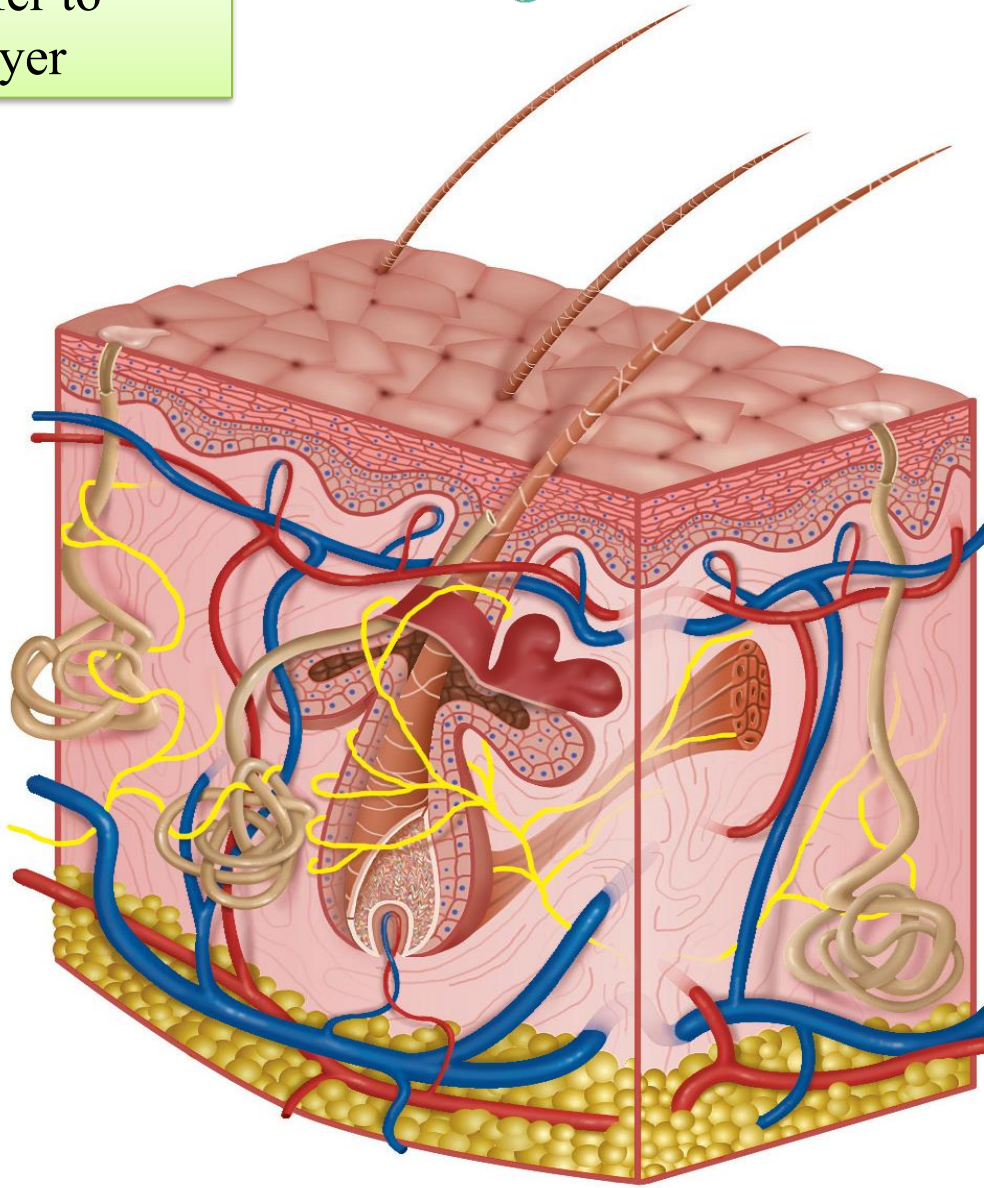
Note: that the thin and thick refer to the thickness of epidermal layer



Thick skin



Thin skin

Types of skin

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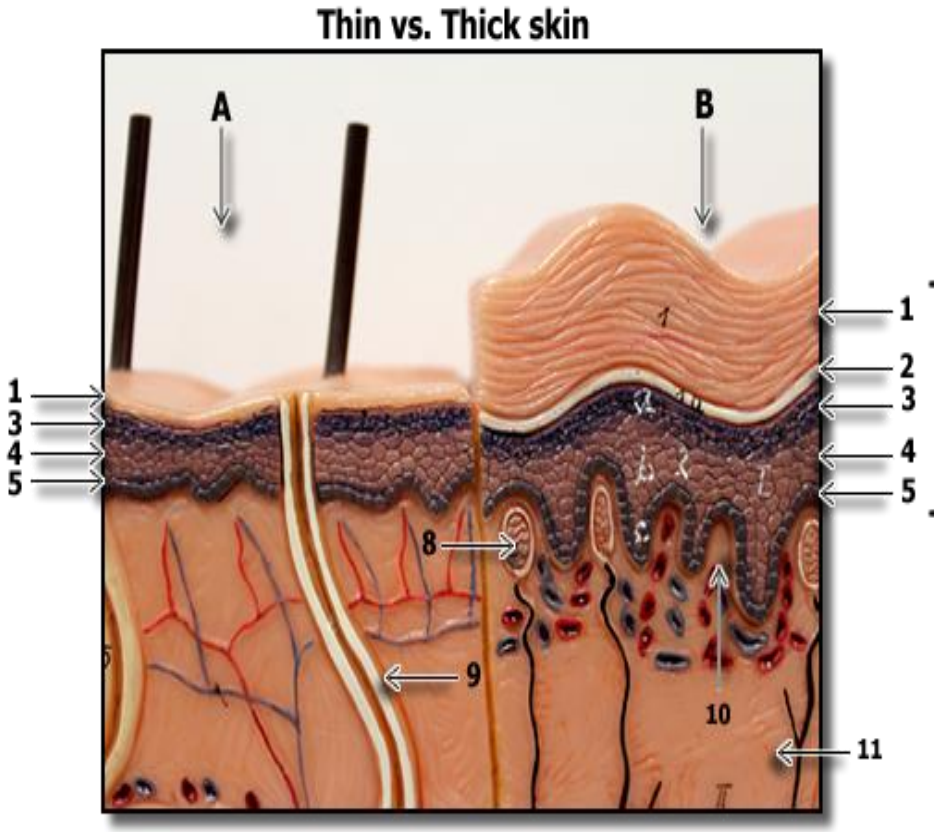
Thin skin

Thick skin

The terms thick and thin refer only to the thickness of the epidermis, not the dermis.

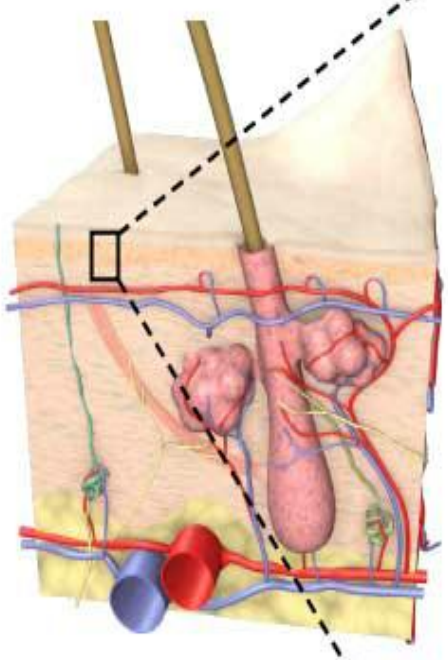
*** Dominant and lines most of the body surface**

The skin of the back is thin…..The skin of the eyelids is thin too!!!



*** Palms of the hands and soles of the feet**

Thick skin resists the abrasion and friction



Non-hairy skin 1.5mm

Hairy skin 0.1mm

Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Stratum basale
Basement membrane
Sensory nerve
Dermis

Langerhans cell
Merkel cell
Melanocyte
Keratinocyte

Langerhans cell
Merkel cell
Keratinocyte
Melanocyte

Types of skin

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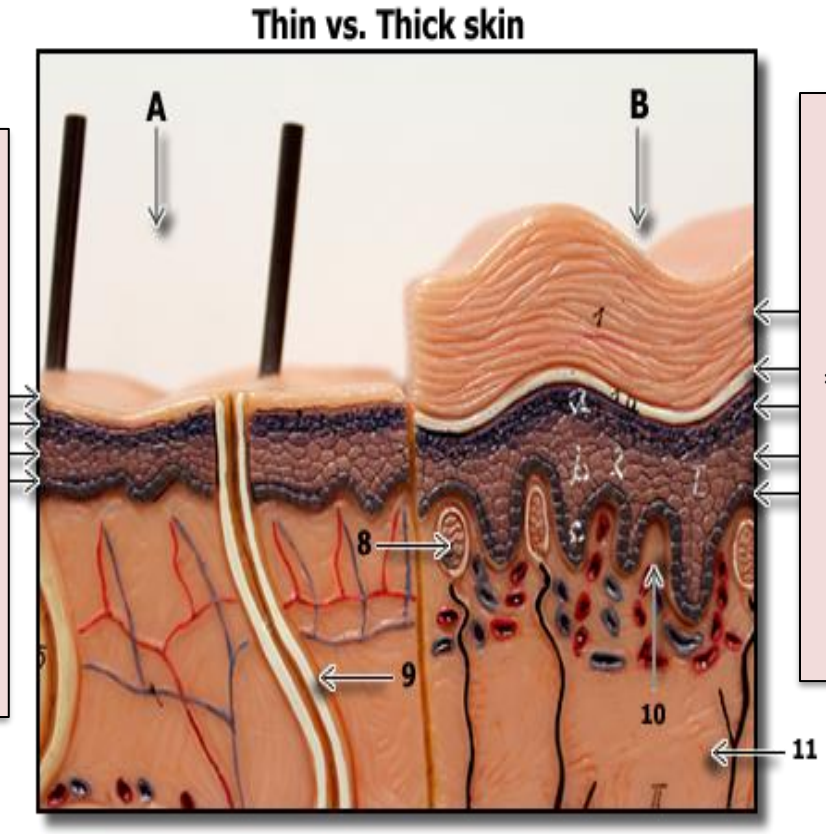
Thin skin

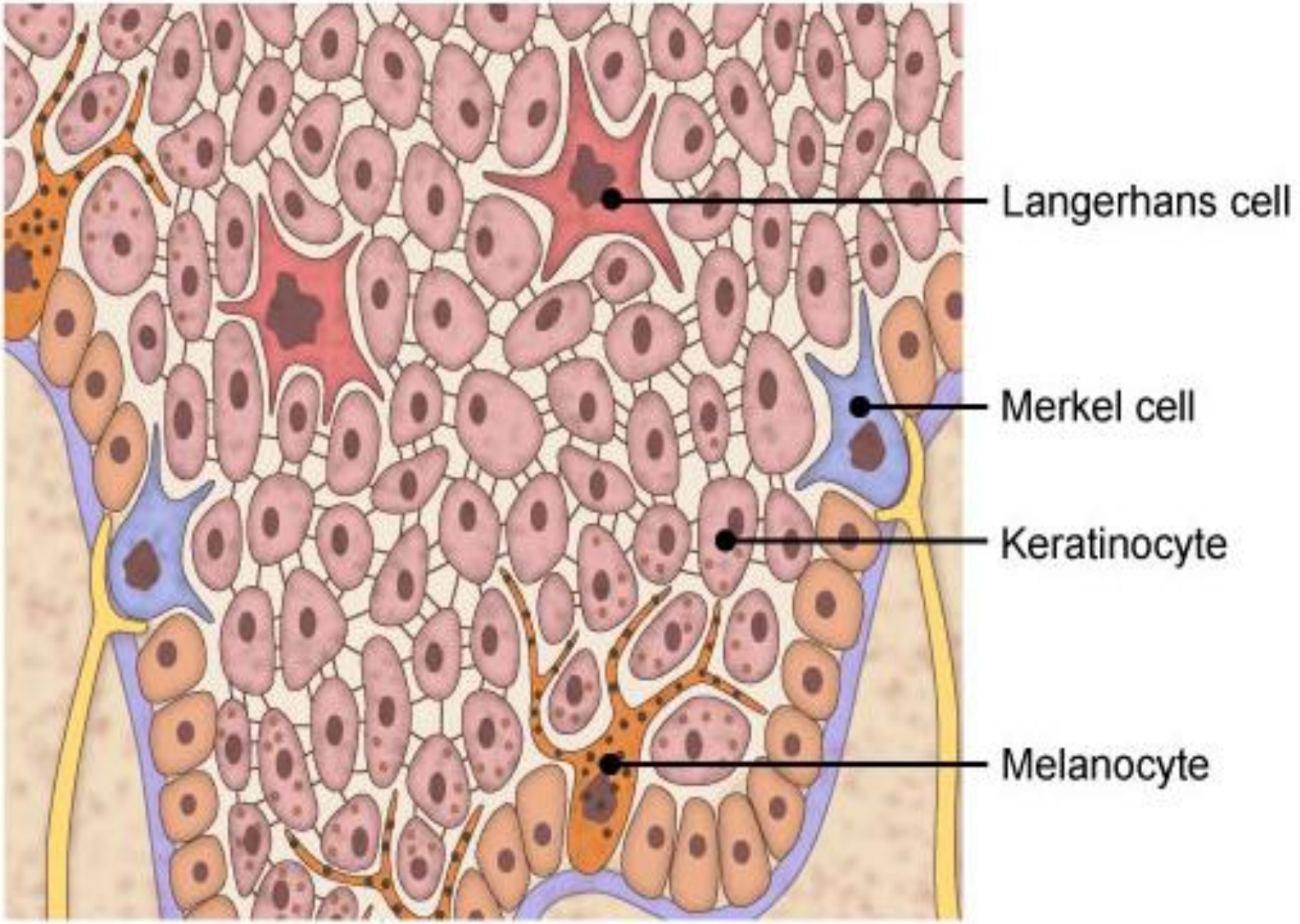
*4 layers
* Less Prominent stratum corneum
* Less developed stratum granulosum
* Dominant and lines most of the body surface
* Thin epidermis + variable dermis thickness (often thicker on back)
* Hair and sebaceous glands

Thick skin

*5 layers
* Prominent stratum corneum
* Well developed stratum granulosum
* Palms of the hands and soles of the feet
* Thick epidermis + relatively thick dermis
* No hair and sebaceous glands



TYPES OF EPIDERMAL CELLS



(1)-keratinocytes:

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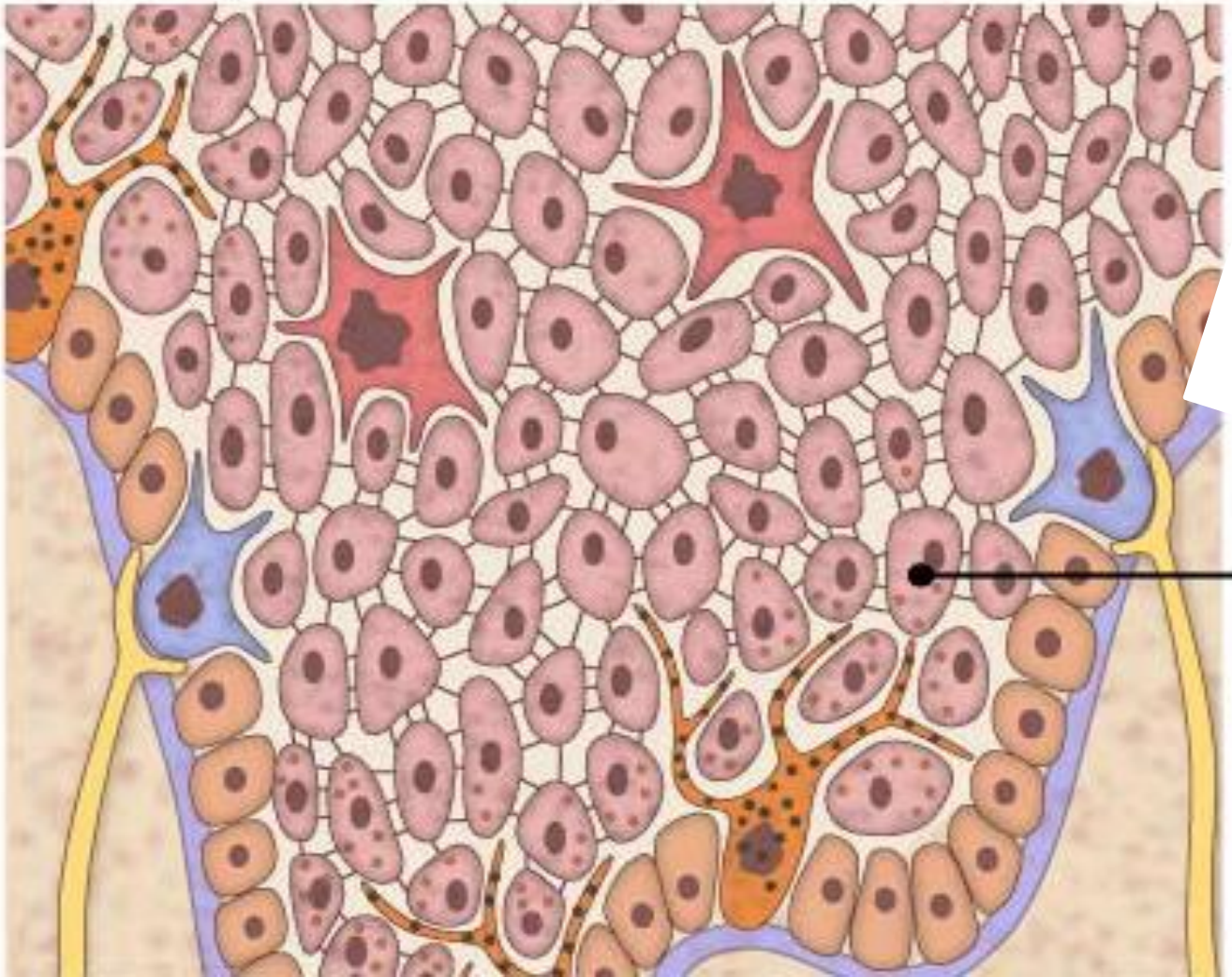
- Approximately 90% of epidermal cells are keratinocytes.
- Produce **keratin**
- Produce **lamellar granules** that helps waterproof the skin



NOTE: The structure of keratinocytes changes dramatically as they mature (during migration toward the surface): they change from square-shaped cells to flat cells.

Throughout their life they become engorged with keratin before eventually dying, losing all of their internal structures.

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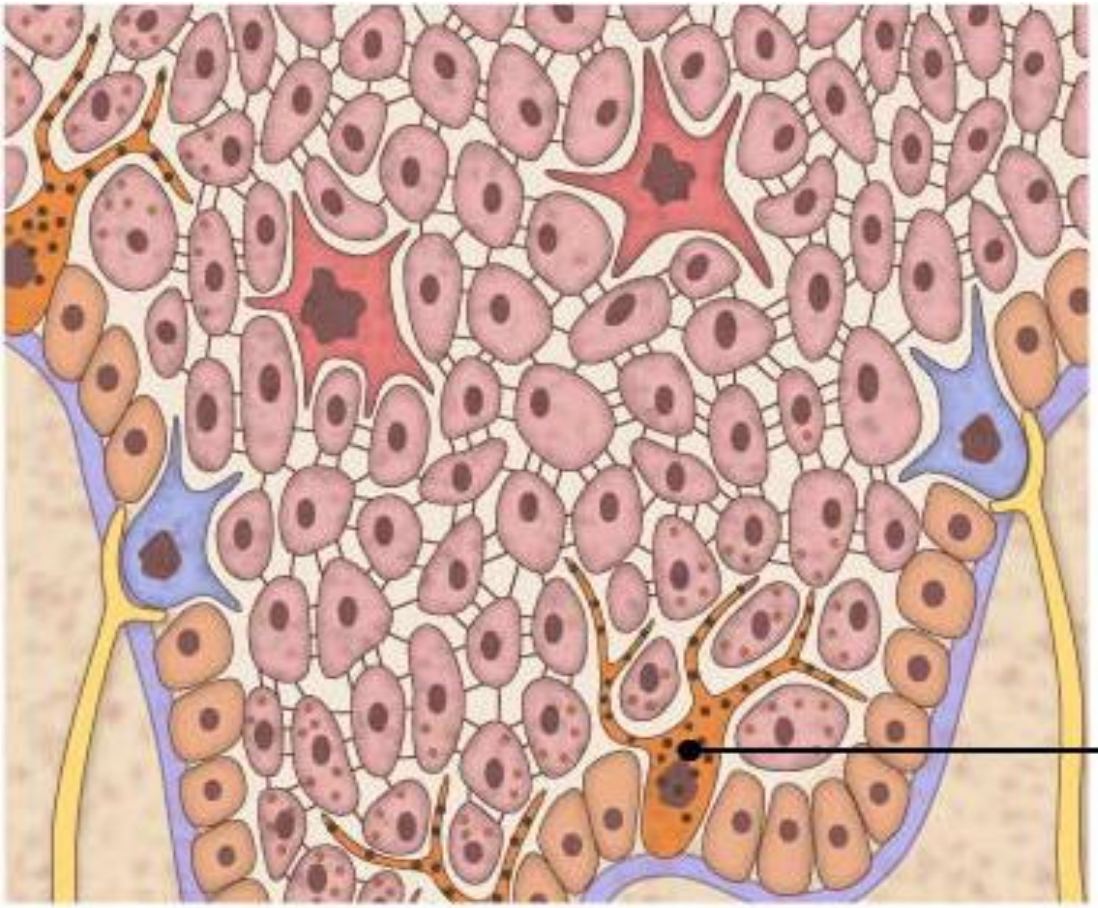
(2)-Melanocytes:

Melanocytes are our natural **SPF**

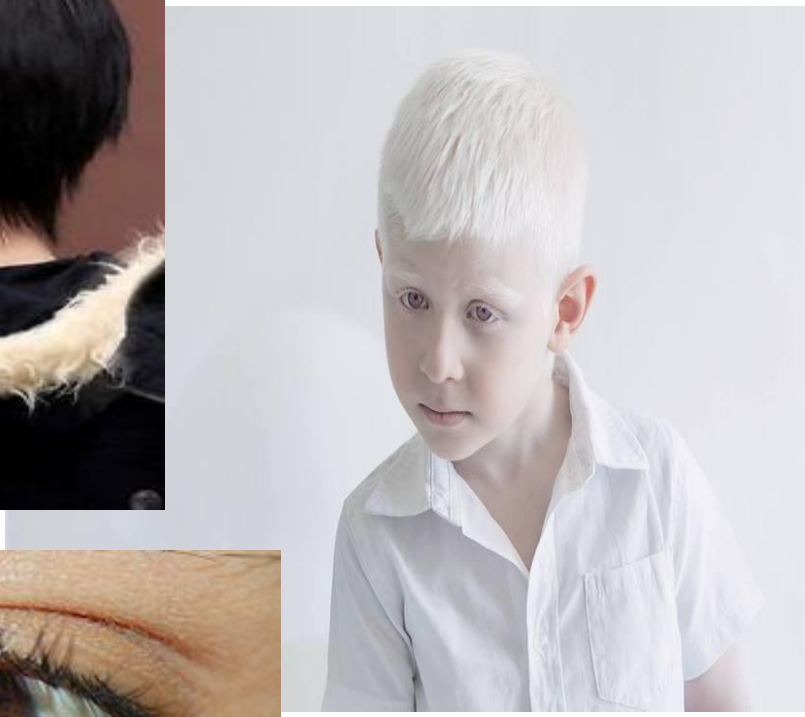
- Are derived from the neural crest cells.
- Have protrusions that transfer melanin granules to the keratinocytes
- Are located in the stratum basale
- Synthesize the dark brown pigment melanin
- Melanin protects the skin from the damaging effects of ultraviolet radiation



Melanin imparts a dark color to the skin, and exposure of the skin to sunlight promotes increased synthesis of melanin

1 melanocyte for every 10 basal keratinocytes

Albinism



(3)- Langerhans cells:

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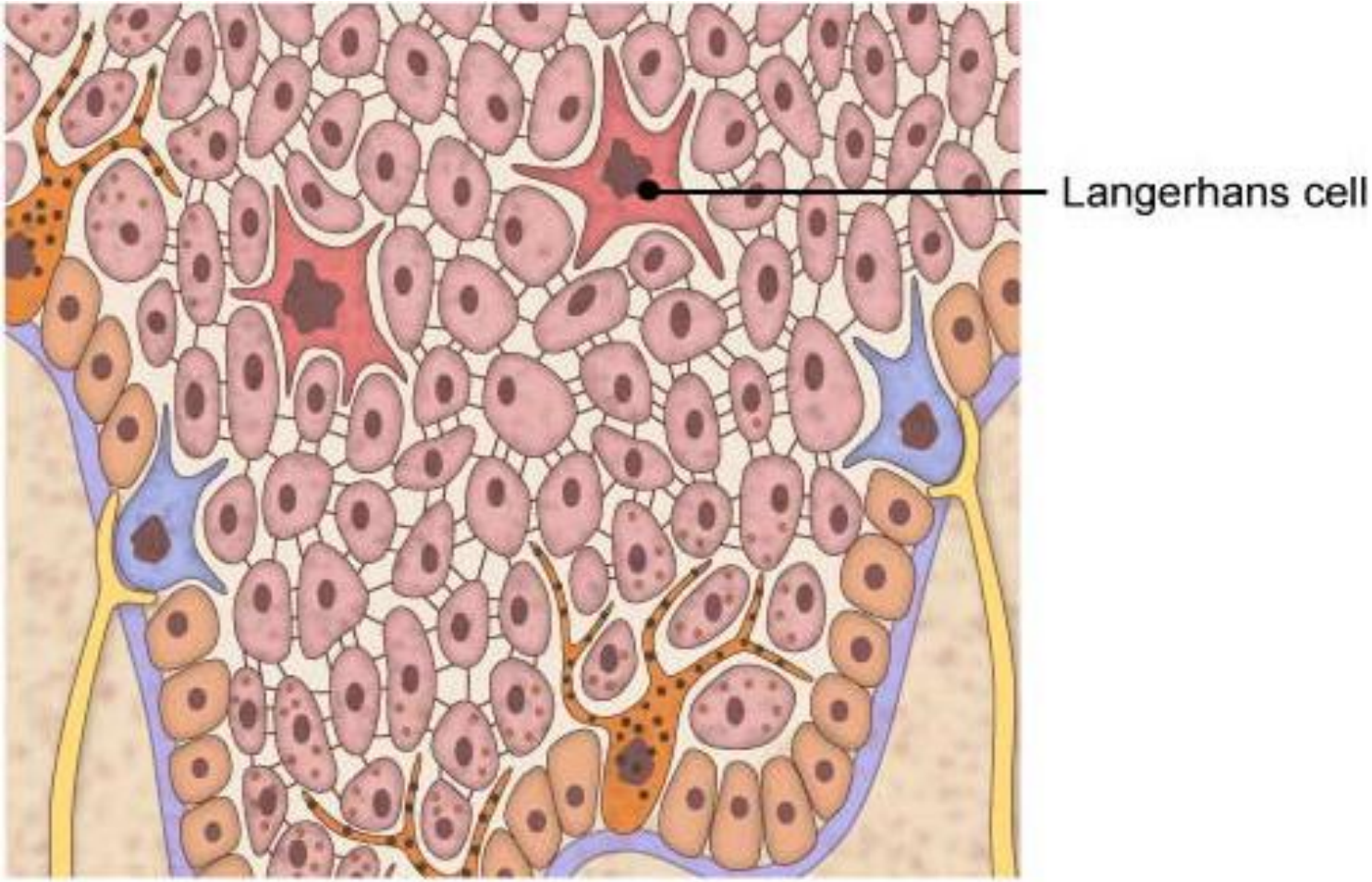
- Originate from bone marrow (monocytes)
- Mainly in the stratum spinosum
- Langerhans cells recognize, phagocytose, and process foreign antigens
- Represent 2-8% of epidermal Cells



(4)- Merkel cells:

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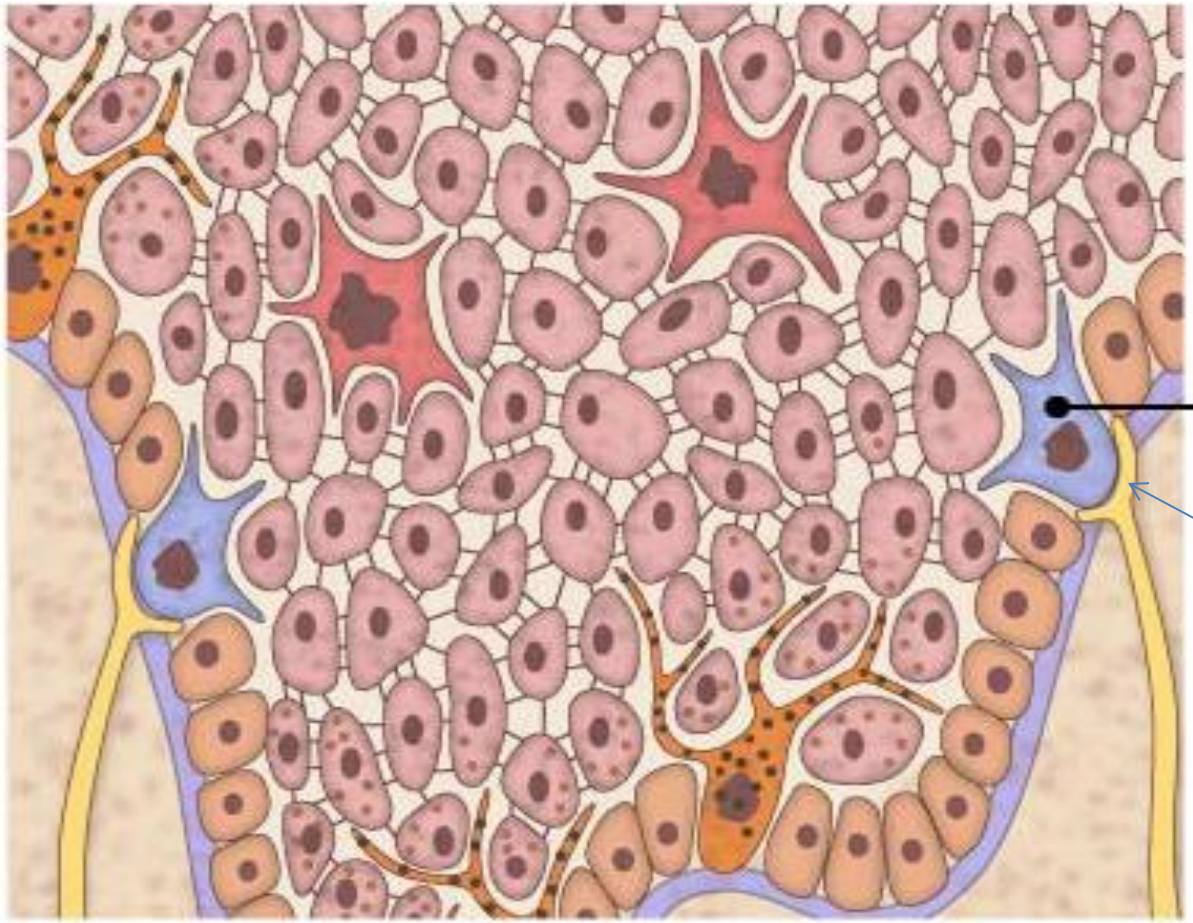
- Are found in the stratum basale
- Are most abundant in the fingertips
- Are closely associated with afferent (sensory) unmyelinated Axons
- Function as light touch receptors (mechanoreceptors)



NOTE: Sensory nerve fibers form terminal disk under Merkels cells

Dermis

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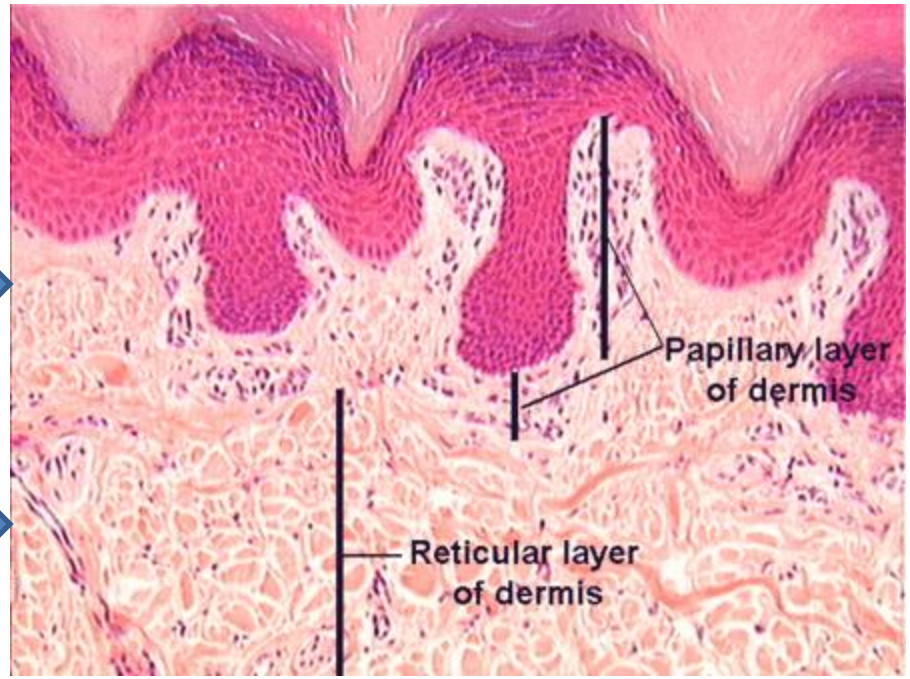
- The dermis lies immediately beneath the epidermis and is much thicker.
- It is responsible for the elasticity and strength of skin
- Contains blood vessels and nerve supply

It supplies the epidermis with nutrients,
and plays an important role in thermoregulation

- Is derived from mesoderm

The dermis can be divided into two sub-layers:



(1)-Papillary layer of dermis

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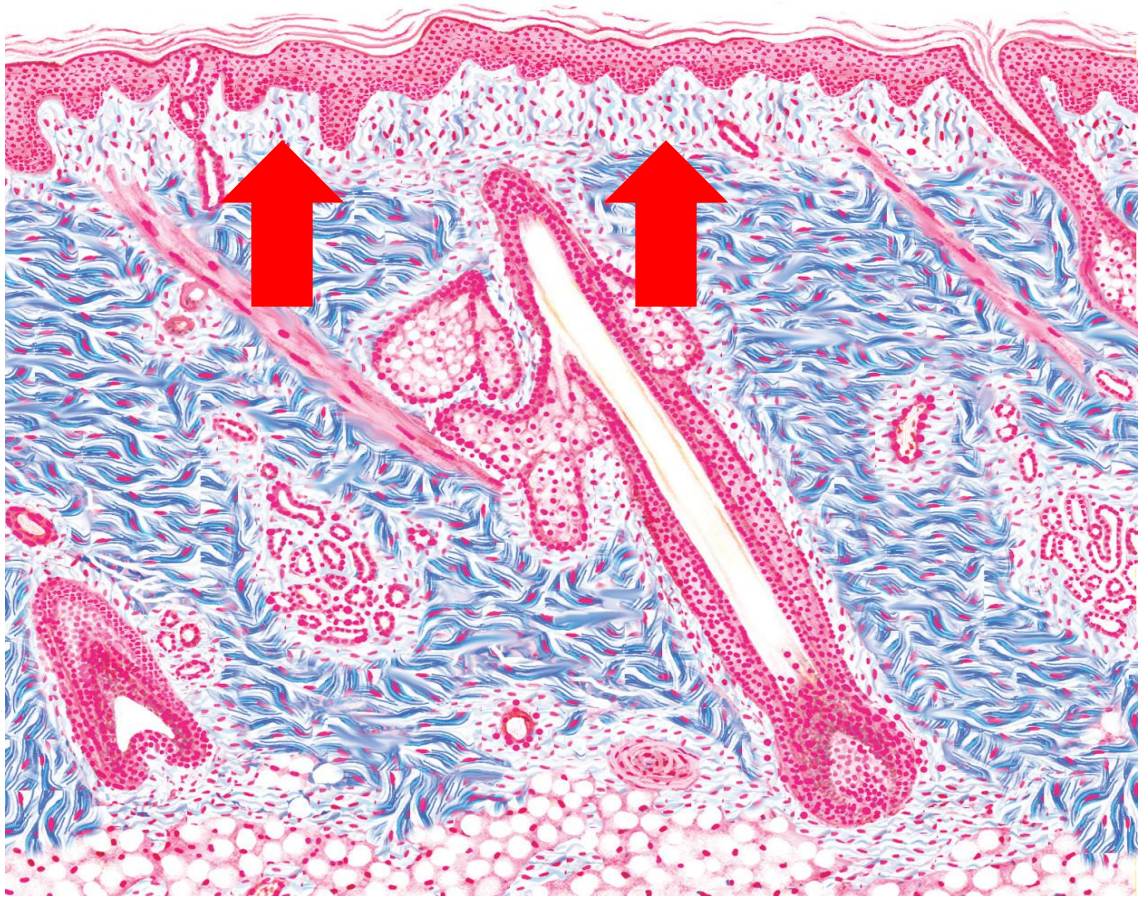
The papillary dermis consists of loose type of c.t



(2)Reticular layer of dermis

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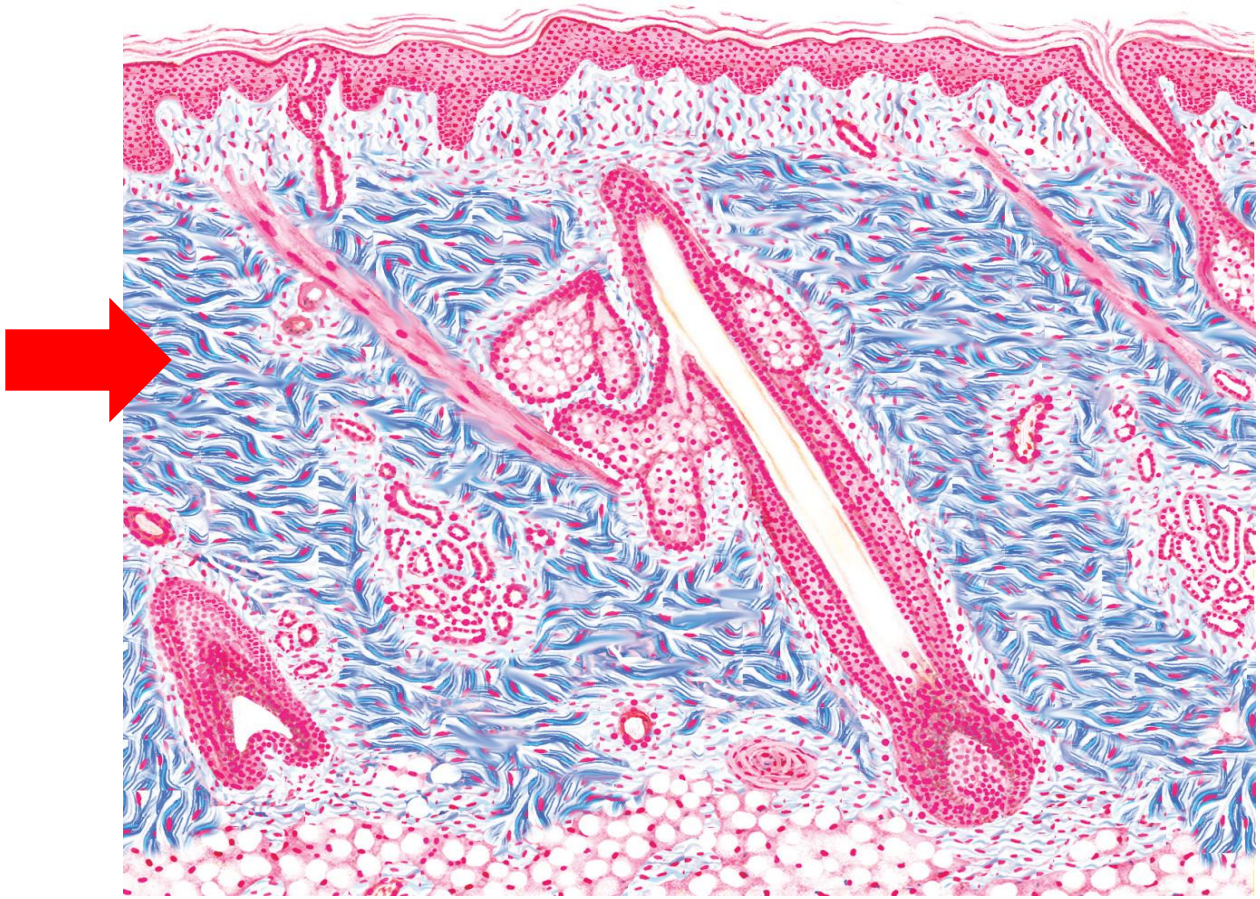
- Dense irregular connective tissue



The blood vessels form two major plexuses:

Subpapillary plexus

Thermoregulation

Subdermal plexus

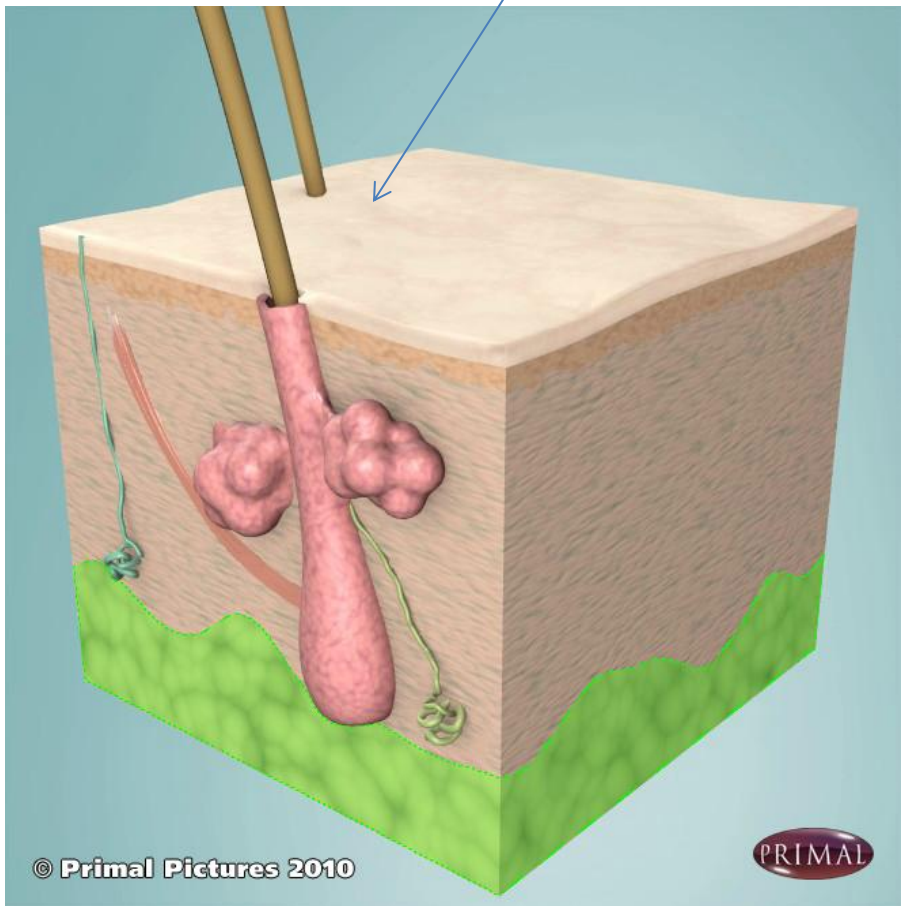
Hemorrhage from the cutaneous blood vessels is called **ecchymosis** (bruise)

The **acid mantle** is a very fine, slightly acidic film on the surface of human skin

Is made up of natural oils, sweat, and dead skin cells, and is slightly more acidic in nature to prevent harmful (naturally alkaline) contaminants from penetrating and damaging the skin

The **acid mantle** adds protection from bacteria, environmental pollutants, and moisture loss.

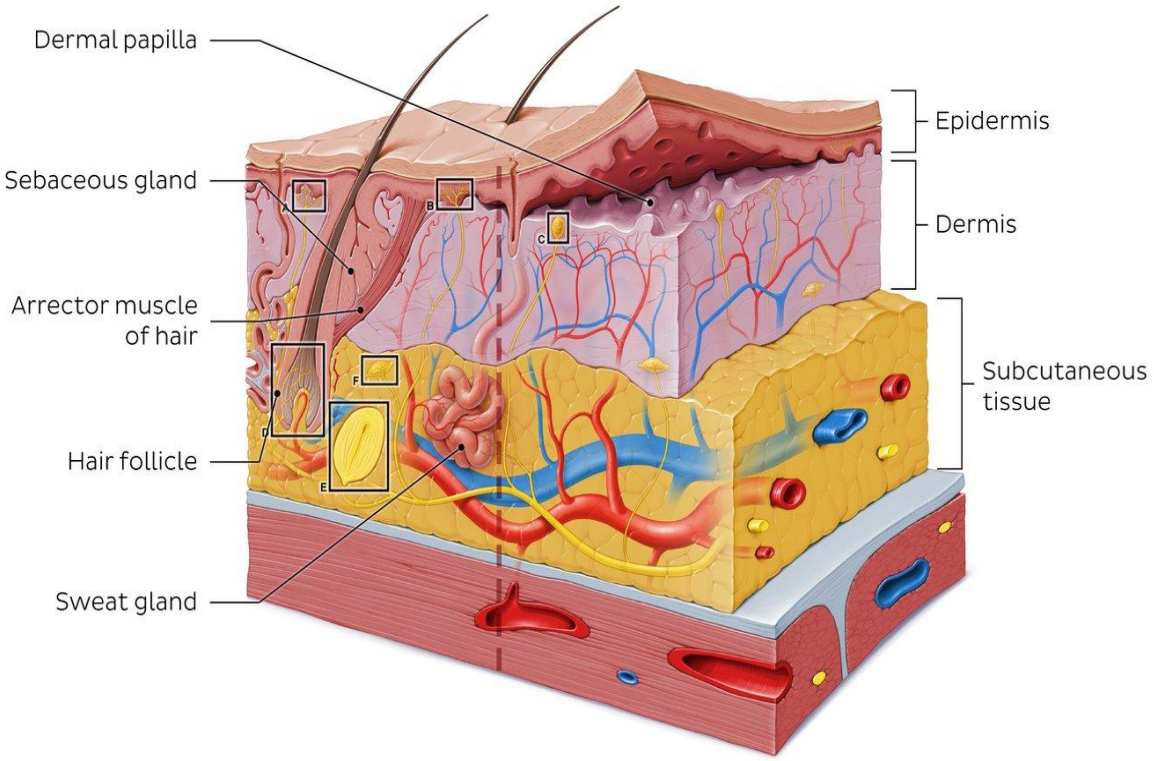
Ph: 5.5

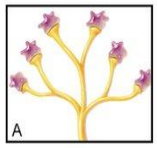


Sensory receptors

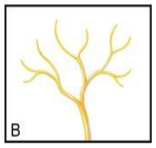
Unencapsulated receptors

Encapsulated receptors

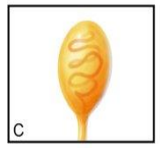




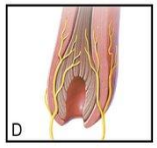
Epithelial tactile complex



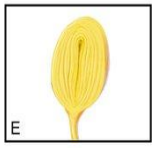
Free nerve ending



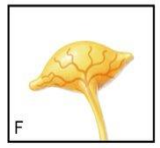
Tactile (Meissner) corpuscle



Hair follicle ending



Lamellar (Pacinian) corpuscle



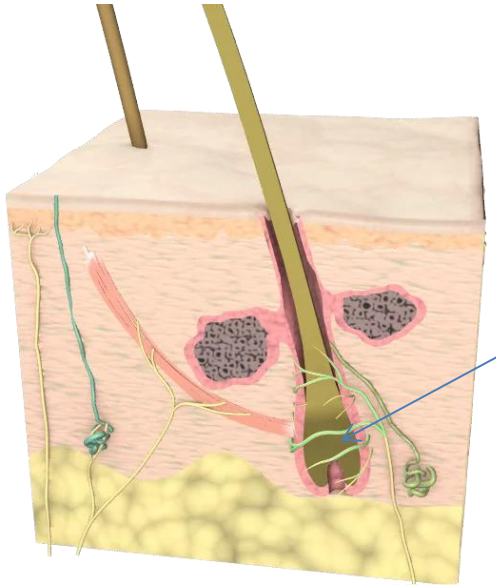
Bulbous (Ruffini) corpuscle

Unencapsulated nerve receptors

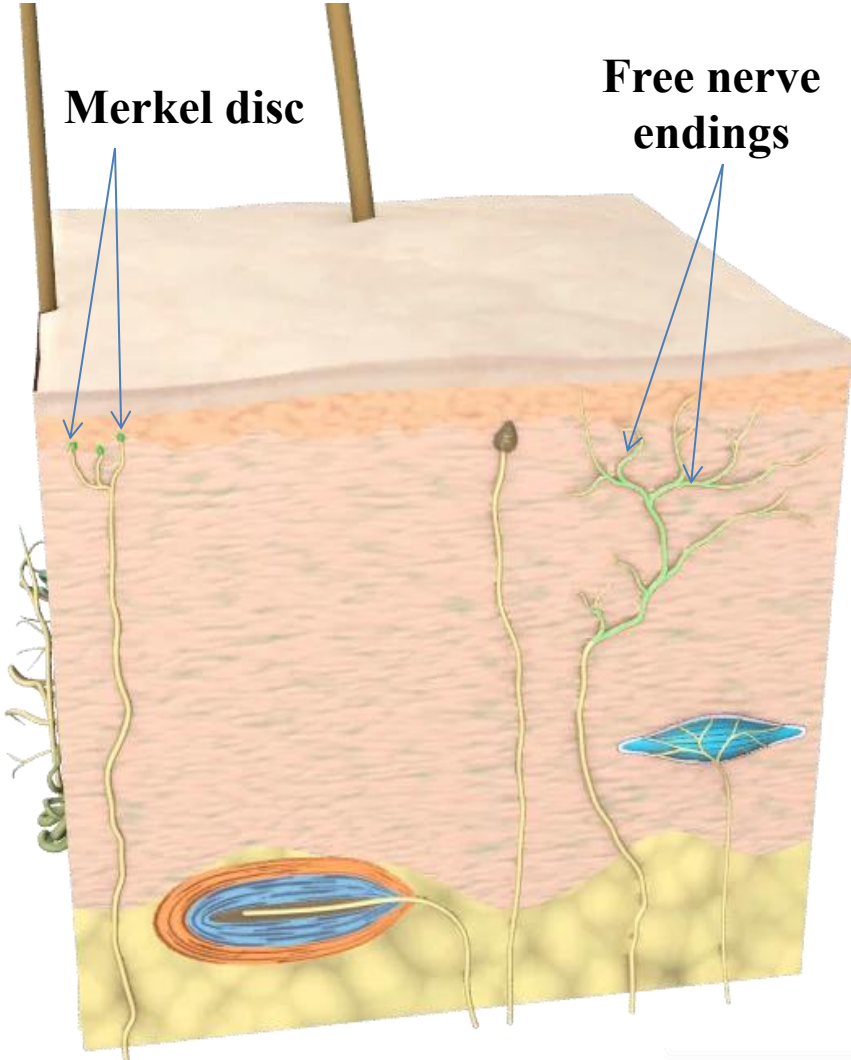
1- Merkel disc
- for light touch and sensing an object texture
- expanded nerve endings associated with merkel cell

2- Free nerve endings
- In papillary dermis
- Temperature, pain, itching, tactile sensation

3- Root hair plexuses
- Surround the bases of hair follicles in reticular dermis
- Detect movements of hair



Root hair plexuses

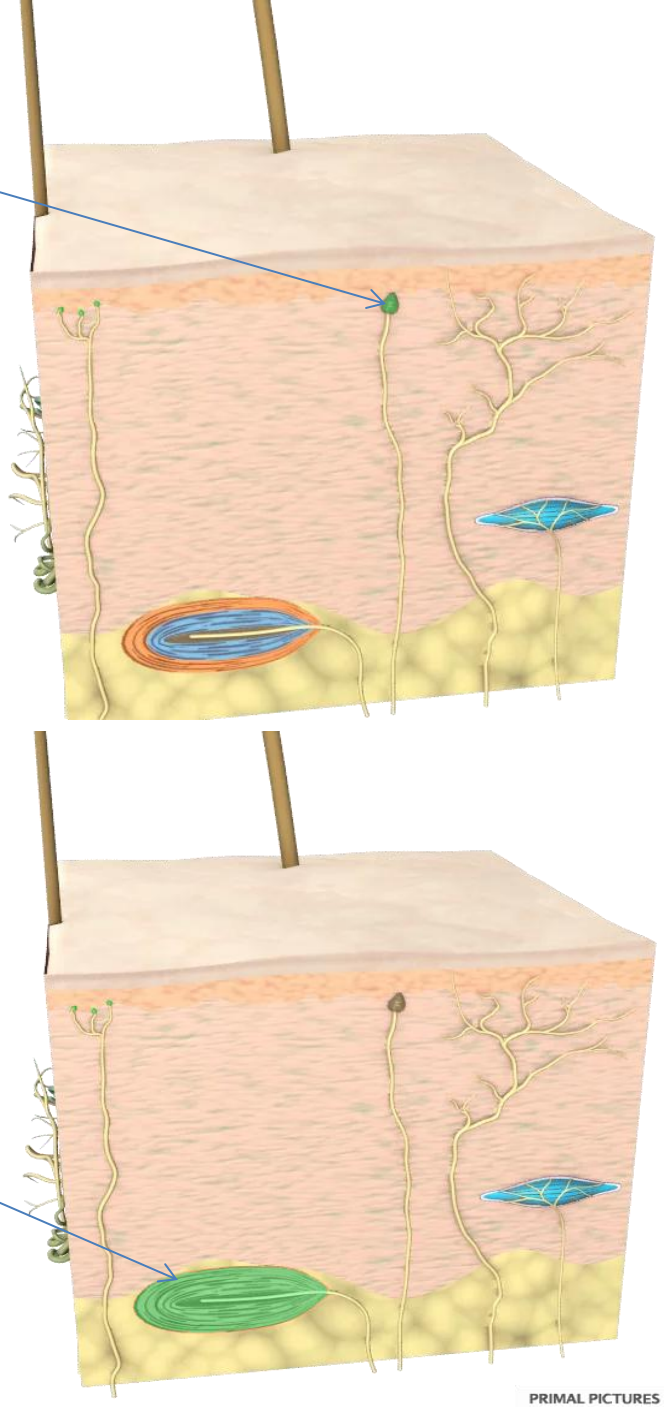


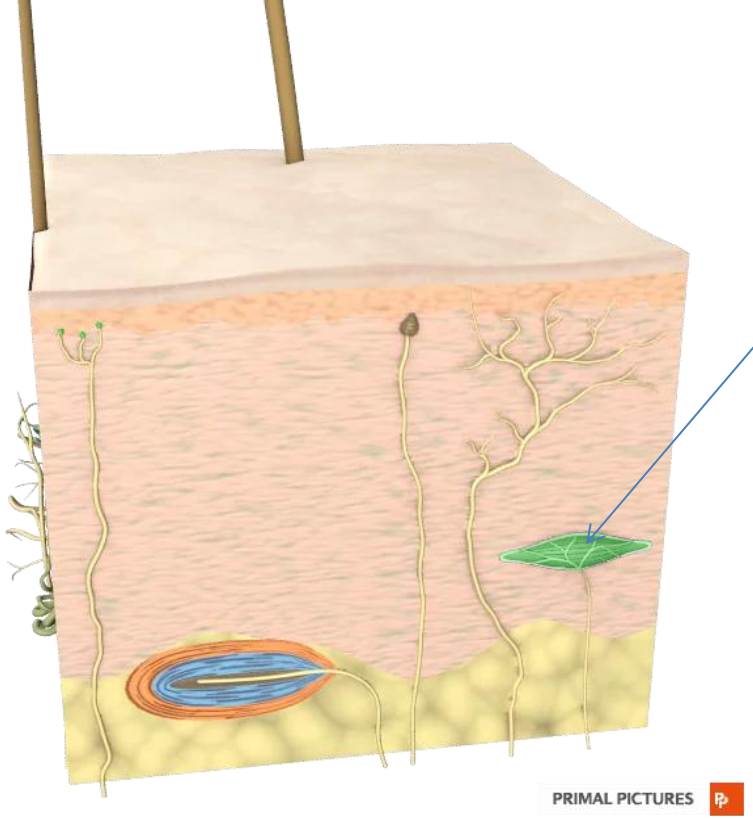
Meissner corpuscles:

- Encapsulated
- In the dermal papilla
- Light touch
- Are numerous in fingertips, palms and soles
- Decline in number with aging

Pacinian corpuscles

- Encapsulated
- Found deep in reticular dermis and hypodermis
- Coarse touch, pressure (sustained touch) and vibrations





Ruffini corpuscles:

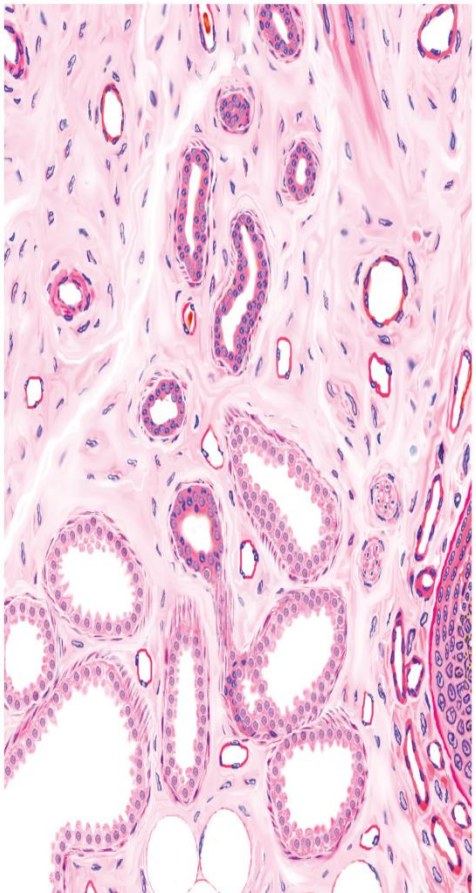
- Encapsulated
- Stretch (tension) and twisting (torque)

Skin Appendages

Prof. Dr. Heba Kalbouneh

Hair Follicles and hair

Sweat glands



Sebaceous glands

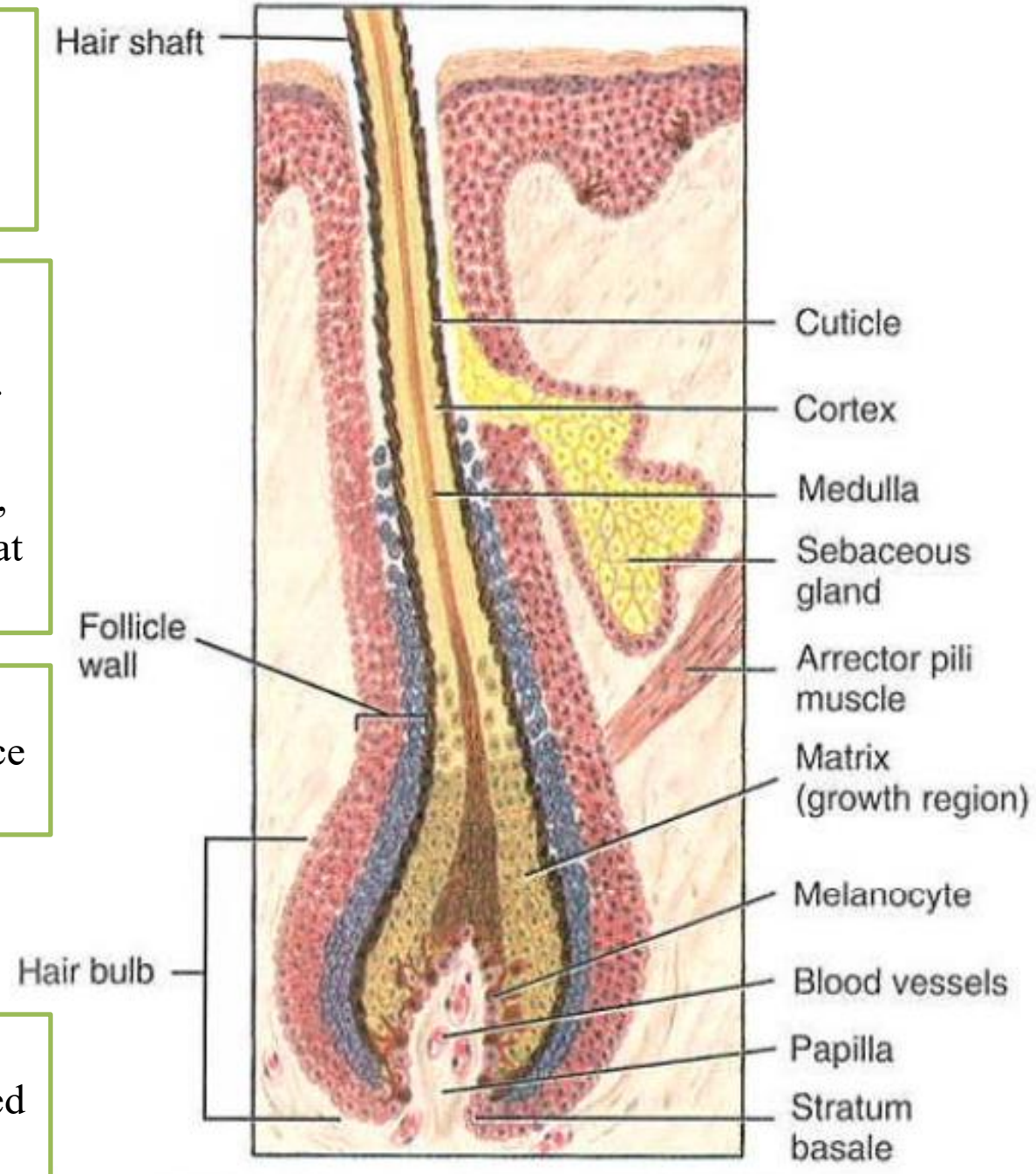
Nails

Hairs are elongated keratinized structures that form within epidermal invaginations (hair follicles)

Types of hair:
1- Lanugo: fetal hair
2- Down hair: light colored hair of child
3- Terminal (adult) hair: thicker, darker hair that begins to grow at puberty

Hair shaft: The part of a hair extending beyond the skin surface (visible part)

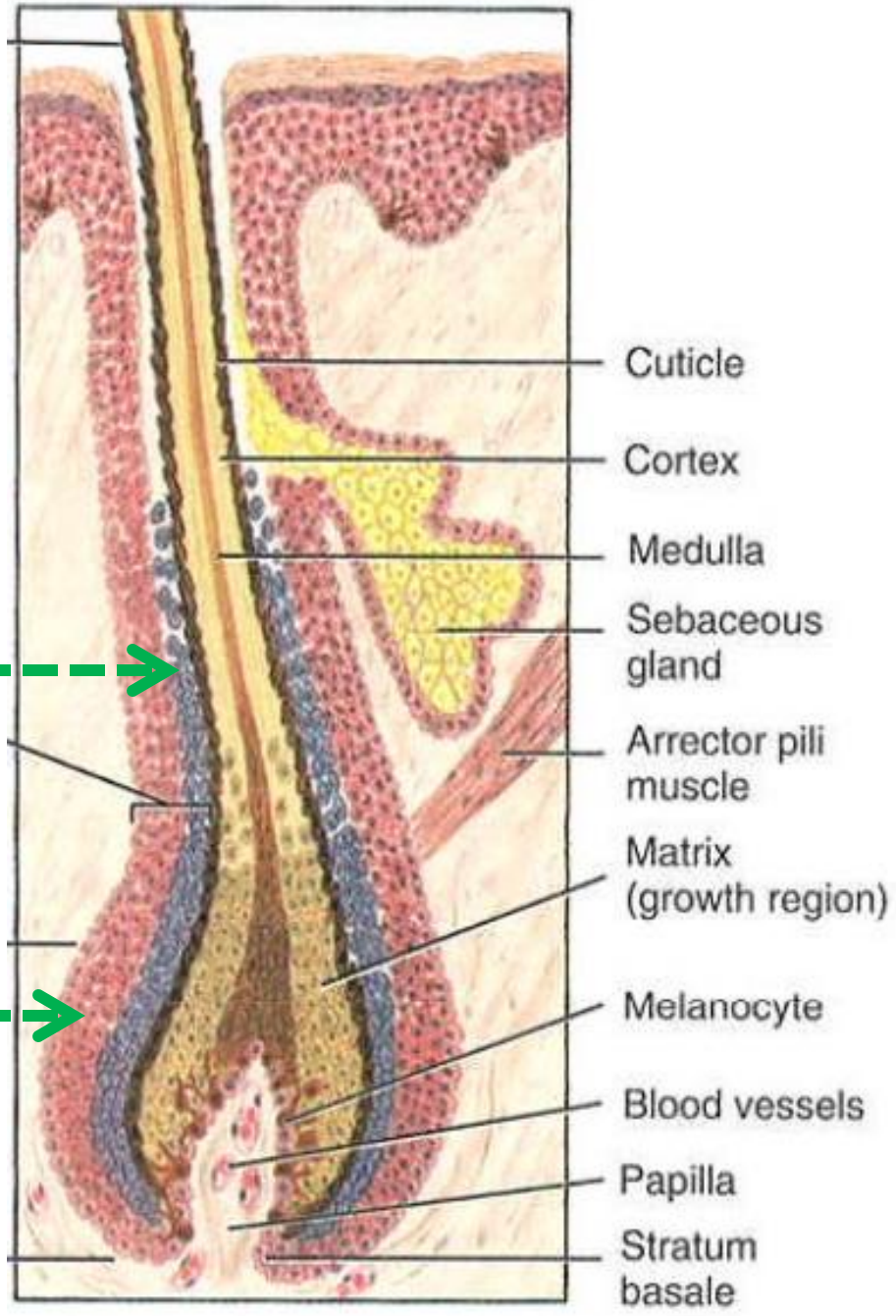
Hair root: The part of a hair below the skin surface (embedded part)

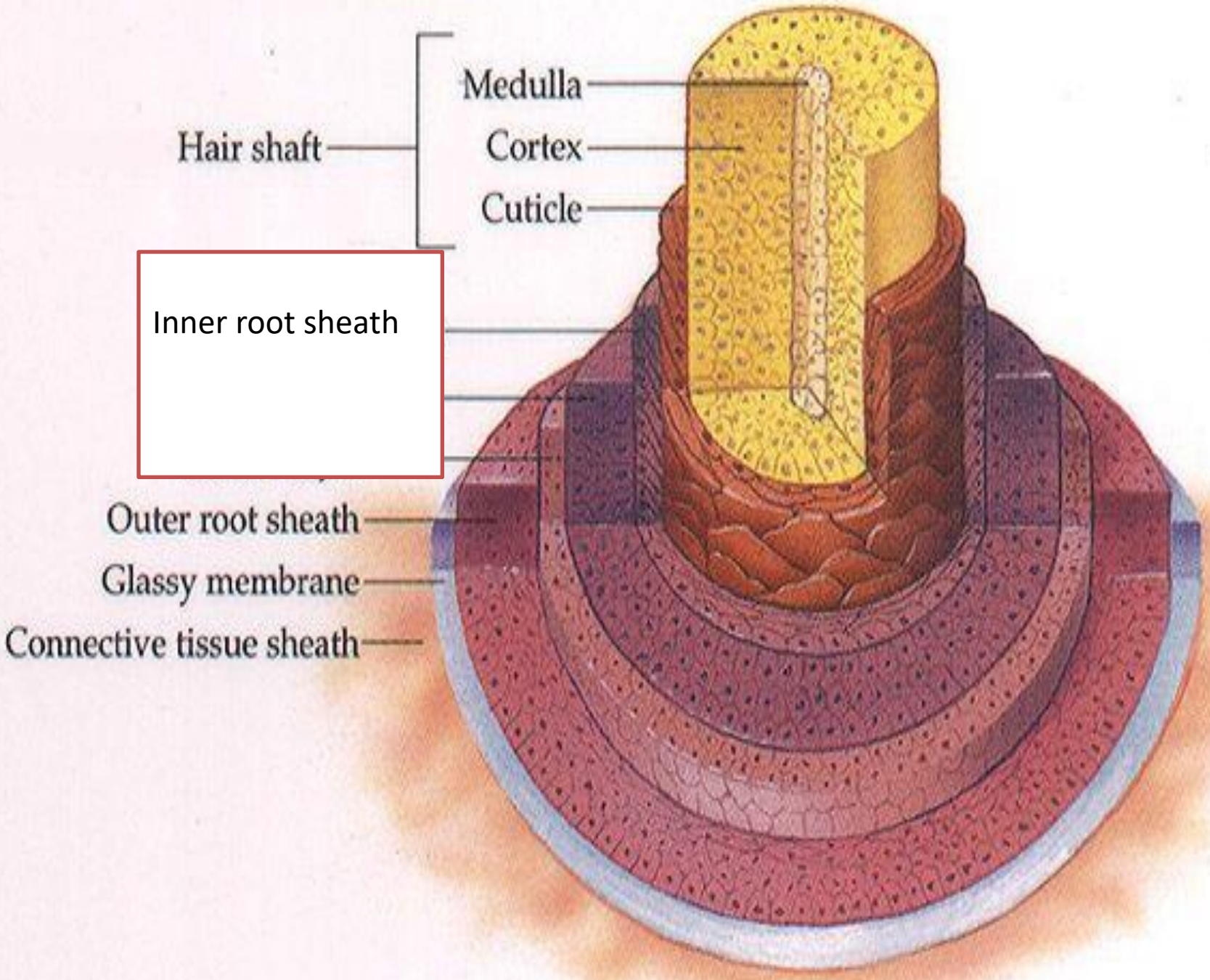


Hair follicle is a tube of stratified squamous epithelium, invaginated into the dermis

INNER ROOT SHEATH
Disintegrates at the level of the sebaceous gland

OUTER ROOT SHEATH
- Is continuous with the epidermis
- It does not take part in hair formation
- Surrounded by a glassy basement membrane
- Basement membrane is surrounded by a connective tissue sheath.

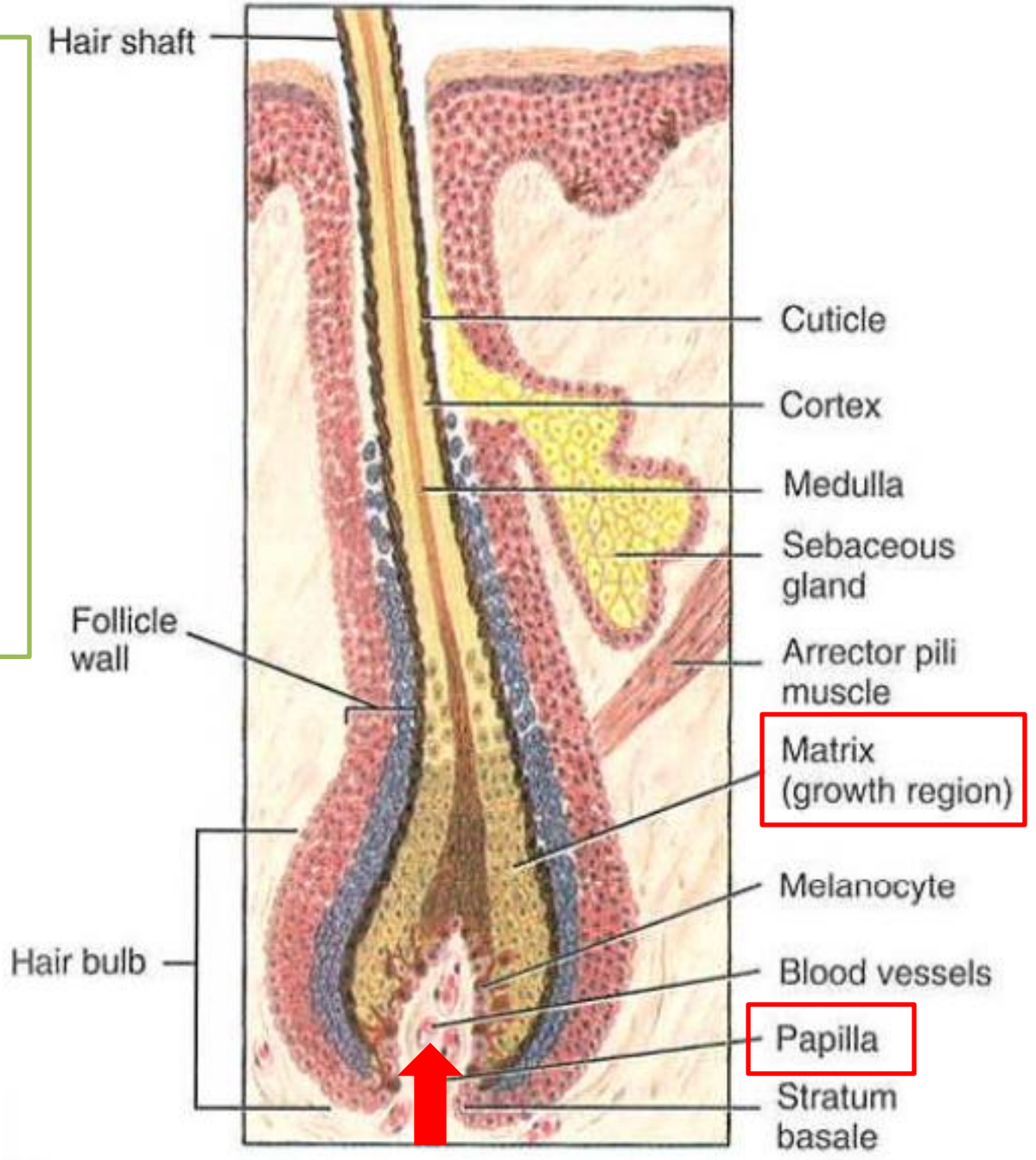



Hair shaft
Medulla
Cortex
Cuticle
Inner root sheath
Outer root sheath
Glassy membrane
Connective tissue sheath

Hair matrix

- Contains the proliferating cells that generate the hair and the internal root sheath
- Located just above the dermal papilla
- Melanocytes located in the matrix produce hair color.

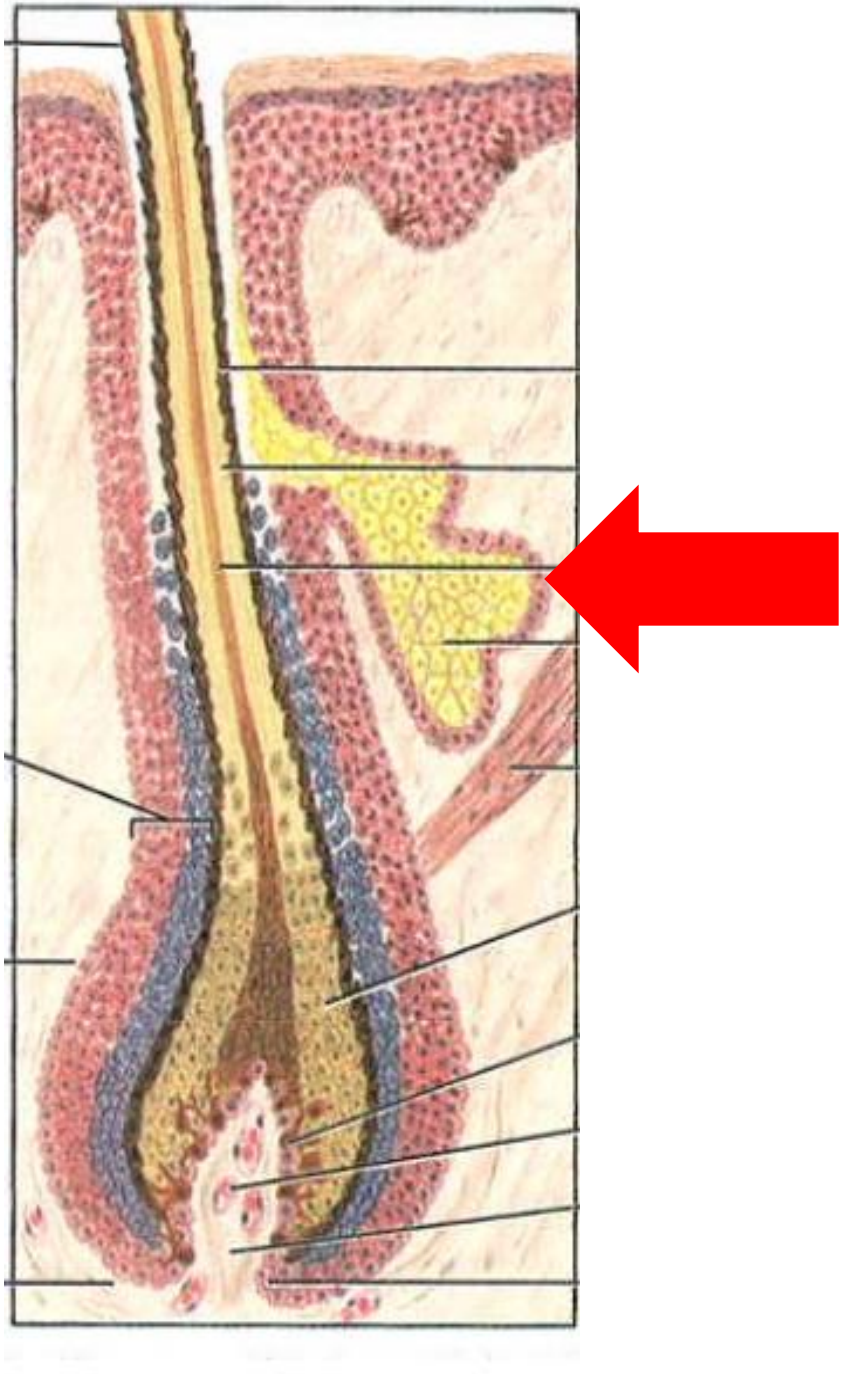
The cells in the hair matrix proliferate and move upwards, gradually becoming keratinized to produce the hair.



Sebaceous glands

➢ secrete an oily or waxy matter, called **sebum**, to lubricate and waterproof the skin and hair

➢Secrete by holocrine mode of secretion



Acne

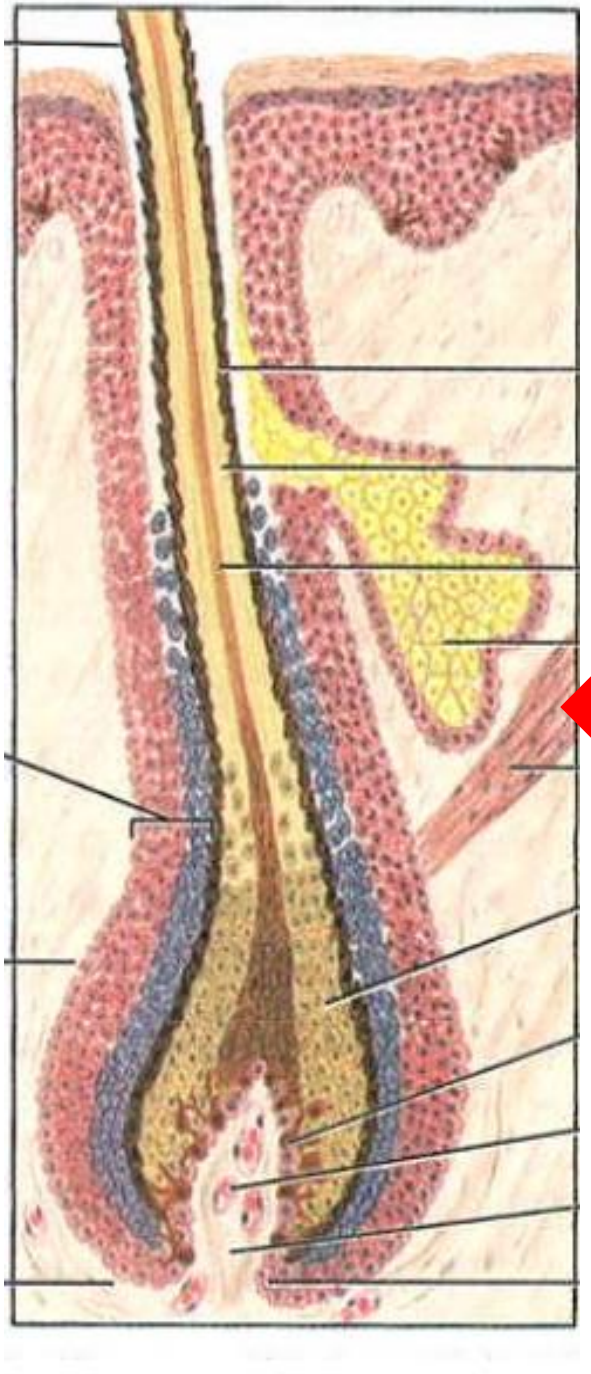
A comedo is a clogged hair follicle (pore) in the skin. Keratin combines with oil to block the follicle

Comedo (blackheads)

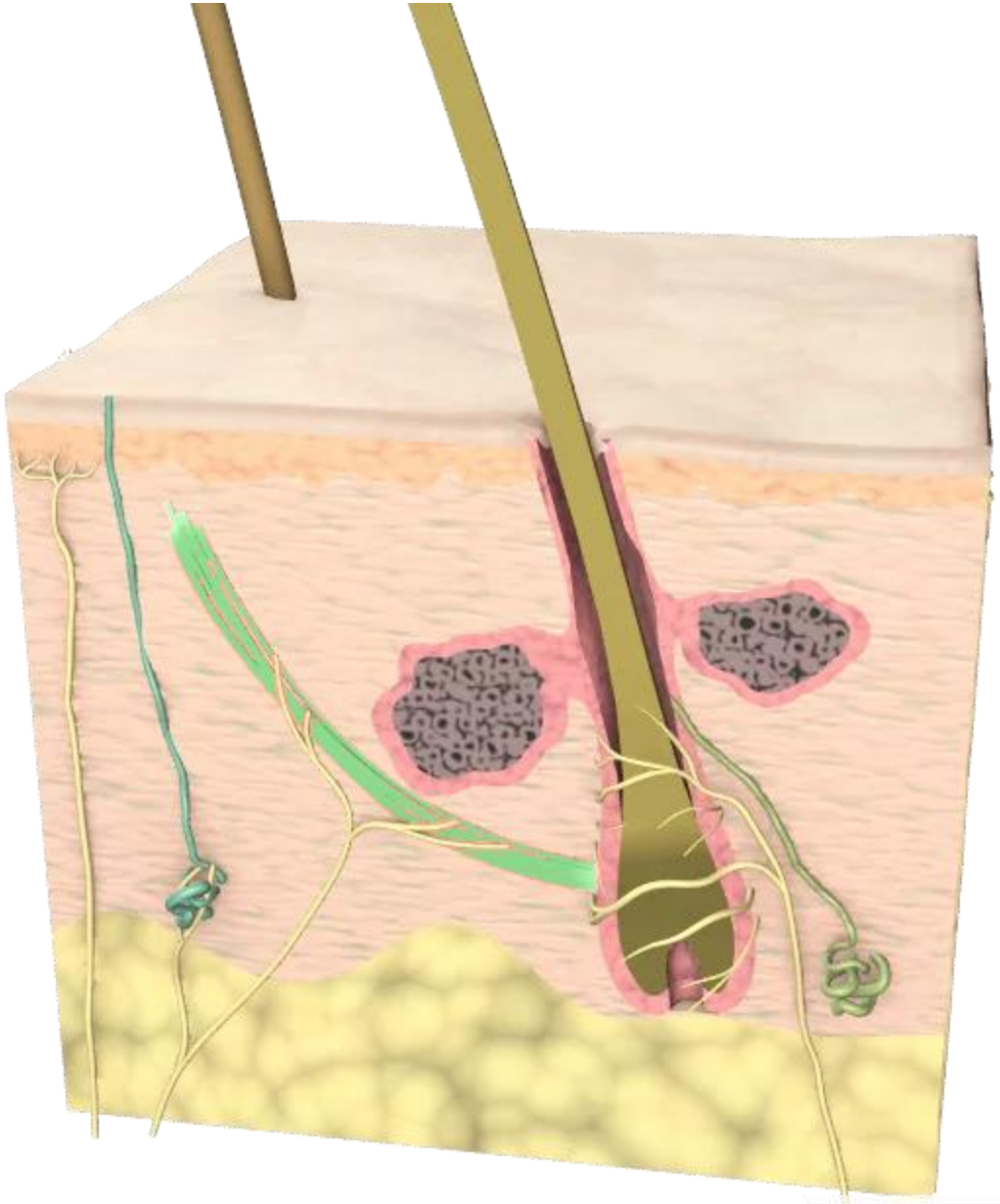
Arrector pili muscles are small muscles extend from hair follicles to the papillary dermis.

- Contraction of these muscles causes the hairs to stand on end (goose bumps)

- Innervated by the autonomic nervous system (sympathetic)



Depilatory



Pulls hairs upright when cold or frightened

Structure of the hair shaft

Note:
During hair formation in the hair follicle:
1.Matrix cells in the hair bulb are nucleated and alive.
2.As they move upward, they undergo keratinization.
3.They lose their nuclei and organelles.
4.They become flattened, hard, keratin-filled cells → forming the cortex (and cuticle).

Medulla (center)

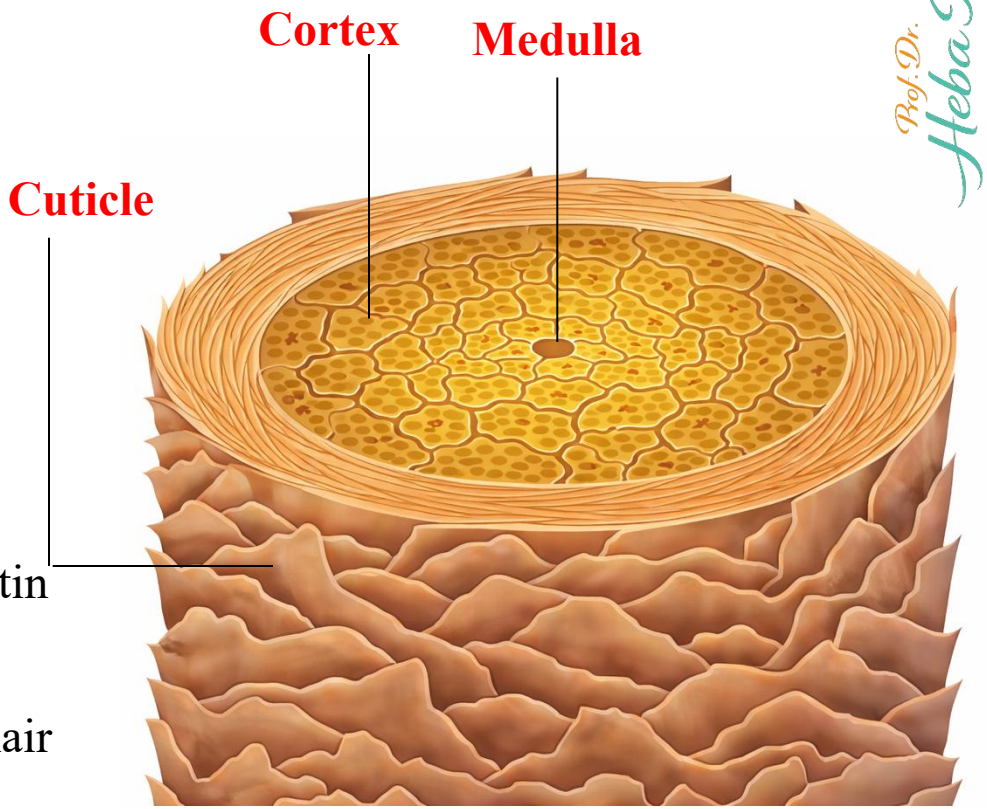
- Located in the core
- Appears as loosely arranged cells
- May contain air spaces

Cortex (middle, thickest layer)

- Makes up the bulk of the hair shaft
- Contains tightly packed keratinized cells
- Responsible for strength and pigment

Cuticle (outermost layer)

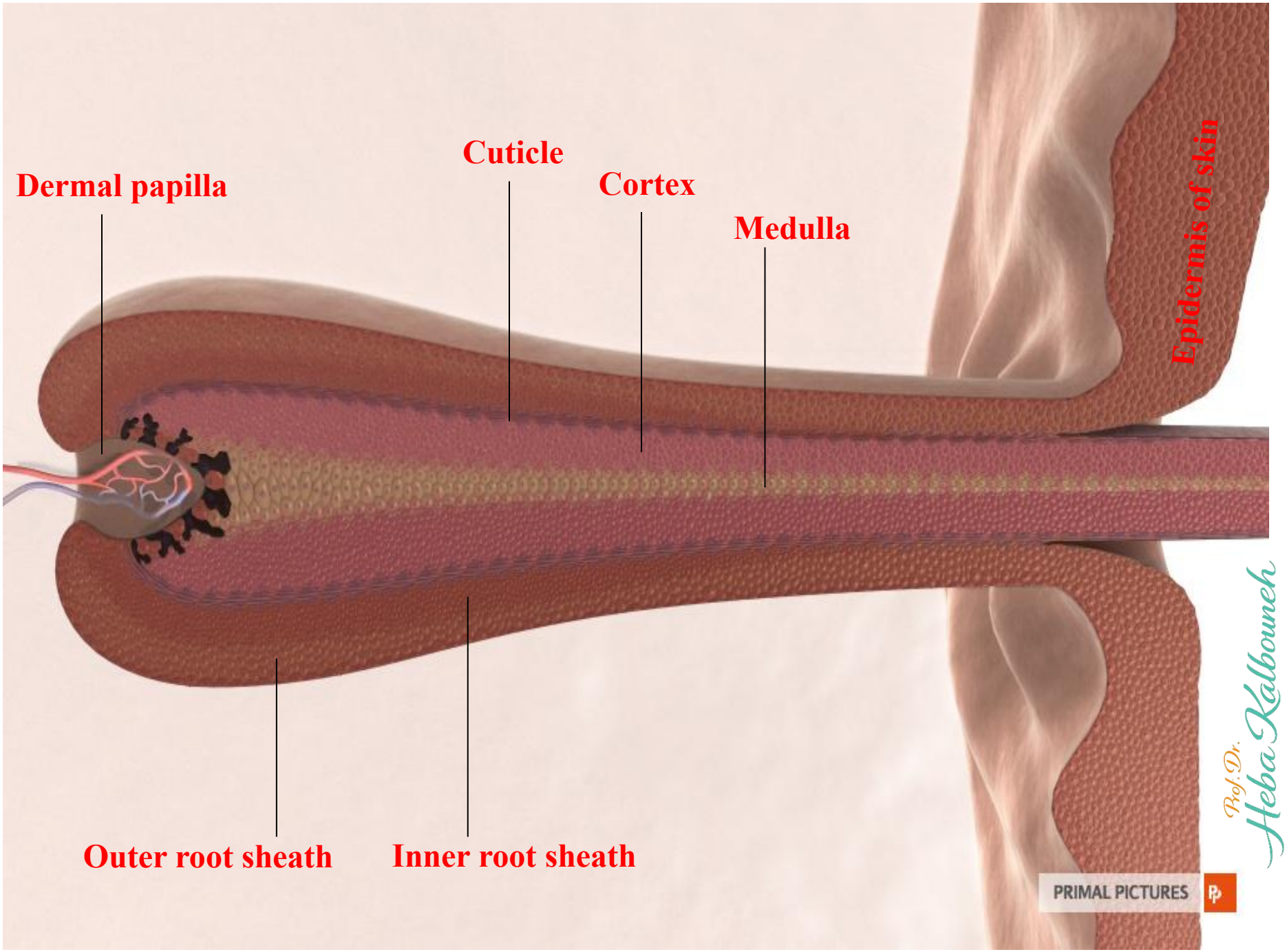
- Composed of overlapping, scale-like keratin plates
- Scales point toward the distal end of the hair

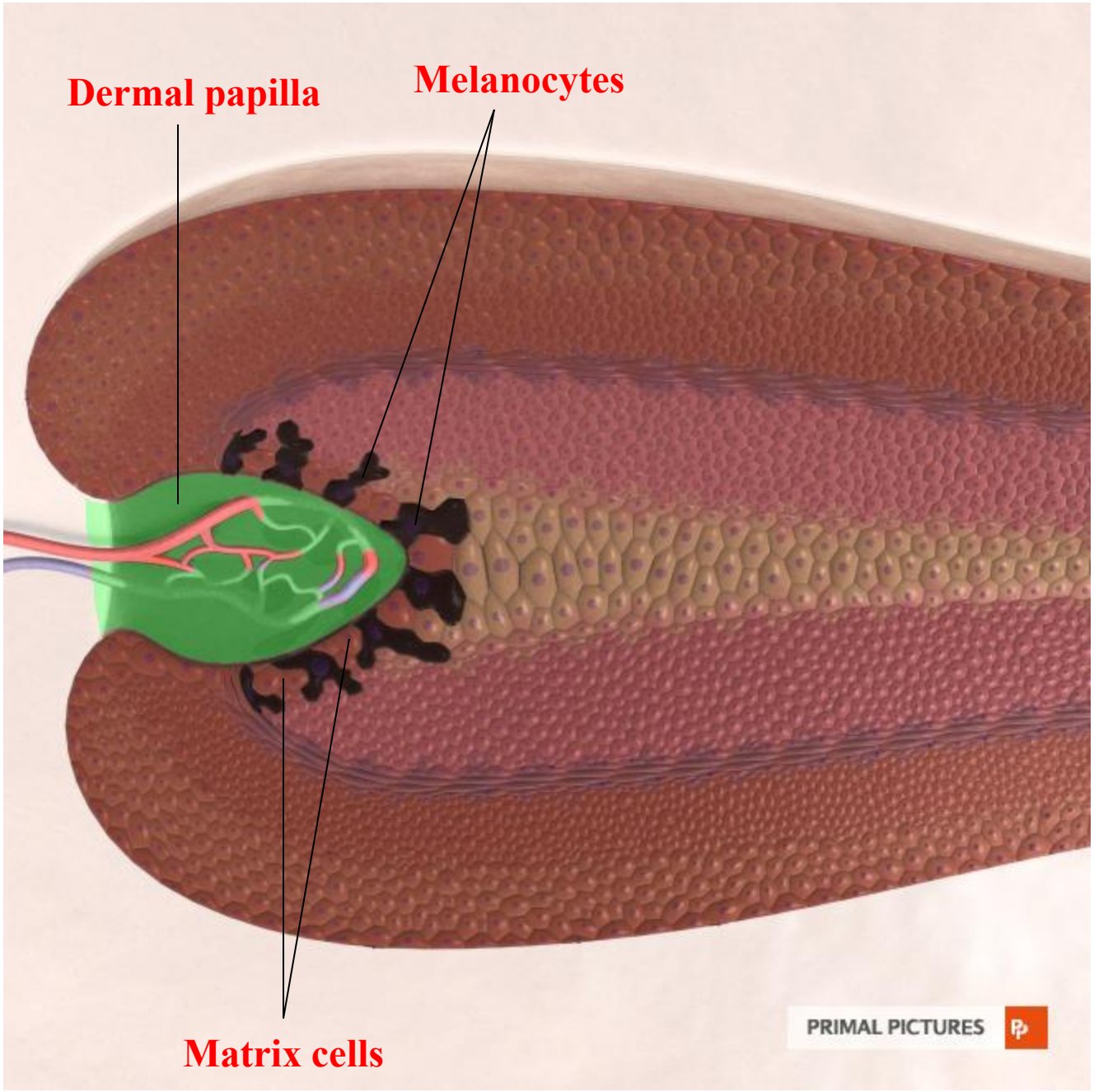


Medulla: large vacuolated and moderately keratinized cells

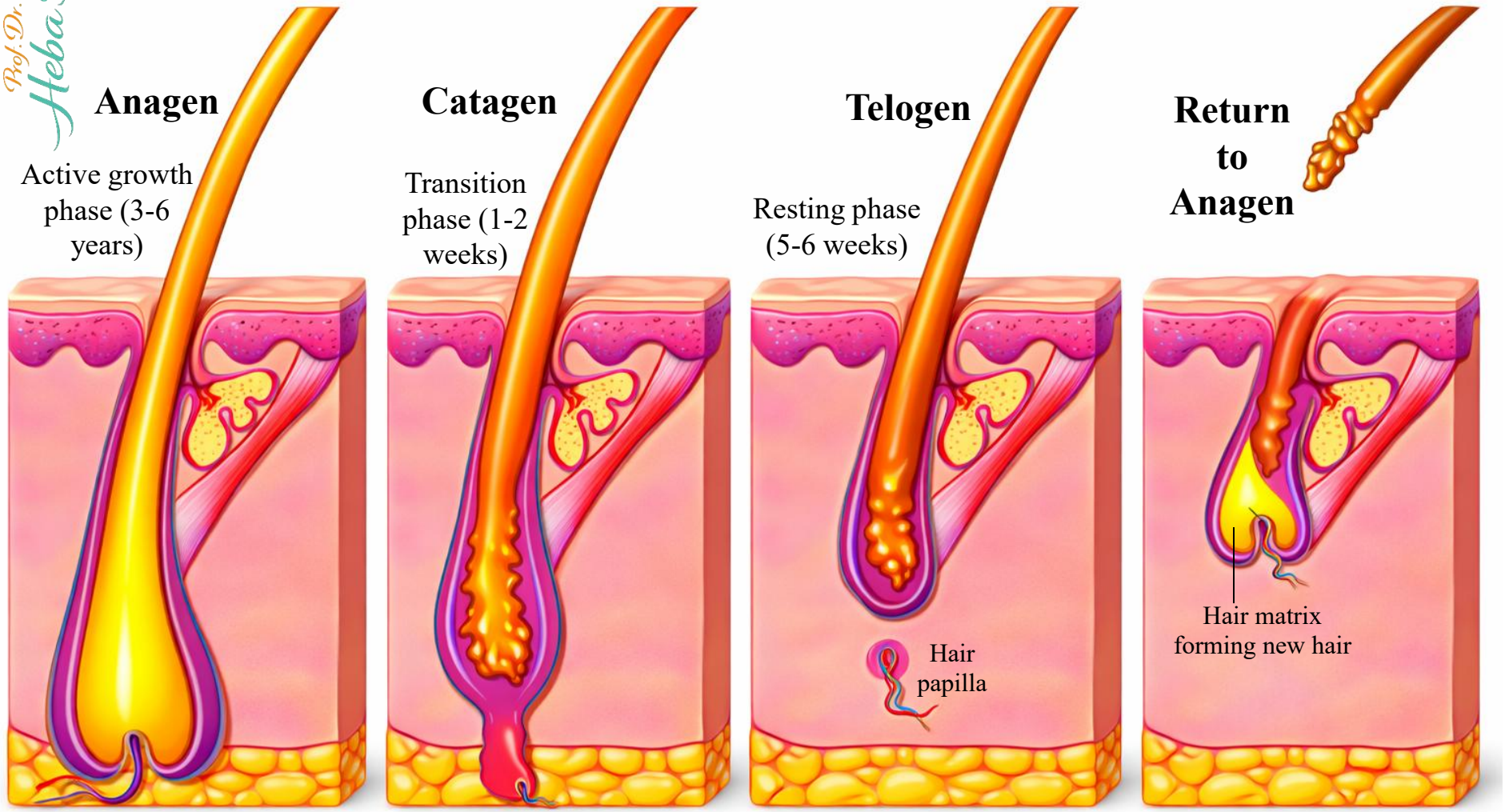
Cortex: heavily keratinized and densely packed cells

Cuticle: thin layer heavily keratinized squamous cells covering the cortex


Dermal papilla
Cuticle
Cortex
Medulla
Epidermis of skin
Outer root sheath
Inner root sheath
PRIMAL PICTURES
Prof. Dr. Heba Kalbouneh



Hairs grow discontinuously, with periods of growth followed by periods of rest and this growth does not occur synchronously in all regions of the body or even in the same area



Hair growth cycle

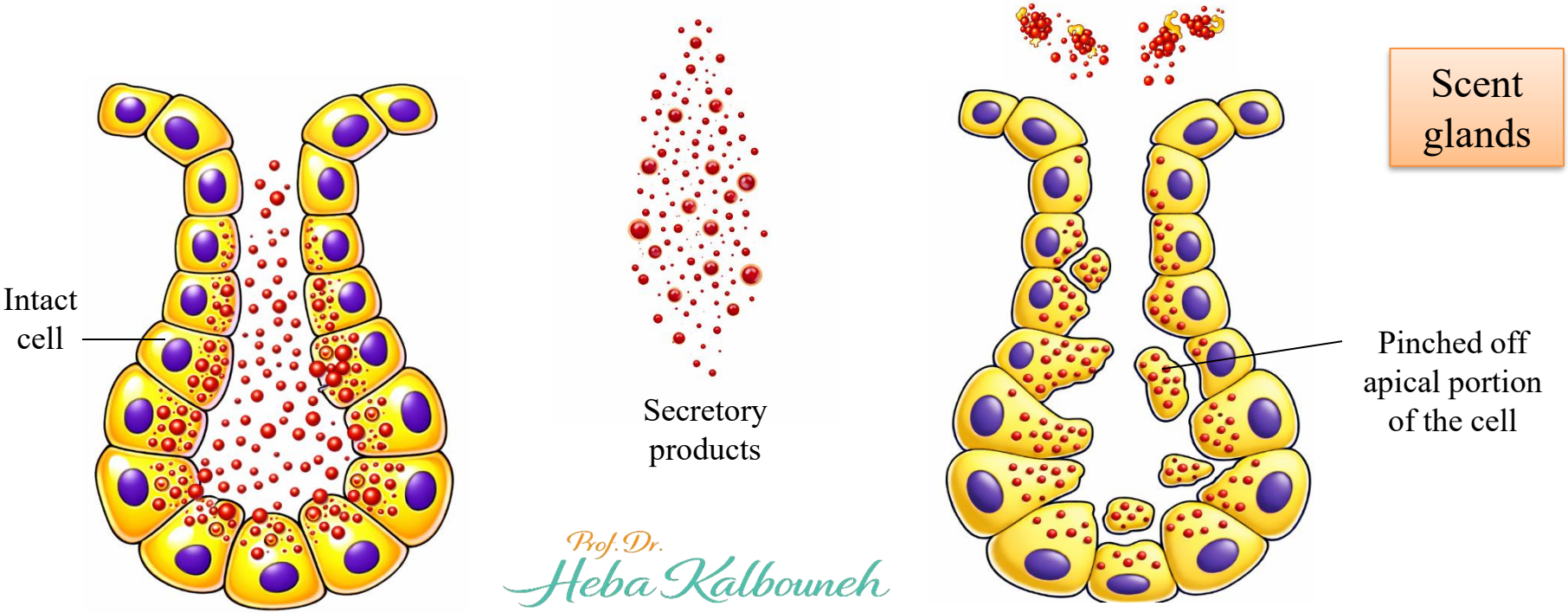
Sweat Glands

Eccrine sweat gland

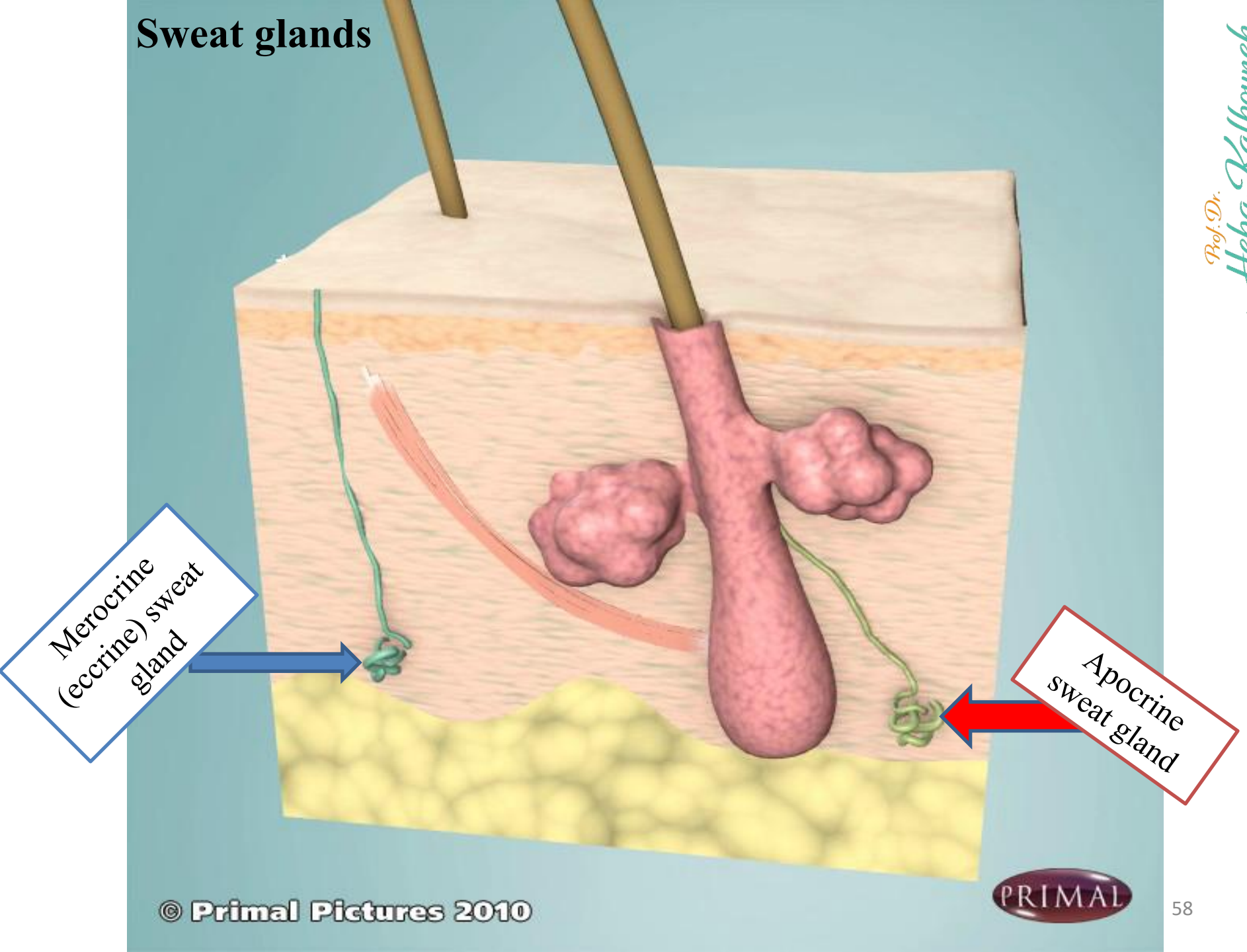
- Merocrine secretion
- Empty directly onto skin surface
- Location: most all over body (esp. abundant on palms & soles: ~ 500/cm^2)
- Clear, watery secretion (99% H_2O; rest NaCl + some waste products

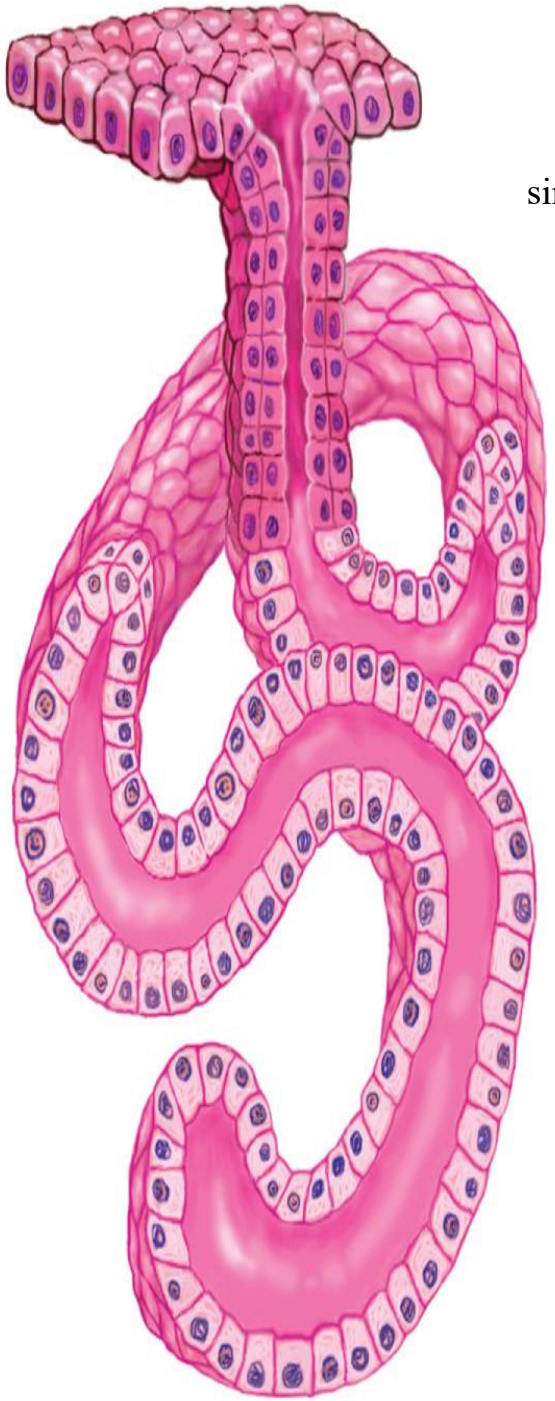
Apocrine sweat gland

- Empty into hair follicle
- Location: armpits, groin, nipples
- Viscous, cloudy secretion → good nutrient source for bacteria (odor !!)
- Secretion may contain Pheromones
- Secretion begins at puberty and is stimulated during emotional distress



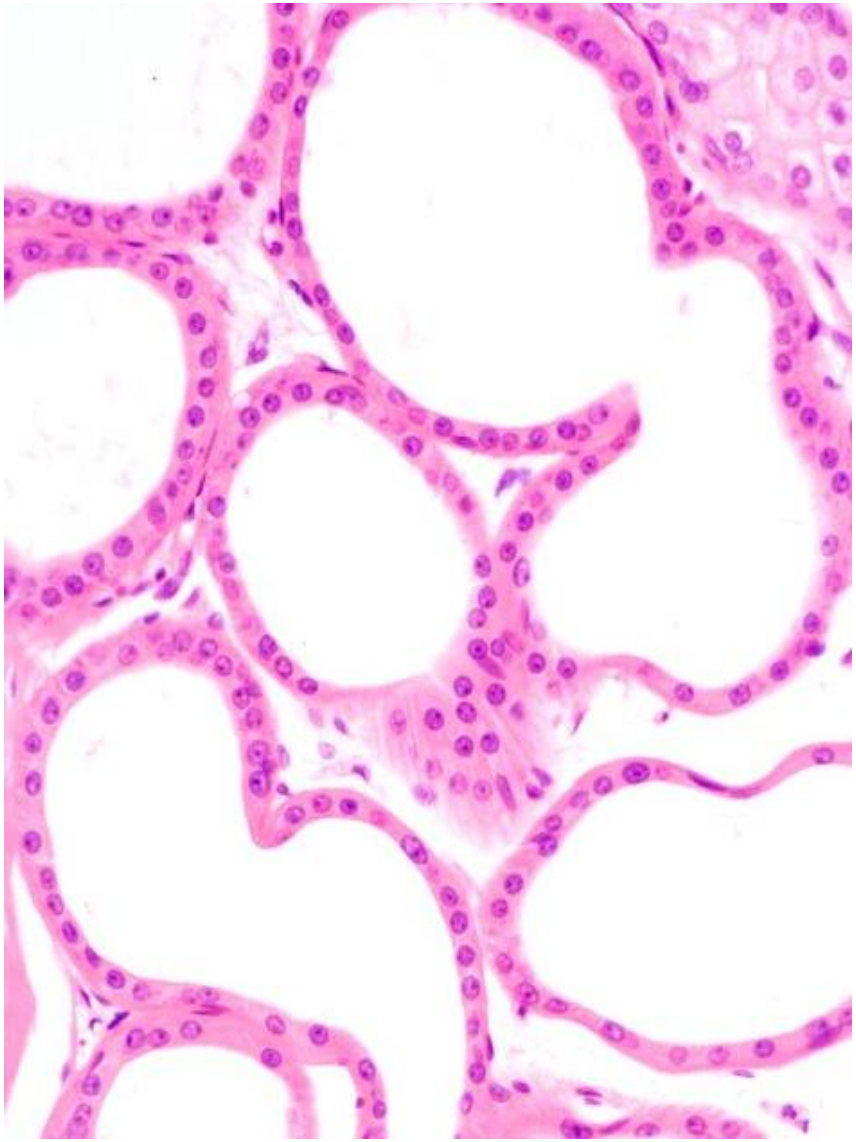
Sweat glands



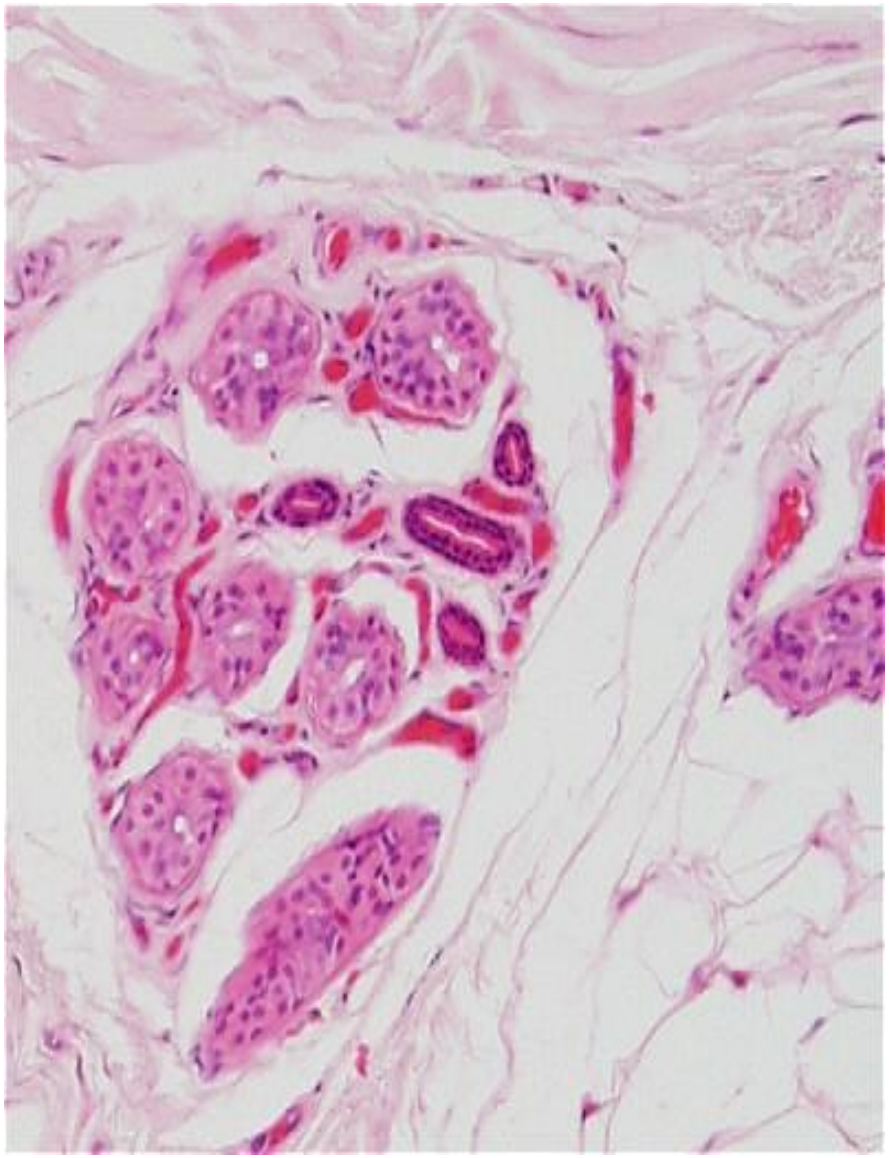


Sweat gland is a simple coiled tubular gland

Apocrine sweat glands



Eccrine (merocrine) sweat glands



Note: Apocrine sweat glands are named historically but actually secrete by merocrine (exocytosis) mechanism.

Nail

Nails

Hard plates of keratin on the dorsal surface of each distal phalanx
Lack of pigment makes them colorless

Nail parts

1. Free edge: the part you cut
2. Body: pink part
3. Lunula: white semicircle area
4. Eponychium: proximal nail fold (cuticle)
5. Hyponychium: under the free edge where dirt accumulates
6. Nail bed: directly under the pink part
7. Nail matrix: growth