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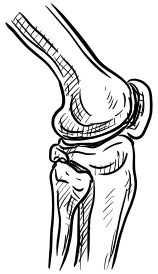

HISTOLOGY

MID | Lecture #1

Skin Histology

Written by: Raghad Altiti
Zain Al-Ghalaieni

Reviewed by: Rania Nassar

وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم

اللهم استعملنا ولا تستبدلنا

Skin Histology

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REMEMBER FROM GENERAL HISTOLOGY

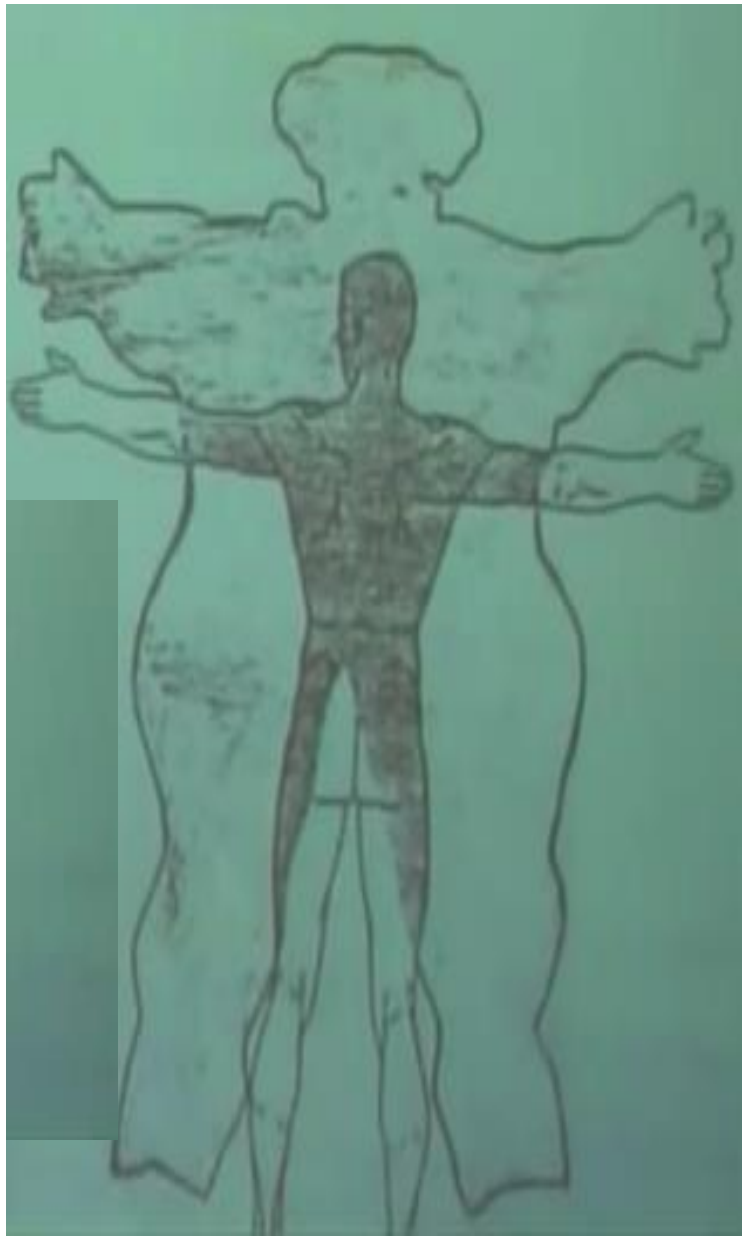
- **Epithelial cells are connected by desmosomes that anchor the cells preventing their separation that are anchored to intermediate filaments (keratin in the skin) inside the cytoplasm of the cells (you will need it in slide #19)**
- Apocrine: product accumulates at the cells' apical ends, portions of which are then extruded to release the product together with small amounts of cytoplasm and cell membrane
- Holocrine (sebaceous): cells accumulate product continuously as they enlarge and undergo terminal differentiation, culminating in complete cell disruption which releases the product and cell debris into the gland's lumen.
- Monocytes are precursors of macrophages.
- Langerhans cell are part of the mononuclear phagocyte system, the process and present antigens.
- Dense Irregular CT • Consists Of Randomlyarranged Collagen Fibers And A Few Fibroblasts. • Found In Dermis Of Skin, capsules of joints and organs • Function = Provide Strength and protection

Some information to begin with:

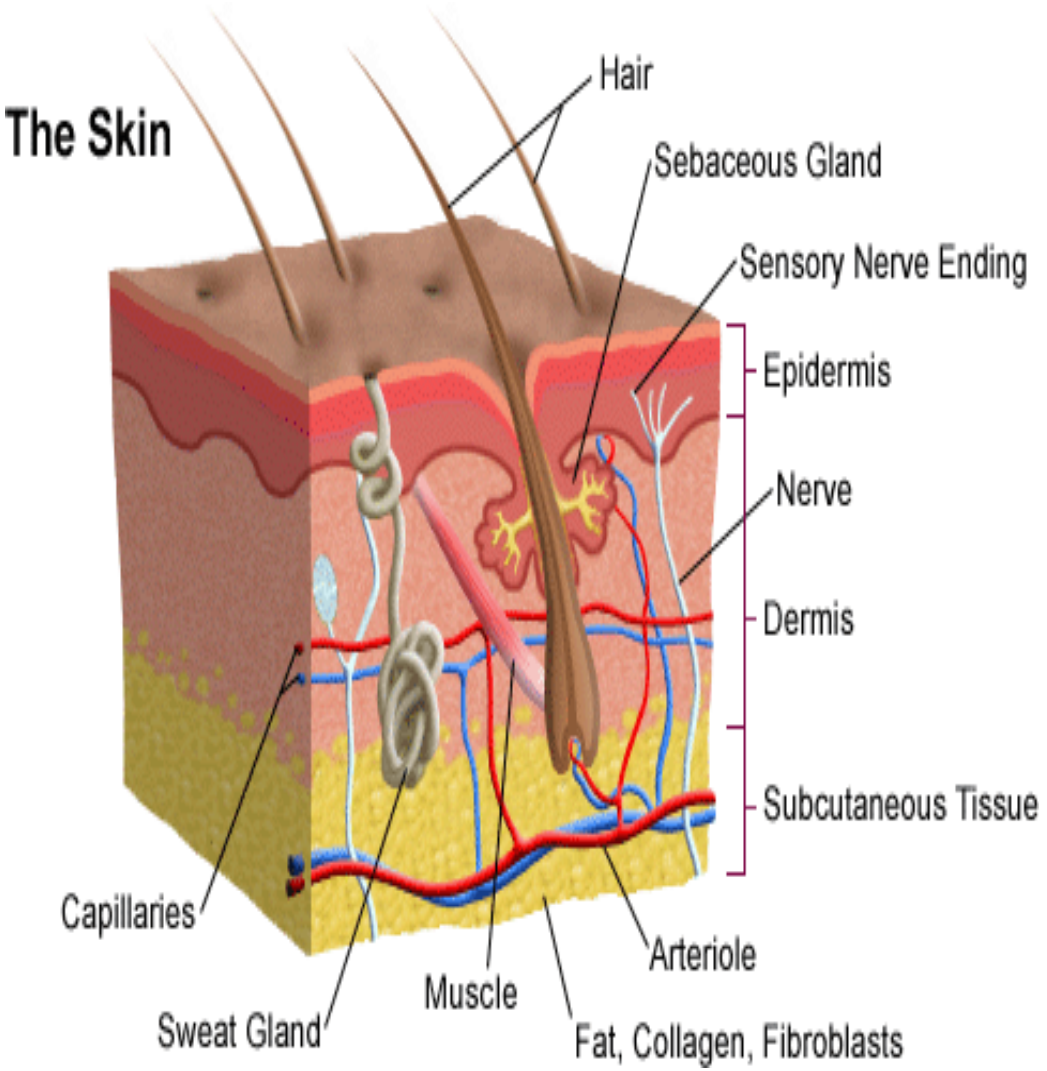
- Skin not a tissue as it has more than one type of tissues forming it so it's considered an organ
- It's the largest organ in our body & its weight is about 5kg covering area of 2 m^2
- The anatomical term of the skin is Integumentary system (integumentum means covering)
- Some terminology:
- Epi= above
- Dermis = skin
- Membrane = connective tissue + epithelial tissue
- Stratum = layer

Connective Tissue Proper			
Loose (areolar) connective tissue	Much ground substance; many cells and little collagen, randomly distributed	Supports microvasculature, nerves, and immune defense cells	Lamina propria beneath epithelial lining of digestive tract
Dense irregular connective tissue	Little ground substance; few cells (mostly fibroblasts); much collagen in randomly arranged fibers	Protects and supports organs; resists tearing	Dermis of skin, organ capsules, submucosa layer of digestive tract

Integumentary system



The skin is considered the largest organ of the body



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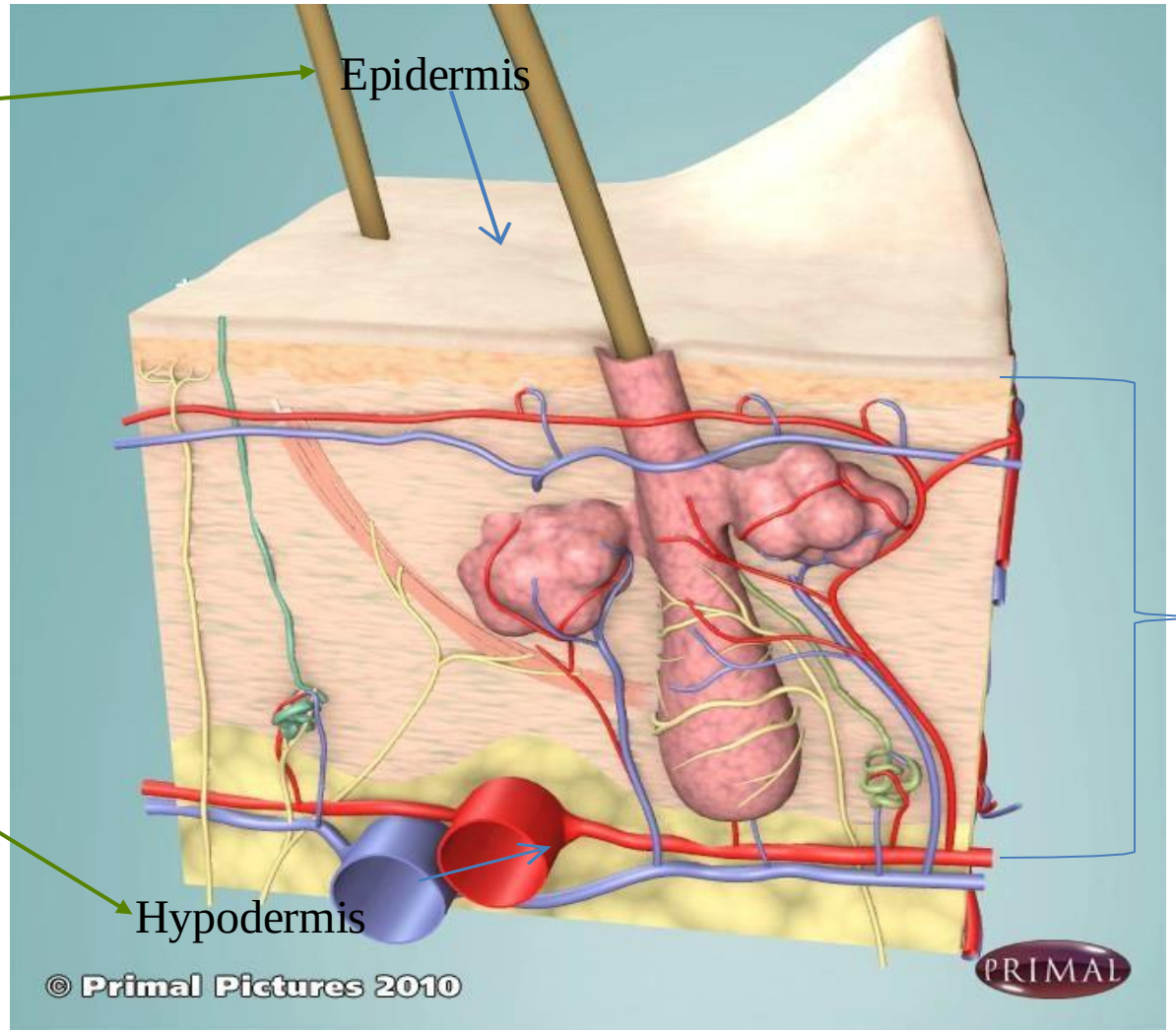
Basic Skin Histology

Skin is an important subject to know no matter what clinical field you want get into

Dermis + epidermis = cutaneous membrane

1

Epithelial layer of stratified keratinized epithelium



3

It's an Adipose tissue (subcutaneous tissue) it's mainly fats & it's the superficial facia that you can see in the anatomy labs. Deep facia is underneath it surrounding the deep structures (bones & muscles)

2

Dermis

It's a connective tissue

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Basic Skin Histology

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

Skin is an important subject to know no matter what clinical field you want get into

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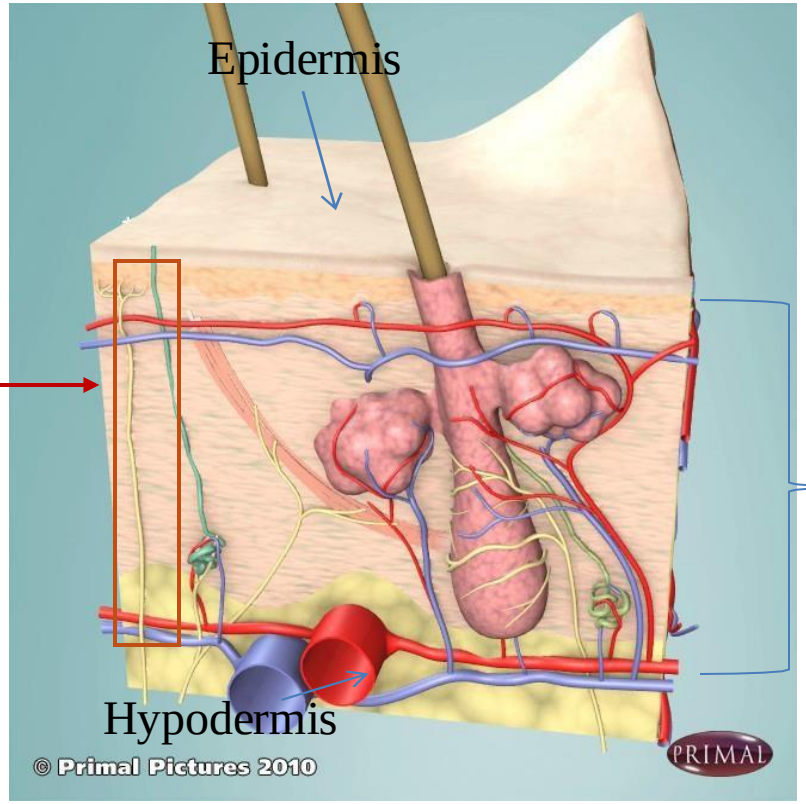

Major Skin Functions

➢ Protection

- acts as a mechanical barrier against microorganisms and they can get in in case of injury.
- It's also a waterproof layer preventing water gain and mainly water lose protecting us from dehydration.
- It forms a barrier against UV lights that can damage the skin cells causing burns and most seriously causing mutations In the DNA leading to Cancer as too much UV lights exposure is the most common cause of it.

➢ Sensory Perception (by sensory neurons that form many sensory receptors for pain,touch etc..)

Basic Skin Histology

The skin is composed of two layers: the outer epidermis and the deeper dermis
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Skin is an important subject to know no matter what clinical field you want get into

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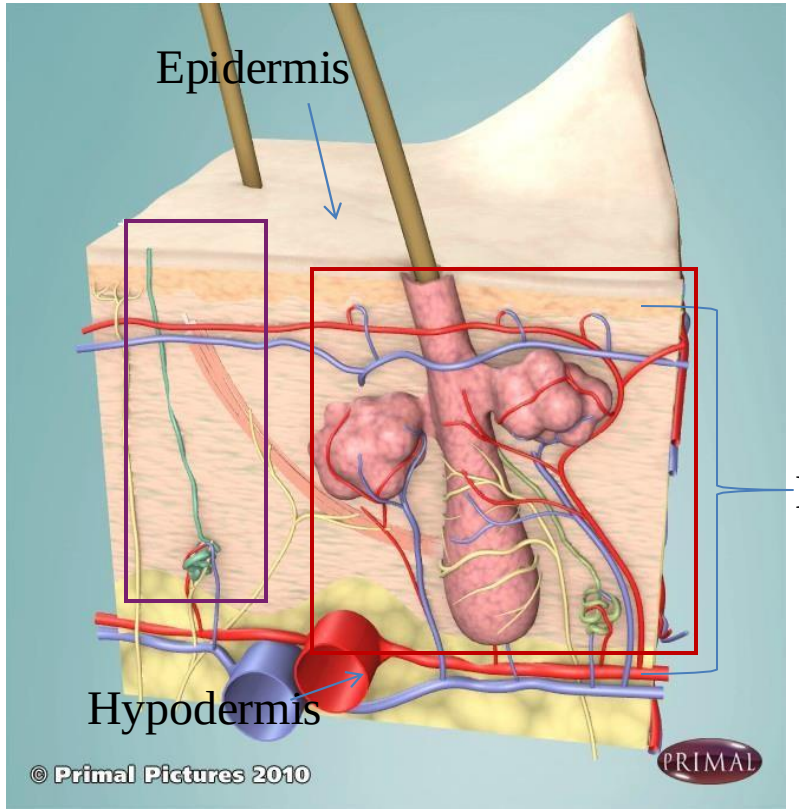
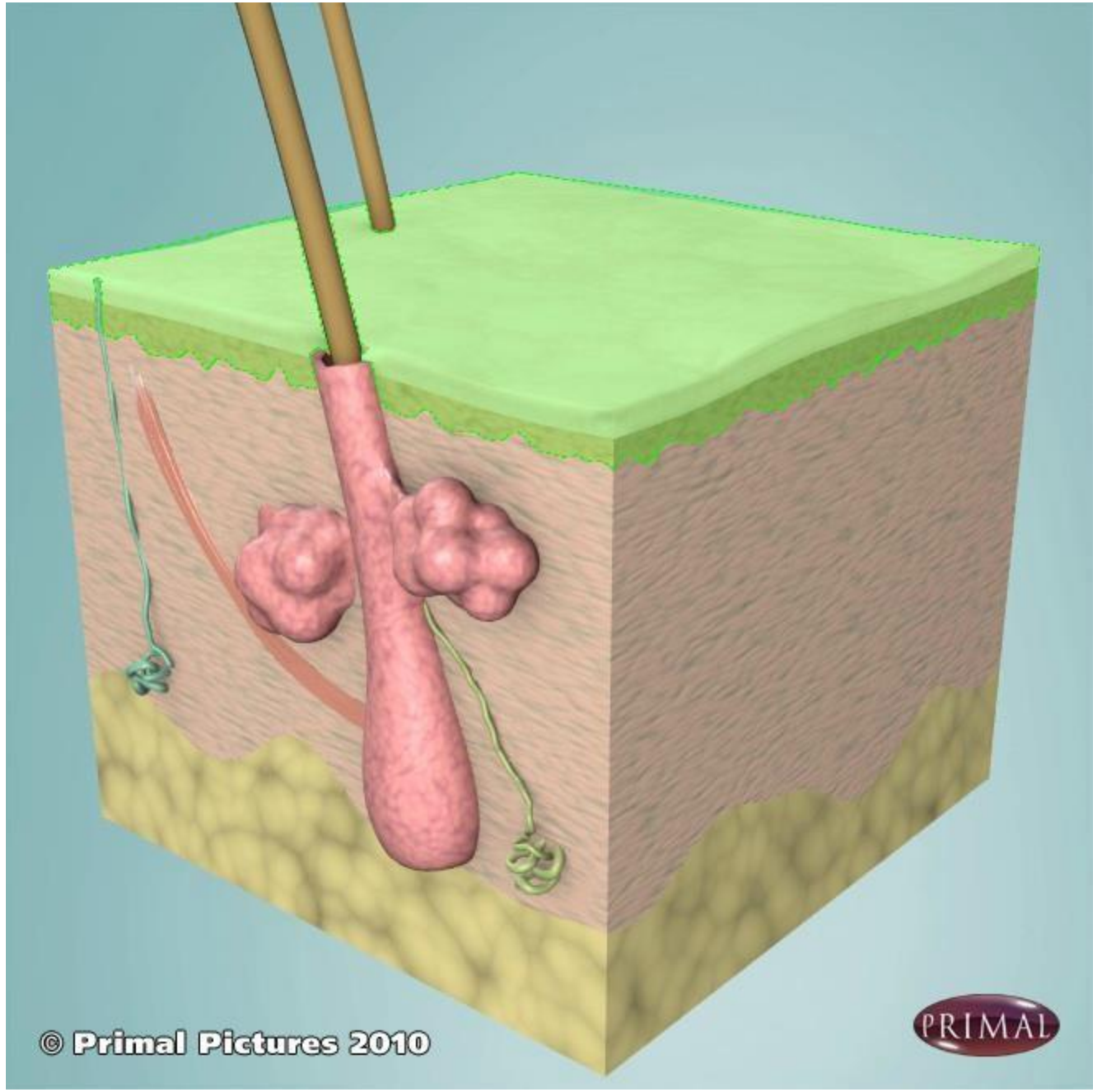


Major Skin Functions

- Temperature Regulation
  - The **first way** is by the ductal sweat glands that open in the surface of the epithelium so it can sweat when overheated then the sweat will evaporate causing the body to cool down which is obstructed by humidity. That's why some people can tolerate more in the dessert rather than humid places.
  - Now the **second way** is through cutaneous blood vessels that constrict when you feel cold reducing the blood flow to the surface making the skin pale or dilate when you feel hot increasing the flow of the warm blood to the surface making the skin red.
- Excretion of sweat that includes water , electrolytes and some waste products like urea.
- Formation of Vitamin D
  - The skin is a gland that produces a steroid hormone called calciferol (Vitamin D) from cholesterol & it also needs sunlight then it'll be secreted into the bloodstream then it'll actin on the small intestine to increase the absorption of calcium.
  - Nowadays, children don't get enough vitD due to the lack of sun exposure which affects their bones & teeth so scientists decided to add it to the milk to increase the calcium absorption.

Epidermis



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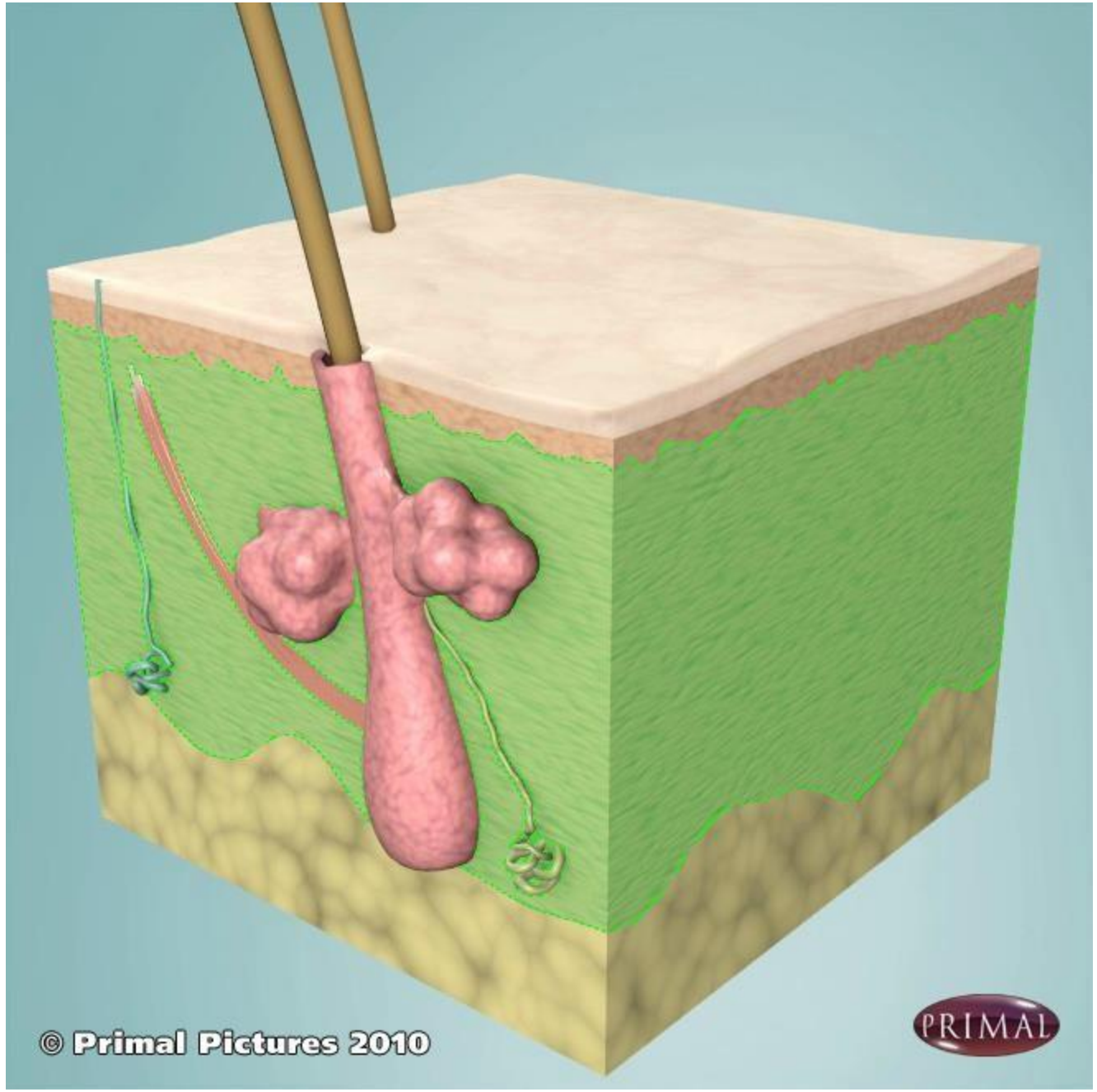
Dermis



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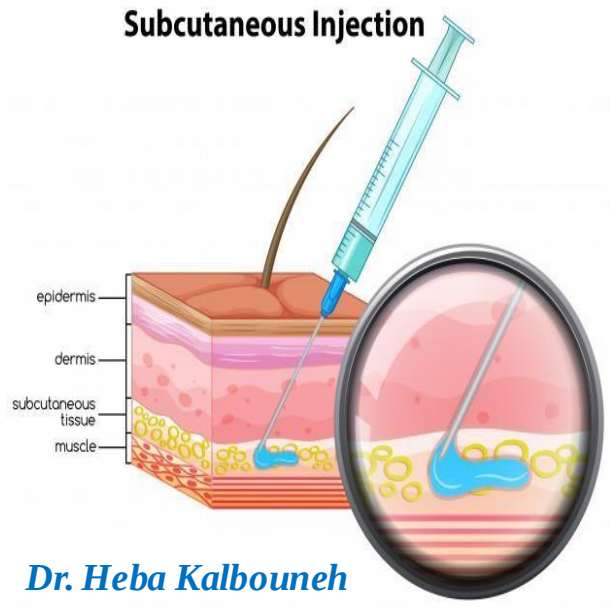
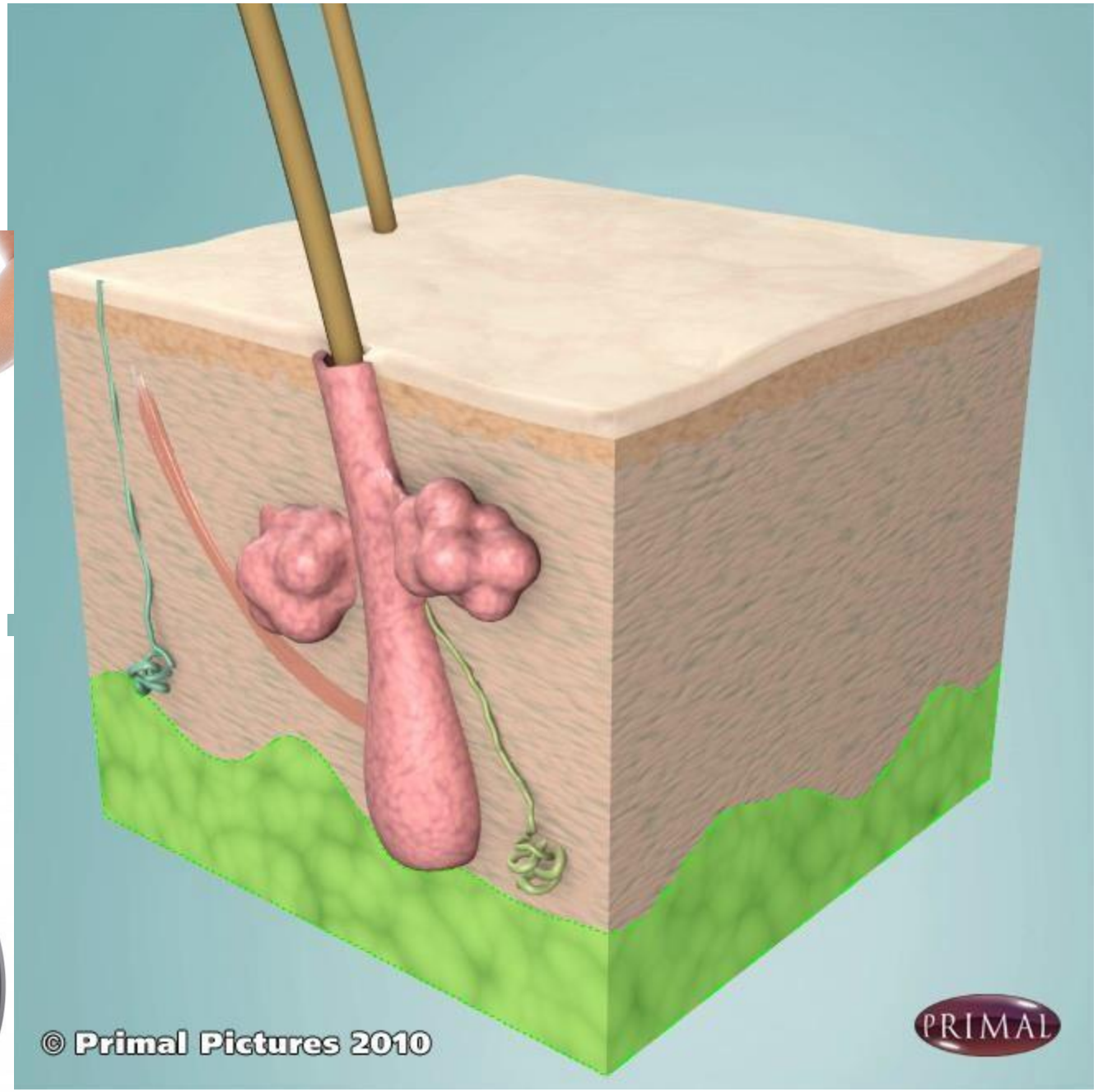
Hypodermis
Superficial fascia
Subcutanous tissue
Subdermal fat





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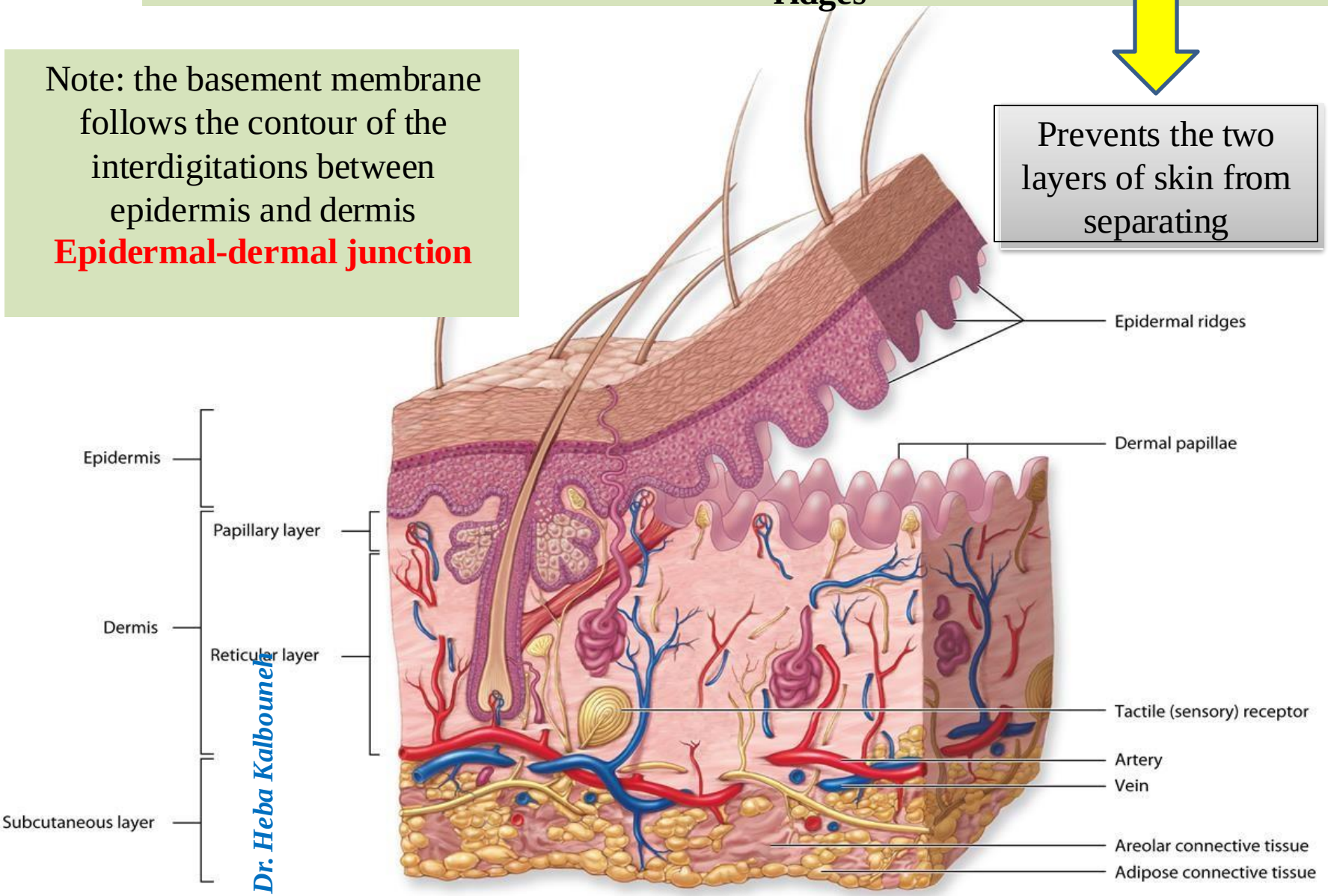
The **dermal papillae** are nipple-like extensions of the dermis into the epidermis

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



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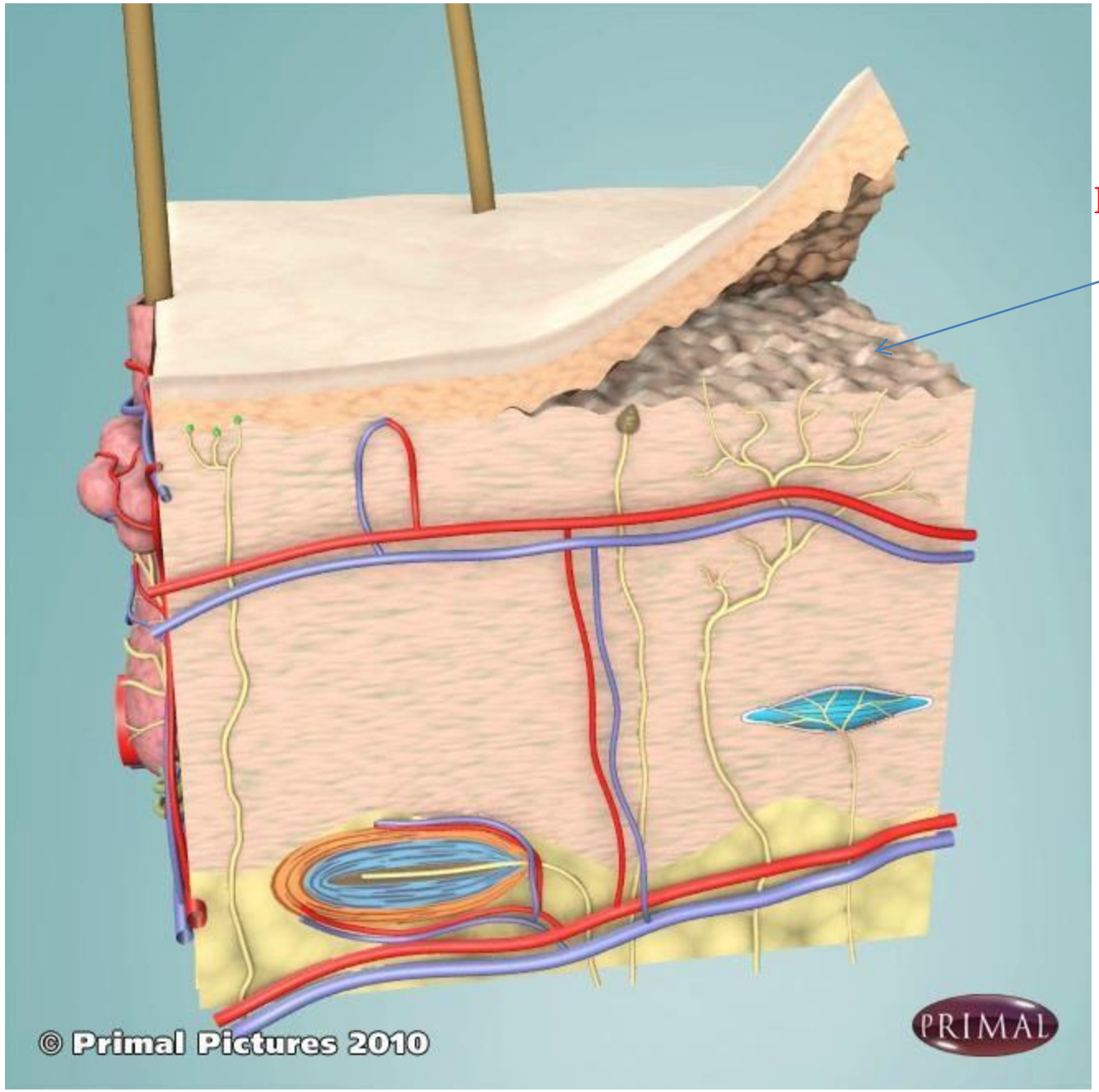
- **The function of this wavy junction :**

1) It presents to increase the adhesion of the epidermis to the dermis as if it's a straight line it'll be sensitive to trauma causing the epidermis to slide on the dermis
2) The epidermis is avascular depending on the underlying connective tissue for nutrients and by the wavy line on papillae the surface area of contact increases causing an increase in nutrients diffusion



Epidermal-dermal junction

More prominent in palms and soles

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

These interdigitations are called **friction ridges**

For grasping with our hands

And for walking barefoot

Blisters

Blisters are where the epidermis is separated from the dermis creating a bucket filled with fluid

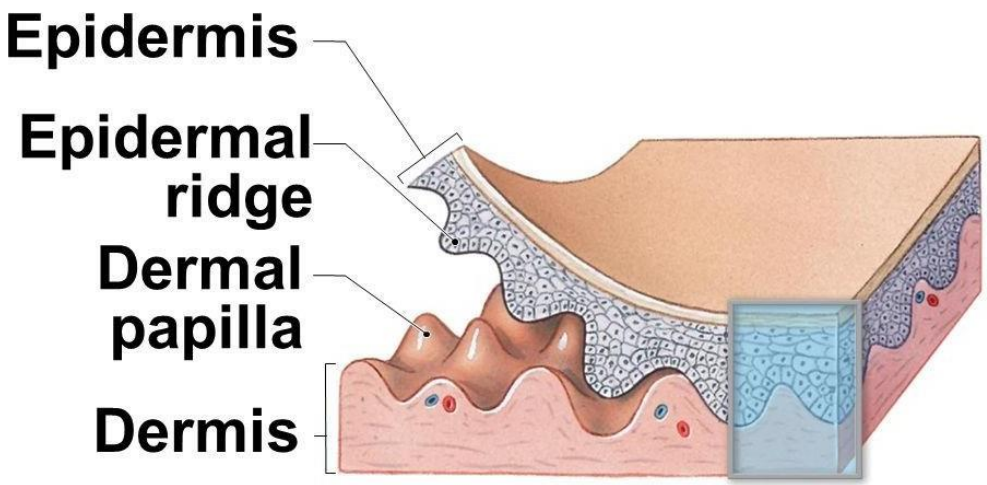

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Figure 4.1 1

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Epidermal ridge
Dermal papilla
Epidermis
Dermis
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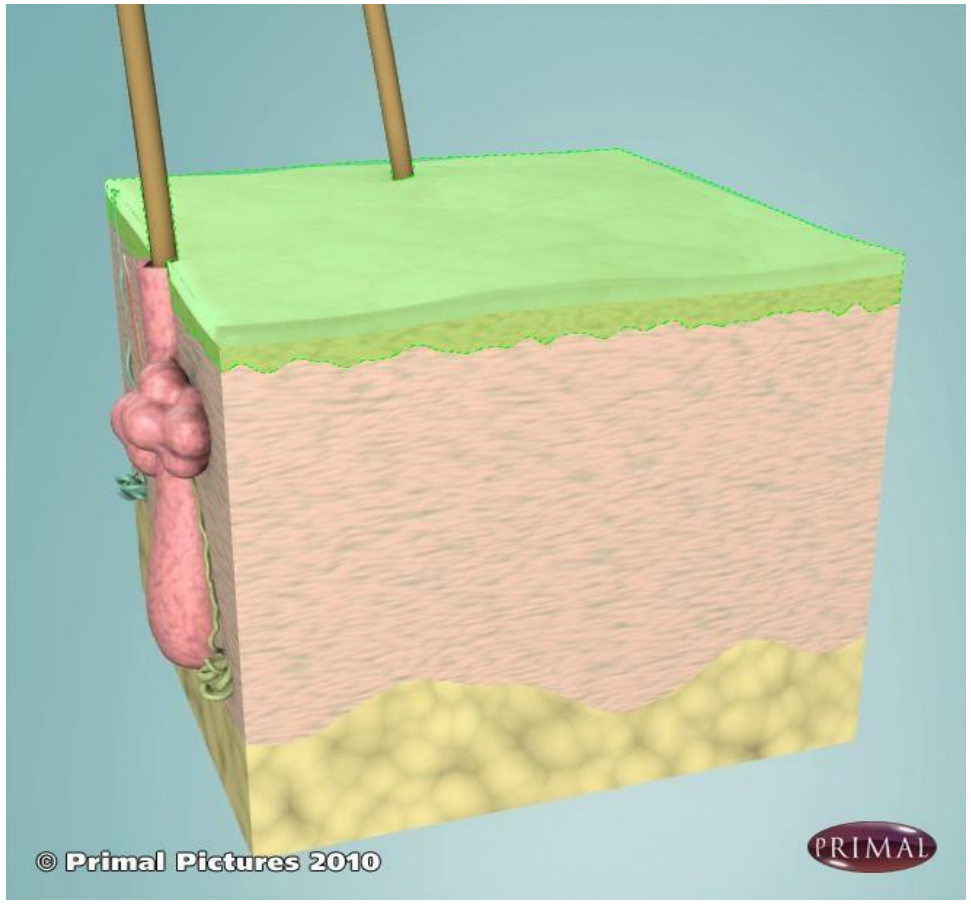
Epidermis

- 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

The most present one & it has keratin



Keratinized stratified squamous epithelium

(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

- It'll form new cells and as they are formed they are going to be pushed to form the different layers of epidermis

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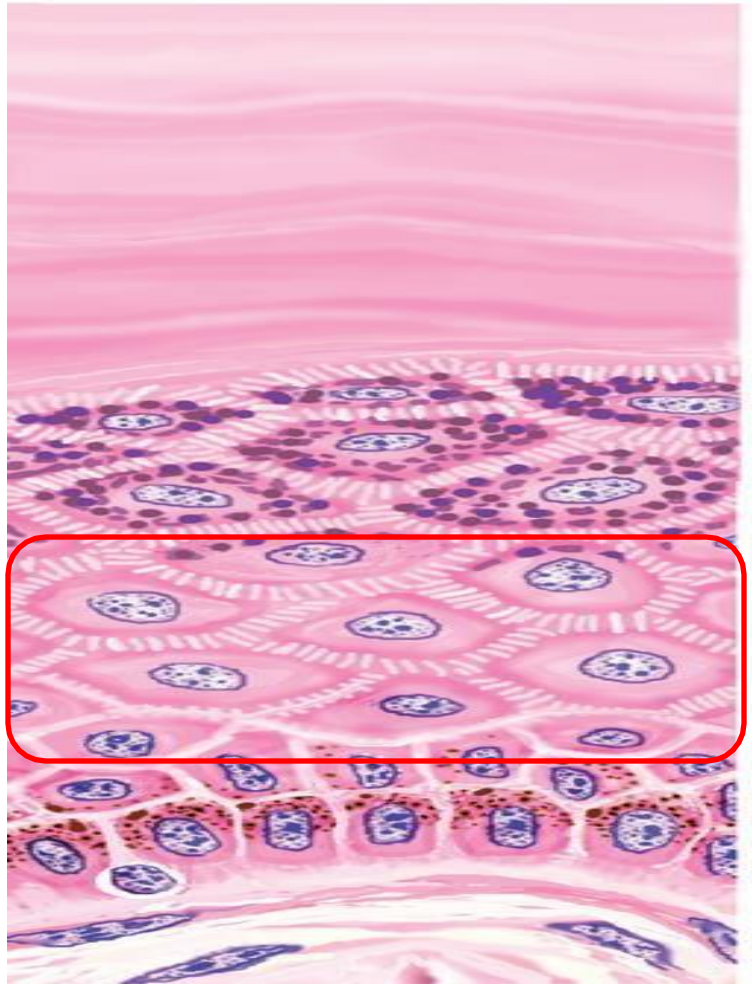
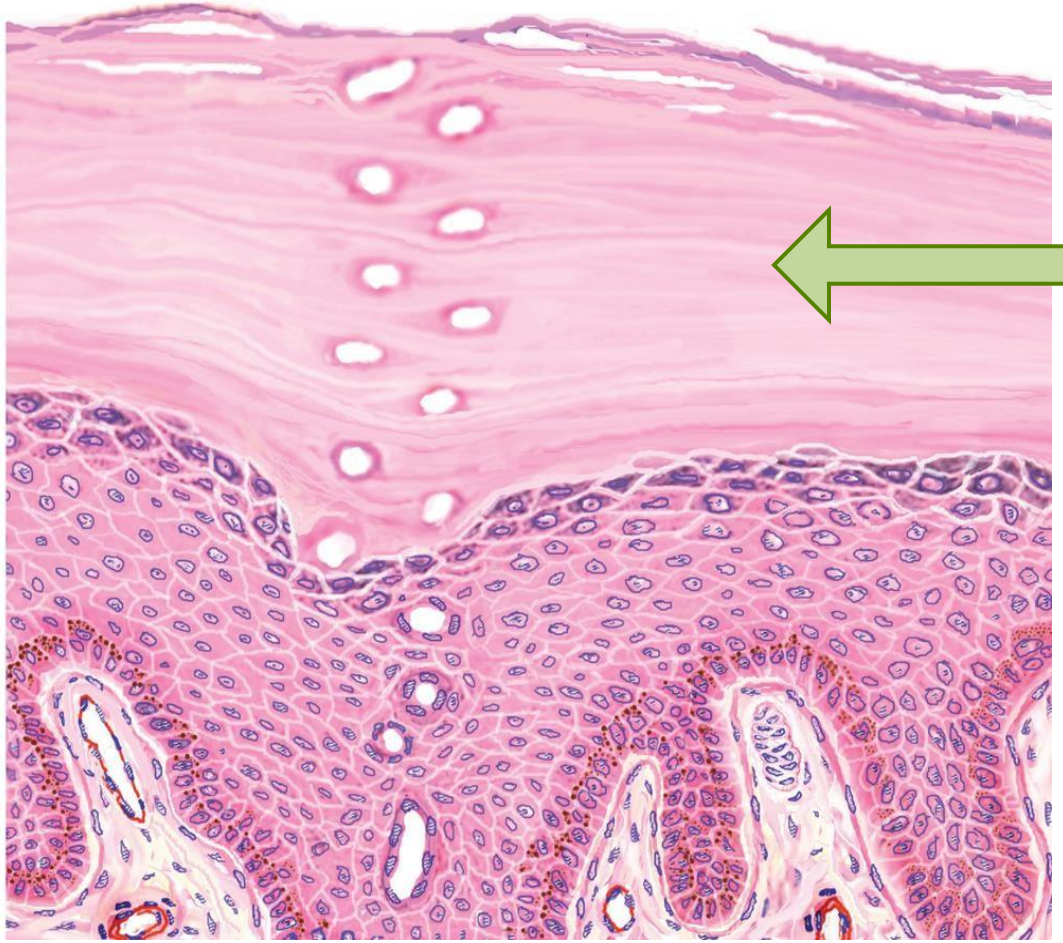
- Is the layer above the stratum basale
- Consists of 8-10 rows of cells
- Cells synthesize keratin filaments that become assembled into tonofilaments
- During histologic preparation, cells shrink and intercellular spaces appear as spines
- Spines represent sites of desmosome attachments to keratin tonofibrils





- As we go away from the basal layer the keratinocytes will form more keratin until we end up with dead cells with a cytoplasm full with keratin & no organelles
- It's called stratum **spinosum** as spines like structures appears in it

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

Stratum germinativum

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(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

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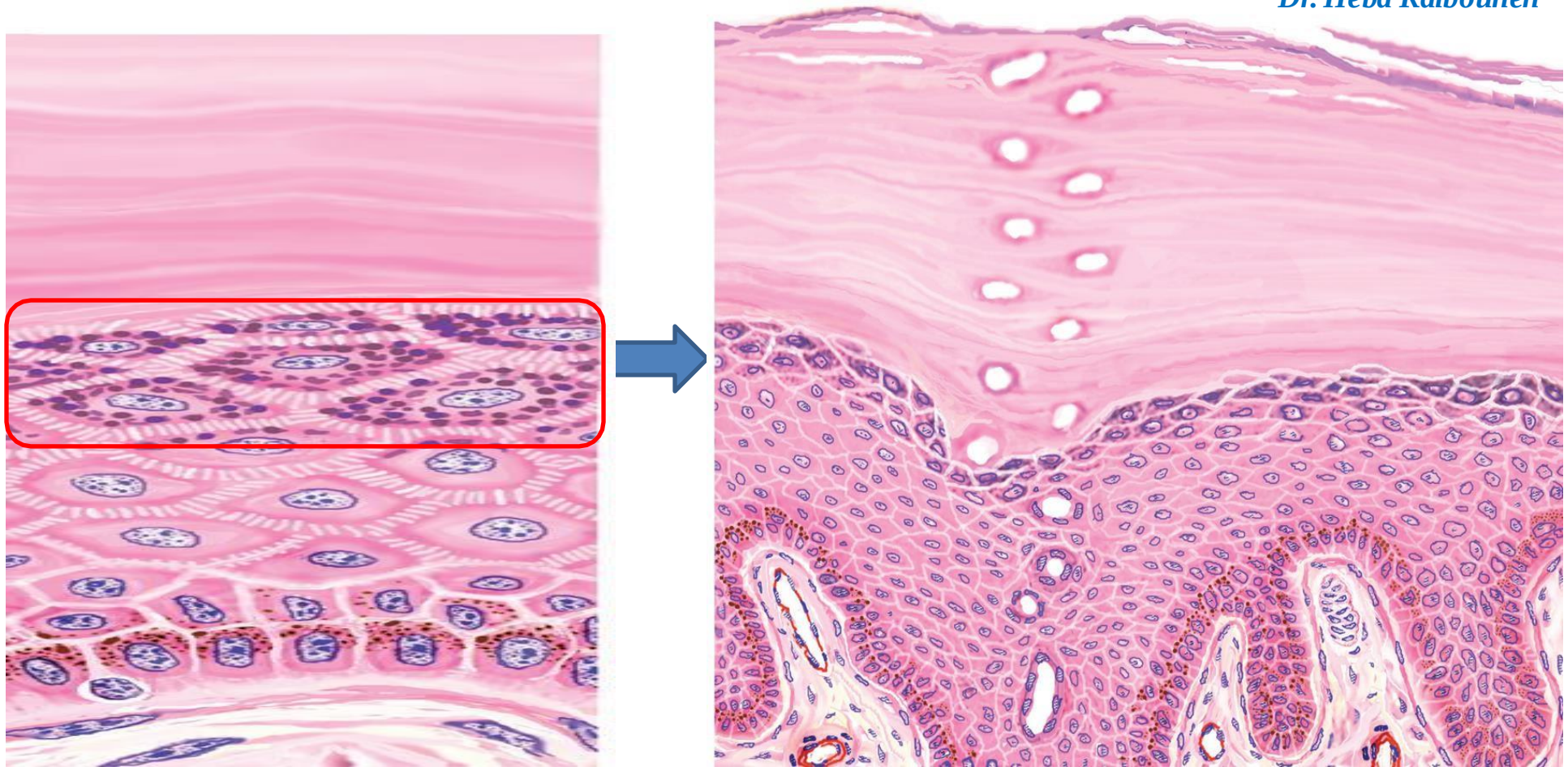
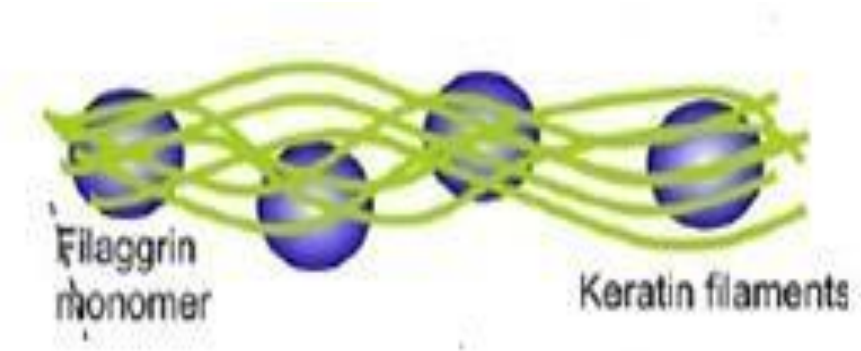


- It's called stratum **granulosum** as it has a granular appearance due to its basophilic granules

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

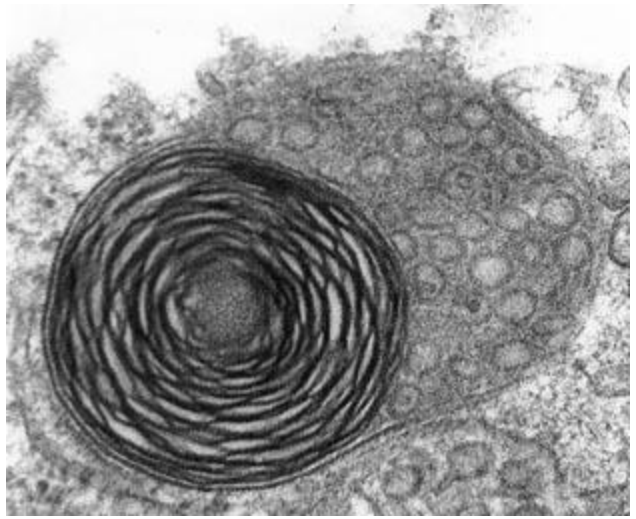


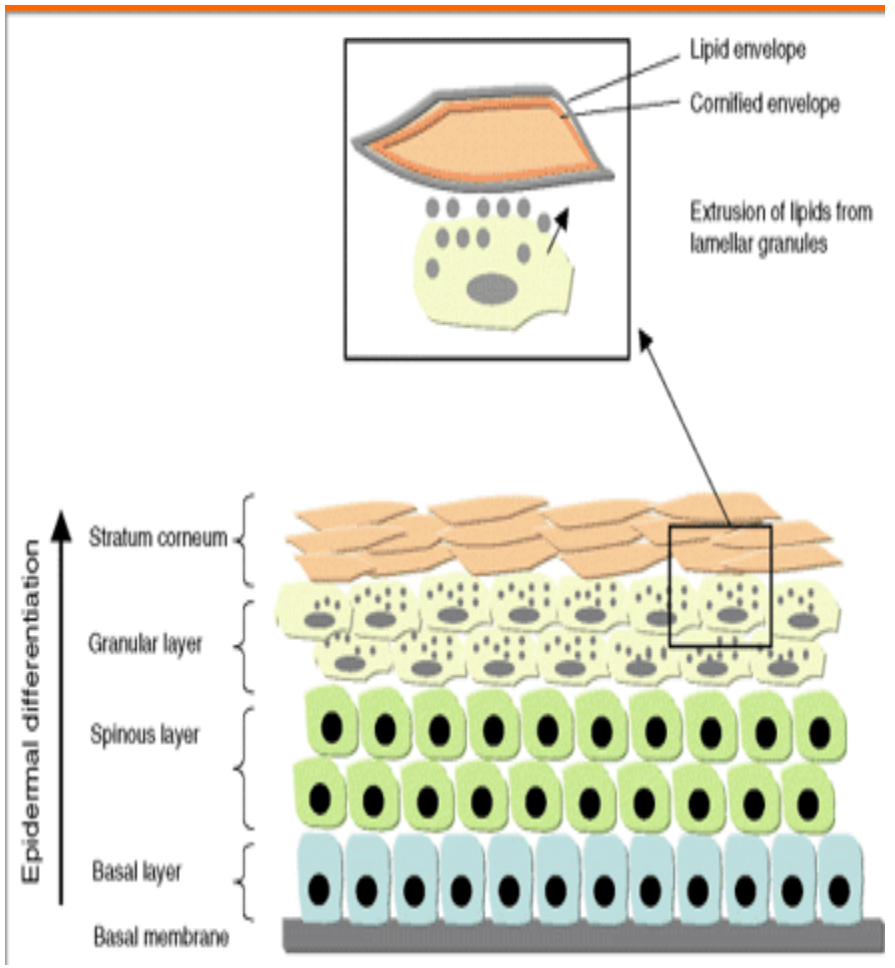
It's Tonofilaments cross linked by linker proteins (filaggrin) → **Tonofibrils**

Thicker

Intermediate filaments= keratin = Tonofilaments

Lamellar granules discharge lipid material between cells and waterproof the skin



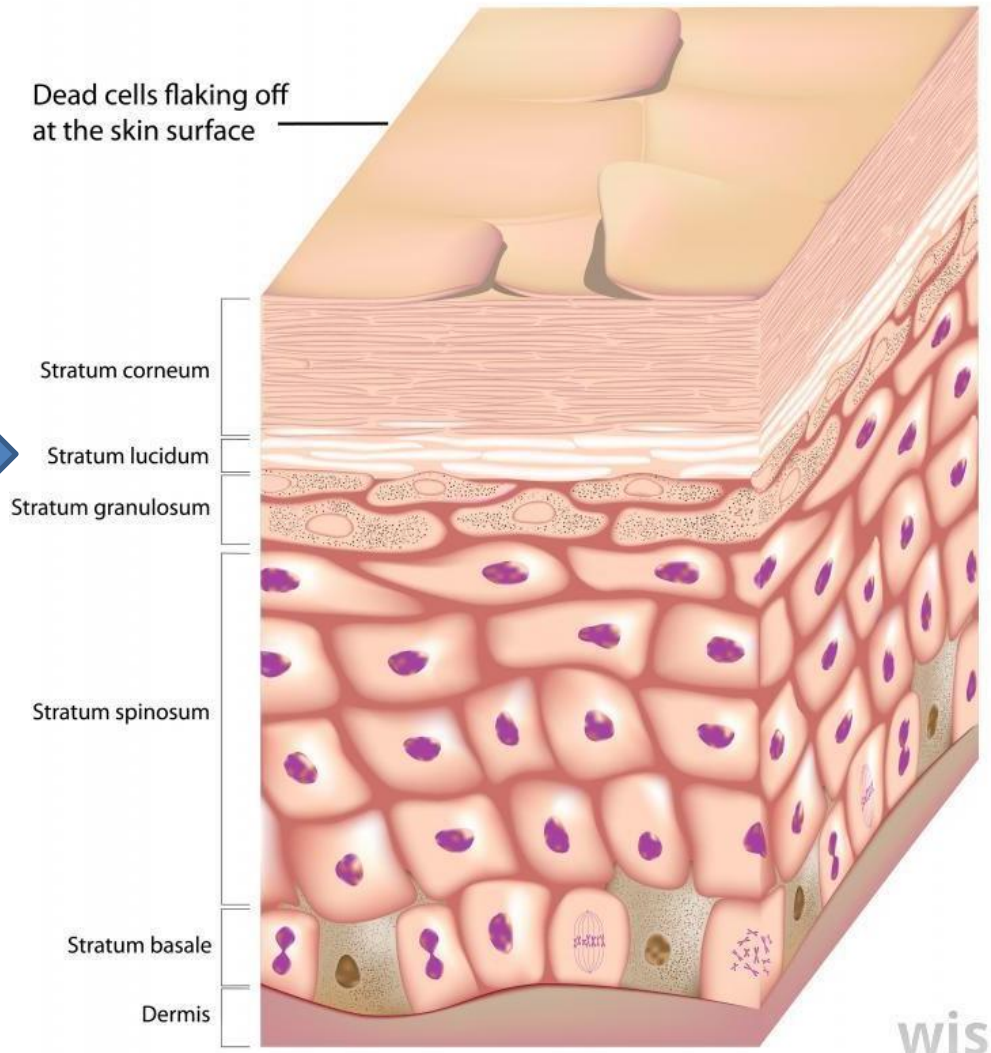


- In the previous slides we talked about keratohyalin granules that appears under the **light microscope** but now we will talk about lamellar granules (lipids) that appears under the **electron microscope**
- Another difference between the two granules is that the lipid doesn't stay inside the lamellar granules like the keratohyalin graunules (keratin) but will leave by exocytosis to the intercellular space between the keratinocytes creating a waterproof layer

(4)Stratum Lucidum

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

They appear lighter as the keratin is less tightly packed than the layer above it



(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.

- As we mentioned in slide #23 the intercellular space is filled with lipid
- So the basal cell layer forms new cells that will be pushed away until we end up with dead cells that will undergo desquamation which is shedding of the dead cell of the epithelium

Calluses and corns

The continues pressure will cause the statüm corneum to grow thicker forming calluses & corns

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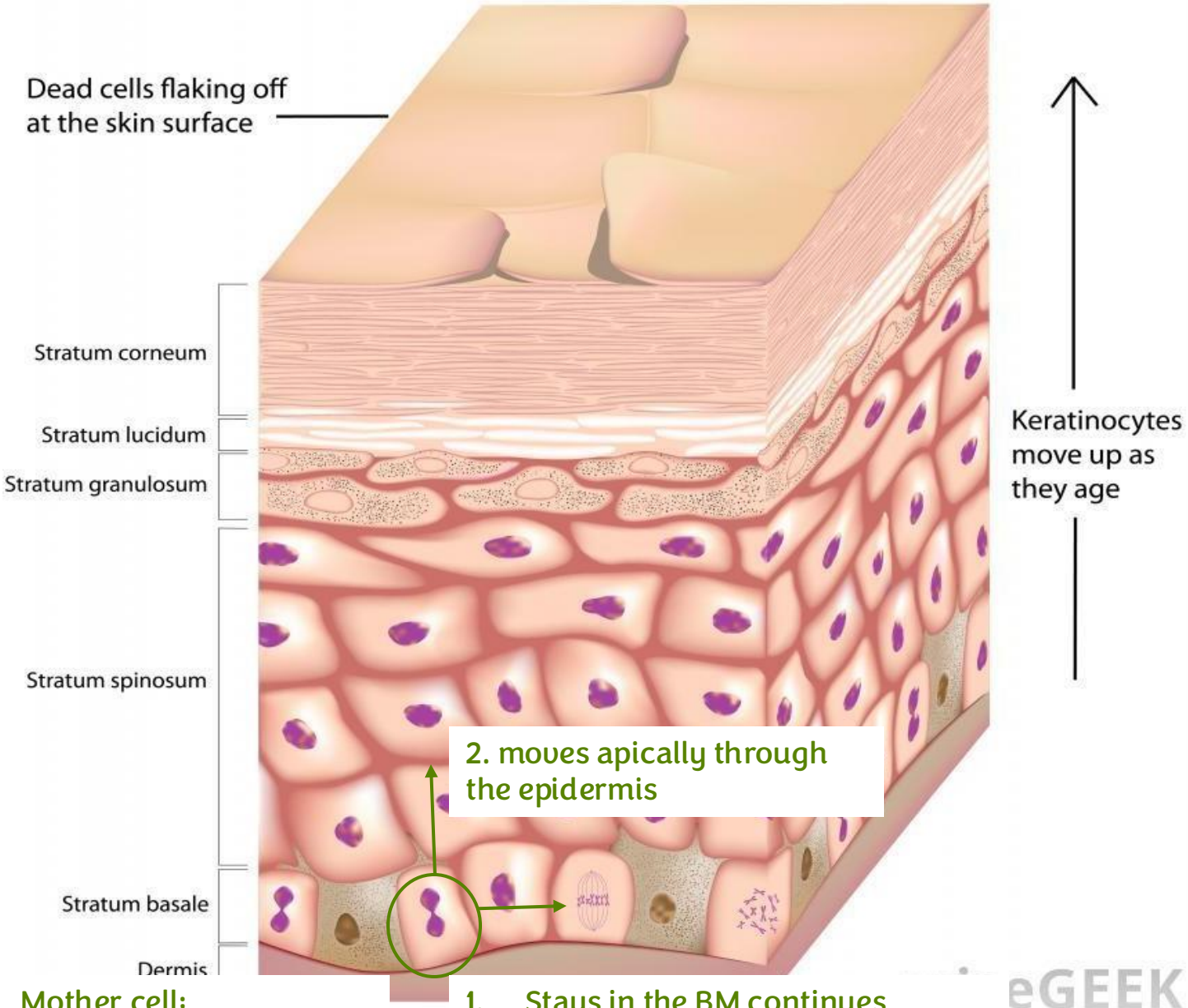
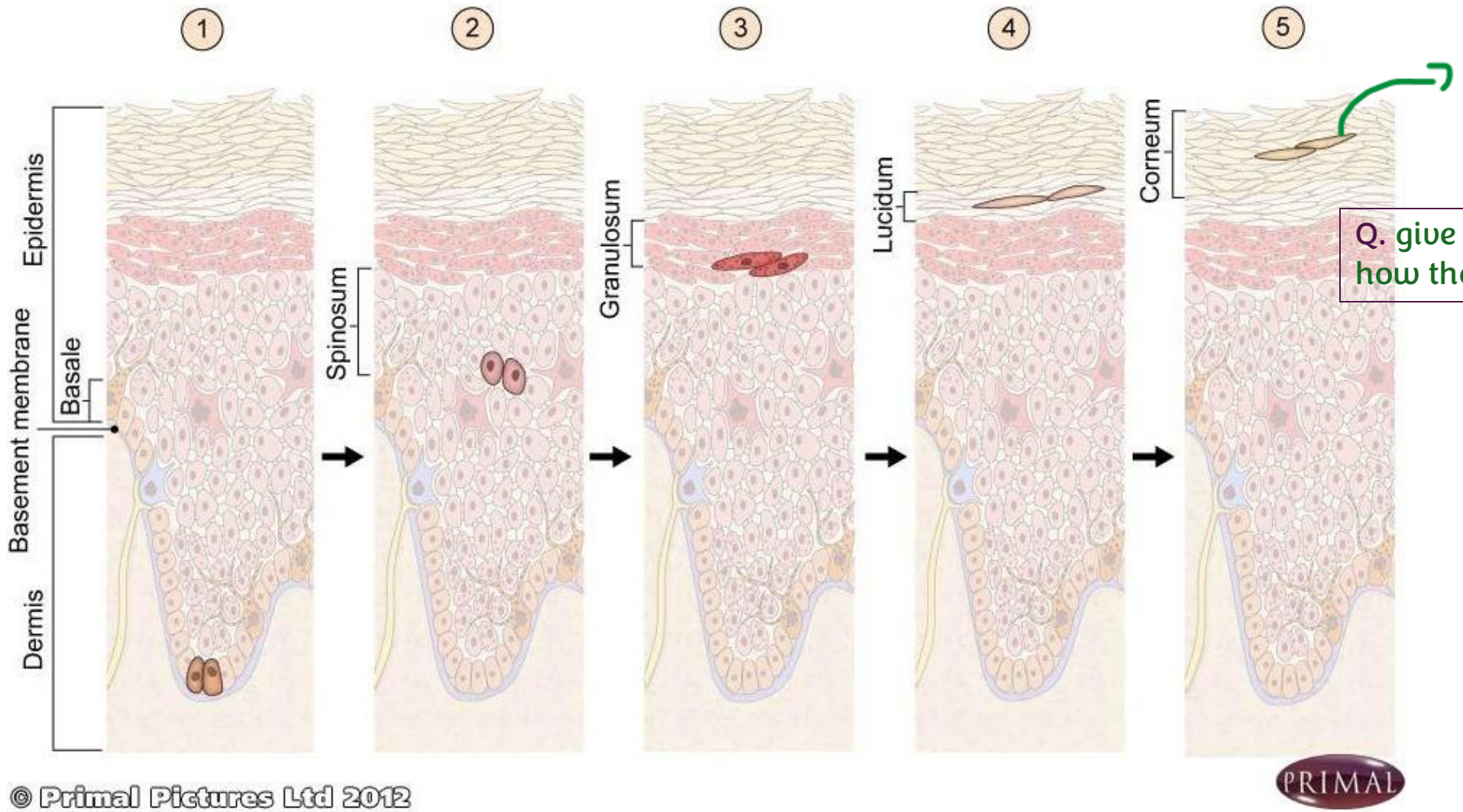
By the end of keratinization, the cells contain only keratin with plasma membranes surrounded by lipid rich layer

Q. What is the significance of the Basal's layer mitotic activity?



Let's follow the journey of these 2 cells
It's over the course of 2-4 weeks

Eventually, they'll be desquamated from the surface of the epithelium.



Q. give reasons as how these cells died.

Psoriasis is a common skin condition. It causes the life cycle of skin cells to speed up, leading to the rapid buildup of extra skin cells. These extra cells form scales and red patches on the surface of the skin that are itchy and sometimes painful.

Accelerated keratinization of skin cells (keratinocytes)

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Types of skin

Thin skin

Differences:
1. Location.
2. Sweat glands.
3. Hair follicles.

See next slide

4. epidermal thickness

Thick skin

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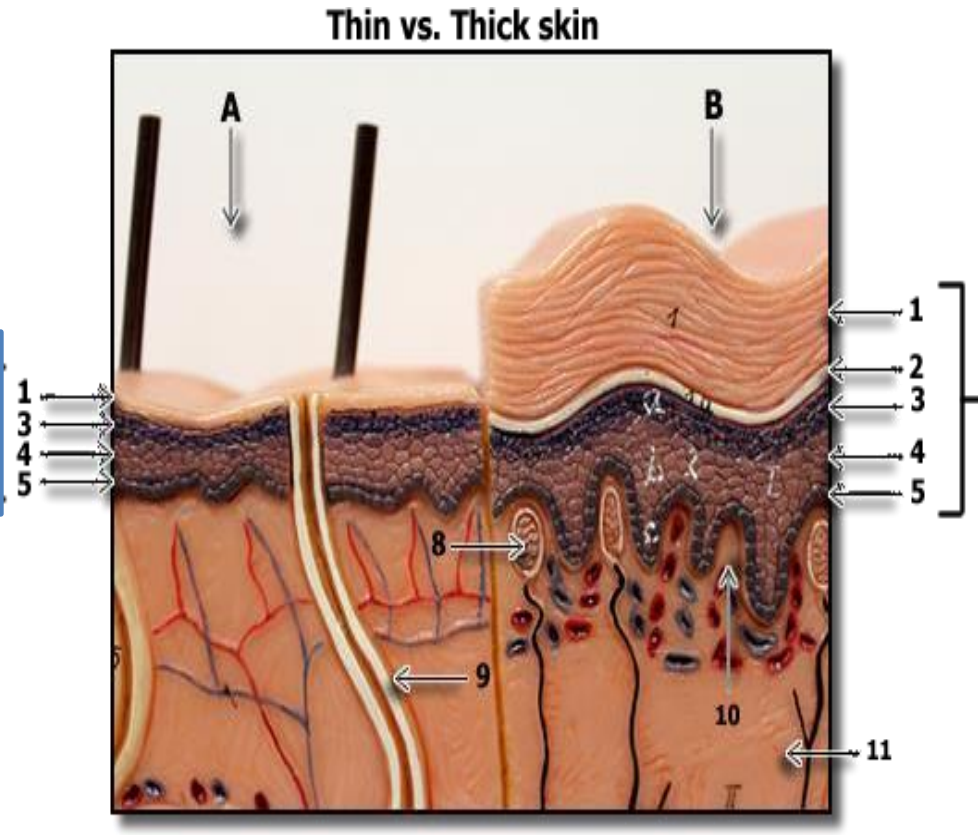
*** Dominant and lines most of the body surface**

The skin of the back and eyelids.

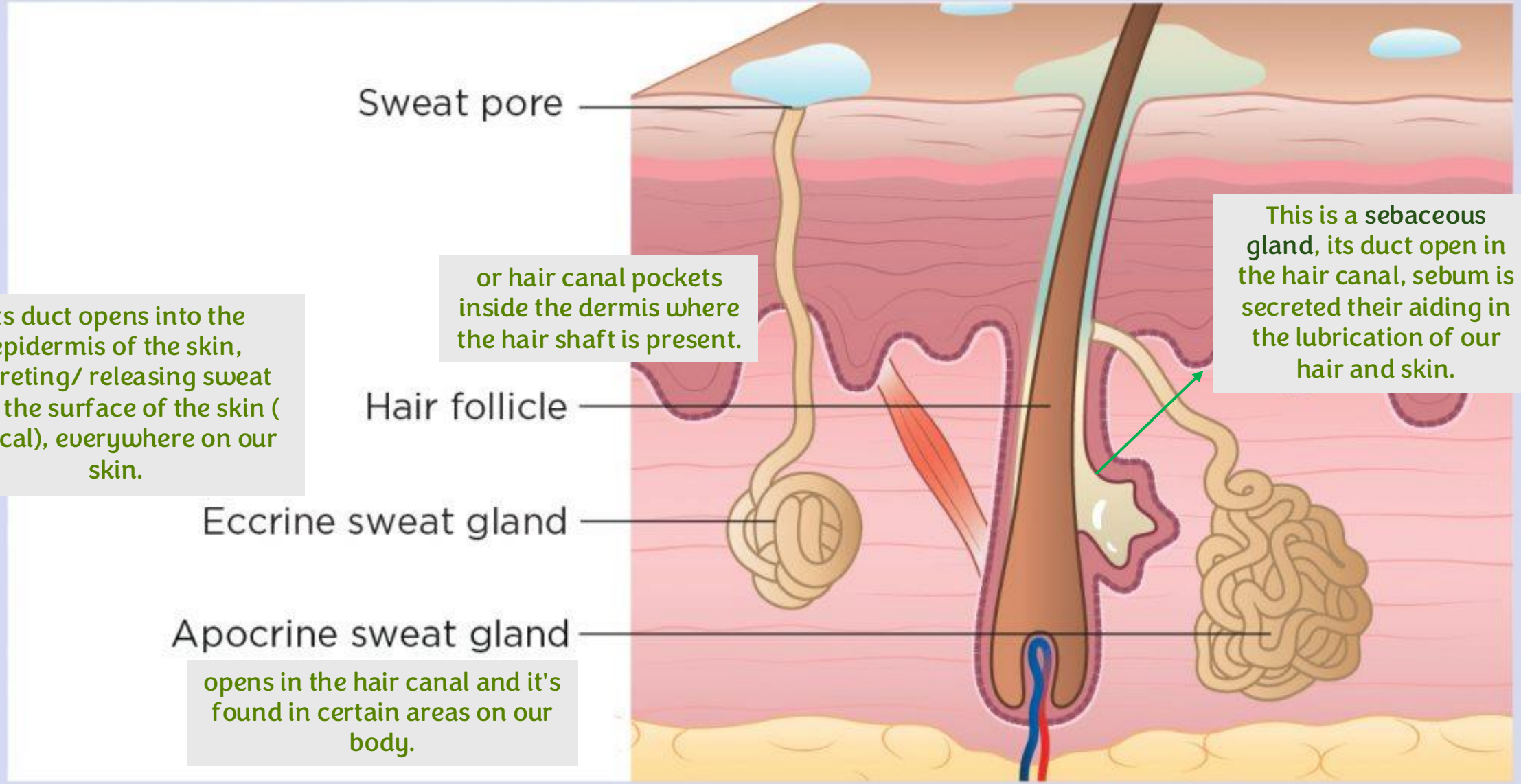


*** Palms of the hands and soles of the feet**

Resists friction and abrasion

Fig 2. **Eccrine and apocrine sweat glands**

Simple coiled tubular gland



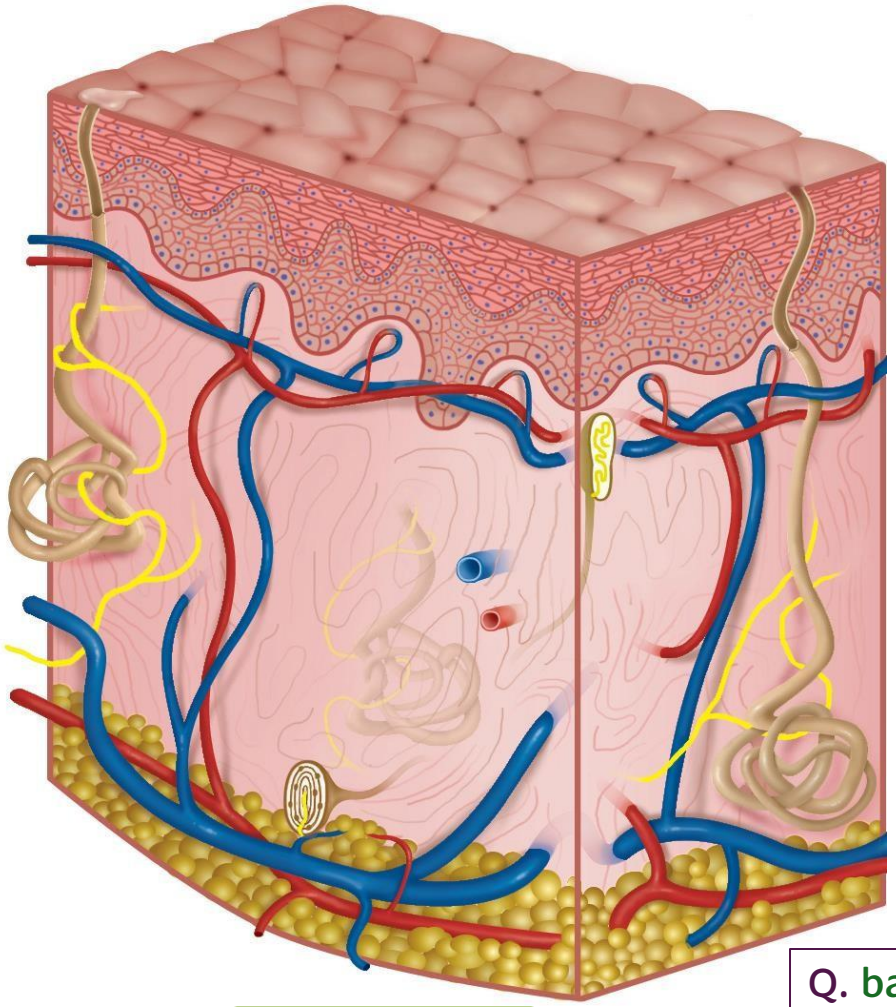
Its duct opens into the epidermis of the skin, excreting/ releasing sweat into the surface of the skin (typical), everywhere on our skin.

or hair canal pockets inside the dermis where the hair shaft is present.

This is a sebaceous gland, its duct open in the hair canal, sebum is secreted their aiding in the lubrication of our hair and skin.

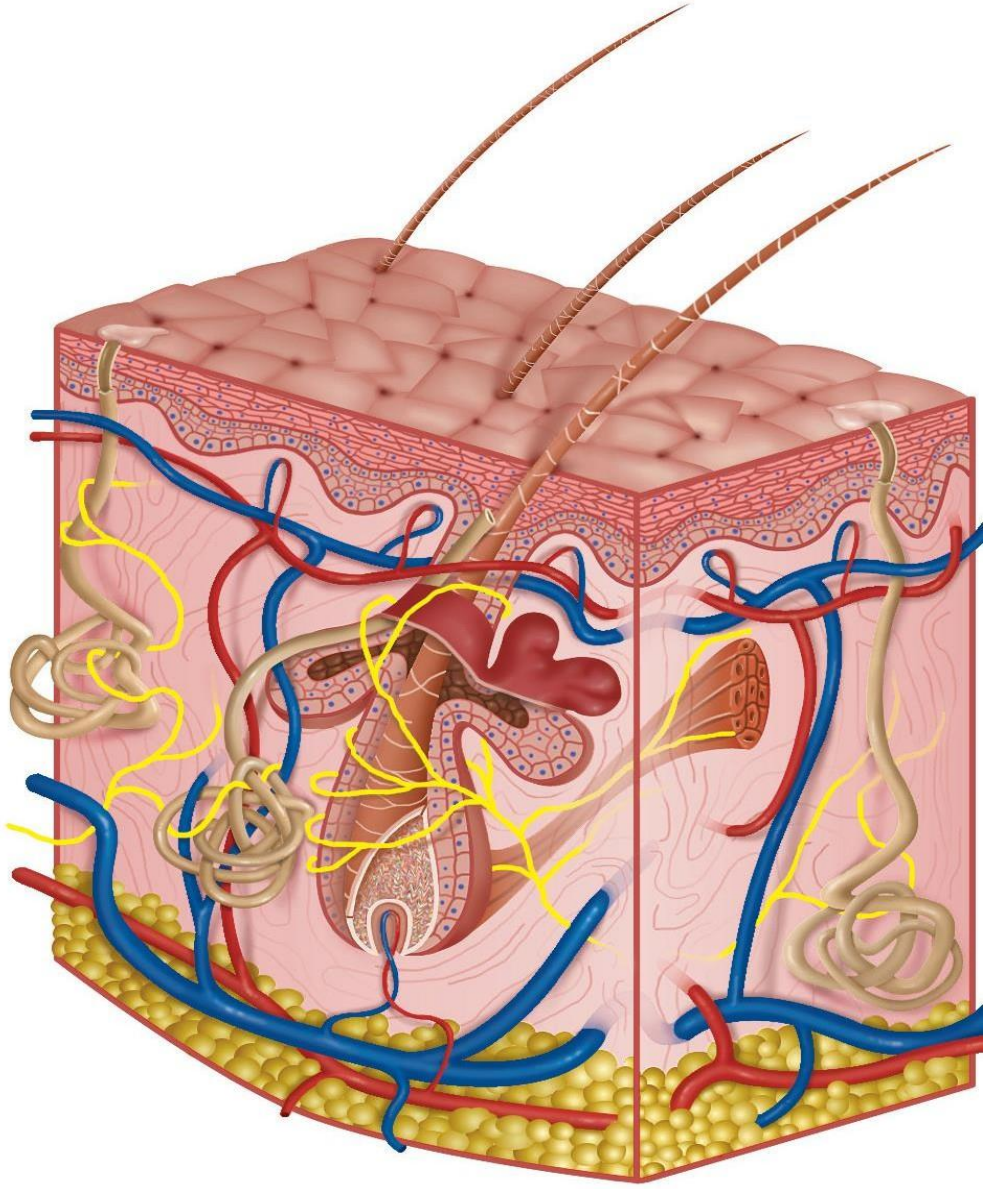
opens in the hair canal and it's found in certain areas on our body.

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



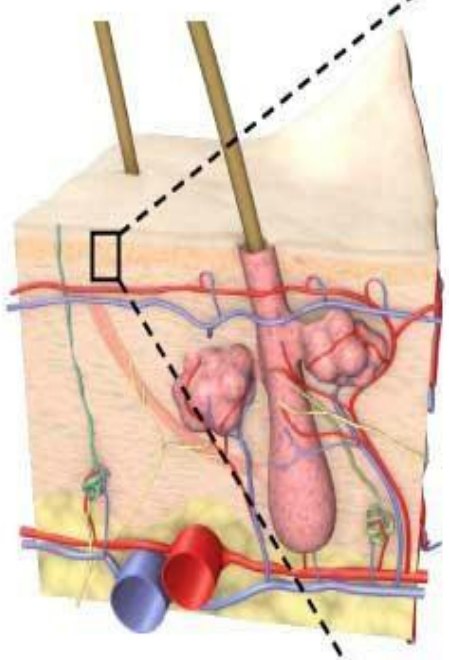
Thick skin

Q. based on the previous slide, what glands are missing in thick skin?

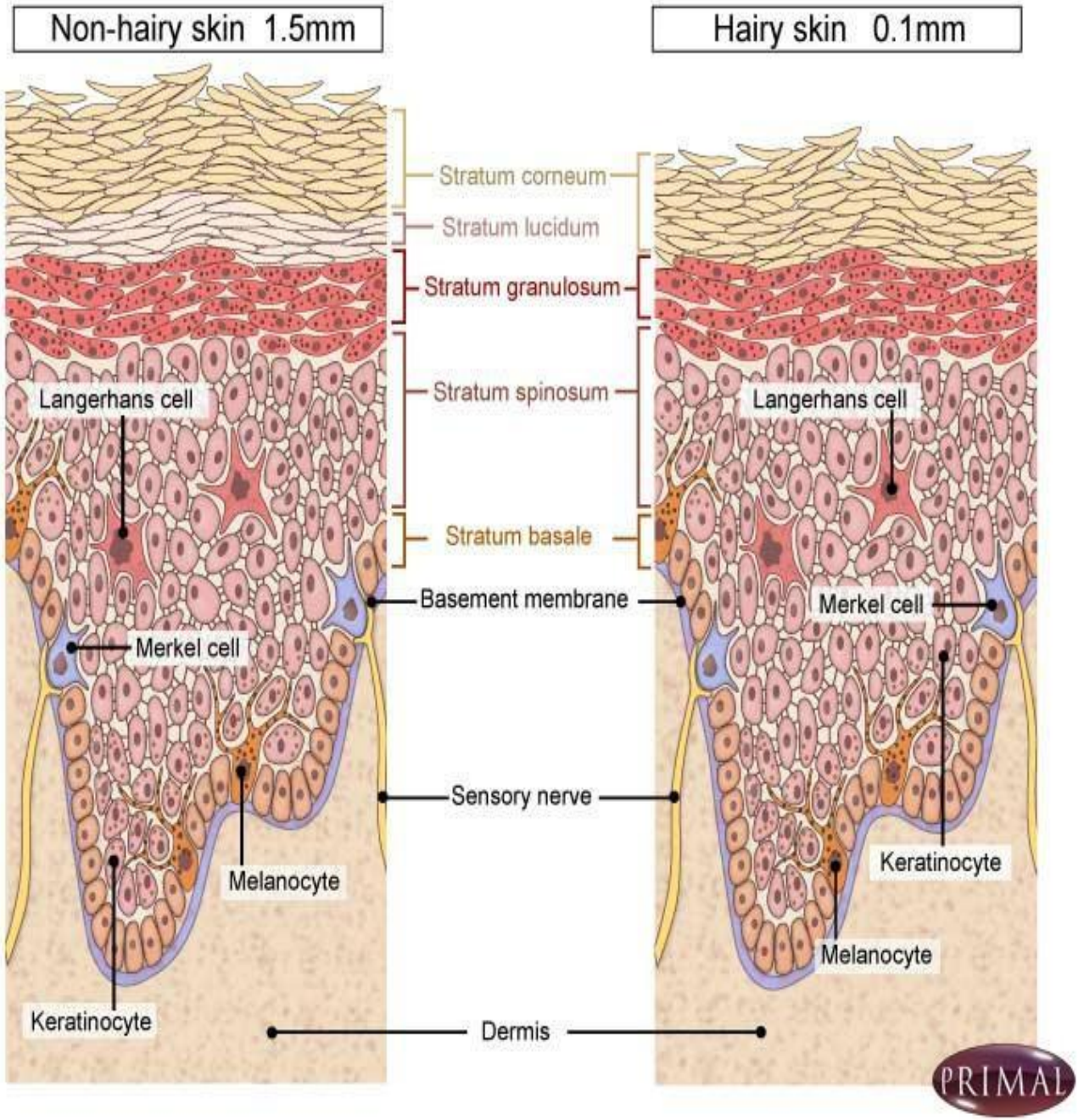


Thin skin

Q. give another name for thick and thin skin.



Q. what layer is present in thick skin but not thin skin?



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Types of skin

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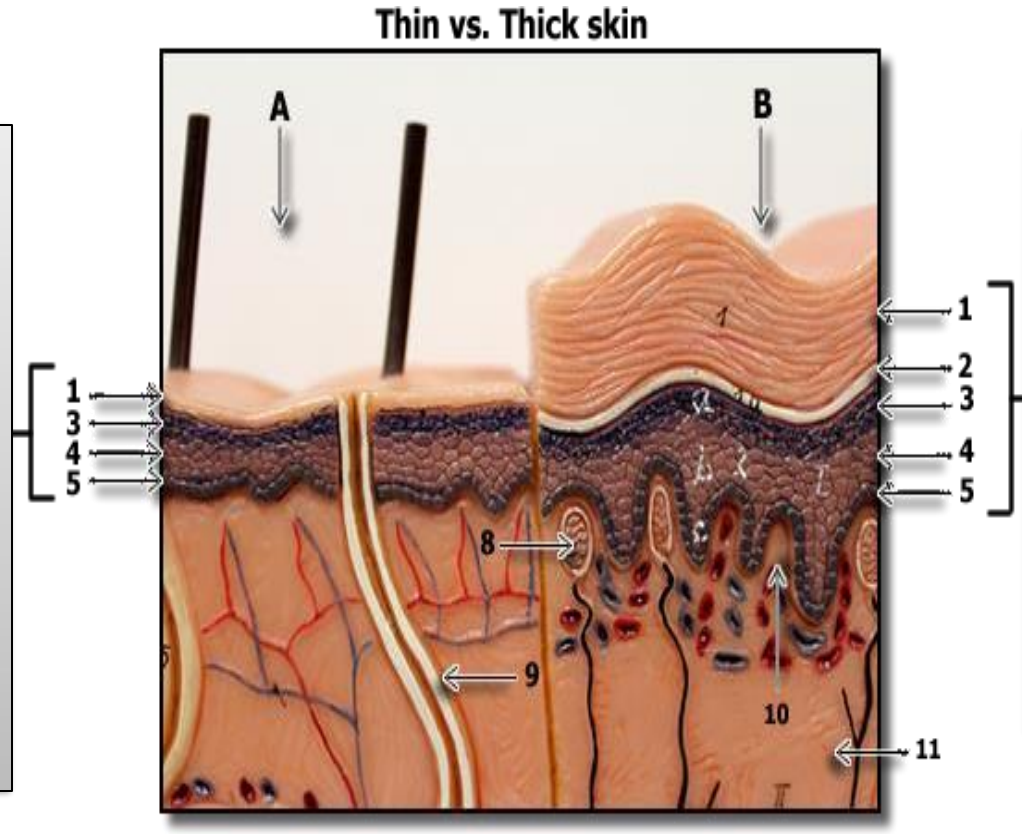
Thin skin

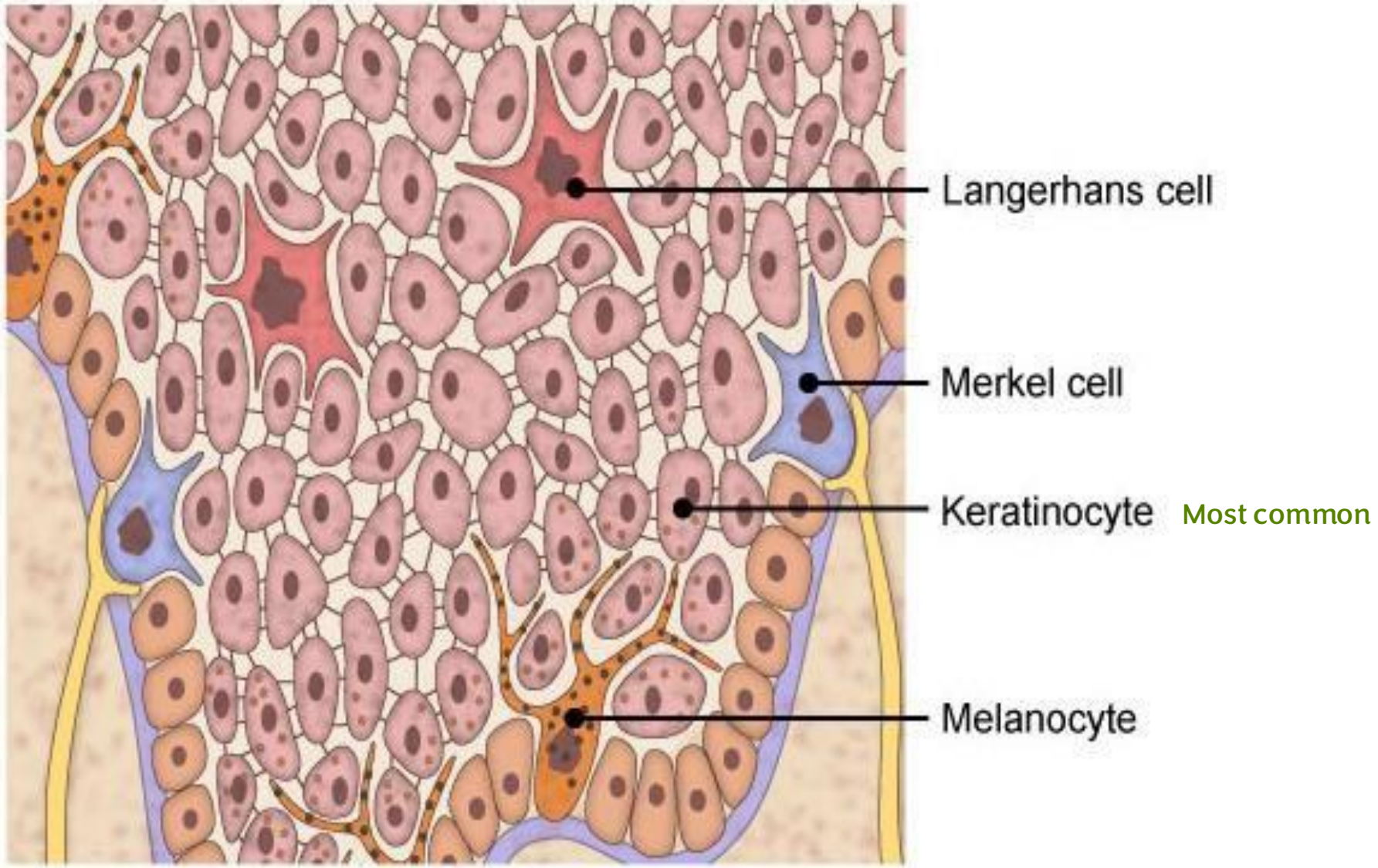
*4 layers
*less Prominent stratum corneum
* Less developed stratum granulosum
* Dominant and lines most of the body surface
* Thicker dermis
* hair and sebaceous glands

Thick skin

*5 layers
* Prominent stratum corneum
* Well developed stratum granulosum
* Palms of the hands and soles of the feet
* Thinner dermis
* No hair and sebaceous glands

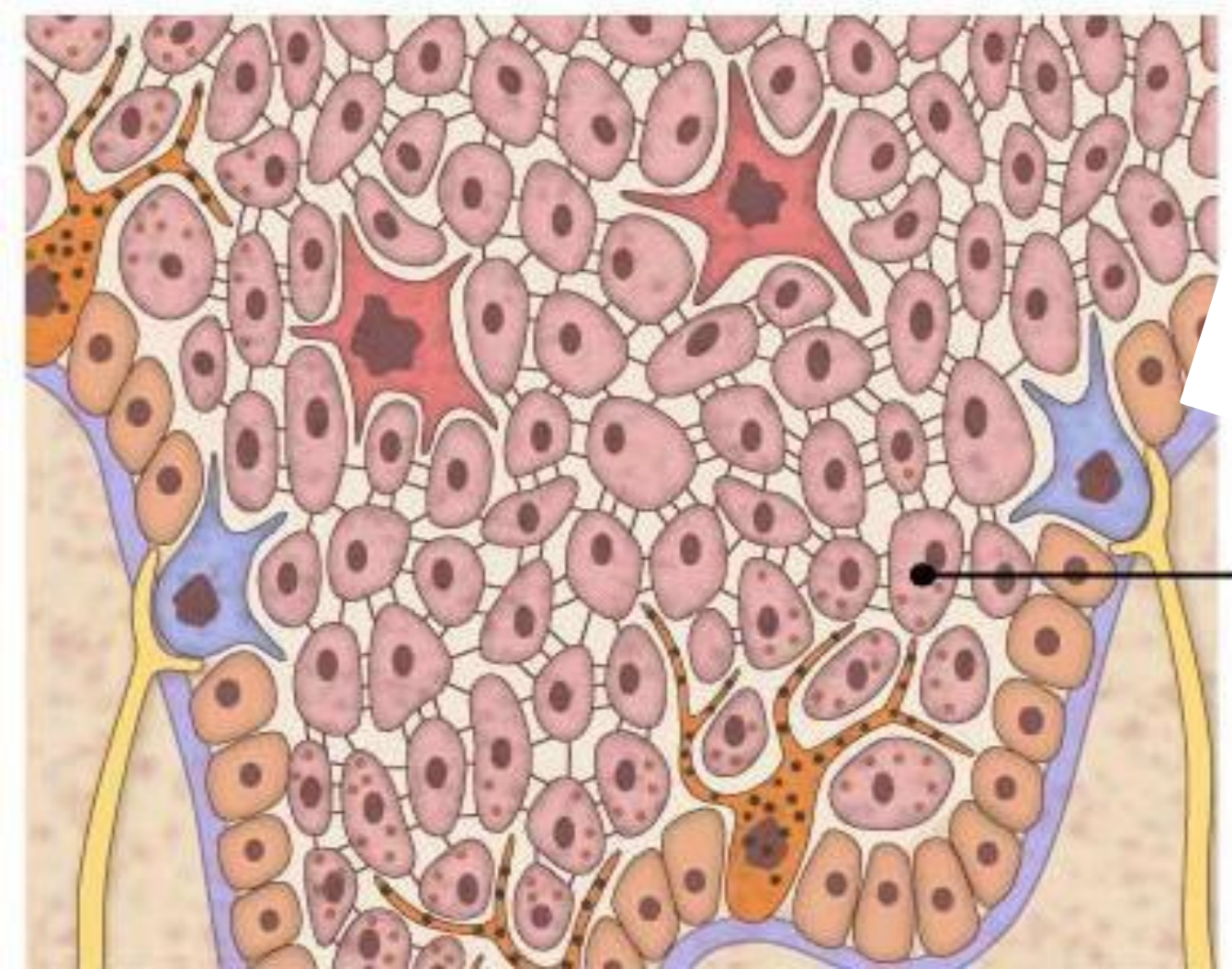


TYPES OF EPIDERMAL CELLS



(1)-keratinocytes:

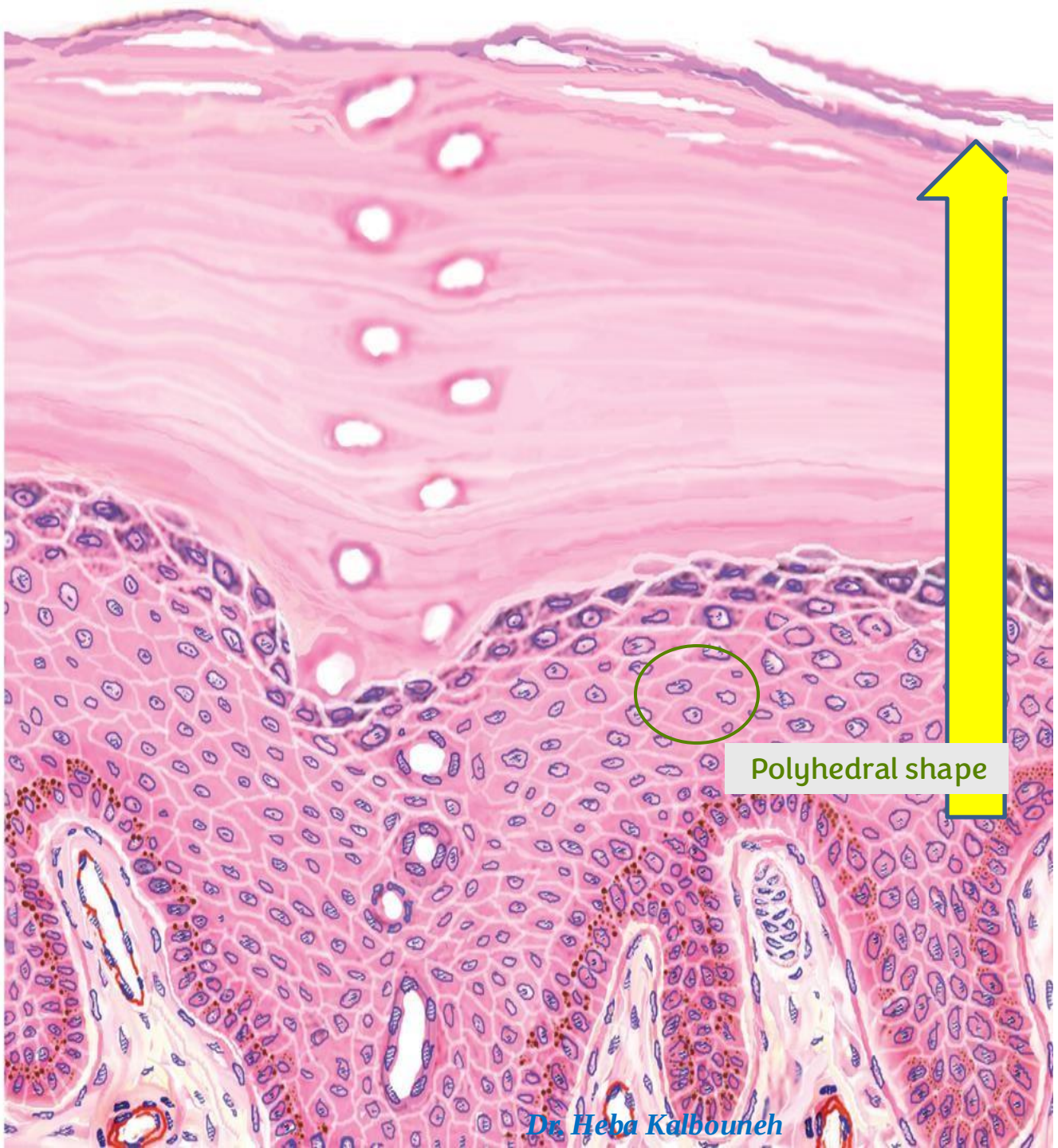
- Approximately 90% of epidermal cells are keratinocytes.
- Produce **keratin**
- Produce **lamellar granules** that helps waterproof the skin



keratinocytes continuously shed and regenerate every 2-4 weeks

NOTE: The structure of keratinocytes changes dramatically as they mature: 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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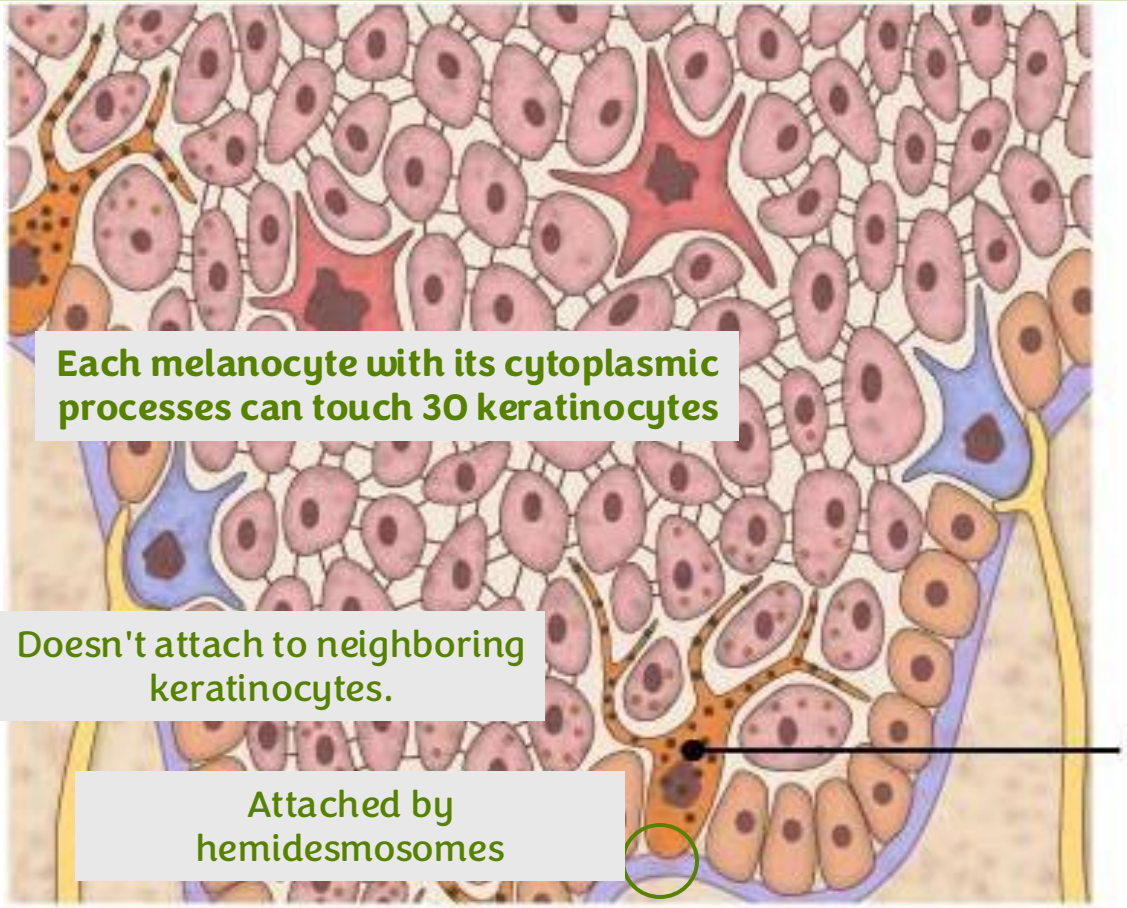
(2)-Melanocytes:

Melanocytes are our natural **SPF**

- Are derived from the neural crest cells.
- Have protrusions cytoplasmic processes that transfer melanin granules (melanosomes) to the keratinocytes by phagocytosis
- Are located in the stratum basale
- Synthesize the dark brown pigment melanin they don't store it!
- Melanin protects the skin from the damaging effects of ultraviolet radiation



1 melanocyte for every 10 basal keratinocytes

Q. ratio/frequency of melanocytes to keratinocytes?

Q. how does melanin behave as a natural SPF?

Supranuclear position, provides protection from UV light.

Q. is melanin as significant apically as it is basally?

Albinism

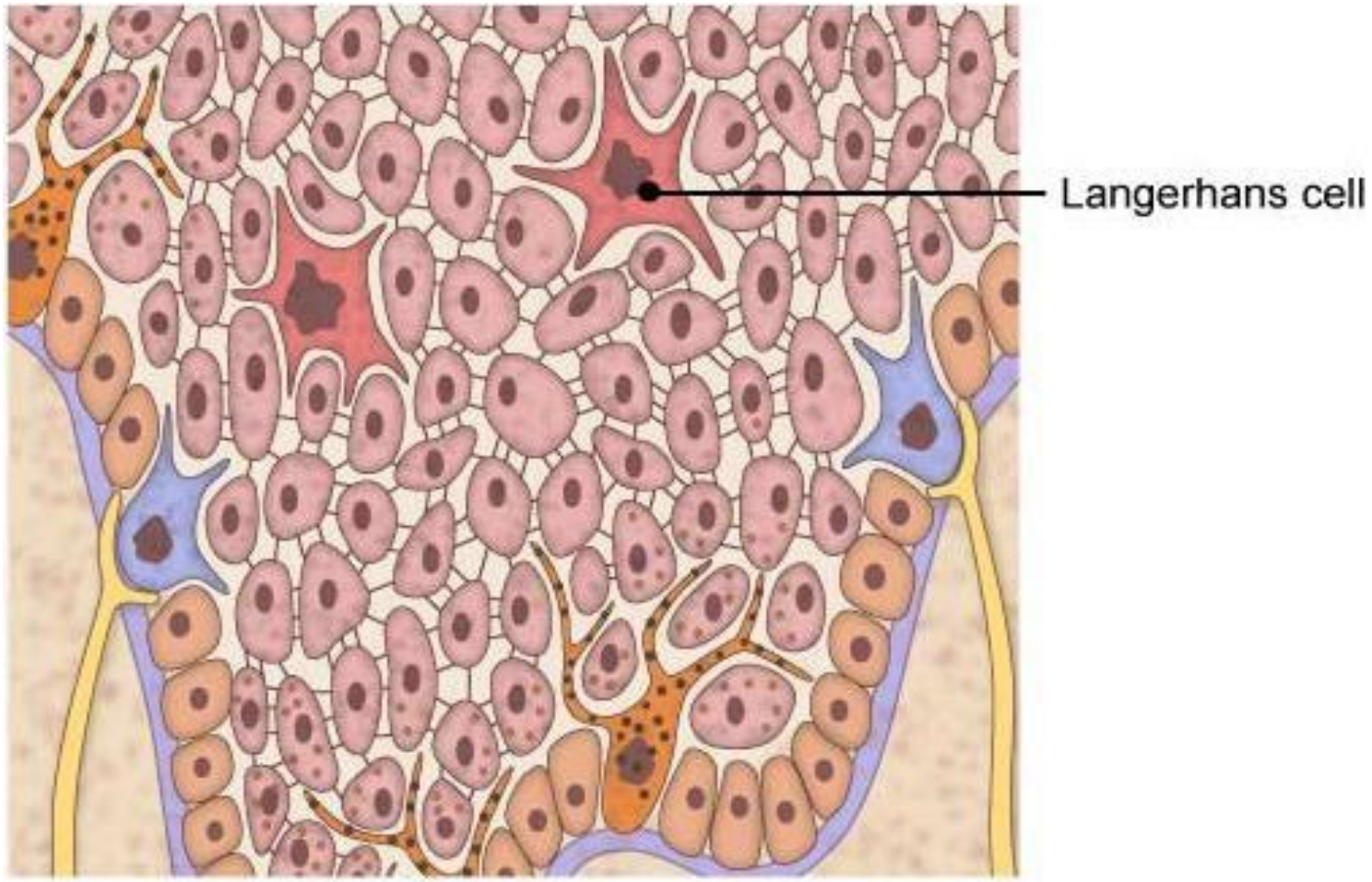
Genetic defect, normal melanocyte number with low melanin production, due to low tyrosinase activity or defective tyrosine transport. High risk of skin cancer.

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

(3)- Langerhans cells:

immune cells of the skin

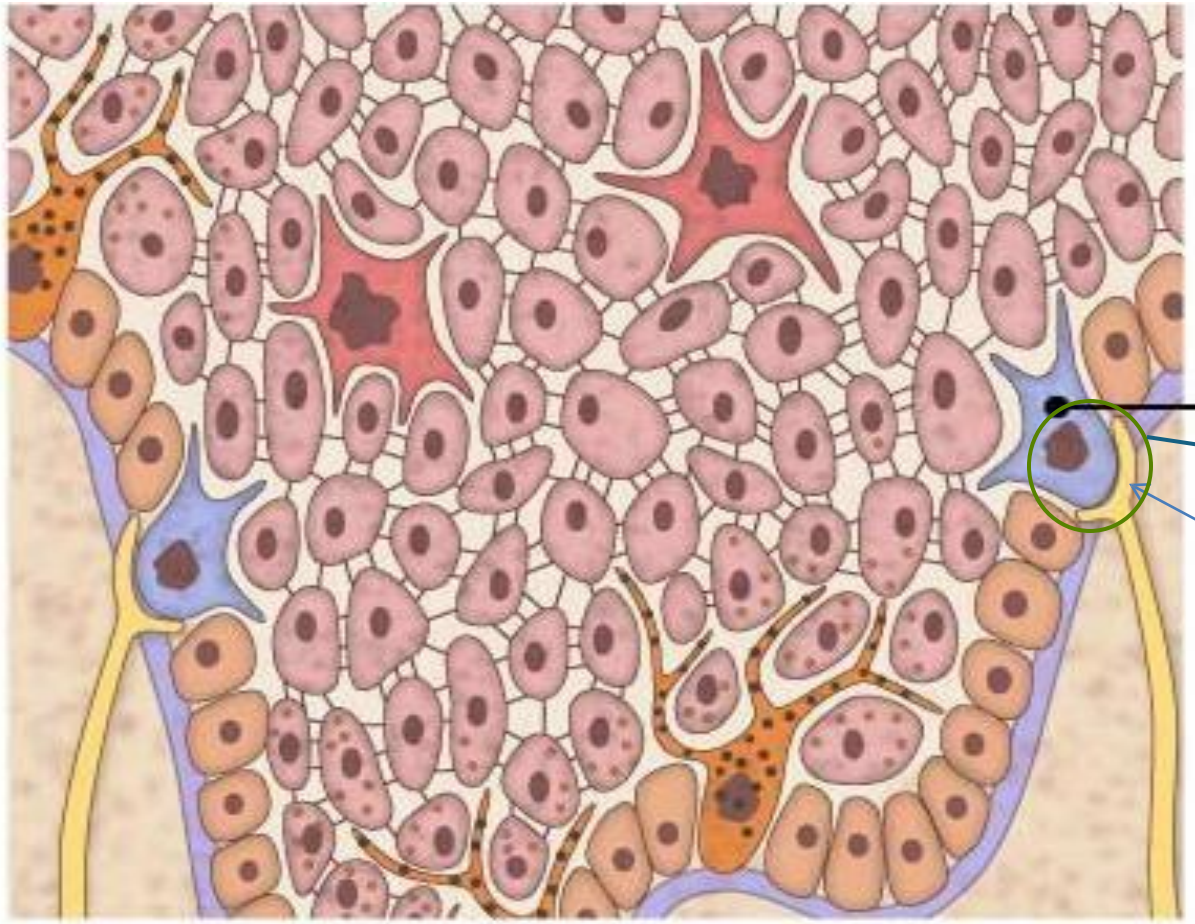
- Originate from bone marrow (monocytes)
- Mainly in the stratum spinosum
- Langerhans cells recognize, phagocytose, and process foreign antigens
- Represent 2-8% of epidermal Cells



(4)- Merkel cells:

- 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)

Respond to sustained light and pressure in highly sensitive areas like fingertips, and lips.



Attaches to neighboring cells and basal layer.

NOTE: Sensory neurons form terminal disk under Merkels cells

Dermis

Convictive tissue

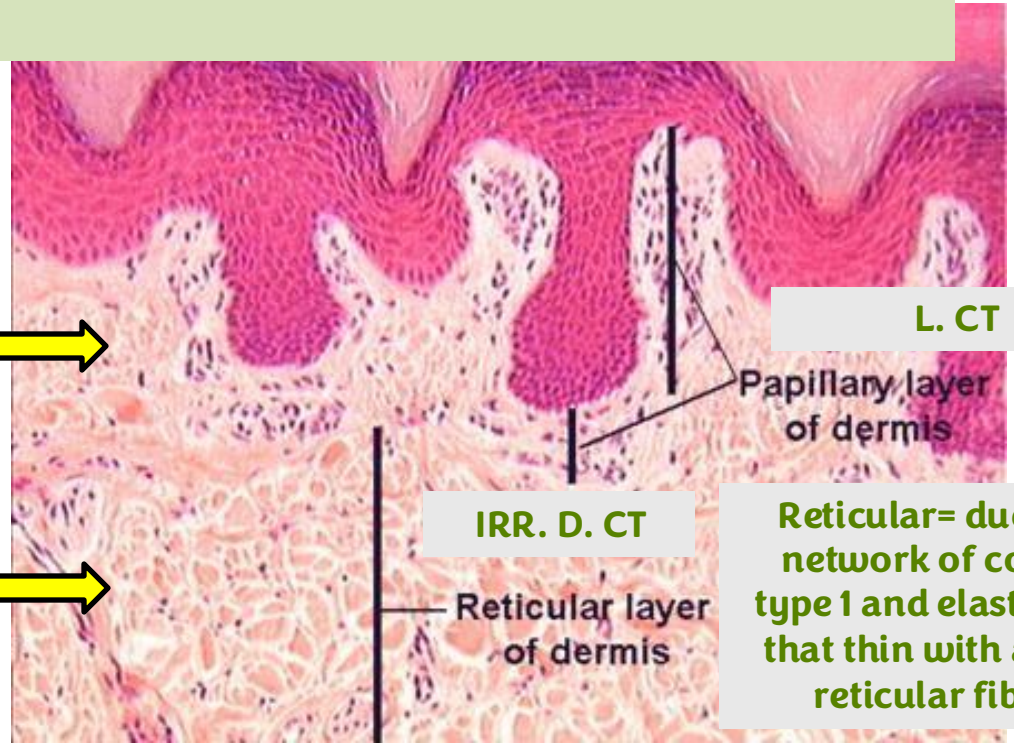
- The dermis lies immediately beneath the epidermis and is much thicker.
- It is responsible for the elasticity and strength of skin
- Contains blood vessels and nerve supply

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:

It's important to be irregular:
1. **Resists against forces.**
2. **Supports the epithelium and its underlying LCT**



Reticular= due to the network of collagen type 1 and elastic fibers that thin with age, not reticular fibers.

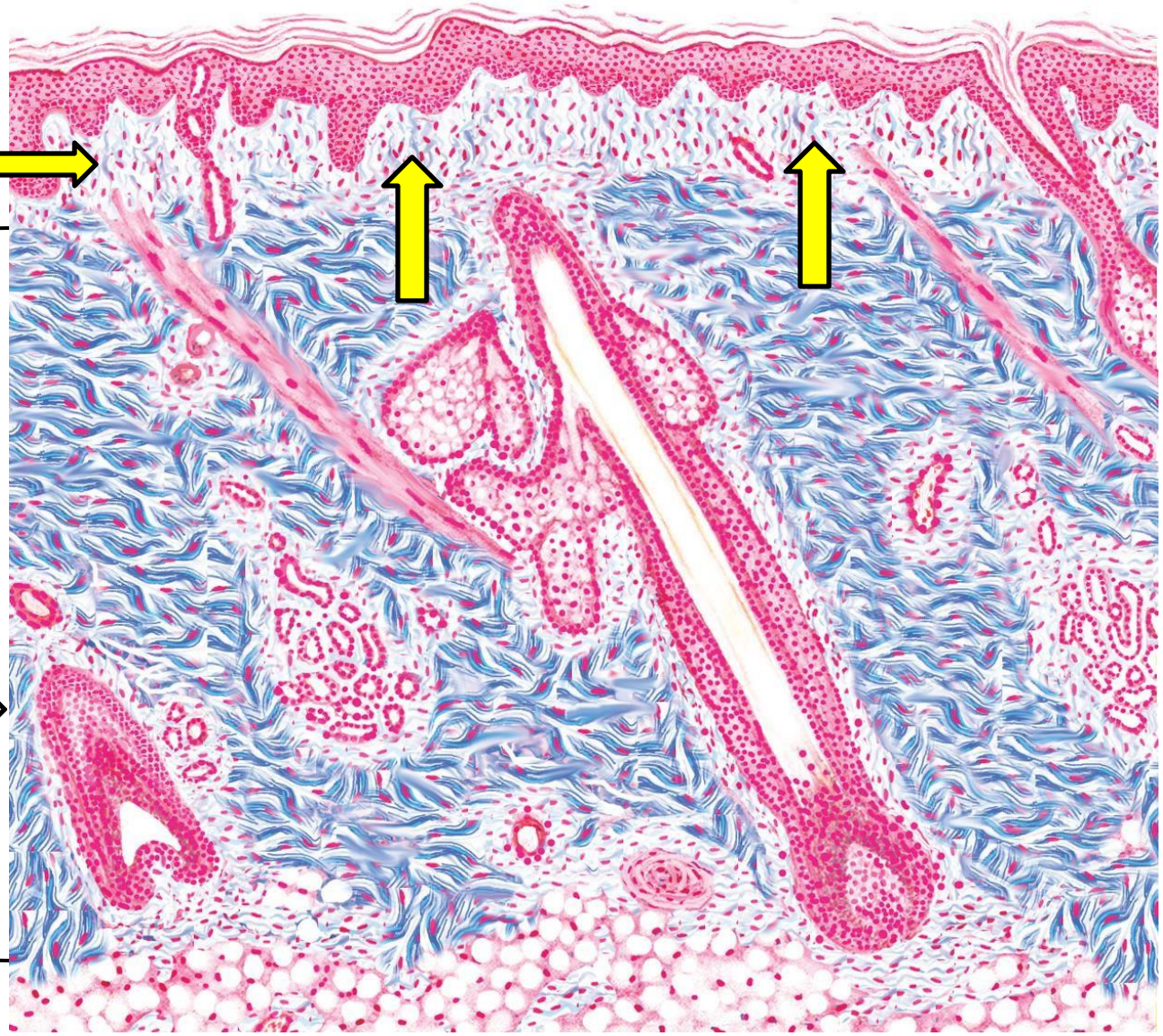
(1) Papillary layer of dermis

Loose connective tissue

(2)Reticular layer of dermis

Dense irregular connective tissue

Is important in giving the skin it overall strength (collagen1) and elasticity (elastic fibers),



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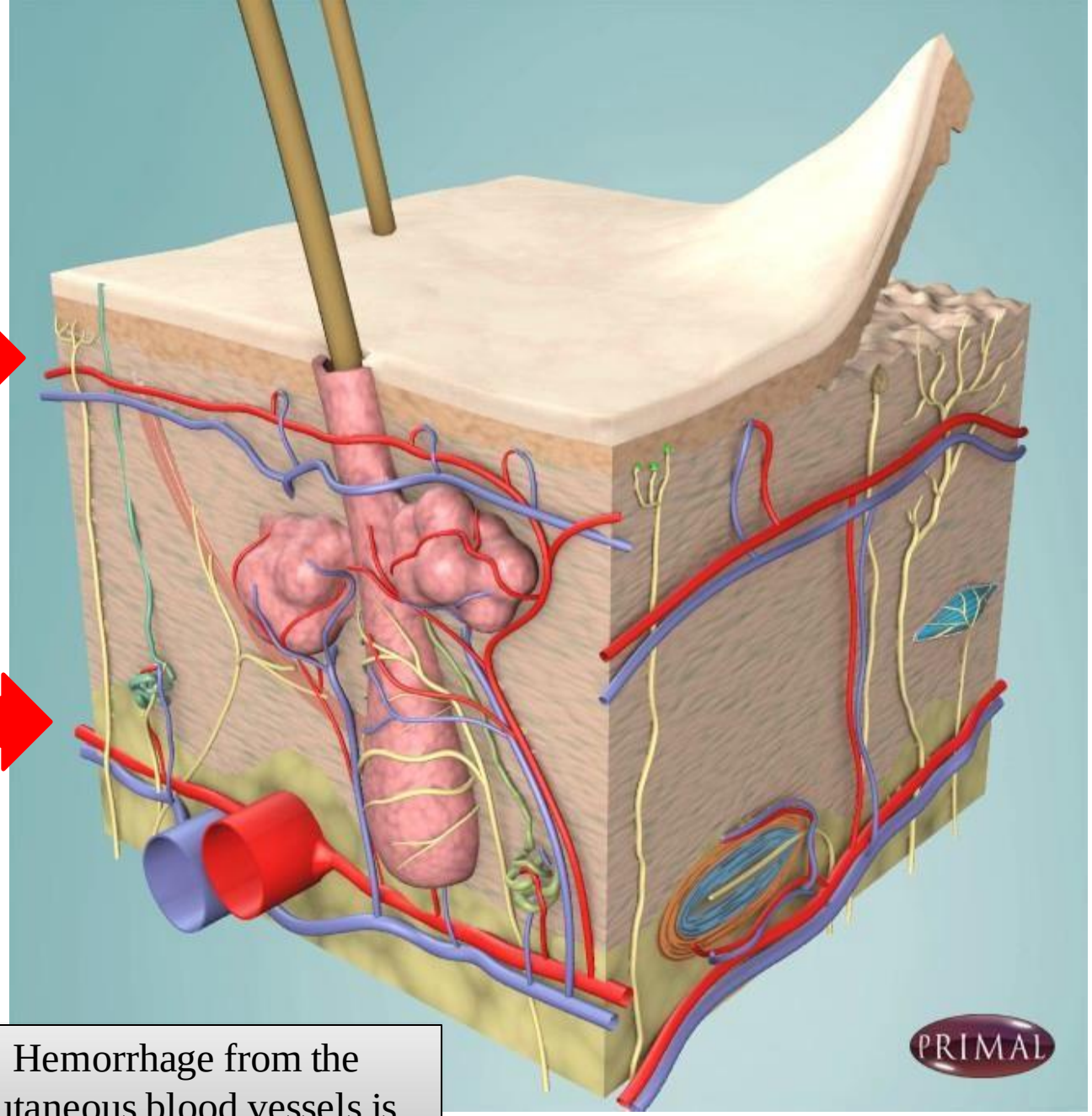
The blood vessels form two major plexuses:

Subpapillary plexus

Thermoregulation

Subdermal plexus



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

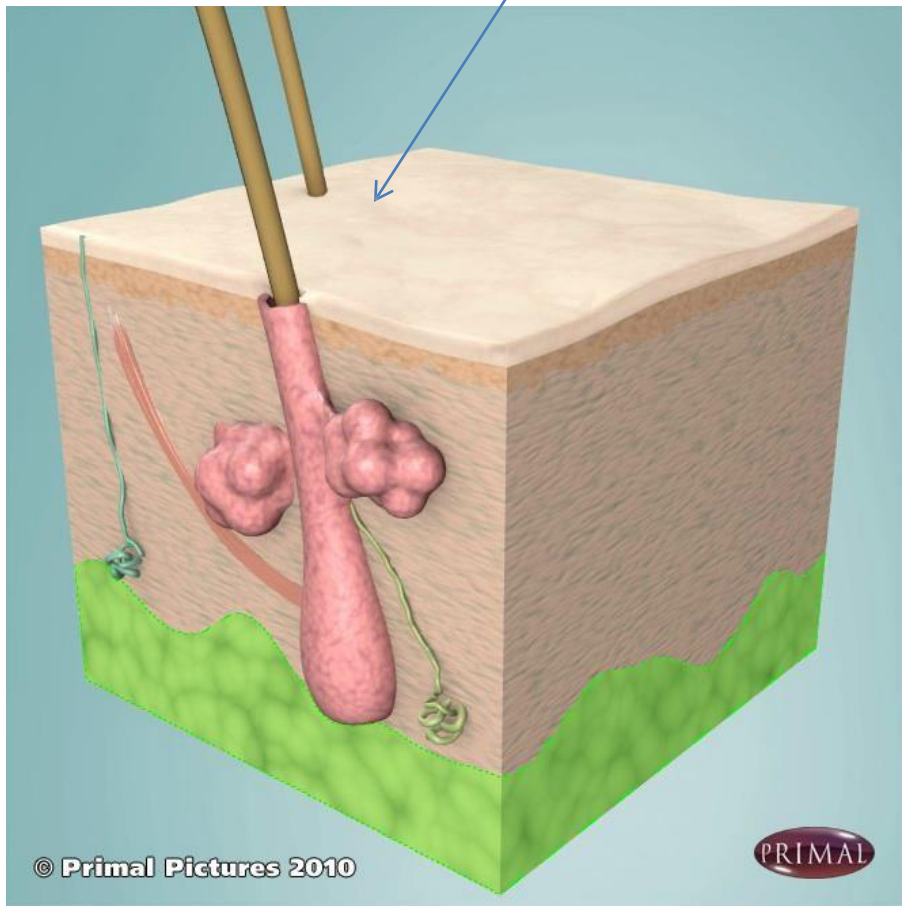
Dr. Heba Kalbouneh

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



Q answers :)

- To replace the dead cells shed at the surface of the epithelium in a process called keratinization (maturation of keratinocytes) in 2-4 weeks.
- 1. keratization and loss of organelles.

2. degradation by hydrolytic enzymes.

3. limited nutrients and oxygen supply.

- Since there're hair follicles, there'll be no apocrine sweat glands nor sebaceous glands.
- Hairy and non-hairy.
- 1:10
- It prevents DNA mutations induced by UV light through to its supranuclear position
- No because apical cells are dead.

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			

Additional Resources:

رسالة من الفريق العلمي: