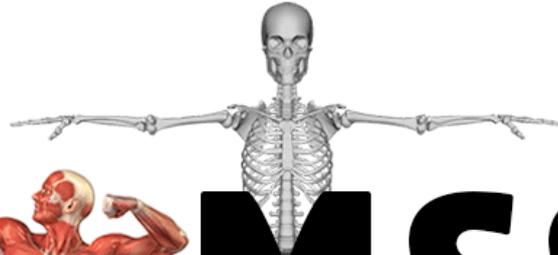




1.1



**MSS**

Musculoskeletal System

**Histology**

Doctor 2018 | Medicine | JU

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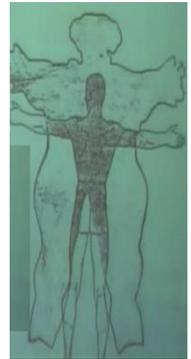
# Skin Histology

The skin is an organ not a tissue it has more than one type of tissues forming it.

It is the largest organ in our body (5 kg weight) and it can cover an area of 2 m<sup>2</sup> which is enough to cover the mattress of your bed.

The Anatomical term for the skin is (*Integumentary system*)

“Integument =to cover” and the skin covers the outer surface of our body



## Basic skin Histology

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

**Epidermis...** *Epi = above*

*Derma=skin*

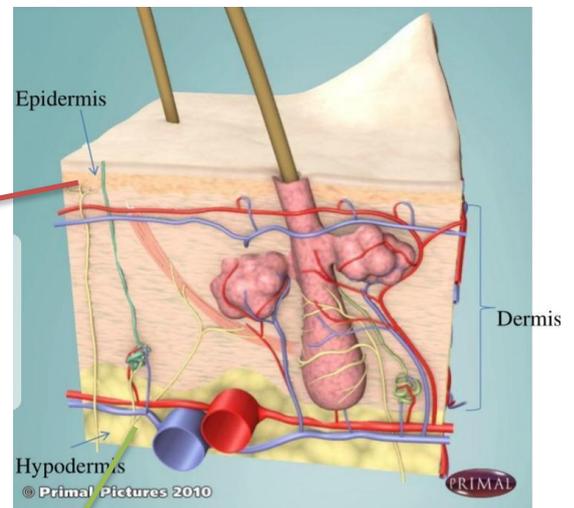
**\*And this is an epithelial layer  
of stratified keratinized type of epithelium**

Under the epithelium we have CT of skin which is called **Dermis**.

**Epidermis + Dermis --» cutaneous membrane**

Epithelium + the underlying CT --» membrane

Under the cutaneous membrane we have this **Adipose tissue** or **Subcutaneous tissue** or **Hypodermis**. this tissue is mainly Fat, and it is the superficial fascia. under this layer we have deep fascia surrounding the deep structures (Bones and muscles).



## Major skin Functions

### 1 . Protection:

A. Skin acts as a mechanical barrier against the entry of microorganisms and that's why when you have skin wound (an opening in your skin) this makes an entry point for bacteria getting into your body.

B. skin protects us from WATER LOSS and WATER GAIN, so it forms a WATERPROOF LAYER. The main benefit of this layer is to prevent WATER from getting out (DEHYDRATION) that is why we can be exposed to sun for hours without getting dehydrated, unlike snails that die from exposure to Sun light.

C. Skin protects us from UV light, which is type of radiation that can damage skin cells and many of us had a sunburn, more seriously too much harmful UV light is the most common cause of skin cancer since it can mutate the DNA in our cells.

## **2. Sensory perception:**

Skin acts as a Sensory organ since we have many types of sensory neurons forming sensory receptors for pain, touch and heat.

## **3. Temperature regulation 2 ways:**

A. We have sweat gland and its duct opens into the surface of the epithelium, in a hot day this gland secretes sweat and the evaporation of it cools the body down but when heat is humid the sweat doesn't evaporate it sticks to the surface of epithelium, that's why some people can tolerate the dry heat but can't tolerate the humid heat.

B. Blood vessels that are inside the cutaneous membrane (cutaneous blood vessels) that dilate when you're overheated and this is called (the flow of warm red blood to the surface of your skin), that's why when you put your hand in a hot water it appears red. On the other hand, blood vessels constrict and reduce blood flow when we are cold in this case the skin appears pale.

## **4. Excretion**

Remember sweat glands that secrete sweat which is Water, electrolytes and some waste products like urea.

## **5. Formation of Vitamin D which is a steroid hormone (Calciferol):**

Our skin is actually a gland that produces a steroid hormone (made from cholesterol) and it is called Calciferol. In order for skin cells to synthesis it they need: A. Sun light B. cholesterol

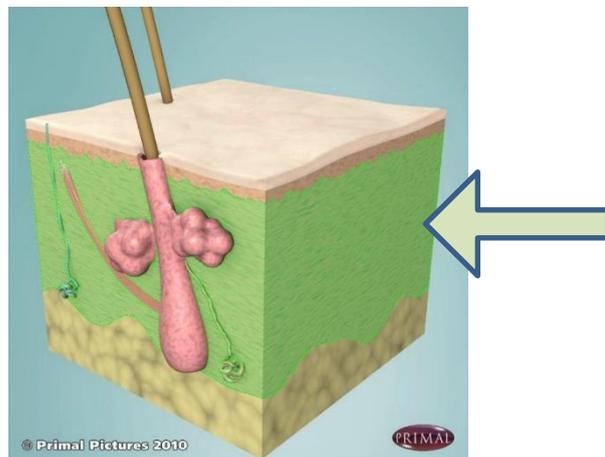
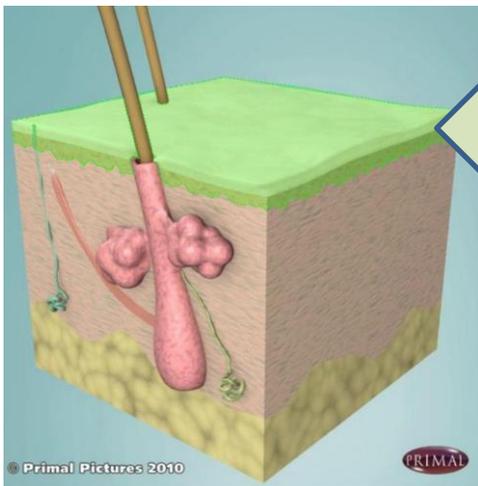
So too much Sun light is harmful, but we still need sunlight to make Calciferol that'll be secreted into the blood stream and acts in small intestine to increase the absorption of Ca from our small intestine.

The problem is that most of us are indoors playing Video games and do not expose to sun so many of us do not get enough sun light to make Calciferol. The nutritionists in America recognize that children are not getting enough synthesize this hormone and to absorb calcium for their growing bone and teeth, that's why they decided to add Calciferol to the milk

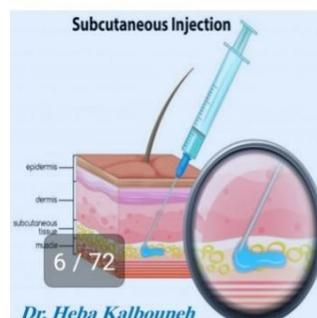
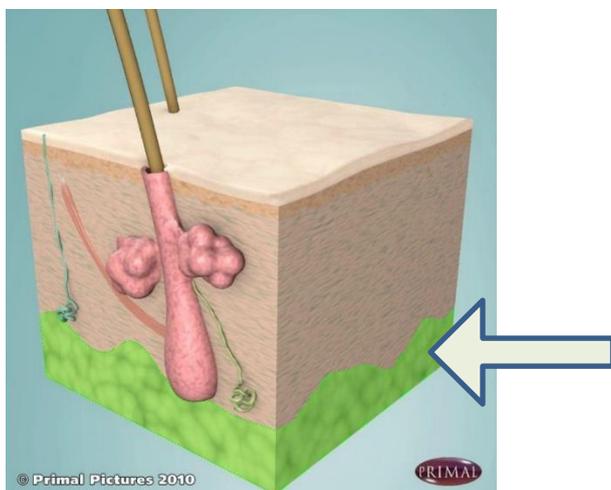
## THE LAYERS OF SKIN

### 1.Epidermis (the top layer)

### 2.Dermis



### Hypodermis, superficial fascia, substance tissue, subdermal fat



The epithelial cells rest on a basement membrane and this membrane separates the epithelial cells from the CT. usually this membrane is a straight line but in case of the skin it is a wavy line that represents the junction between the epidermis and dermis and that is why it is called **Epidermal-dermal junction**.

### What if this junction was a straight line?!

Any trauma to the skin will cause sliding of epidermis on the top of Dermis. That's why it is not a straight line; it is interdigitating, and it holds the epidermis on the Dermis, and this will increase the adhesion between them.

The epidermis is Avascular (it has no blood vessels running inside) and it depends on the underlying CT for diffusion of oxygen and nutrients and the **Epidermal-dermal junction** increases the surface area of contact between the epithelium and the underlying CT so more diffusion will take place nourishing these cells

As we can see in the picture:

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

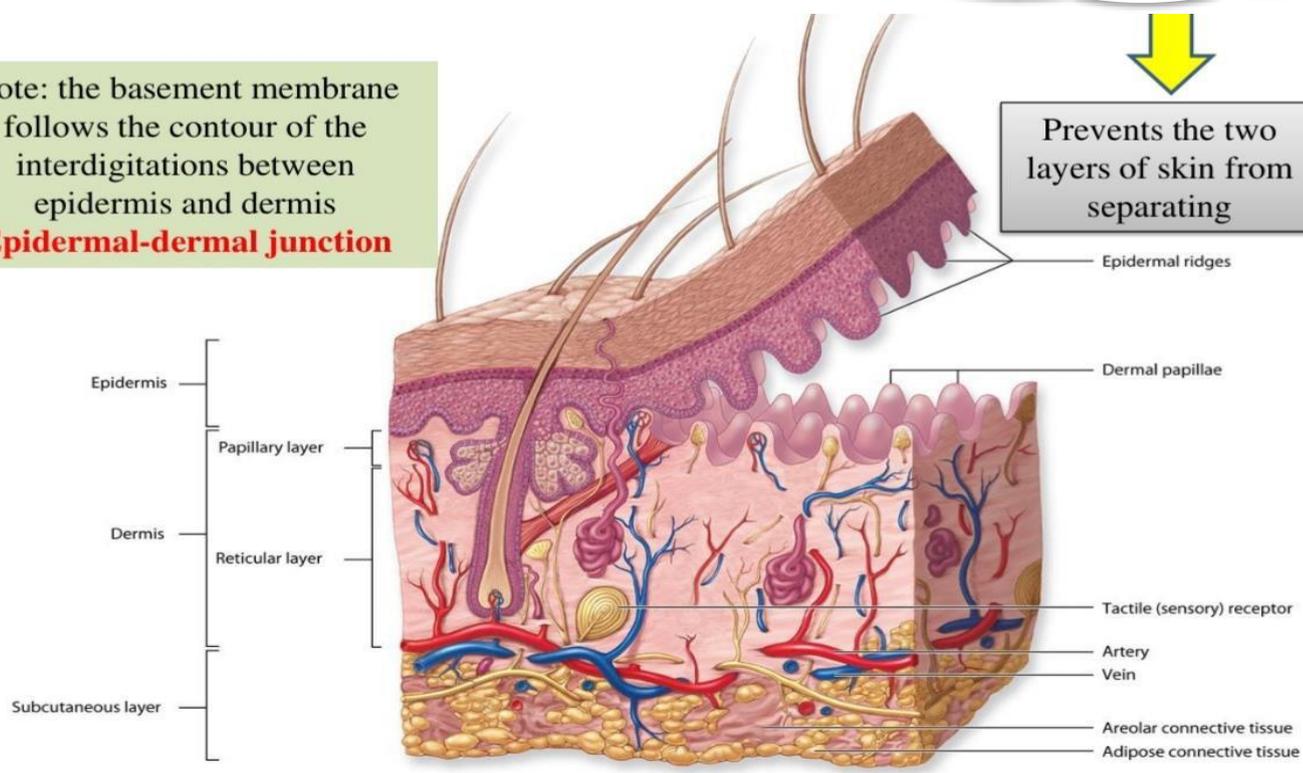
The epidermis conforms to the contours of the underlying dermal papillae forming epidermal ridges

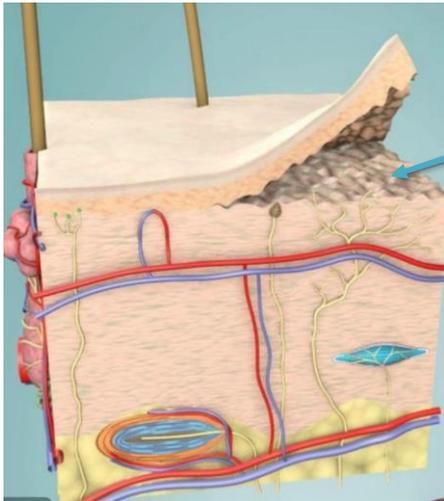
Note: the basement membrane follows the contour of the interdigitations between epidermis and dermis  
**Epidermal-dermal junction**

EPIDERMAL RIDGES



Prevents the two layers of skin from separating





**Epidermal-dermal junction**

This junction is more prominent in the palms of our hands and the soles of our feet.

Then these interdigitations are called **Friction Ridges**

They are important for grasping with our hands and for walking barefoot.

Wrapping of skin will not cause separation of the Dermis and epidermis because of:

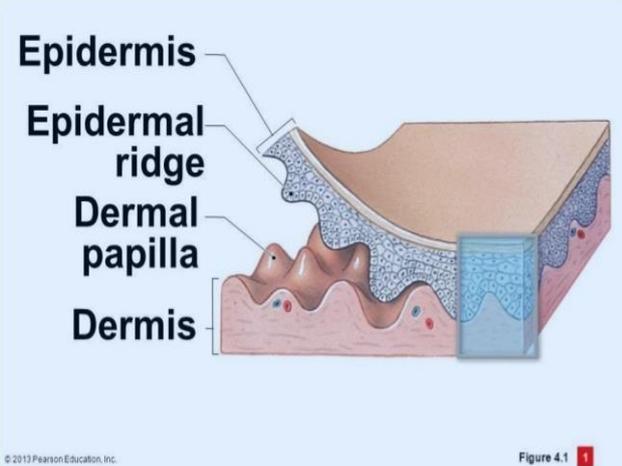
- 1. dermal epidermal junction
- 2. Dermal papilla

**But**, with repeated Wrapping of your skin the 2 layers will start pull apart from each other like when you wear new shoes and continue Wrapping over and over against your heel you develop what is called Blisters

The dermis will separate away from the epidermis forming a bucket filled with fluid and this is called BLISTER

The Friction Ridges are unique for each individual even for identical twins this. unique pattern creates (fingerprints and footprints)

That's why they are used for identification purposes



This Section is taken from the epidermis of skin and underlying the epidermis you have the dermis



## EPIDERMIS

Is the outermost layer of the skin derived from ectoderm

Composed of 4 or 5 layers depending on the type of skin

Avascular and Rich in tough protein called keratin

Forms a waterproof layer between external environment and body that resists Friction, microbial invasion and WATER loss

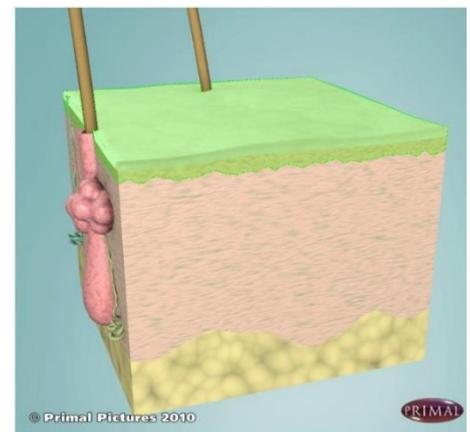
### CONTAINS 4 DIFFERENT CELL TYPES:

Most of the skin cells of epidermis are called **keratinocytes** because they accumulate within their cytoplasm protein called keratin, other cells are

**Melanocytes**

**Langerhans cells**

**Merkel cells**



Keratinized stratified squamous epithelium

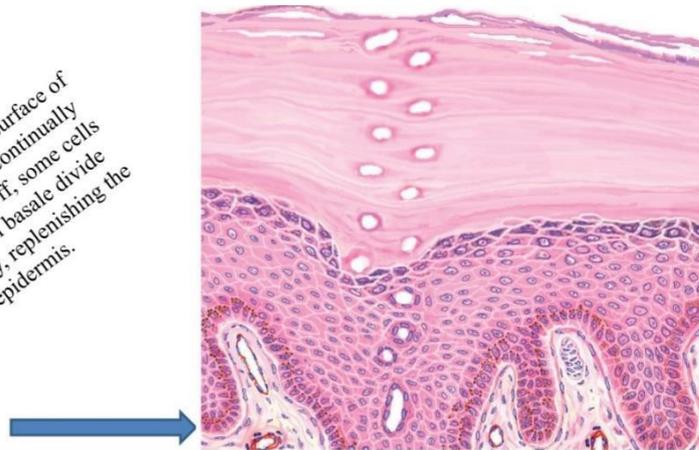
## Layers of the epidermis

### (1) Stratum basale

These cells will undergo mitosis to form new cells and as new cells are formed, they are going to be pushed to form the different layers of epidermis

- 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.



### (2) Stratum spinosum

We know that the epithelial cells are connected by desmosomes to prevent cells separation, and skin cells have high number of desmosomes because our skin is subjected to many mechanical forces and we don't want these forces to separate skin cells. Also, desmosomes are linked by intermediate filaments inside cytoplasm of cells and **intermediate filaments inside cytoplasm of keratinocytes are called keratin**

**keratin represents intermediate filaments of desmosomes.**

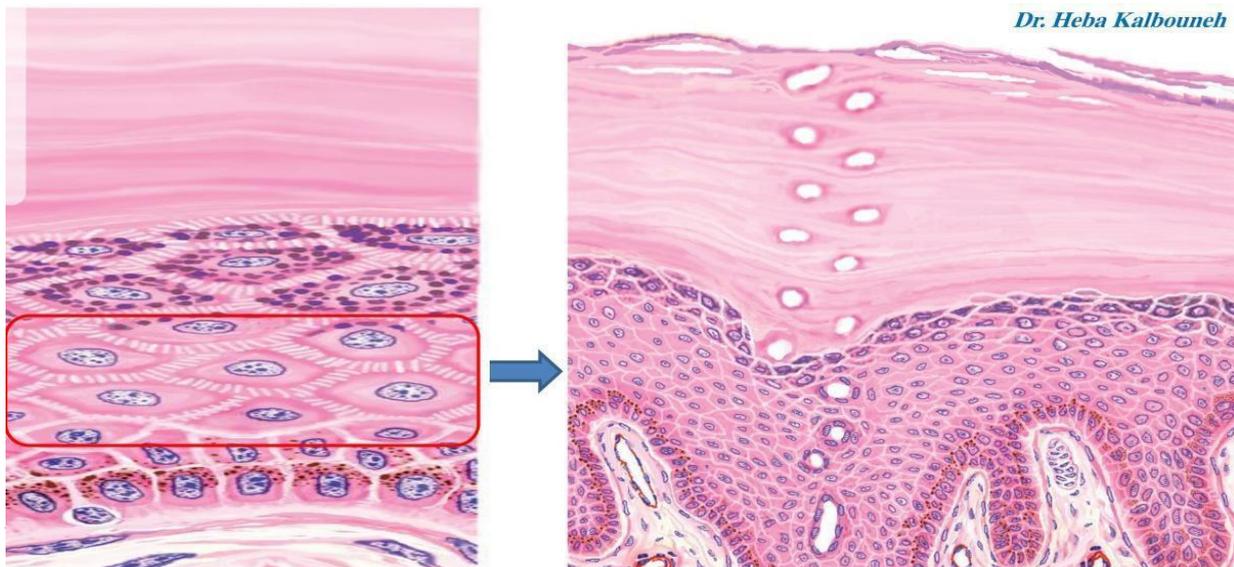
As you go away from the basal layer, cells will synthesize more and more keratin until we end up with flat cell bags of keratin with no nucleus and no organelles.

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 tonofibril

These cells are called spinosum because they are connected by these spines

And these spinal processes represent the desmosomal junctions between these cells



**Why do they appear like spines?**

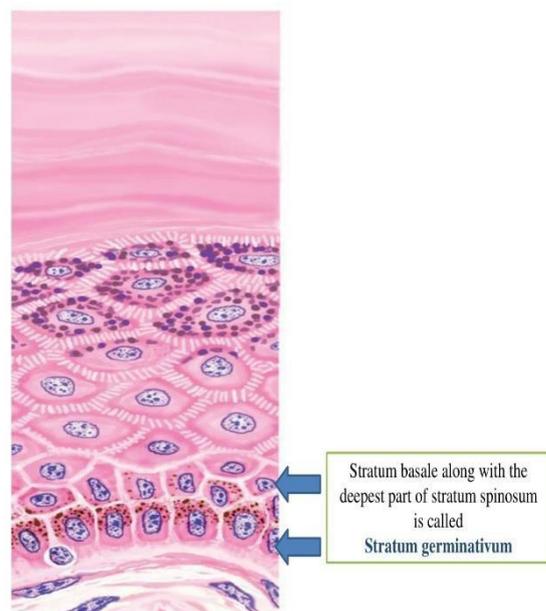
During histological preparation there will be shrinkage of the cells

(cells will become smaller in size but the desmosomal junctions will stay)

### **The cells that can undergo mitosis:**

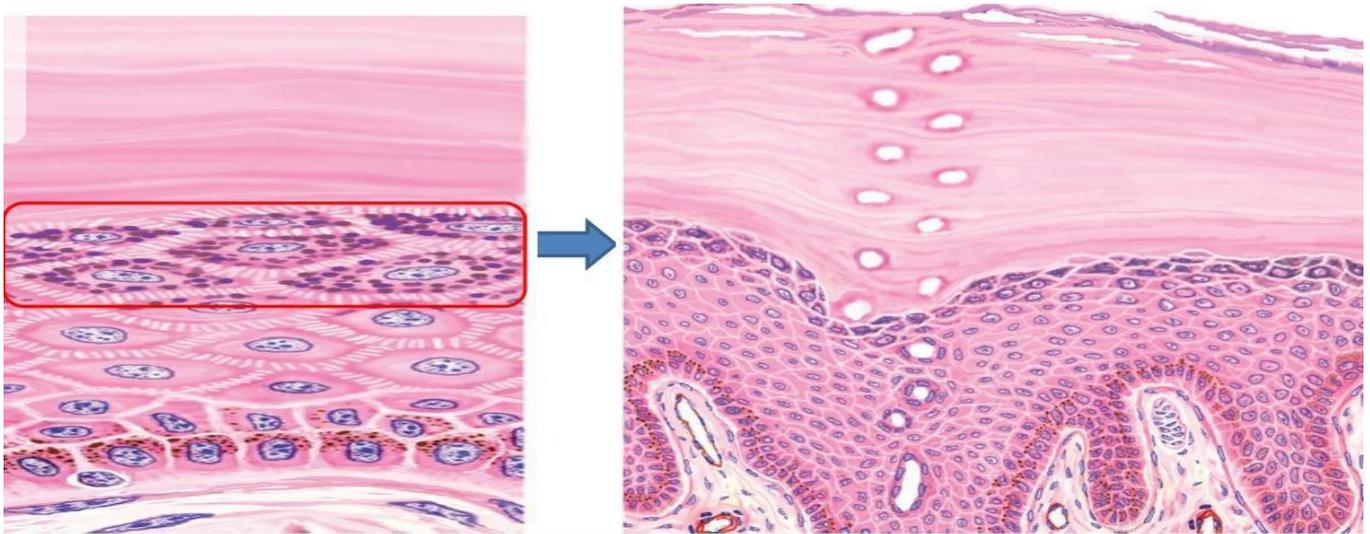
1. Stratum basale
2. The deepest part of Stratum spinosum cells

**Together they are called Stratum germinativum**

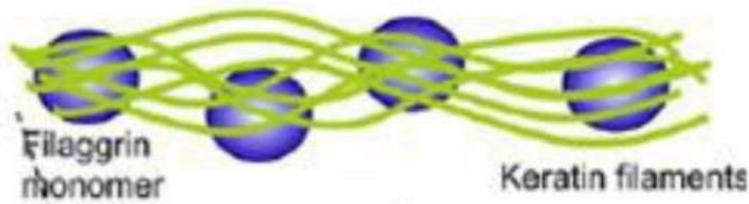


### (3) Stratum granulosum

- » 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
  - » So, it is called granulosum because inside the cytoplasm of these cells we find basophilic granules
- That give the cell granular appearance



**keratohyalin granules** Contain keratin which is the intermediate filament of skin  
And keratin starts as Tonofilaments and as you go upward through epidermis  
keratin will be more and more compacted creating Tonofibril which are keratin  
filaments connected and cross linked by linker proteins like filaggrin protein

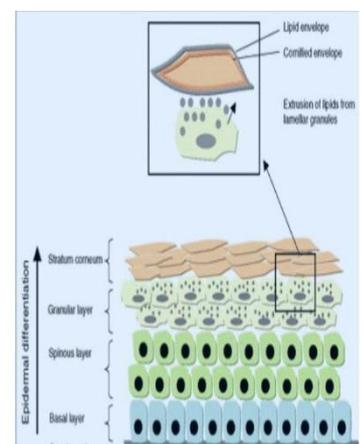


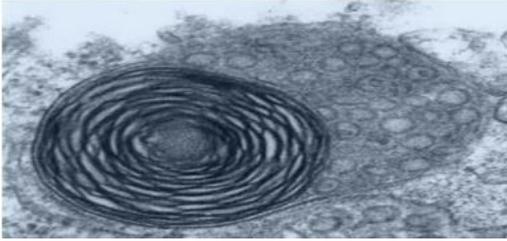
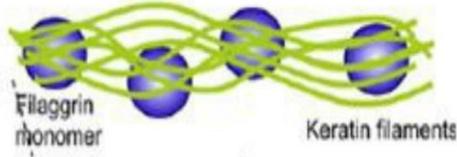
Tonofibrils



Tonofilaments

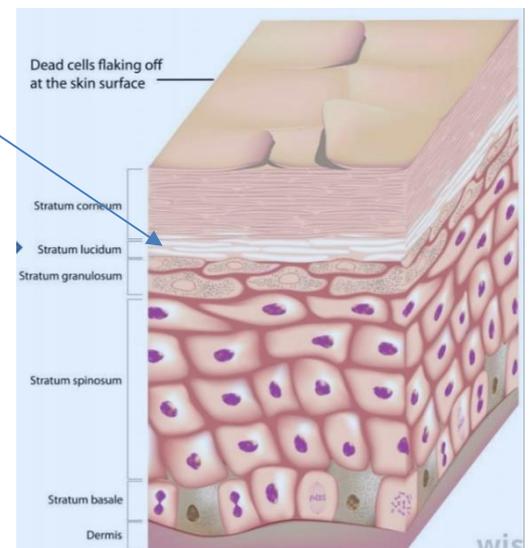
Under the electron microscope we identify another type of granules that are called lamellar granules Lamellar granules discharge lipid material between cells and waterproof the skin



Lamellar granules	keratohyalin granules
	
Visible under electron microscope only	Visible under light microscope
Contains lipid material	Contains compacted type of keratin (tonofibrils)
Lipid will be excreted outside the cell to create waterproof layer	Keratin will stay within the cell to create keratin bags

#### (4) Stratum Lucidum

- » In thick skin only
- » Is translucent and barely visible
- » The tightly packed cells (desmosomes) lack nuclei or organelles and are dead
- ... the basal cell have keratin and as you go upward cells will accumulate more and more keratin and eventually as long as the cytoplasm is being filled with keratin there will be no space for any other organelles so the nucleus and organelles will start to disappear forming this layer of cells filled with keratin



**The keratin in this layer is less compacted than the next layer (Stratum corneum) that is why it appears lighter even though both of them are layers of dead cells filled with keratin.**

## (5) Stratum corneum

- > 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 **that came from the lamellar granules of the stratum granulosum 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.



The constant pressure in your skin will stimulate the stratum corneum layer to grow thicker for example developing of calluses of the hand and corns of the foot. so simply standing for long time will cause the stratum corneum of your soles to grow thicker

