Structure and Function of the skin: Basic and physiology

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Skin is the largest and the heaviest organ in human body, it has a body surface area of 1.5 – 2 m2 and it contributes to 1/6 to 1/7 of body weight .

It serves multiple functions that are crucial for health and survival.

Function

-Immune : barrier to harmful exogenous substance & pathogens , langerhans cells in the skin are part of the adaptive immune system

-Metabolic and endocrine : Prevents loss of water & proteins , vitamin D production after UVB exposure

-Sensory organ contains a variety of nerve endings that responds to heat, cold, touch, pressure, vibration, and pain

-Thermoregulation : through eccrine glands and dermal blood vessels

- Cosmetic importance

Skin Structure

Skin consists of :

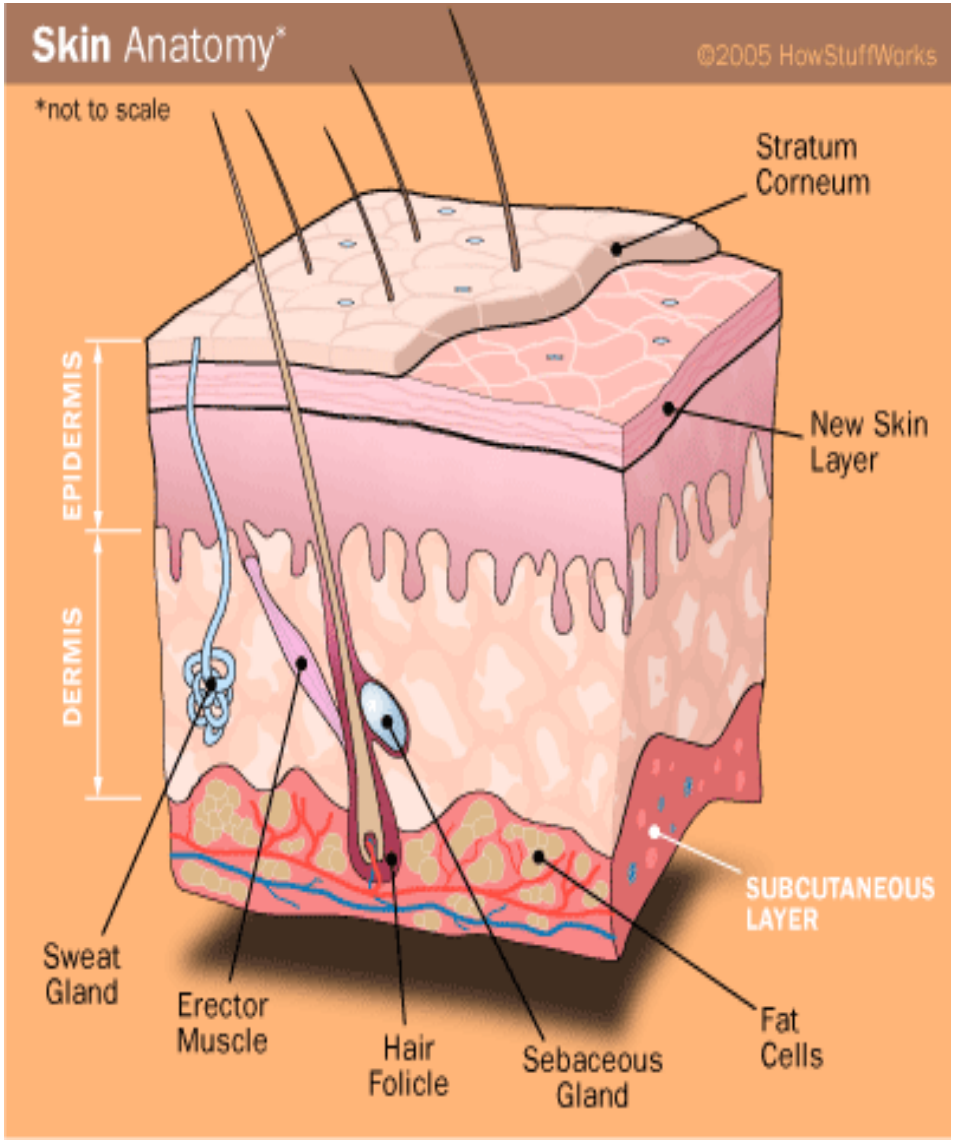
-Epidermis

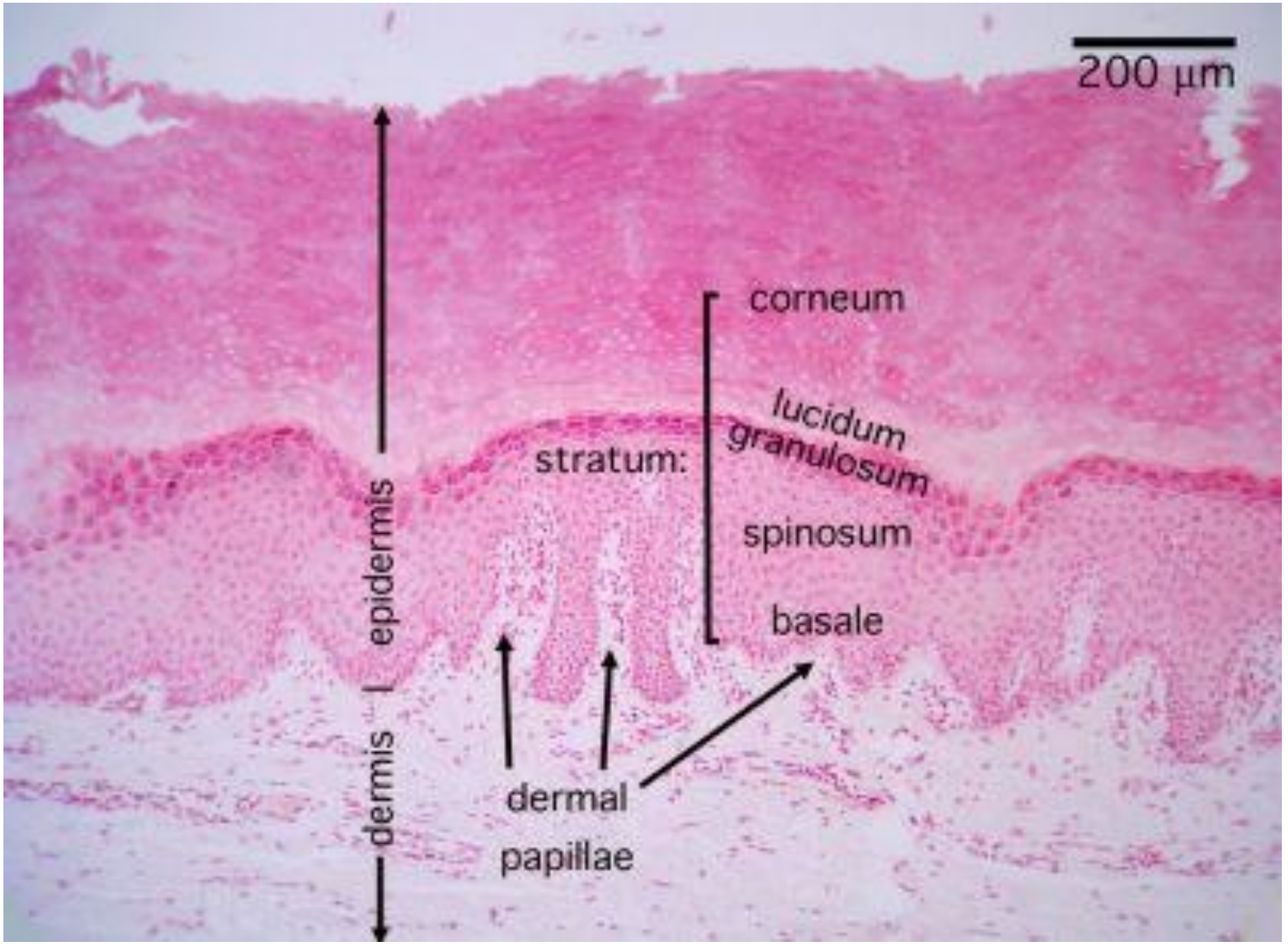
-Basement membrane

-Dermis

-Subcutaneous tissue

-Skin appendages (hair, nail, sweat and sebaceous glands)




200 µm
corneum
lucidum
granulosum
stratum:
spinosum
basale
epidermis
dermis
dermal
papillae

Skin structure

Epidermis

-Is the outermost layer of the skin and is composed primarily of keratinocytes and other cells like (melanocytes , langerhans cells)

Skin structure

Epidermis

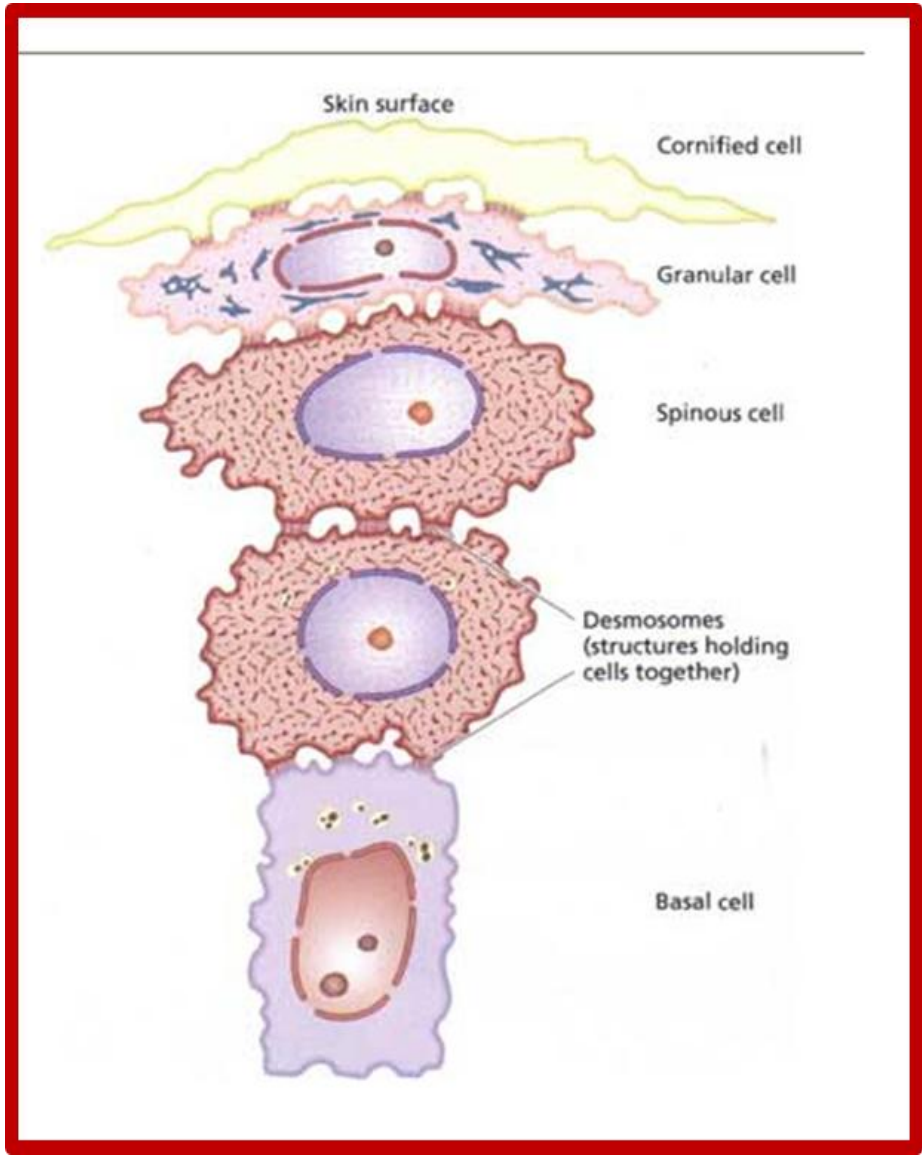
The epidermis is composed of four layers :

-Stratum basalis (basal layer) : columnar or cuboidal dividing cells that are in contact with basement membrane

-Stratum spinosum : so called because of desmosomes and keratin filaments that gives the cells spiny appearance

-Stratum granulosum : formed of flat cells containing keratohyaline granules.

-Stratum corneum : the outermost layer , composed of elongated and flattened dead cell with no nuclei or organells called corneocyted .



Skin structure

Stratum basalis

-Rest on the basement membrane

-The basal cells divides continuously and move upwards

-Melanocytes are dendritic cells lying between basal cells in a ratio of 1:10

-They synthesize melanin stored in melanosomes

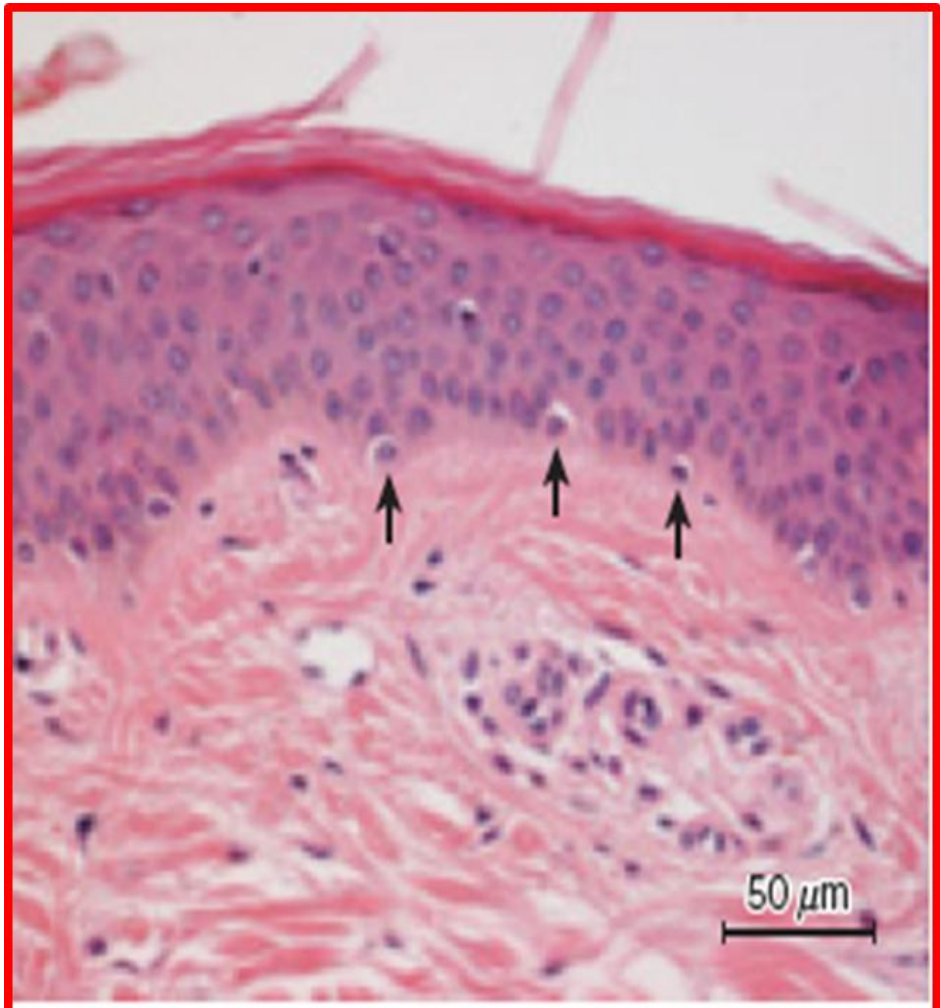


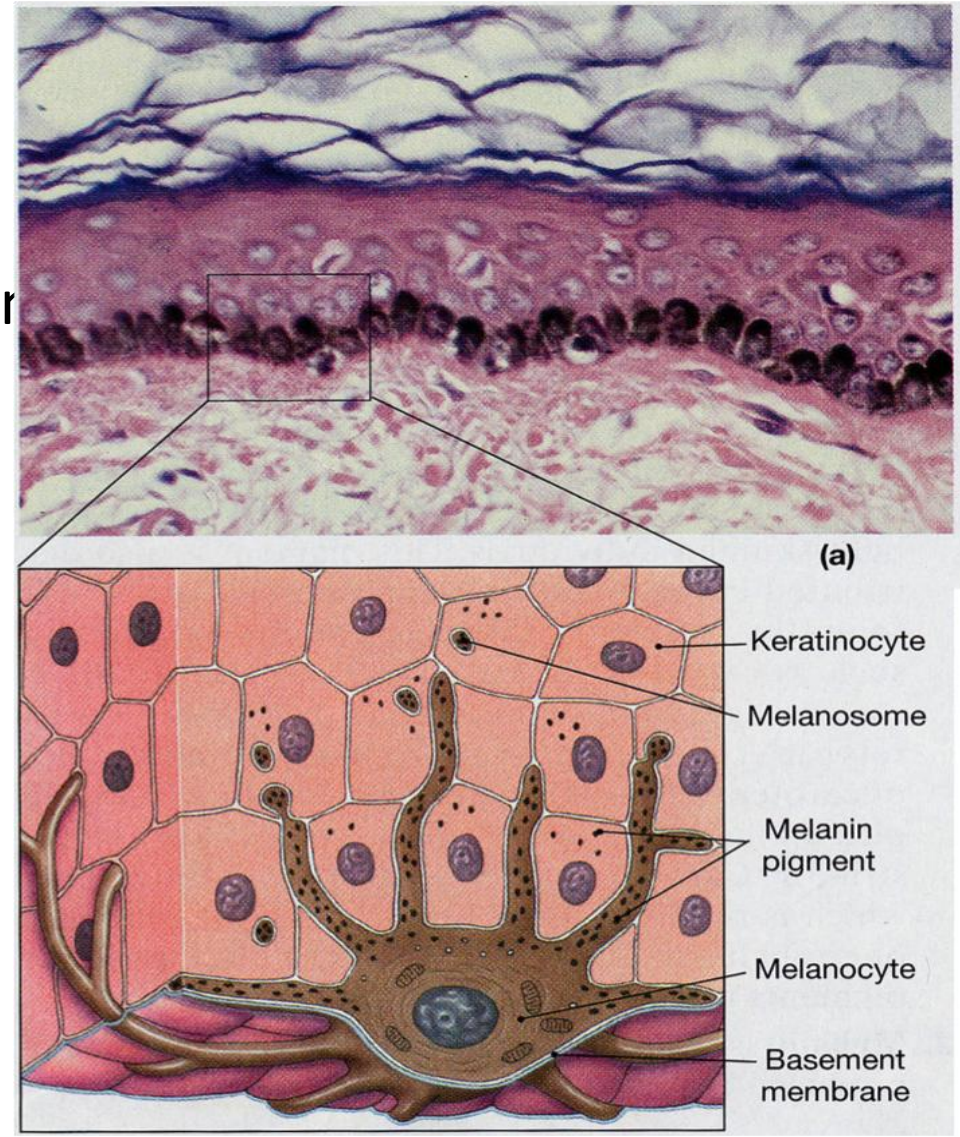
Fig. 1.17 Melanocytes.

Skin structure

-Melanosomes are transferred to adjacent epidermal cells by means of dendrites thus forming the (Epidermal Melanin Unit)

-The size of melaosomes and packaging differentiate white from dark skin.

-The number of melanocytes are equal in white and dark skin.



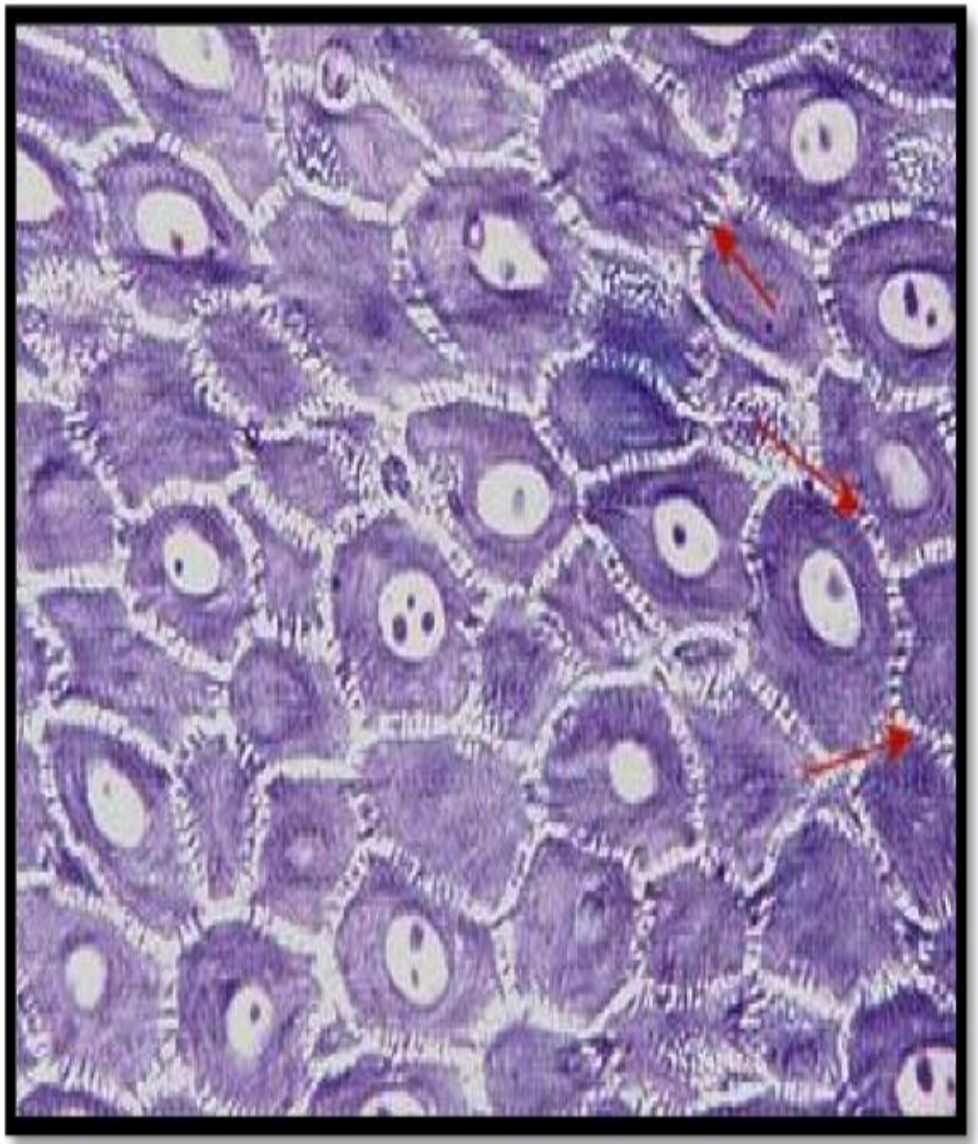
Skin structure

Stratum spinosum

-Keratinocytes adhere to each other by desmosomes (complex modification of the cell membrane)

-Desmosomes appear like spines

-Langerhans cells are antigen presenting cells that present in this layer

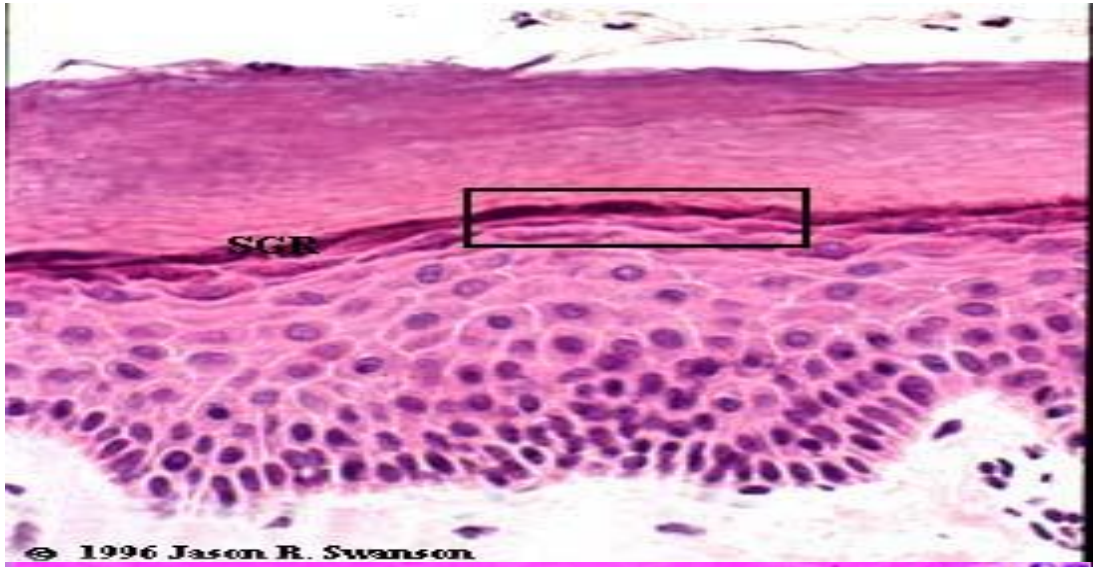


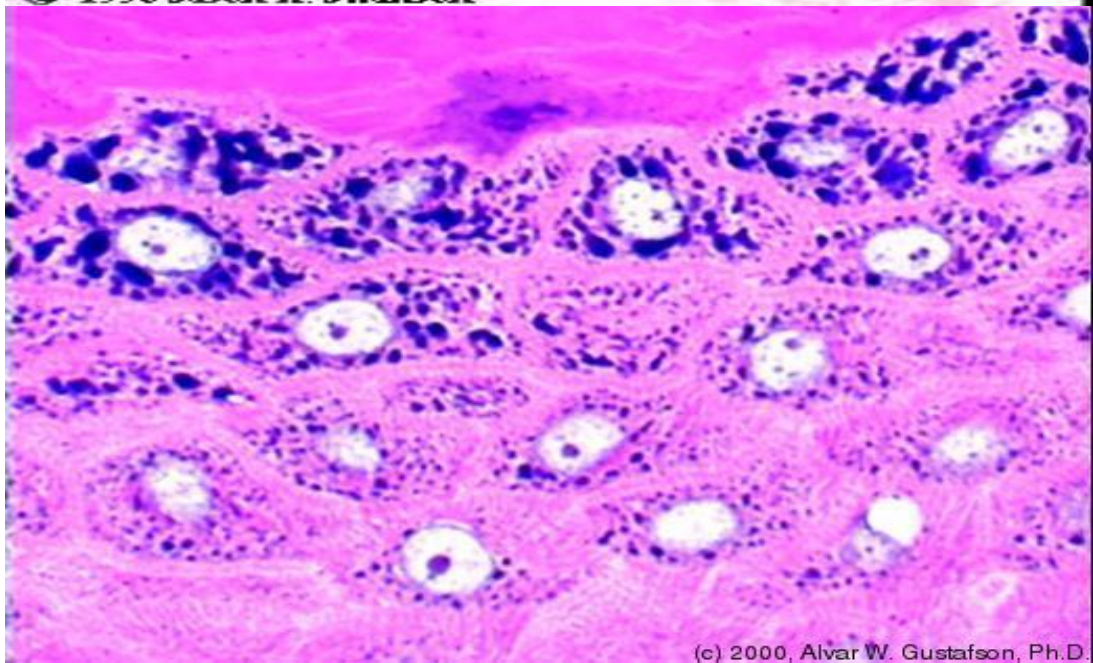
Skin structure

Granular cell layer :

-Diamond shaped cells

-Cytoplasm is filled with keratohyaline granules.





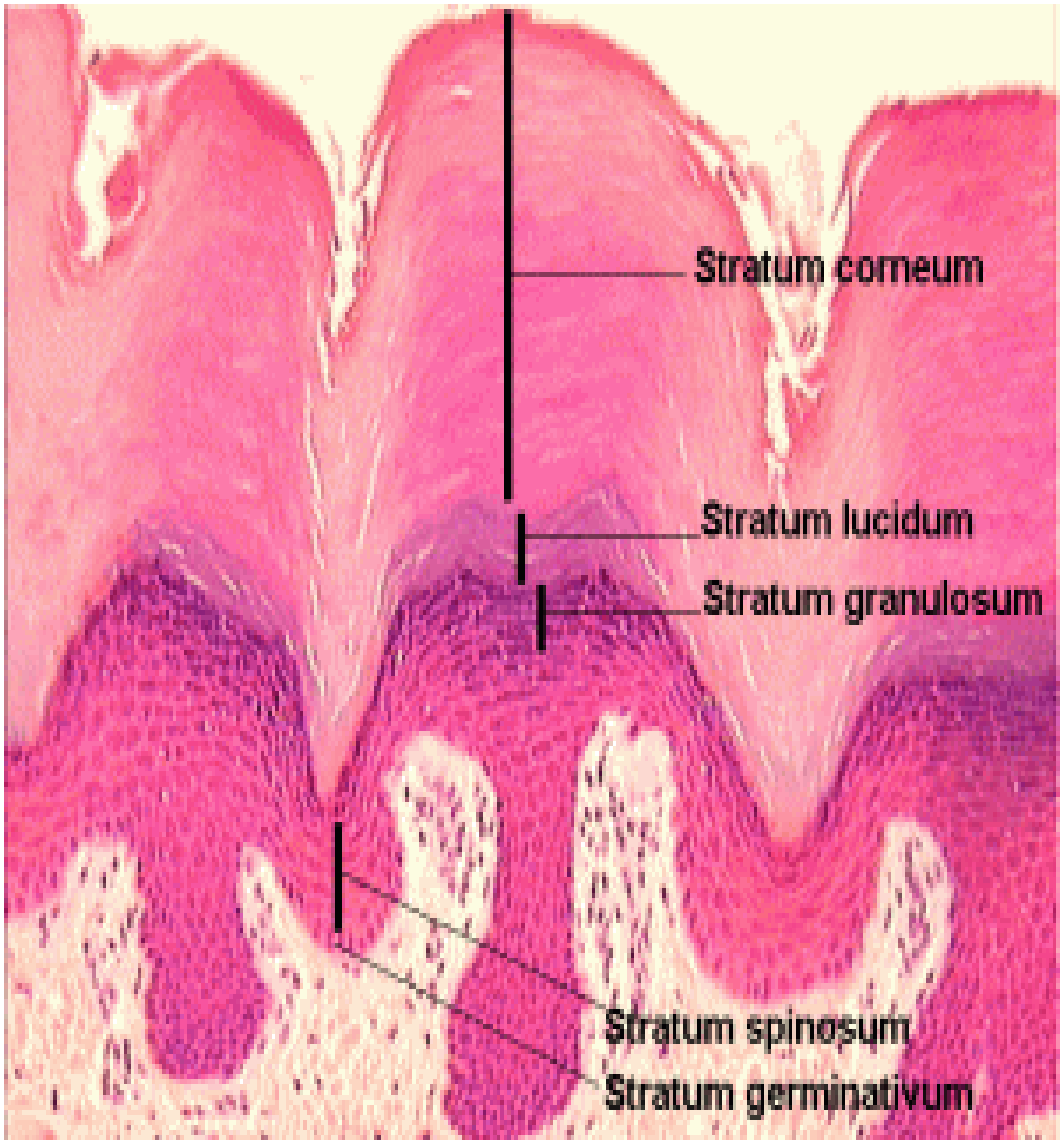
Skin structure

Stratum corneum layer:

- The cells in this layer are flattened and have no nucleus .

-Cells have thick envelope that resist chemicals.

-Stratum lucidum is found in thick skin of palms and soles below Stratum corneum.



Skin structure

Basement membrane

-It is a pink homogenous area between the epidermis and dermis

-It consist of number of proteins.

-It is the site of attack injury in blistering diseases.

- Thickened in certain skin diseases like discoid lupus erythematosus

Skin structure

Basement membrane

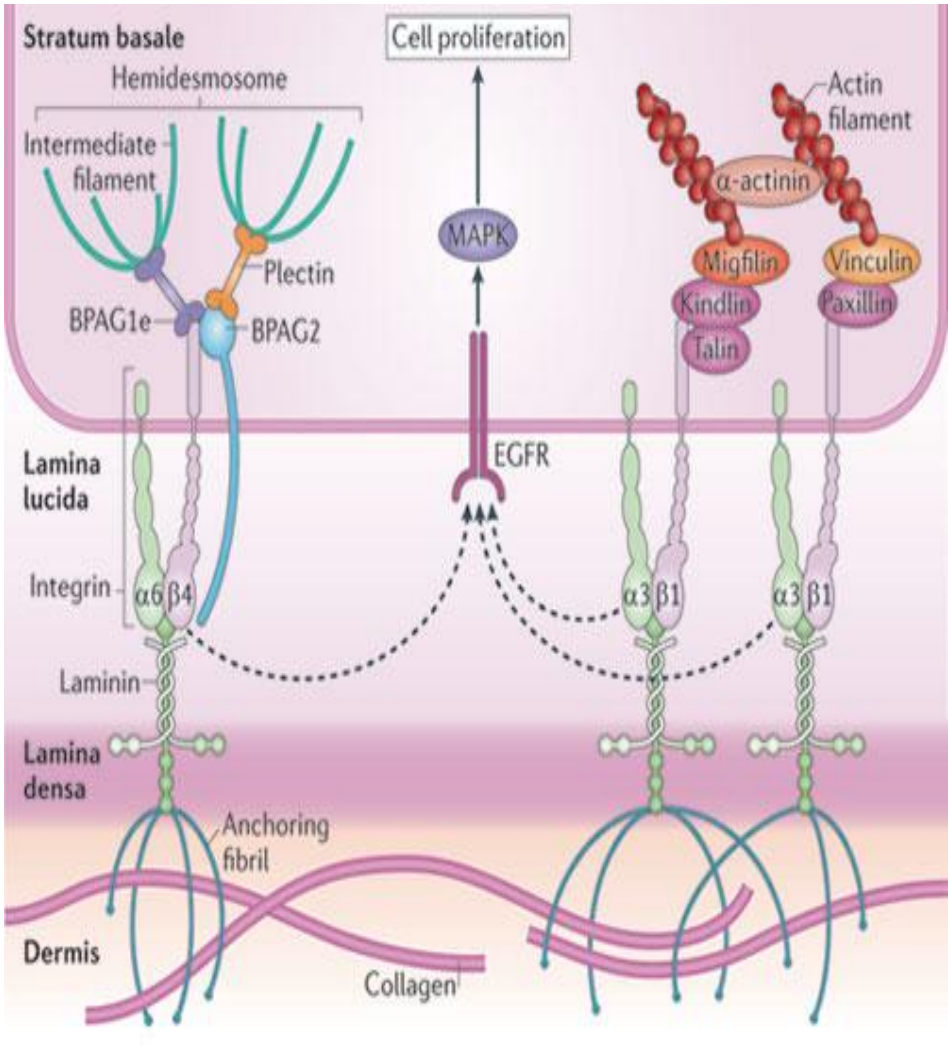
Formed by:

-Plasma membrane of basal cells and hemidesmosomes (protiens that anchors the basal cells to basement membrane)

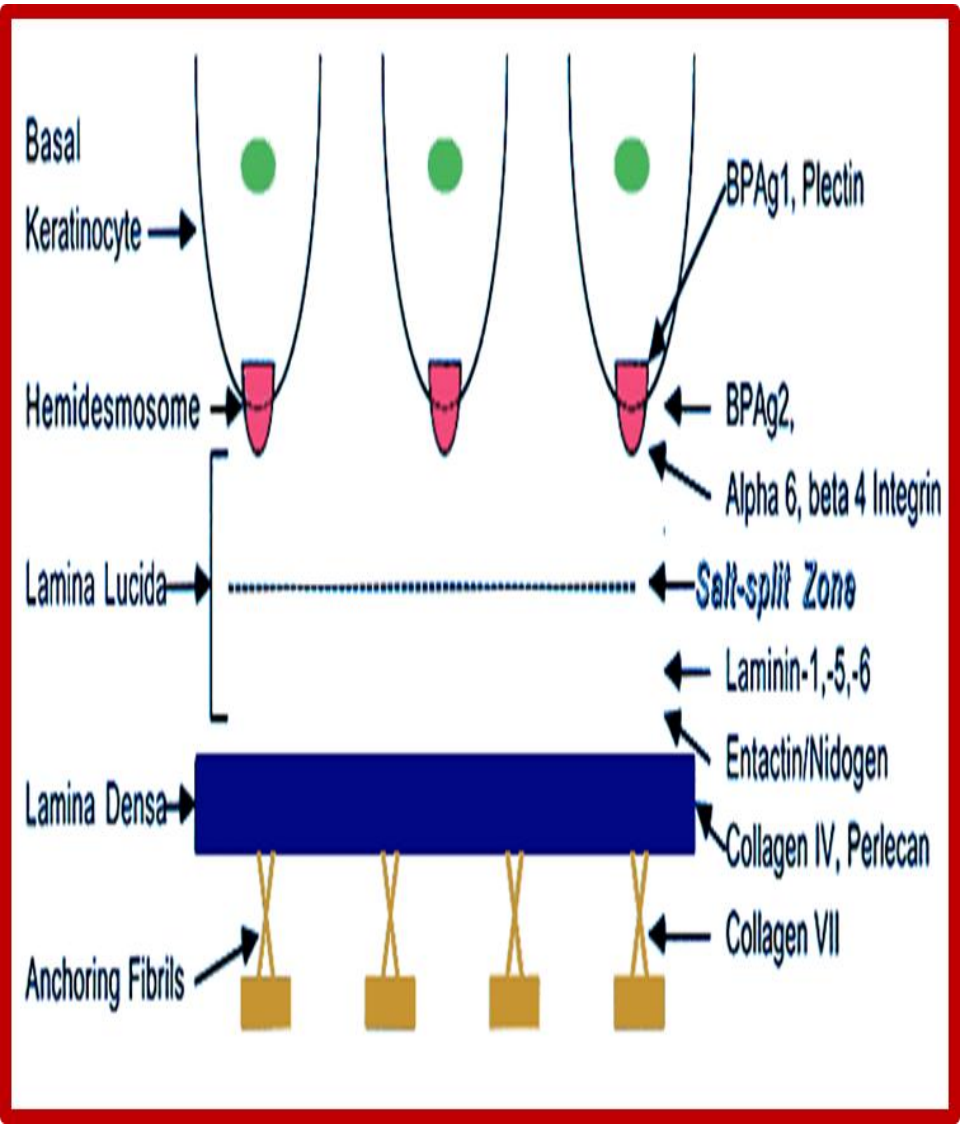
-Thin clear amorphous space (lamina lucida)

-An electron dense area (lamina densa)

- Anchoring fibrils that anchors the epidermis to dermis .



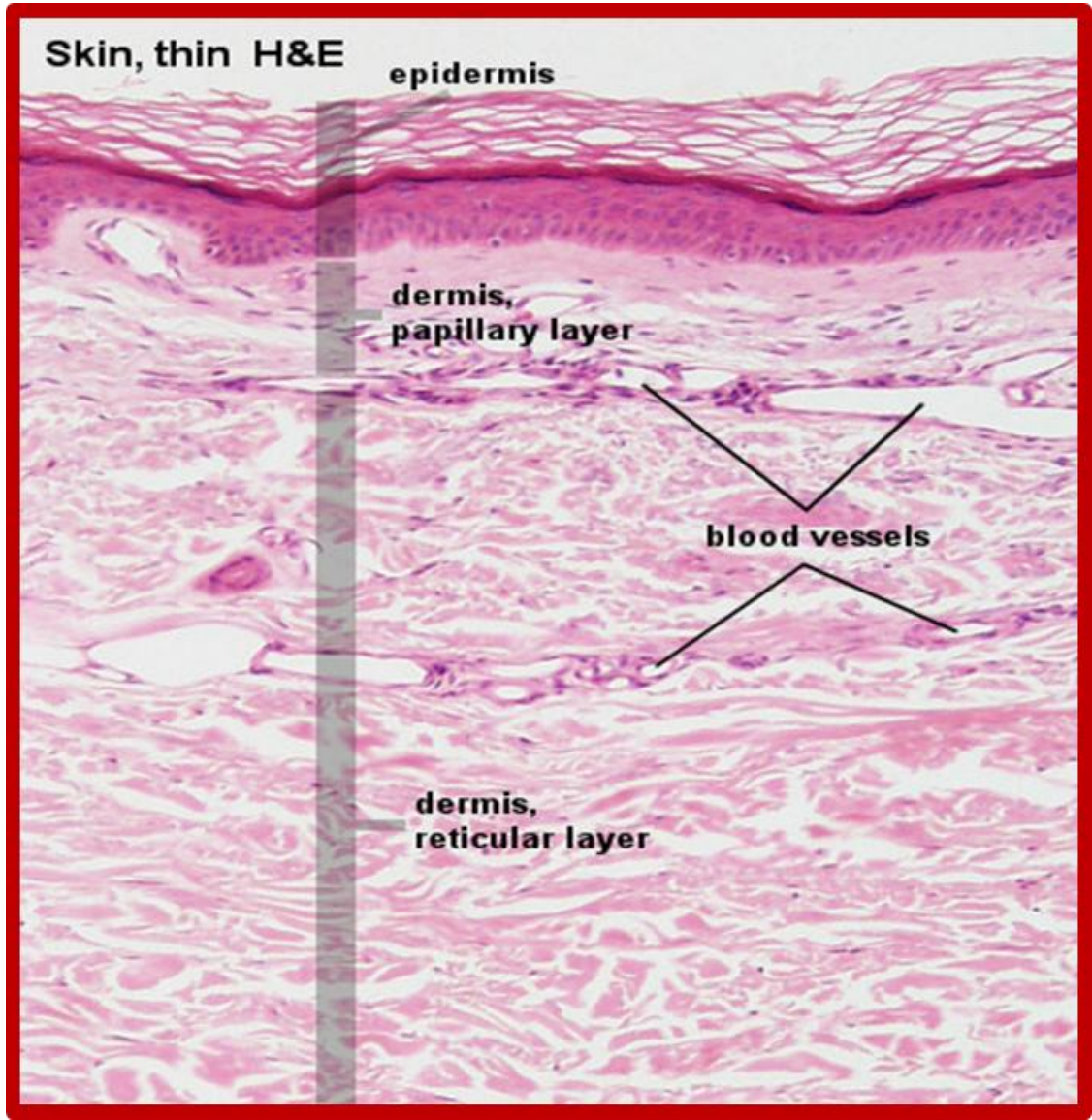
Basement membrane



Skin structure

Dermis

- Is divided into :
  - Papillary dermis
  - Reticular dermis



Skin structure

Dermis

1.Collagen fibers (70-80 %): Provides strength to skin

2. Elastic Fibers (1-3%): Provides elasticity

3. Ground substance (proteoglycans) : it binds water and maintains the skin turgor.

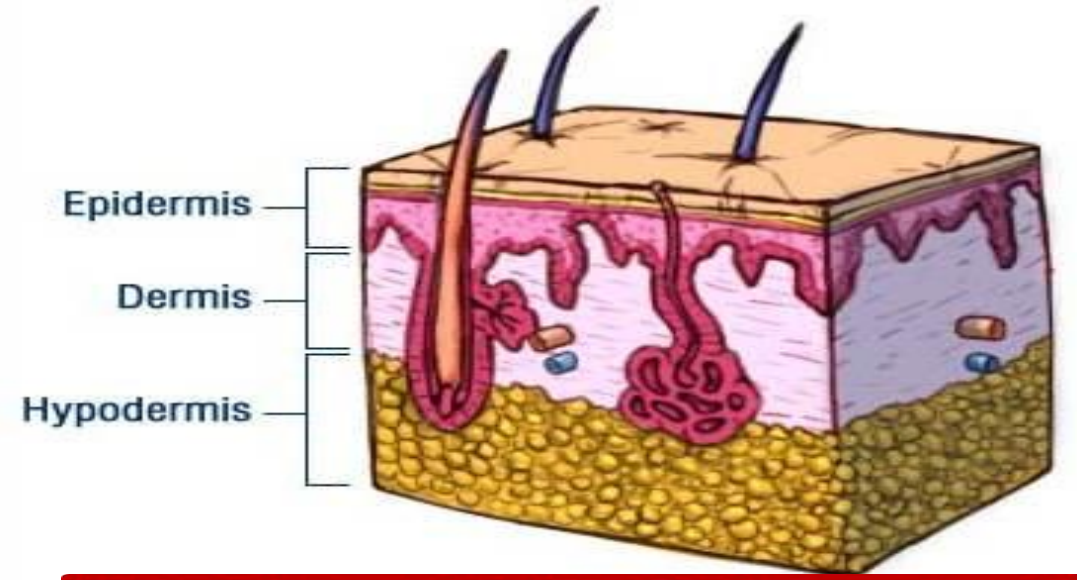
4. Blood vessels

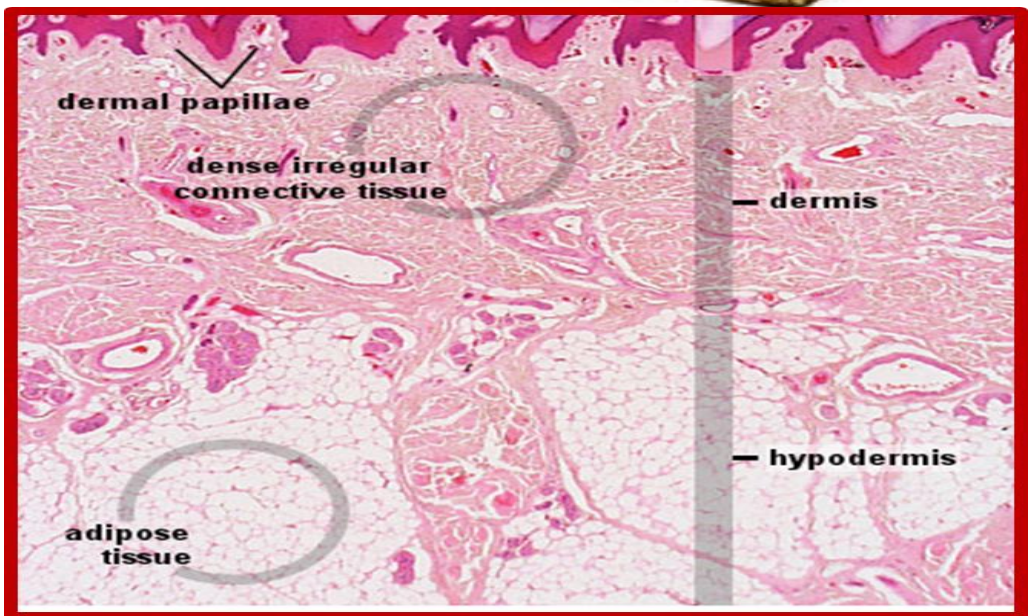
5. Fibroblasts : Produce the above elements..

Skin structure

Subcutaneous Fat:

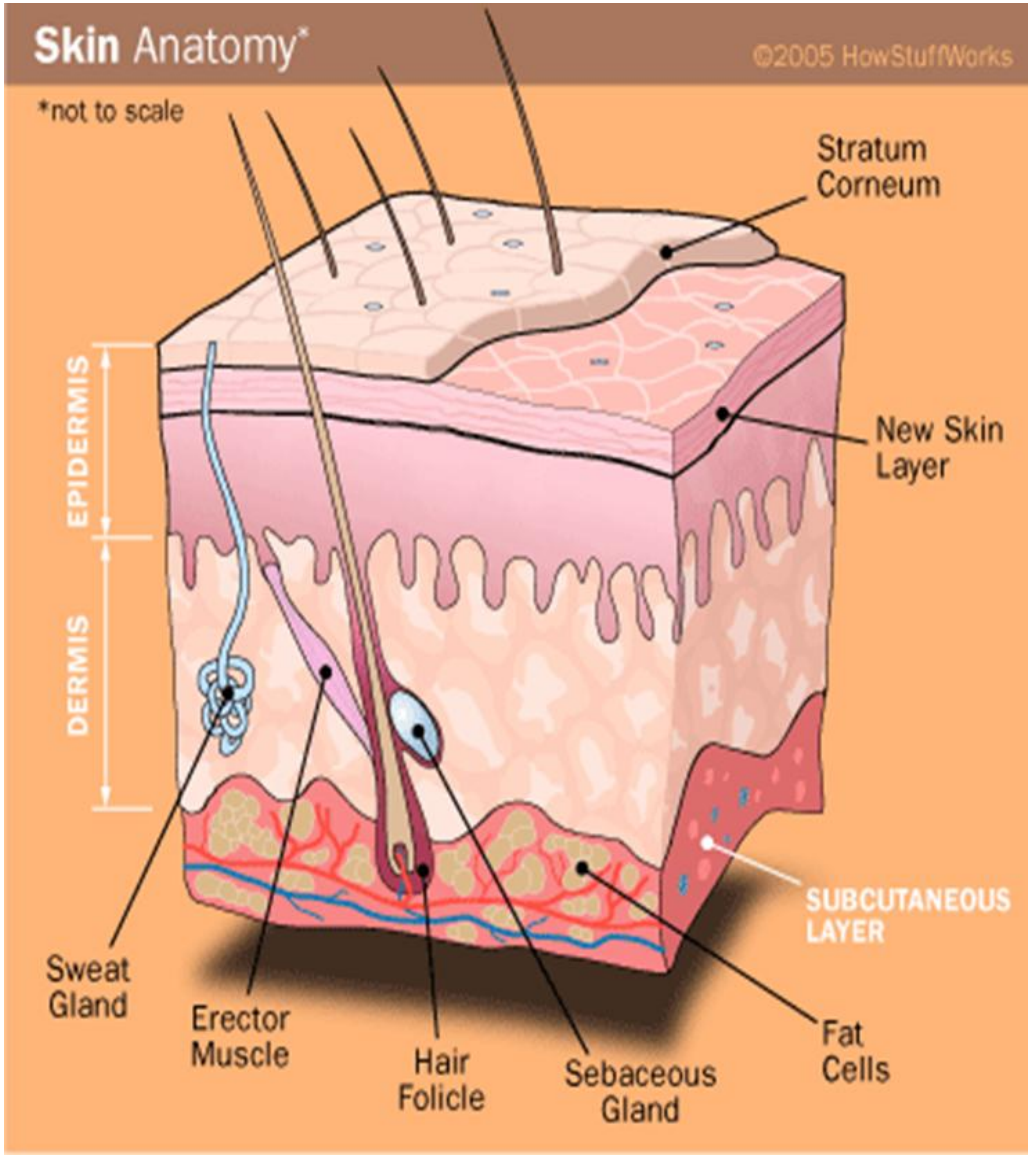
Composed of lipocytes



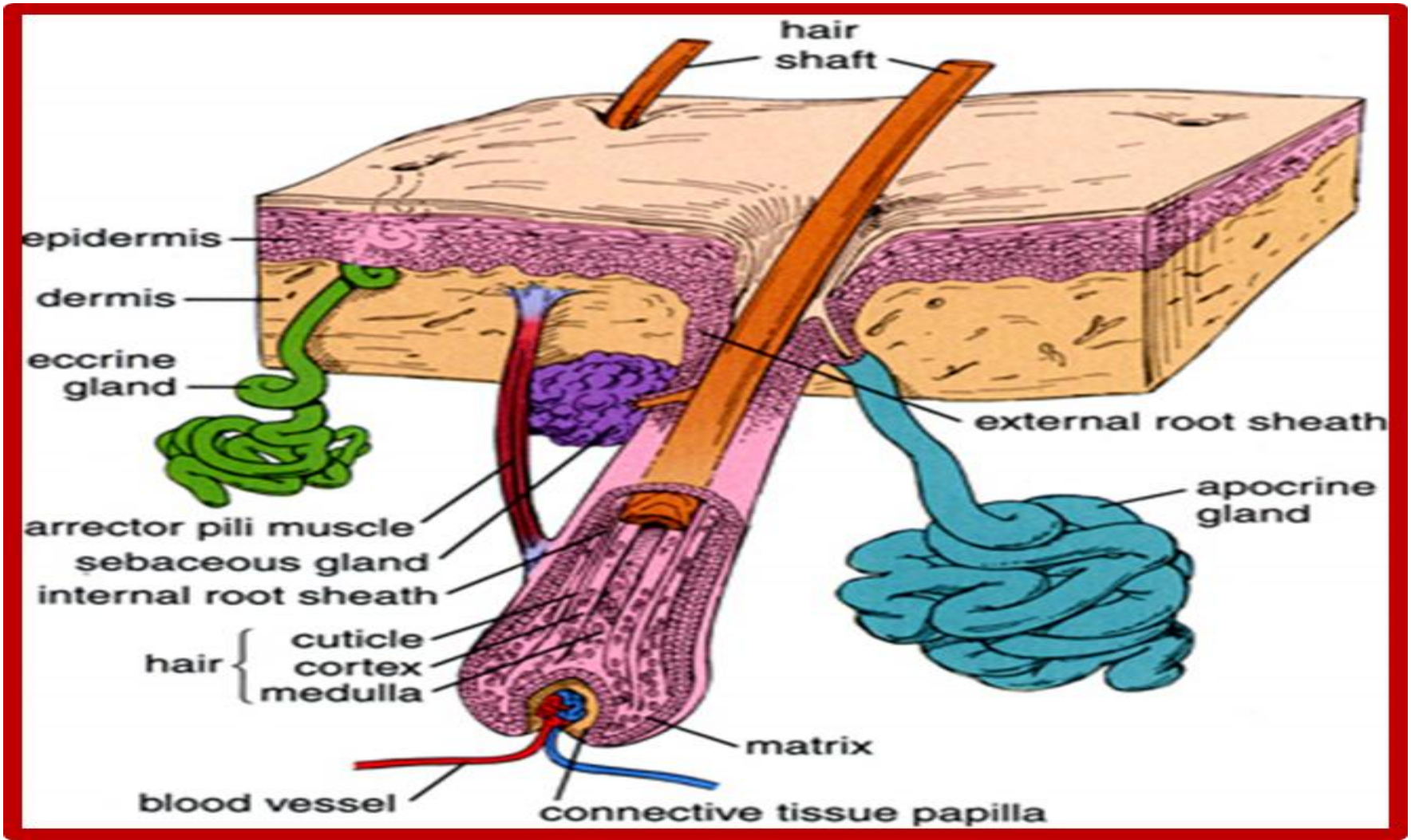


Skin appendages

- Hair follicle
- Nails
- Eccrine/ apocrine sweat glands
- Sebaceous glands



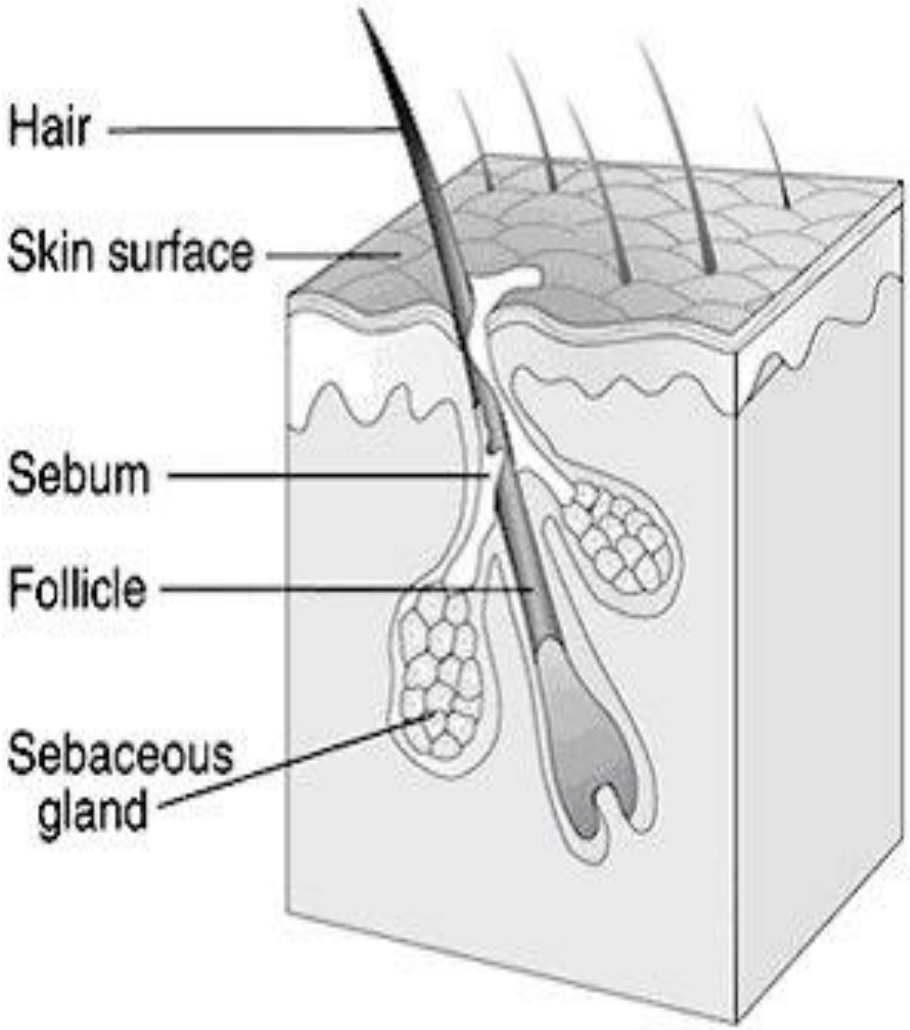
Skin appendages



Skin appendages

- **Pilosebaceous unit**

Formed by the hair follicles with it's attached sebaceous gland



Skin appendages

Sebaceous gland

-Attached to hair follicles or open freely.

-Present in the scalp, forehead, face ,upper chest except palms and soles.

-Sebaceous glands in the areola are called Montgomery tubercles and Meibomian glands in the eyelid


outer root sheath
hair canal
dermis
sebaceous gland

Skin appendages

Sebaceous gland

Ectopic sebaceous glands in the mucous membrane are called fordyce spots.

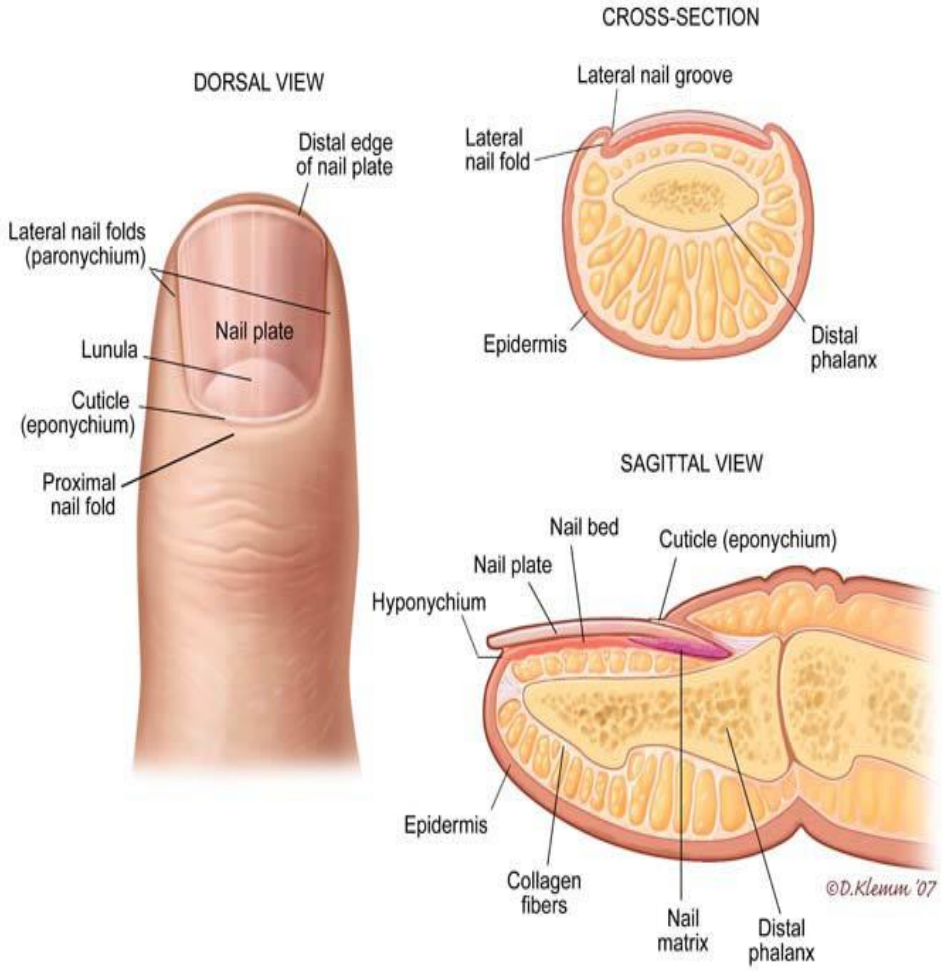
Skin appendages

Nails :

- The nail plate is formed of hard keratin

-Fingernails grow 3mm/month

-Toenails grow 1mm/month



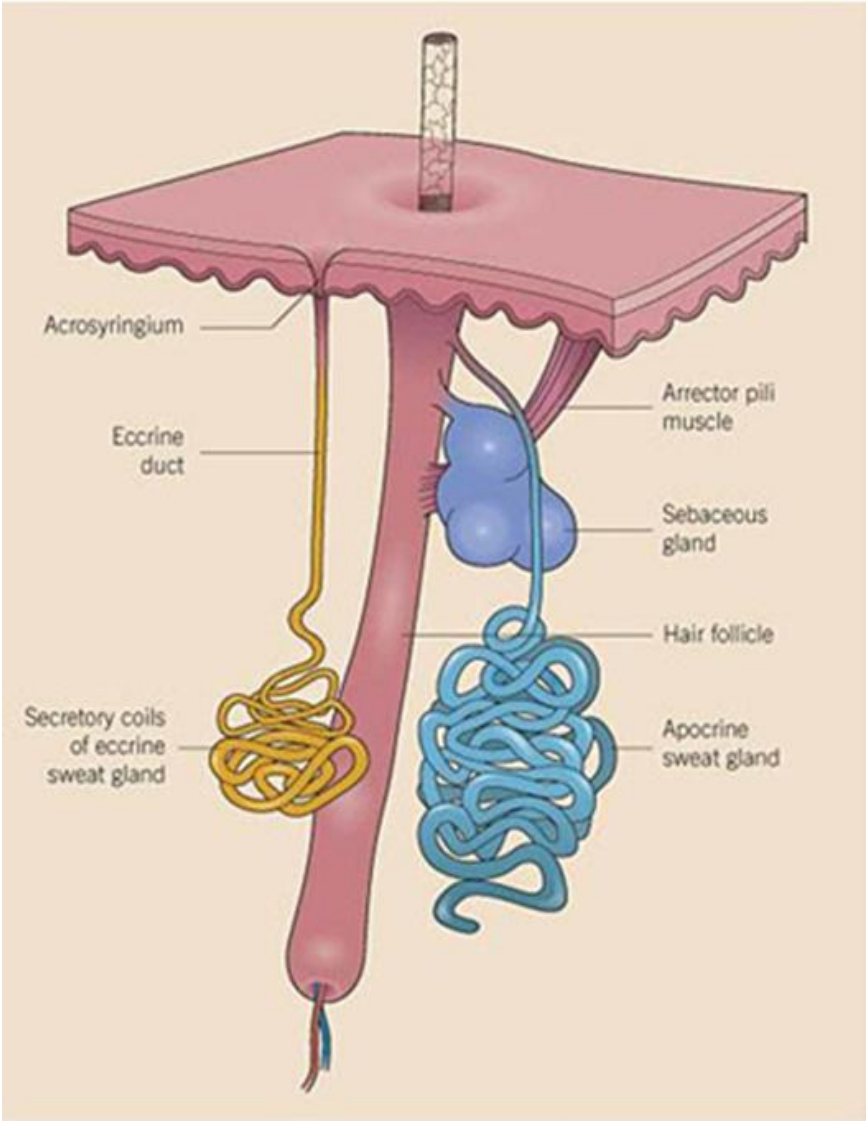
Skin appendages

Eccrine sweat glands

-Tubular structures open freely on the skin not attached to hair follicles.

-Under cholinergic stimuli

-Present everywhere except the vermilion border of lip , nail beds , labia minora , glans



Skin appendages

Apocrine sweat glands:

- Are modified sweat glands that present in the axillae, anogenital ,external ear canal , the eye lids (moll's glands) and areolae.

- Under adrenergic stimuli.

The Language of Dermatology: Descriptive and Morphology skills

Dr. Eman Almukhadeb

Consultant dermatologist , Assistant professor

Why do dermatologist use words that are rarely used by other medical specialties ?

The language of dermatology is different and the use of correct dermatologic terms is important to accurately describe skin lesions .

A good description of a skin lesion enables the listener to formulate a series of differential diagnoses .

Approach to the patient with skin lesion

- History
- Examination
- Investigation

Approach to the patient with skin lesion

History :

-Personal data : age, gender

-Chief Complaint : Onset , duration , progression , associated symptoms (itching, pain) , triggering and relieving factor (sun , heat ,…. Etc)

-Drug and allergy

-Family Hx

-Social Hx

-Systemic review

Examination

- **Use good light when examining a patient**

- **Examine nails , hair & mucous membrane**

- **Describe skin lesion as follow :**
- Distribution
- Configuration
- Size
- Border and shape
- Color
- Morphology (Primary lesion and Secondary changes)

Distribution

Distribution refers to how the skin lesions are scattered or spread out. Skin lesions may be isolated (solitary or single) or multiple. The localization of multiple lesions in certain regions helps in diagnosis, as skin diseases tend to have characteristic distributions. What is the extent of the eruption and its pattern?

DISTRIBUTION

- Acral : Affects distal portions of limbs (hand, foot) and head (ears, nose).
- Dermatomal : Corresponding with nerve root distribution.
- Extensor : Involving extensor surfaces of limbs. Contrast with flexor surfaces.
- Flexural: Involving skin flexures (body folds); also known as intertriginous.
- Generalised : Universal distribution: may be scattered or diffuse
- Koebnerised : Arising in a wound or scar. The Koebner phenomenon refers to the tendency of several skin conditions to affect areas subjected to injury.

DISTRIBUTION

- **Photosensitive** :Favouring sun exposed areas.
- **Seborrhoeic** : The areas generally affected by seborrhoeic dermatitis, with a tendency to oily skin (seborrhoea). Scalp, behind ears, eyebrows, nasolabial folds, sternum and interscapular.
- **Symmetrical** : In the same regions, the left side is affected in a similar way to the right side.
- **Unilateral** : Wholly or predominantly on one side of the affected region.

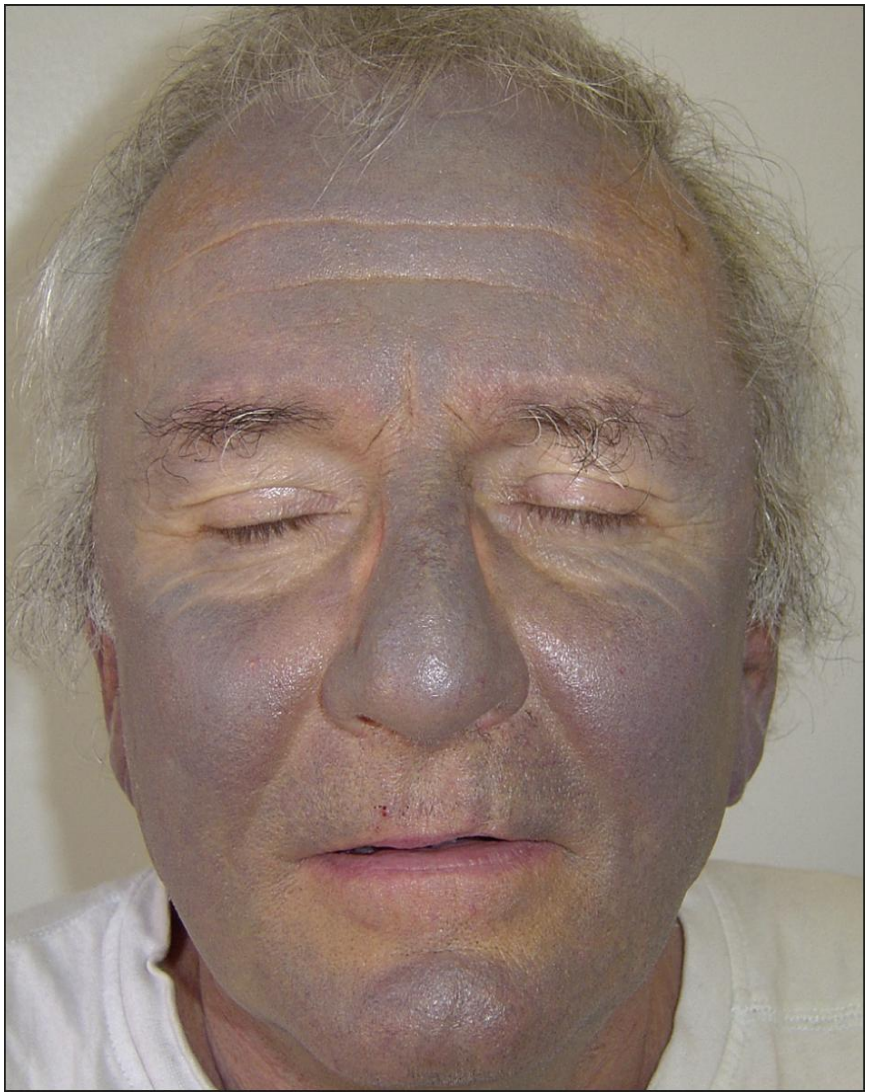
Generalized/ universal

Bilateral / symmetrical

Dermatomal

e.g: herpes zoster

Photosensitive



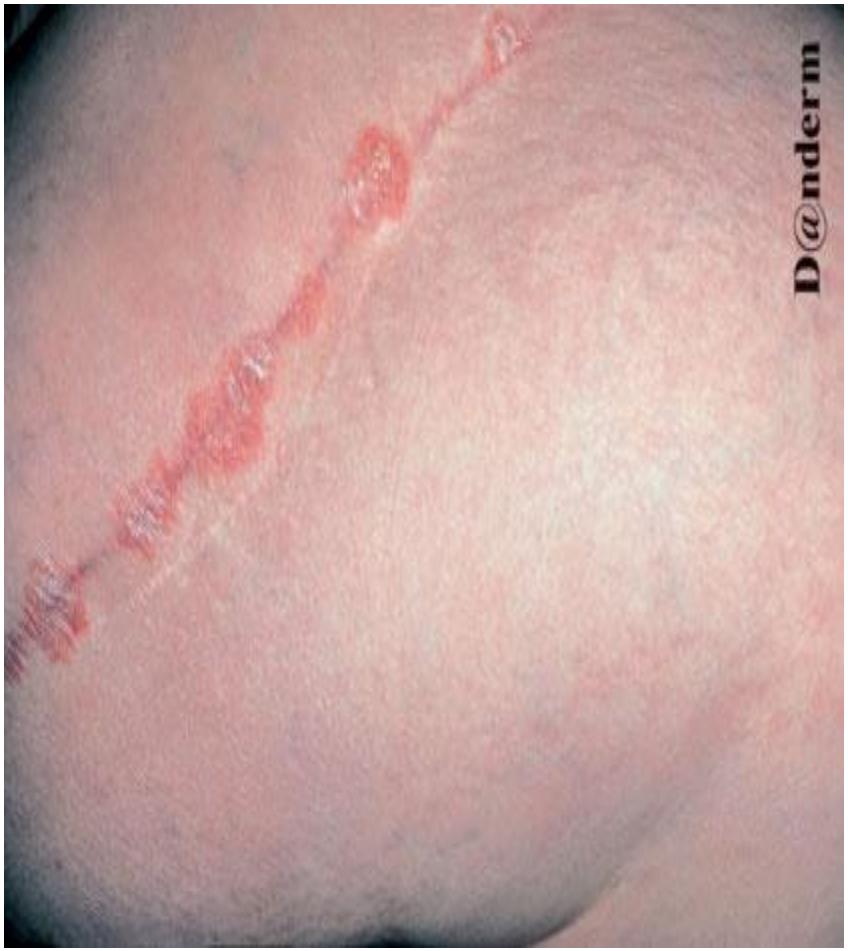
Koebnerised

e.g. psoriasis

Lichen planus

Vitiligo

Lichen nitidus



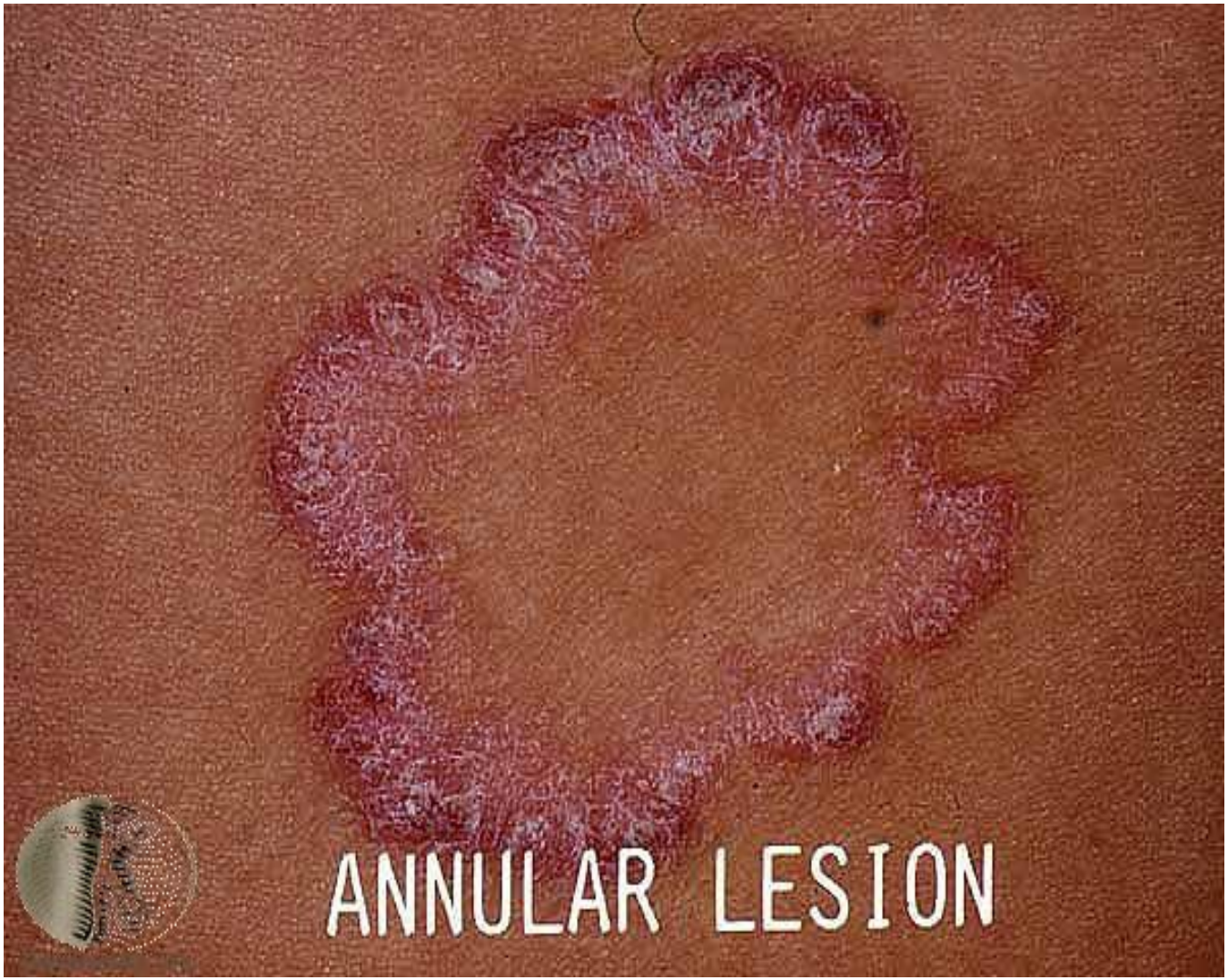
Configuration

Configuration refers to the shape or outline of the skin lesions. Skin lesions are often grouped together.

Configuration

- Nummular lesion : Round (coin-shaped) lesions. Also known as discoid.
- Linear lesion : A linear shape to a lesion often occurs for some external reason such as scratching.
- Target lesion: Concentric rings Also known as iris lesion.
- Annular : Lesions grouped in a ring like pattern
- Grouped : as herpes simplex lesion
- Reticular: net like pattern

Configuration



Numular/ discoid lesion

Configuration

Linear

Target lesion

Grouped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Morphology

Skin lesions are divided into

-Primary :Basic lesion.

- Secondary: Develop during evolution of skin disease created by scratching or infection

Morphology

- **Primary skin lesions :**

Macule/patch
Papule/plaque
Nodule
Cyst
Wheal
Vesicle/bulla
Pustule
Burrow

- **Secondary skin lesions :**

Excoriation
Erosion
Scale
Fissure
Ulcer
Scar
Lichenification

Primary skin lesions

- Macule : Flat circumscribed discoloration that lacks surface elevation or depression , less than 0.5 cm in diameter .

Primary skin lesions

- Patch:

Flat circumscribed skin discoloration; a large macule, more than 0.5 cm

Primary skin lesions

- Papule :

Elevated, Solid lesion

< 0.5cm in diameter.

Notice color and surface changes eg.Umblicated, Keratotic, Papillomatous

Flat topped.

Primary skin lesions

- Plaque:

Elevated, solid confluence or expansion of papules > 0.5 cm (lacks a deep component).

Primary skin lesions

- Nodule :

Elevated, Solid lesion > 0.5 cm in diameter; with deep component

Primary skin lesions

- **Cyst:**

Nodule that contains fluid or semisolid material

Primary skin lesions

- Vesicle:

Elevation that contains clear fluid and are less than 0.5 cm .

- Bulla: Localized fluid collection >0.5cm in diameter a large vesicle, can be tense or flaccid

Primary skin lesions

- Burrow:

Linear tunnel in the epidermis induced by scabies mite

Primary skin lesions

- Pustule:

A pustule is a purulent vesicle. It is filled with neutrophils, and may be white, or yellow. Not all pustules are infected

Primary skin lesions

- Wheal (hive) :

Firm, edematous plaque that is evanescent (transient or short lived) Last leas than 24 hrs and pruritic.

Secondary skin lesions

- Excoriation :

Linear erosion induced by scratching

Secondary skin lesions

- Erosion:

A partial and superficial focal loss of epidermis that heals without scarring.

Secondary skin lesions

- Crust:

- A collection of cellular debris, dried serum and blood .

- Antecedent primary lesion usually a vesicle, bulla, or pustule.

Secondary skin lesions

- **Scale:**

Thick stratum cornium

Parakeratosis : is retention of nuclei in stratum corneum

Secondary skin lesions

- **Fissure :**

Vertical loss of epidermis and dermis with sharply defined walls: crack in skin

Secondary skin lesions

- Ulcer :
- A full thickness focal loss of epidermis and dermis; heals with scarring

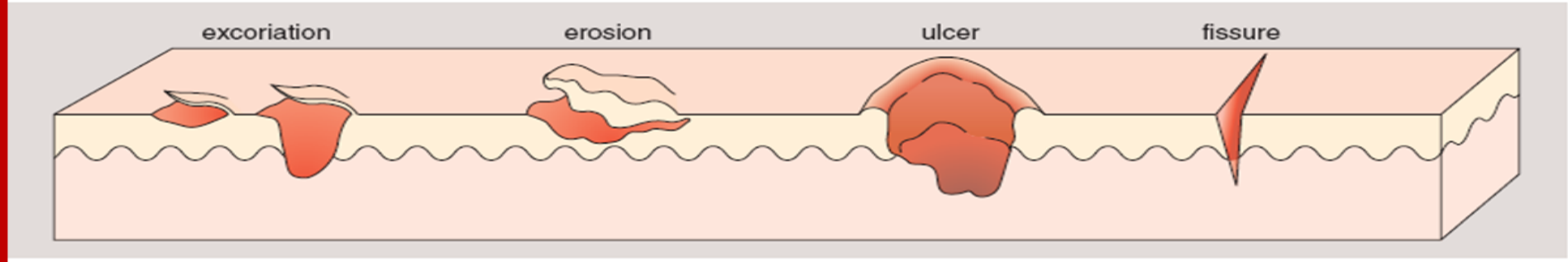

Fig. 4.24 Excoriation, erosion, ulcer and fissure.

Secondary skin lesions

- Scar:

A collection of new connective tissue; may be hypertrophic or Atrophic; implies dermoepidermal damage

Secondary skin lesions

- Lichenification
- Increased skin markings

secondary to scratching.

Important Signs in Dermatology

- NIKOLSKY SIGN:

Rubbing of apparently normal skin induce blistering Seen in pemphigus vulgaris and toxic epidermal necrolysis (TEN)

Figure 2. A positive Nikolsky's sign in toxic epidermal necrolysis.

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AUSPITZ SIGN

Removal of scale on top of a red papule produces bleeding points

Seen in psoriasis

- Koebner's phenomenon:
- Trauma to the skin produce certain diseases like

a.Psoriasis

b.Vitiligo

c.Lichen planus.

d.Warts.

- DERMATOGRAPHISM

Firm stroking of the skin produce erythema and Wheal Seen in physical urticaria

In patient with atopy, stroking produces white dermatographism rather then red.

Investigations

- Wood's lamp :
- Produces long wave UVL (360 nm)
- Useful in :
- Tinea Versicolor- yellowish green flourescence
- Tinea Capitis -yellow green flourescence in M.canis, M. audouini
- Vitiligo - Milky white.
- Erythrasma –coral red flourescence

- KOH preparation for fungus:

- Cleanse skin with alcohol Swab.
- Scrape skin with edge of microscope slide onto a second microscope slide

- KOH preparation for fungus:
- Put on a drop of 10% KOH

- Apply a cover slip and warm gently

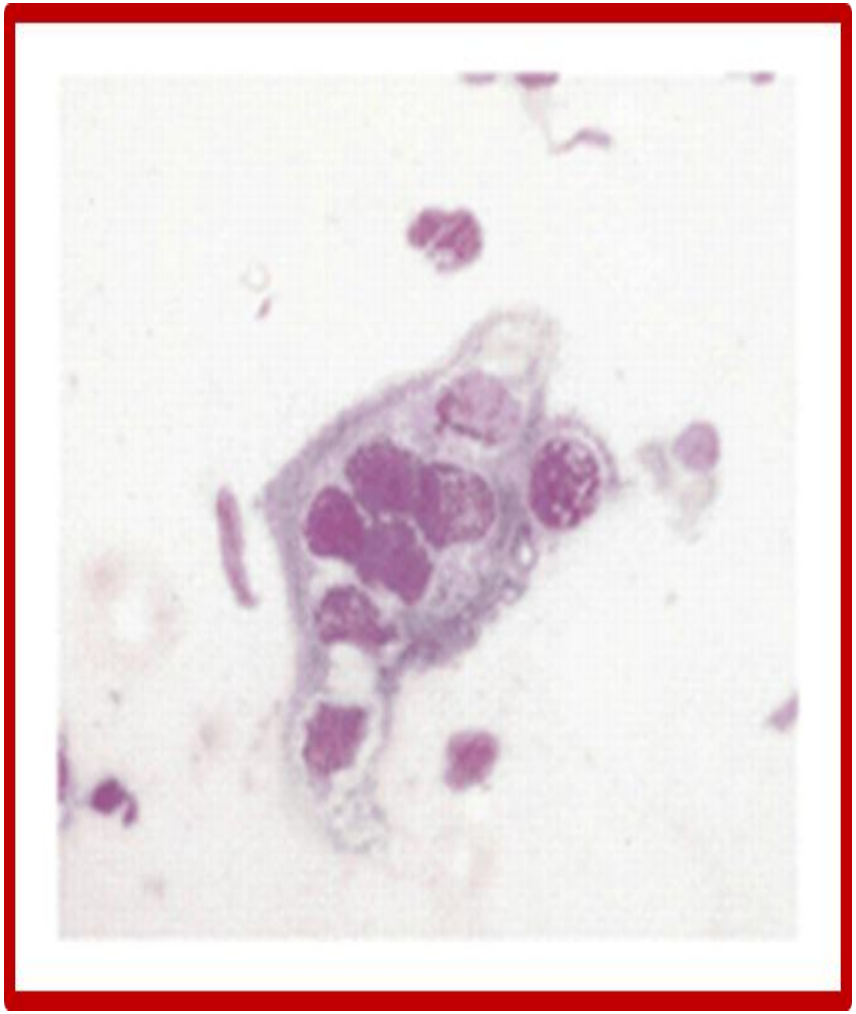
- Examine with microscope objective lens

Figure 2: 10% KOH preparation showing broad thin walled aseptate hyphae with irregular branching (500x)

- Tzank smear :
- Important in diagnosing:

-Herpes simplex or VZV (multinucleated giant cells)

-Pemphigus Vulgaris (acantholytic cells).



- **Tzank smear:**
- METHOD :

- Select a fresh vesicle.
- De-roof and scrape base of the vesicle.
- Smear onto a slide.
- Fix with 95% alcohol.
- Stain with Giemsa stain.
- Examine under microscope.

Prick test :

-Put a drop of allergen containing solution
A nonbleeding prick is made through the drop.
After 15-20 minutes the antigen is washed , the reaction is recorded.

-A positive test shows urticarial reaction at site of prick.
Detects immediate-type IgE mediated reaction
Emergency theraputic measures should be available in case of anaphylaxis.

- PATCH SKIN TEST
- Important in contact dermatitis

- Select the most probable substance causing dermatitis

- Apply the test material over the back

- Read after 48 & 72 hr. look for (erythema, edema, vesiculation)

- Positive patch test showing erythema and edema.

In severe positive reaction vesicles may be seen

- **SKIN PUNCH BIOPSY**

-Clean skin with alcohol

-Infiltrate with 1-2% xylocaine with adrenaline

-Rotate 2-6 mm diameter Punch into the lesions

SKIN PUNCH BIOPSY

Lift specimen and cut at base of lesion

Fix in 10% formalin

For Immunoflourescence

Put in normal saline

Suture if 5 mm is used

Thank you