Introduction
Basic structures & function

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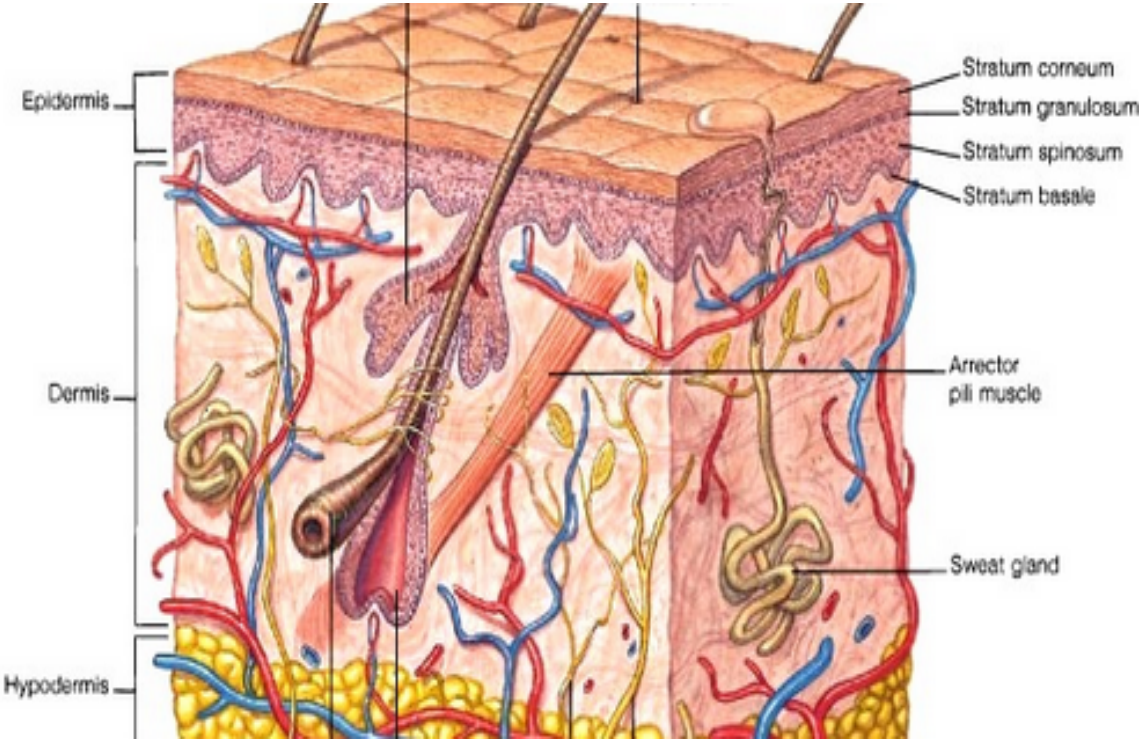
Skin : is the boundary between The humans & their environment, it's the largest organ in the body , weighs about 4 kg , and cover an area of 1.8 m^2.

Function of the skin :

1. Protection against:
   - UVL radiation → melanocytes
   - chemicals , particles → Horney layer
   - microbes , Ags. , haptens → langerhans cells
2. Prevents loss of water, electrolytes, macromolecules → Horney layer
3. Preservation of balanced internal environment → Horney layer
4. Shock absorber → dermis and subcutaneous fat
5. Temperature regulation → blood vessels and eccrine sweat gland
6. Insulation → subcut. Fat

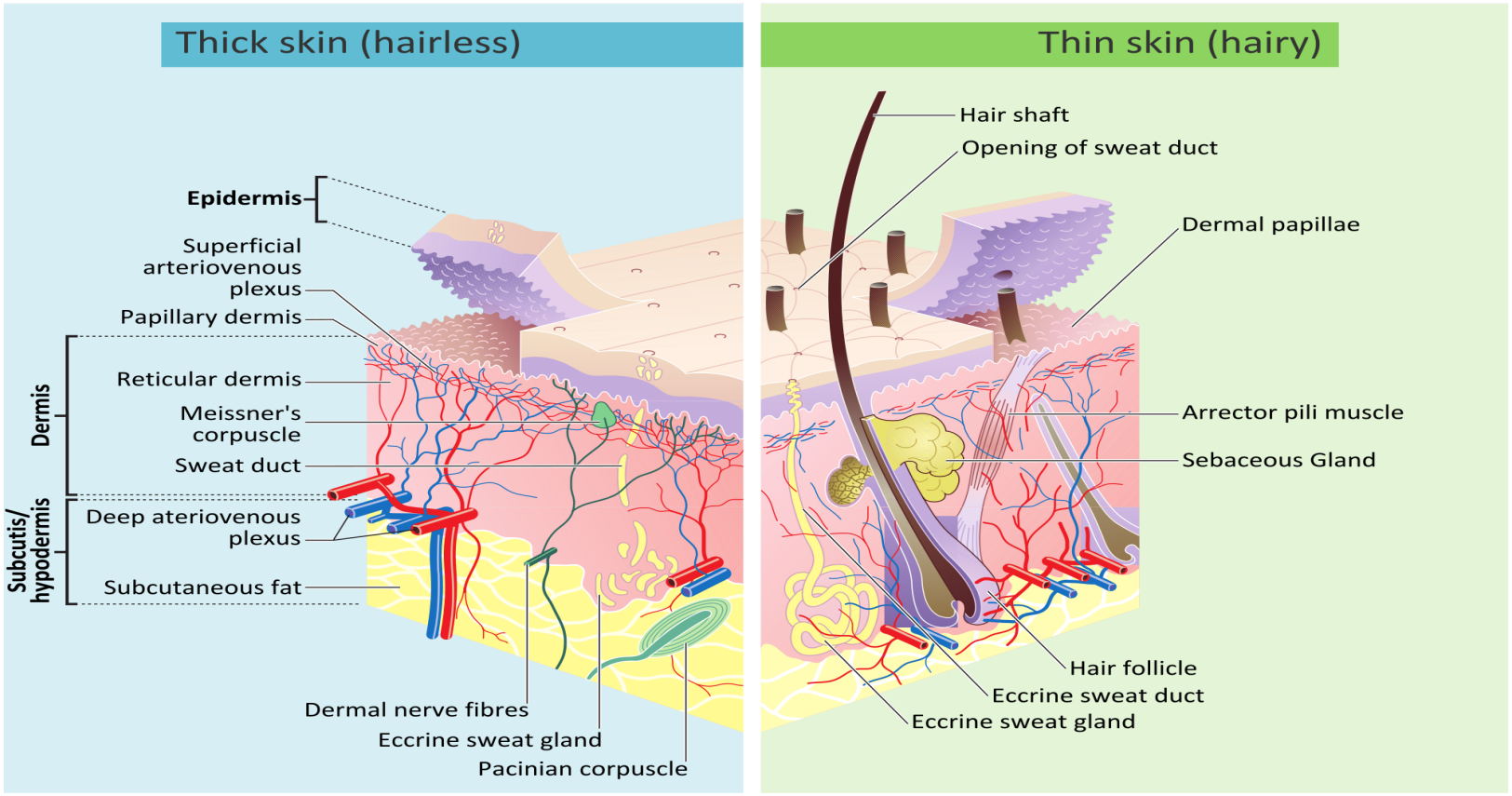
7. Psychological display: skin, lips, hair and nails
8. Sensation: specialized nerve endings
9. Lubrications: sebaceous gland
10. Protection and prising :nails
11. Calorie reserve: subcut. fat
12. vit. D synthesis: keratinocytes
13. Body odor ,pheromones: apocrine gland
14. Immune surveillance by Langerhans cells.



Anatomy : skin is divided into 3 layers :

1. Epidermis.
2. Dermis.
3. Subcutaneous fat (panniculus adiposus).

There are 2 main kinds of human skin:



1.Glabrous skin (non – hairy skin).

- found on palms & soles.
- characterized By:

A) thick epidermis

B) the presence of encapsulated sense organs within the dermis.

C) lack of hair follicle & sebaceous gland

2. Hair – bearing skin : has both hair follicle ,sebaceous gland & lack of all encapsulated sense organs.

** All skin sites are composed of 3 layers but with variable regional variation in thickness.

e.g. Epidermis is 0.075 - 0.15 mm (body)

0.4 – 0.6 mm (palm & sole)

Dermis is less than 1 mm (eyelids)

more than 4 mm (back)

Subcutaneous Fat thick in abdominal & buttock BUT thin over nose & sternum.

Epidermis :

The outer most layer, continually renewing, avascular, stratified squamous epithelium that keratinized giving rise to derivative structures called (skin appendages).

Populated by 4 main types of cells : **1.Keratinocytes**

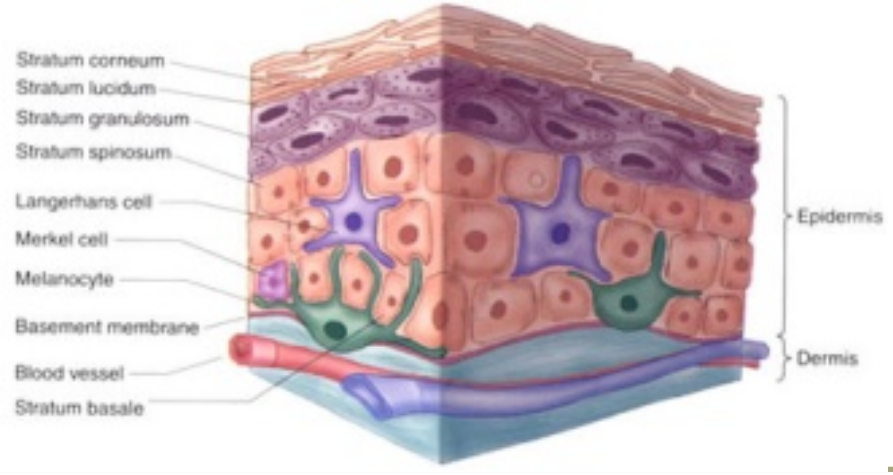
2.Melanocytes

3.Merkel's cells

4.Langerhans cells

Keratinocytes : **it's of ectodermal origin, constitutes at least 80% of the total population of cells, produce keratin (filamentous protein which form surface coat of epid. It is the structural protein of hair and nails).**

:the epidermis Composed of 4 layers (from IN → OUT)



** 1.Basal layer(Stratum germinativum):

Basally situated, single layer (columnar ,basophilic cytoplasm with hyperchromatic nucleus , it's cell proliferate & move upwards as moving upwards they loss their organelles & nuclei & get flattened till reached the Horney layer.

The process of differentiation of basal layer to Horney layer is called

Epidermopoiesis & and the time taken for it's called

Transit time = 60 days

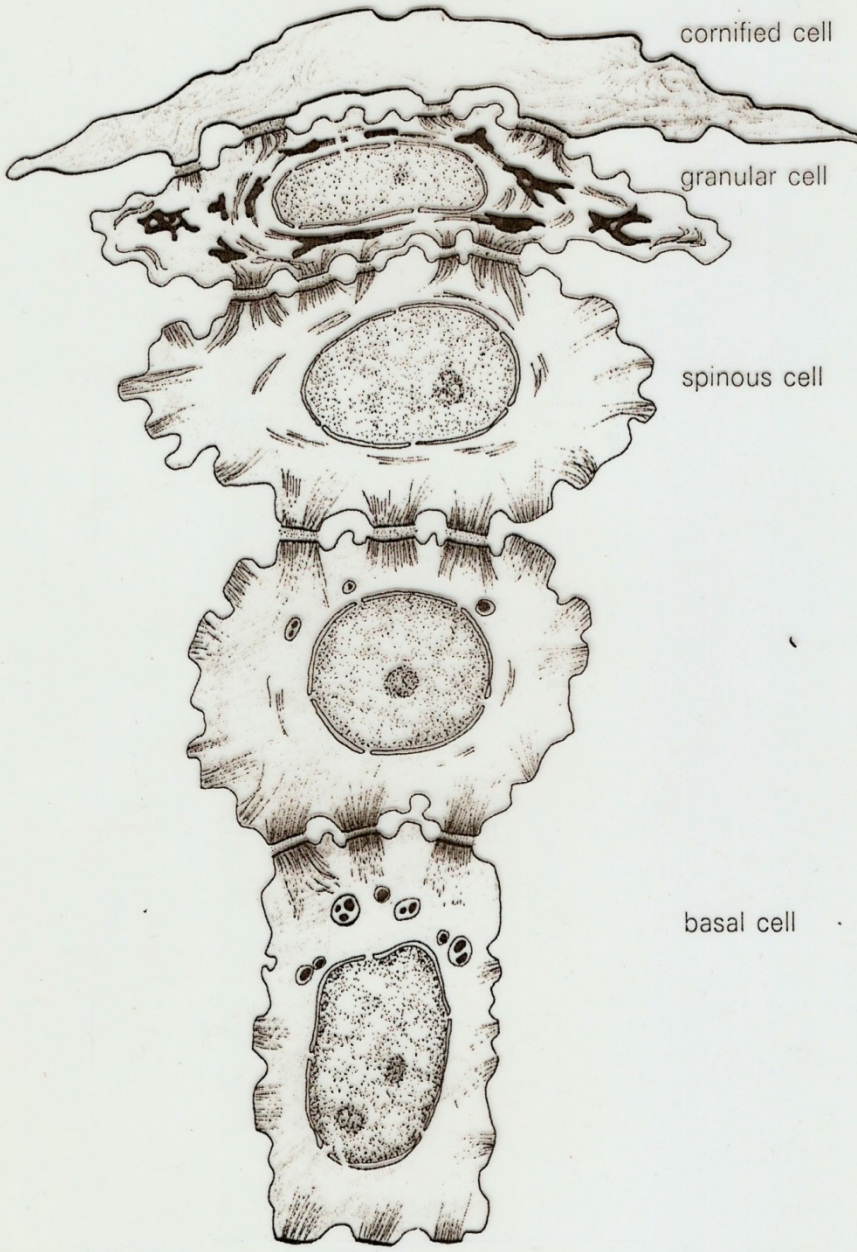


FIG. 1-28. Basal, spinous, and granular cells: stages in conversion of germinati keratinocytes to end stage of epidermal differentiation, namely, cornified keratin cytes. Columnar basal cells thus end up as horizontally aligned, thin, flat cornifi cells.

** 2.Prickle cell layer(Stratum spinosum or malpighii):

Polyhedral, 5-10 layer thick, with rod like thickening (prickles or spines) on their cell membrane w appear to connect them together.

Desmosomes **w appear histologically as lines between cells.**

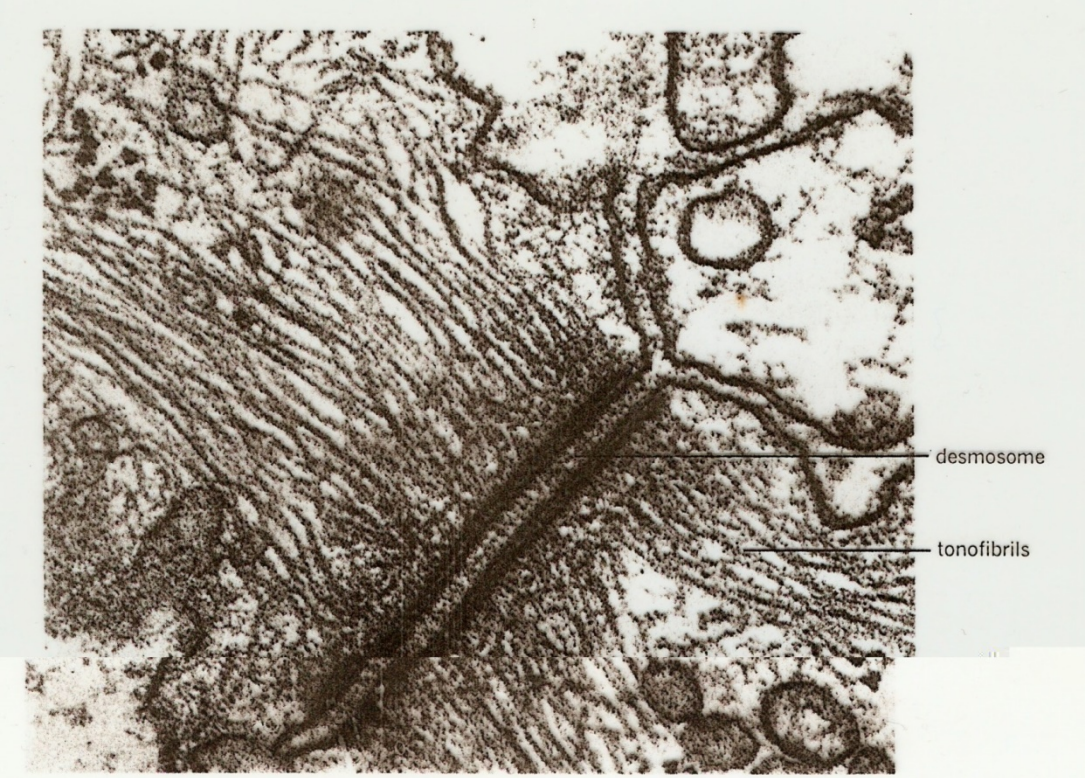


FIG. 1-33. Looping of tonofibrils at desmosome between adjacent keratinocytes (× 132,000.) (Courtesy Douglas E. Kelly, Ph.D.)

** 3.Granular cell layer(Stratum granulosum):

1-3 layers thick, called so because their cells contain keratohyalin granules that provide materials for the formation of stratum corneum

** 4.Horney cell layer (Stratum corneum):

-flattened dead cells ,anucleated with no intracytoplasmic organelles

-surrounded by thick insoluble envelope(involucrin).

-stick tightly together ,but flake off at the surface

Q: is there any connection between the cells ? How ?

Epidermal cells are joined to one another by specialized intercellular attachment device called (Desmosomes – tonofilament complexes & intercellular substance)

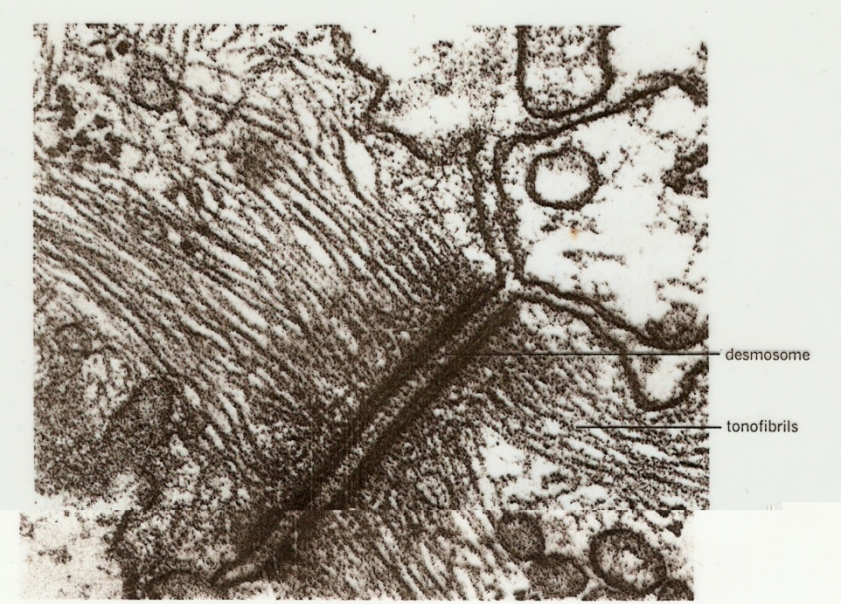


FIG. 1-33. Looping of tonofibrils at desmosome between adjacent keratinocytes (× 132,000.) (Courtesy Douglas E. Kelly, Ph.D.)

Od Land Bodies(keratinosomes): **They are membrane coating granules, found intracellularly in the prickle cell layer & intercellular through granular & Horney layer.**

These granules contain lipid so they : 1- establish a barrier to water loss.

2- they mediate st.cor.cell cohesion

Melanocytes :

- Dendritic, pigment producing cell in skin, derived from neural crest and migrate to Epidermis
- also found in Hair follicle (anagen phase) , leptomeninges, uveal tract and retina
- they reside in BCL & associated with keratinocytes in frequency of 1-10 cells, forming <u>Epidermal – melanin unit.</u>
- - contain Melanosomes : Melanin pigment granules. the melanosomes transferred by dendrites to be engulfed by adjacent keratinocytes
- Melanin is synthesized from tyrosin using enzyme Tyrosinase and cupper.
- appear clear on routine stain because they lack desmosome so they require sp. Stain to be identified (silver and dopa reaction)

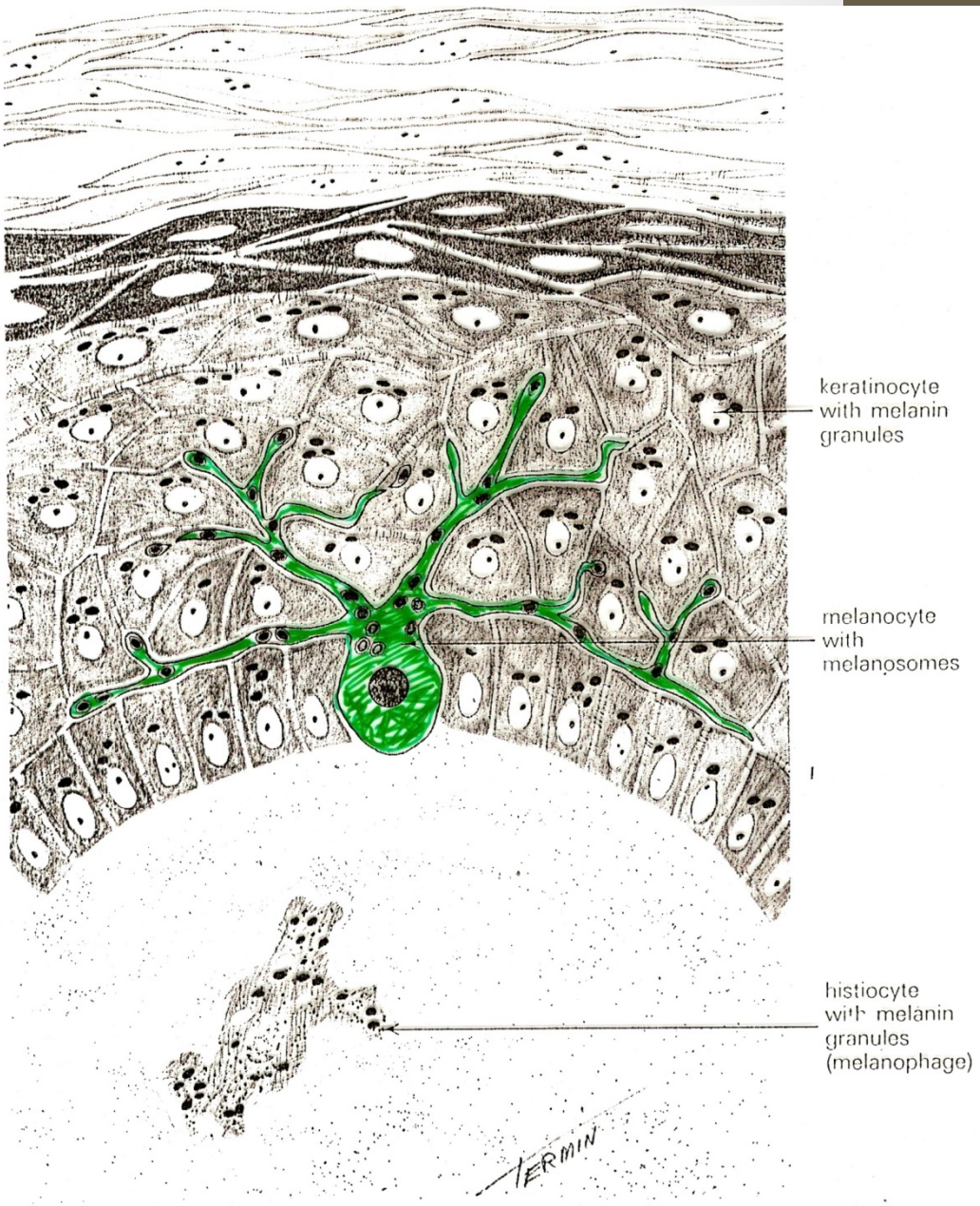


FIG. 1-38. Dendrites of a melanocyte. Note extension in all directions, especially along basal-cell layer and upward between keratinocytes in spinous-cell layer. Once melanin is formed, it is transferred from melanocytes into keratinocytes by apocopation.

Main function of melanin is PHOTO PROTECTION.

Q: What determine the color of skin ?

Number of melanocytes is the same for each sexes and for all races, but the no. and size of melanosomes will determine.

Langerhans cells :

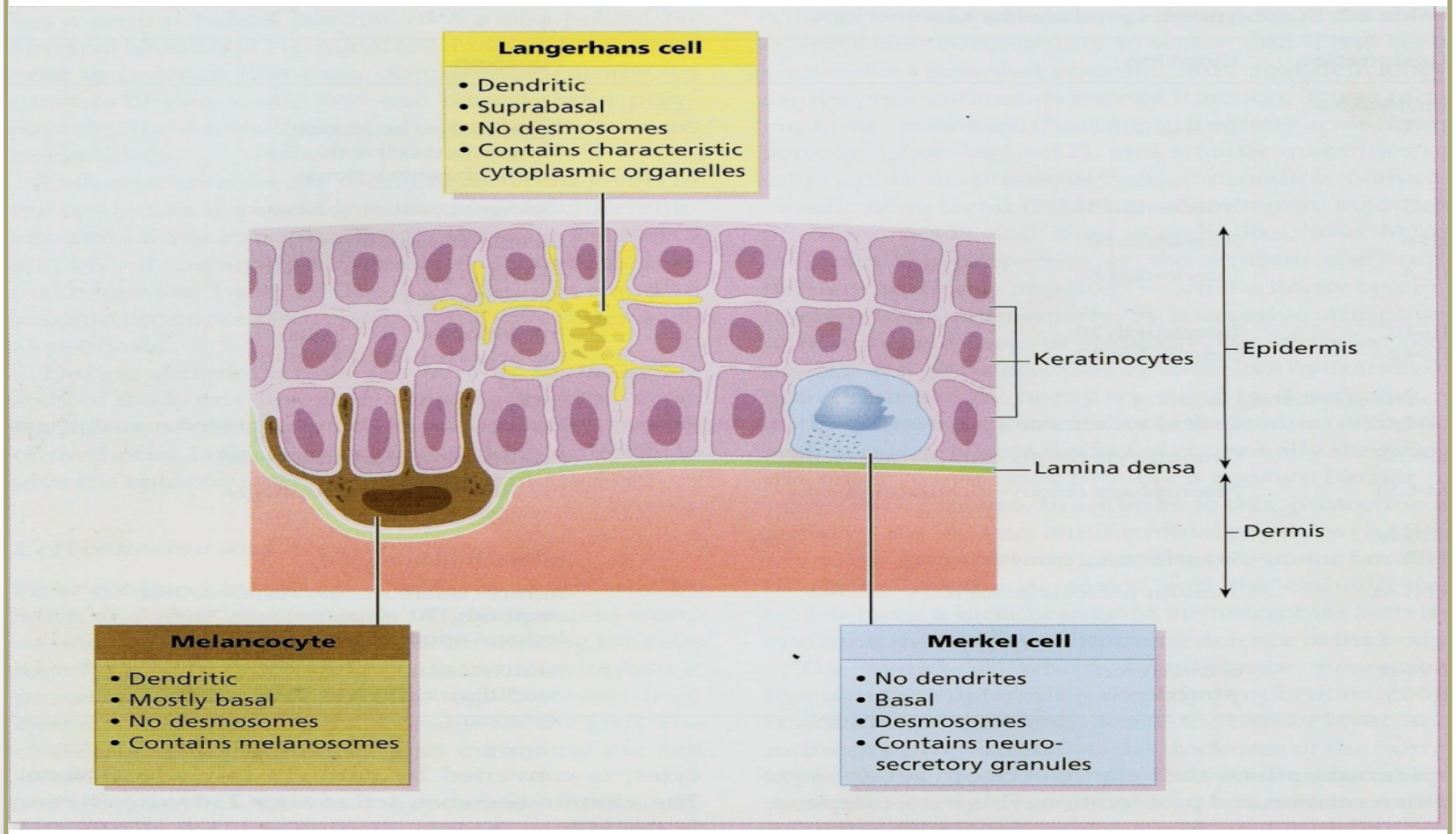
- Dendritic, originated in the bone marrow.

- usually found in suprabasal layer, it constitutes 2-4% of total epid. Cells population.

The Ag attached to these cells → cross the basement membrane and go to the dermis and presents the Ag to lymphocytes, so it's called Ag presenting cells

Merkel's cells :

Neural crest origin, non-dendritic, located directly above B.M, act as transducer of fine touch.



Dermo – epidermal junction:

Lying between epid. and dermis, join the epid. To dermis 0.5 - 1 µm thick.

under light microscope appear as one line (homogeneous)

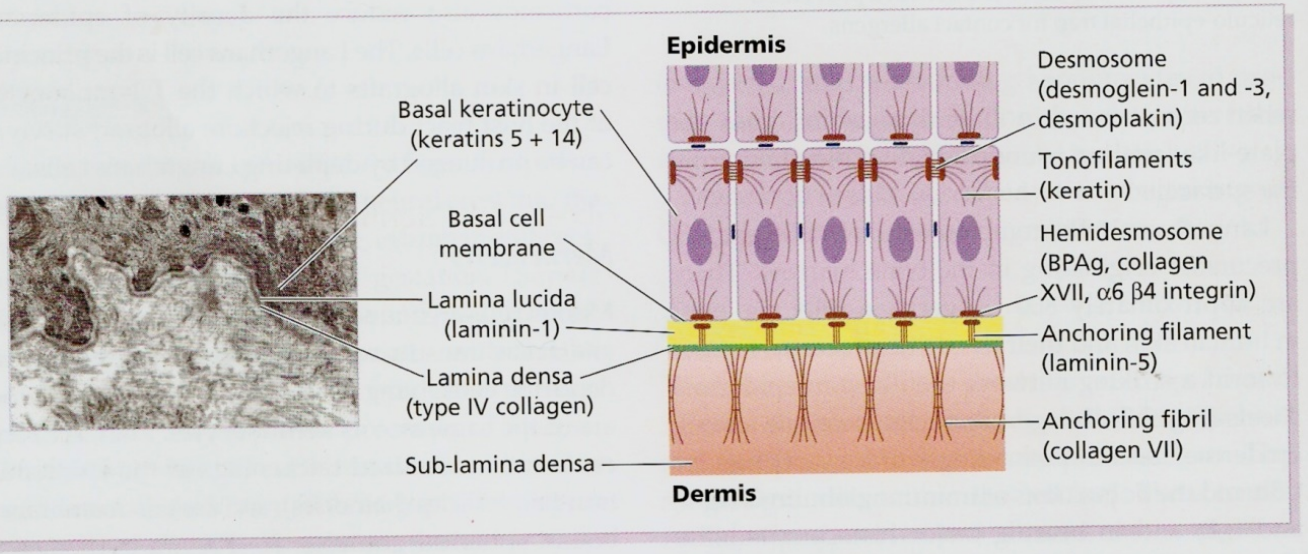


Fig. 2.9 Structure and molecular composition of the dermo-epidermal junction.

The function of Basement Membrane:

1- semi – permeable membrane that allows the exchange of fluid and cells between Dermis and epid.

2- hold the epidermis and dermis together

3- give structural support to the epidermis.

Epidermal appendages(adenxia)

Hair, nail, sebaceous gl. and sweat glands.

Eccrine sweat gland:

- All over the skin, more abundant in palm & sole, axilla & face.
- Composed of 4 parts :

1- Coiled secretory gland
2- Coiled dermal duct
3- Straight dermal duct

} Secretory parts

4- Spiraled intraepidermal duct (acrosyringium)

The sec. G. lies deep in dermis layer near the s.c fat & composed of :

1- contractive myoepithelial layer (outer L)
2- secretory cells (inner L)
- LARGE, faint, eosinophilic containing. glycogen, initiate the formation of sweat.
- SMALL, dark, basophilic, for reabsorption of Na+ , K+ and Cl- from sweat and change it from isotonic to hypotonic.

** Sweat CONTAIN Na+ , K+ , Cl- , lactate , ammonia & urea.

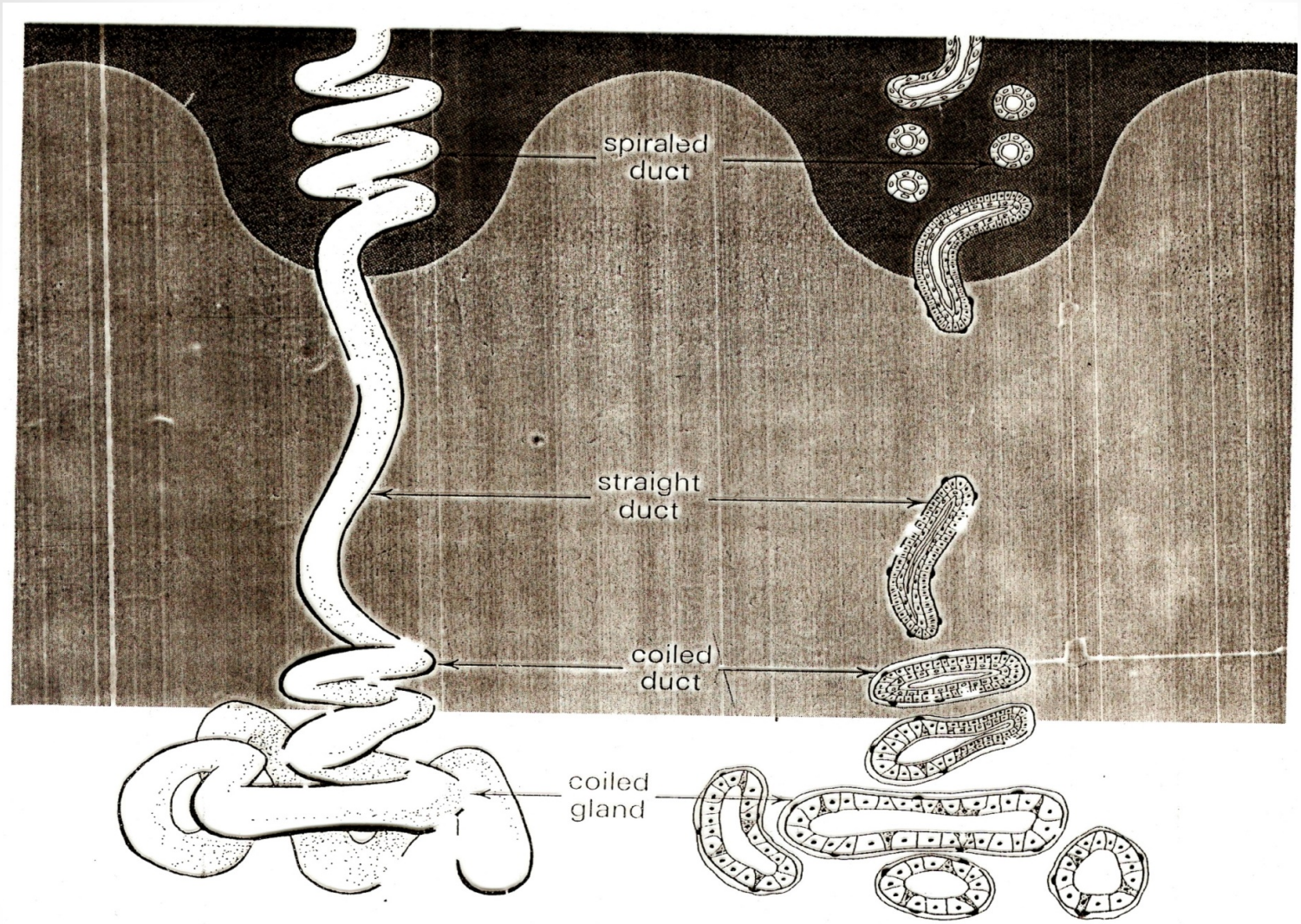


FIG. 1-68. Eccrine sweat unit. A simple hollow tube opens upon skin surface from intraepidermal spiral and ends in an irregularly coiled cul-de-sac deep in dermis or in subcutaneous fat. Both ends of the tube are connected by a straight duct.

The eccrine gland primarily serve in regulation of heat

**Sweat is odorless BUT when reaches the surface and by the action of flora it will have a special odor

Sweat secretion stimuli : **Cholinergic innervation** heat (Face)

Emotion (palm and sole)

**There are 3 types of sweating :

1)Thermal : due to effect of heat, face and trunk.

2)Emotional : due to nervousness and anxiety. As in exam (palm, sole).

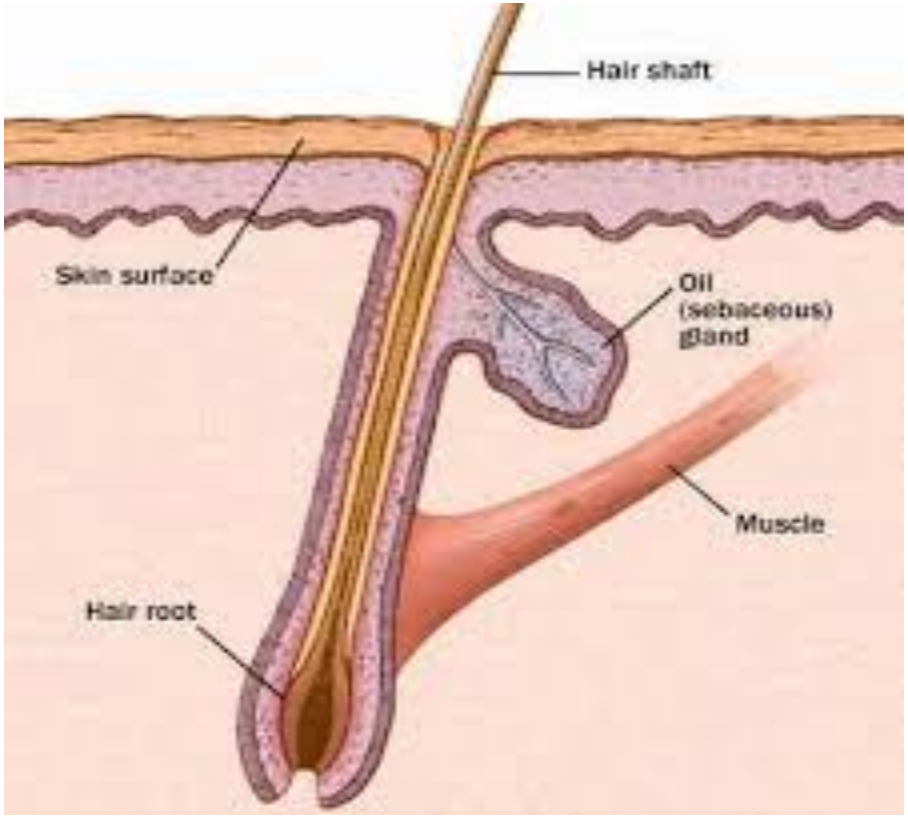
3)Gastatory : due to spicy food, affecting lips, nose and forehead.

Sebaceous gl.:

-Multi lobulated, secrete by holocrine mechanism by disintegration of cells, developed from H.F &

attach to it and it's canal opened

in the hair forming Pilosebaceous unit



-It's under the control of hormones.

-It's rudimentary before puberty BUT become active and large after that because of the effect of androgen.

-Abundant in scalp, face, chest ,perianal area and genital area.

**The secretion is called sebum w is composed of cholesterol esters, squalen, glycerides, wax esters, cholesterol.

Sebum Function : - lubricating agent.

- Mild bactericidal.
- Fungistatic.

Dermis:

- Epid. Is completely dependent on underlying dermis for support and nutrition .

- Dermis lies beneath the epid. And it's thicker than it

it is consist of 2 parts :

1- Papillary Dr. lies just below DEJ.

2- Reticular DR. in which the eccrine gland, seb. Gland and H.F found.

****Dermis composed of 3 types of fibers:**

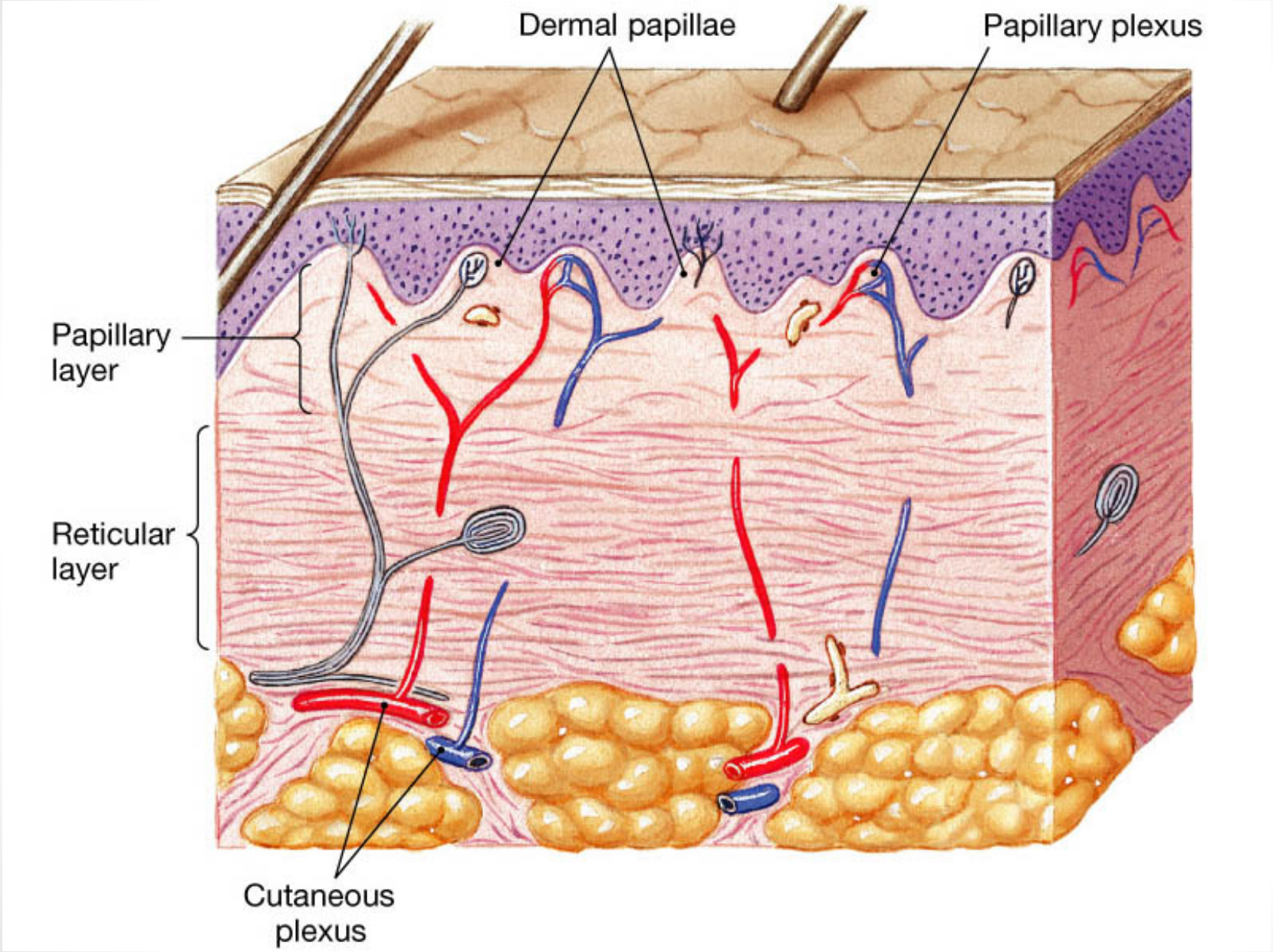
Collagen : forms the main bulk of the Dermis ,other proteins, Elastin and Reticulin

All 3 protein Contribute to extensibility & tensile strength.

All 3 are set in an amorphous material called Ground substance.

fibroblast, the most numerous cells in the dermis responsible for the synthesis of all 3 protein and ground substance.

Other cells, Macrophage, lymphocytes, mast cells and Langerhans cells


Dermal papillae
Papillary plexus
Papillary layer
Reticular layer
Cutaneous plexus

NO blood vessels in the epidermis.

Responsible for nutrition and temp. control.

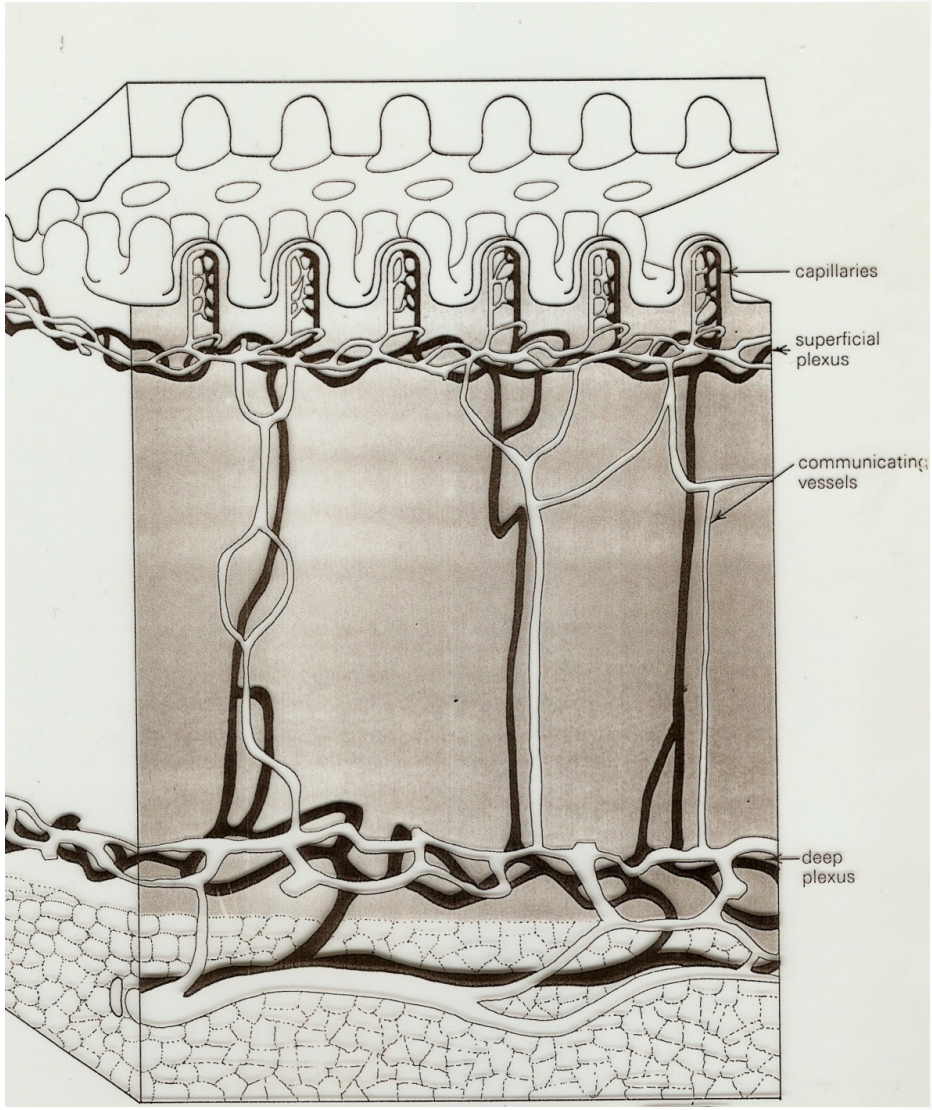
<u>In the dermis there are 2 plexuses :</u>

i. superficial : upper part of the dermis

ii. Deep : around hair follicle and eccrine gland

Both are linked by arterioles and venules

Dermis also rich in lymphatics



Nerves of the Skin:

1-Sensory :

i. Unmylinated nerve endings, mediate a sense of pain, itch and temp.

ii. Two encapsulated sense organ terminals:

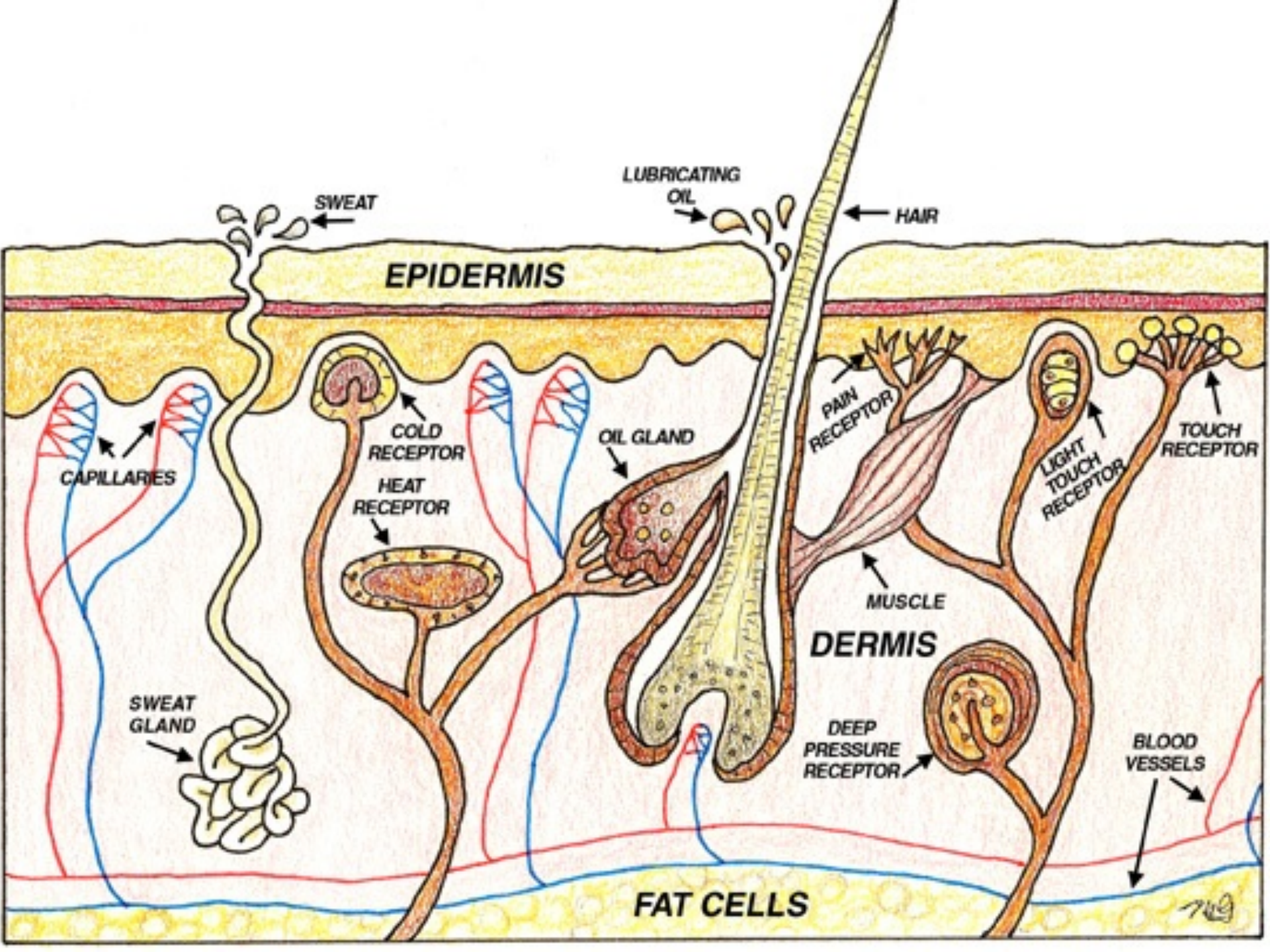
Meissner's corpuscles → Touch and vibration.

Pacini corpuscles → pressure.

**** They act as Mechanoreceptors**

2-Motor : supplied from sympathetic autonomic

- **Cholinergic fib → ecc. G.**
- **Adrenergic fib → apocrine g.**
  Bl. vs. "vasoconstriction"
  Hair erector ms.


SWEAT
LUBRICATING OIL
HAIR
EPIDERMIS
CAPILLARIES
COLD RECEPTOR
HEAT RECEPTOR
OIL GLAND
PAIN RECEPTOR
LIGHT TOUCH RECEPTOR
TOUCH RECEPTOR
MUSCLE
DERMIS
SWEAT GLAND
DEEP PRESSURE RECEPTOR
BLOOD VESSELS
FAT CELLS

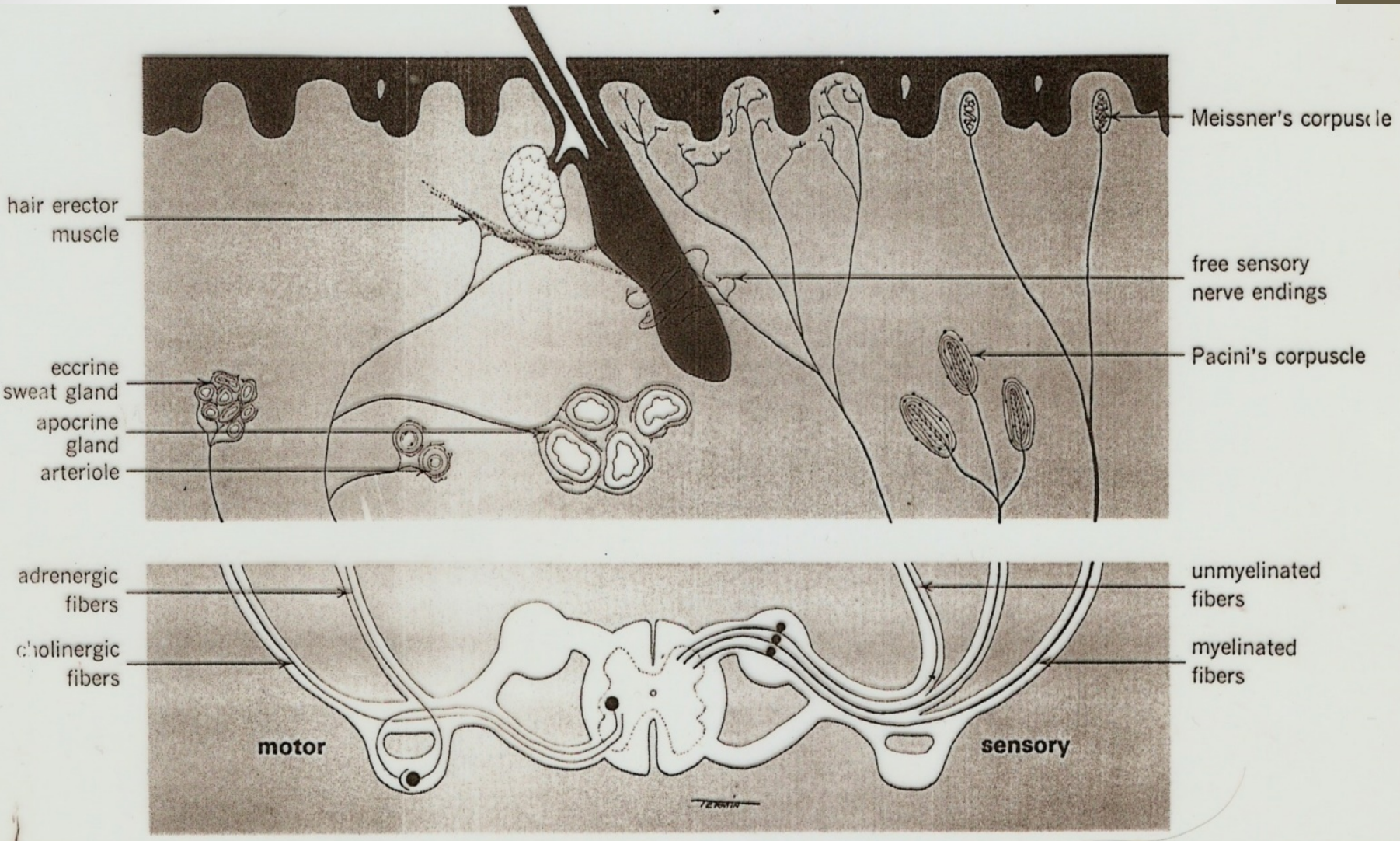


FIG. 1-25. Unmyelinated cutaneous nerve endings that transmit sensations of touch, pressure, temperature, pain, and itch via dorsal root ganglia to central nervous system. All motor fibers in skin are supplied by autonomic nervous system. Adrenergic fibers activate arterioles, glomus body, hair erector muscle, and apocrine glands; cholinergic fibers stimulate eccrine sweat glands.

The color of the Skin:

3 pigments are responsible for the color of the skin

i. Melanin : Most important of 2 types:

-Eumelanin → Dark hair

-Pheomelanin → Blond or red hair

ii. Hb in B.vs.

-Oxygenated → Red

-Deoxygenated & reduced → cyanosis → blue

-Low Hb → pale

-Some drugs (dapson) → Meth haemoglobinemia(blue)

iii. Caroten : precursor of vit. A, yellow substance in S.C. fat