

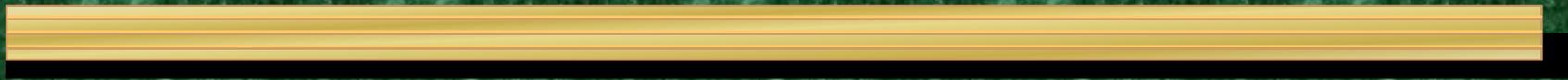


**“Seeing much, suffering much
and studying much are the
three pillars of learning.”**

–B Disraeli

Integumentary system

Skin





Introduction:

- largest organ of the body 15-20%
- The skin and its derivatives constitute the integumentary system
- made up of multiple layers of epithelial tissues covering CT, muscles and organs

Functions

- Protection
- Sensation
- Heat regulation
- Control evaporation
- Aesthetic and communication
- Storage and synthesis
- Excretion
- Absorption



Skin structure

- Skin is composed of three primary layers
 - **Epidermis** which provides waterproofing and serves as a barrier to infection
 - **Dermis** appendages of the skin
 - **Hypodermis** (superficial fascia) subcutaneous adipose layer
- The thickness of the skin varies from less than 1mm to more than 5mm.
 - Thick skin** (hairless skin) contains thick epidermis e.g palms of hands soles of feet. It has sweat glands, no hair follicles and no sebaceous glands.
 - Thin skin** (thin epidermis) contains hair follicles, sweat glands and sebaceous glands.



Epidermis

Consists of a keratinized stratified squamous epithelium.

layers of **keratinocytes**

differentiate and become filled with keratin migrates upward through layers (keratinization), desquamated

Sub-layers

• **stratum germinativum** (also stratum basale or basal cell layer)

single layer simple cuboidal to low columnar

basophilic cytoplasm

active mitosis

scattered intermediate filaments

10- 25% are melanocytes

• **stratum spinosum**

multi-layered arrangement of cuboidal cells

adjacent cells are joined by desmosomes

spiny appearance (it is called **prickle cell layer**)

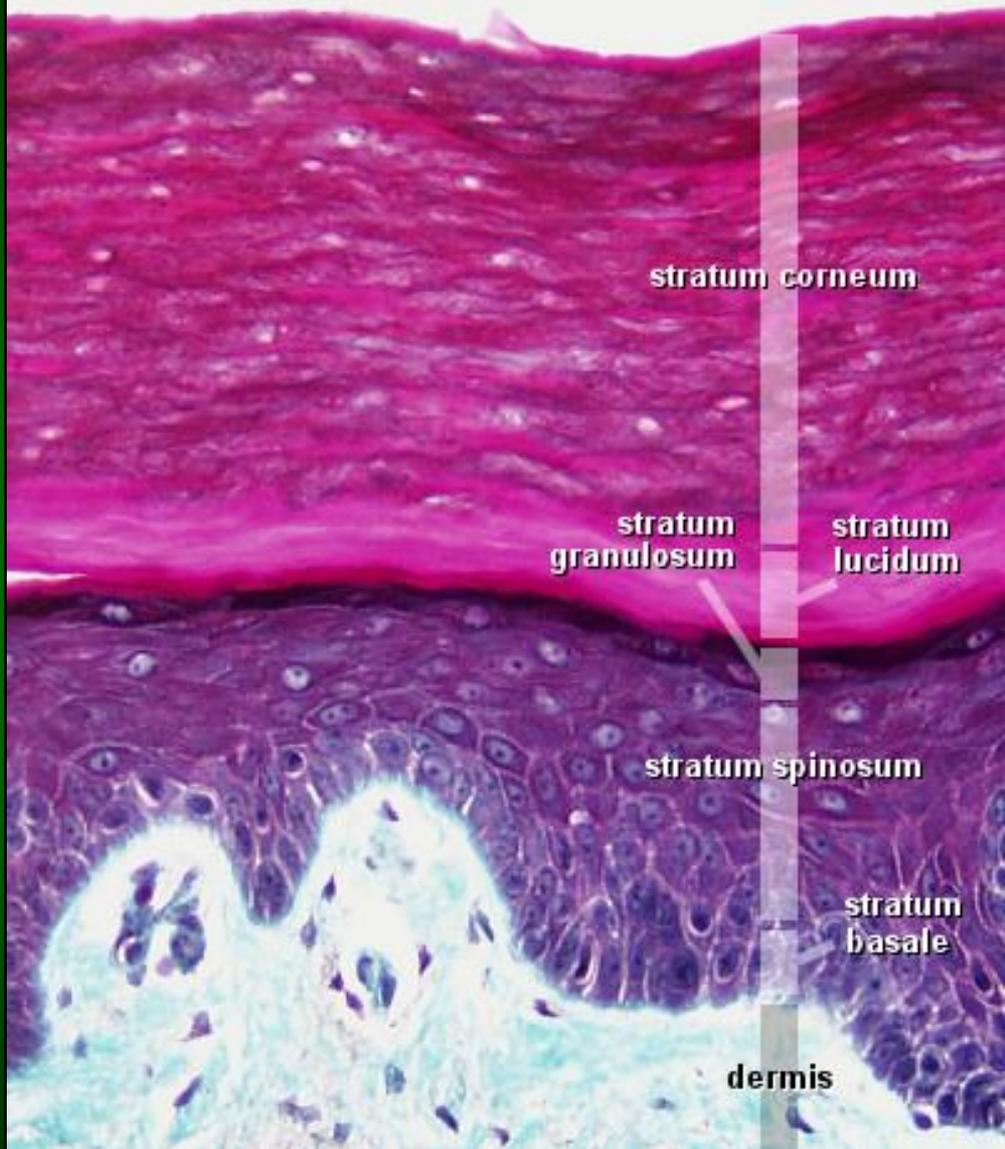
structural support, resist abrasion

intermediate filaments (light microscope) called **cytokeratins**

Skin, thin H&E



Skin, thick trichrome





- **stratum granulosum**

- 1 to 3 rows of squamous cells with many small basophilic granules
 - keratohyalin granules (lamellar granules)
 - soft keratin

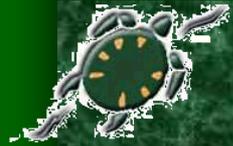
- **stratum lucidum**

- a thin, clear layer of dead skin cells
 - only found on the thick skin
 - non nucleated cells and immature keratin

- **stratum corneum**

- dead squamous cells that lack nuclei and filled with keratin
 - protein that helps keep the skin hydrated
 - also absorb water
 - thickness varies

Pruning, calluses



Skin pruning



Palm calluses

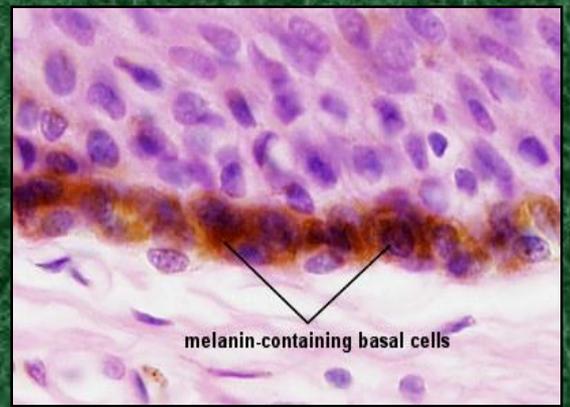
Other cells of the epidermis include

1. Melanocytes
2. Langerhans cells
3. Merckle cells

Melanocytes

- melanin gives the brown colour component of the skin (**melanin**)
- ectodermal in origin, neural crest
- dendritic cells with **no desmosomes** with keratinocytes
- melanosomes for melanogenesis
- mainly in the epidermis basal layer, could not be identified in LM
- found in skin, eye and hair
- **melanogenesis under the effect of**
 - race
 - exposure to light
 - hormones
 - age

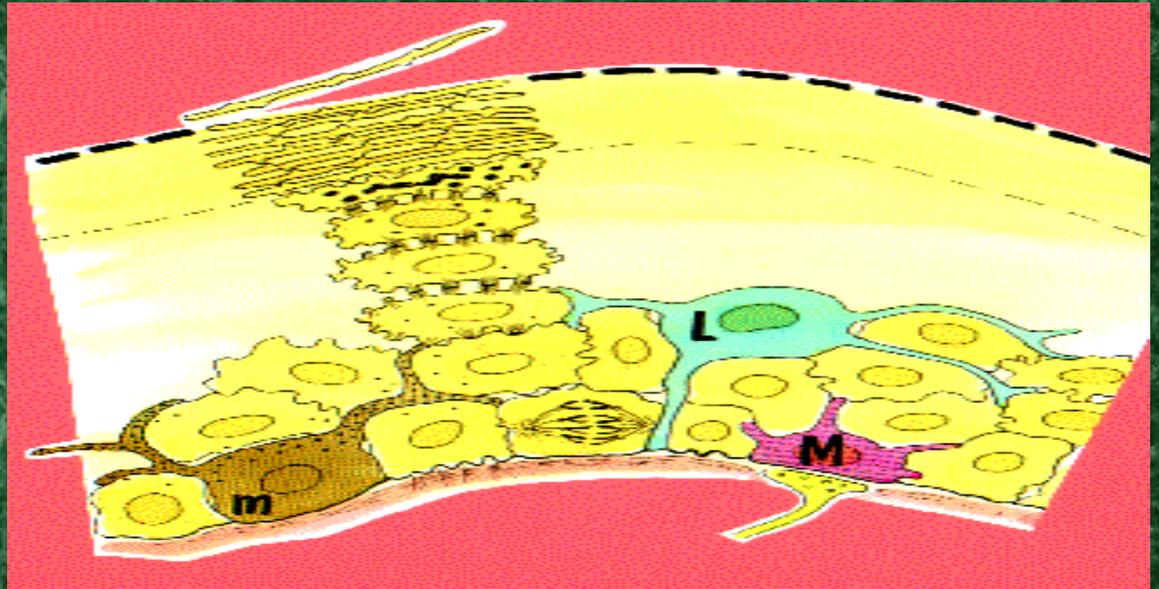
Albinism recessive hereditary condition





Langerhans' cells

- dendritic cells
- contain large granules called Birbeck granules
- important in immune reactions of the epidermis/ macrophages (antigen-presenting cells)
- no desmosomes



Merkel cells

- large oval cells
- numerous cytoplasmic granules
- commonly associated with free nerve endings
- sensory mechanoreceptors / neuroendocrine cells



Dermis

Papillary region

loose areolar CT

fingerlike projections called *papillae*

very well-vascularized

friction ridges occur in patterns

(fingerprint)

arterio-venous anastomoses /thermoregulation

Reticular region

much thicker

dense irregular connective tissue

collagenous, elastic, and reticular fibers

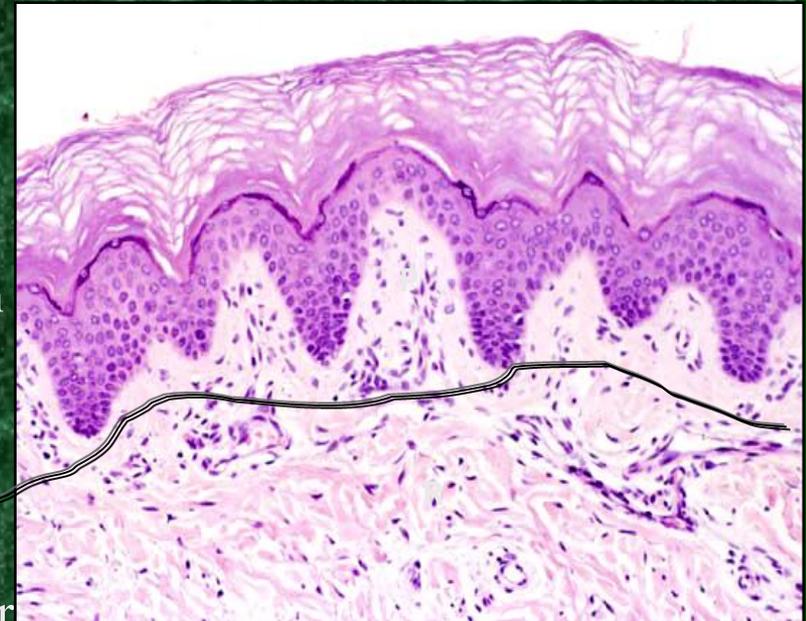
strength, extensibility, and elasticity

aging thickening of the collagen and

lose the elasticity

roots of the hair, sebaceous glands,

sweat glands, receptors, and blood vessels





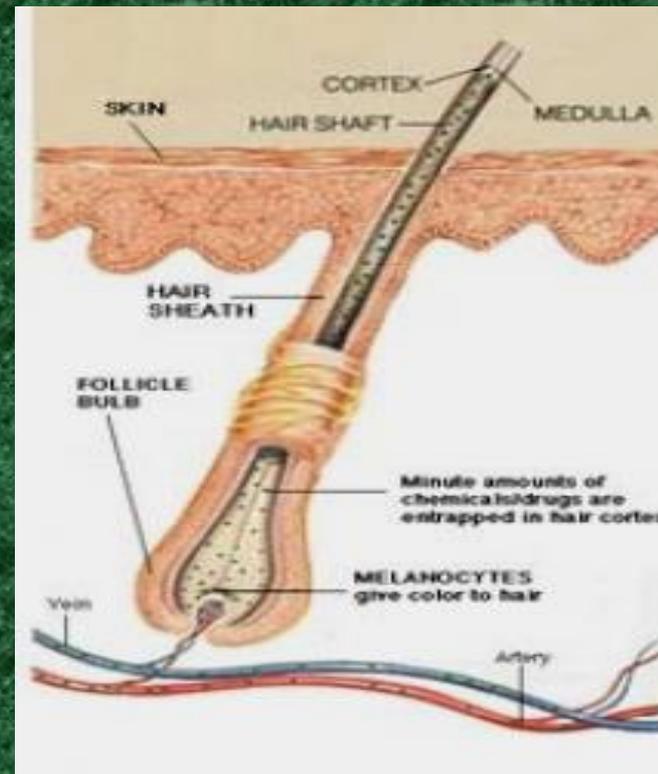
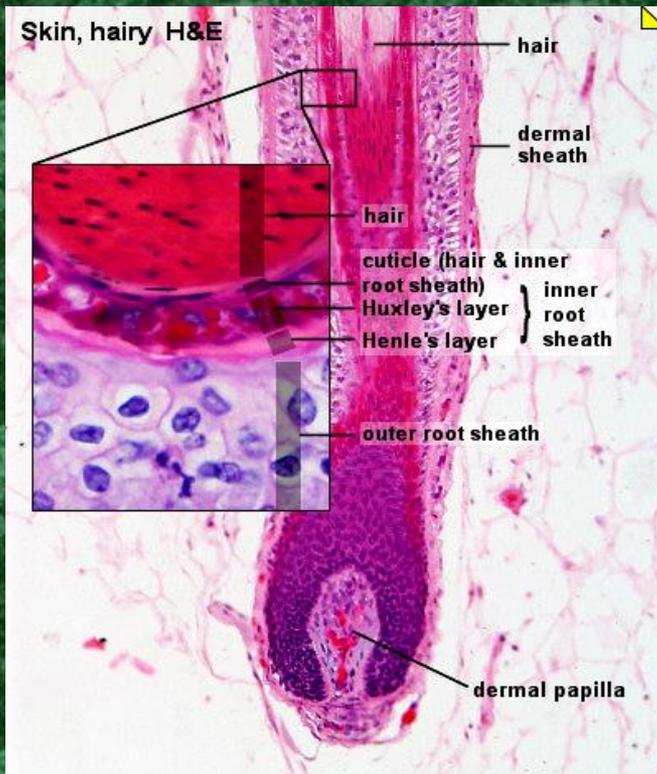
Appendages of the Skin

Hair (hard keratin)

thin filaments of keratin

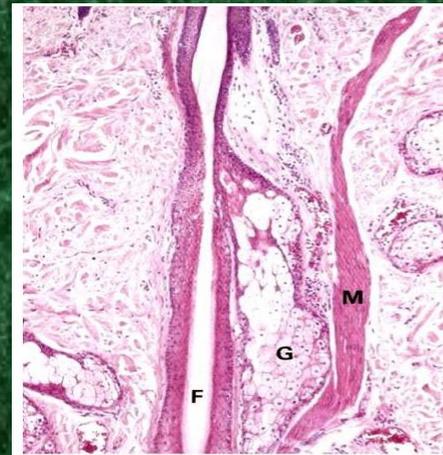
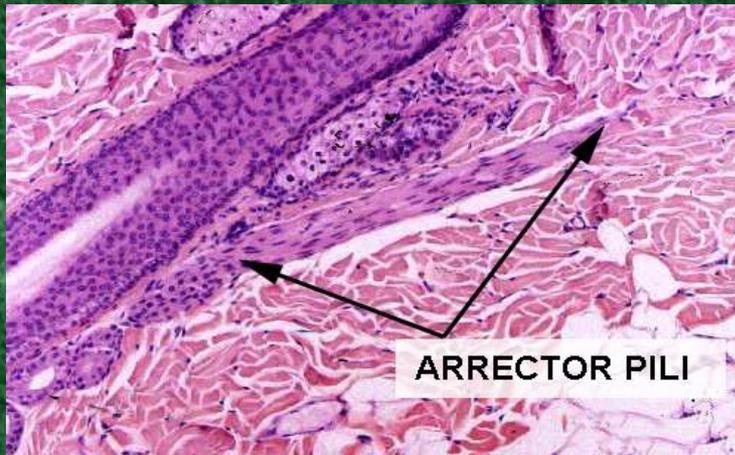
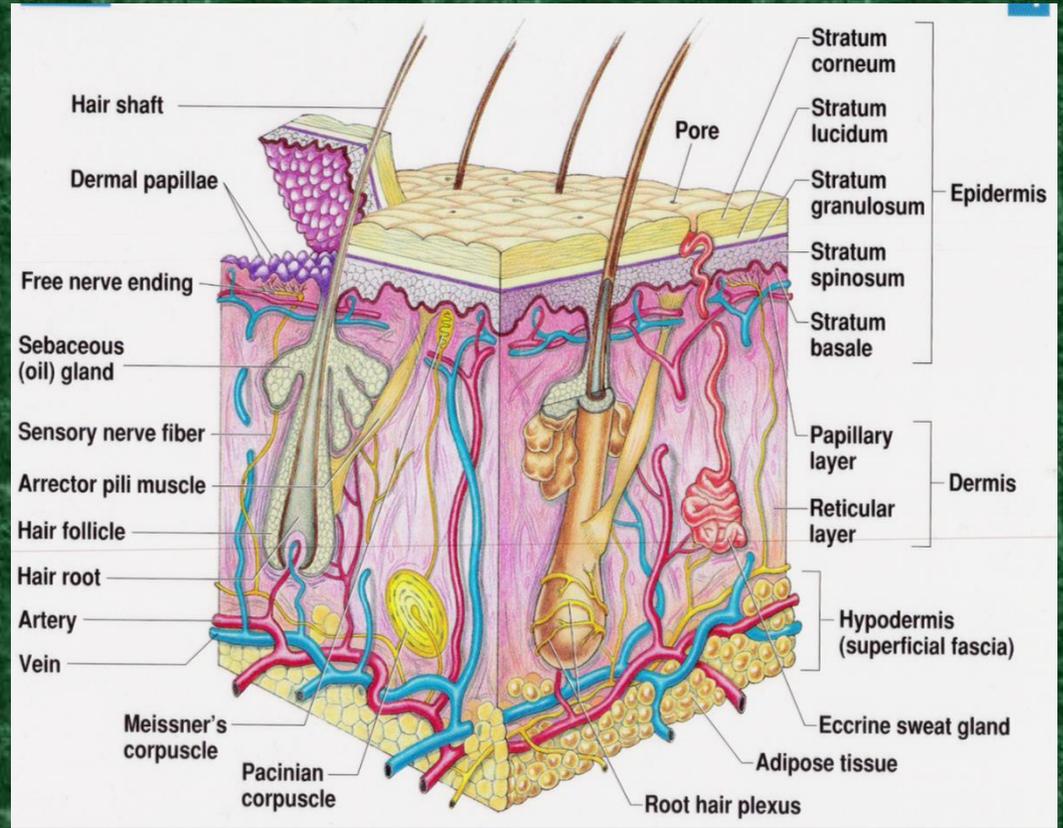
epithelial invaginations of the epidermis

Shaft, root, sheath, hair follicle, bulb, arrector pili muscle



Sebaceous glands

- dermal exocrine glands associated with hairs
- holocrine secretion
- secrete an oily substance (sebum) for hair flexibility
- the sebum secretion is influenced by sex hormones/ adolescence acne



F= hair follicle
 G= sebaceous gland
 M= arrector pili muscle



Sweat glands

- **Eccrine sweat glands** (Merocrine sweat glands)

all over the body.

coiled tubular glands

body temperature regulation.

cholinergic innervations/

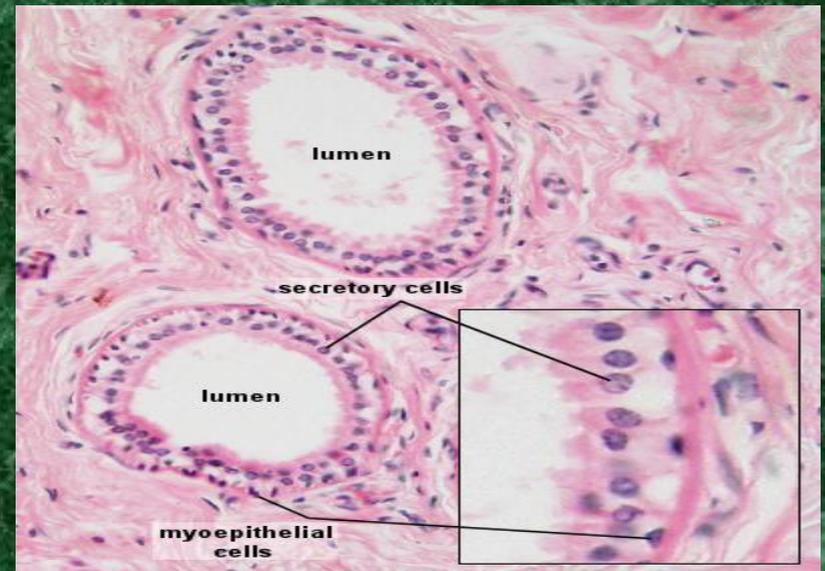
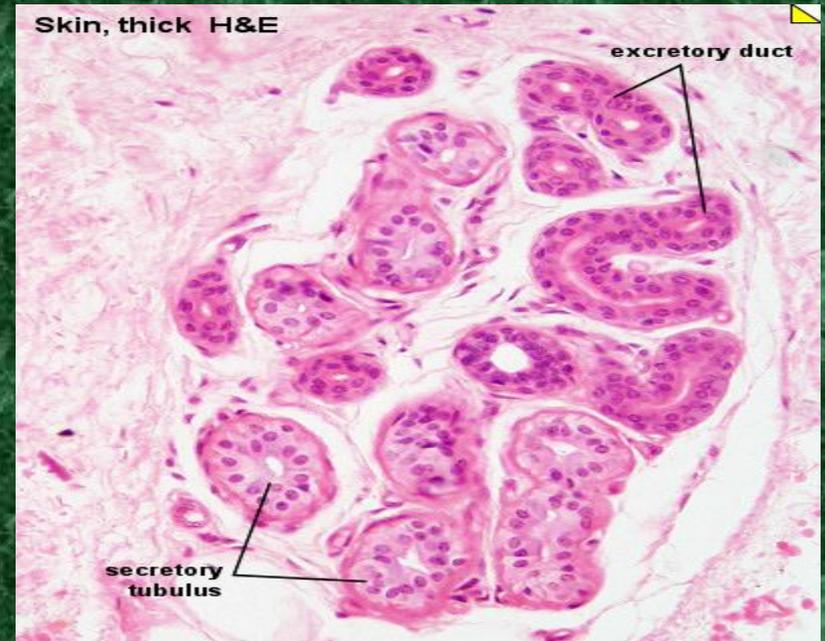
respond to heat.

- **Apocrine sweat glands**

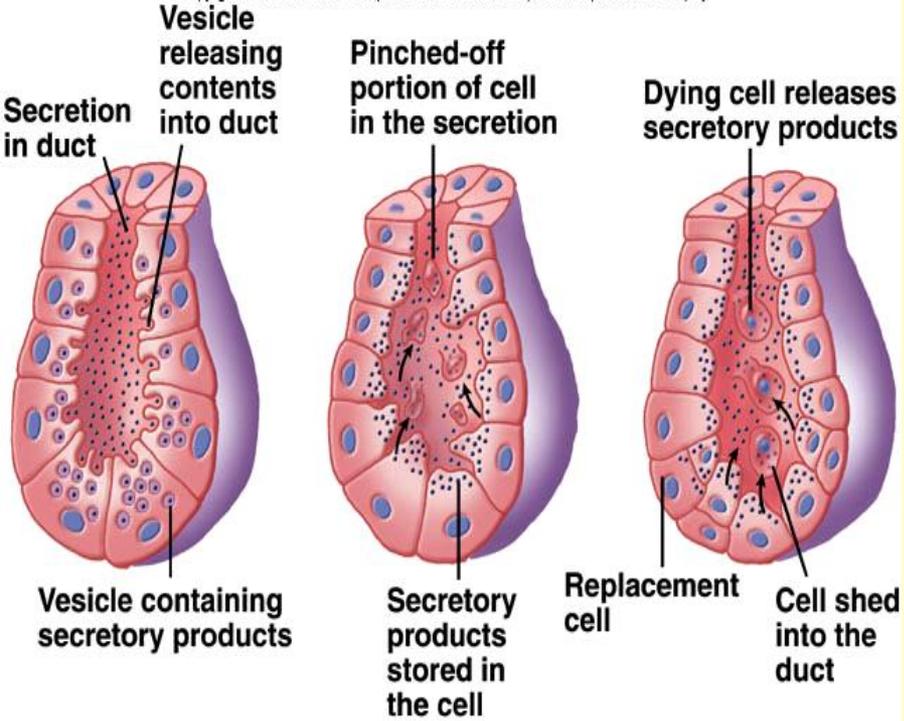
large /axilla /external genitalia
and anus

functional at puberty

adrenergic innervation/ respond
to emotional and sensory stimuli

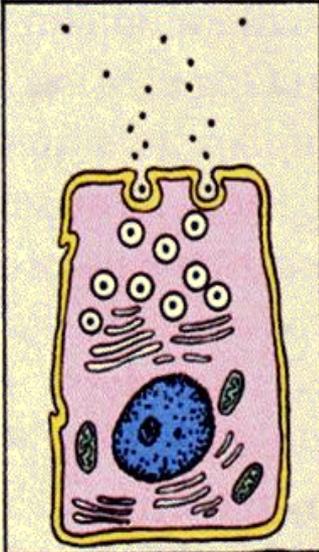
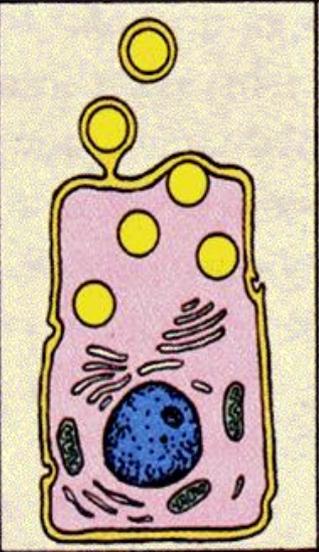
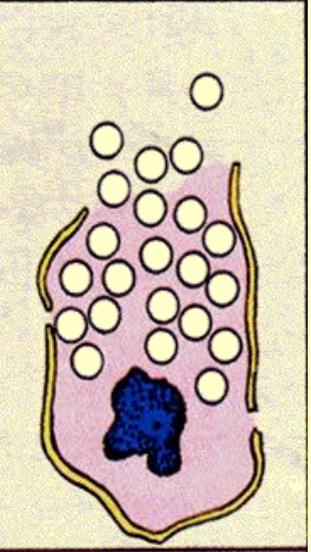


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(a) Merocrine gland (b) Apocrine gland (c) Holocrine gland

Exocrine Glands

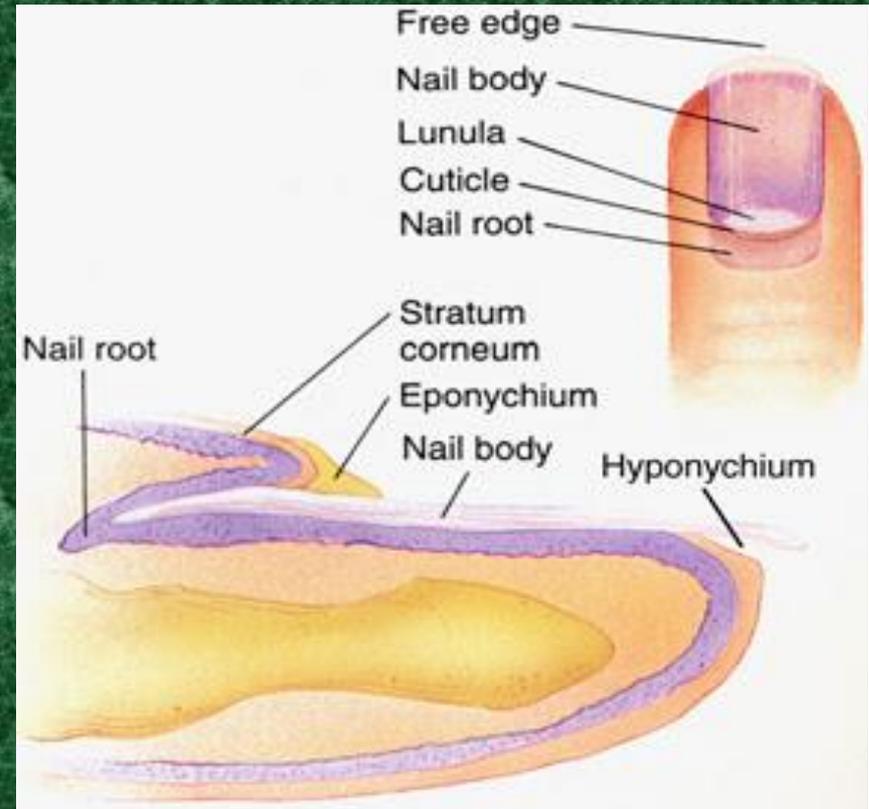
Merocrine	Apocrine	Holocrine
		



Nails

plates of keratin

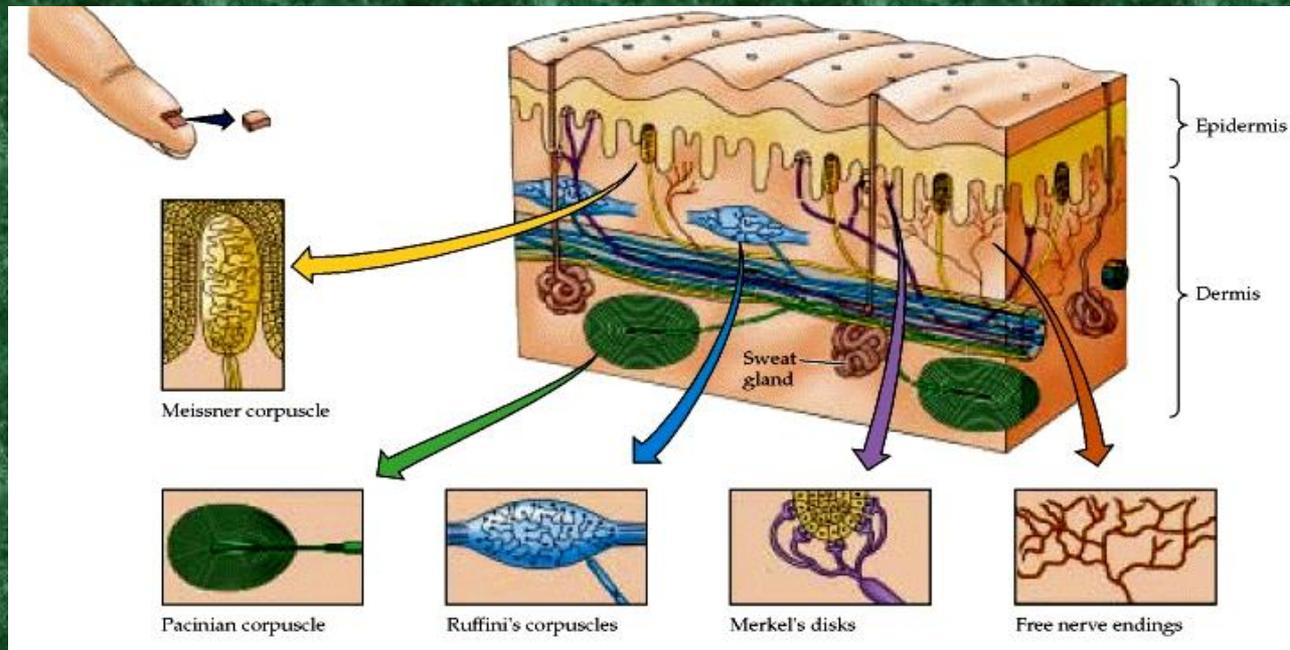
nail plate, nail bed, nail groove, nail root, dorsal and ventral matrix, lunula eponychium or cuticle, hyponychium



Nerve supply

-**Free** such as free endings, Merkel's disc and hair follicle receptors.

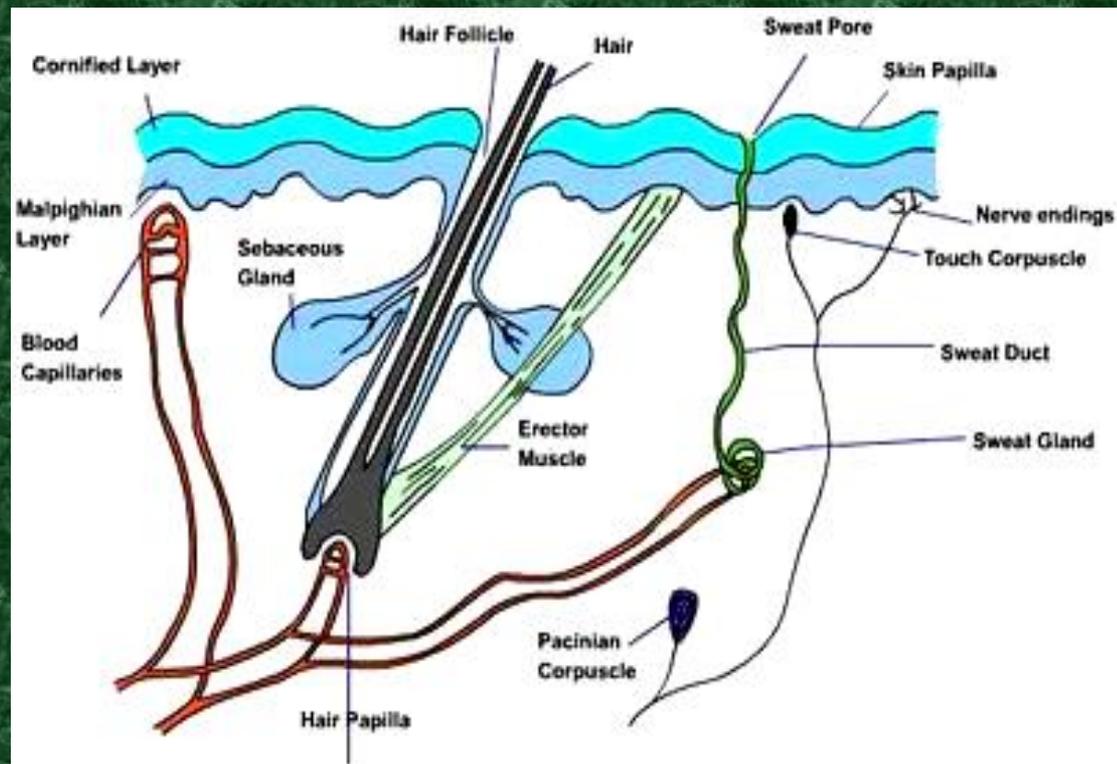
- **Encapsulated terminals** such as tactile (Meissner's) corpuscles, bulboid corpuscles (Krause's end bulb), lamellar (Pacinian) corpuscles, and Ruffini's corpuscles





Free nerve endings

no complex sensory structures/ **non-encapsulated**/ epidermis/ sense pain and temperature.



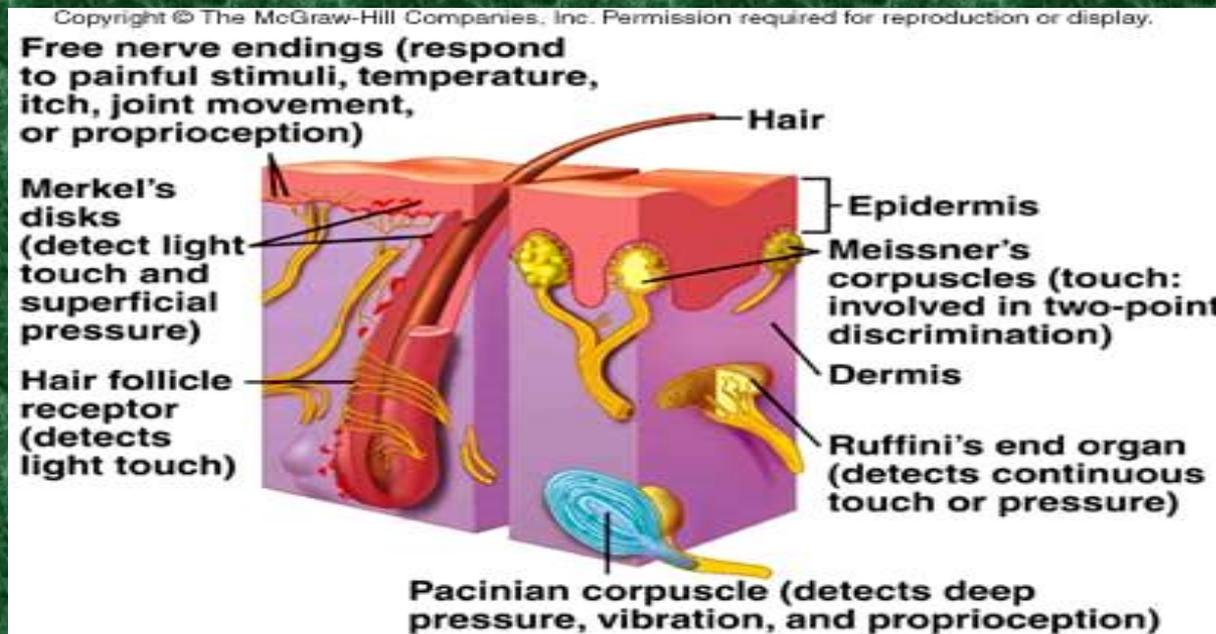


- **Merkel disk receptor**

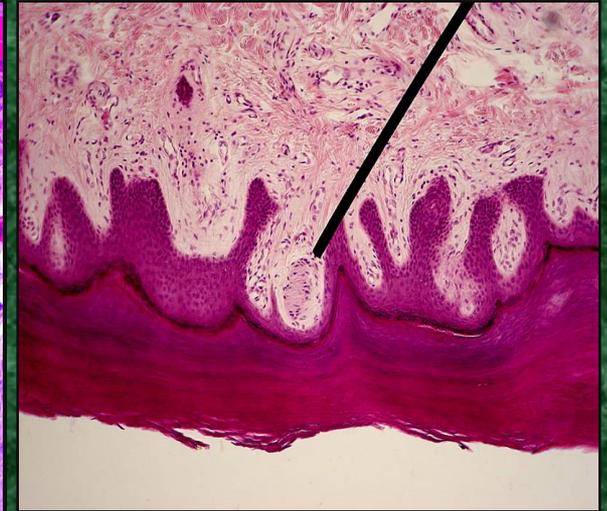
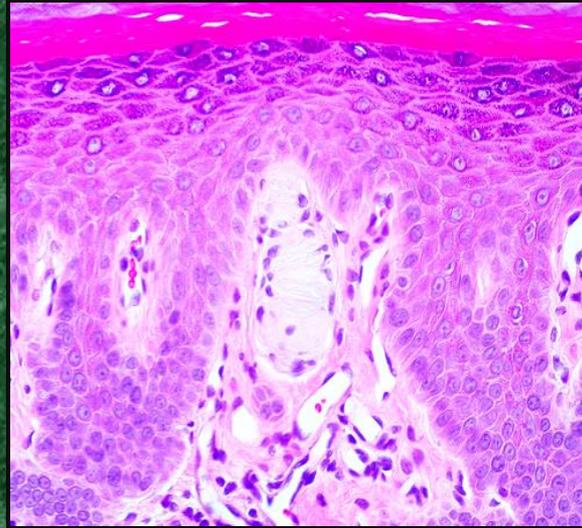
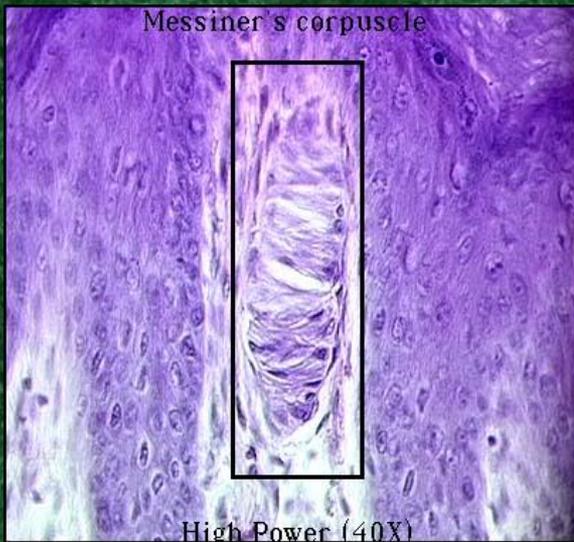
- **non- encapsulated** mechanoreceptors/ surrounding hair follicles/ **touch/ basal layer/ the most sensitive** of the main types of mechanoreceptors to **vibrations at low frequencies**

- **Hair follicle receptors**

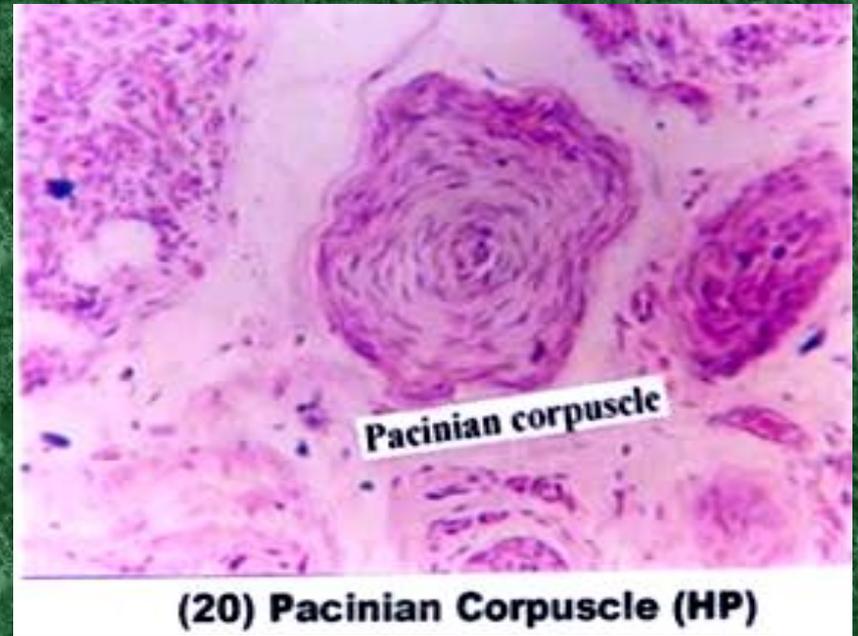
- these mechanoreceptors sense the **presence and direction of hair displacement.**



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- **Meissner's corpuscles (or tactile corpuscles)** encapsulated mechanoreceptors present in the dermal papilla / sensitivity to **light touch** (sensitive to **low frequency stimuli**) / **do not** detect pain/ their number drops with age

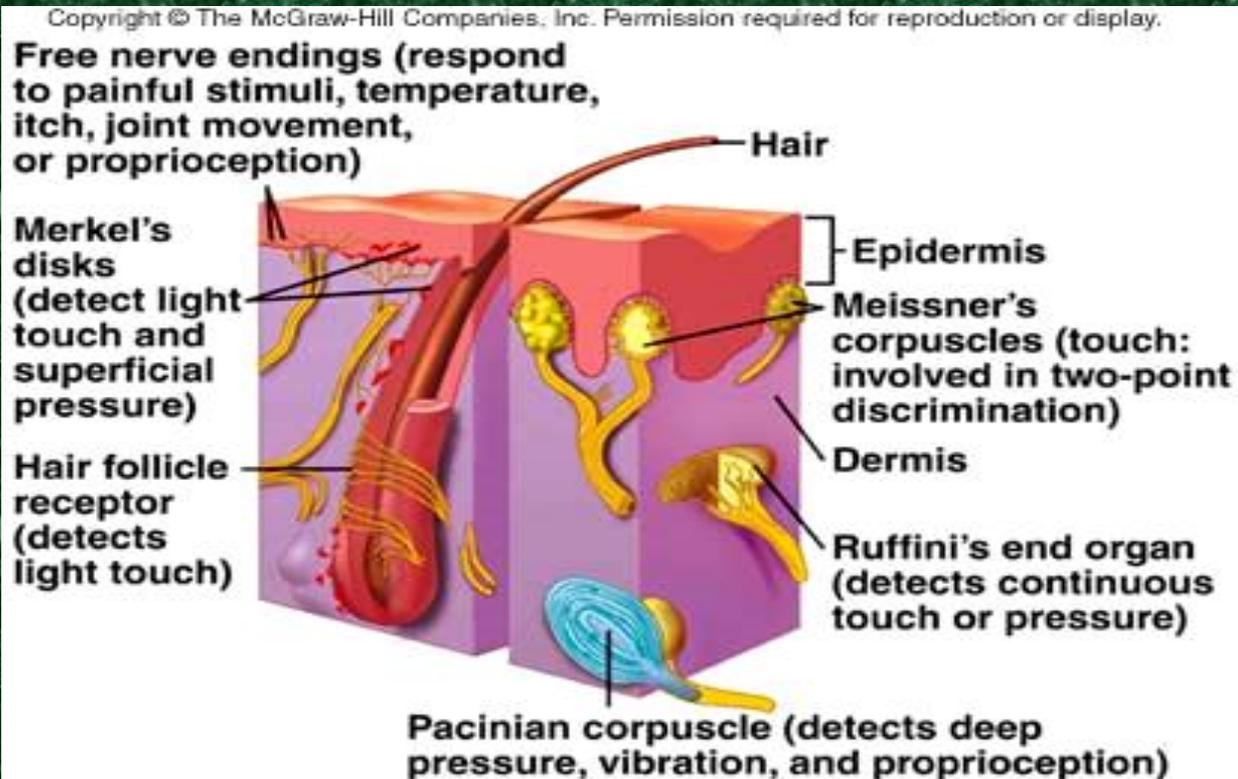


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- **Pacinian corpuscles** dermis of thick skin of fingers /respond to **pressure and vibration**. large **receptive field** on the skin's surface with an especially sensitive center. **larger and fewer than others**





Ruffini's corpuscles – are encapsulated mechanoreceptors /deep in the **reticular layer** where they respond to **distortion or stretching** of the skin (sustained or **continuous stress**)



- 
- **Krause end bulbs (bulboid corpuscles)** encapsulated mechanoreceptors in the papillary layer dermis oral mucosa of the oral cavity and tongue / respond to **cold** and low-frequency **vibration**

