



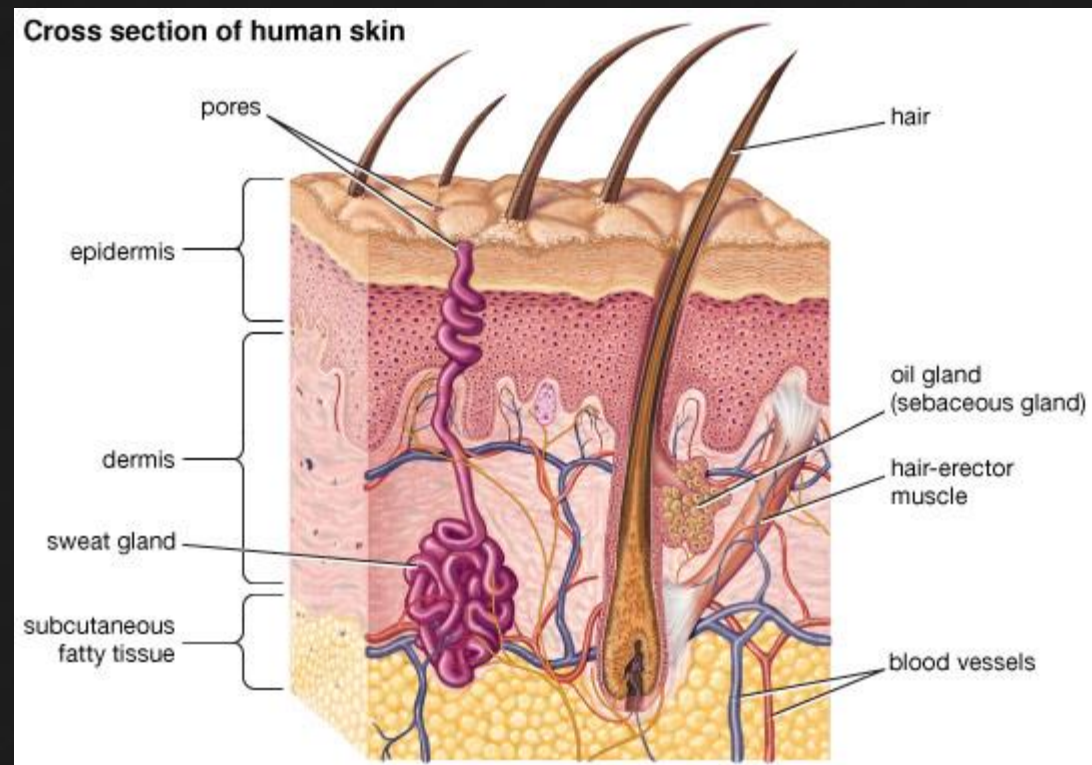
Skin

Alžběta Blanková



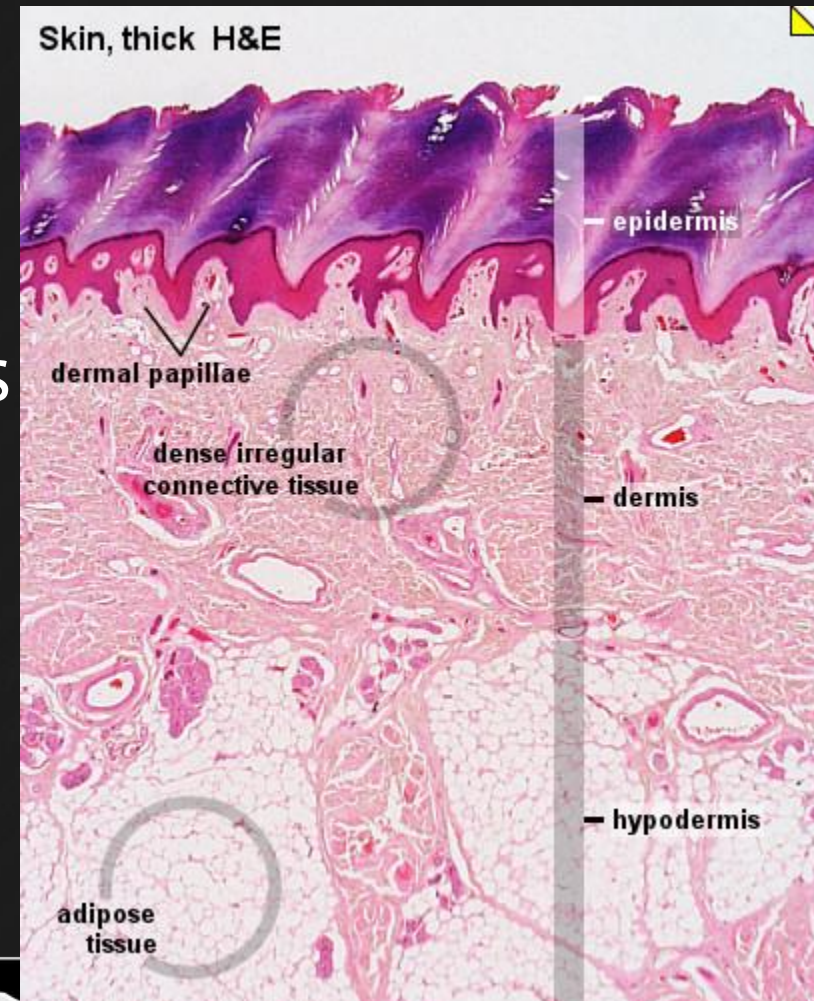
Skin

- Epidermis
- Dermis
- Tela subcutanea
- Skin adnexa
- 8-16% of weight
- 1,2-2,3 m² (1,73 m²)



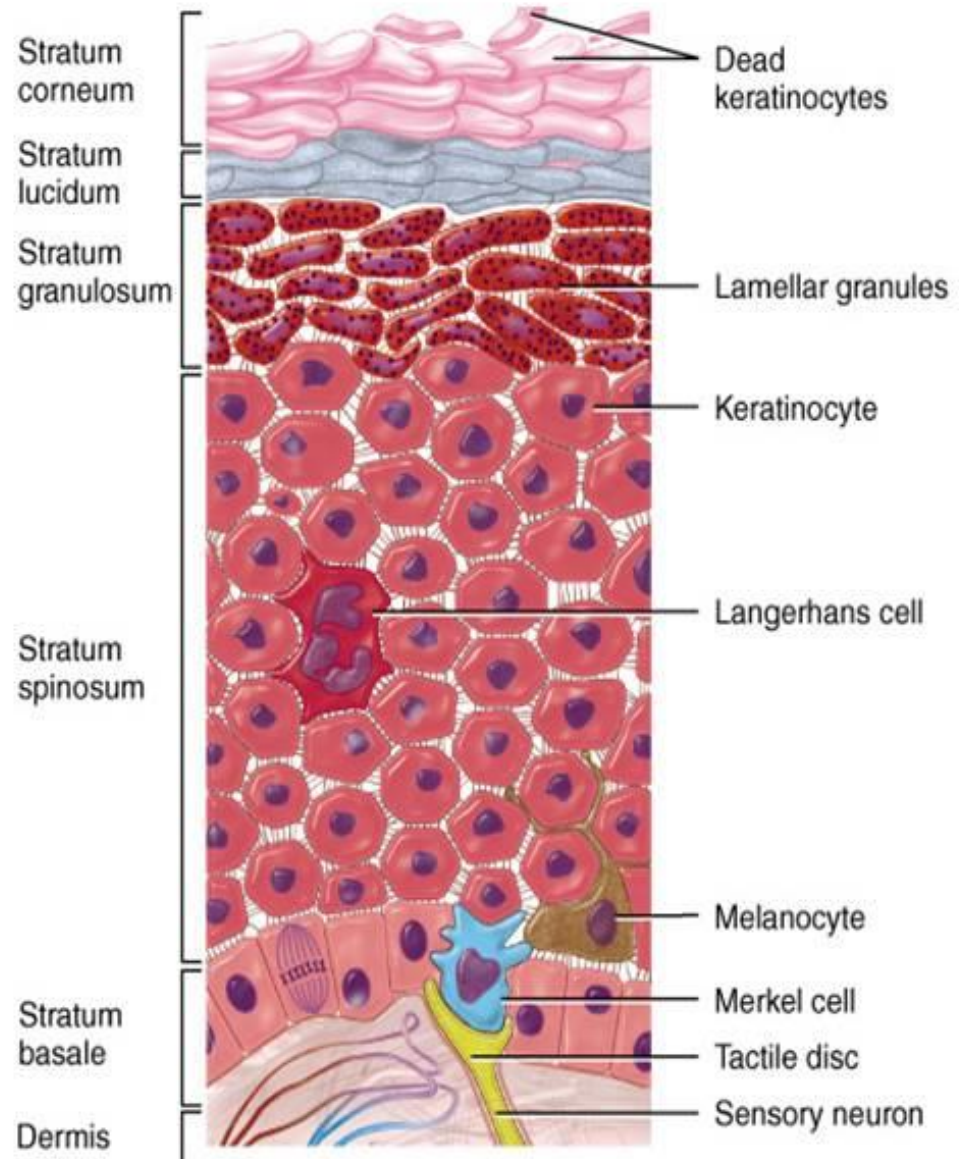
Epidermis

- Keratinized stratified squamous epithelium
- Keratinocytes
- Melanocytes
- Dendritic Langerhans cells
- Merkel cells
- 5-6 layers – according to localization

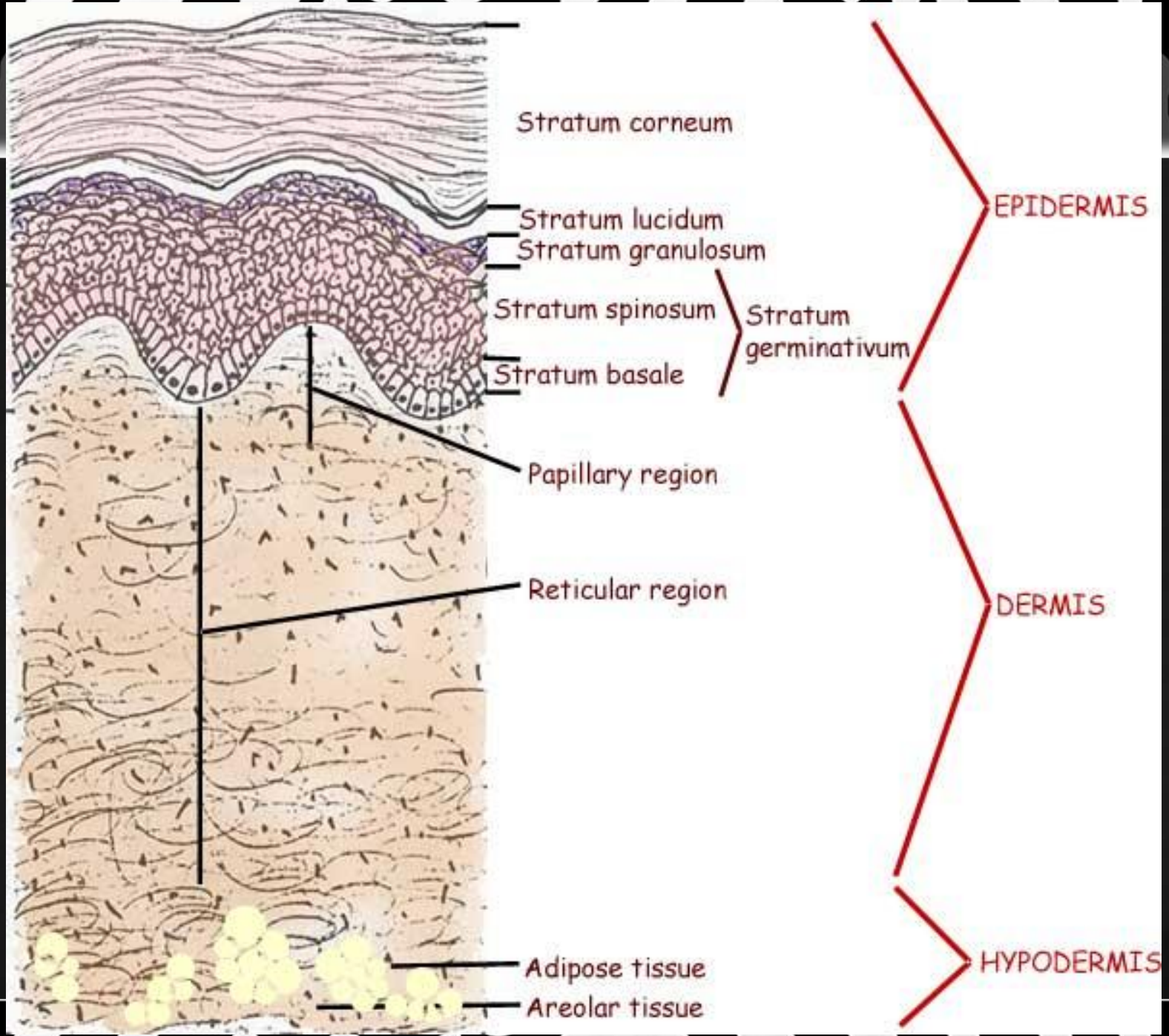


Layers of epidermis

- Stratum basale
- Stratum spinosum
- Stratum granulosum
- Stratum lucidum
- Stratum corneum
- (stratum disjunctum)



Stratum basale + stratum spinosum = stratum germinativum

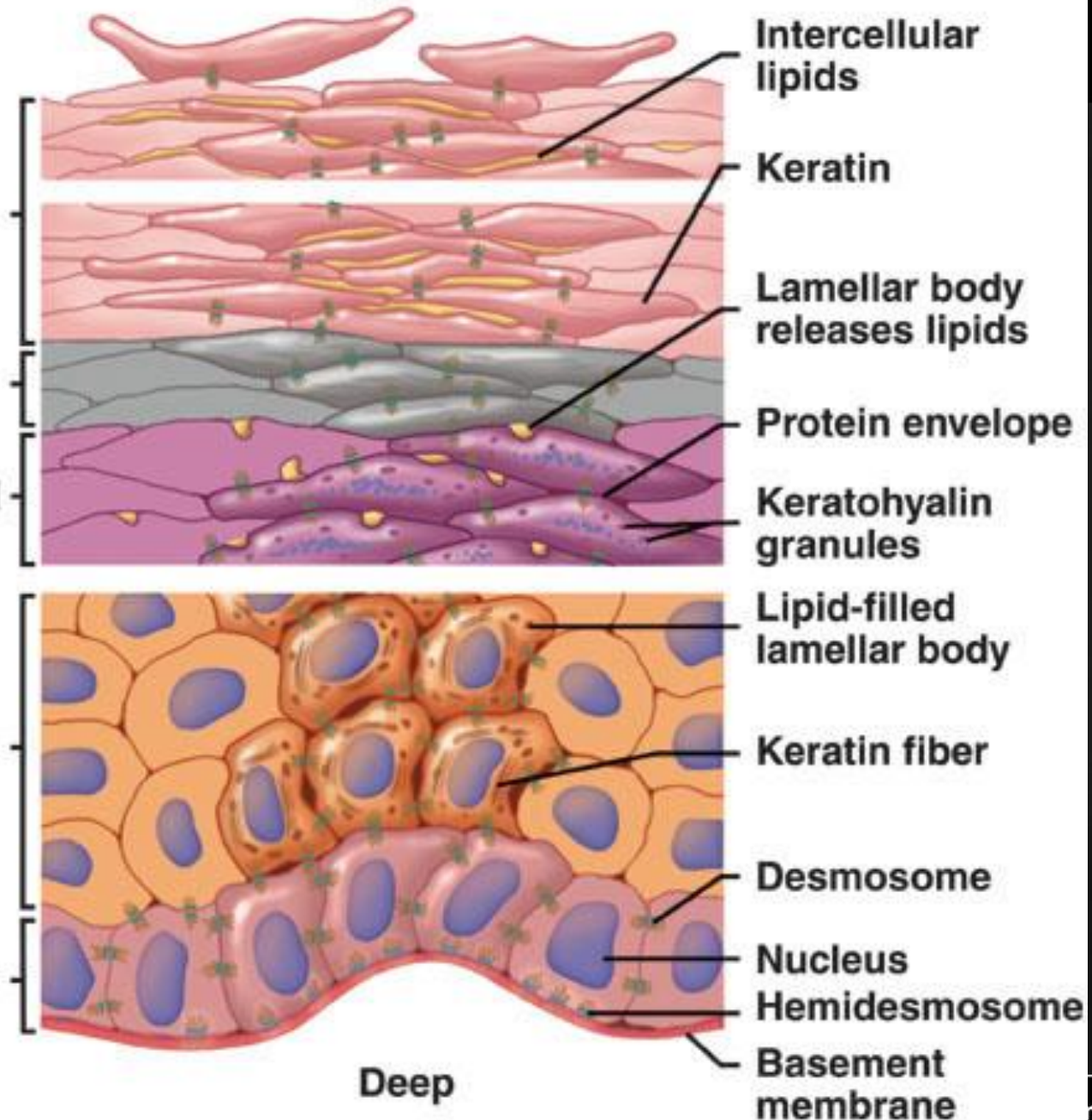


Stratum basale

- 1 layer of columnar (cuboidal) cells on basal lamina
- Basophilic – mitotic activity (stem cells)
- Restoration of epidermis (15-30 days)
- contain filaments of cytokeratin (10 nm)
 - Increasing towards surface

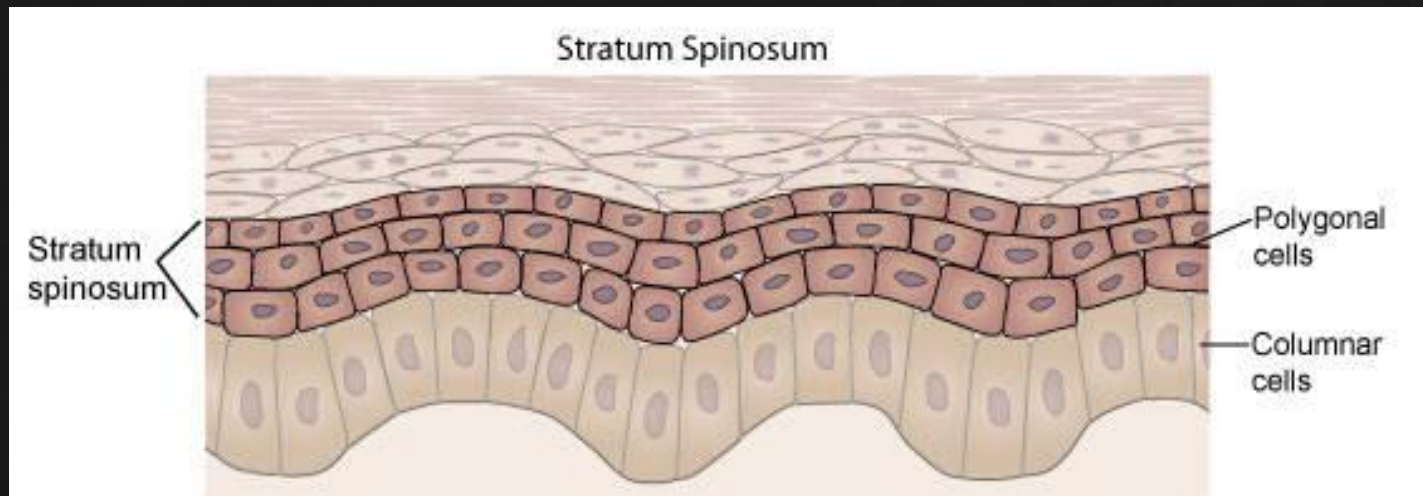
Superficial

5. **Stratum corneum**
Dead cells with a hard protein envelope; the cells contain keratin and are surrounded by lipids.
4. **Stratum lucidum**
Dead cells containing dispersed keratohyalin.
3. **Stratum granulosum**
Keratohyalin and a hard protein envelope form; lamellar bodies release lipids; cells die.
2. **Stratum spinosum**
Keratin fibers and lamellar bodies accumulate.
1. **Stratum basale**
Cells divide by mitosis and some of the newly formed cells become the cells of the more superficial strata.



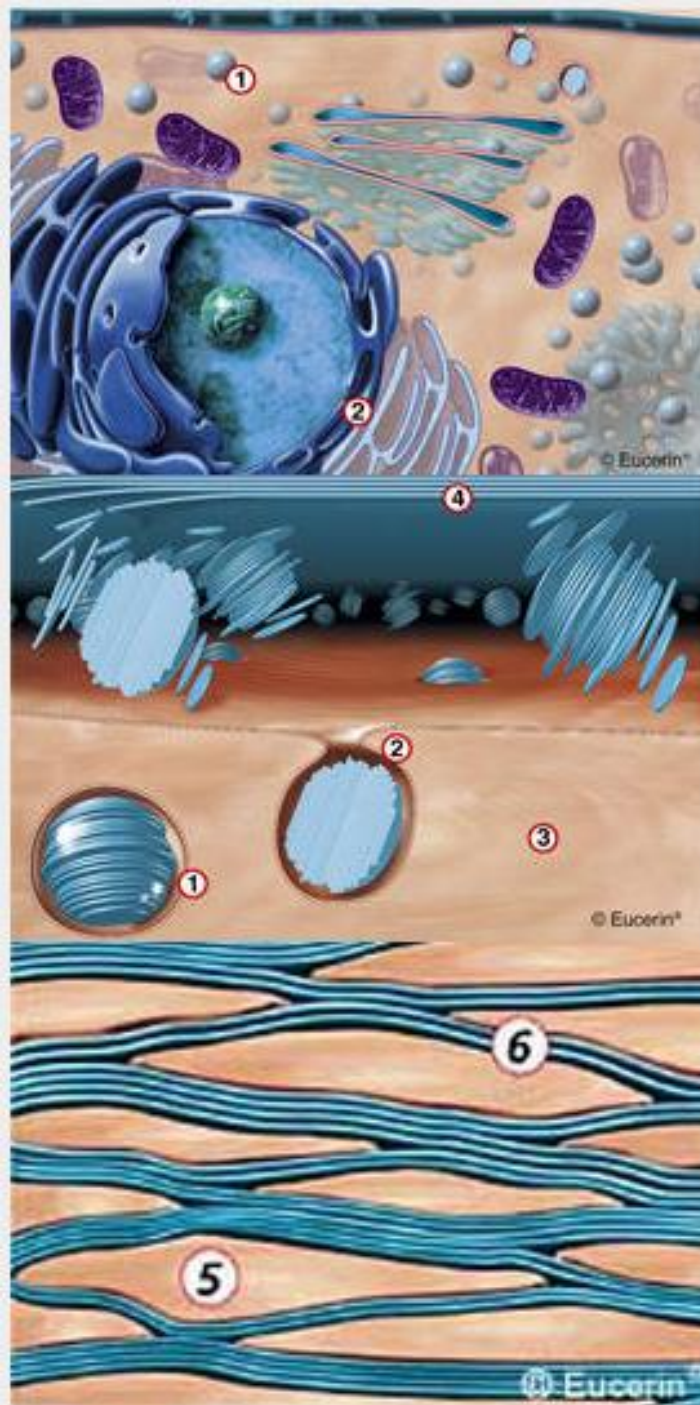
Stratum spinosum

- Polygonal cells with spiny processes – desmosomes
- 2-5 layers
- Thickest layer
- **Stratum basale + stratum spinosum = stratum germinativum**



Stratum granulosum

- 3-5 layers of cells
- Granules with **keratohyalin** (basophilic, lack membrane)
 - Precursor of keratin
- Production of **profilaggrin**
 - Precursor of filaggrin
- **Membrane-coating granules** (lamellar Odland bodies)
 - Lipids (glucosylceramides), enzymes, proteins (corneodesmosin)
 - Released through exocytosis into intercellular space
 - Response to environmental stress



The epidermal lipids are produced in the Golgi apparatus of the keratinocytes in the upper layers of the prickle cell layer.

1. **Odland bodies**
2. **Golgi apparatus**
3. **Exocytosis**
4. **Cell of the stratum granulosum**
5. **Corneocytes**
6. **Bilayer lipid membrane**

The lipids are stacked in the Odland bodies and finally emptied into the extracellular space of the upper granular layer (exocytosis).

The epidermal lipids form the cement that holds the corneocytes tightly together (brick and mortar model).

Stratum lucidum

- in thick skin with prominent cornification
- flat eosinophilic cells filled filled with **eleidin**
- nuclei and organelles indistinct

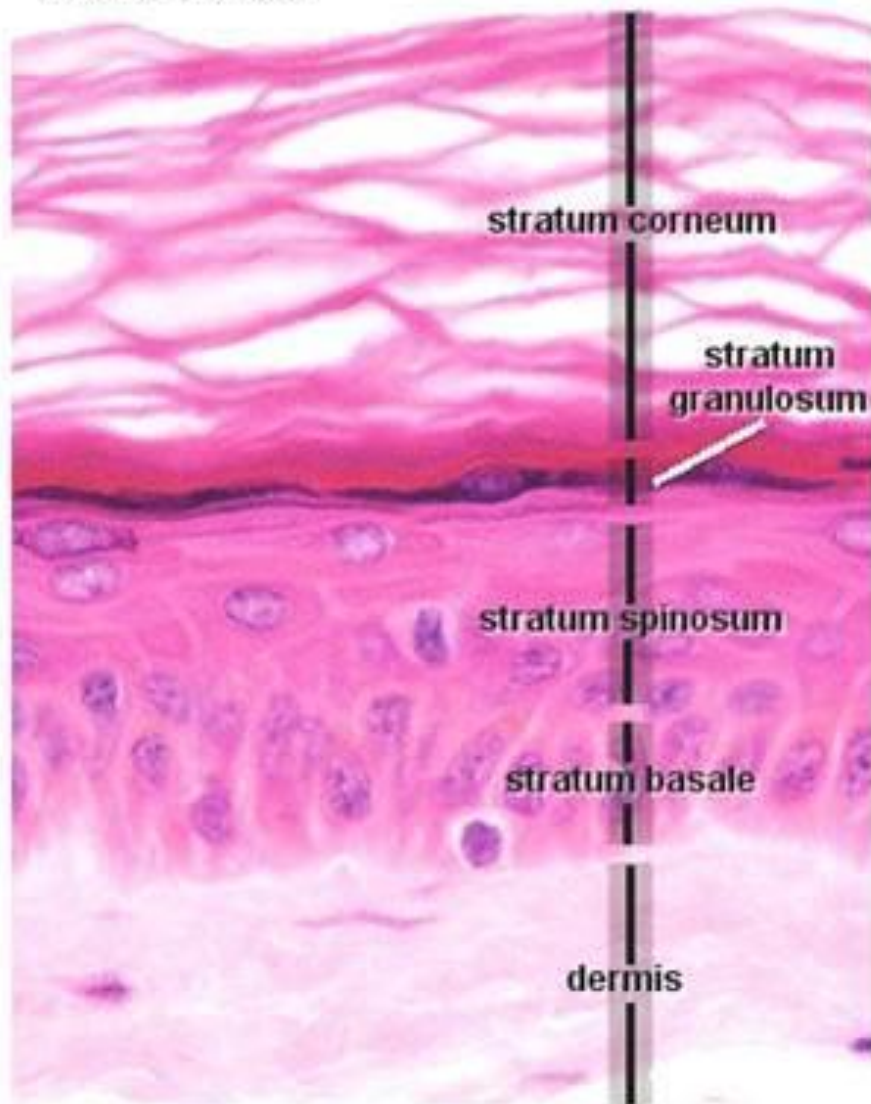


Stratum corneum

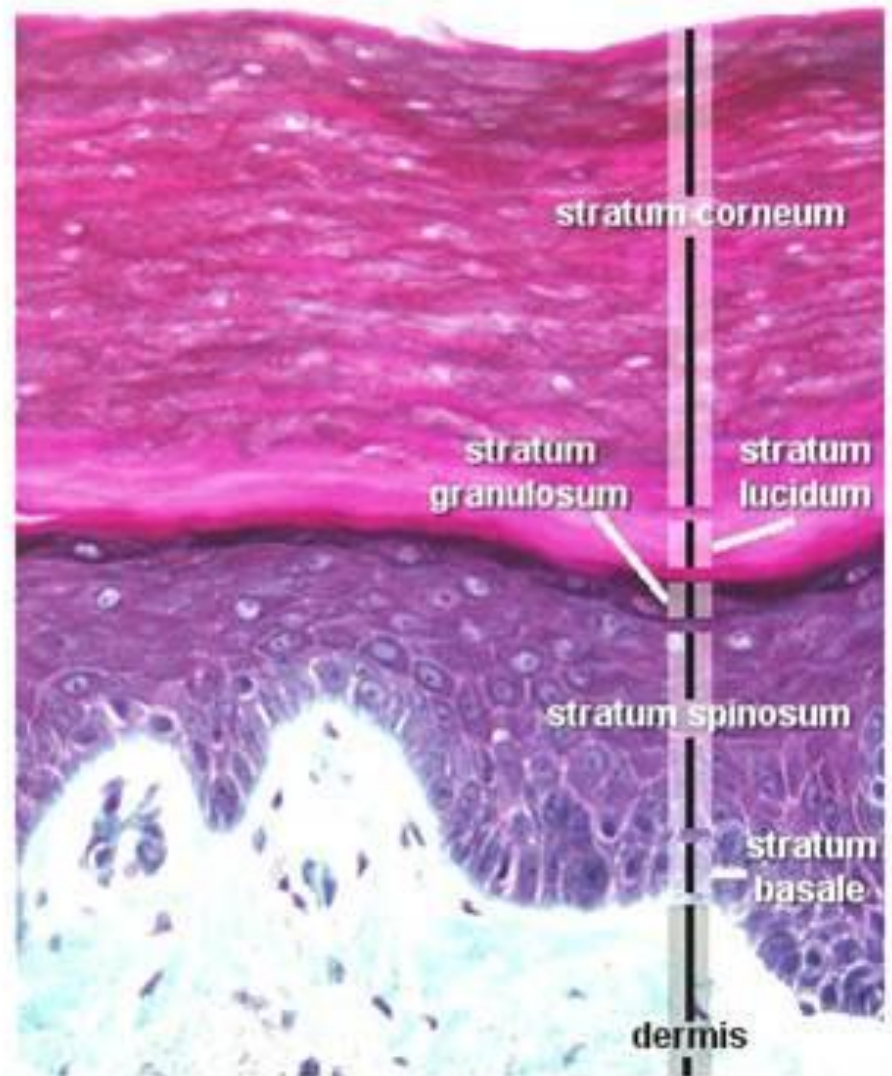
- 15-20 layers of flat cells
- Cells lack nuclei and organelles
- cytoplasm filled with **KERATIN**
 - Assembled into fibers by keratin filament associated proteins (filaggrin)

- **Stratum disjunctum** – thin outermost layer of exfoliating dead cells

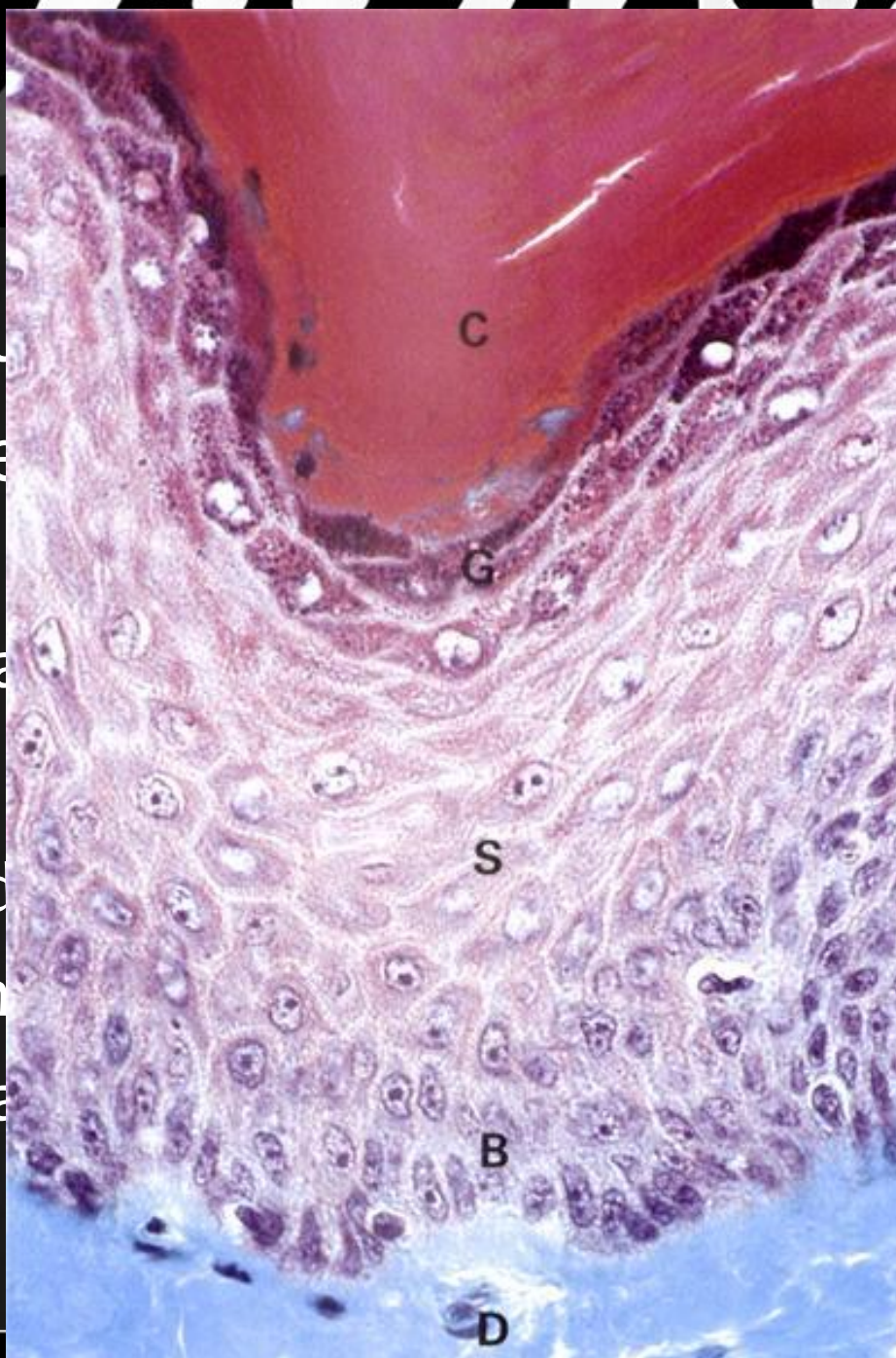
Thin Skin



Thick Skin

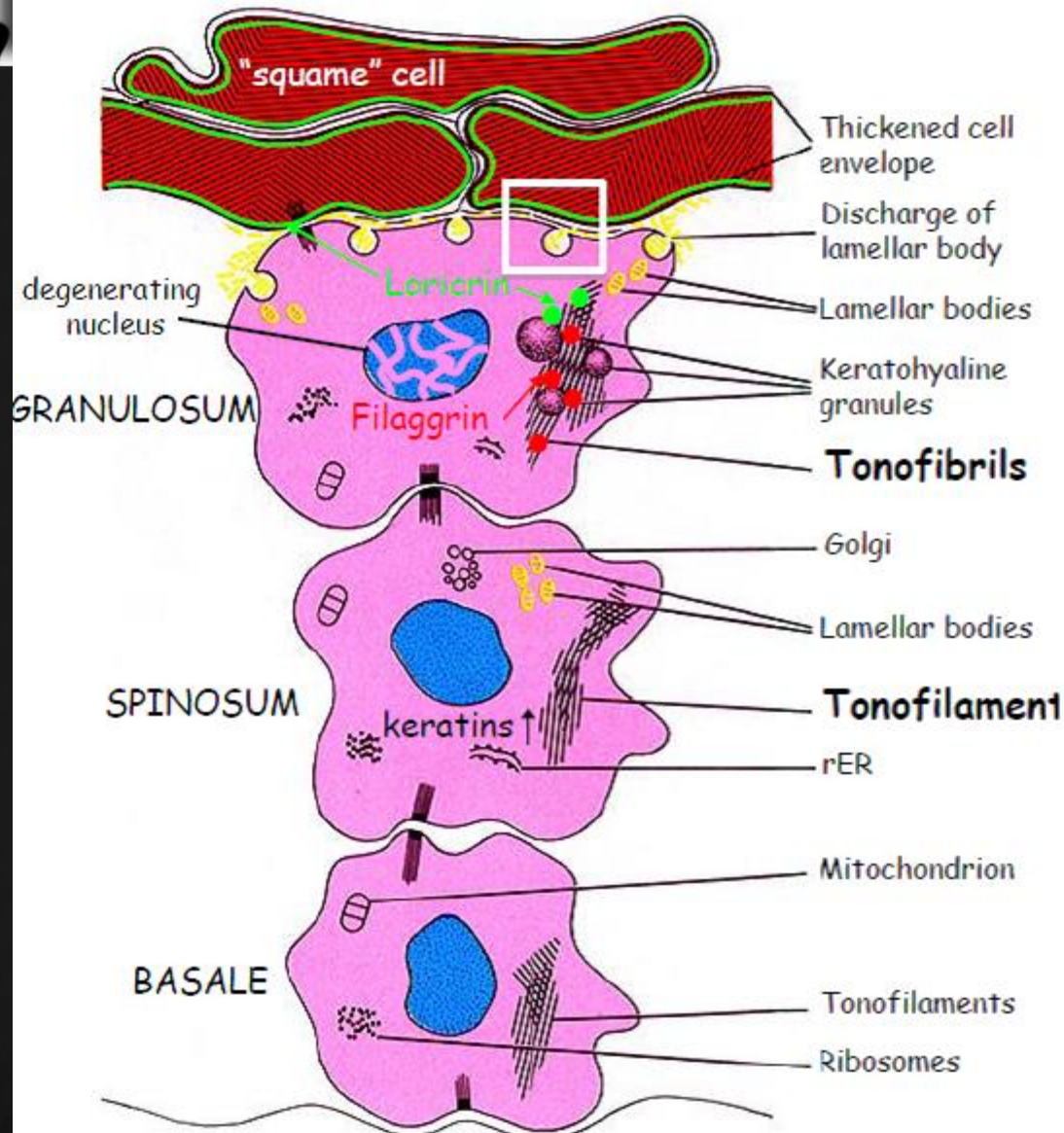


- Str. granu
- Str. corne
- filaggrin
 - Aggrega
- **Keratin**
 - Scaffold
 - Mechan
 - Cell pola

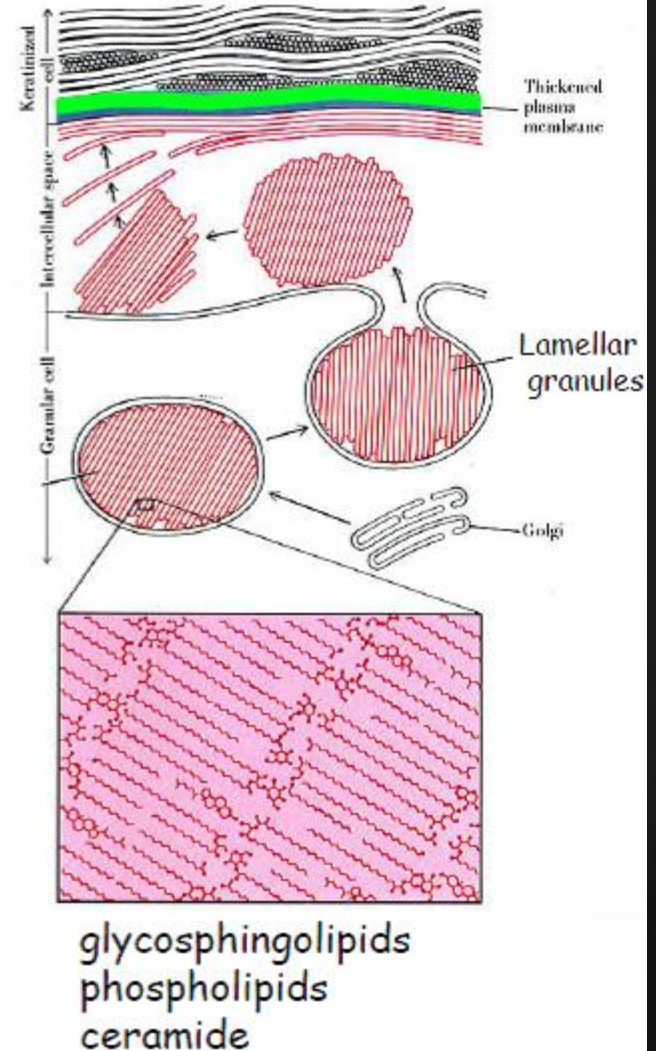


of filaggrin
 into
 fibrils

Keratinization



Lamellar granules



Skin surface

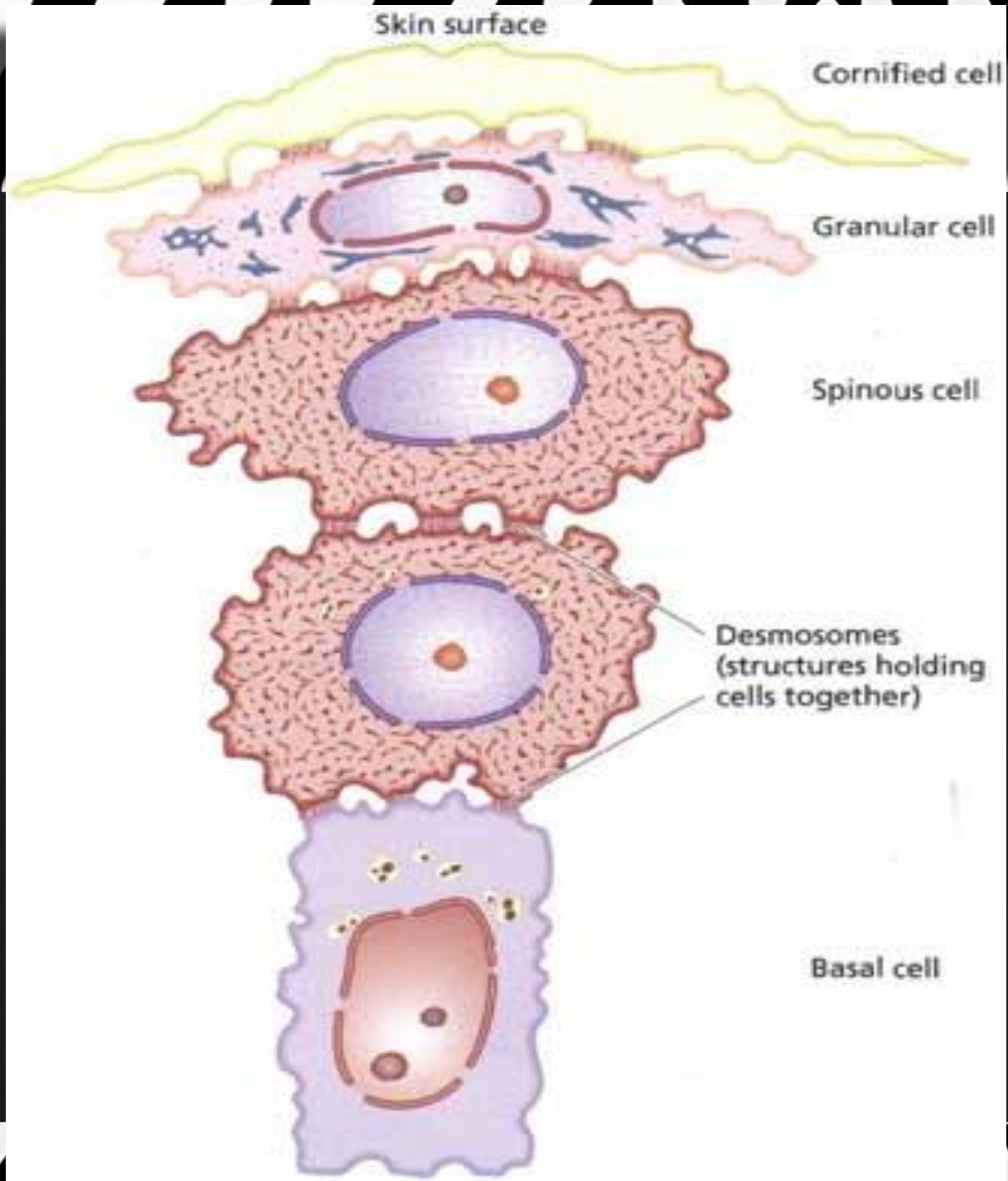
Cornified cell

Granular cell

Spinous cell

Desmosomes
(structures holding
cells together)

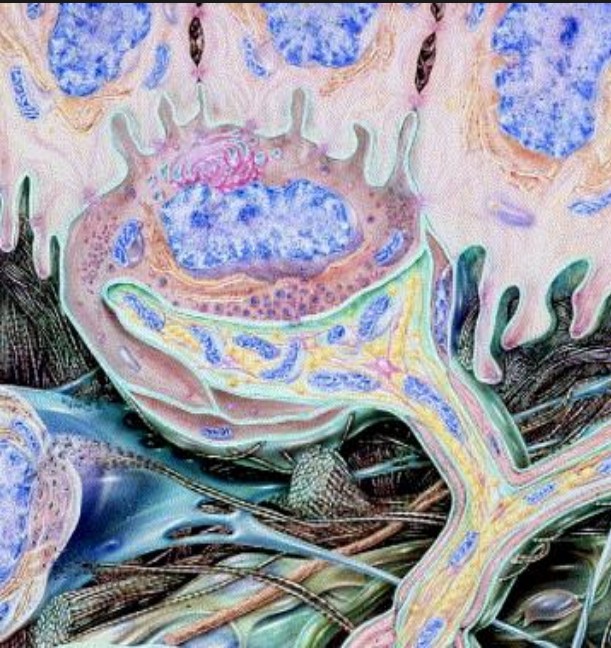
Basal cell



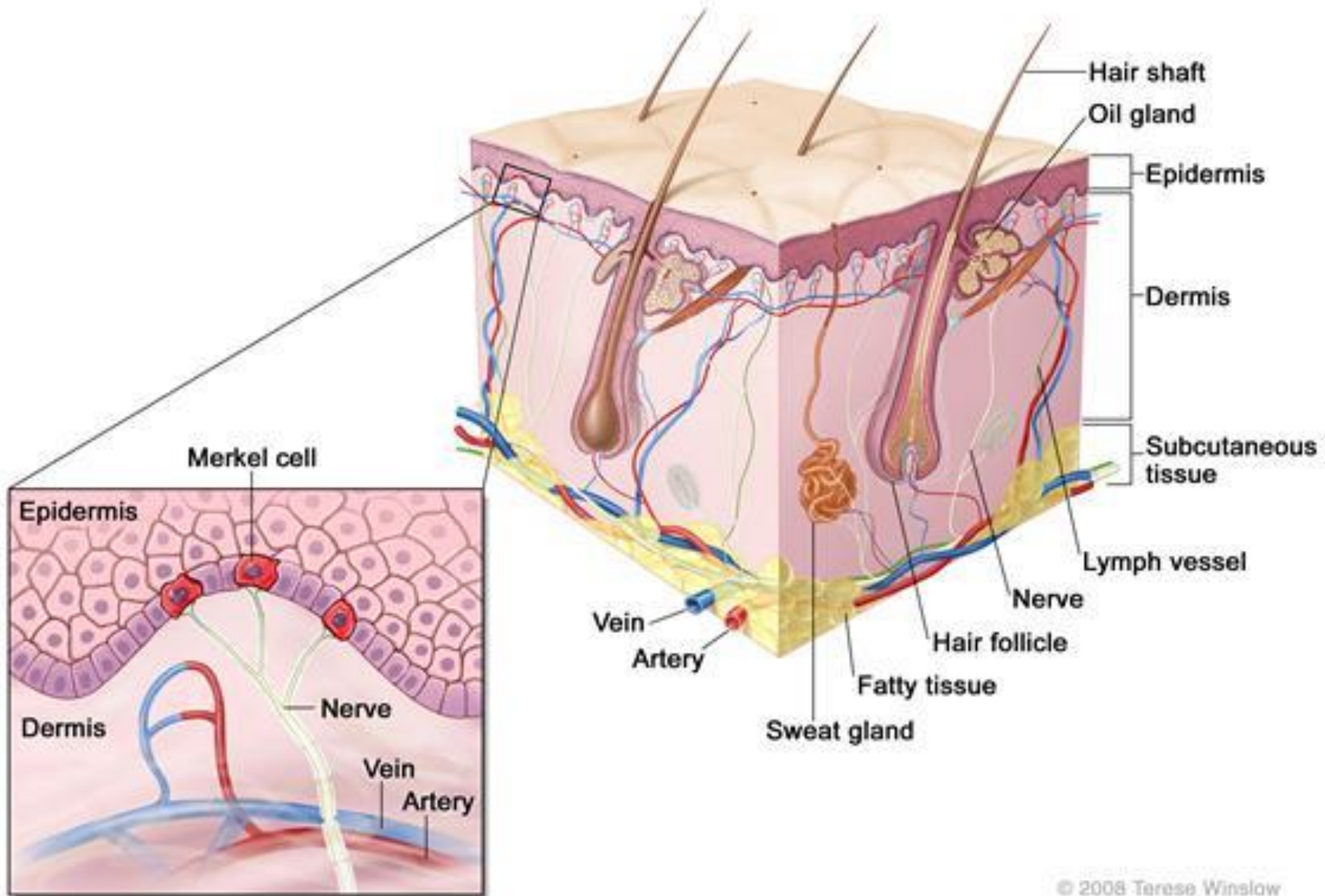
Merkel cells

TACTILE EPITHELIAL CELLS

- ectodermal origin (crista neuralis)
- Light touch sensation (fingertips)
- Merkel nerve endings (synapses with somatosensory afferent nerve fibers)
- Eosinophilic granula with neuropeptides

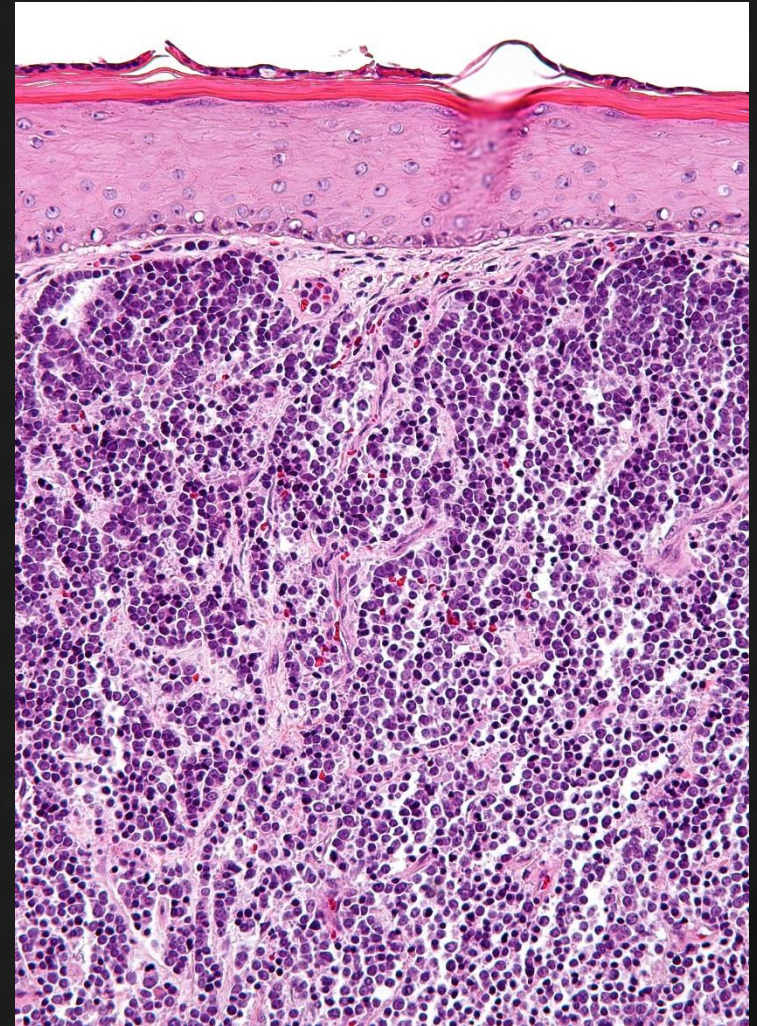


The nucleus of the cell is lobulated and the cytoplasm contains granules of unknown function similar to secretory granules. The axon terminal is filled with mitochondria and covered by a Schwann cell until it enters the Merkel cells.

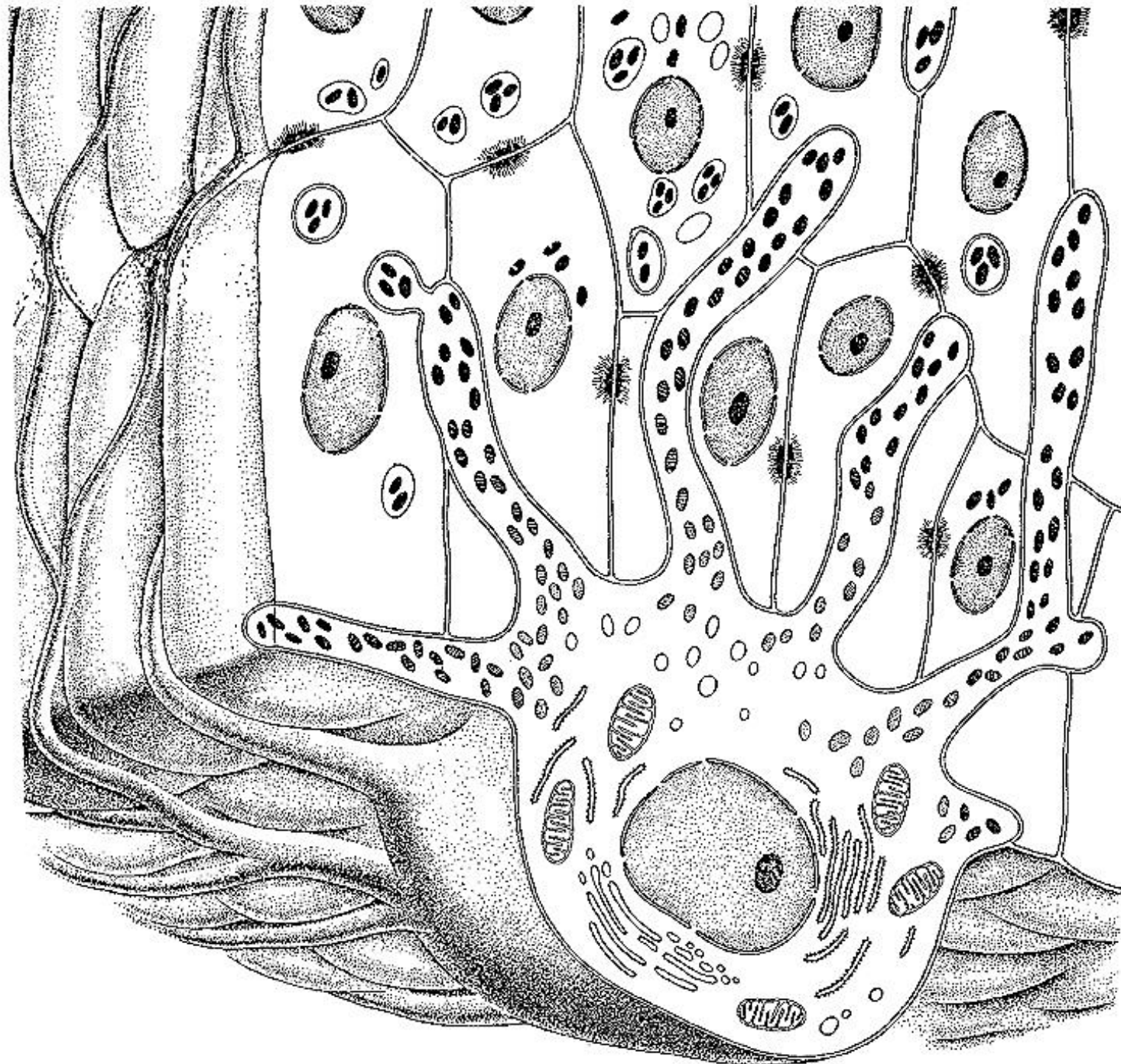


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Merkel cell carcinoma



- Highly aggressive skin cancer
- Neuroendocrine tumor
- Merkel cell polyomavirus



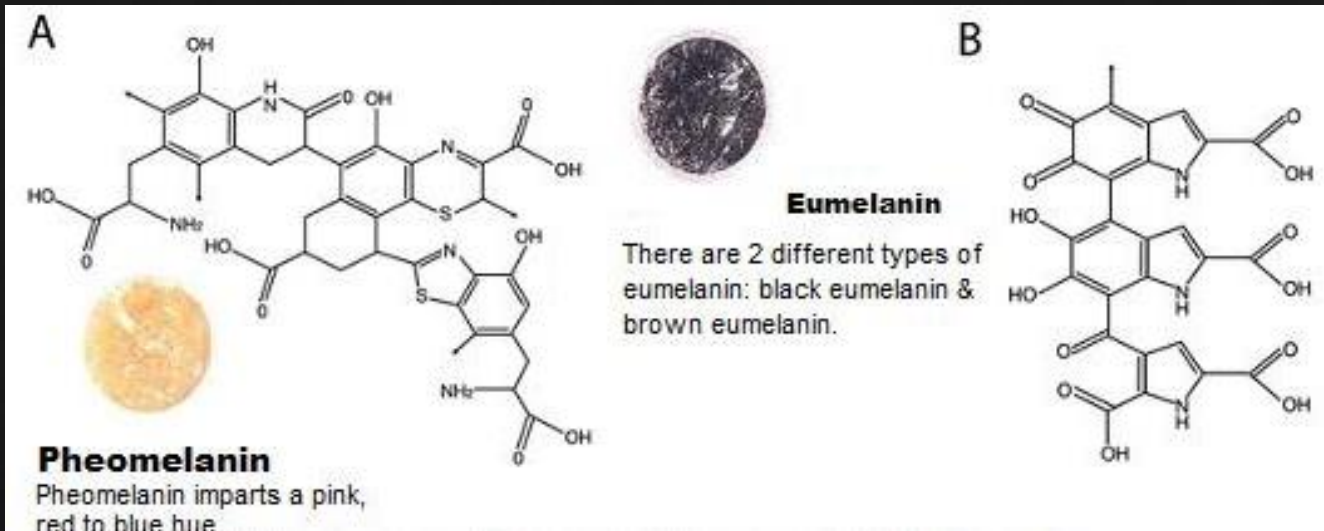
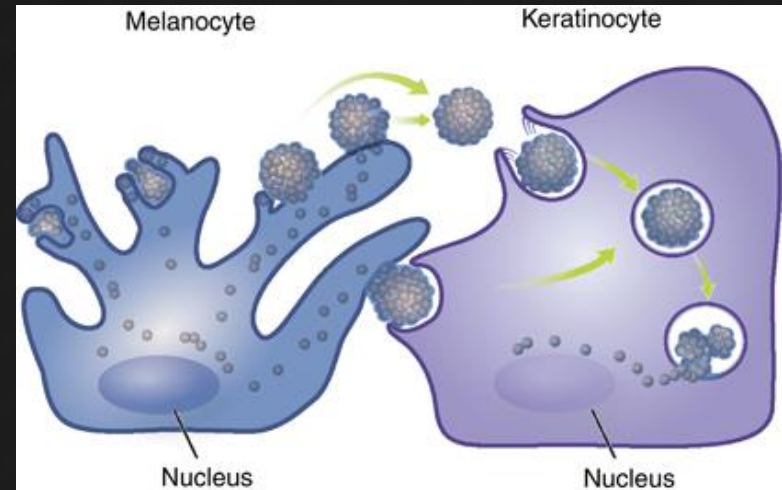
nin granule
(tyrosinase activity)

mel III
(melanin)

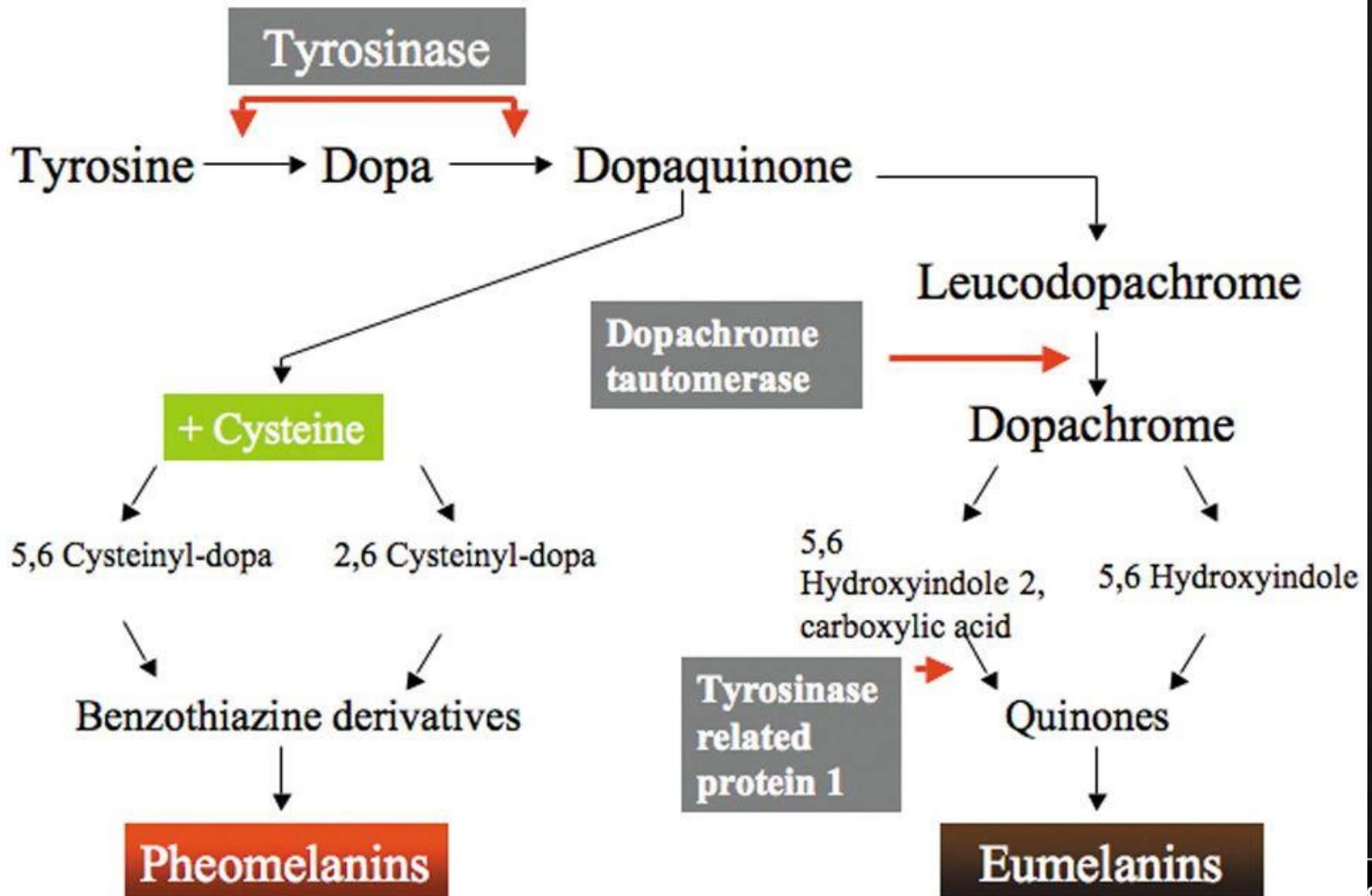
cytoplasmic

Melanin

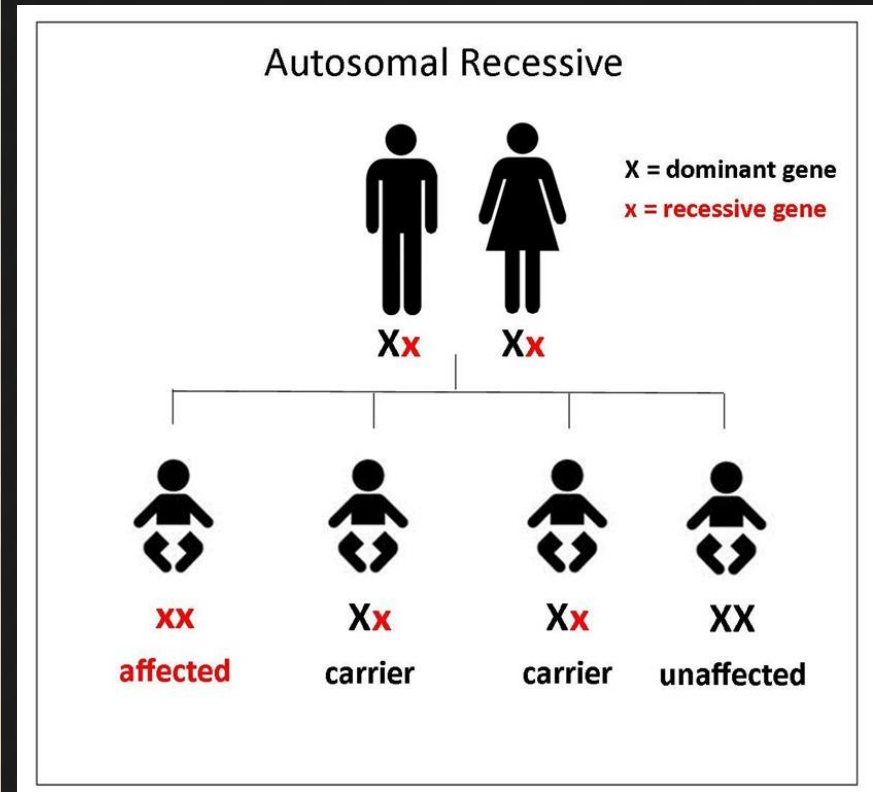
- **Eumelanin**
 - Dark brown-black hue
- **Feomelanin**
 - Pink to red hue



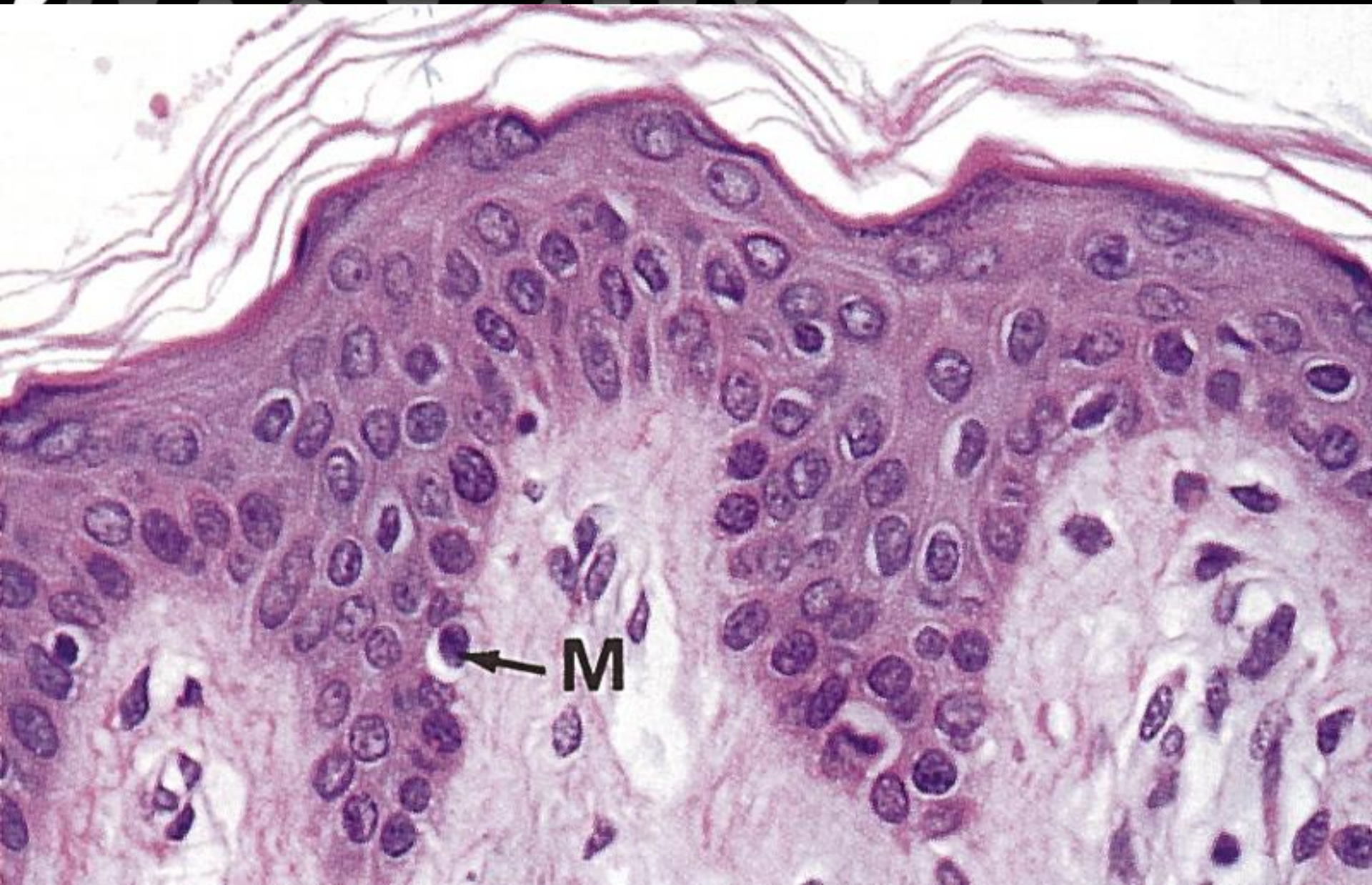
Melanin Synthesis

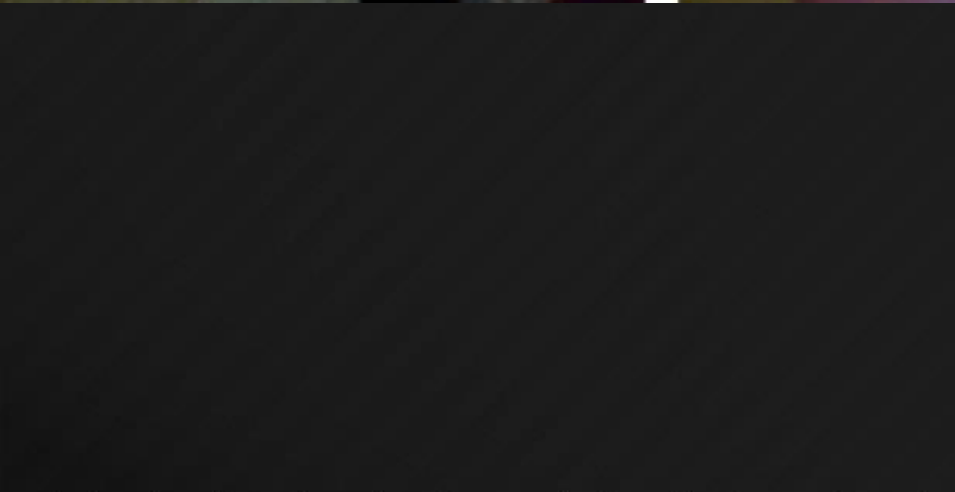
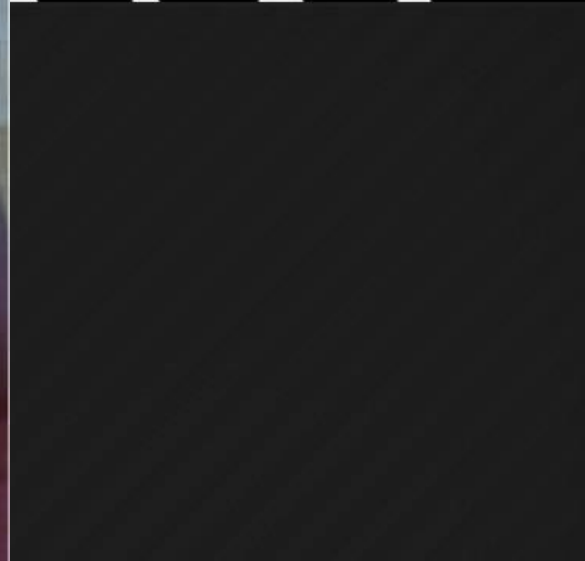


Albinism











Melanocytes





- Me
- sur
- her
- Ag

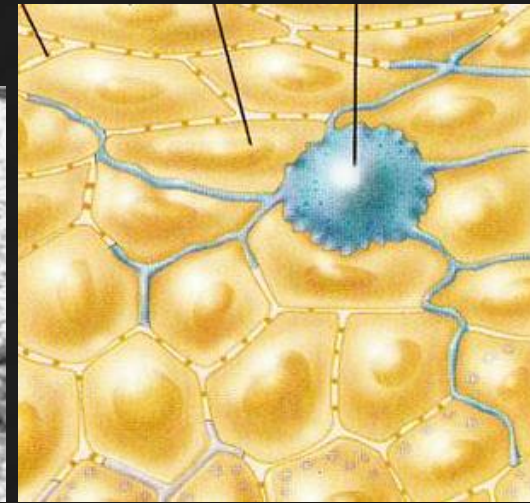
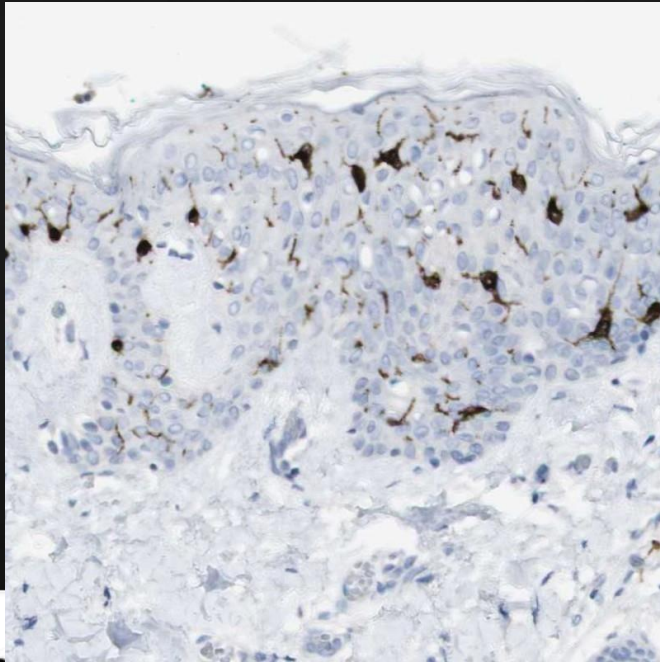


Normal Mole	Melanoma	Sign	Characteristic
		Asymmetry	when half of the mole does not match the other half
		Border	when the border (edges) of the mole are ragged or irregular
		Color	when the color of the mole varies throughout
		Diameter	if the mole's diameter is larger than a pencil's eraser

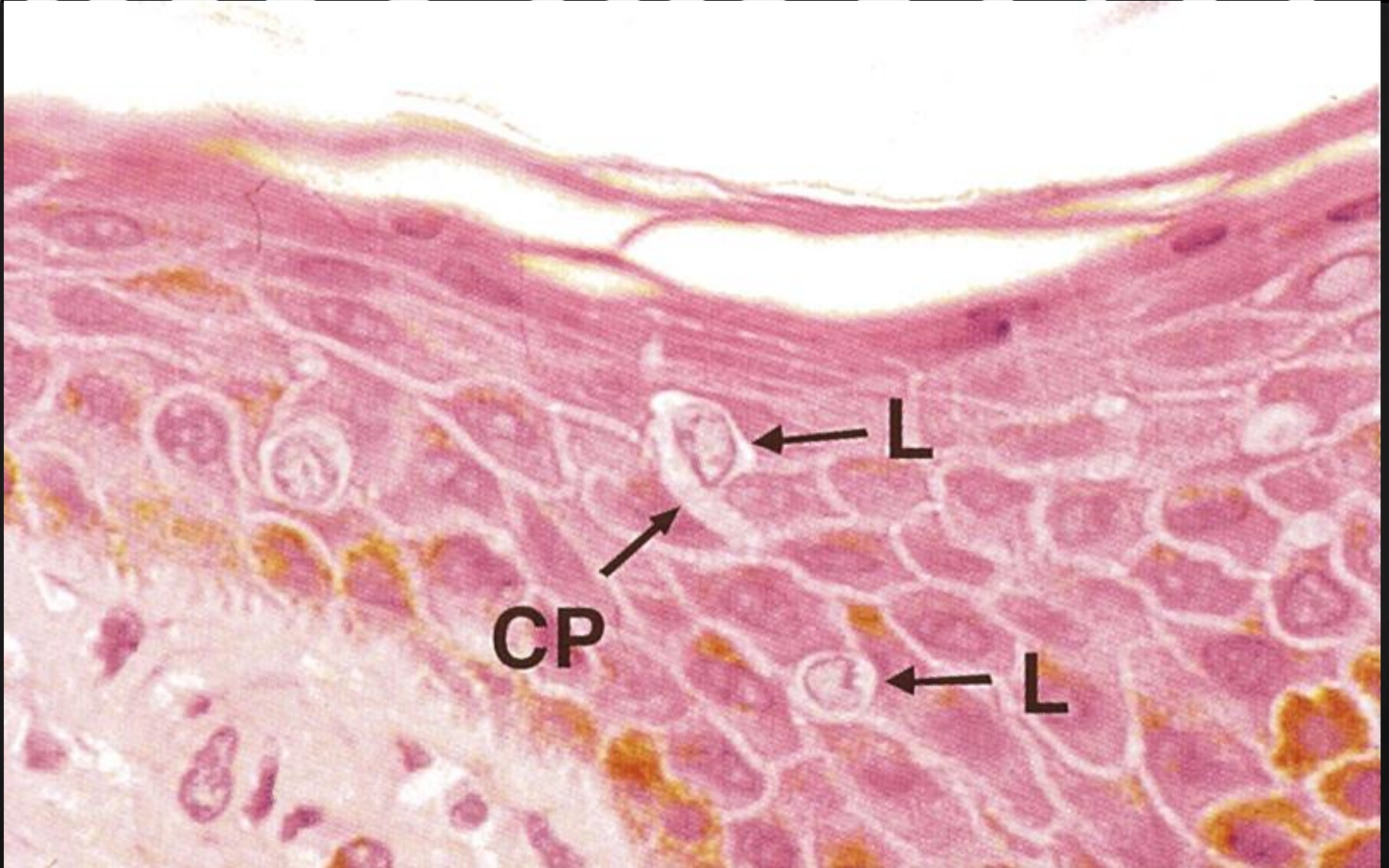
idermis
ermis

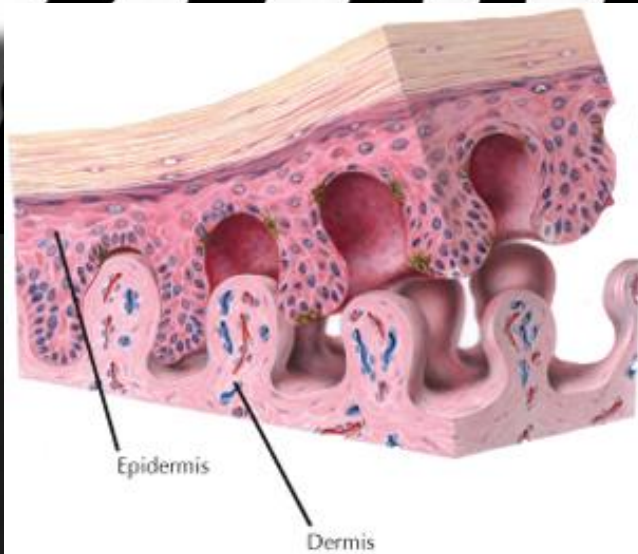
Dendritic Langerhans cells

- Dendritic cells mainly in stratum spinosum
- **APC** – ingestion of antigens
- Origin in bone marrow (monocyte-macrophage system)
- Birbeck granules with **langerin** (CD207)

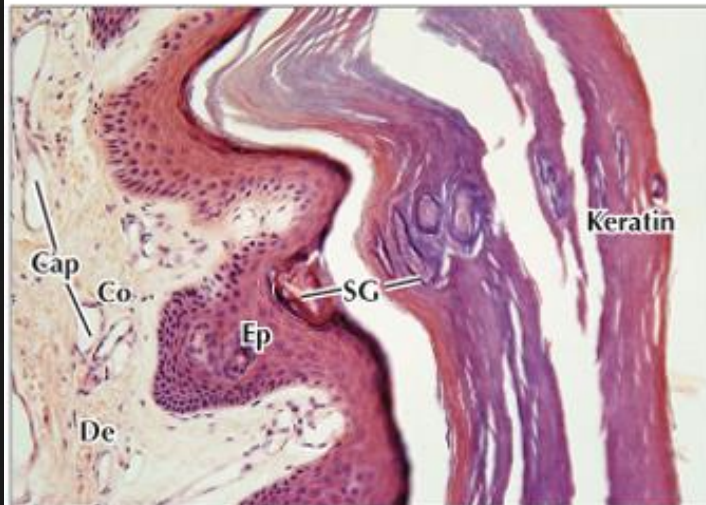
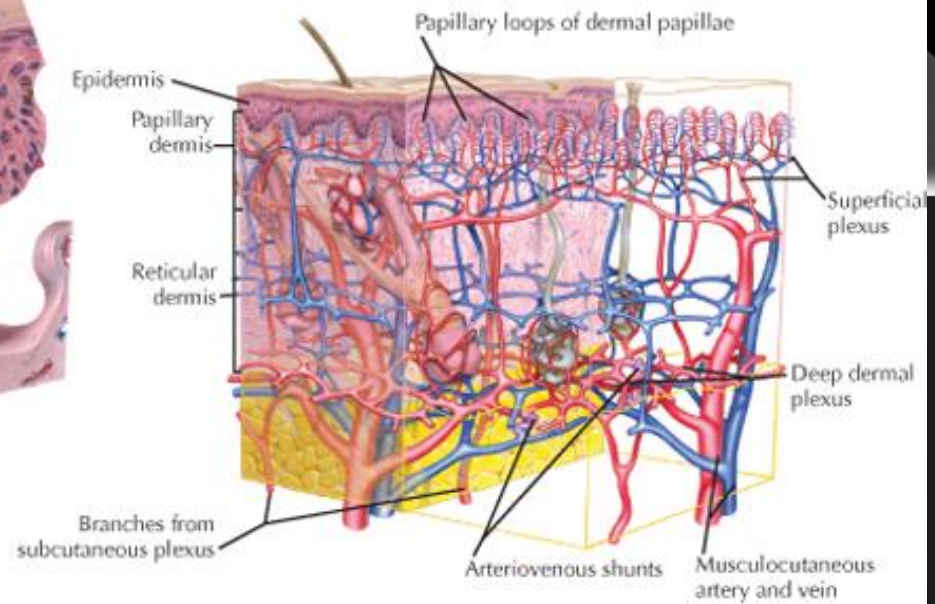


Langerhans cell

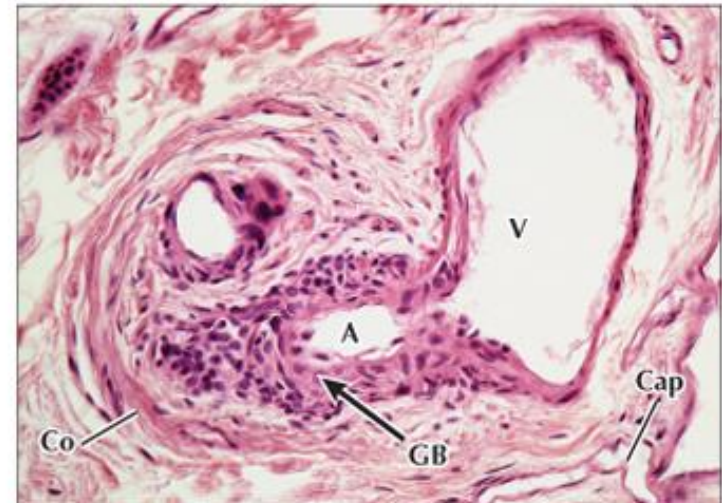




C. Machado
—M.D.



▲ **LM of the dermoepidermal junction.** The dermis (De) is less cellular than the epidermis (Ep). The papillary dermis is loose connective tissue with collagen fibers (Co) interspersed with mononuclear cells. Capillaries (Cap) form loops that extend into dermal papillae and are derived from the horizontal superficial plexus of arterioles. The three-dimensional organization of the papillae has been likened to a candelabra, with the loops representing candles. The fortuitously sectioned duct of a sweat gland (SG) courses through epidermis on its way to the skin surface. 150 \times . H&E



▲ **LM of an arteriovenous anastomosis in the reticular dermis.** This short, coiled vascular shunt consists of the terminal segment of an arteriole (A) directly connected to a venule (V) with no intervening capillary network. The tunica media of the arteriole is thickened with multiple layers of modified smooth muscle cells making up a glomus body (GB), the cells thus known as glomus cells. Condensed connective tissue with bundles of collagen fibers (Co) encapsulates the glomus body. Capillaries (Cap) are in other areas of the dermis. 245 \times . H&E

Dermis

- **Stratum papillare**

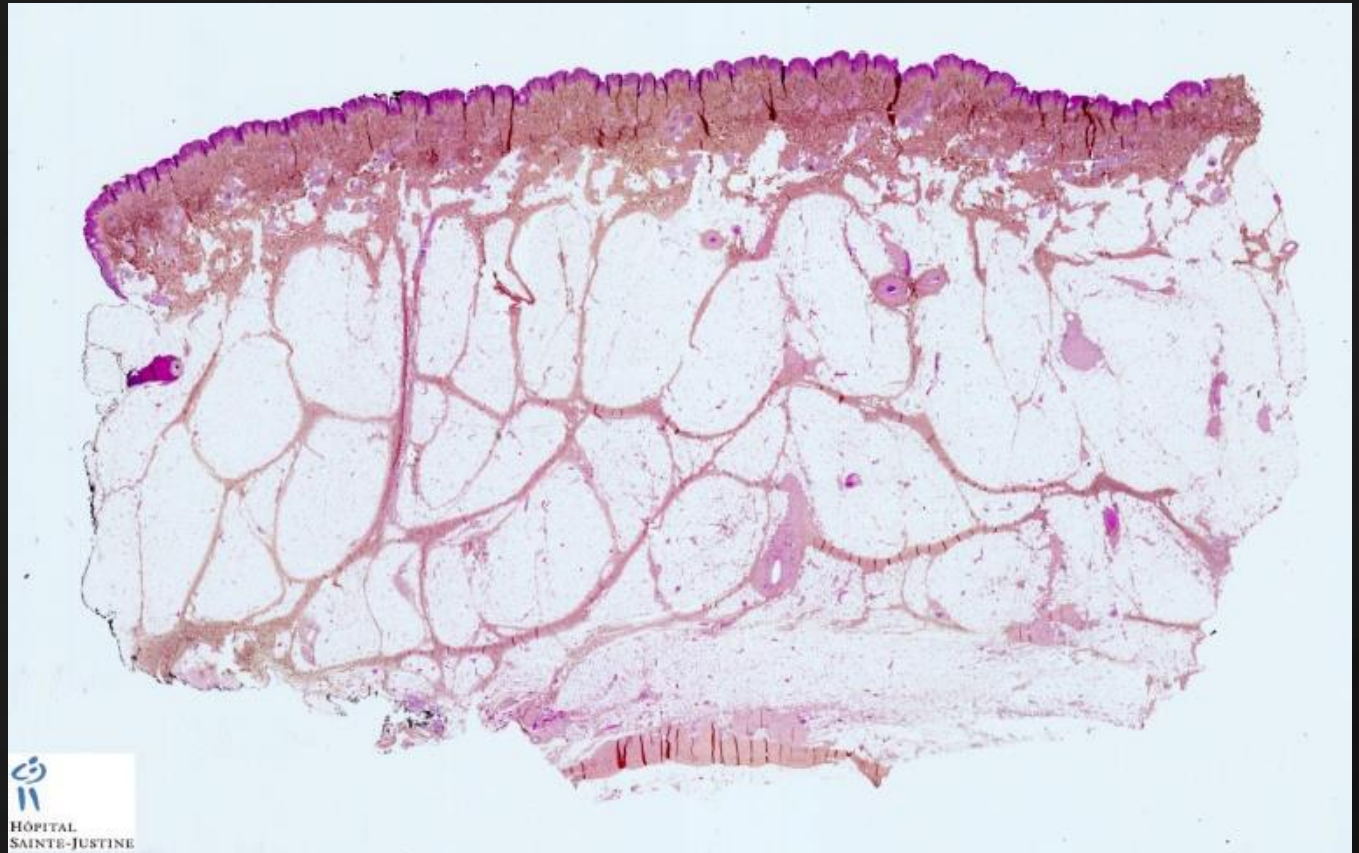
- Loose connective tissue, collagen fibres I, III, elastic fibres, capillary loops, free nerve endings, fibroblasts
- Meissner and Krause bodies

- **Stratum reticulare**

- Dense connective tissue with collagen fibres
- Tensile strength
- Less cellular
- Vater-Pacini and Ruffini bodies

Tela subcutanea

- Adipose cells, collagen and elastin fibers, vessels, nerves, parts of glands, Vater-Pacini bodies...
- termoregulation



Skin types

- **Thick type**

- Areas of abrasion
- Thick SC, prominent SL
- Epidermal ridges - dermatoglyphs
- 400-800 μm thick epidermis
- Dermis lacks hairs, sebaceous glands and sudoriferous apocrine glands – **just sweat eccrine glands**



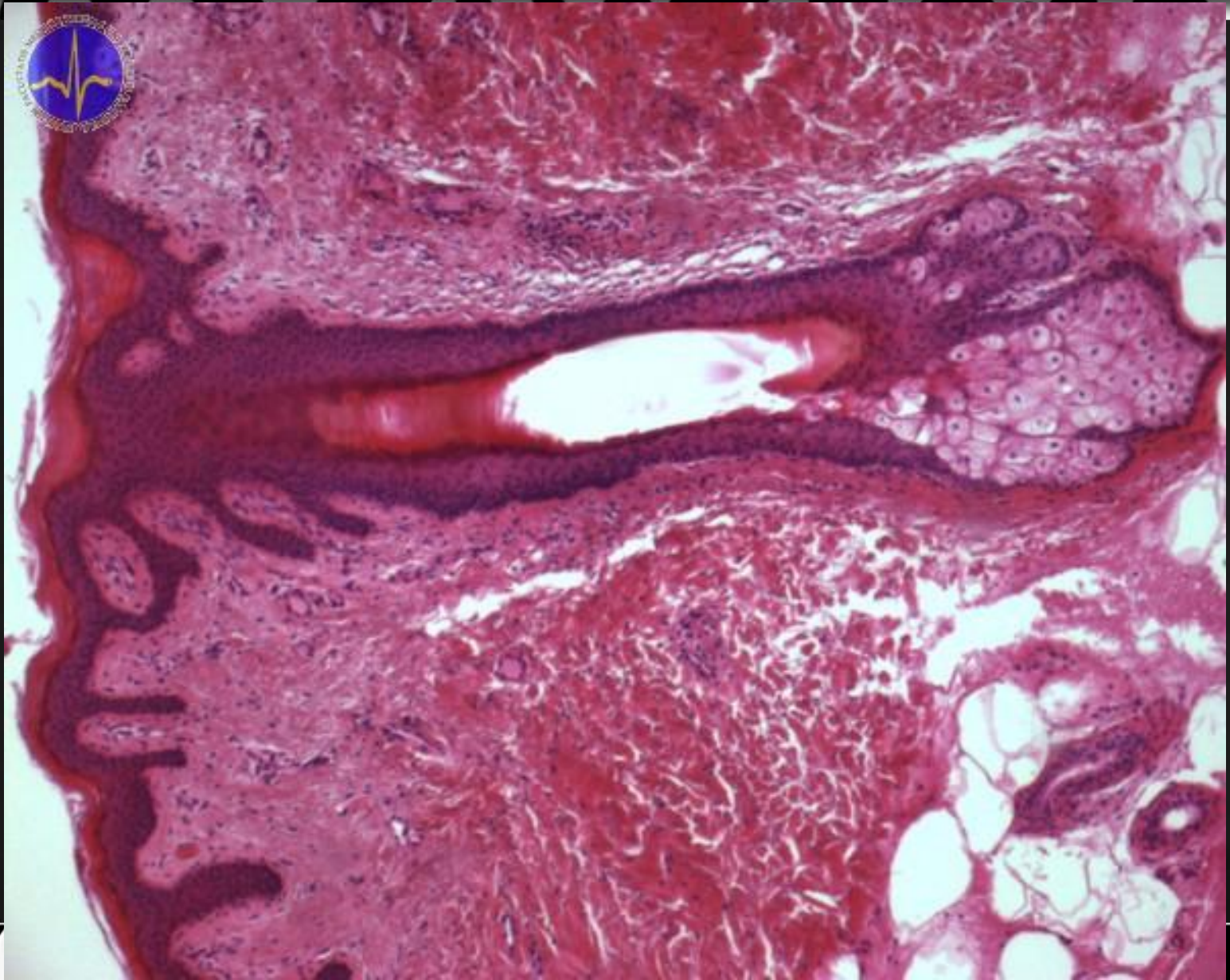
- **Thin type** (*containing all skin appendages*)

- 75-150 μm thick epidermis
- Lacks SL

Thin skin type - axilla

- Thin type of skin
- Hair follicles
- All 3 types of skin glands
 - Sebaceous glands
 - Sweat glands
 - Sudoriferous glands

Axilla (HE)

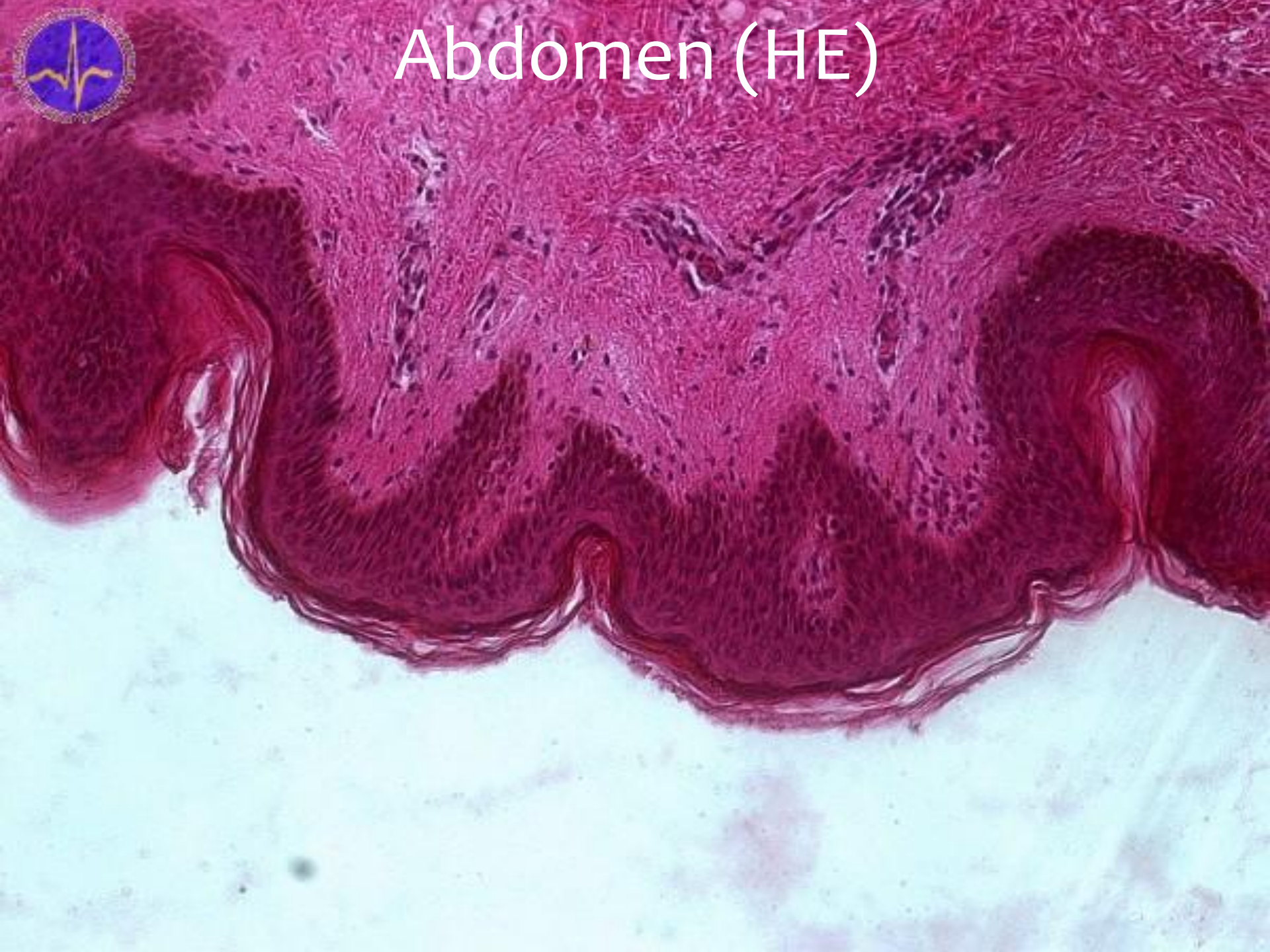


Thin skin type - abdomen

- Thin skin type
- Hair follicles
- sebaceous and small sweat glands
- Thick layer of subcutaneous tissue



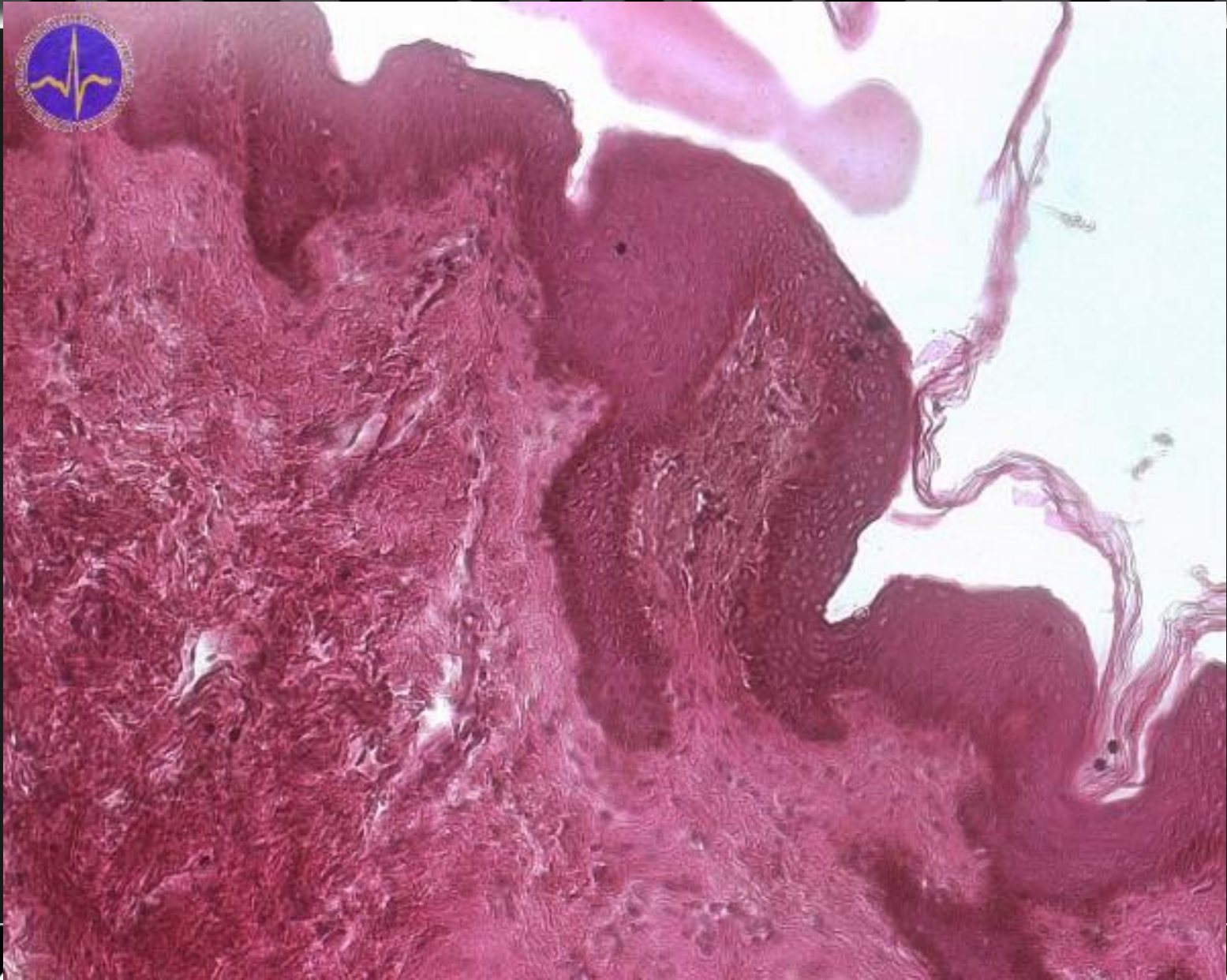
Abdomen (HE)



Thin skin type - scrotum

- Pigmentation in stratum basale
- Smooth muscle cells in dermis

Scrotum (HE)



Thick type skin

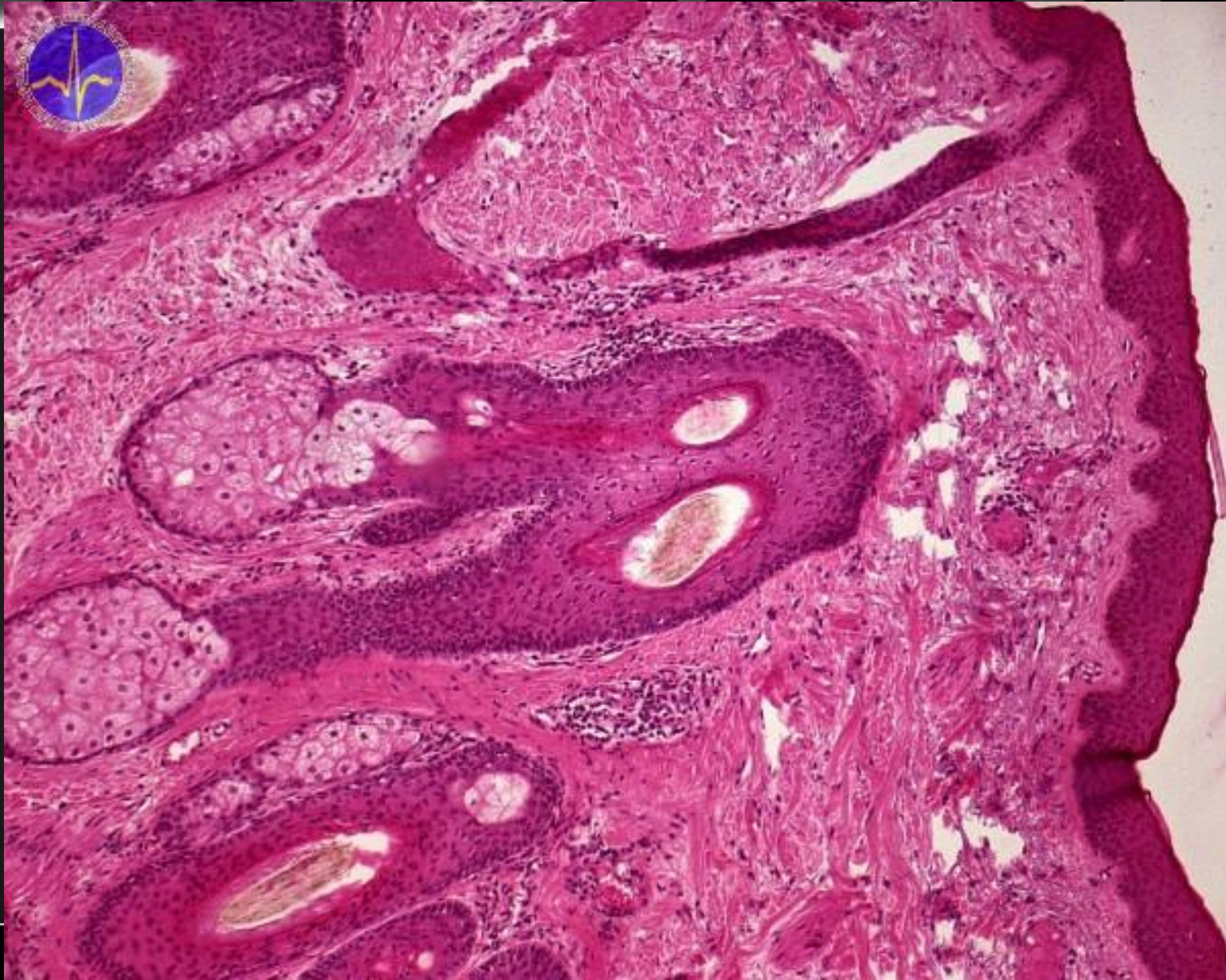
- Thick layer of keratinized cells + Stratum lucidum
- Only small sweat glands
- Sensory endings – Meissner's and Vater-Pacini's bodies

Thick skin type (HE)

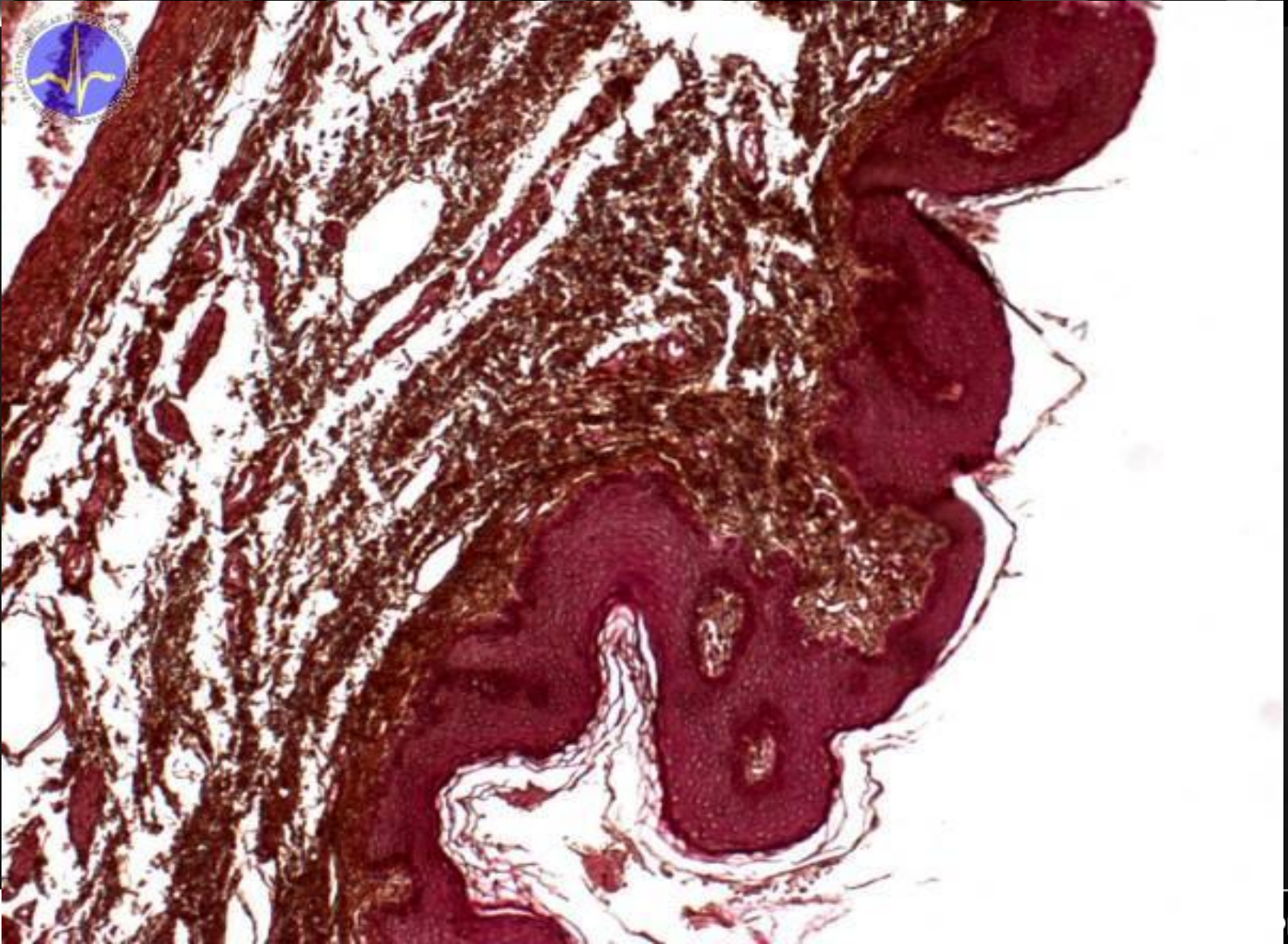




Skin with hair (HE)

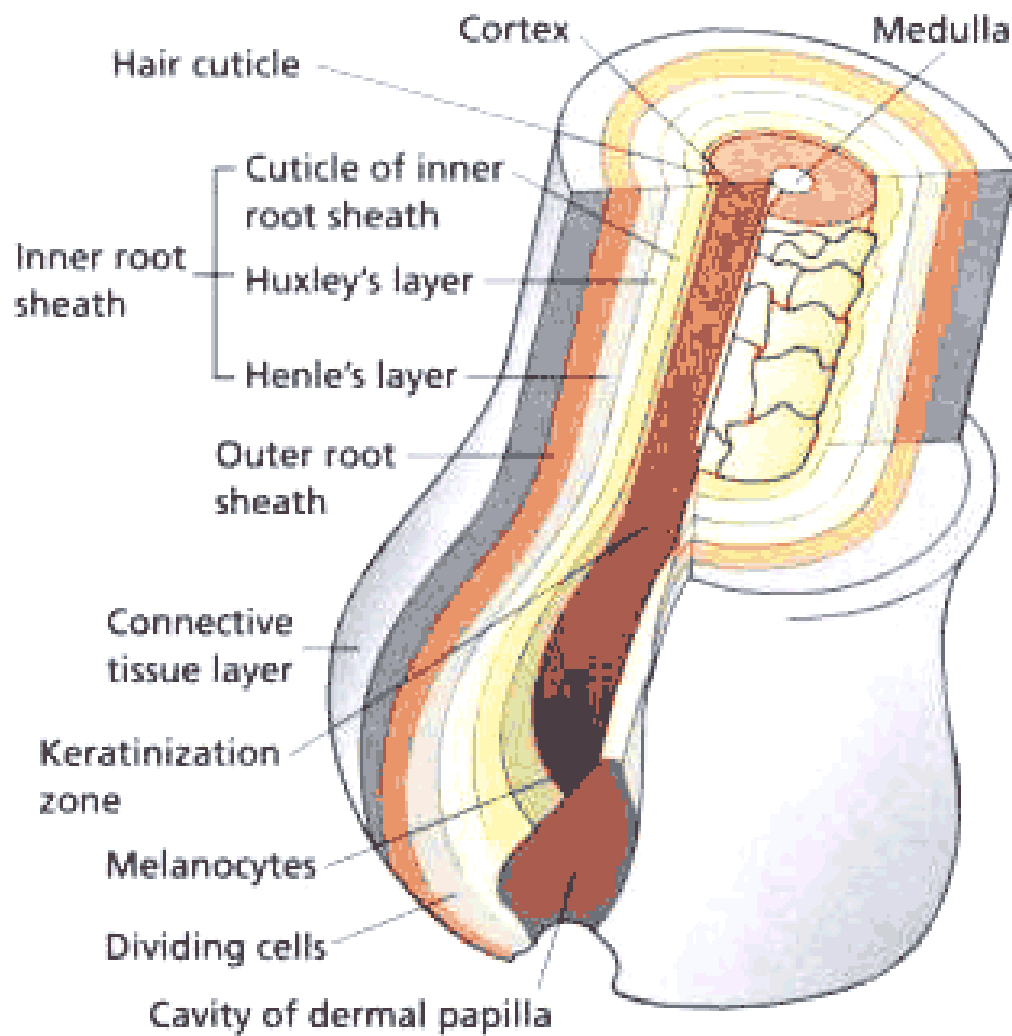


Skin (YT)

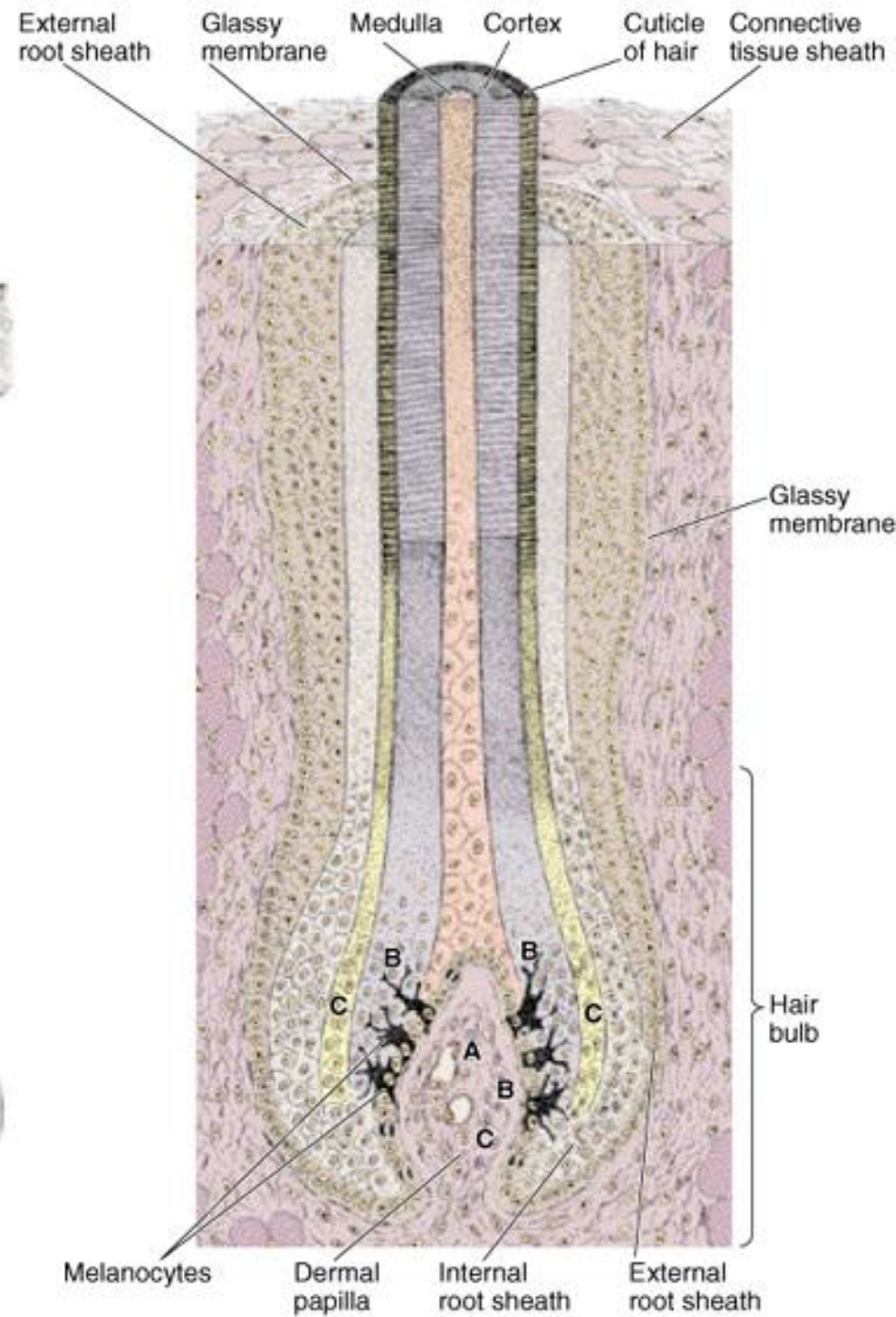
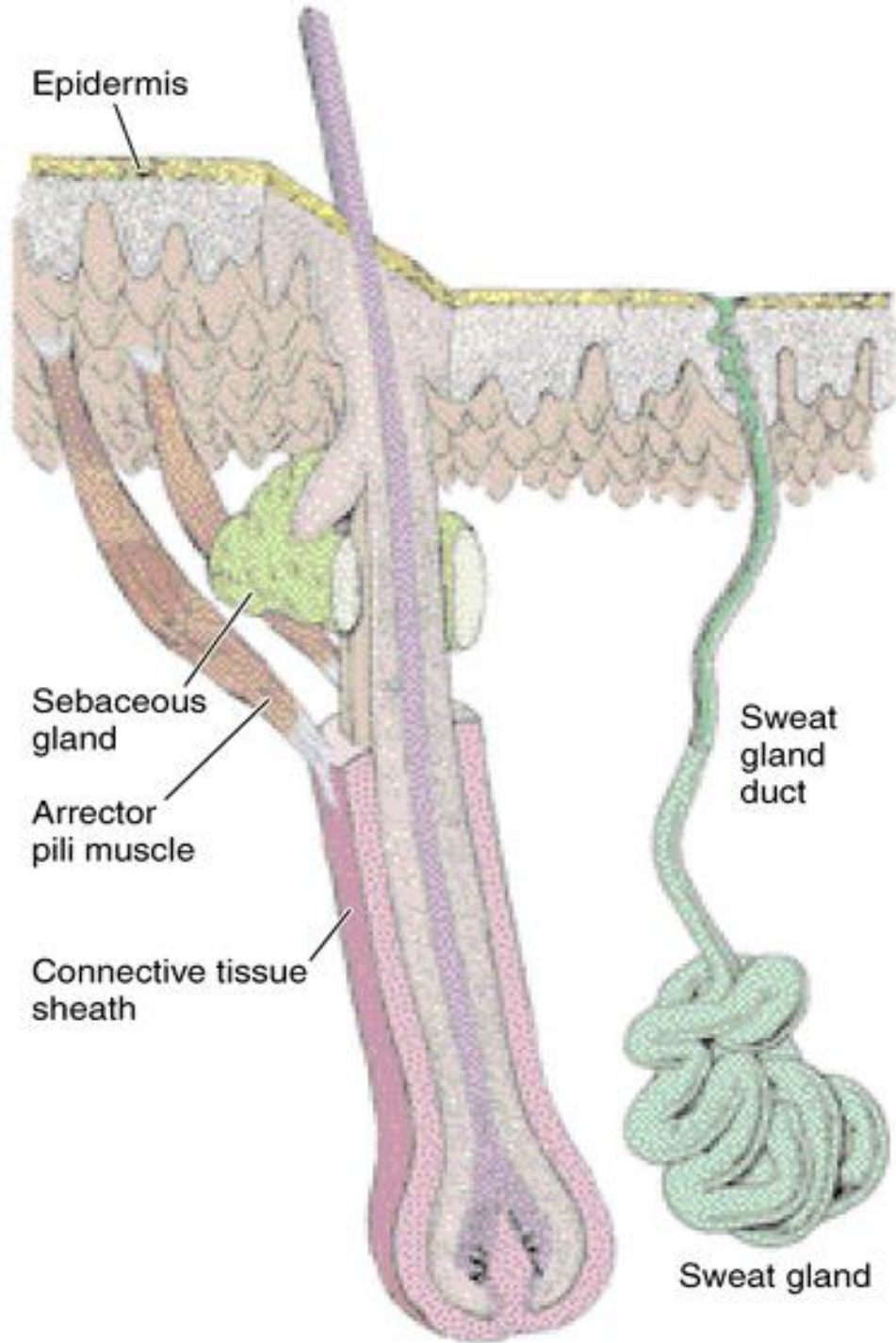


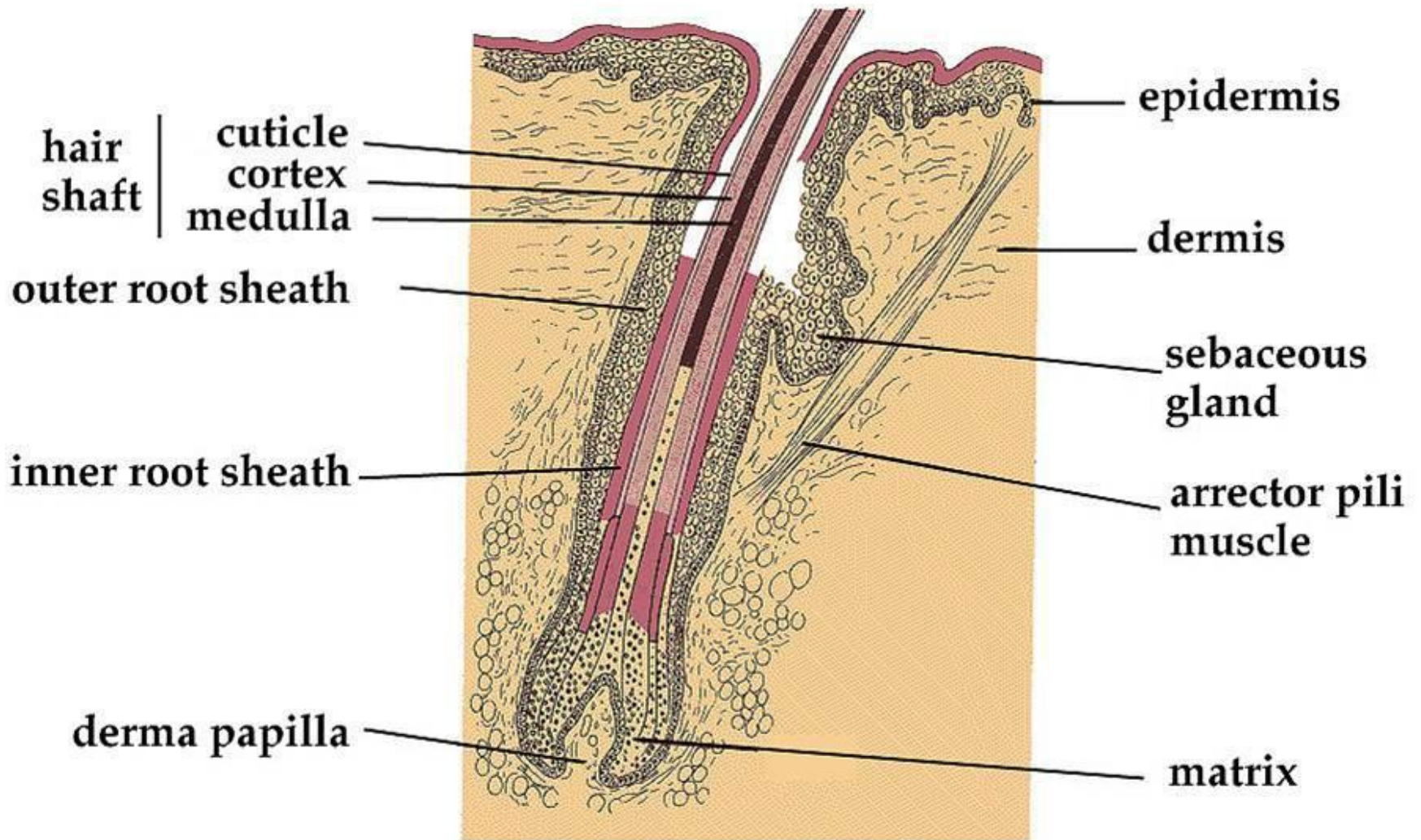
Hair

- Everywhere except palms, soles, lips, glans penis and labia minora
- distribution, bushiness and colour depend on
 - sex, age, race and part of body
 - Effect of hormones (androgens, T_3 , T_4 , corticoids)
- growth periods (anagen)
- resting periods (catagen, telogen)
- **Stalk** and **root**



The structure of the hair bulb

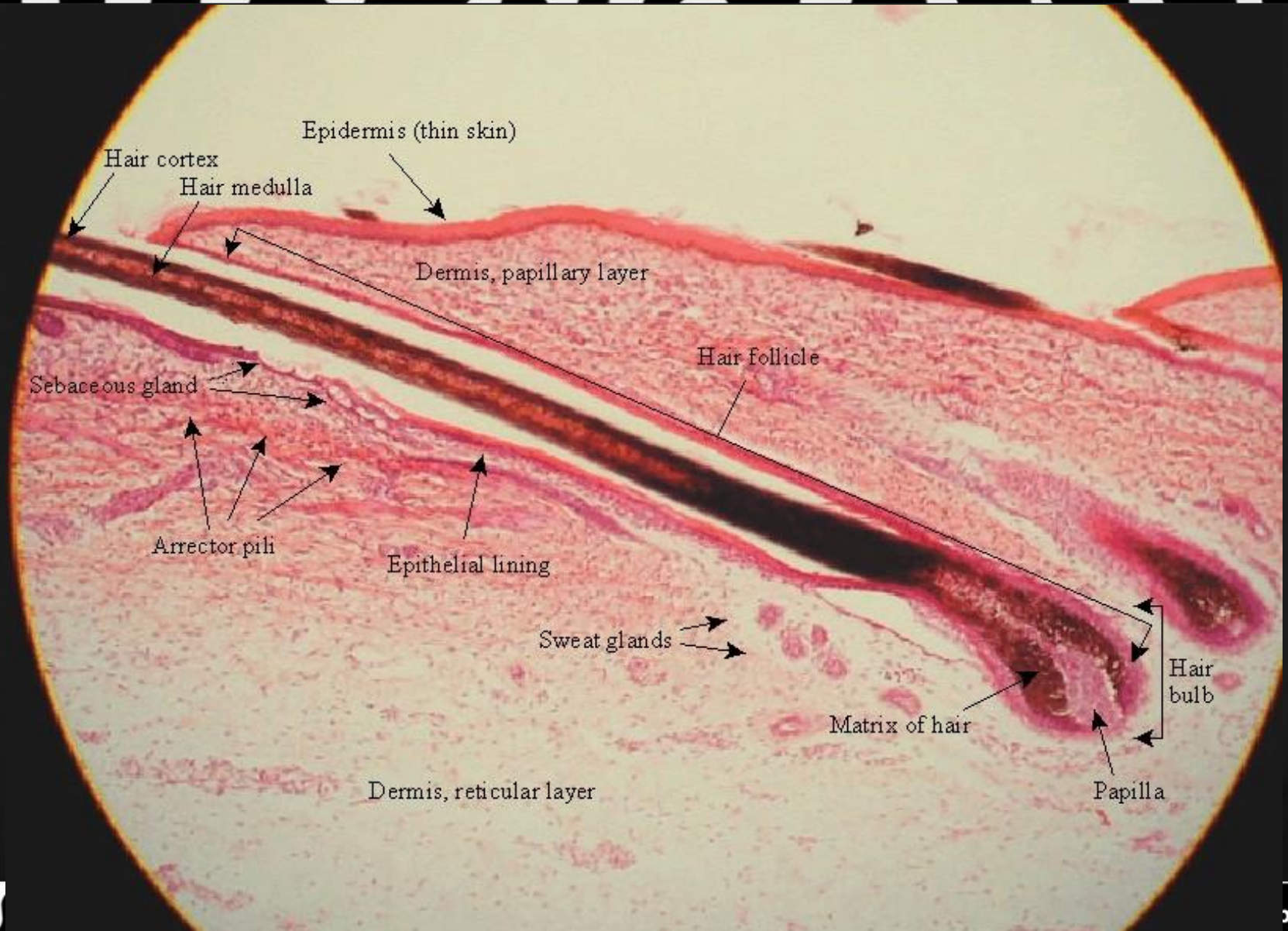


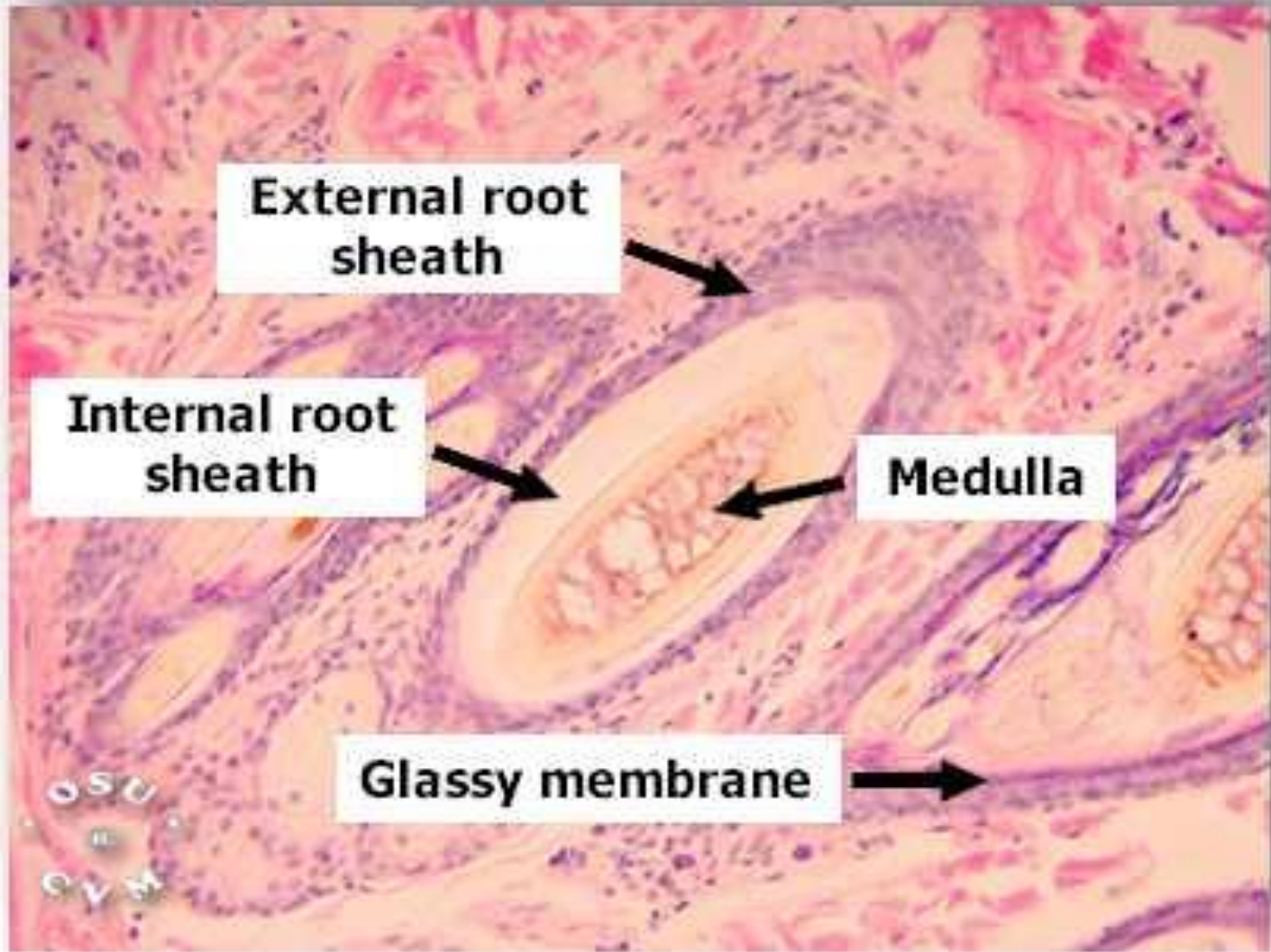


Hair

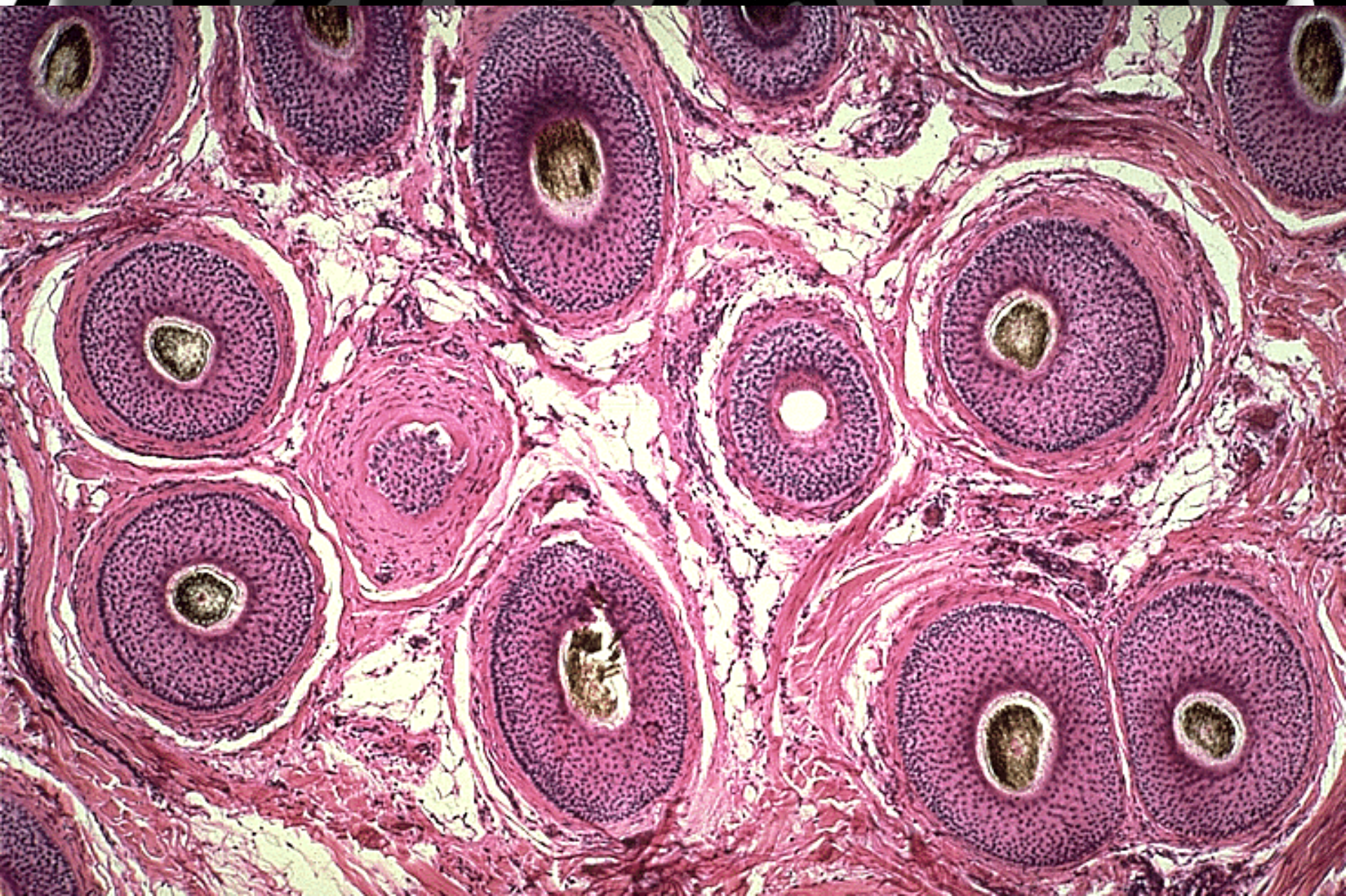
- Hair follicle (*Folliculus pili*)
- Hair bulb (*Bulbus pili*)
- Dermal papilla (*Papilla dermalis pili*)
- **Hair** (medulla, cortex, cuticle)
- **Internal root (epithelial) sheath**
 - Cuticle of inner root sheath, Huxley's layer, Henle's layer
- **External root (epithelial) sheath**
 - Invagination of epidermal basal layer - renewal
- **Connective tissue sheath**
 - Inner circularly arranged fibers, outer longitudinally arranged fibers

Hair follicle



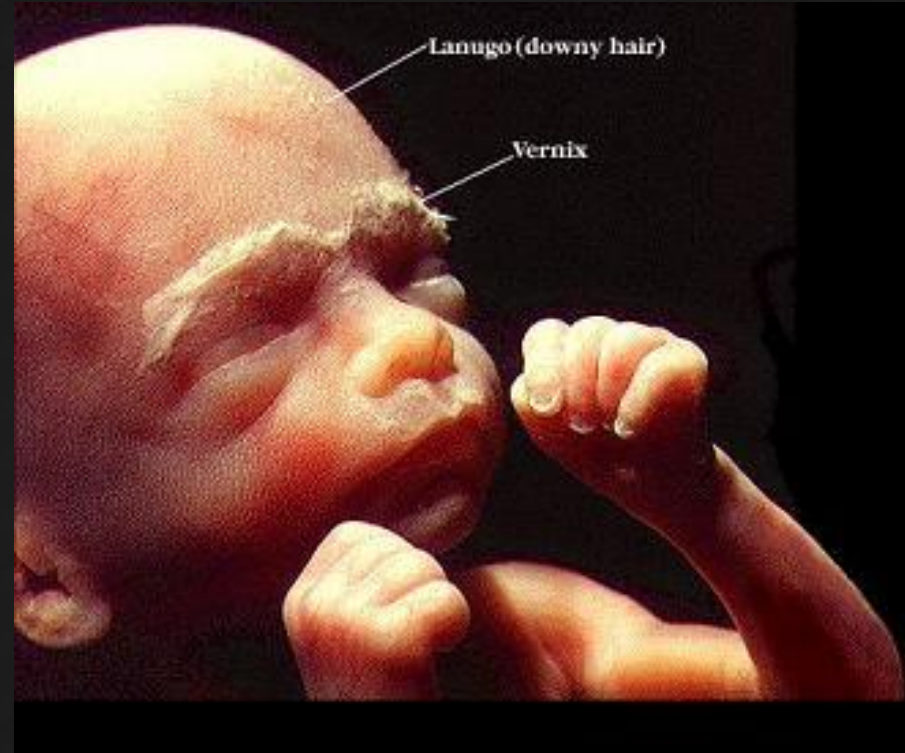






Hairiness

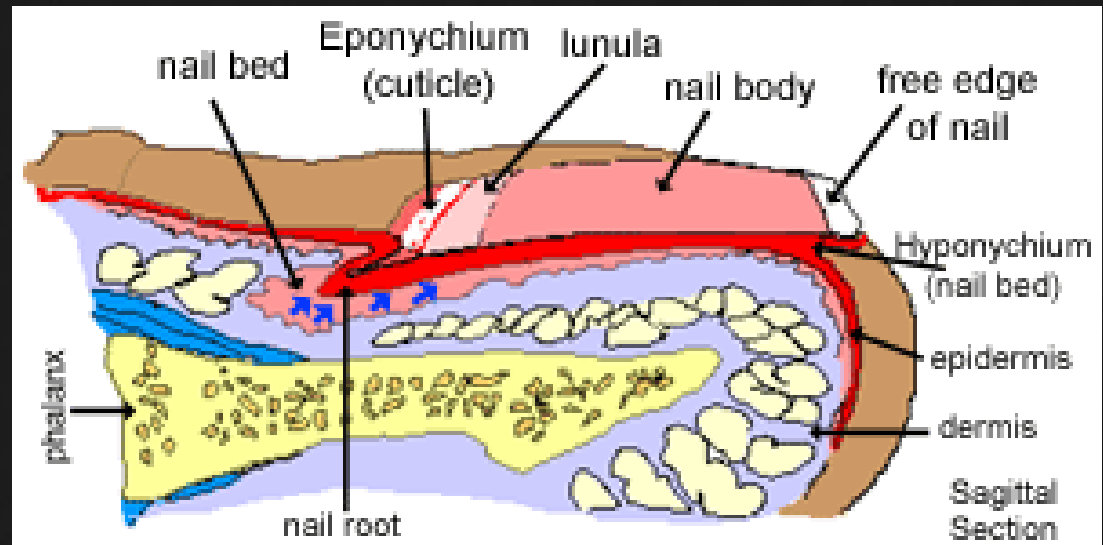
- Primary hair - lanugo
- Secondary hair
 - pili - *pilli*
 - hair- *capilli*
 - eyebrows - *supercilia*
 - eyelashes - *cilia*
- Tertiary hair
 - beard – *barba*
 - Axial -*hirci*
 - Pubic hair -*pubes*
 - Near vestibulum nasi– *vibrissae*
 - In external meatus - *tragi*

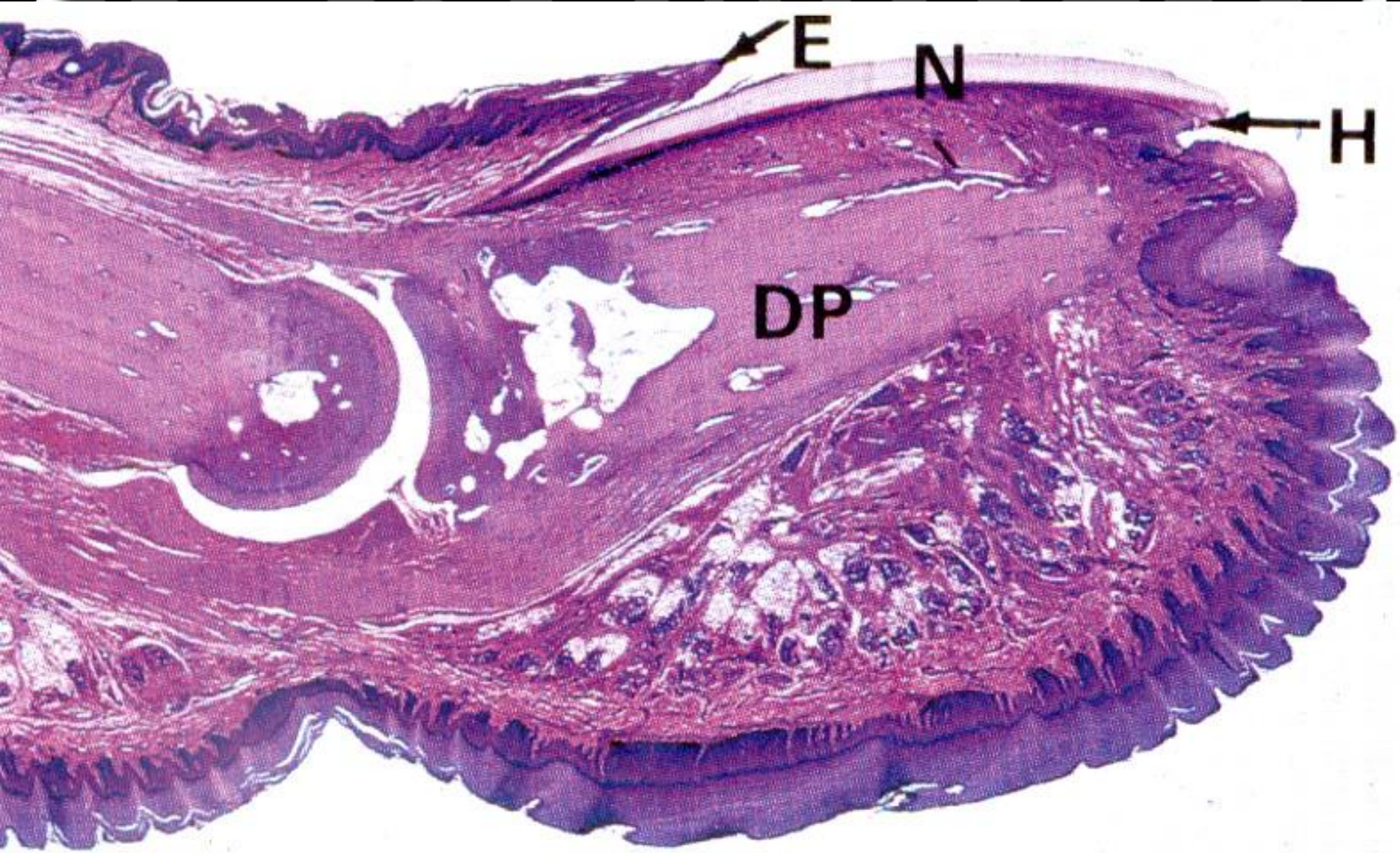


Nail

- Plates from keratinized epithelial cells
- Thickening of epidermis on dorsal surface of distal phalanges
- Nails reach to finger tips = *sign of fetus maturity*

- *Nail plate*
- *Root*
- *Nail matrix*

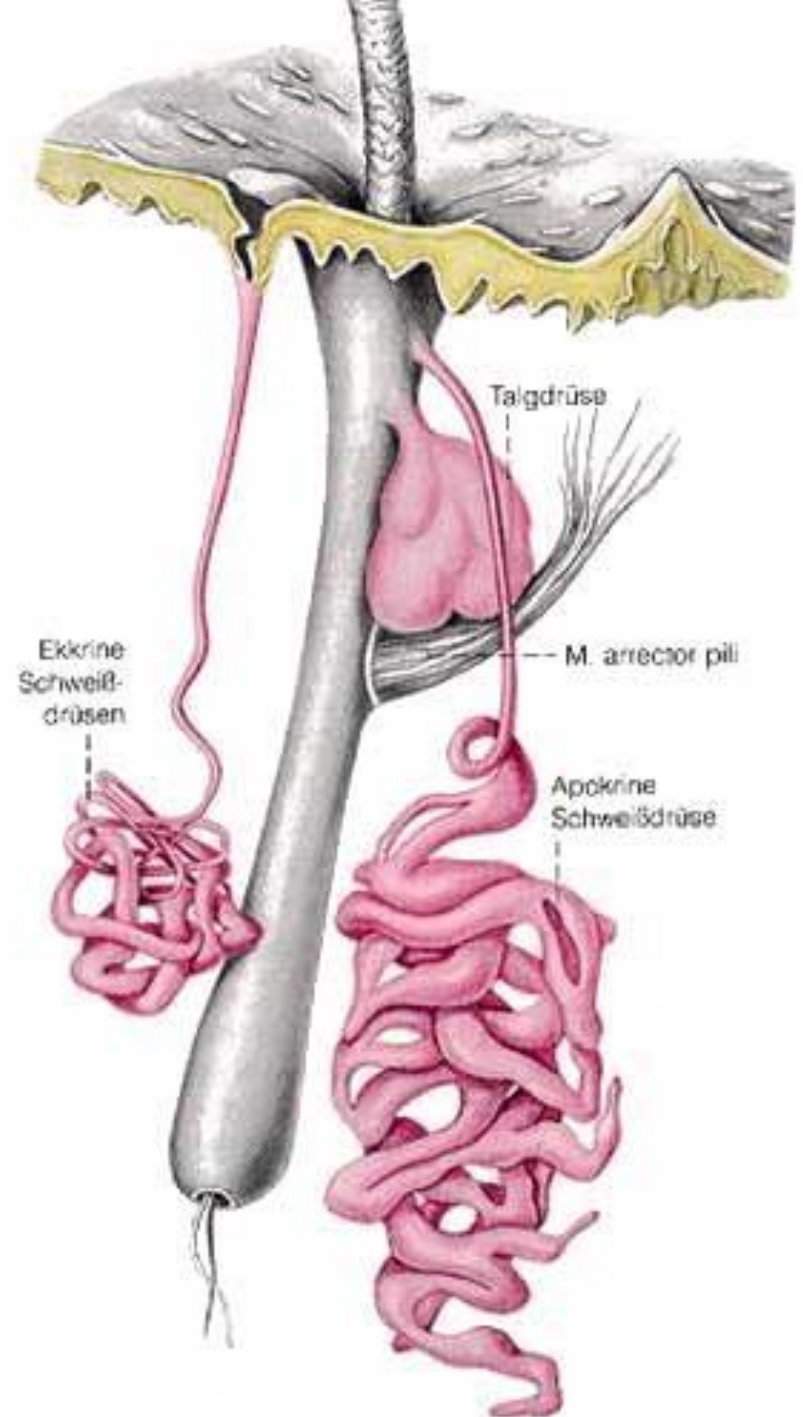






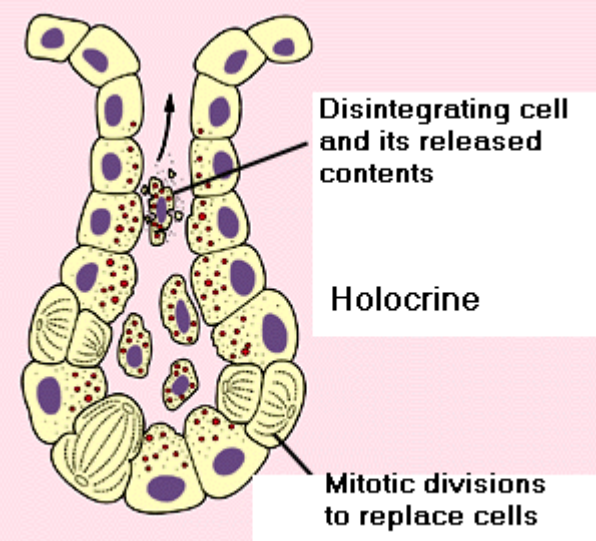
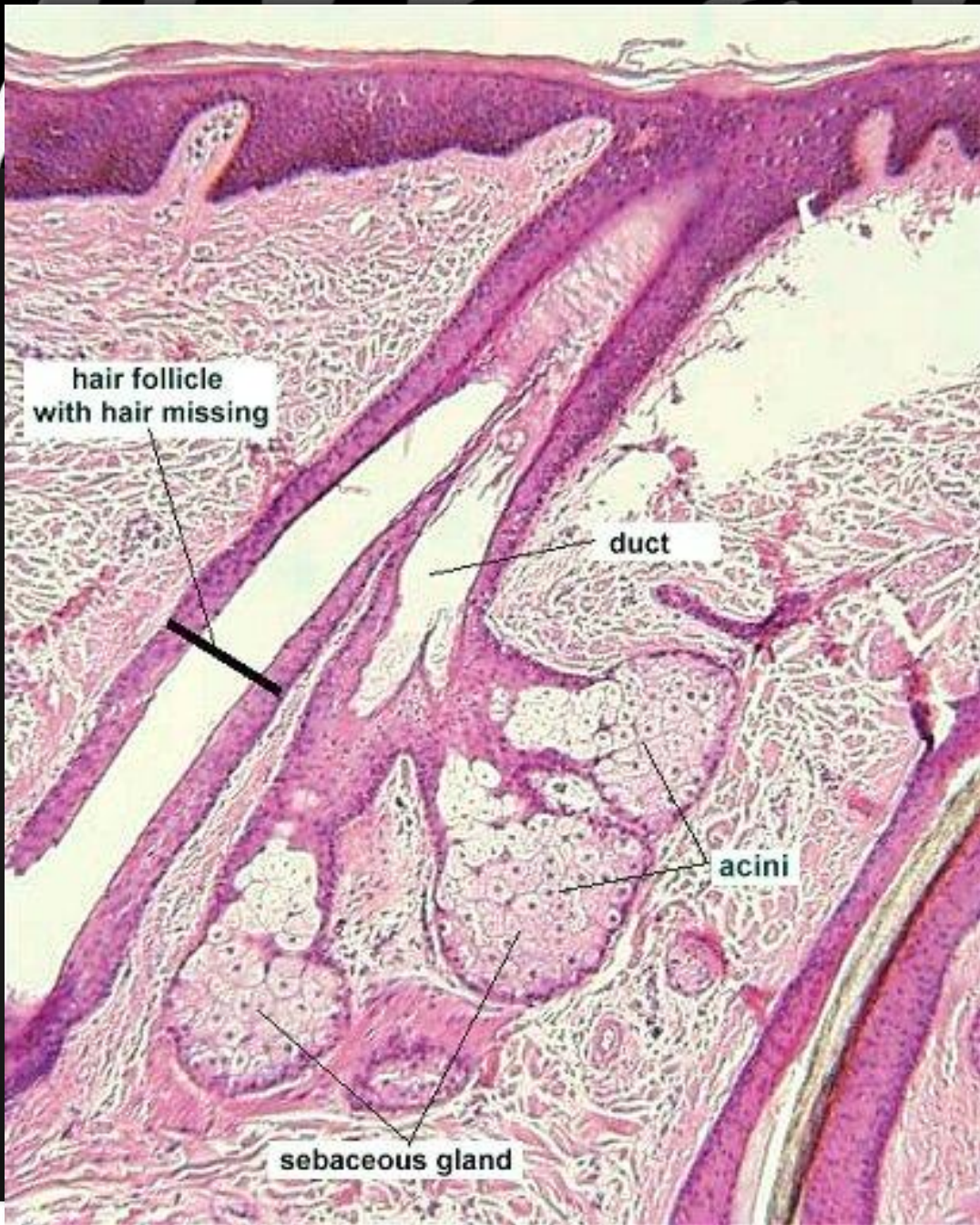
Glands of the skin

- Derivatives of epidermis
- **Sebaceous glands**
- **Sweat eccrine glands**
- **Sudoriferous apocrine glands**



Sebaceous glands *Glandulae sebaceae*

- Branched alveolar glands, holocrine secretion
- Dermis (except thick skin type areas)
- Independent or associated to pilosebaceous unit
- Production of **sebum**
 - Mixture of triacylglycerols, wax, squalene, cholesterol and its esters
 - Waterproof of skin



Sweat glands *Glandulae sudoriferae*

- **Eccrine** – liquid secretion (no cellular component)
 - *Simple coiled tubular glands with eccrine type of secretion*
 - Not associated with hair follicles, ducts lined by two layers of cuboidal ep.
 - Dark and light cells, myoepithelial cells
- **Apocrine** – parts of cells („odour“), rudimentary in humans
 - *Branched coiled tubular glands with apocrine secretion*
 - Wider lumen, associated with tertiary hair follicles

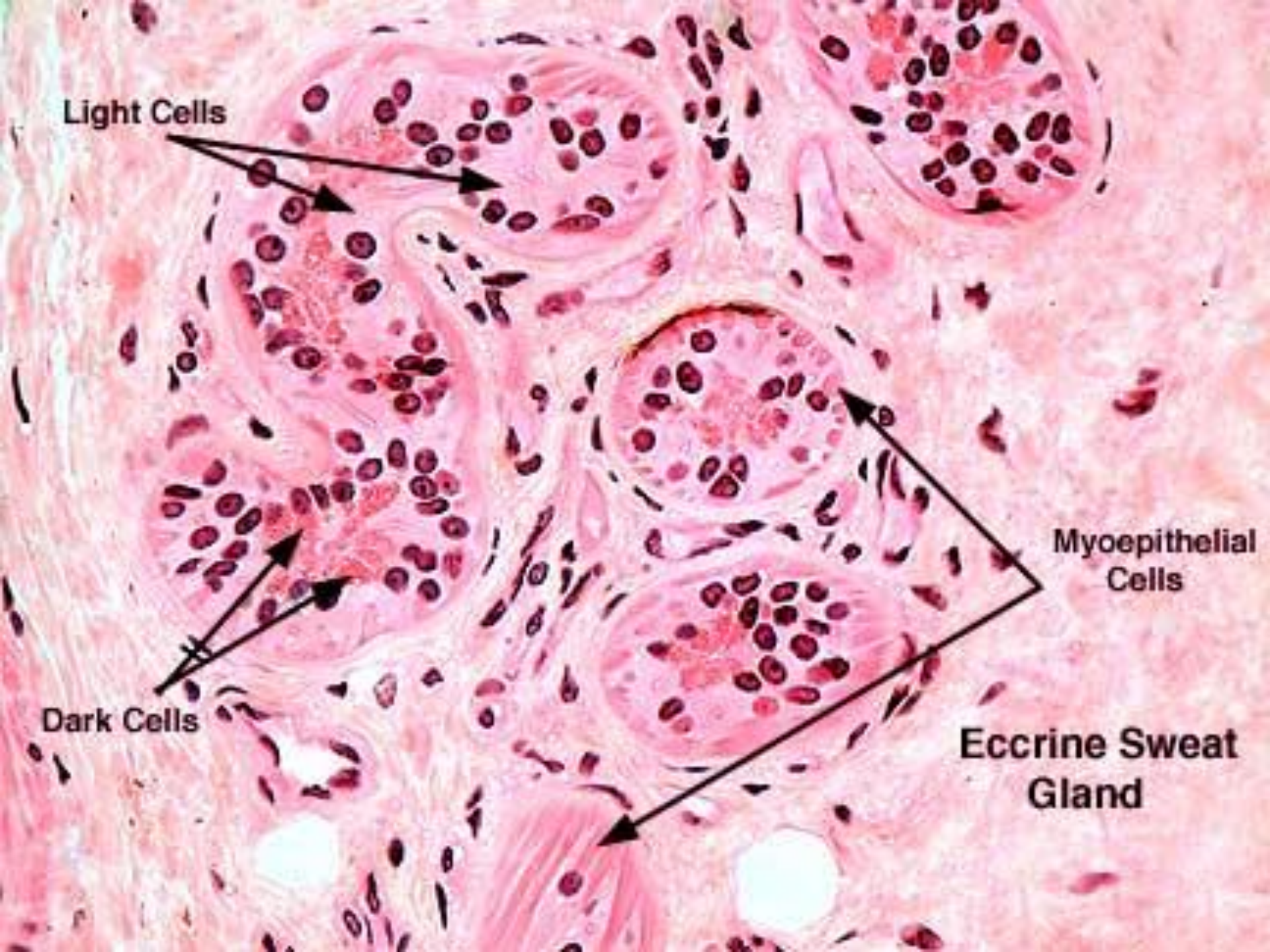
Gll.axillares

Gll.ciliares

Gll.ceruminosae

Gll.sudoriferae nasales

Gll.circumanales

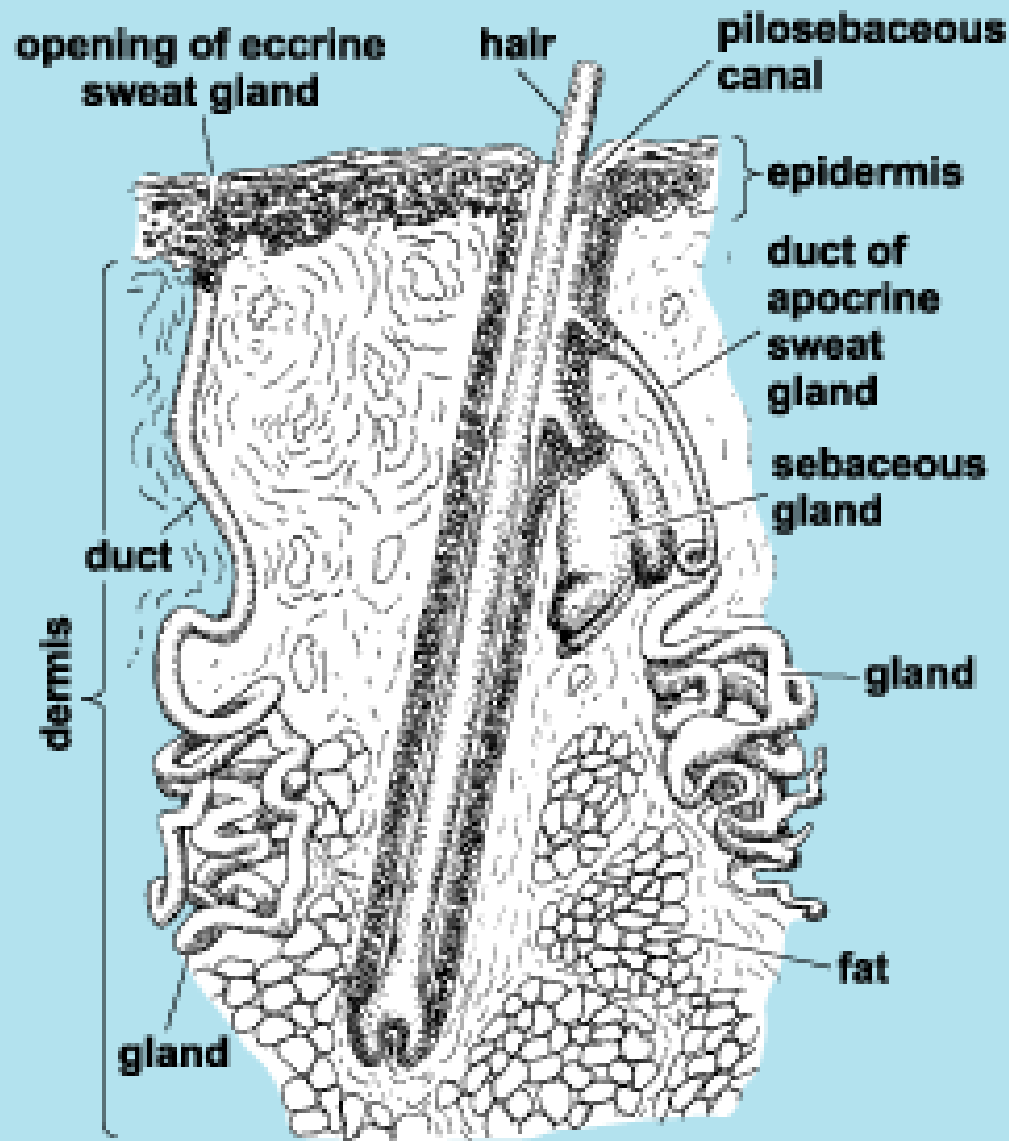
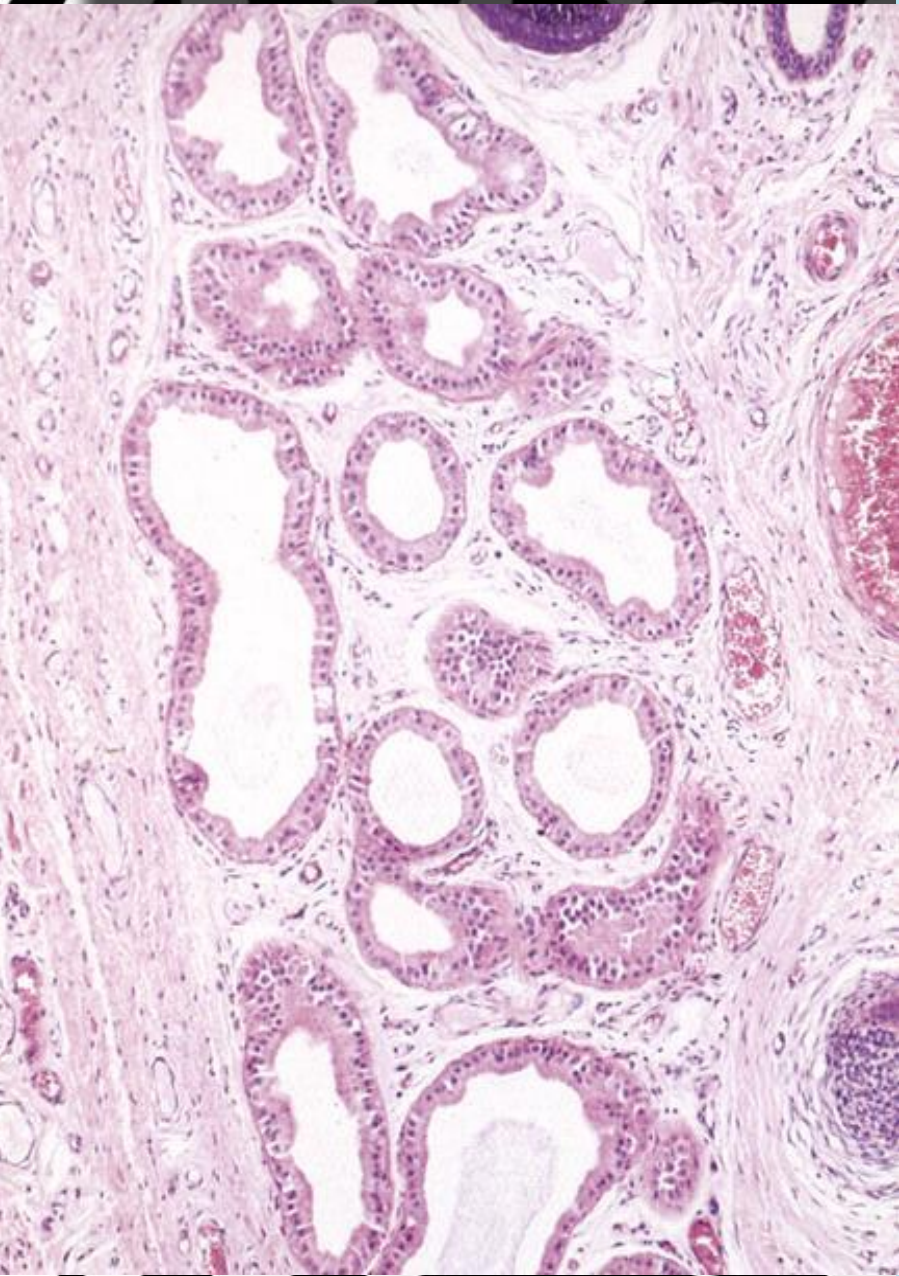


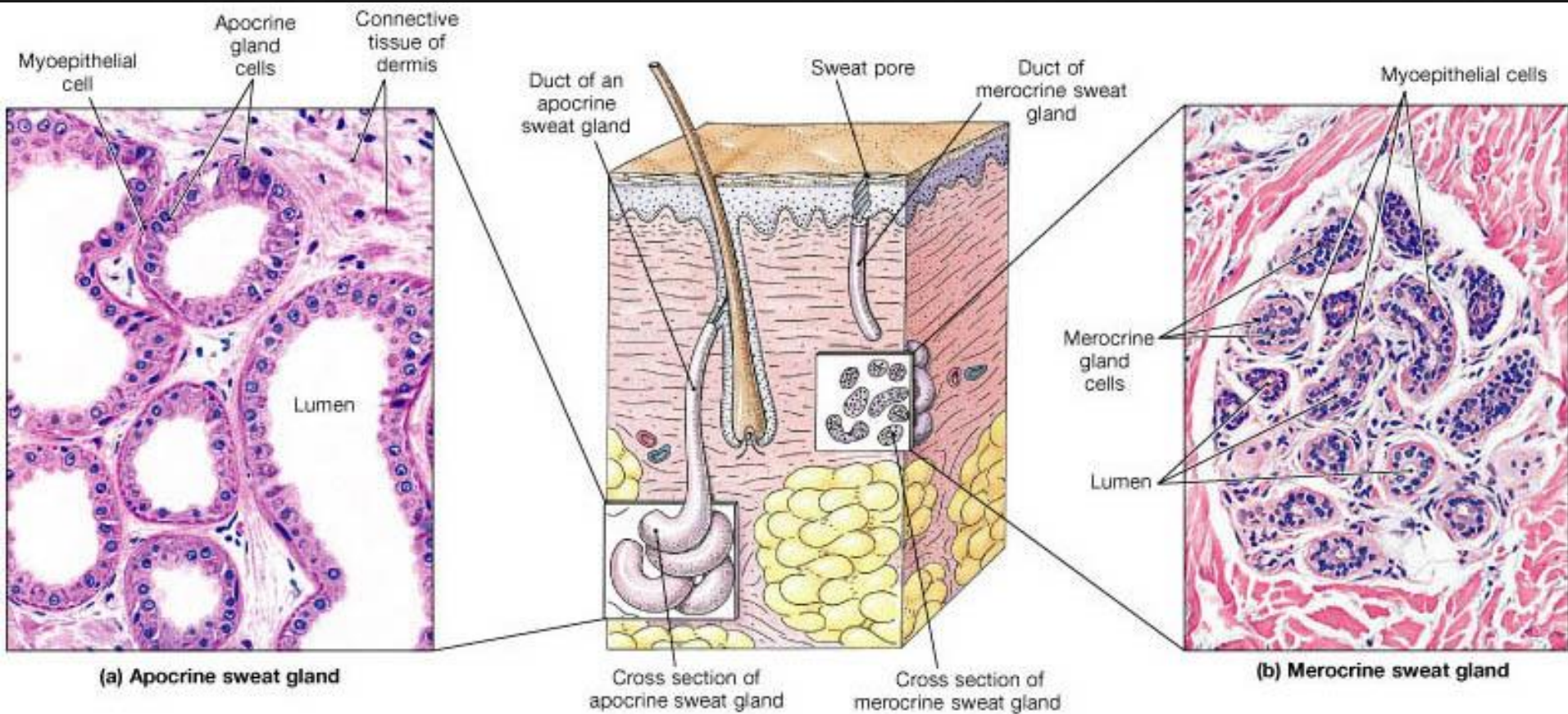
Light Cells

Dark Cells

Myoepithelial
Cells

Eccrine Sweat
Gland





Skin development

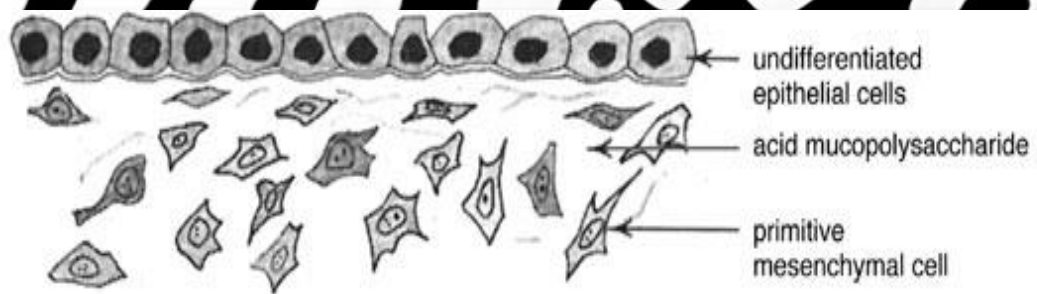
Surface ectoderm → Epidermis

Mesoderm → Dermis
→ Langerhans cells

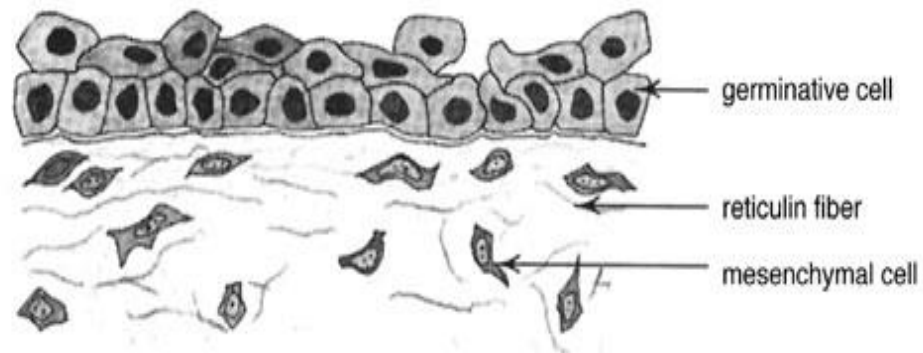
Crista neuralis → Melanocytes
→ Merkel cells

Development skin

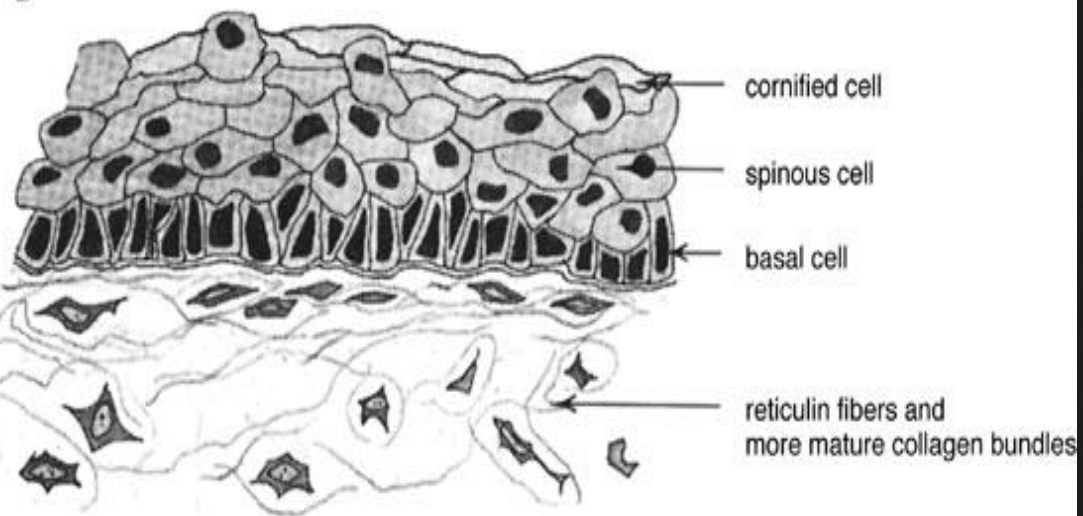
- primordium – 1 layer of epidermal cells (5th week)
- Proliferation of surface ectoderm →
 - **PERIDERM**
 - **BASAL GERMINATIVE LAYER** (= future stratum germinativum)
- Formation of epidermal ridges (8th week)
- Migration of neural crest cells – melanoblasts + Merkel
- keratinization and desquamation = **VERNIX CASEOSA** = **VERNIX OF NEWBORN**
 - Protection before exposition to amniotic fluid
 - Facilitate delivery



A




B



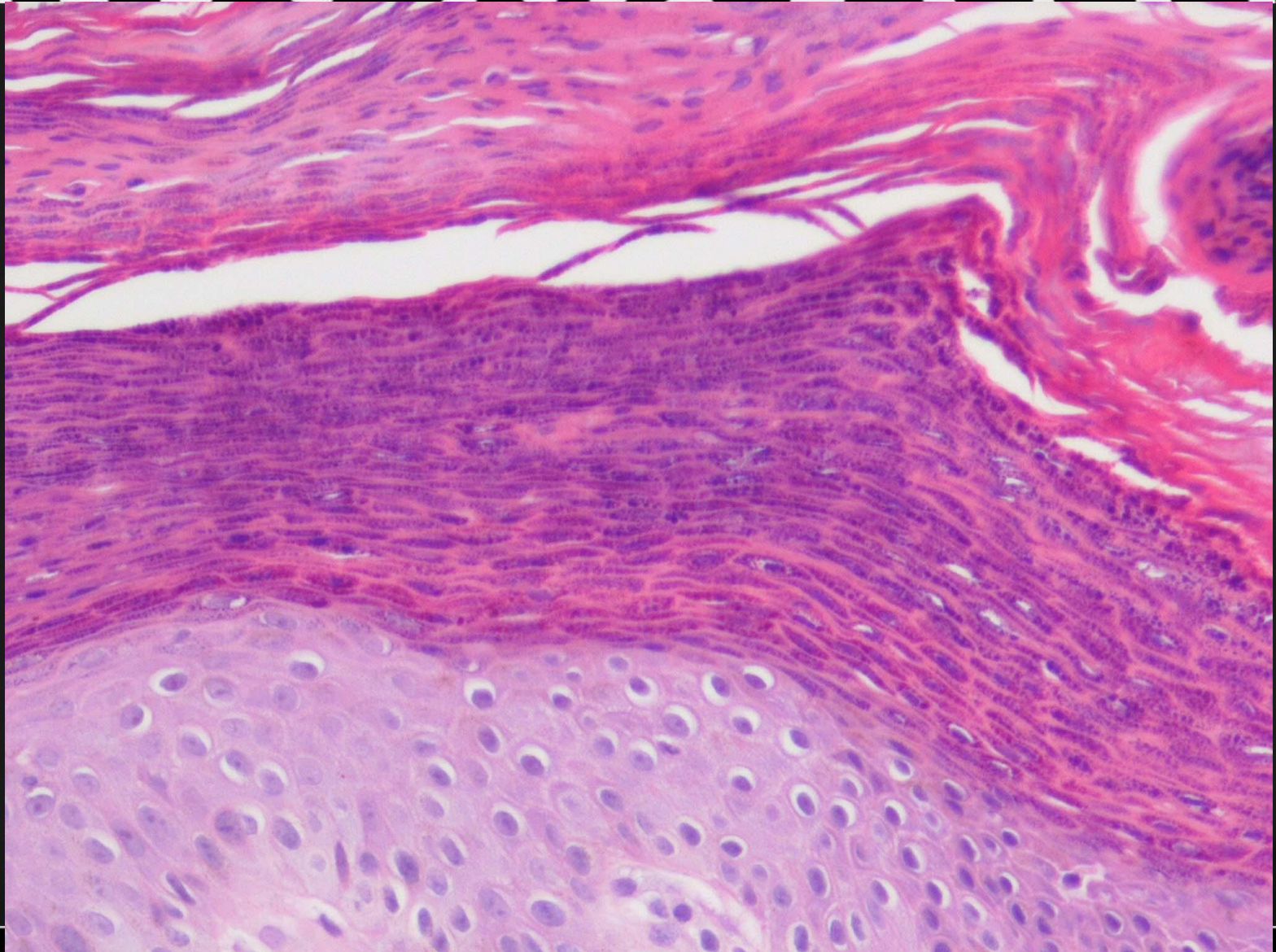
C

Hyperkeratosis

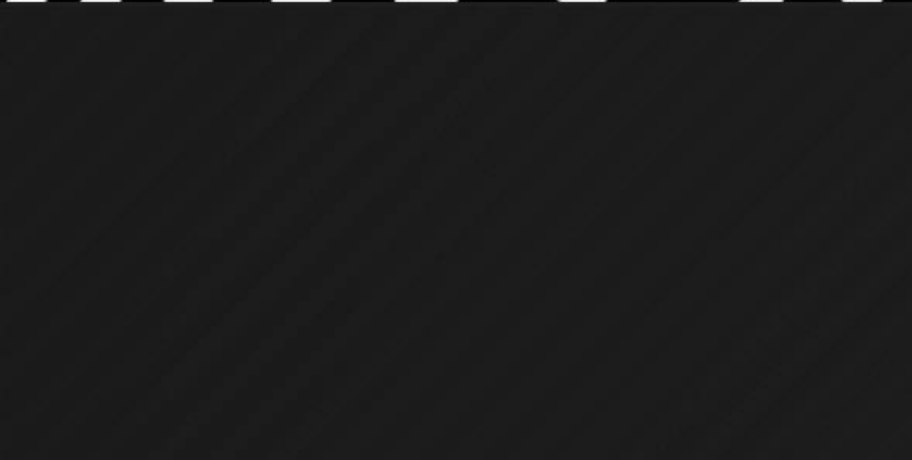


 **Thickened stratum corneum**

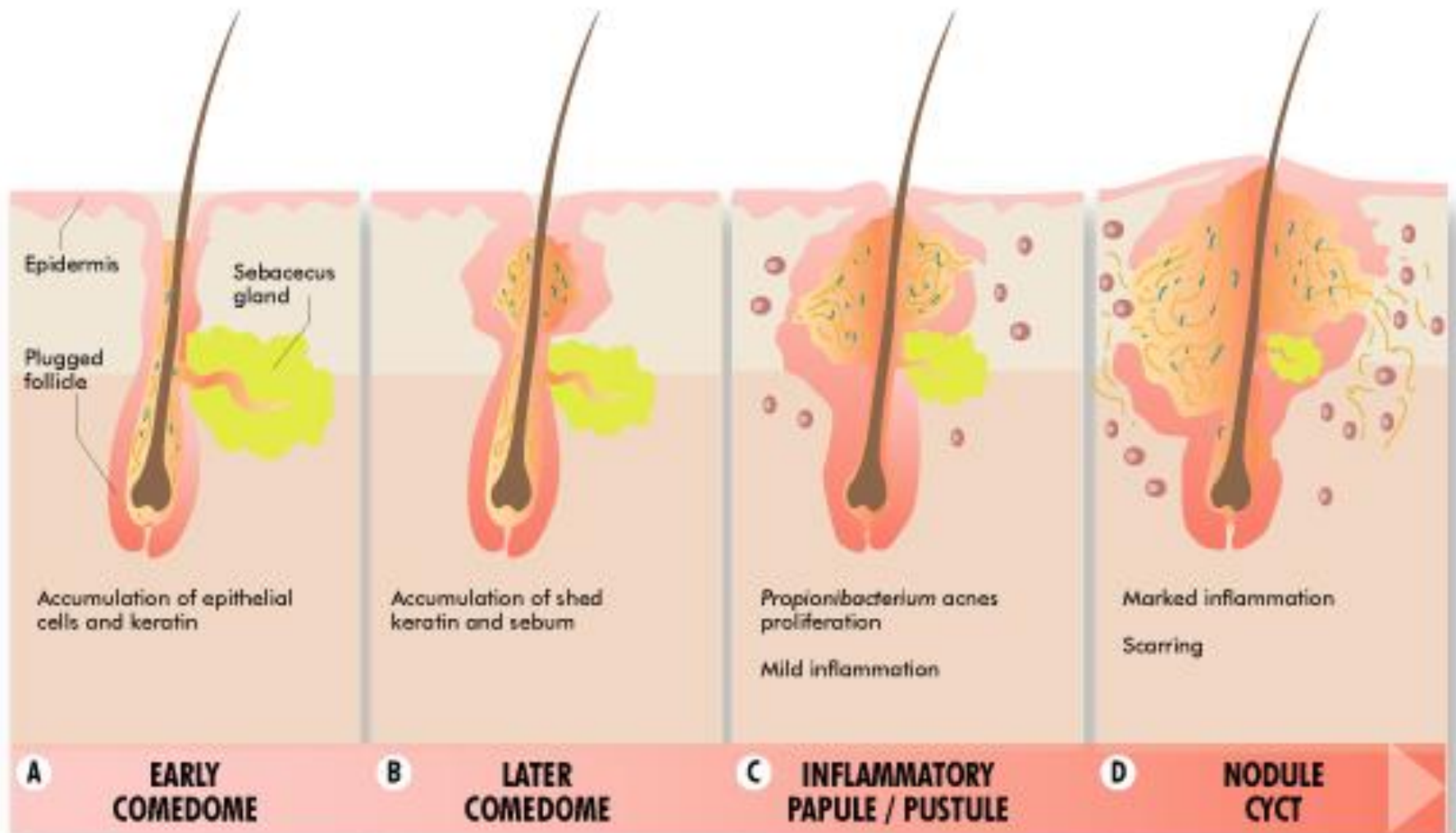
Parakeratosis



Psoriasis vulgaris



Acne vulgaris



Pathogenesis of Acne →

Acne vulgaris



Skin carcinoma

Basal cell carcinoma

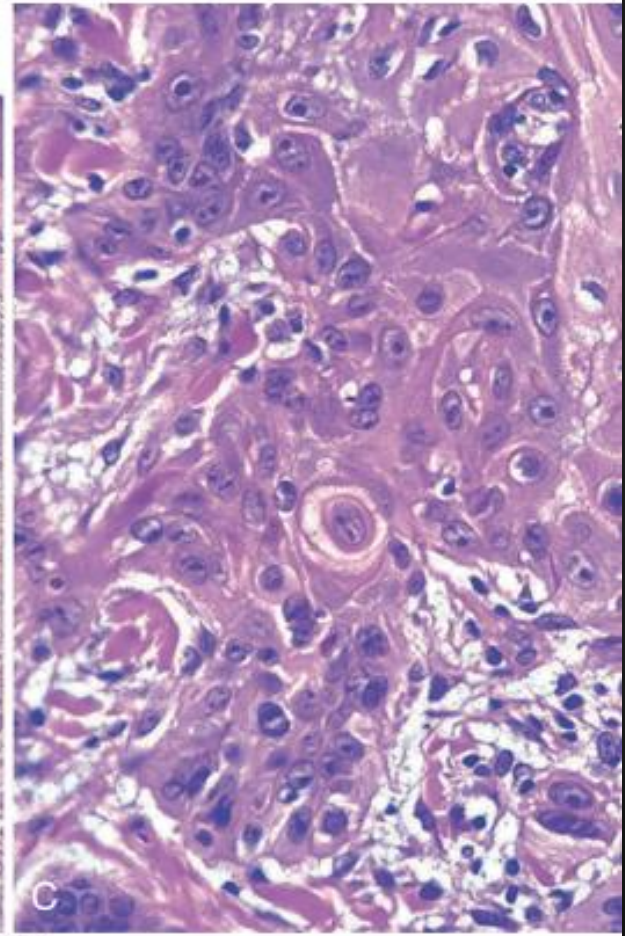
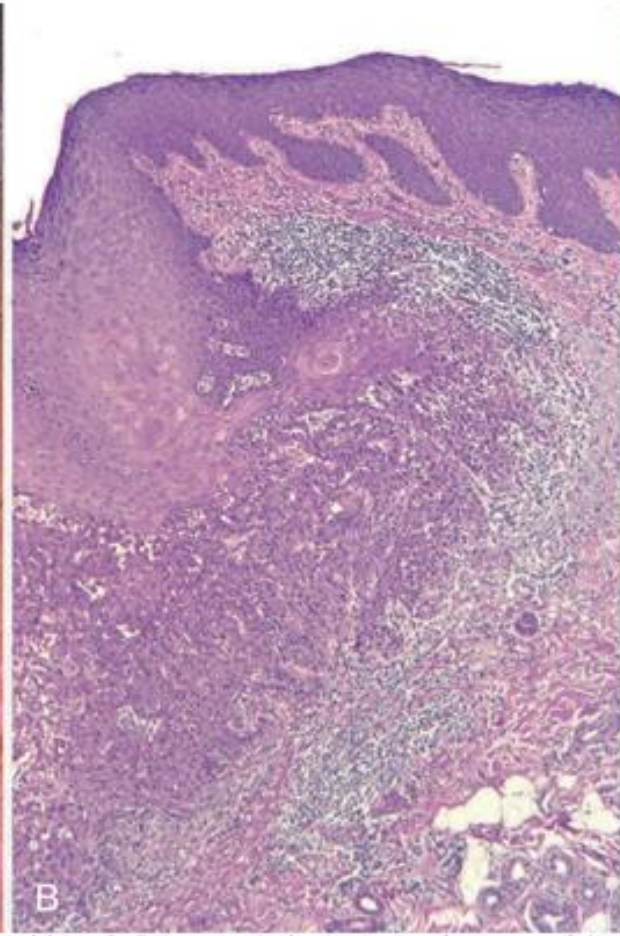
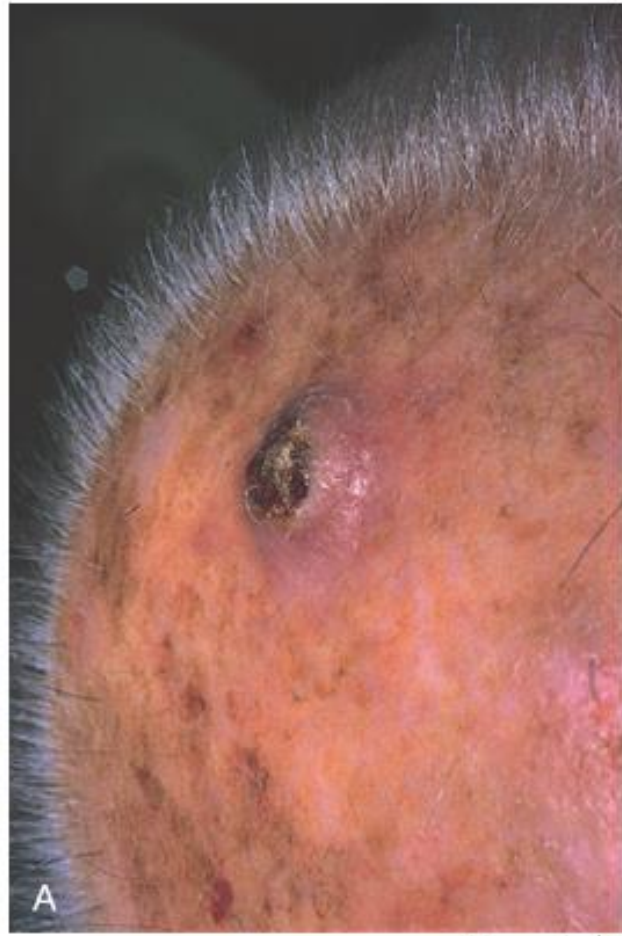


Squamous cell carcinoma



Skin carcinoma





Melanoma



Asymmetry



Border
irregularity

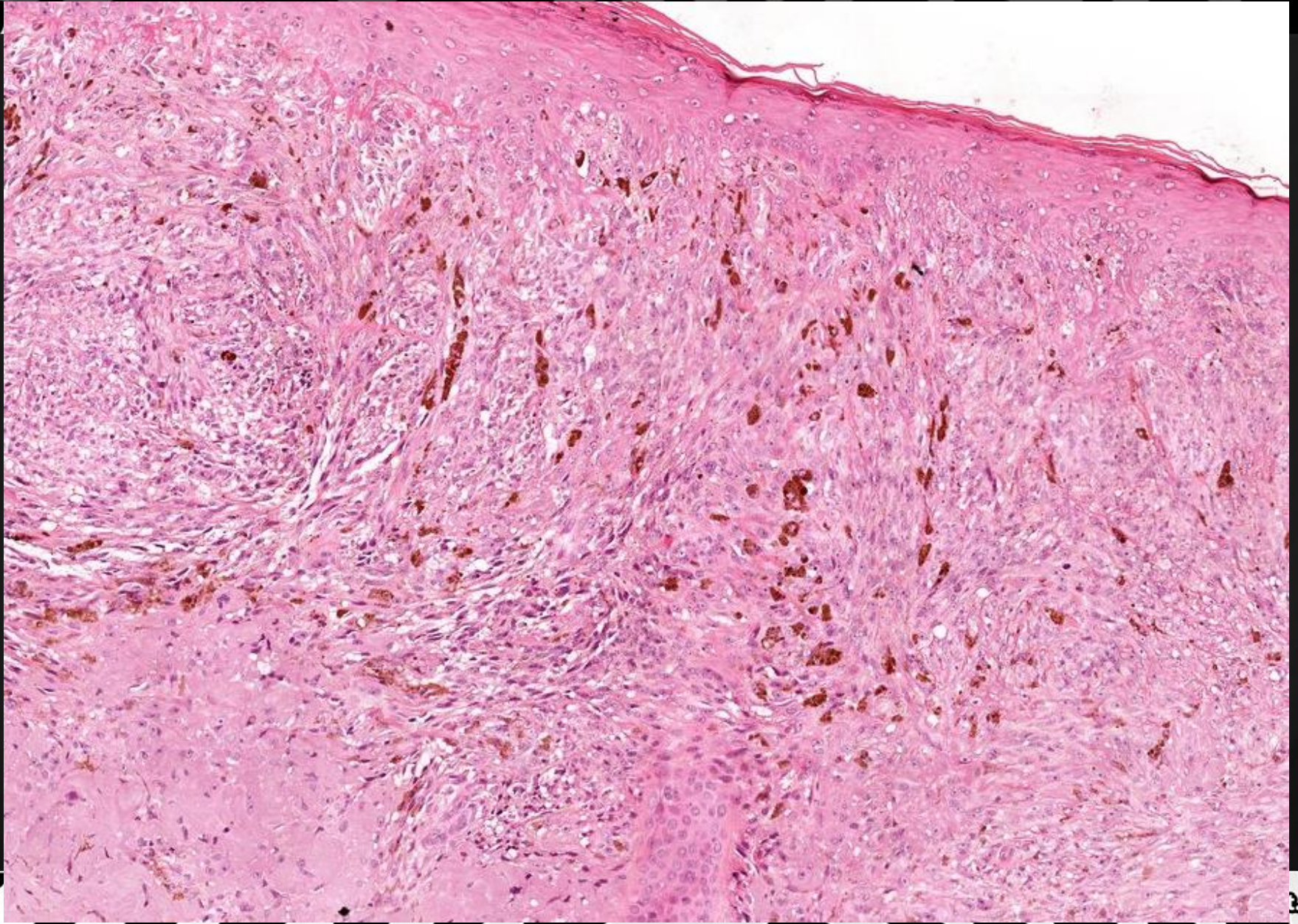


Color



Diameter:
 $\frac{1}{4}$ inch or
6mm

Melanoma



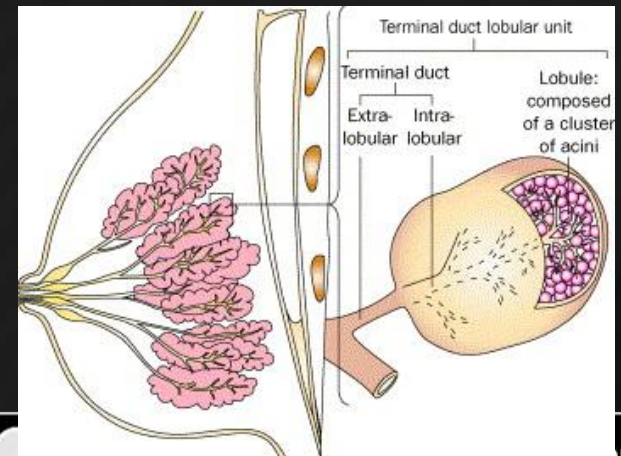
Mammary gland

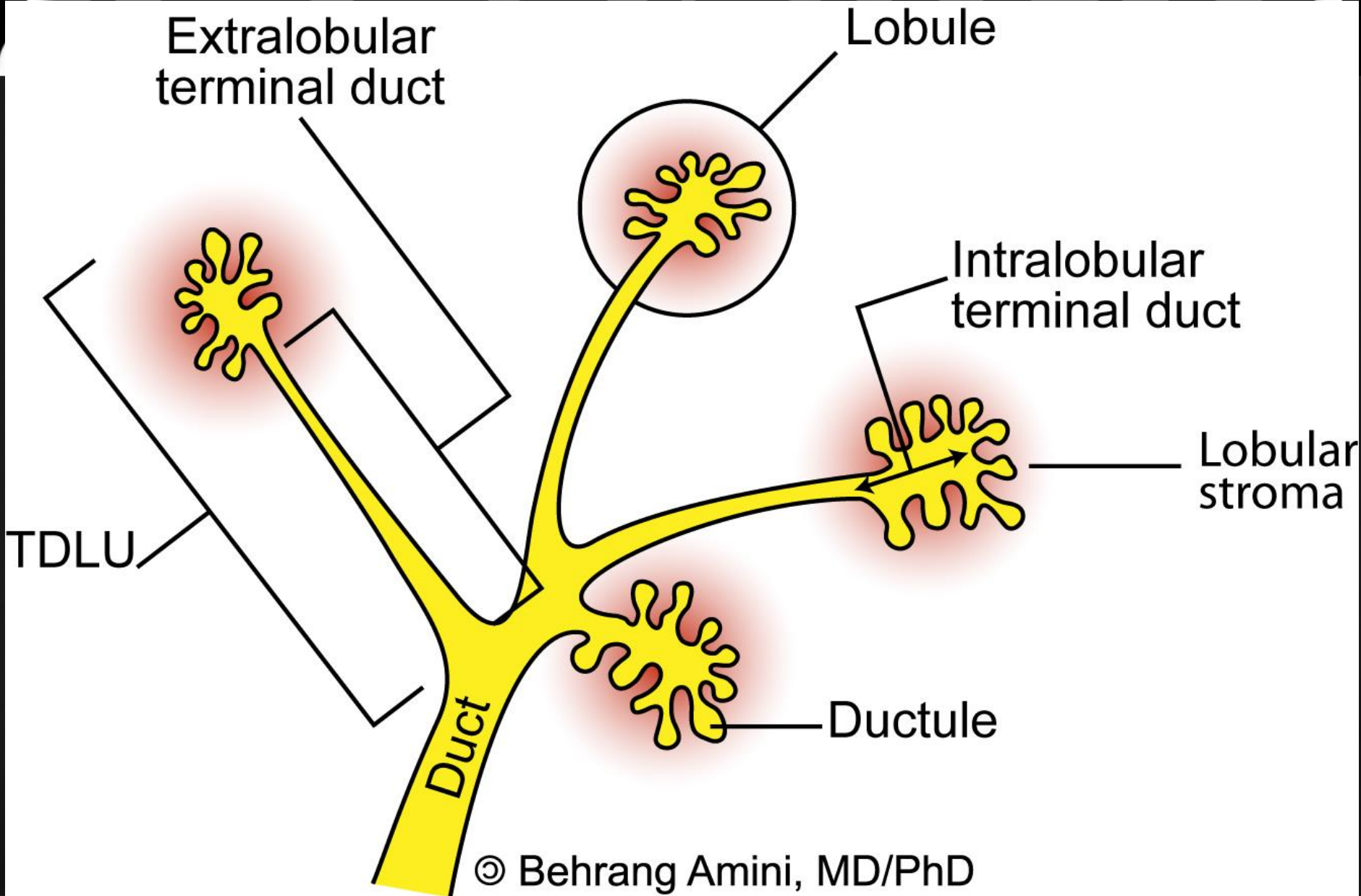
- Compound tubolaveolar apocrine gland
- Milk secretion → newborn nutrition
- 15-25 lobes → lobules → alveoli (glandular epithelium, myoepithelial cells)

Mammary gland

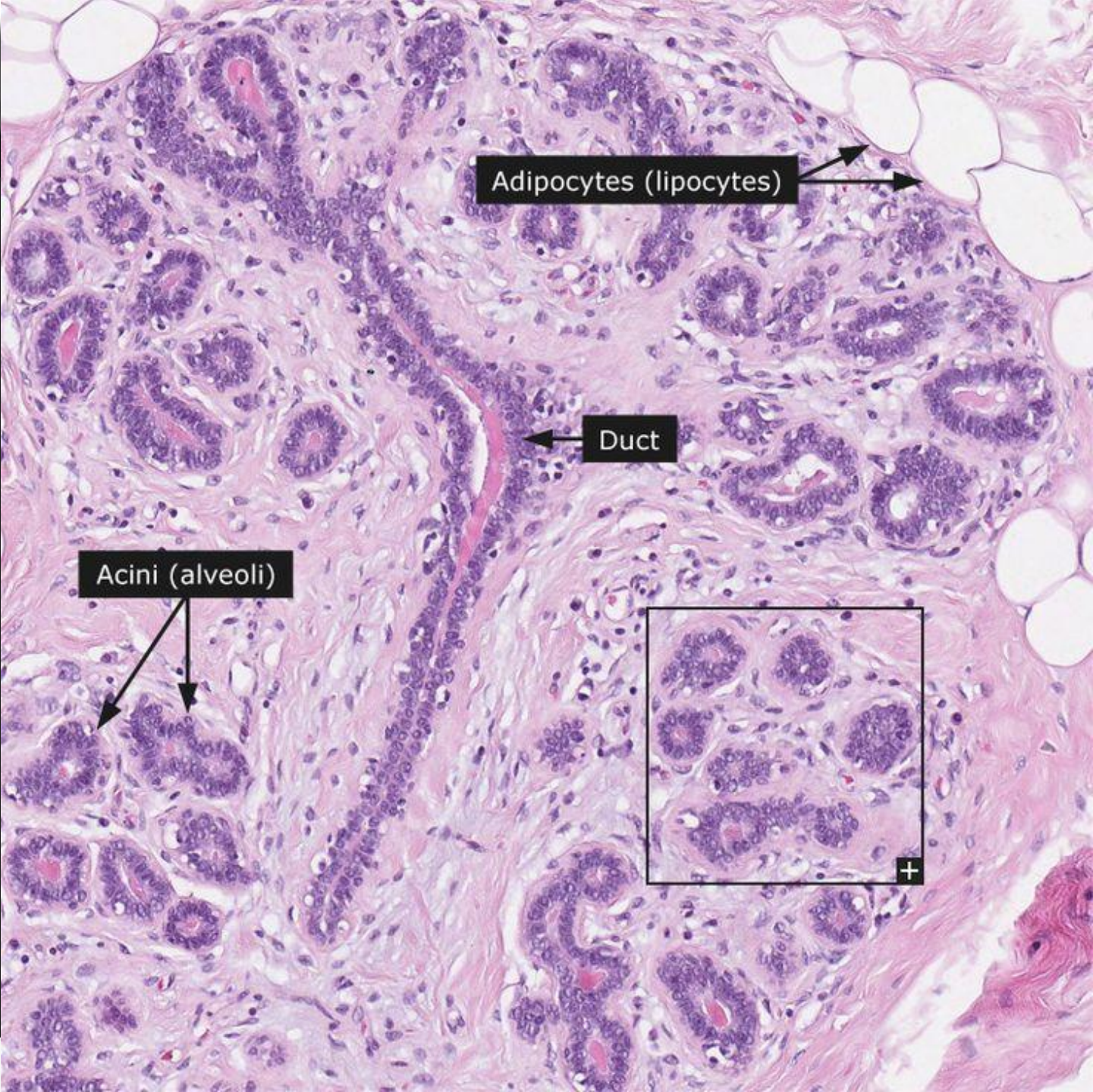
- Glandular lobules surrounded by connective and adipose tissue
- **Alveolus**
 - Simple cuboidal epithelium, myoepithelial cells
 - **terminal ducts (intralobular, interlobular)** → **lactiferous ducts (ductus lactiferi)** → nipple (*papillae mammae*)

- **Terminal duct lobular unit**





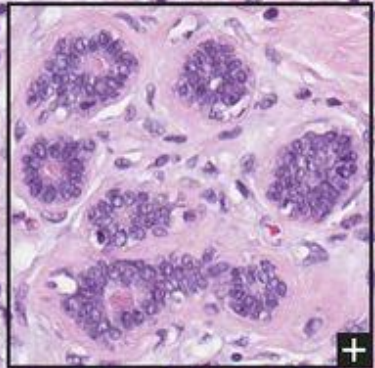
© Behrang Amini, MD/PhD

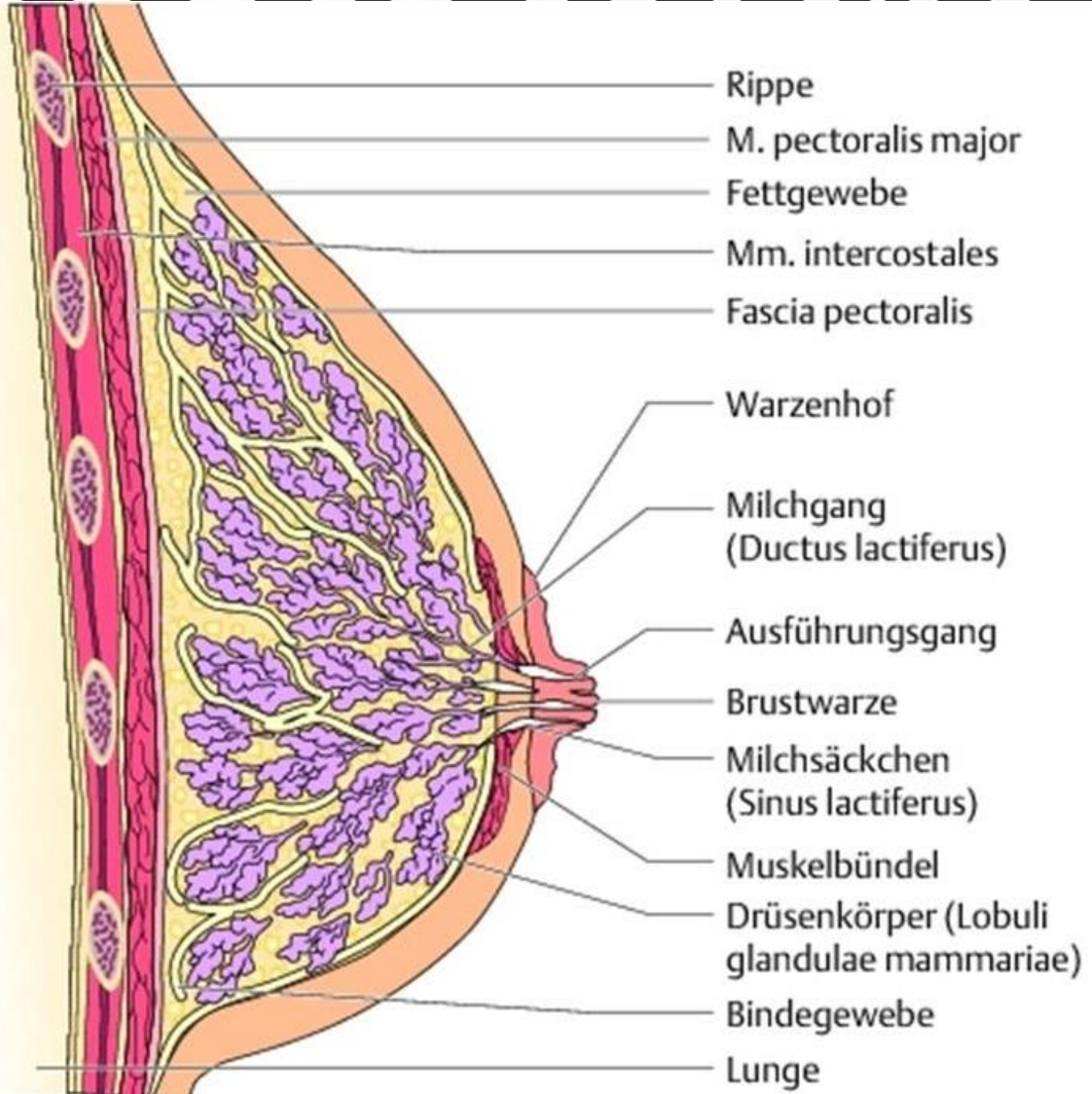


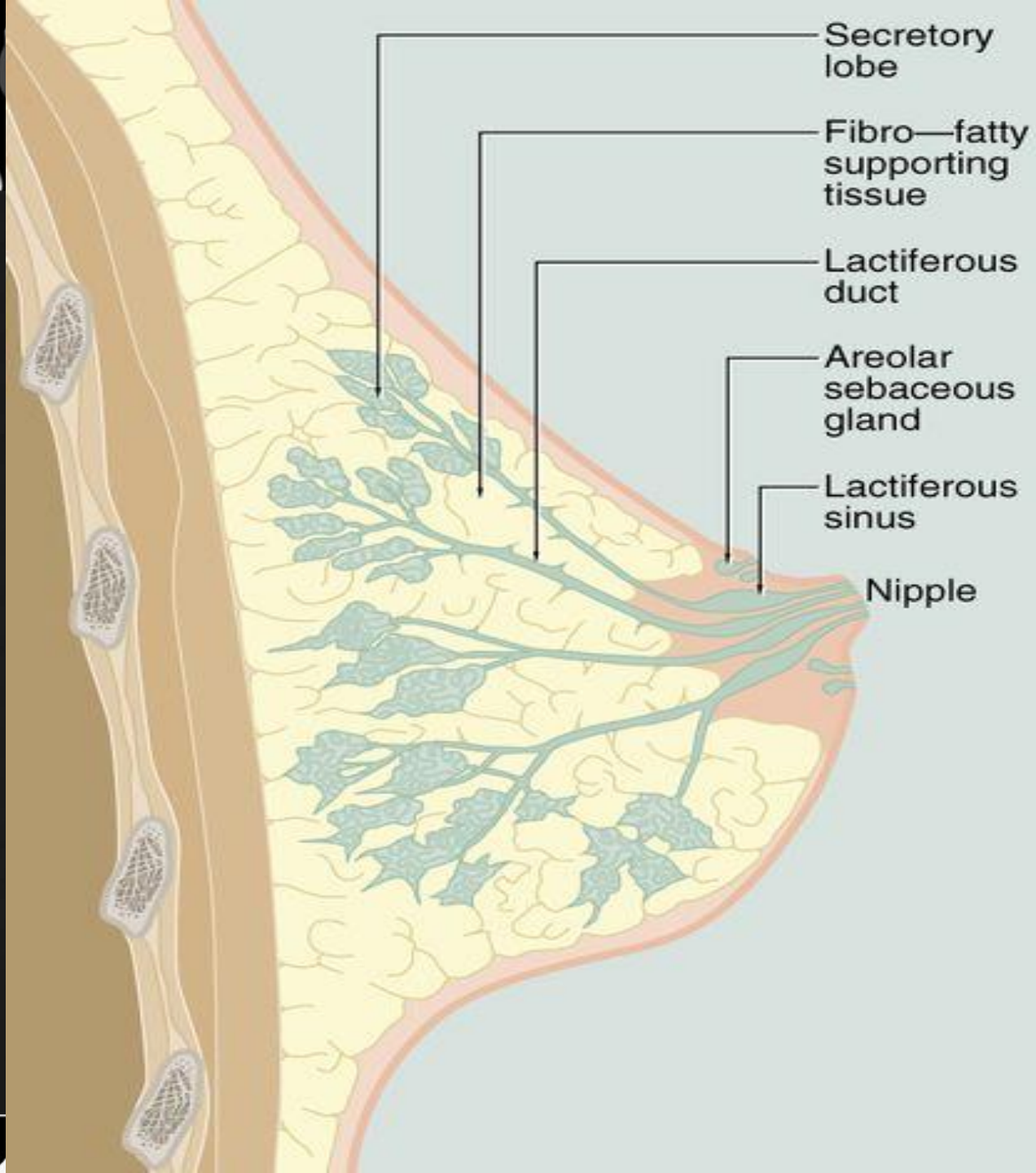
Adipocytes (lipocytes)

Duct

Acini (alveoli)



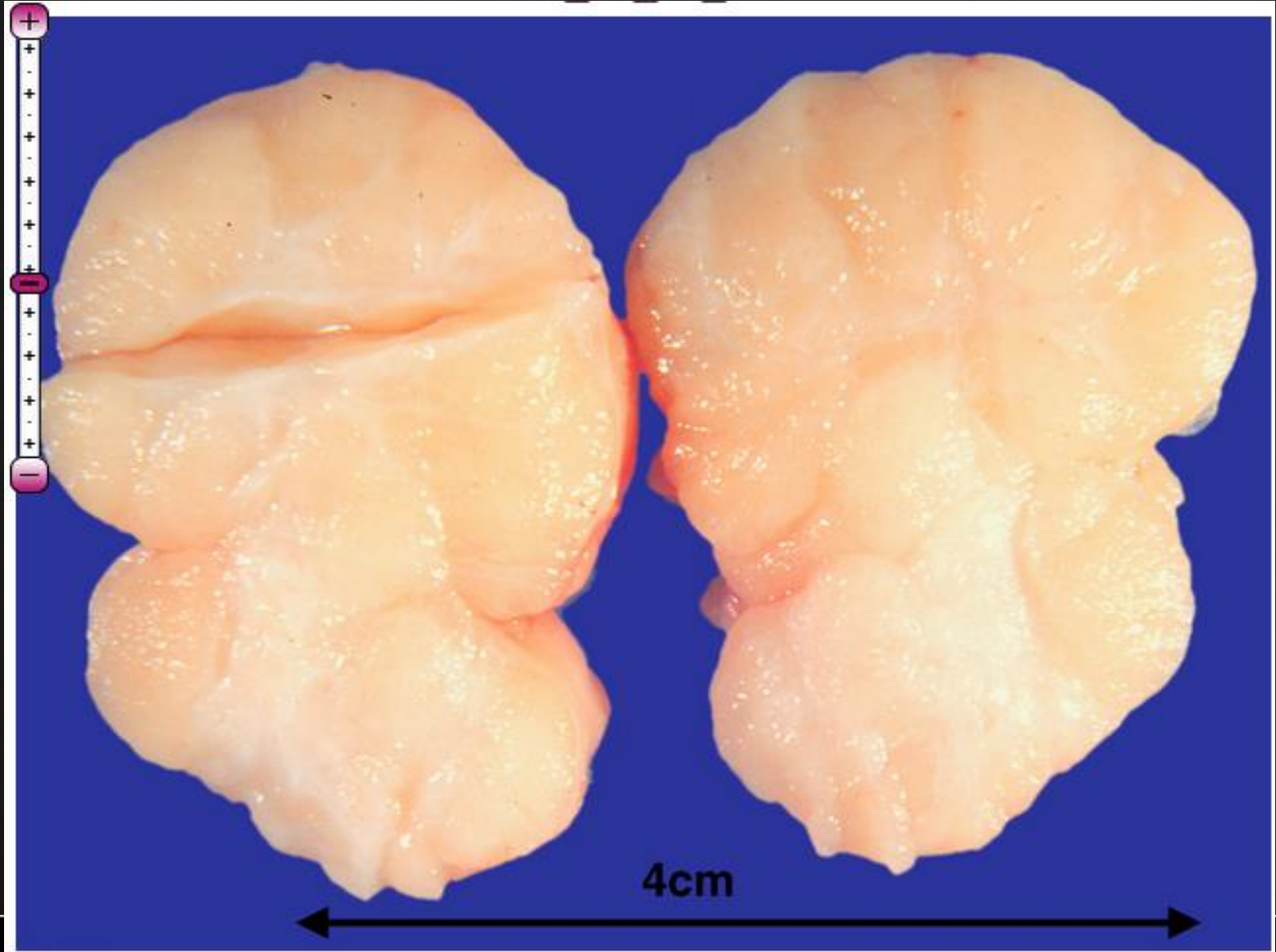




Mammary gland

- **Areola** (*areola mammae*)
 - glandulae areolares *Montgomeryi* (*apocrine*)
 - Smooth muscle – radially arranged
 - pigmentation
- **Nipple** (*papilla mammaria*)
 - area cribriformis papillae
 - Opening of lactiferous ducts (*ductus lactiferi*)
 - Sebaceous glands – protection from maceration
- **Lactiferous duct**
 - Stratified cuboidal to columnar epithelium

Fibroadenoma



Ca mammae

- Most frequent tu in W - 9% of female population
- Clinical signs – swelling, skin/nipple pulled in, ulceration
- investigation – palpation, ultrasound, mamography, lymph nodes

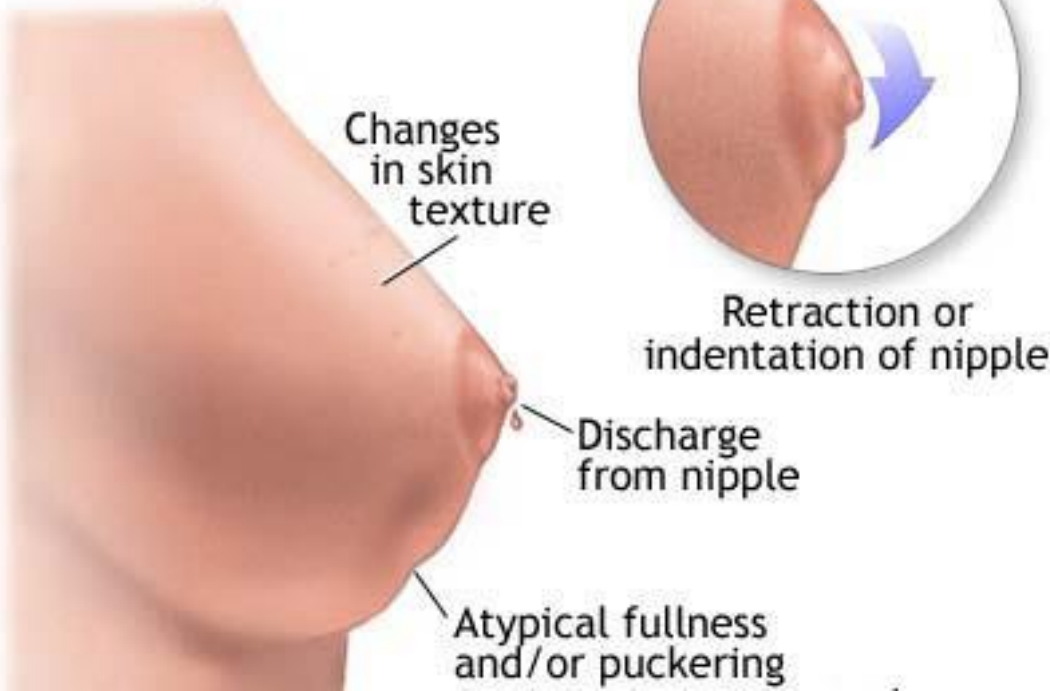
Ca mammae

- 90% from ductal epithelium and only 10% from alveolar epithelium
 - Ductal epithelium express estrogen receptors
- Exstirpation
- Mastectomy



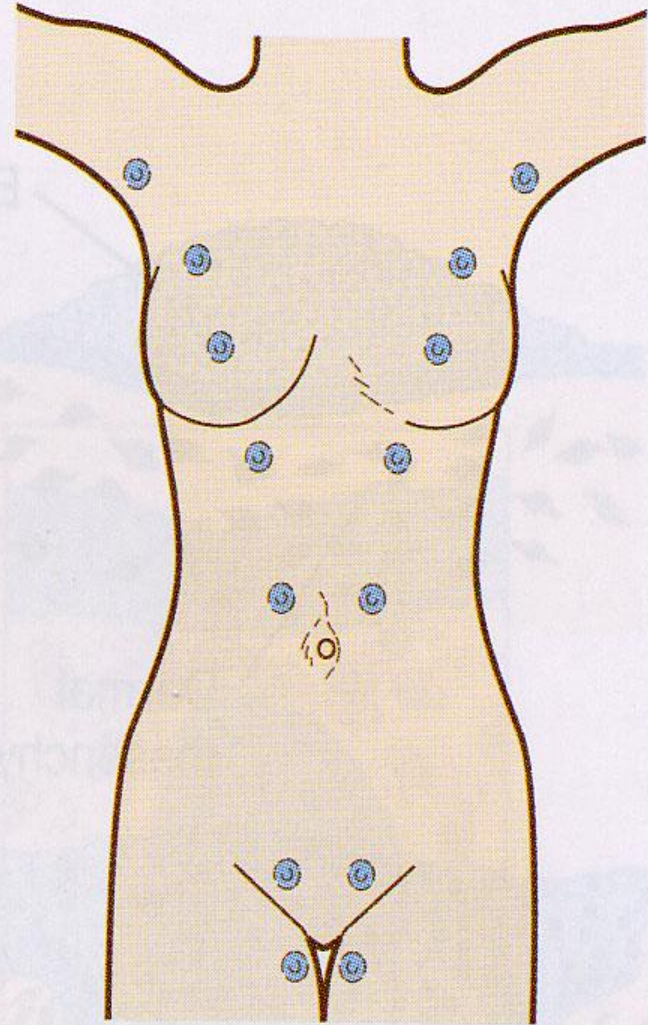
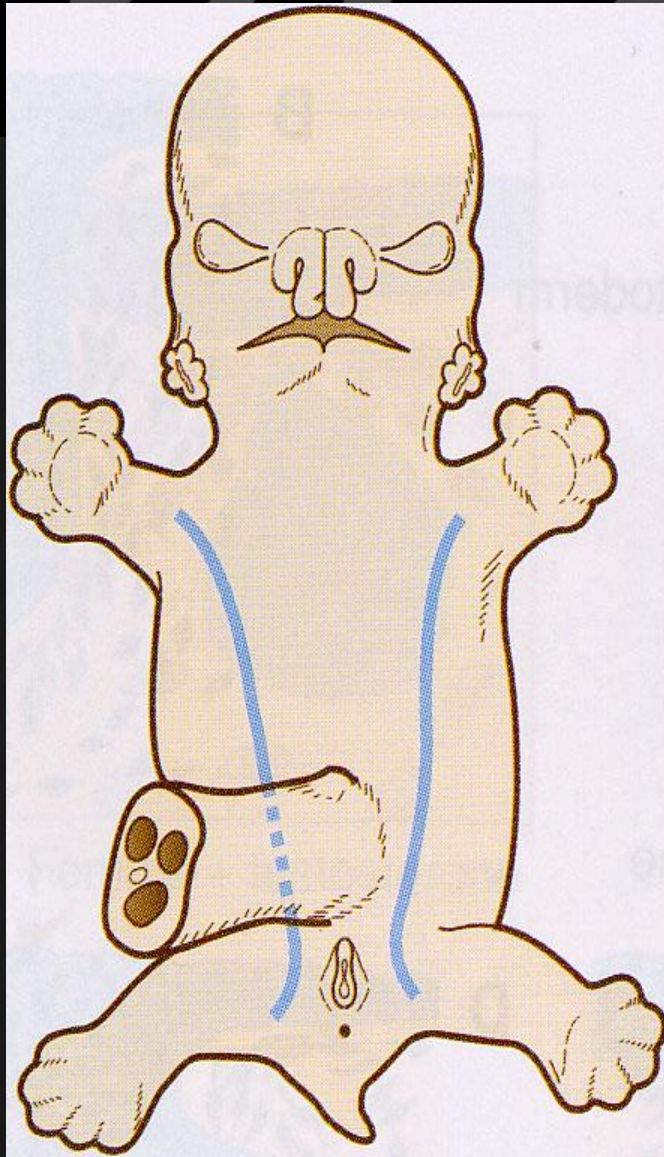


Breast self-exam:
Visual inspection



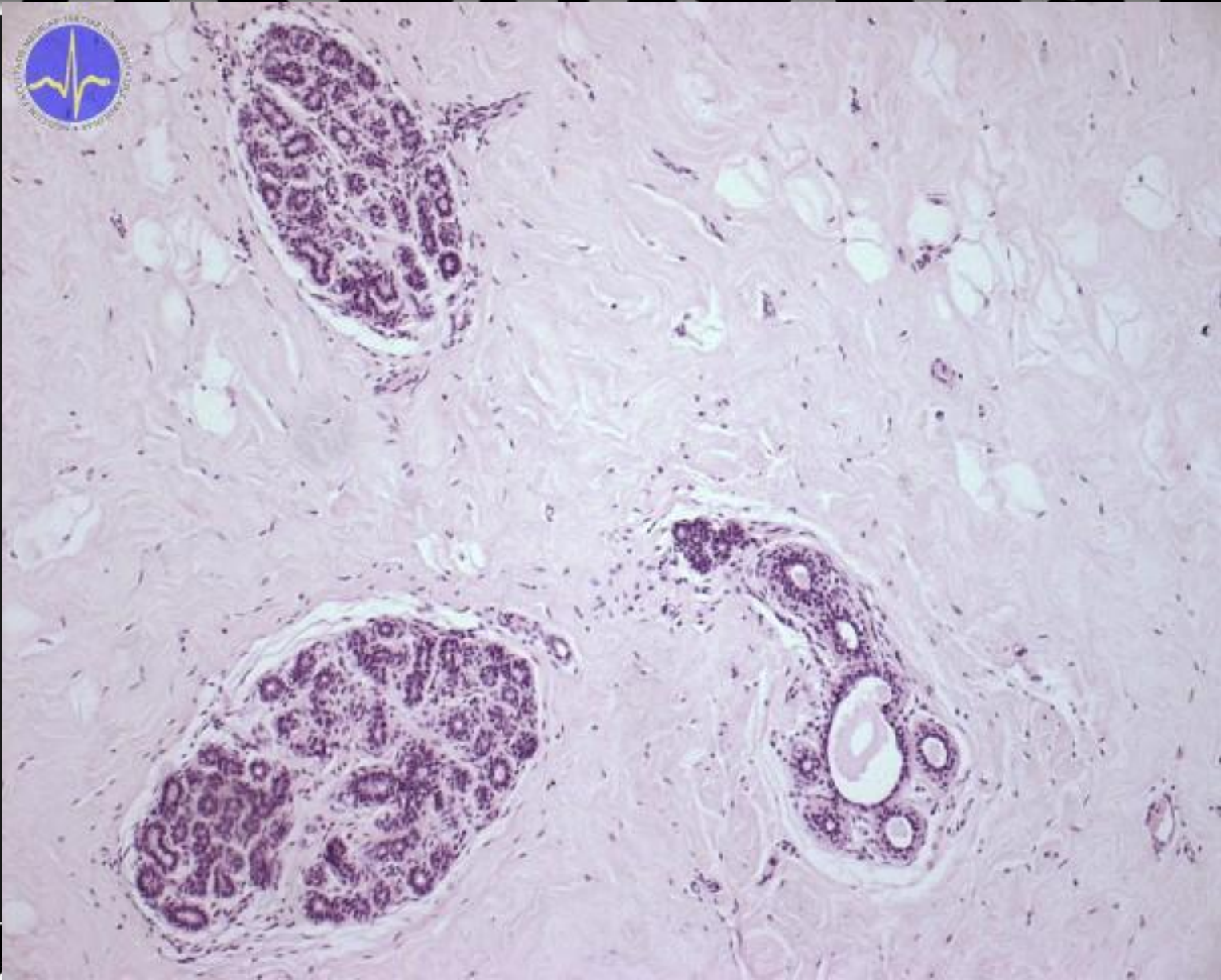
Development

- 6th week mammary ridges
 - thickened ectoderm from axilla to inguinal area
 - Reduction only to thoracic area
- 2nd trimester – 15-20 epithelial buds (sprouts) growing into connective tissue
 - Base of ducts
- Newborns of both genders
 - 3,5- 9 mm diameter
 - ducts bulgy (accumulated secretion)
 - excretion (influence of maternal hormones -Hexenmilch)

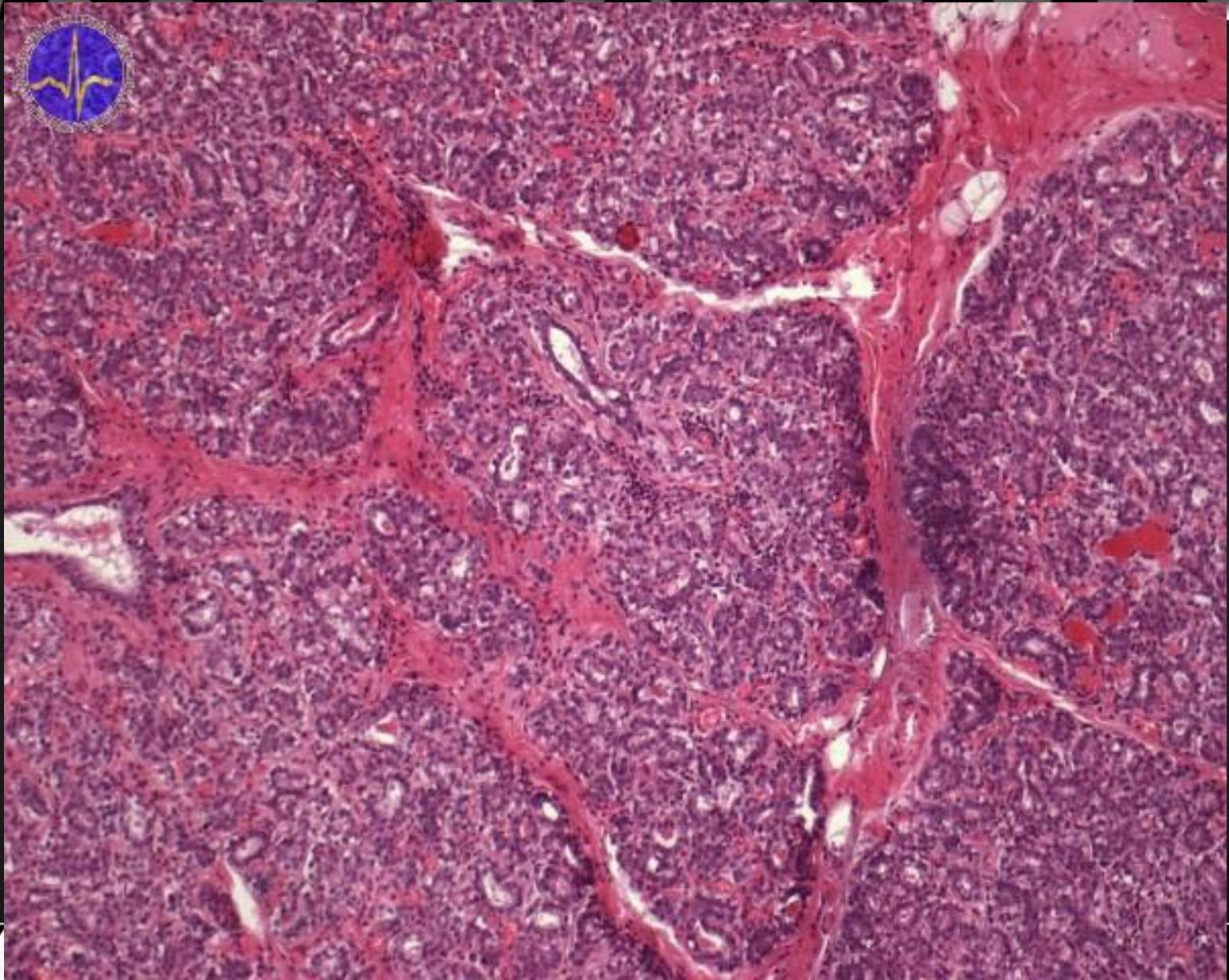


B

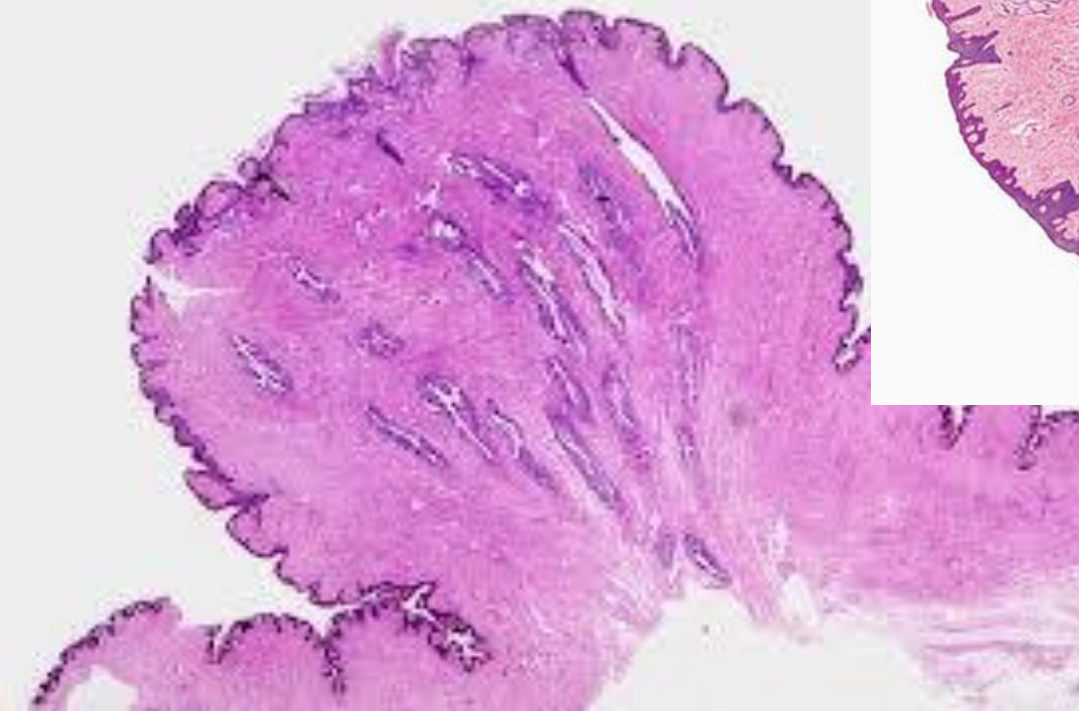
Mamma non lactans



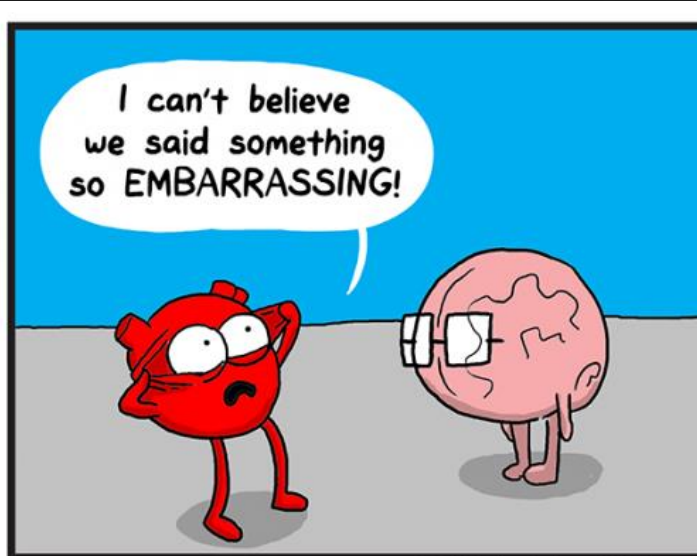
Mamma lactans



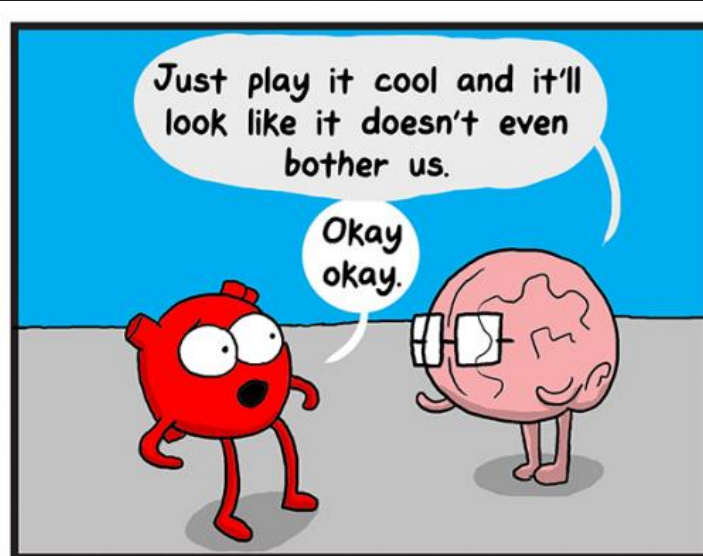
Papilla mammae



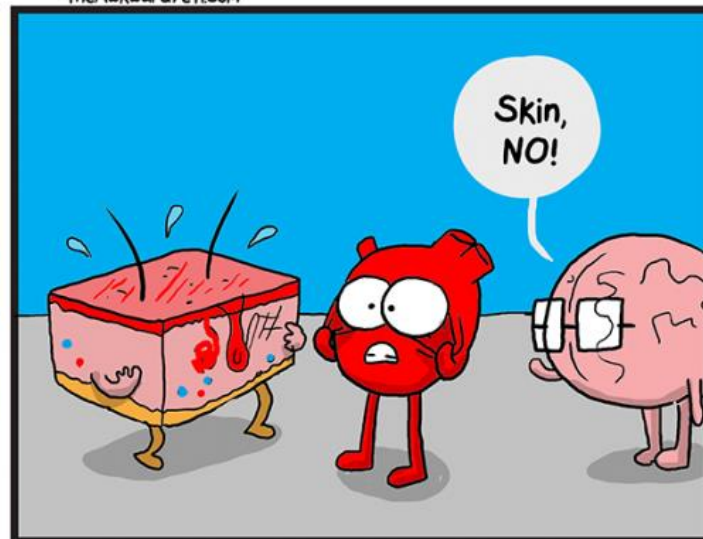
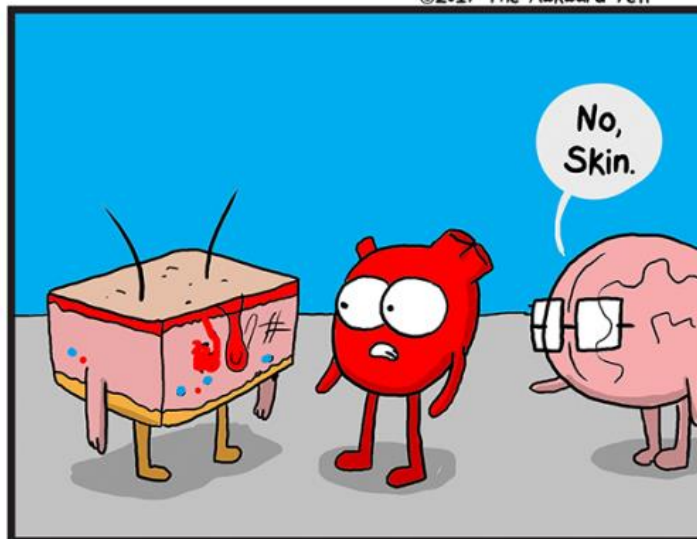
Thanks for attention



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