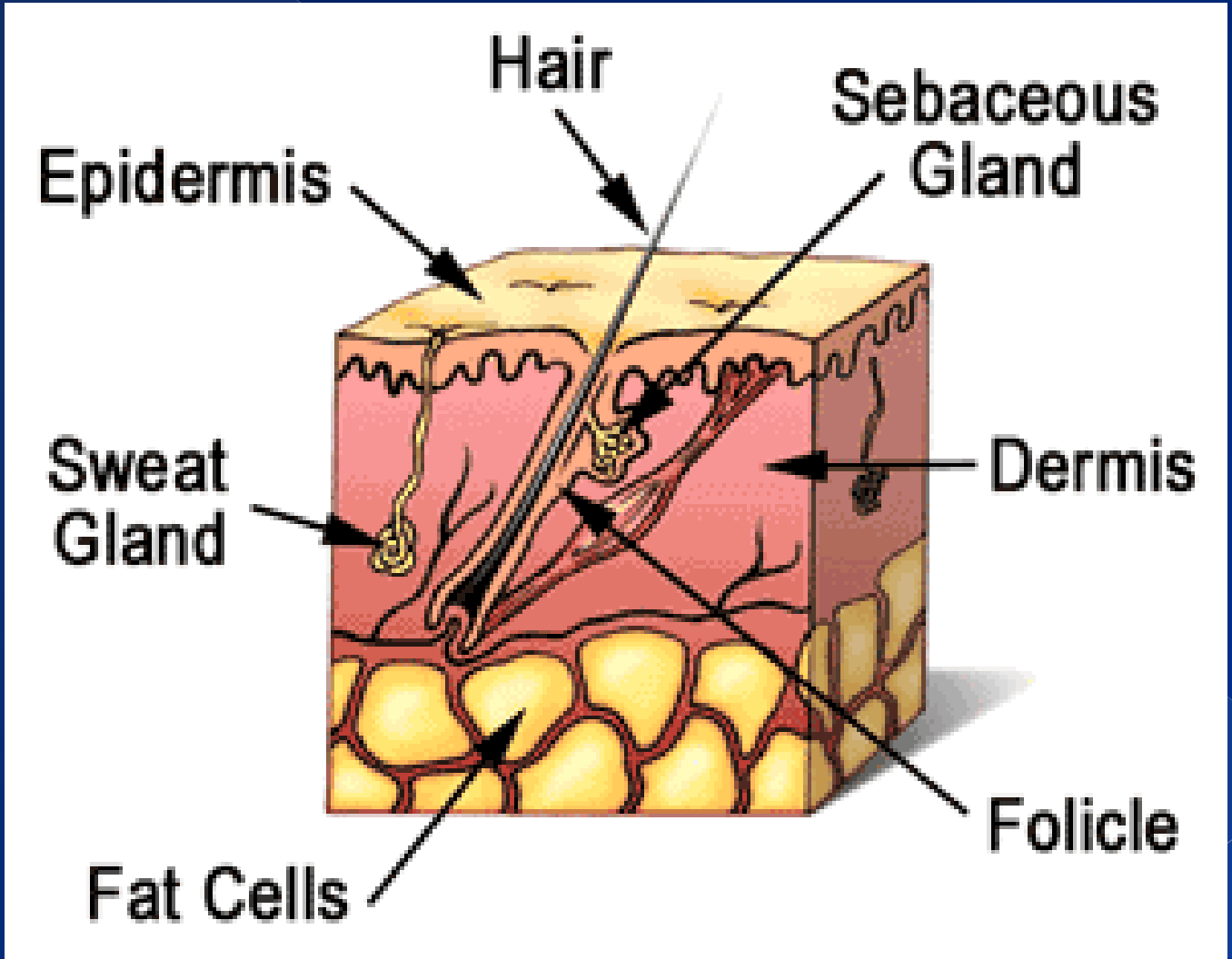
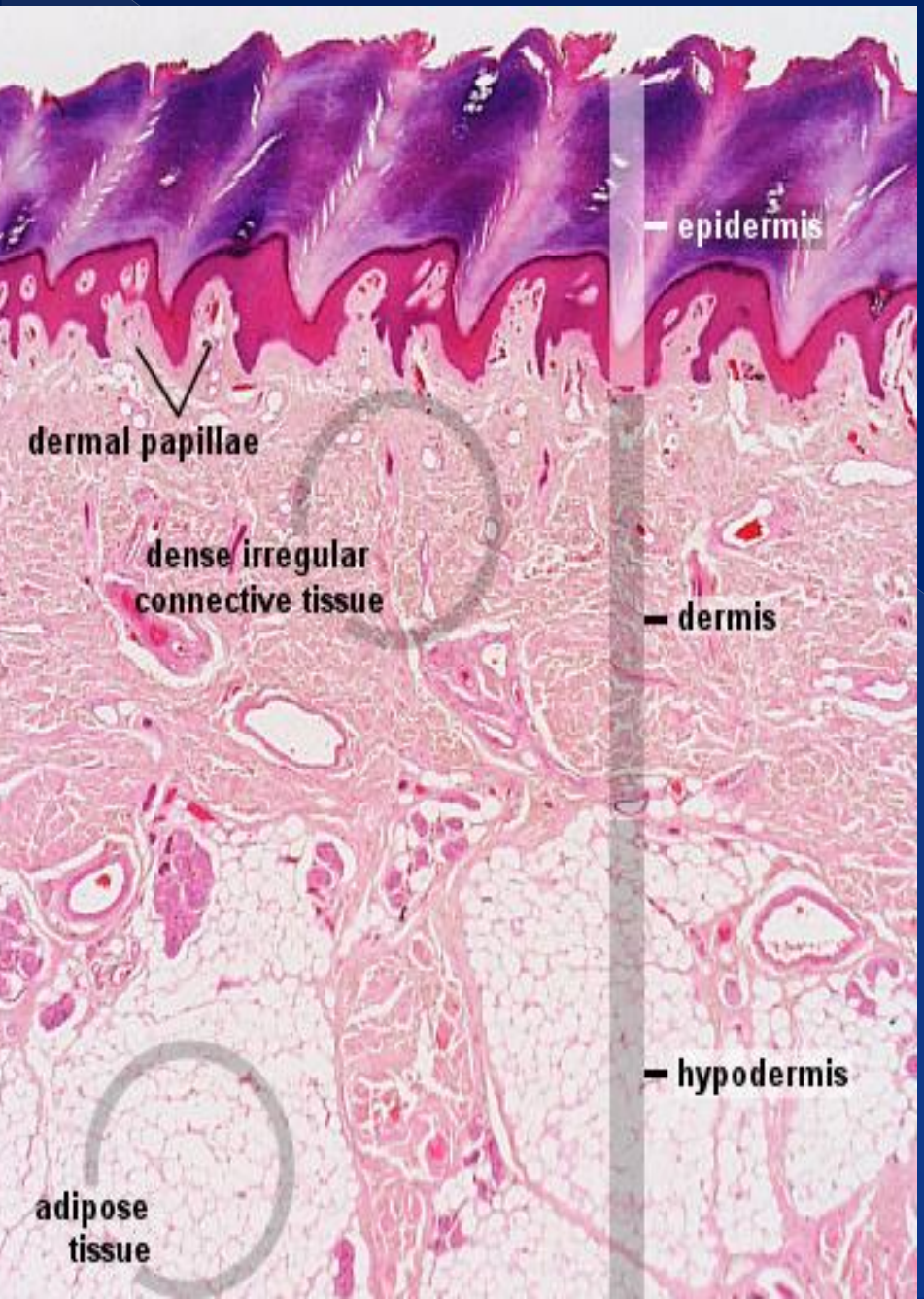

SKIN AND MAMMARY GLAND

Integument - natural covering of an organism

Skin and appendages: sweat glands, sebaceous glands, hair and nails.



Skin – epidermis, dermis (different germ layers)



Epidermis:

- **stratified squamous keratinized epithelium (ectoderm)**

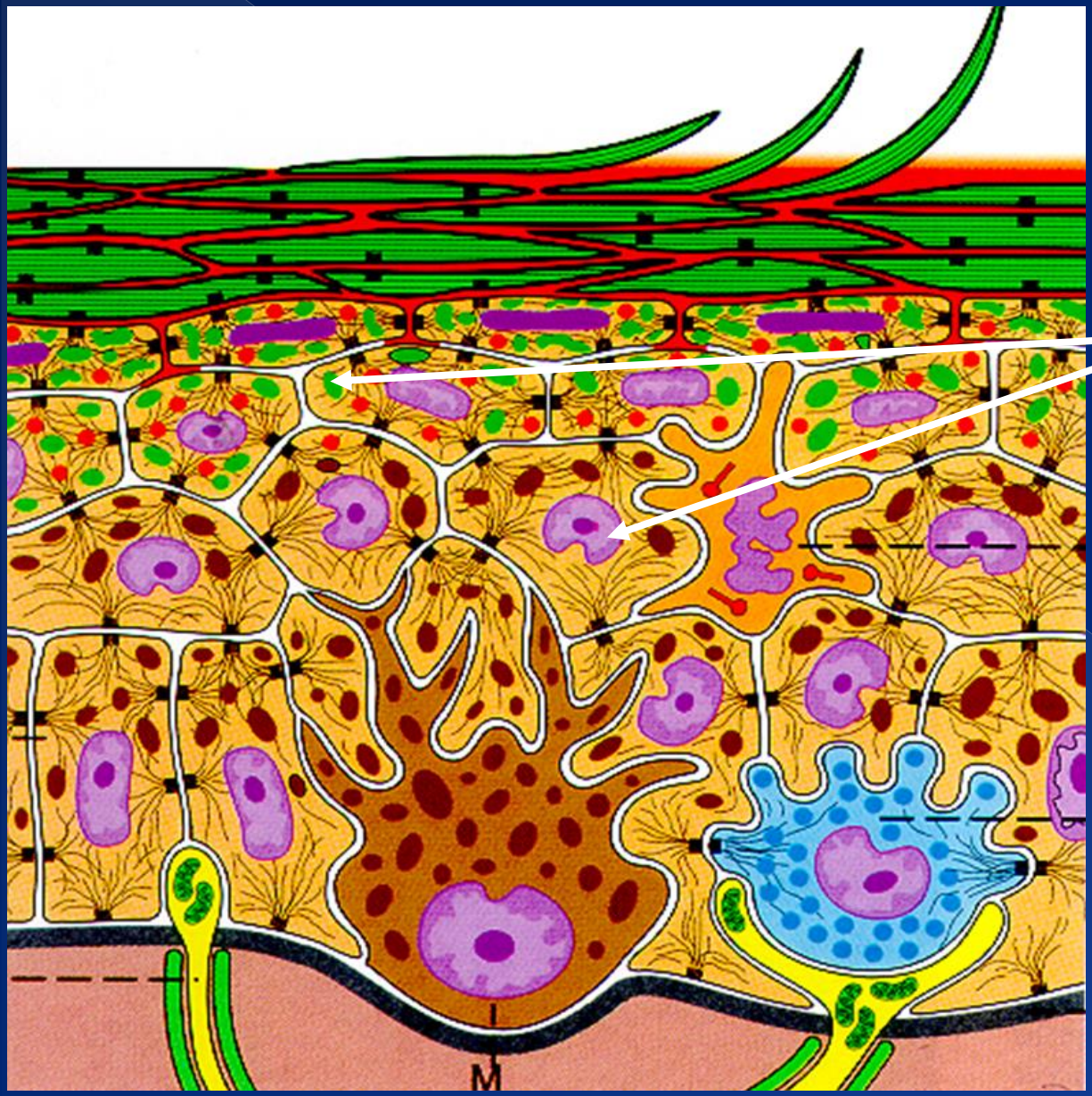
Dermis:

- connective tissue proper (**mesoderm**)

Hypodermis (superficial fascia) - is not a part of the skin

- loose connective tissue with varying amount of **fat cells**.

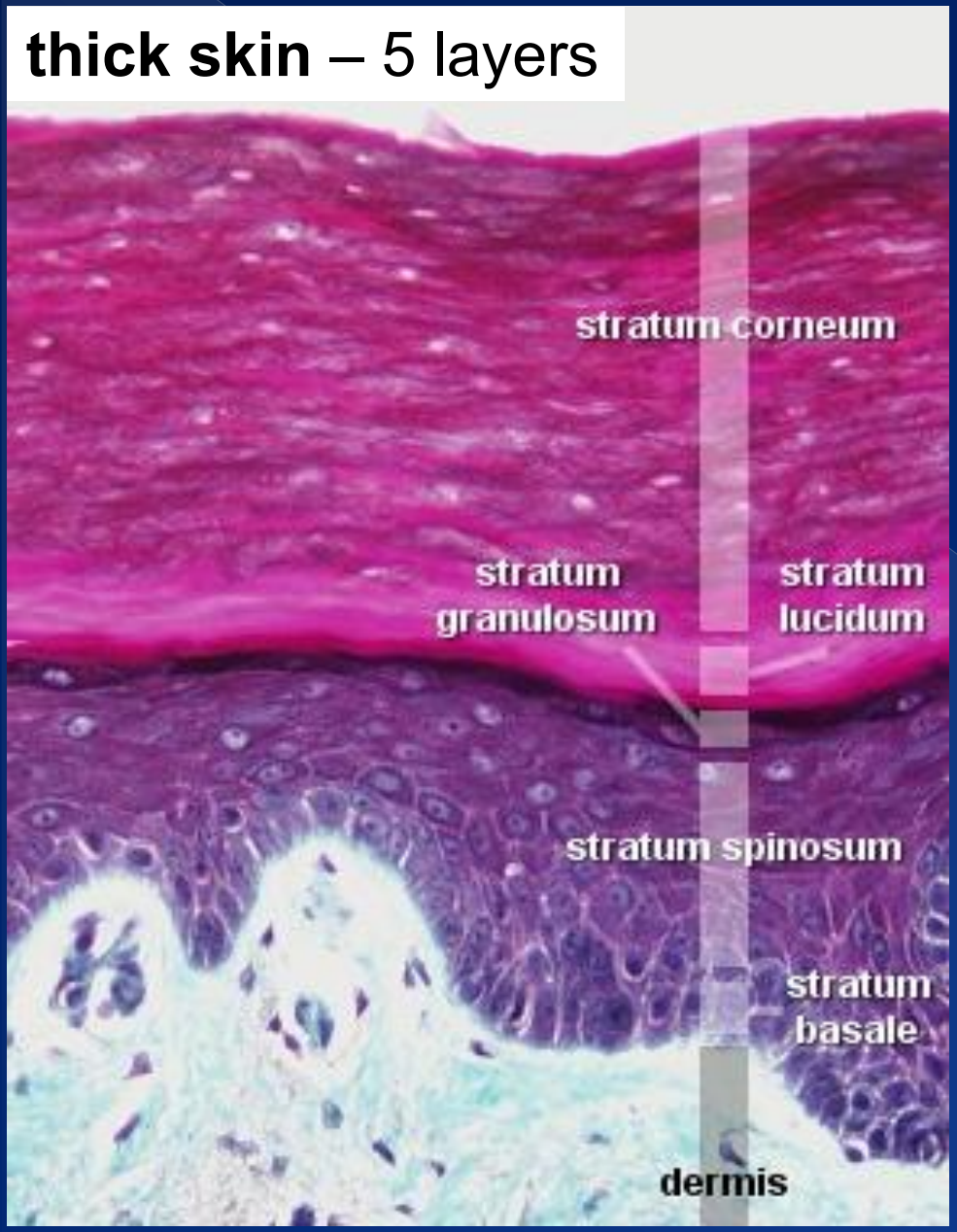
Epidermis - stratified squamous keratinized epithelium



Keratinocytes
(most numerous)

Epidermis

thick skin – 5 layers



thin skin – 4 layers

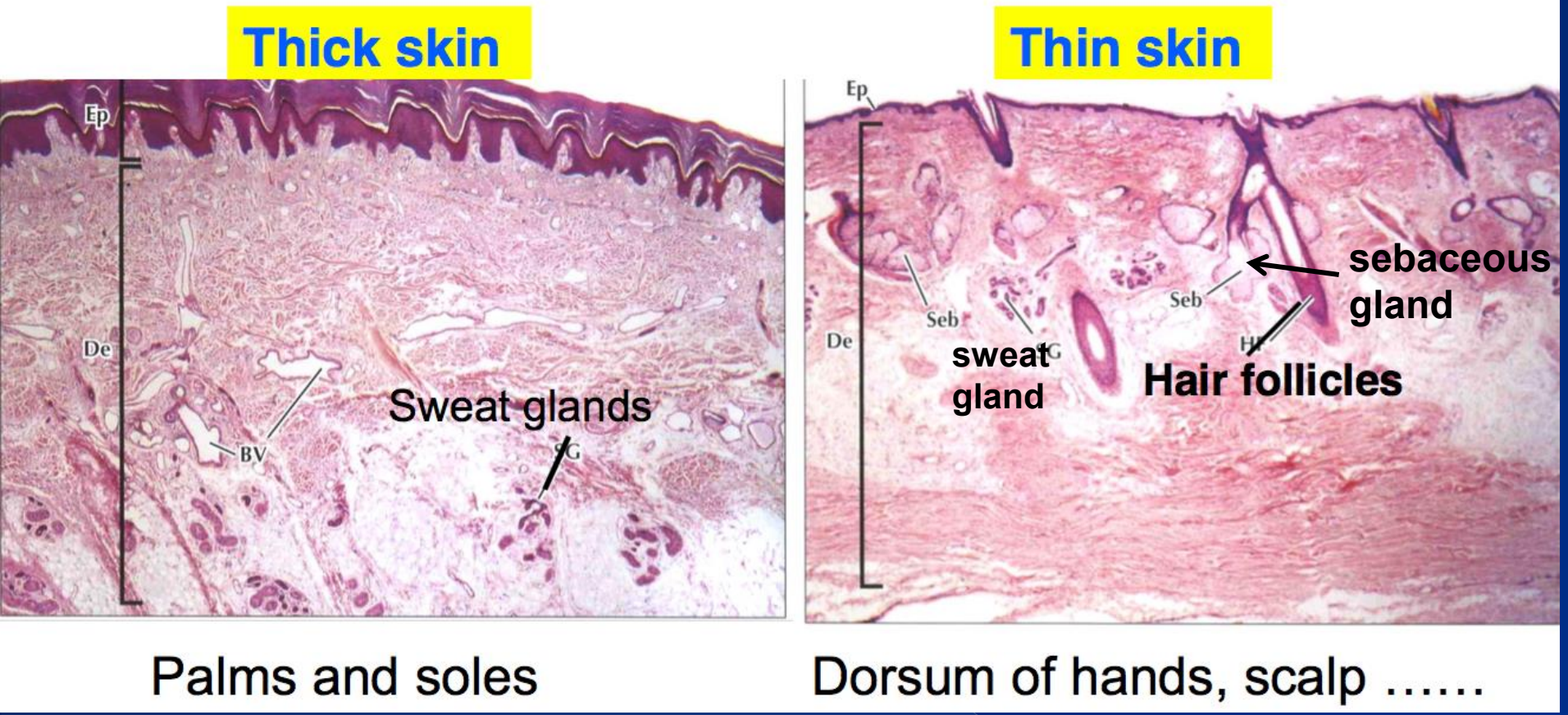
Stratum corneum

Stratum lucidum (only thick skin)

Granular layer

Spinous layer

Basal layer



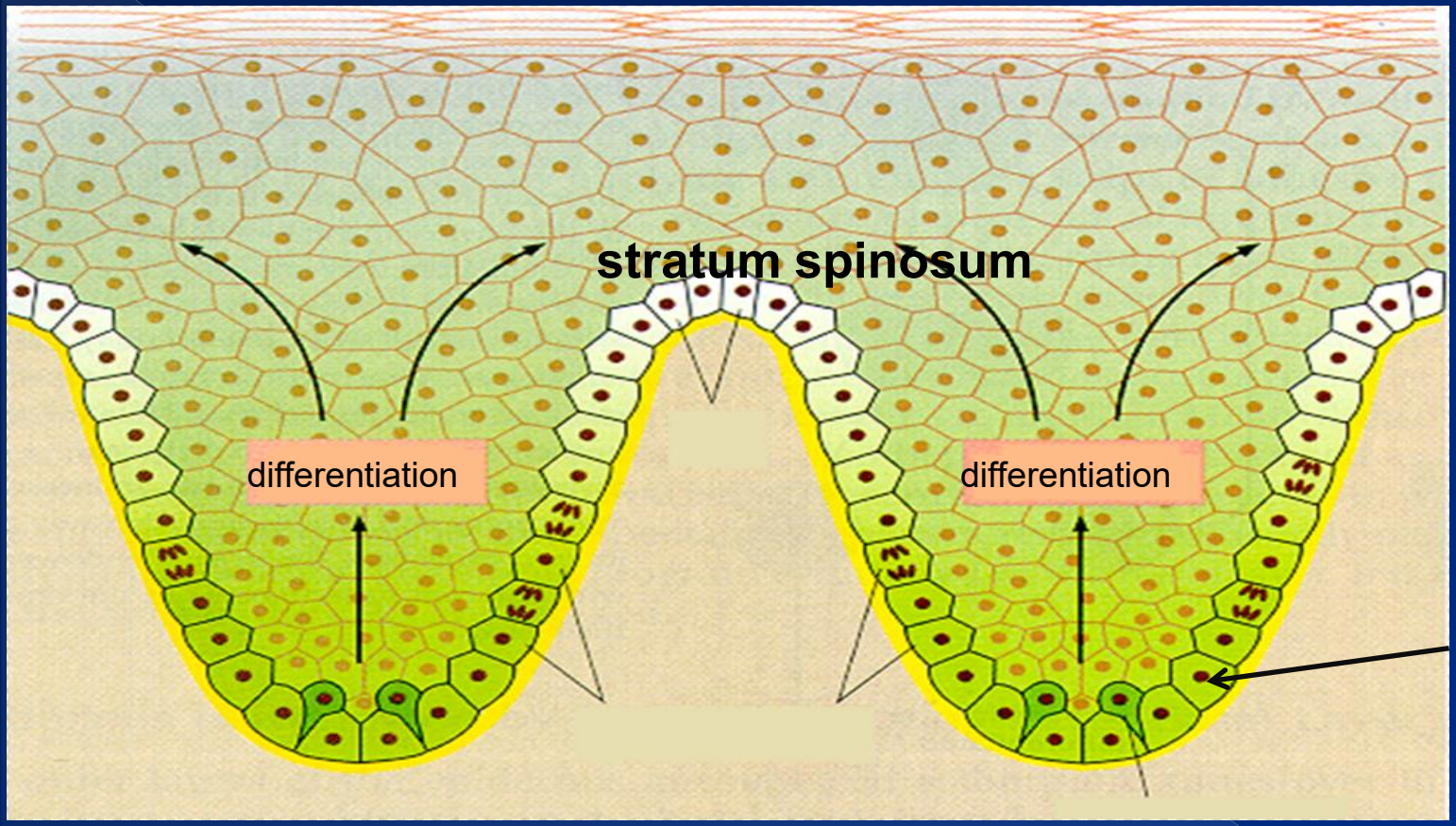
Thick skin

- **palms** and **soles**
- lacks hair follicles and sebaceous glands.

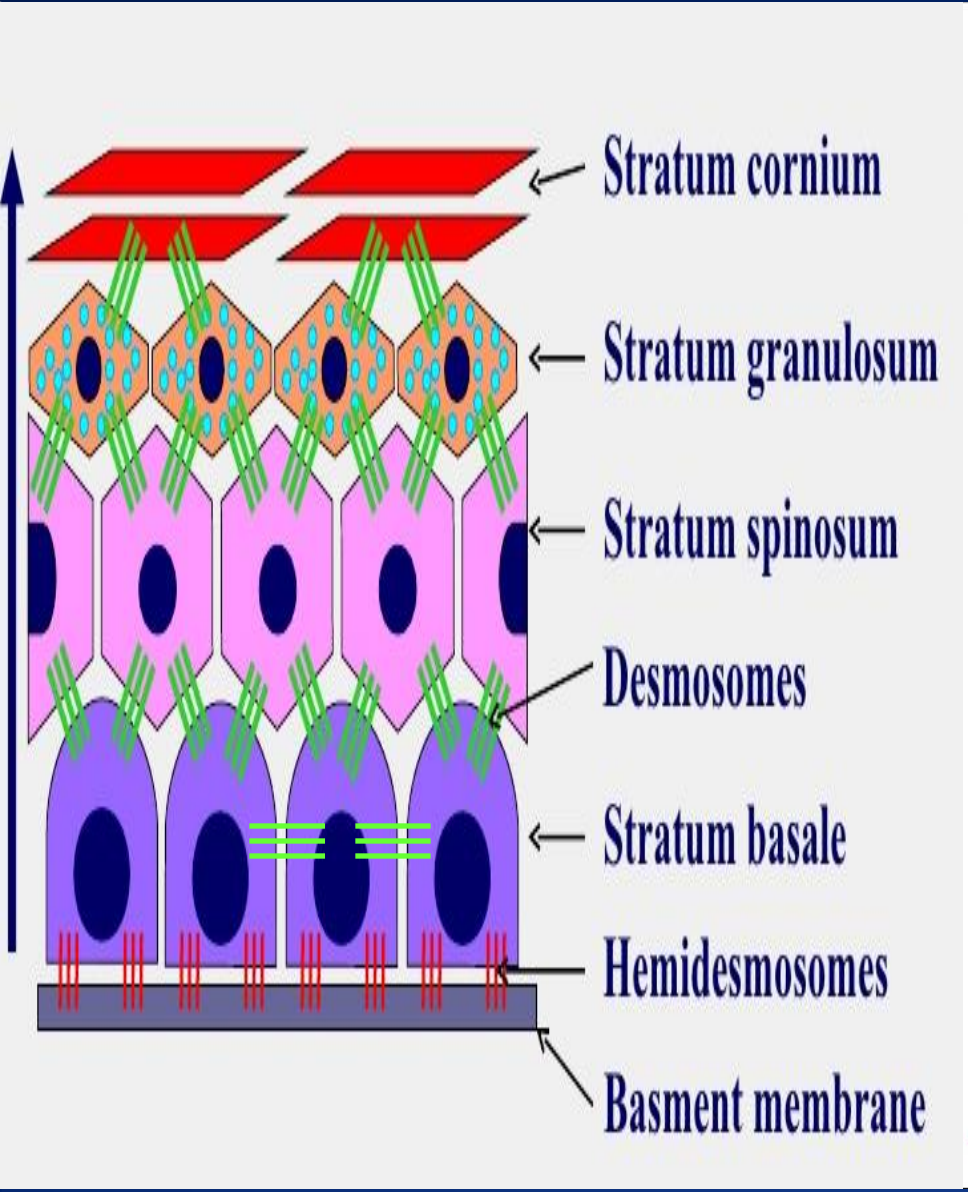
Thin skin

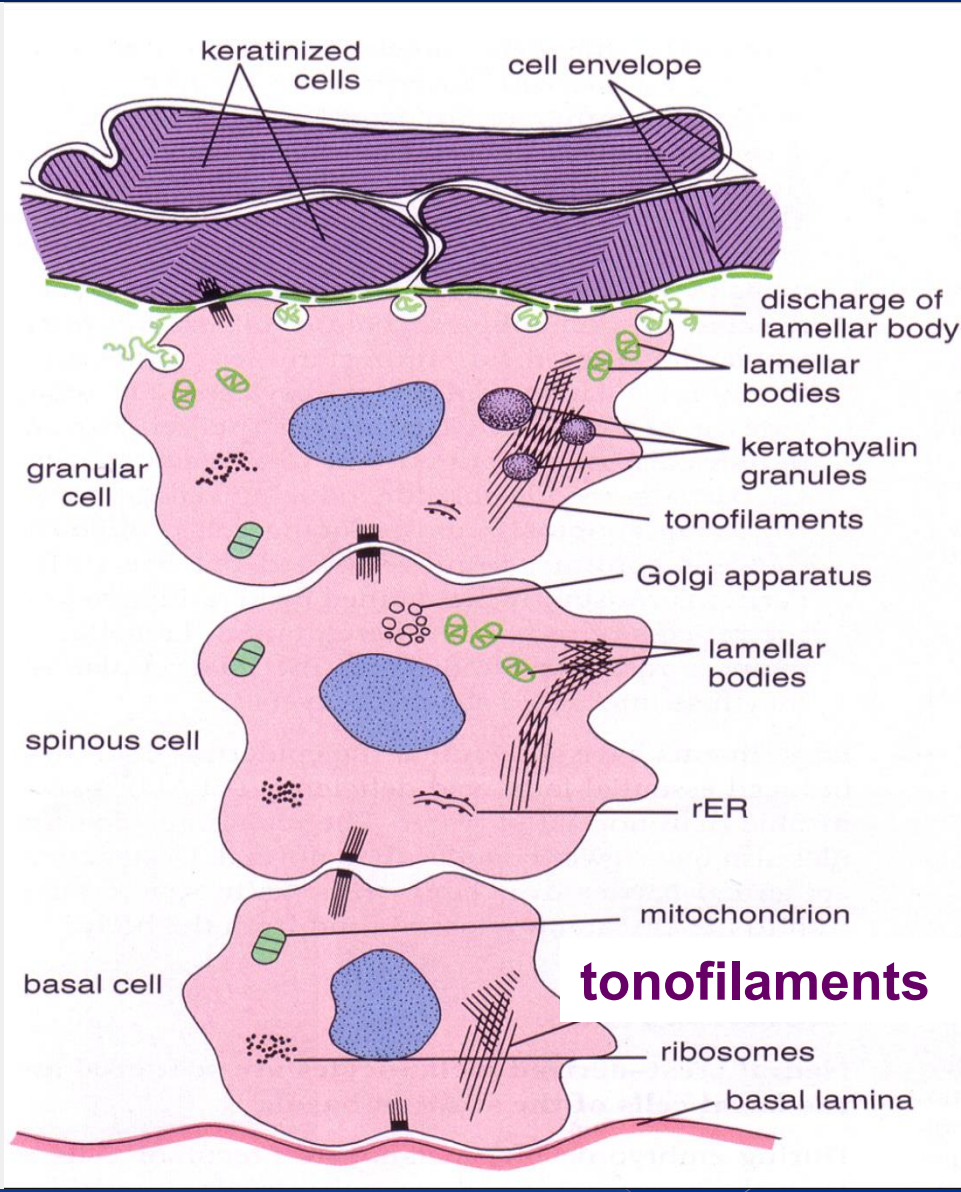
- **thin stratum corneum and lacks stratum lucidum**.
- hair follicles, sebaceous and sweat glands.

Stratum basale (germinativum)



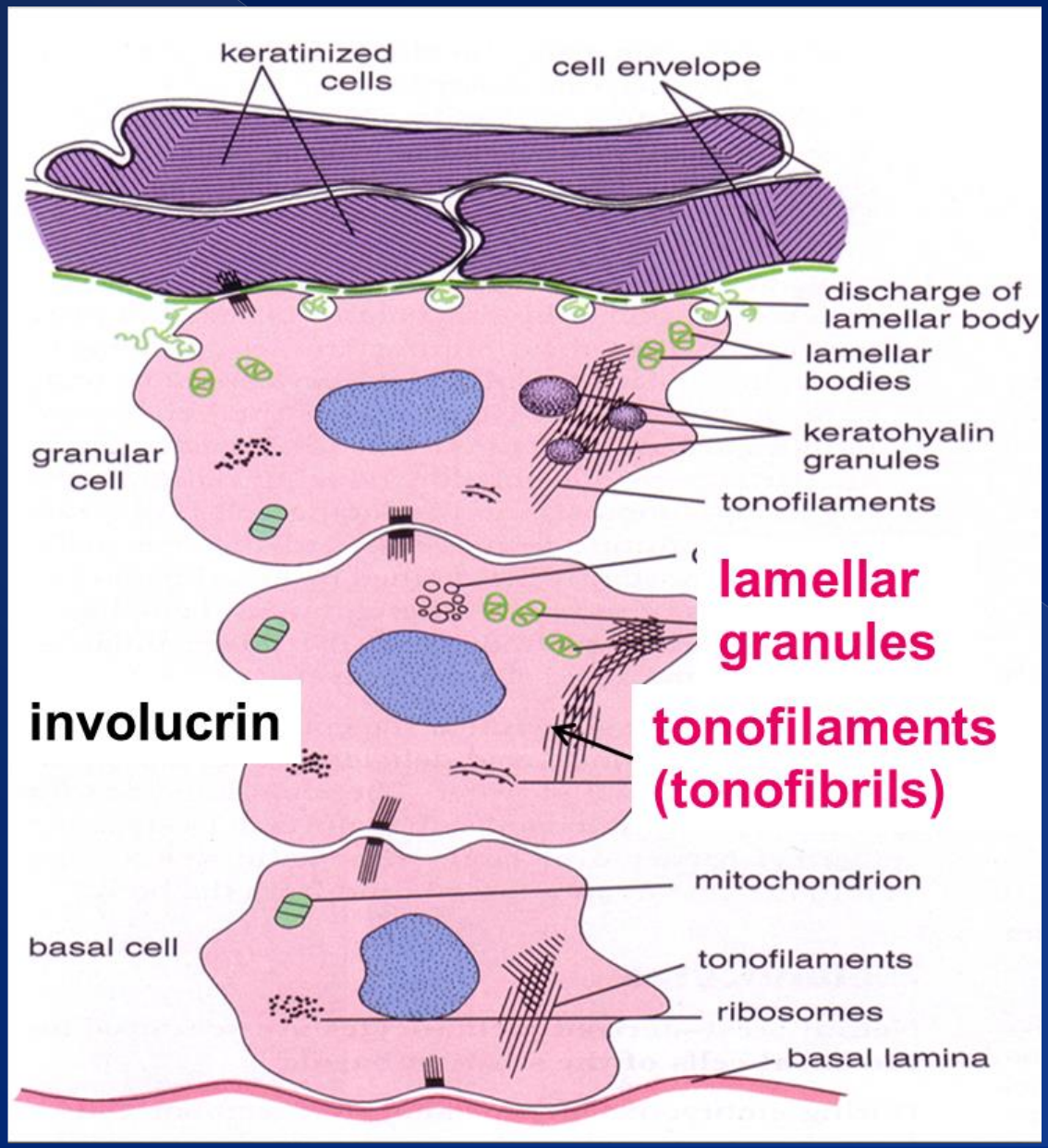
- single layer of **mitotically active**, **cuboidal to columnar** cells (on the basement membrane).
- cells divide and new cells are pushed to the next layer – stratum spinosum (**cell renewal in epidermis).**

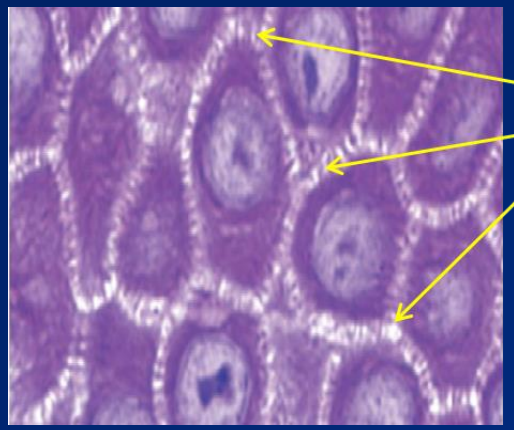




- Desmosomes, hemidesmosomes
- tonofilaments (keratin intermediate filaments)

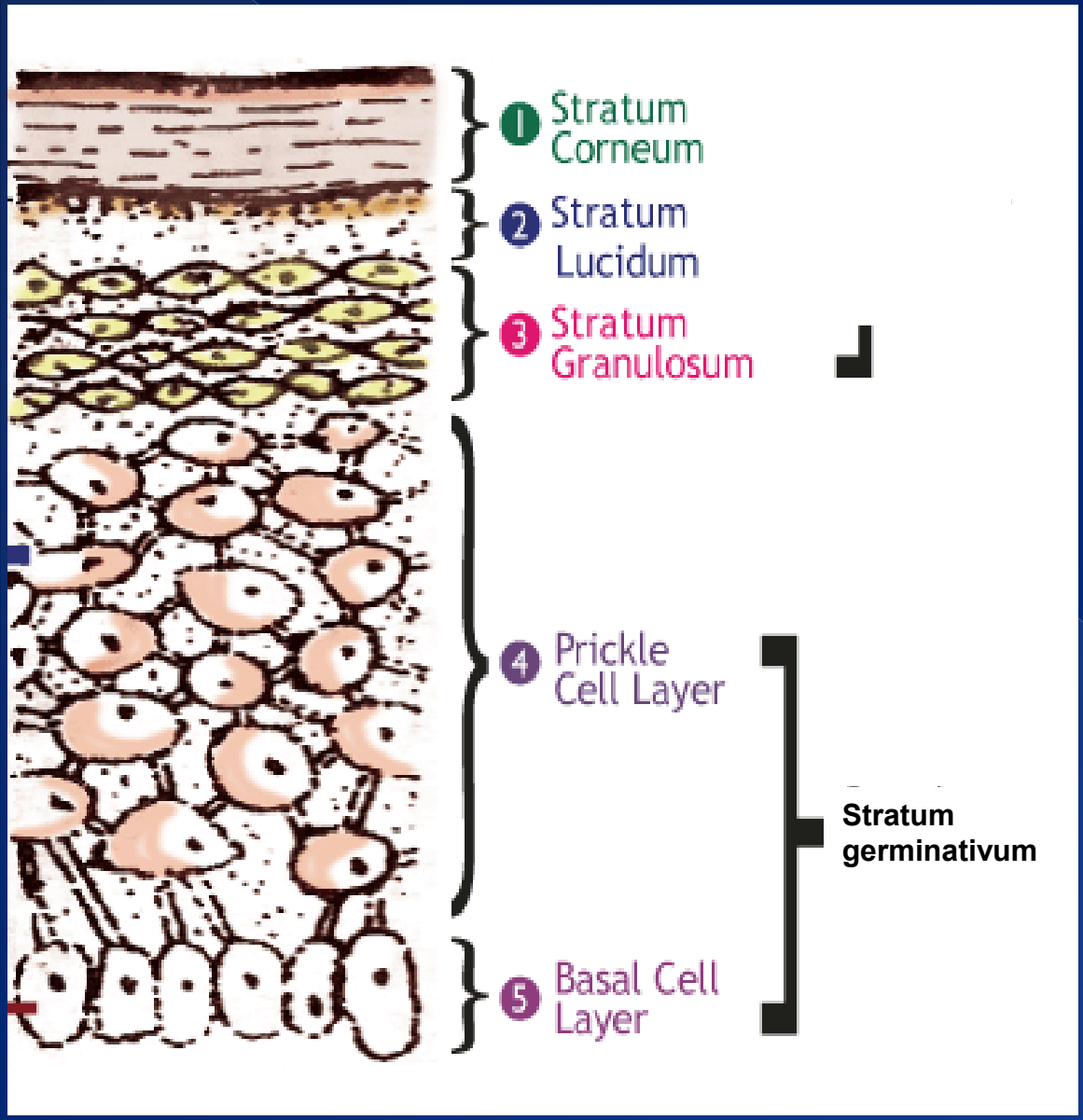
Stratum spinosum (prickle cell layer) - 8-10 layers of cells





- bundles of **tonofilaments (tonofibrils)**
- **involucrin** (keratinization),
- **lamellar granules** – lipids

Stratum spinosum

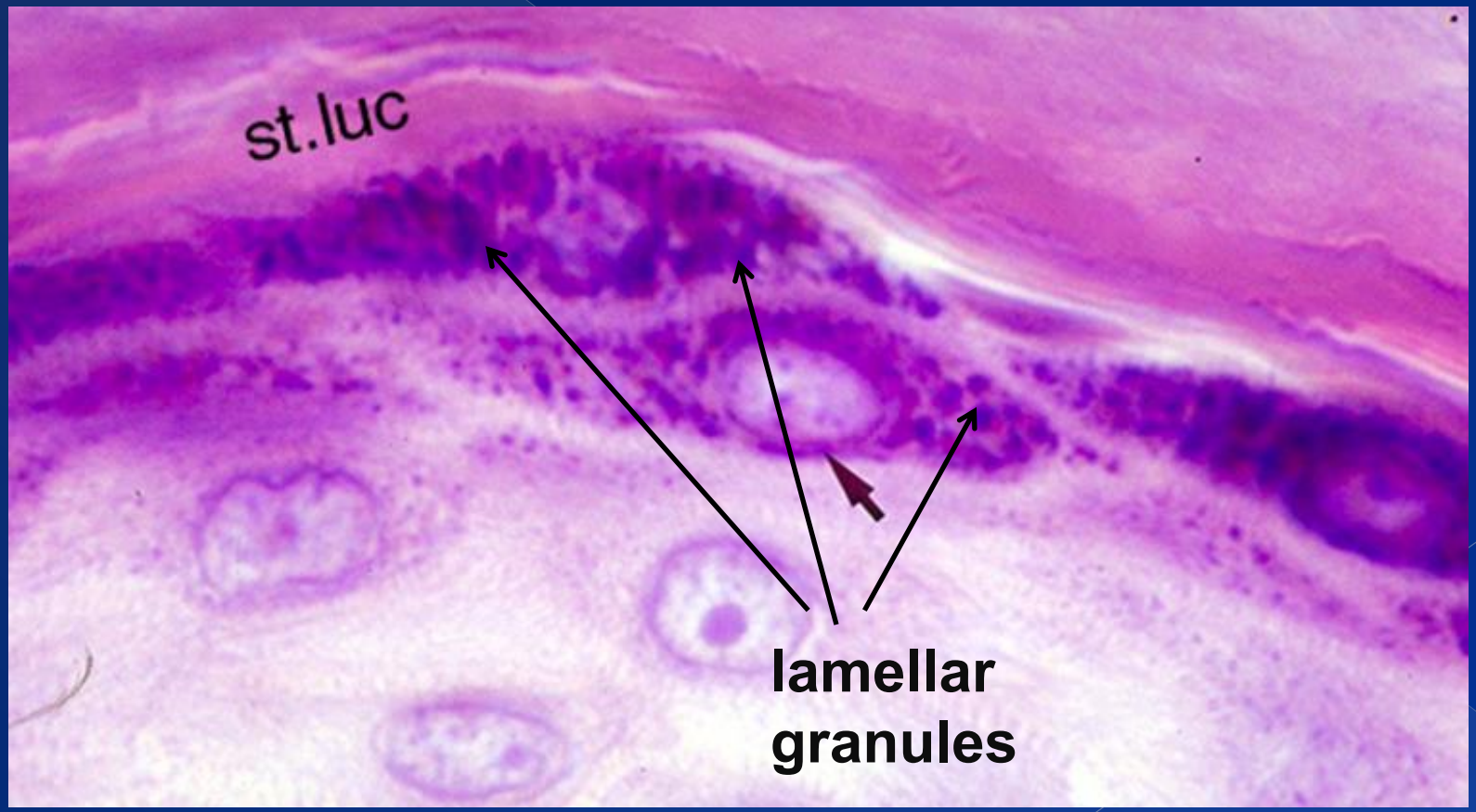


Stratum germinativum

- basally located cells of stratum spinosum and cells of stratum basale divide **- renewal of keratinocytes**

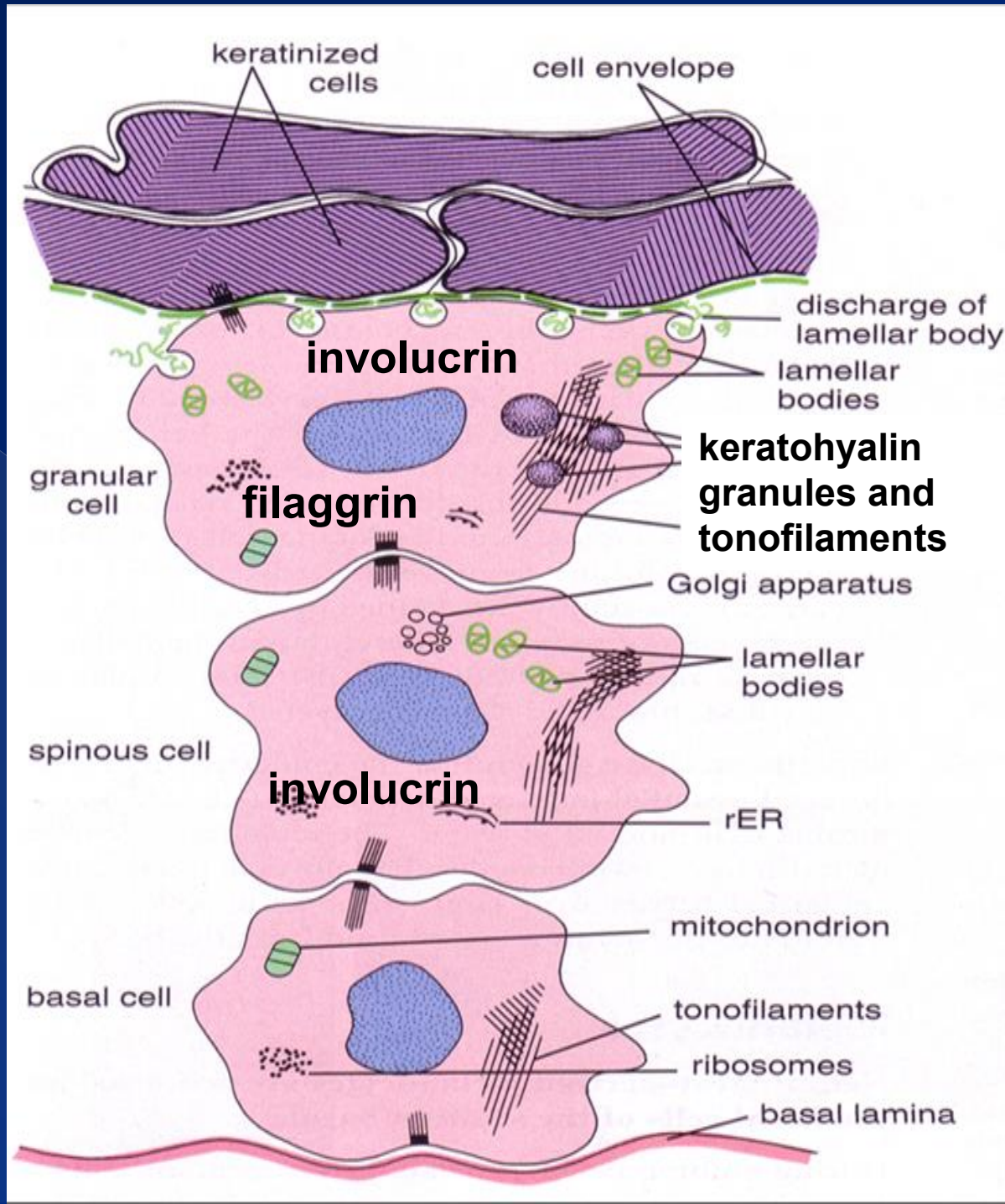
Stratum granulosum

- **lamellar granules** - lipids – in extracellular space form impermeable waterproof barrier (protection against desiccation) – cells superficial to stratum granulosum - devoid of nutrients - die.



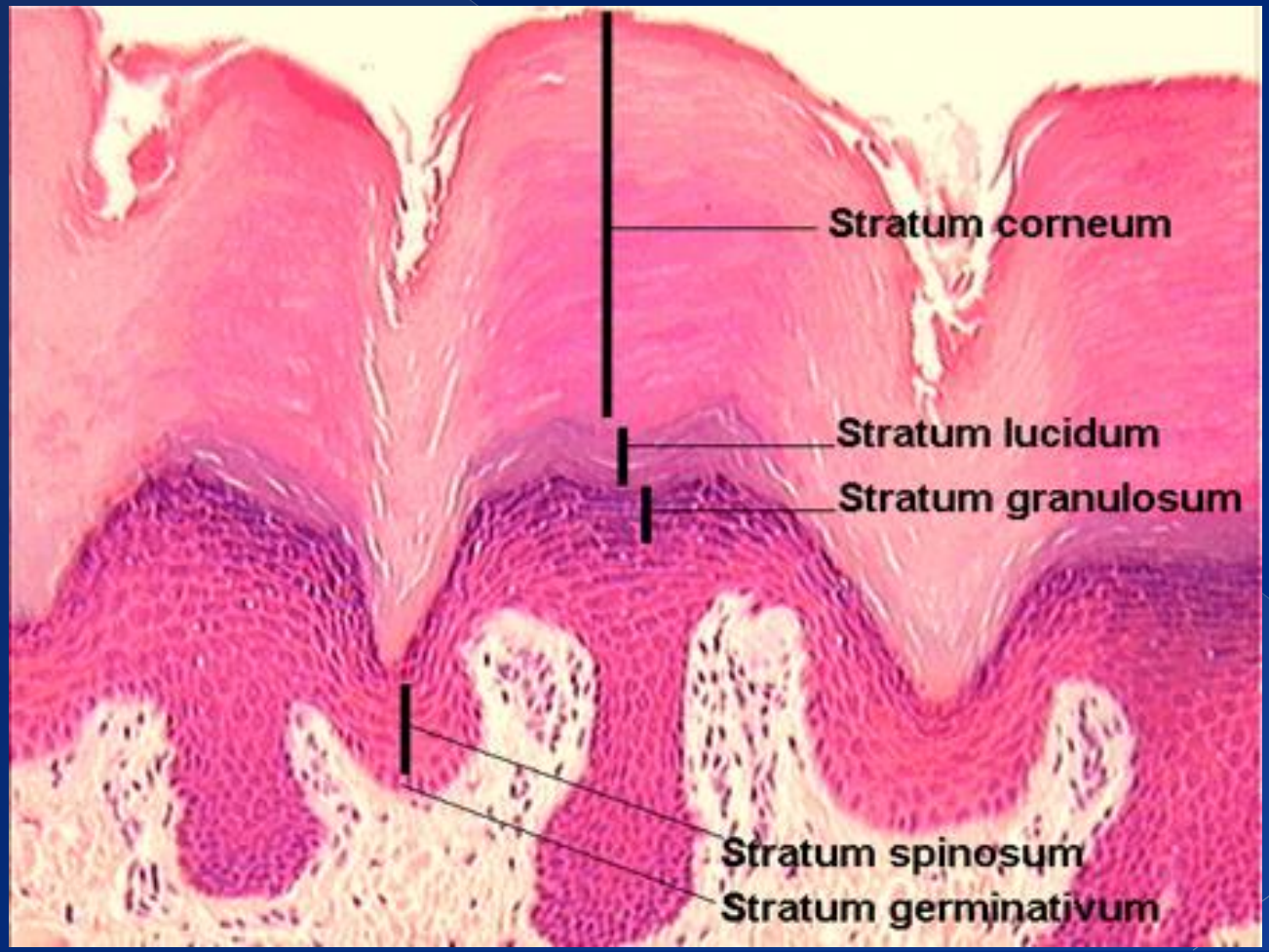
Stratum granulosum

- **keratohyalin** granules (connect with tonofilaments)
- **filaggrin** - involved in keratinization - binds to keratin filaments

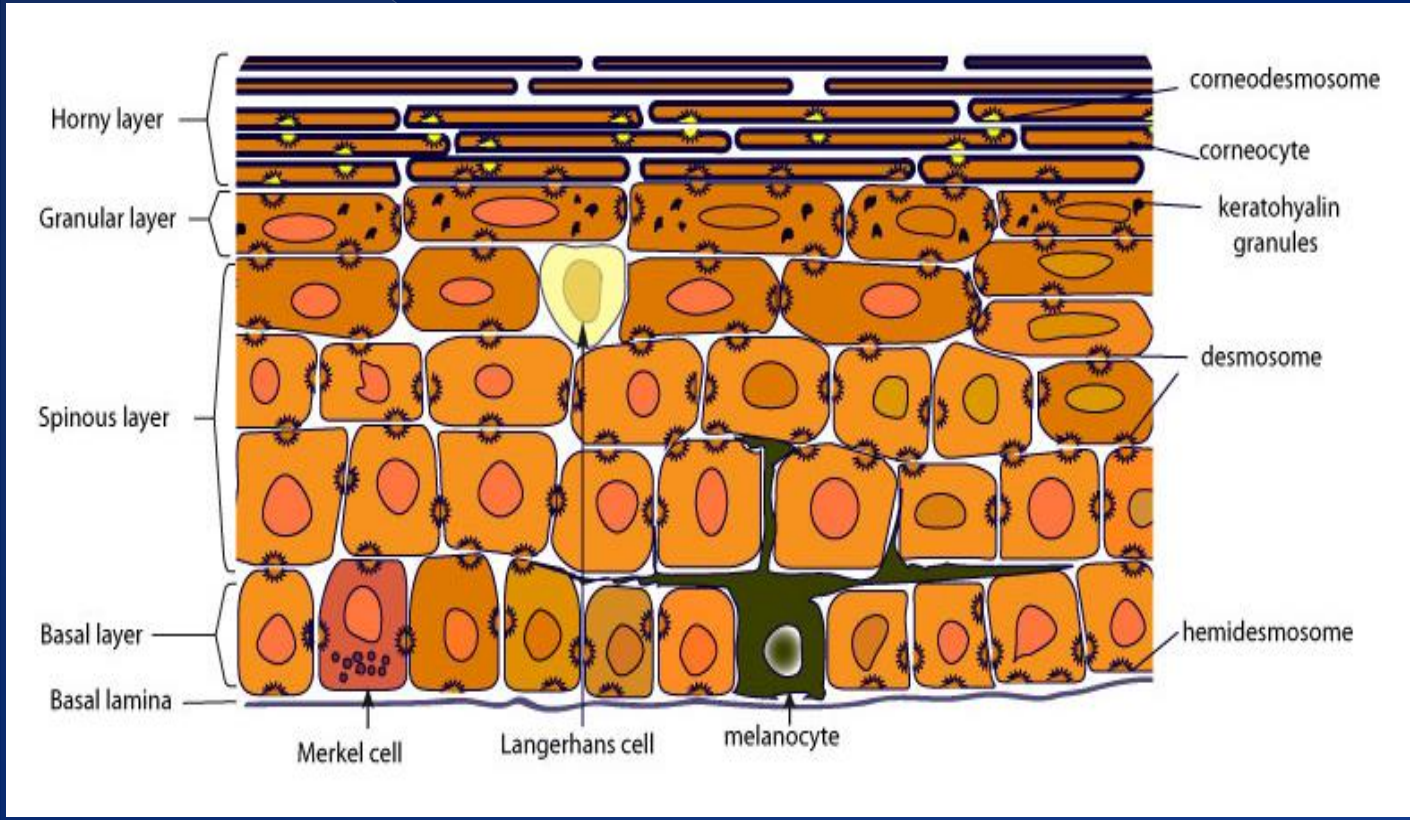


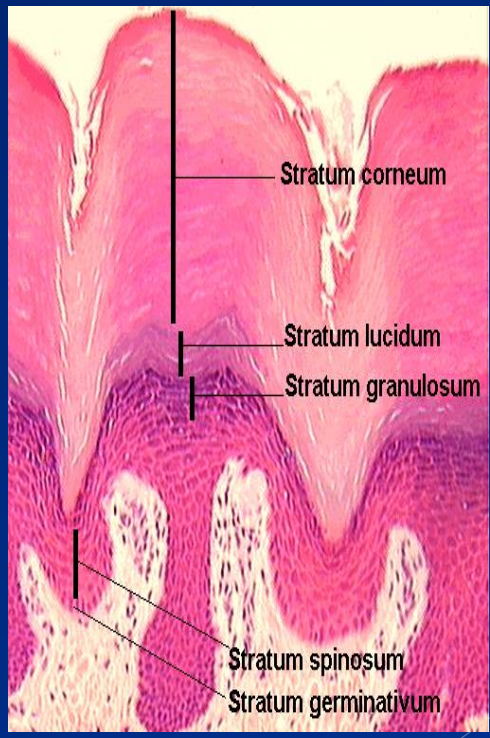
Stratum lucidum

- present only in thick skin, flattened cells devoid of organelles and nuclei - **keratin filaments, filaggrin, keratohyalin**- cells enveloped by **involucrin**



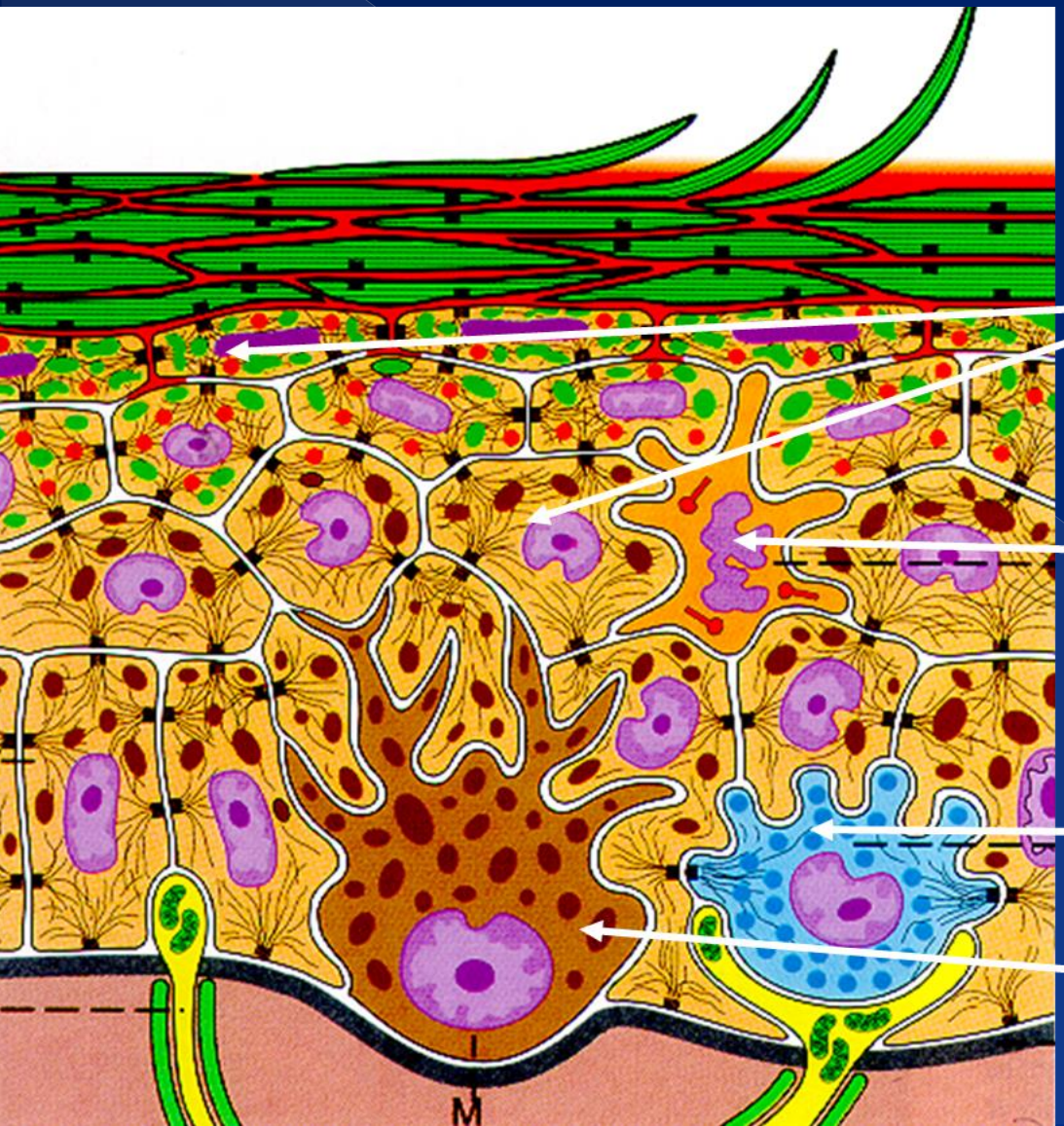
Stratum corneum – corneocytes – lose desmosomes - desquamated from the surface





- several layers of flattened, keratinized, dead cells
- lack nuclei and organelles, keratin filaments embedded in amorphous matrix.

Epidermis - keratinocytes and Langerhan's cells Merkel cells, Melanocytes



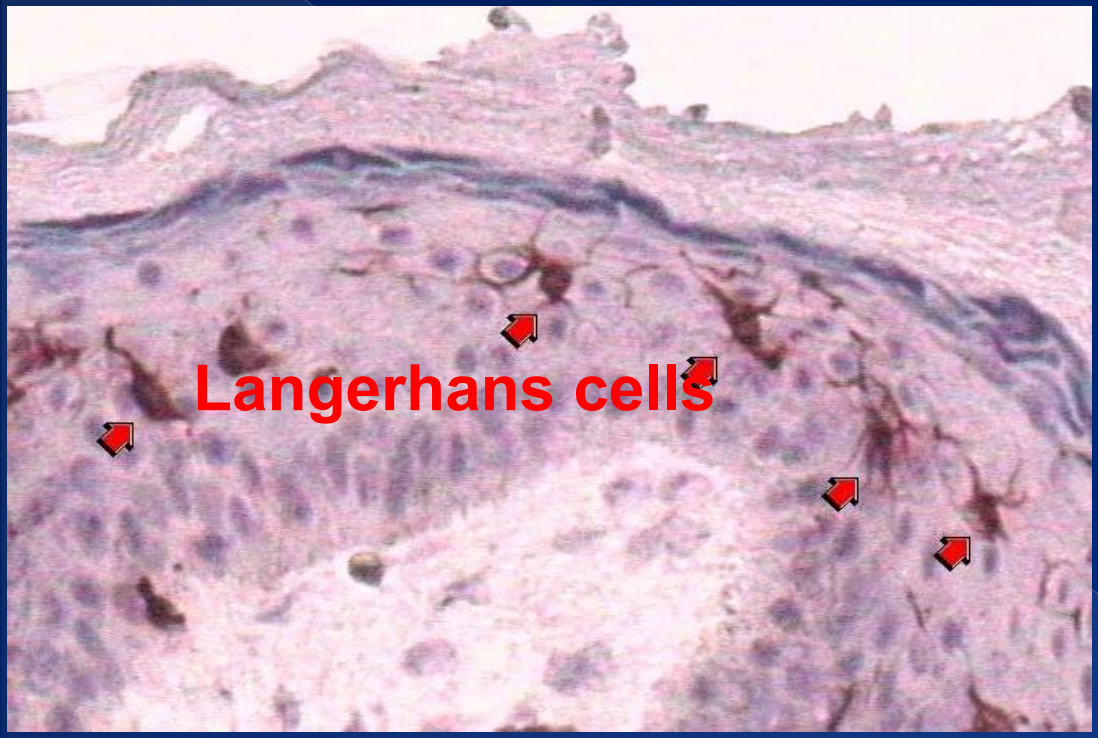
Keratinocytes (most numerous)

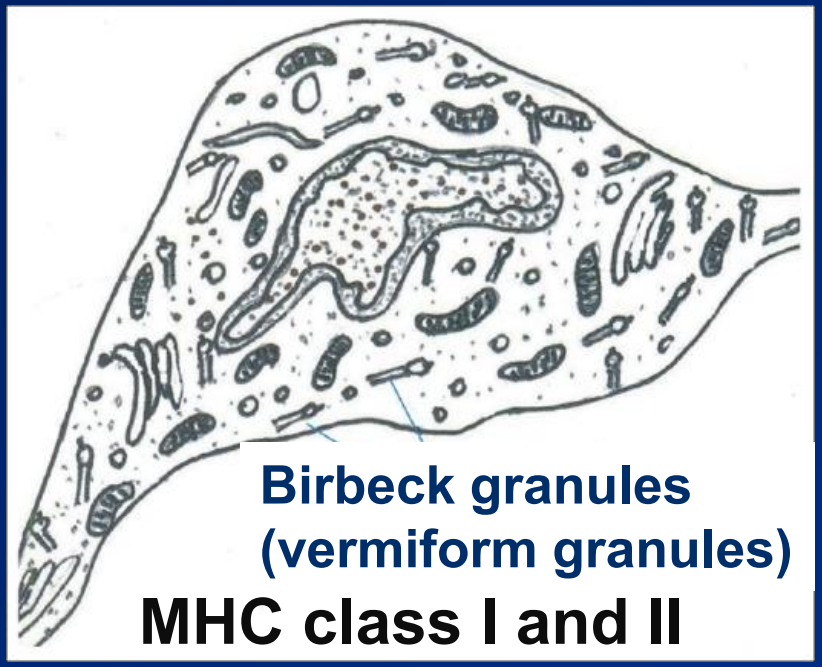
Langerhans cell

Merkel's cell

melanocyte

Langerhans cells - 2- 4% - derived from monocytes

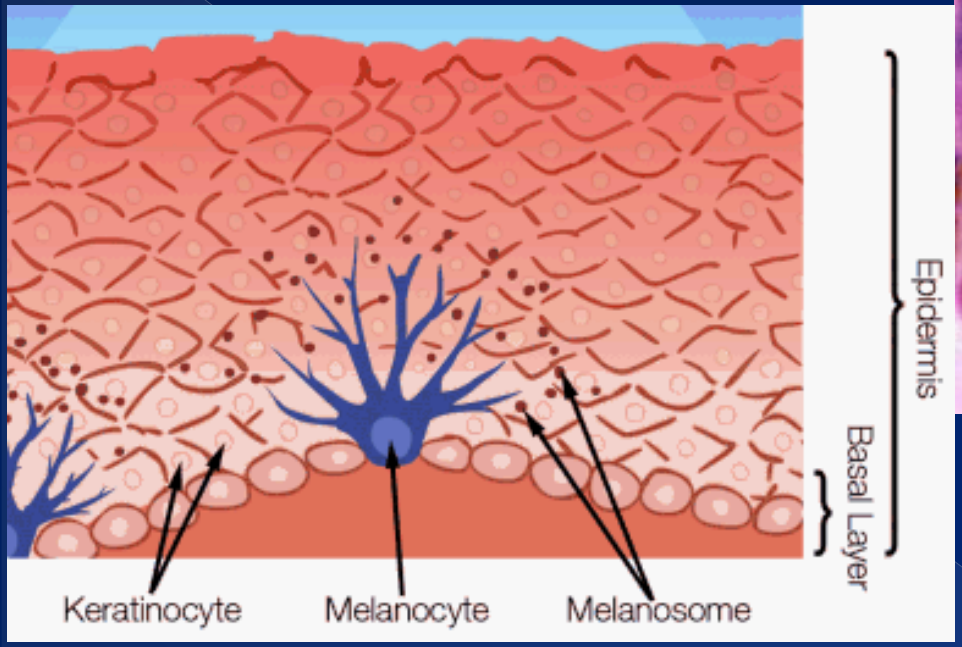


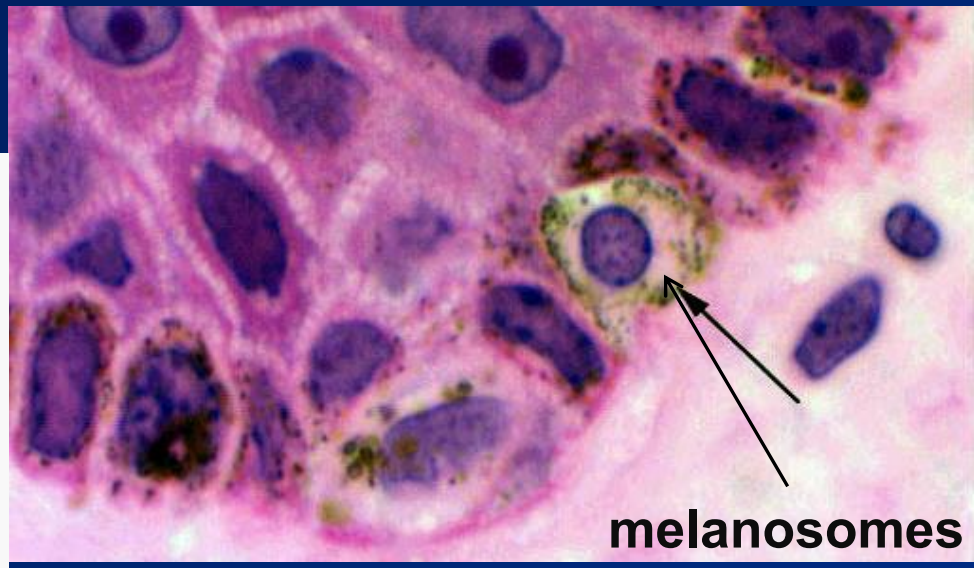


- in all layers (mainly in the **stratum spinosum**)

- **dendritic cells** (antigen-presenting cells) - **Birbeck granules** (vermiform granules), long processes.
- after phagocytosis of antigens - migrate to lymph nodes and present antigen to lymphocytes T.

Melanocytes

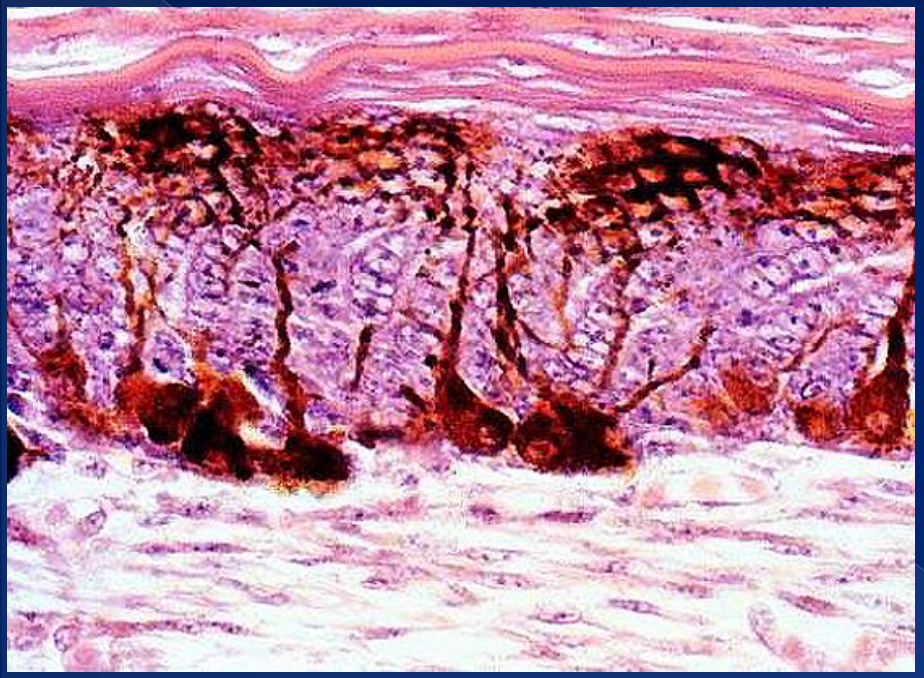




- in **stratum basale – derived from neural crest**

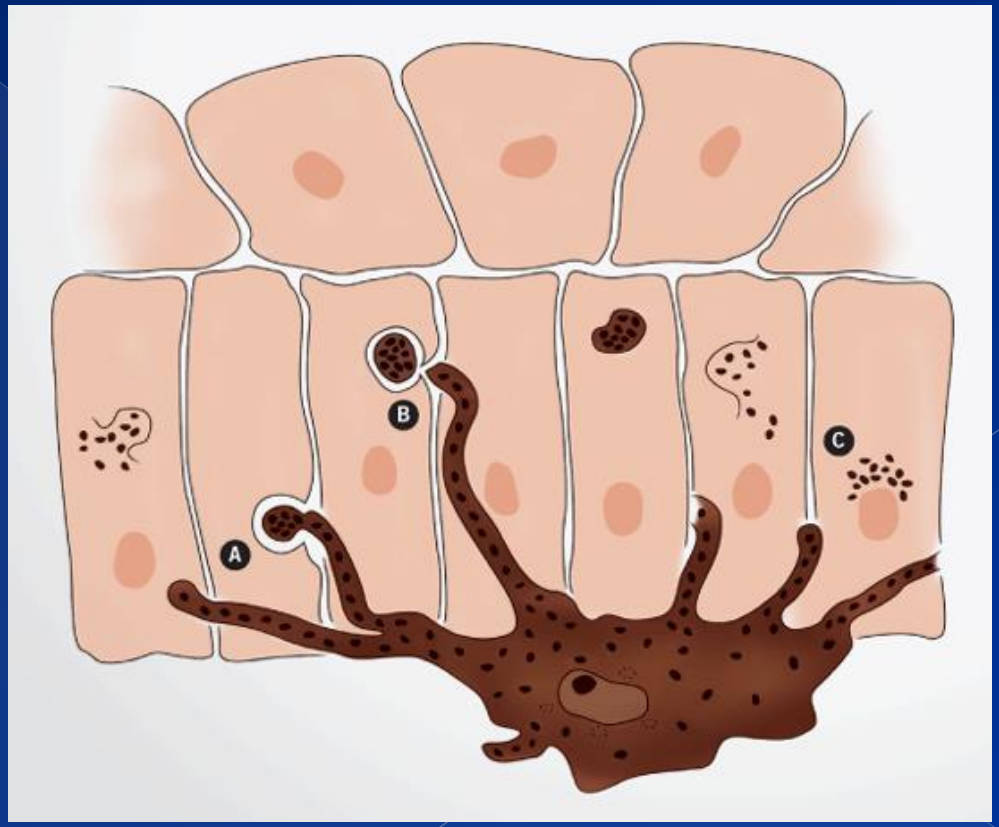
- **melanin** (3 types: **eumelanin**, pheomelanin, neuromelanin) – pigment - brown color
- granules – **melanosomes** - enzyme **tyrosinase (**activated by UV light) - converts amino acid **tyrosine** into **melanin** - melanosomes - phagocytosed by keratinocytes – **epidermal-melanin unit**

Melanocytes

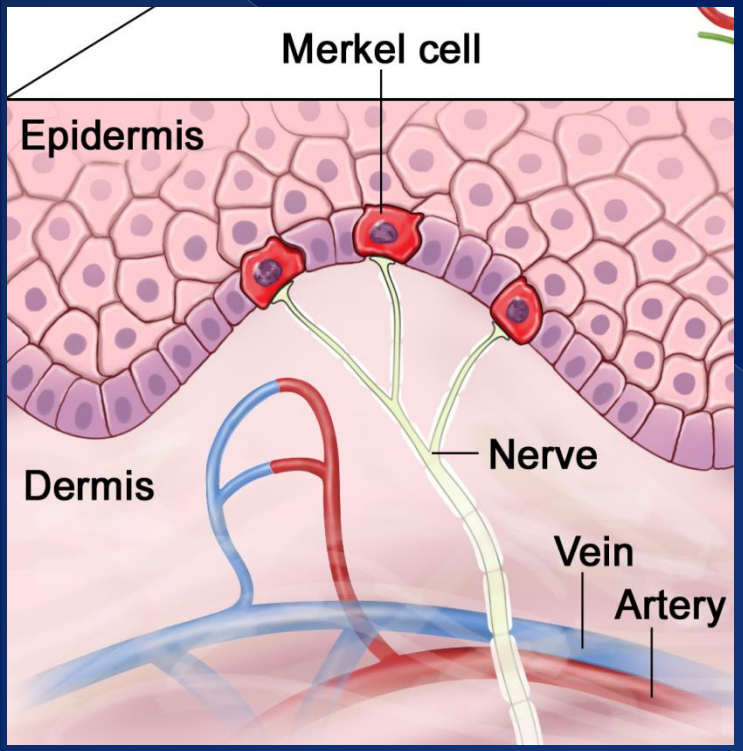


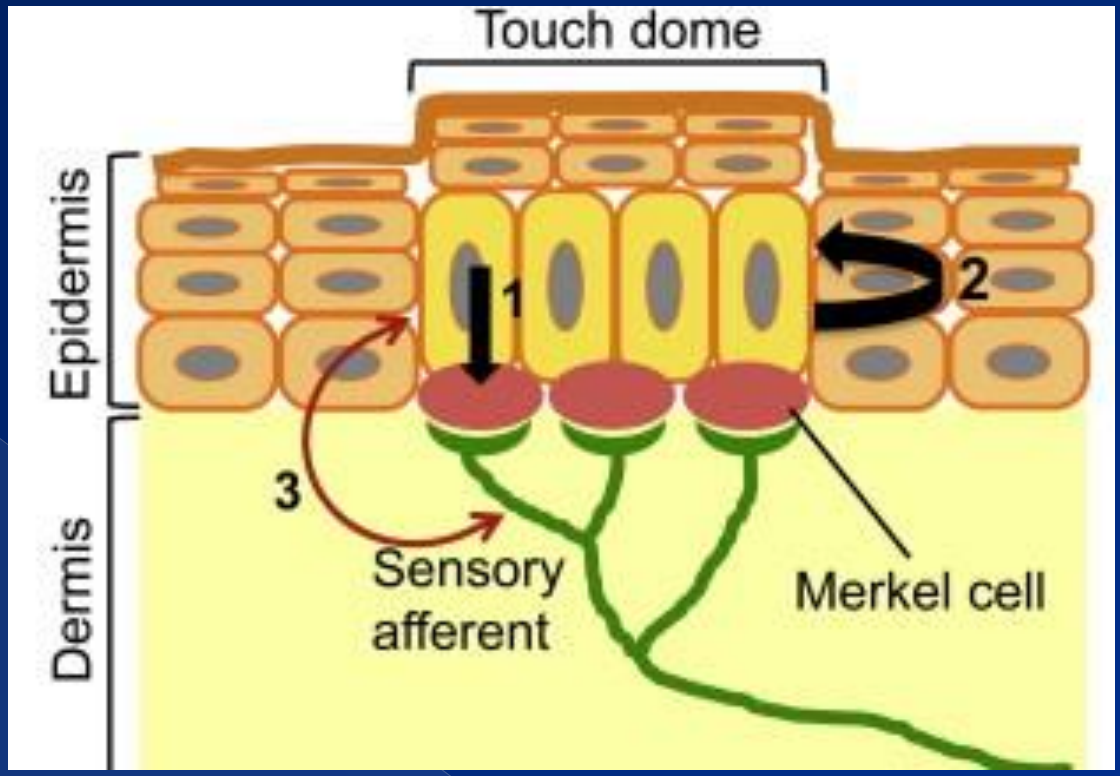
- processes of melanocytes in the stratum spinosum.
- melanosomes travel to the tips of processes, and become pinched off.

- within keratinocytes - melanosomes - between nuclei and surface of the cell - protect nuclei against UV light



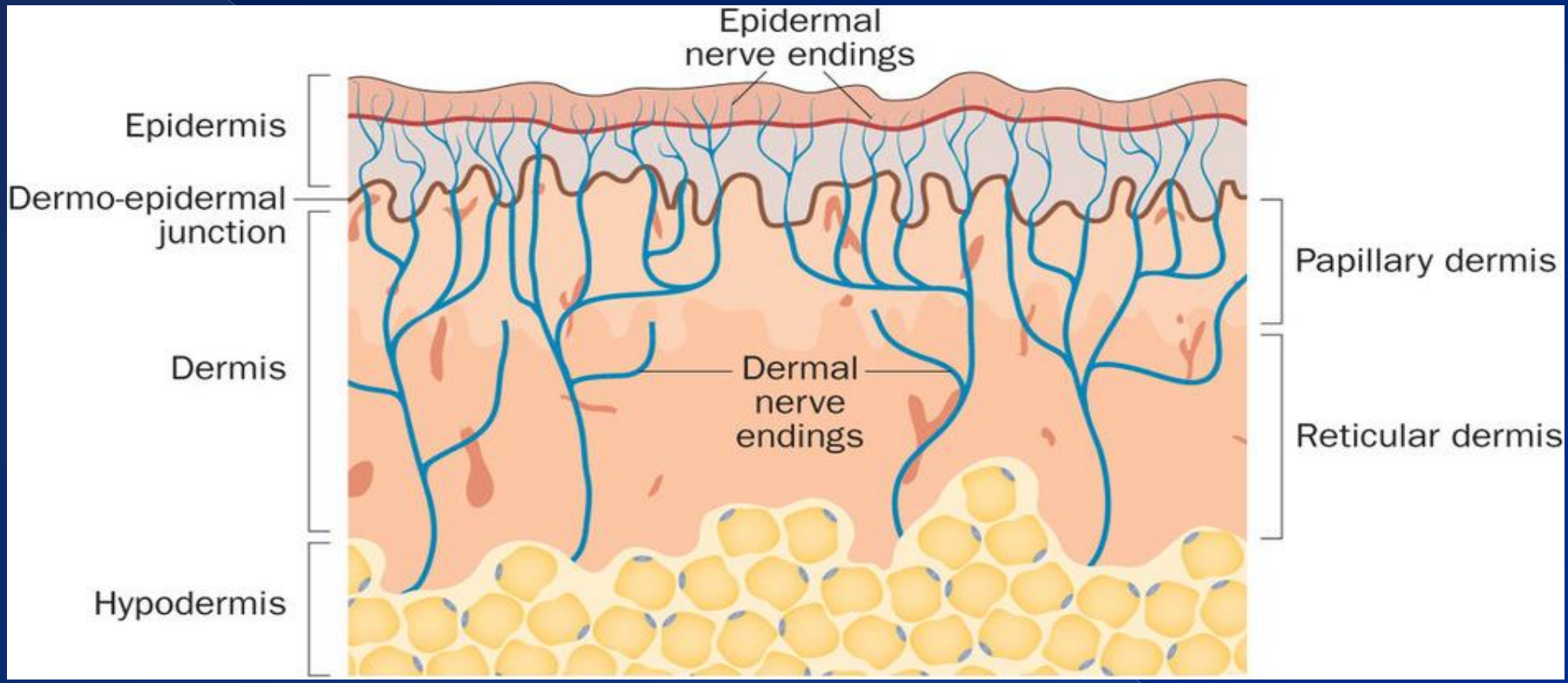
Merkel cells – epithelial tactile cells (mechanoreceptors)



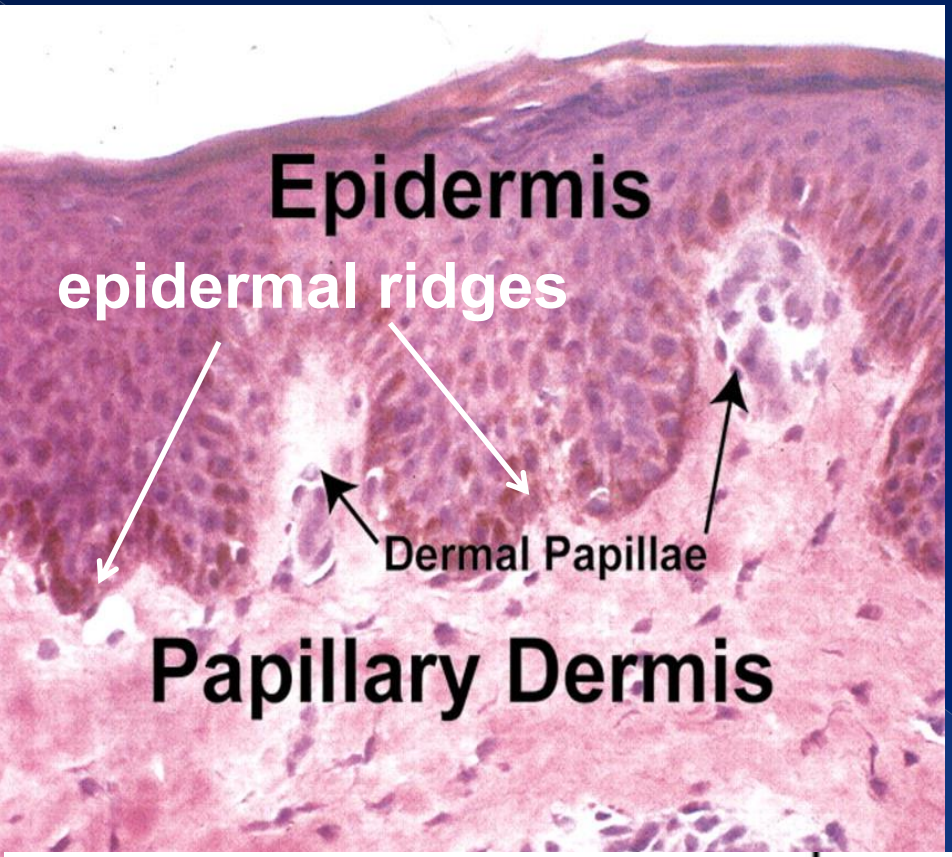


- in **stratum basale (finger tips, at the base of hair follicles)**.
- sensory nerves pass through the basal lamina - form - **Merkel cell-neurite complexes** – mechanoreceptors – gentle **touch** discrimination.

Free nerve endings in epidermis (dermis) (unencapsulated)

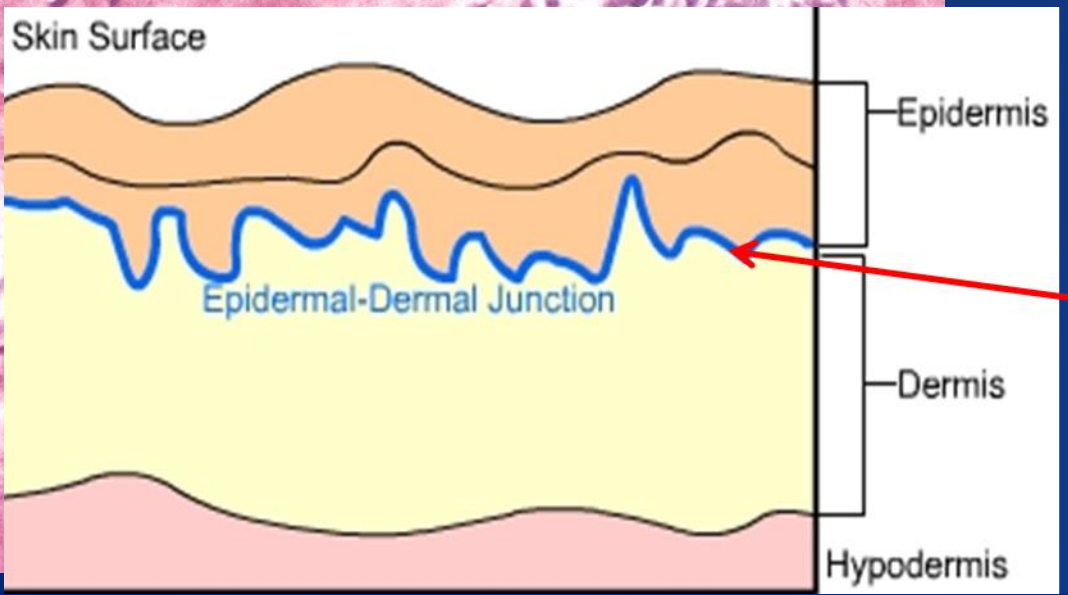


Mechanoreceptors - touch and pressure.
Thermoreceptors - temperature differences
Nociceptors - pain perception (mechanical stress and damage)



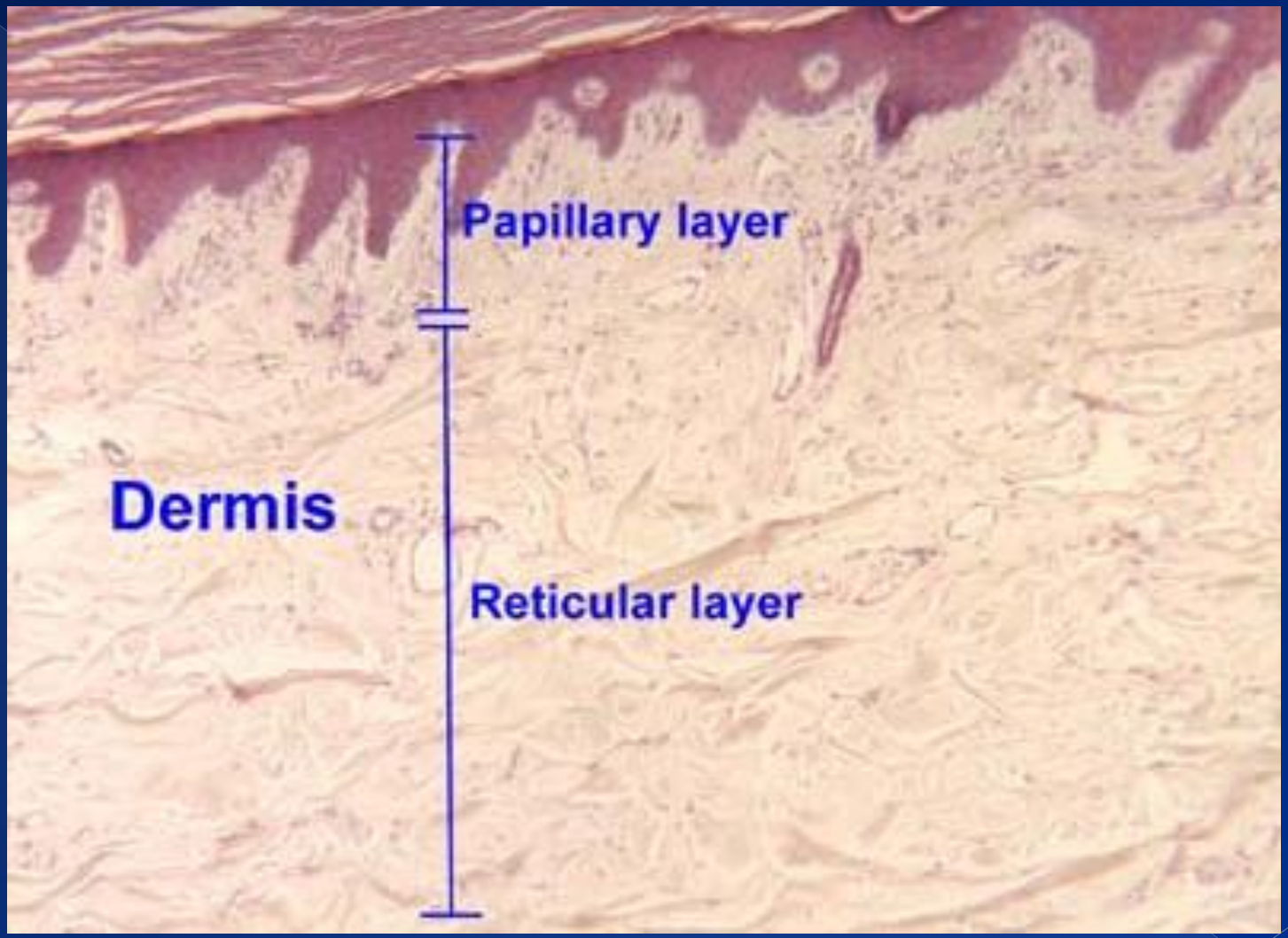
Rete apparatus:

- interface between epidermis and dermis
- formed by **dermal ridges (papillae)** and **epidermal ridges.**

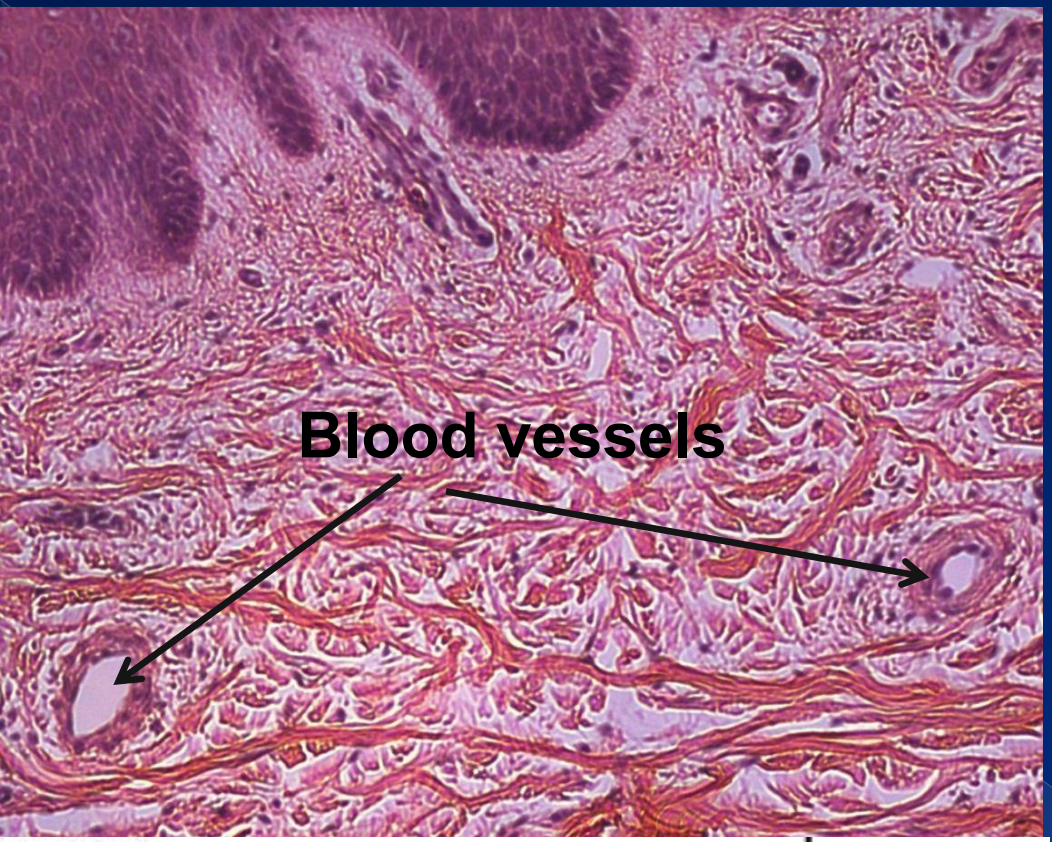


collagen type VII – anchoring fibers

Dermis (corium) - derived from **mesoderm**

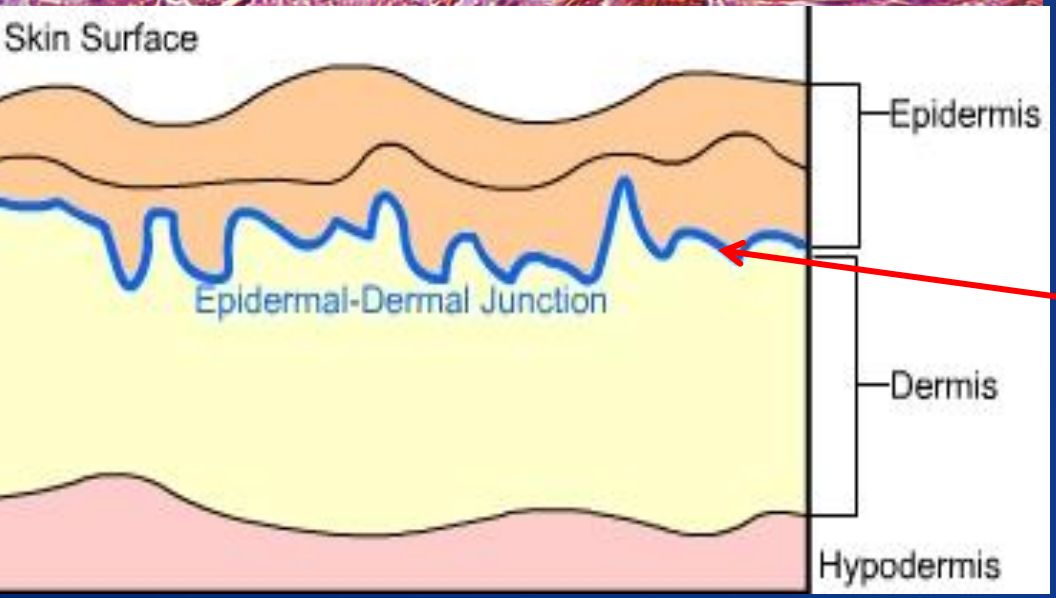


- **papillary** and **reticular layers**.
- connective tissue proper.



Papillary layer

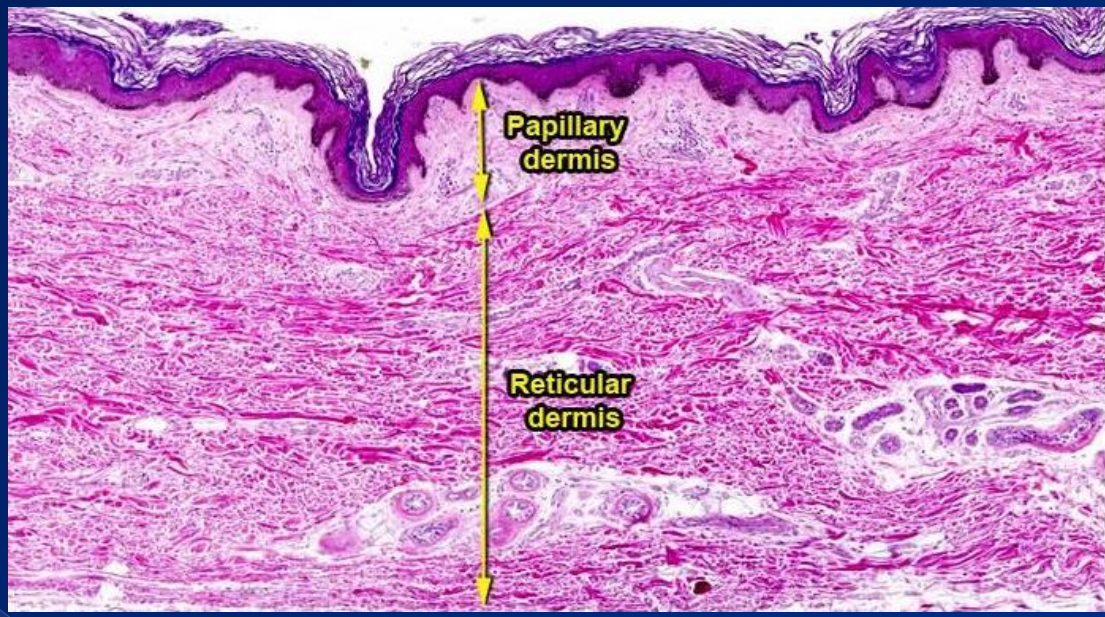
- loose connective tissue
- capillary loops - temperature regulation, nutrients
- anchoring fibers (**collagen type VII**) bind dermis to epidermis.

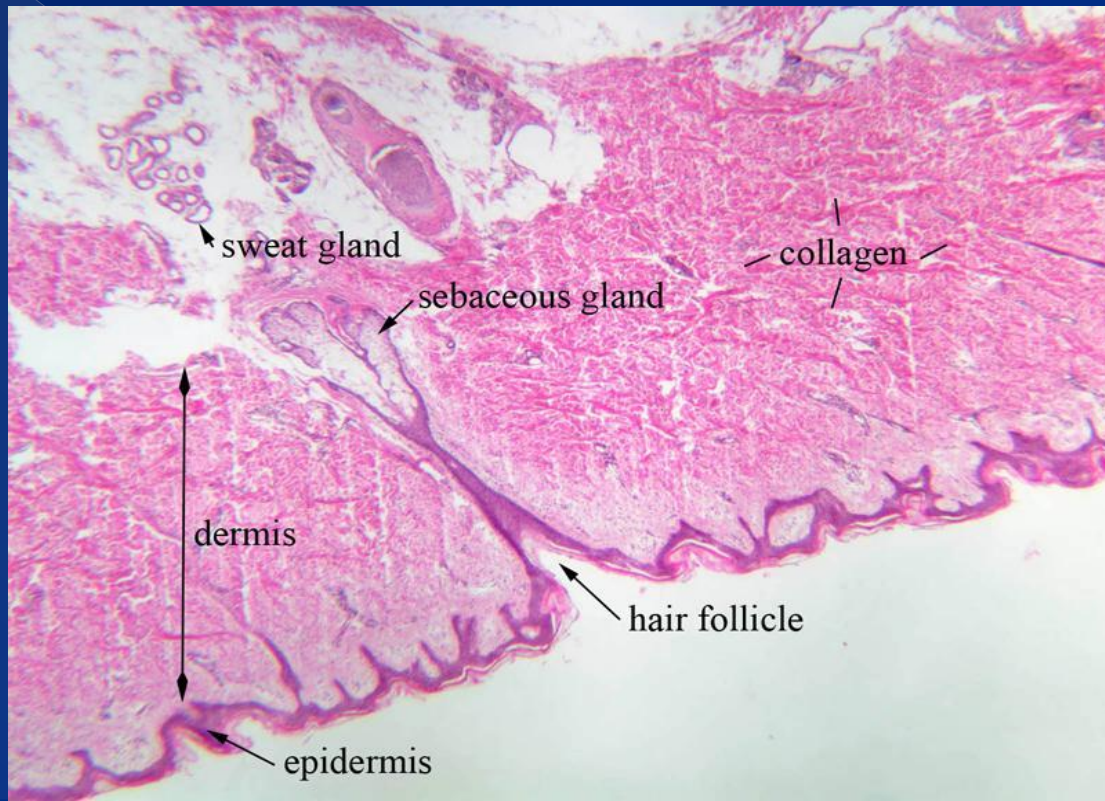


collagen type VII – anchoring fibers

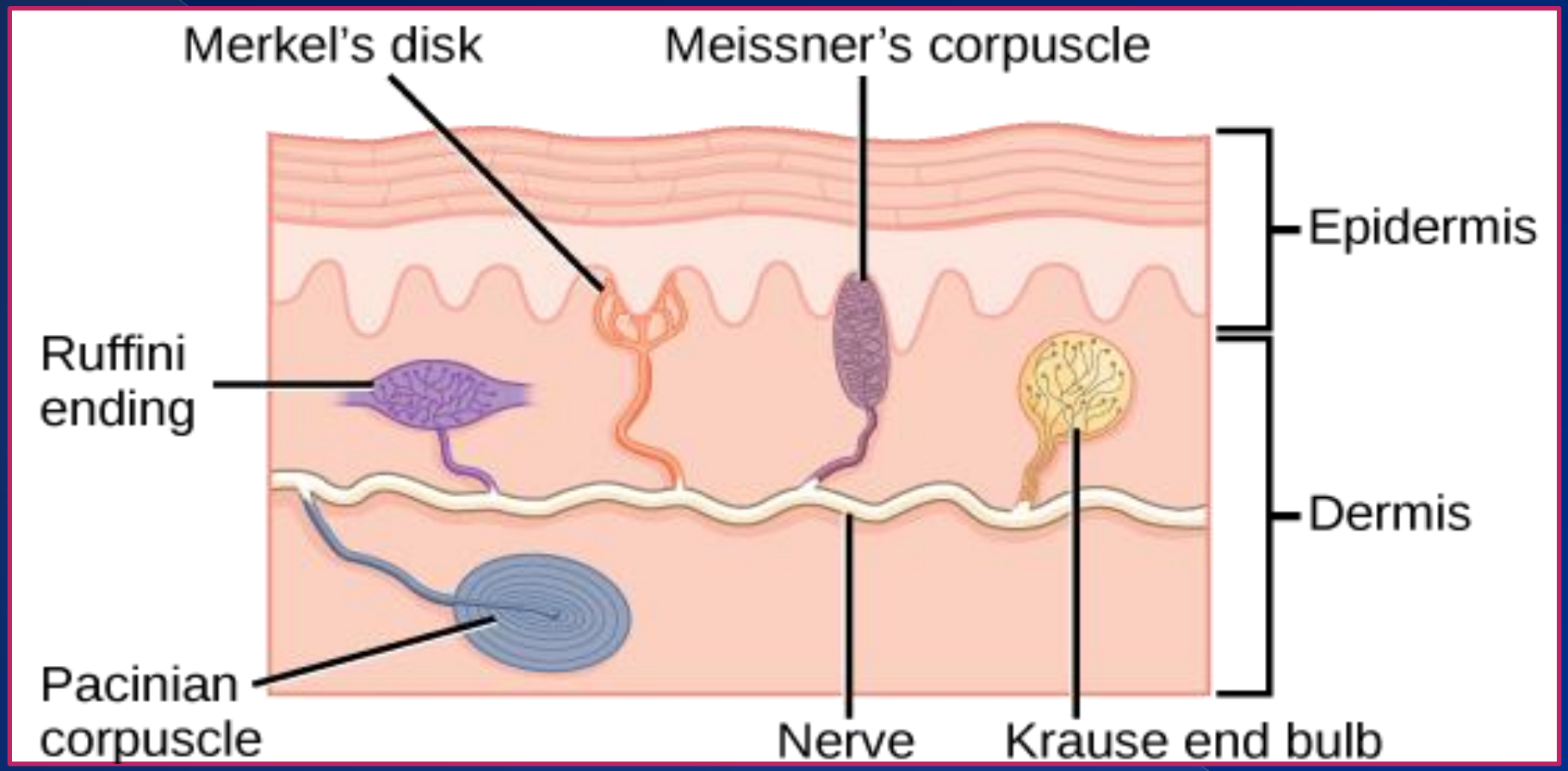
Reticular layer of the dermis

- **dense, irregular connective tissue**
- **sweat**, **sebaceous glands** and **hair follicles**.



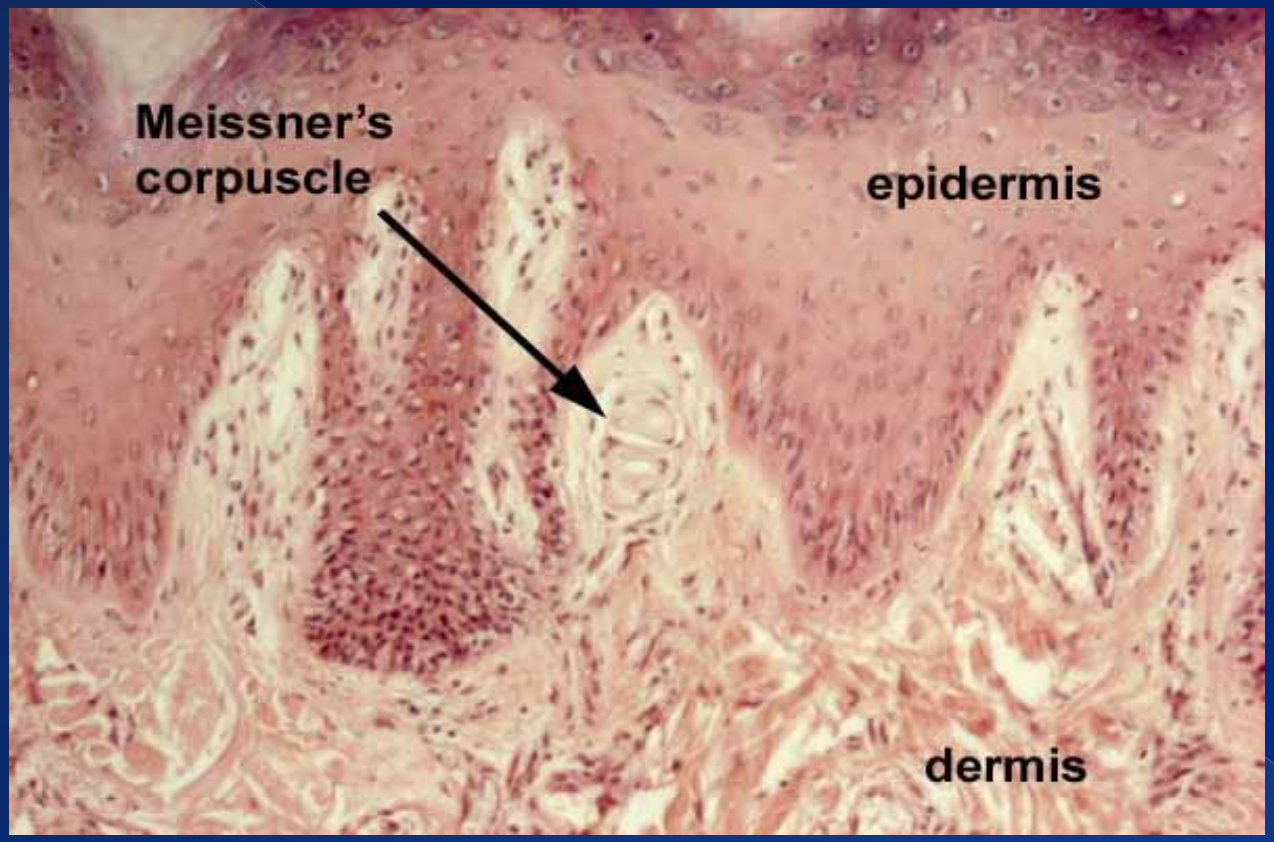


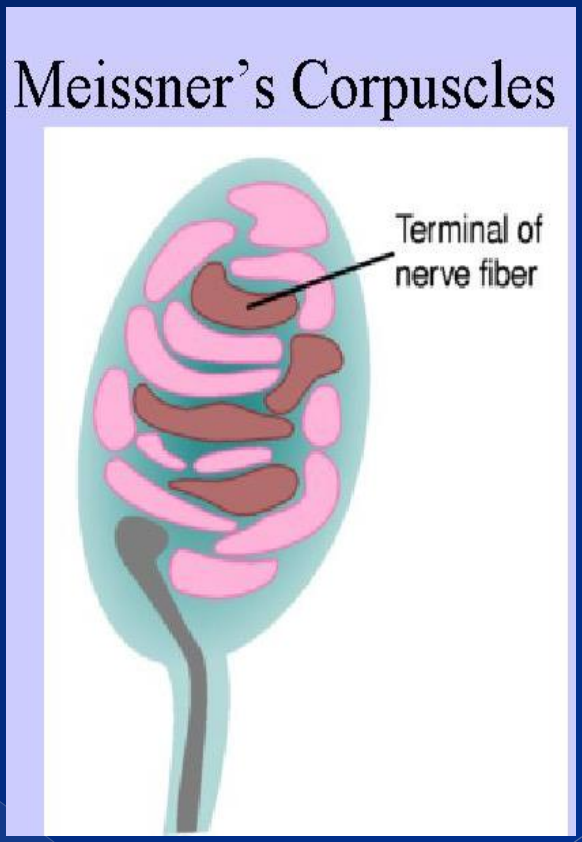
Encapsulated receptors of dermis



- Meissner corpuscles
- Krause end bulbs
- Ruffini corpuscles
- Pacinian (lamellated) corpuscles

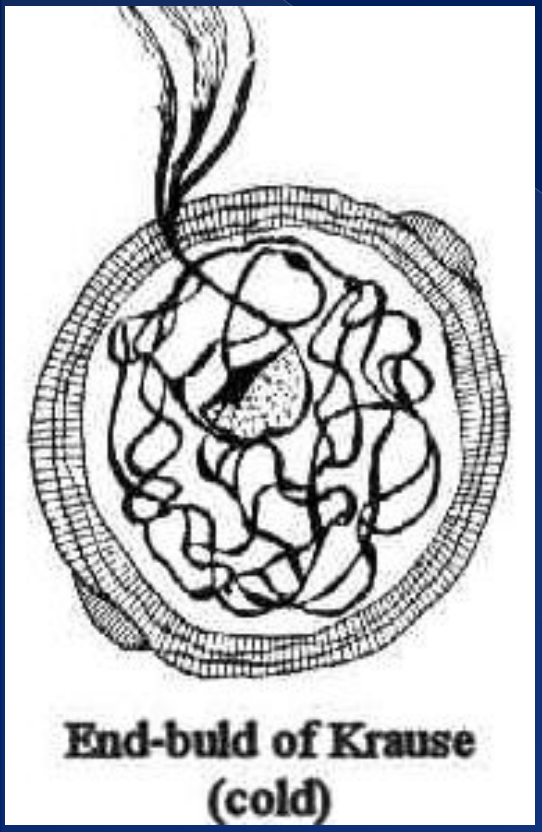
Meissner's corpuscles - in dermal papillae – Mechanoreceptors - sensitivity to **light touch**

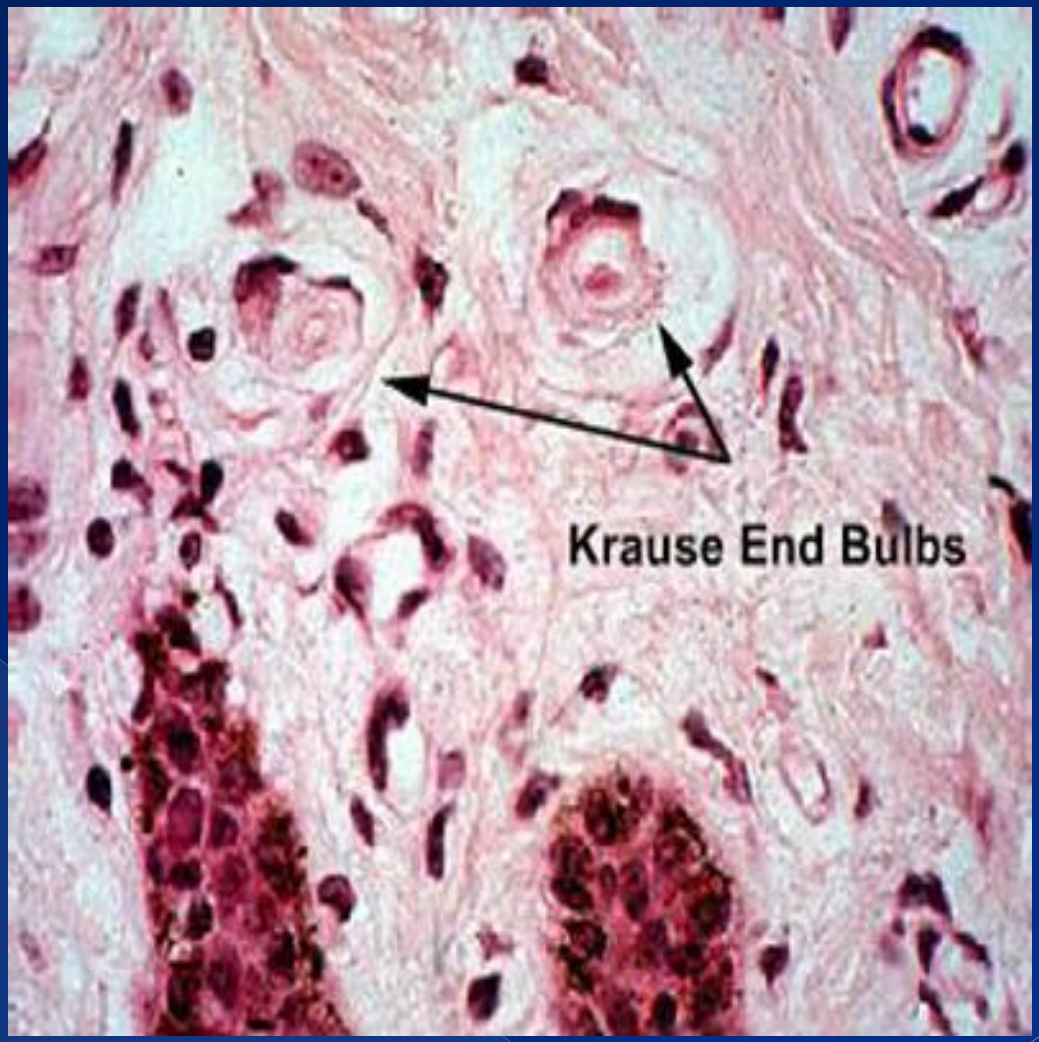




- myelinated nerve endings + connective tissue capsule
- **in nonhairy skin of fingers, lips, external genitalia, palms and feet.**

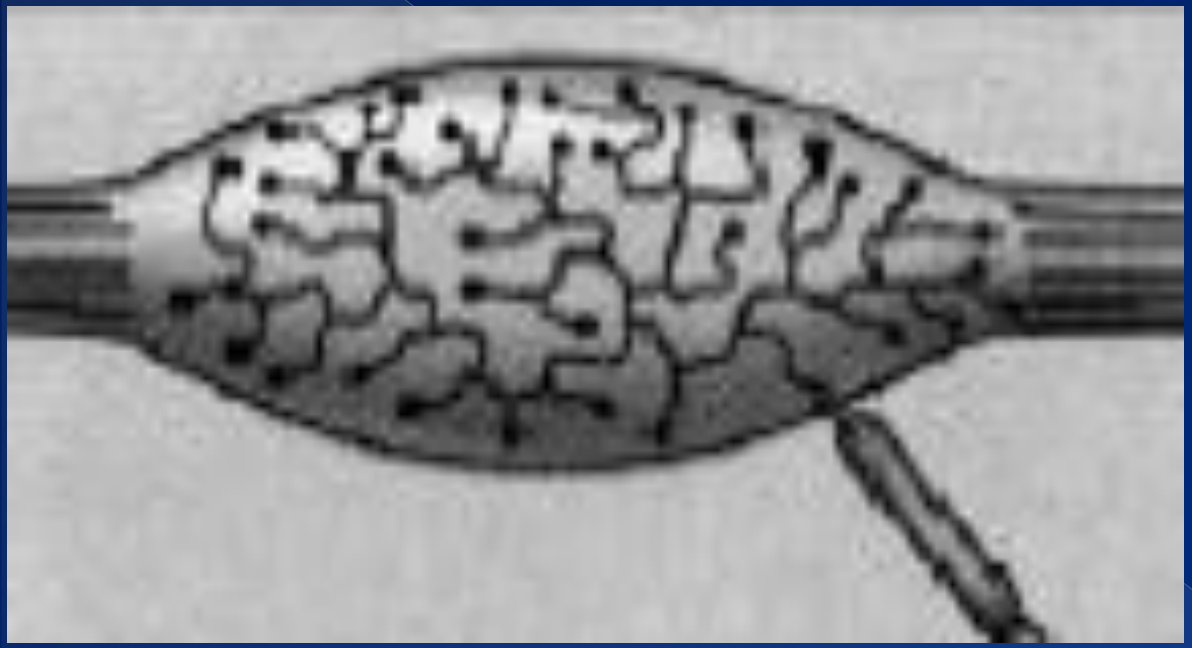
Krause's end-bulb





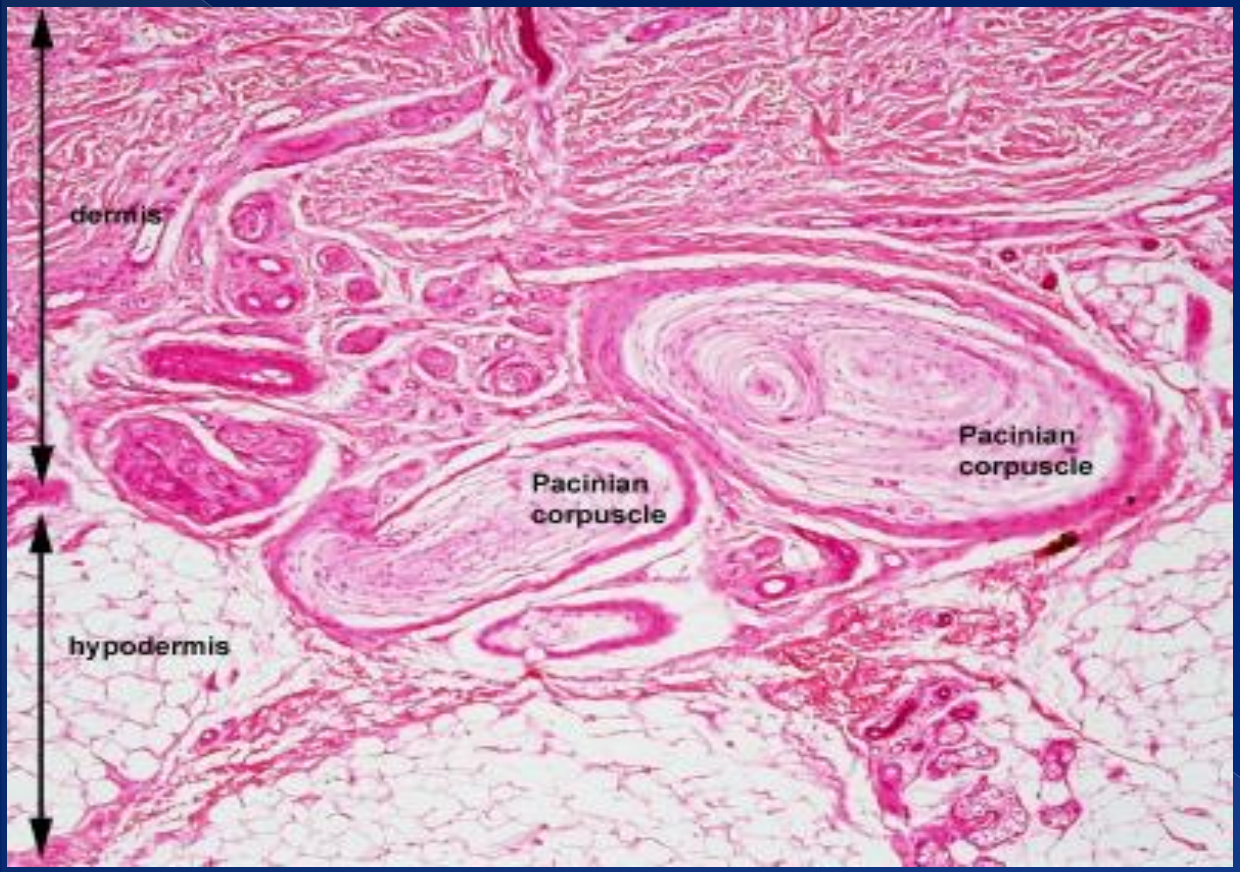
- spherical, thin connective tissue capsule + sensory fibers, in the skin of **penis and clitoris**
- **receptors sensitive to cold? , low-frequence vibrations?**

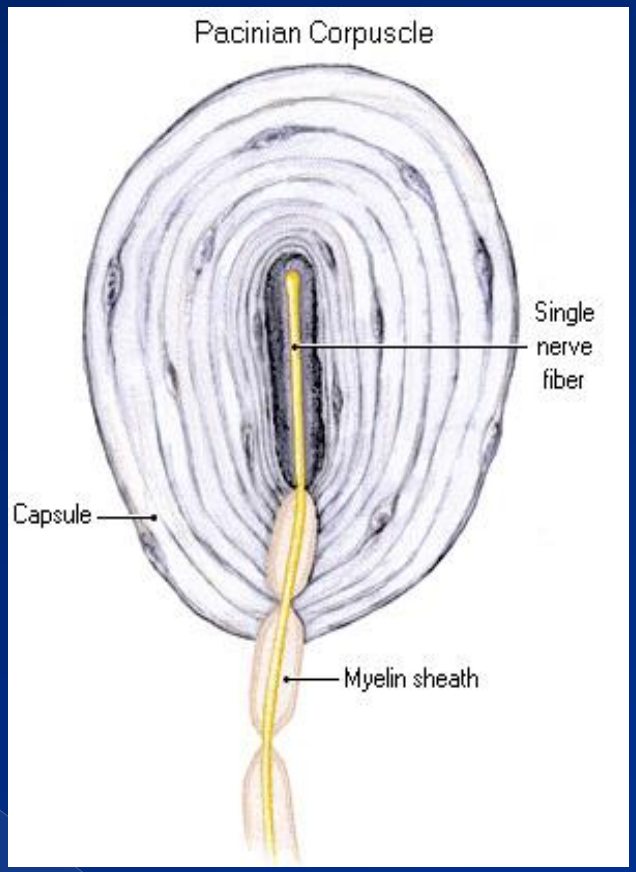
Ruffini's endings (corpuscles) - mechanoreceptors



- **branched nerve endings** + connective tissue capsule
- perception of **stretching, twisting and pressure**.

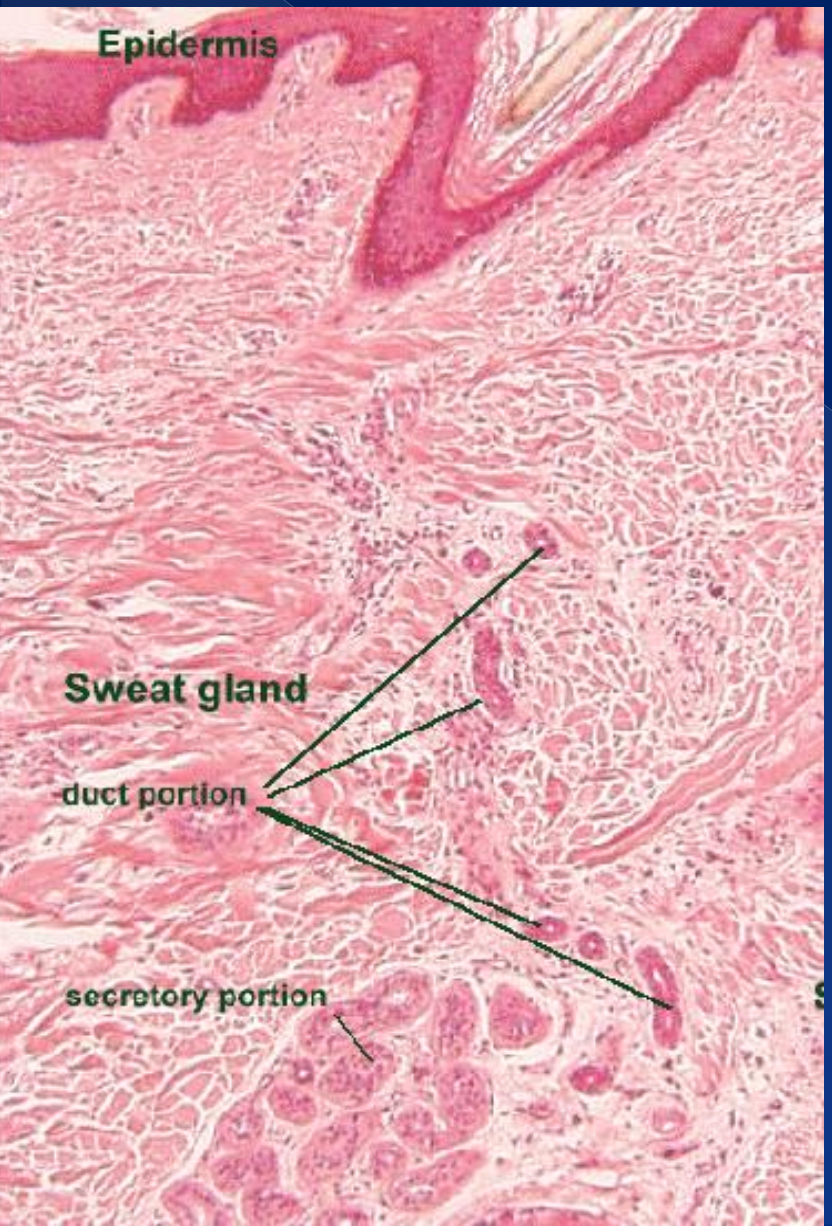
Pacinian corpuscles – dermal reticular layer, hypodermis

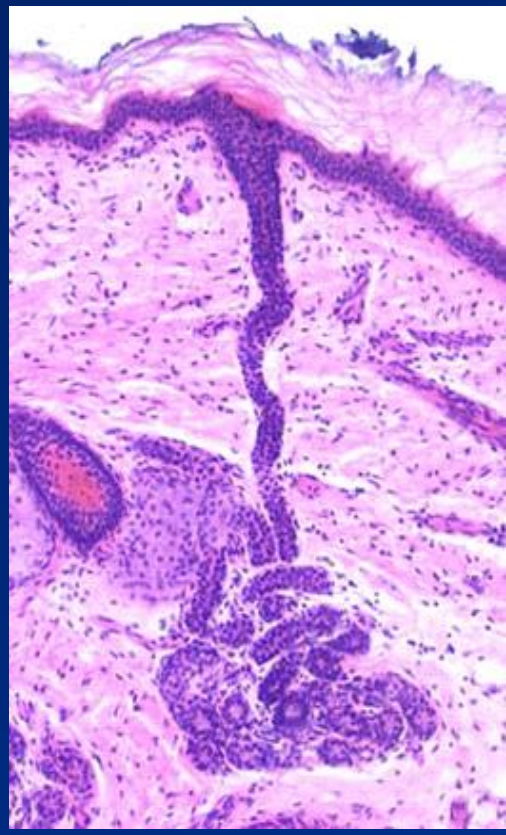




- **Touch, vibration** and **pressure**.
- the core - the nerve ending + **Schwann cells +** layers of modified fibroblasts and connective tissue.
- Also in the wall of **rectum, urinary bladder**

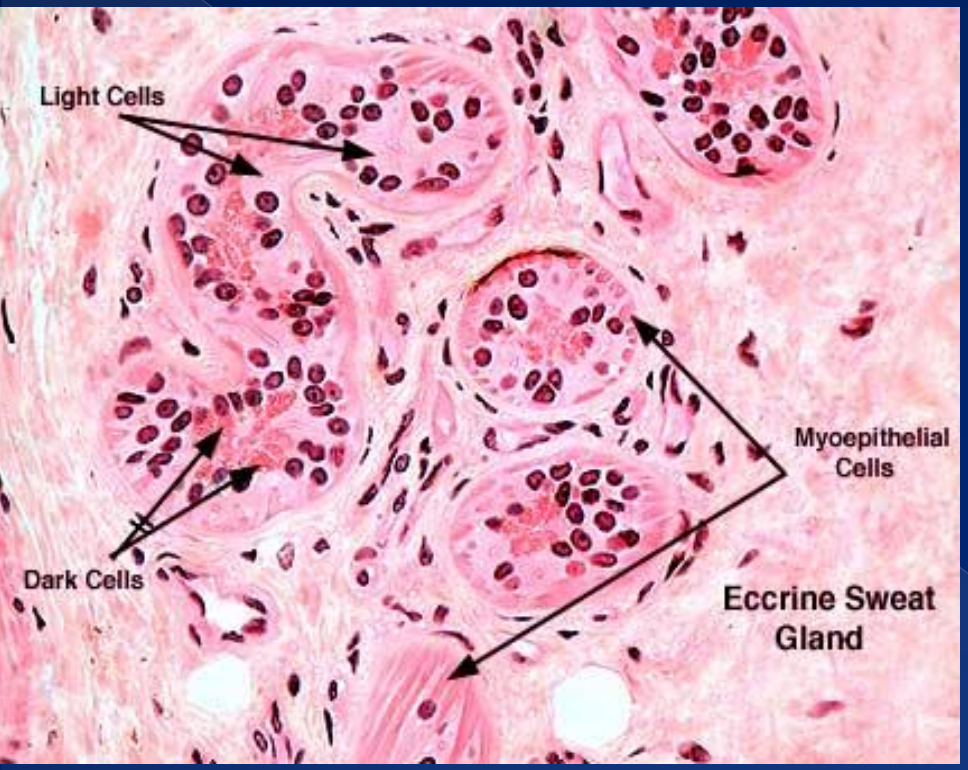
Sweat eccrine glands - merocrine





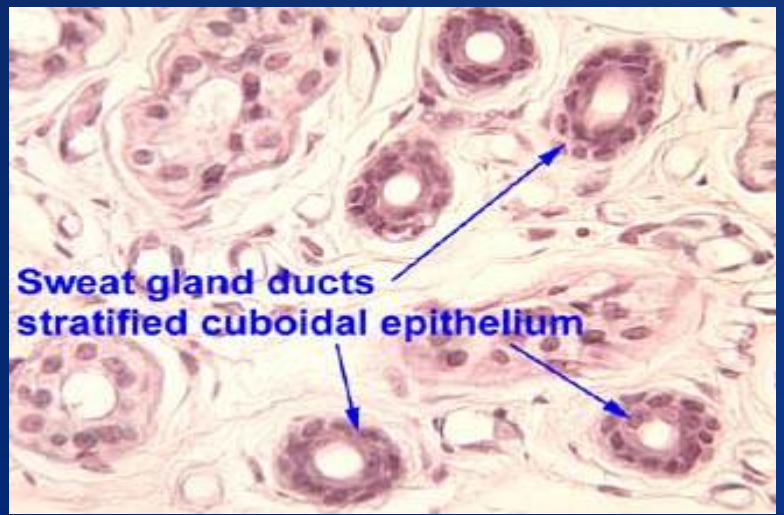
- simple, coiled tubular glands (invagination of the epithelium)
- present throughout the body (mainly on the foot soles)
  - **secretory portoin**
  - **duct portion**

Sweat eccrine (merocrine) glands



Secretory unit

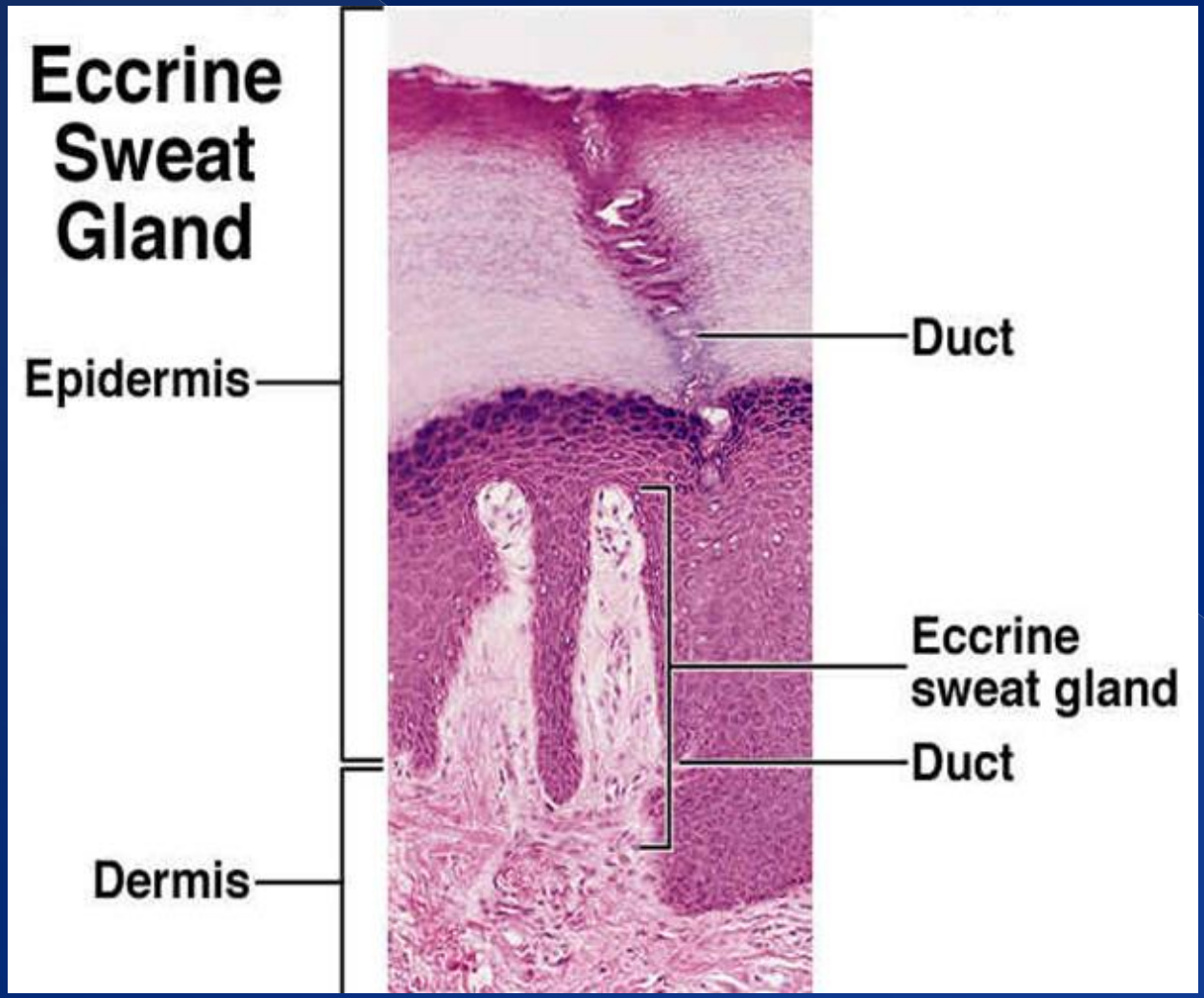
- **stratified cuboidal epithelium**
- **clear cells** - water solution (sweat)
- **dark cells** – glycoproteins (protection)
- **mioepithelial cells** (myosin/actin filaments)



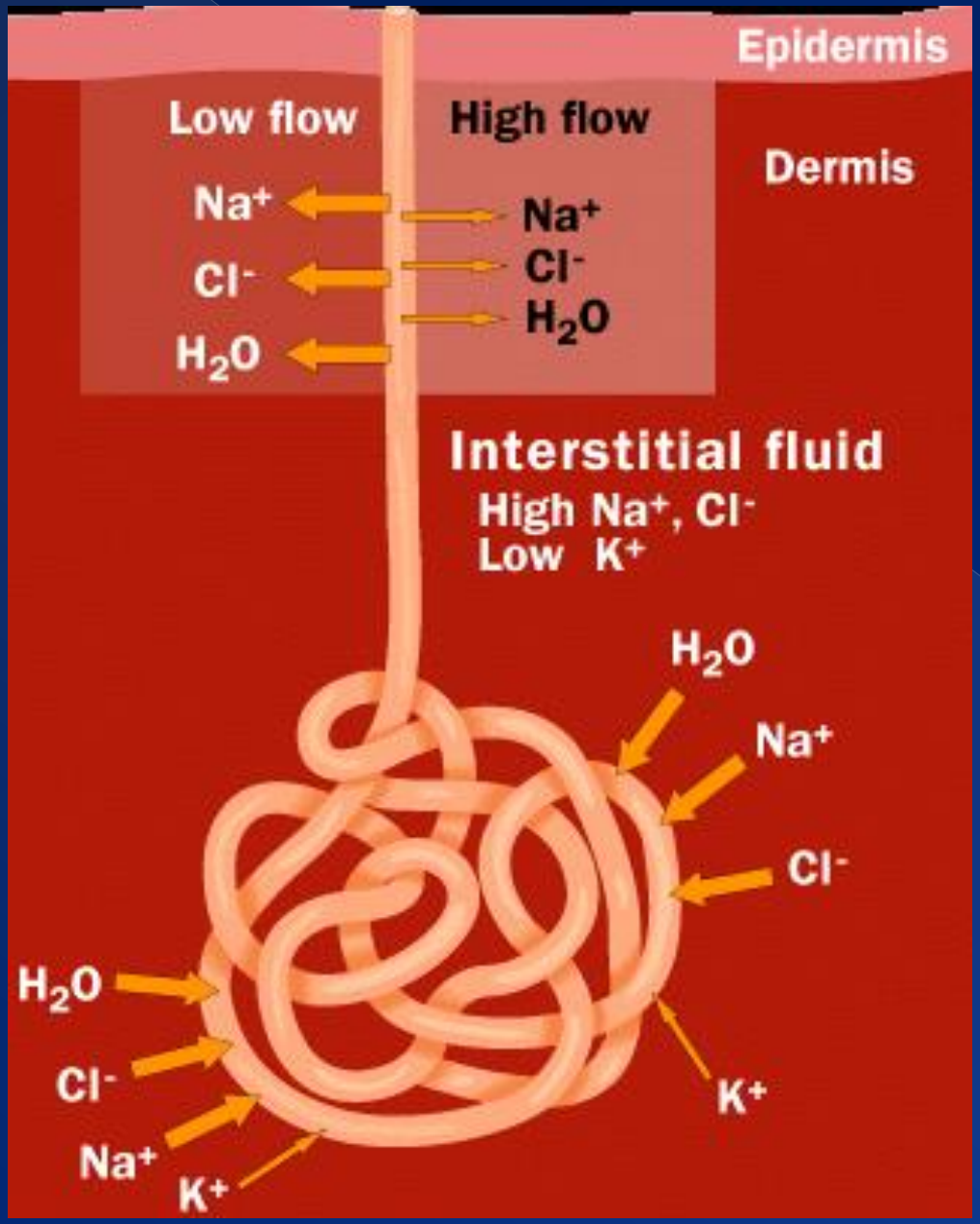
Duct

- **2 layers cuboidal epithelium**: basal and luminal layer.

Sweat eccrine (merocrine) glands
ducts - coiled. In epidermis, keratinocytes constitute walls of ducts (**sweat pores**)

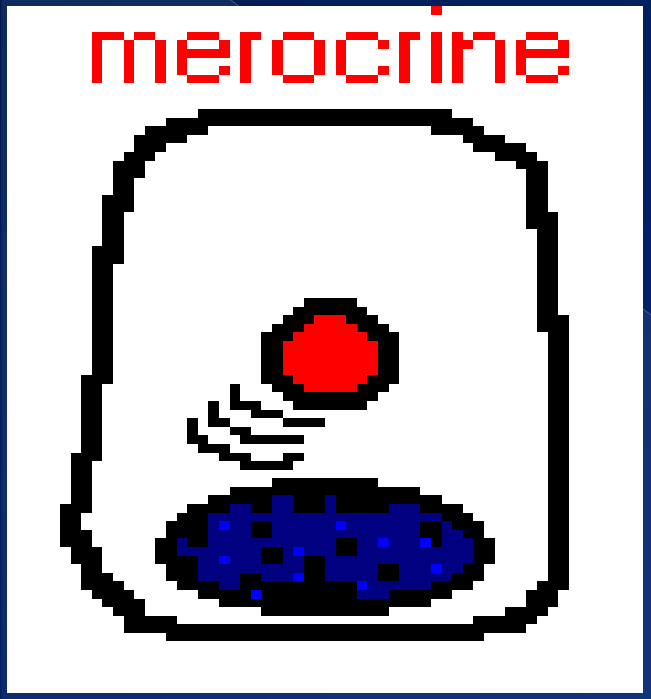


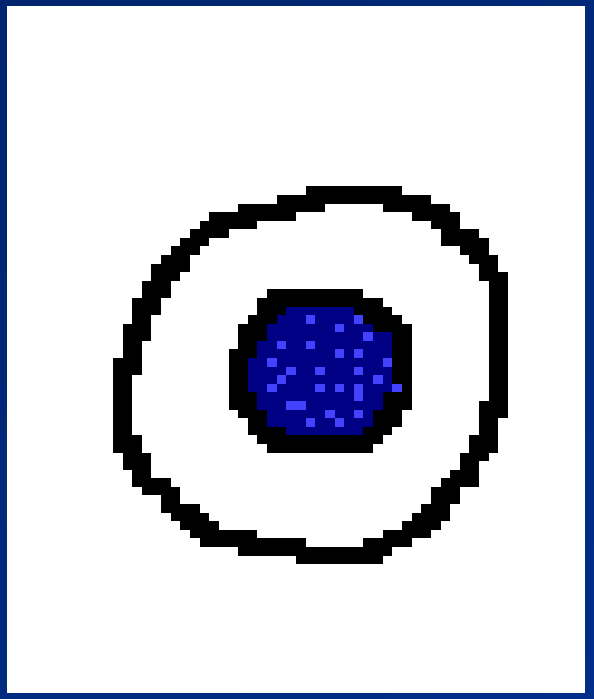
Sweat eccrine (merocrine) glands



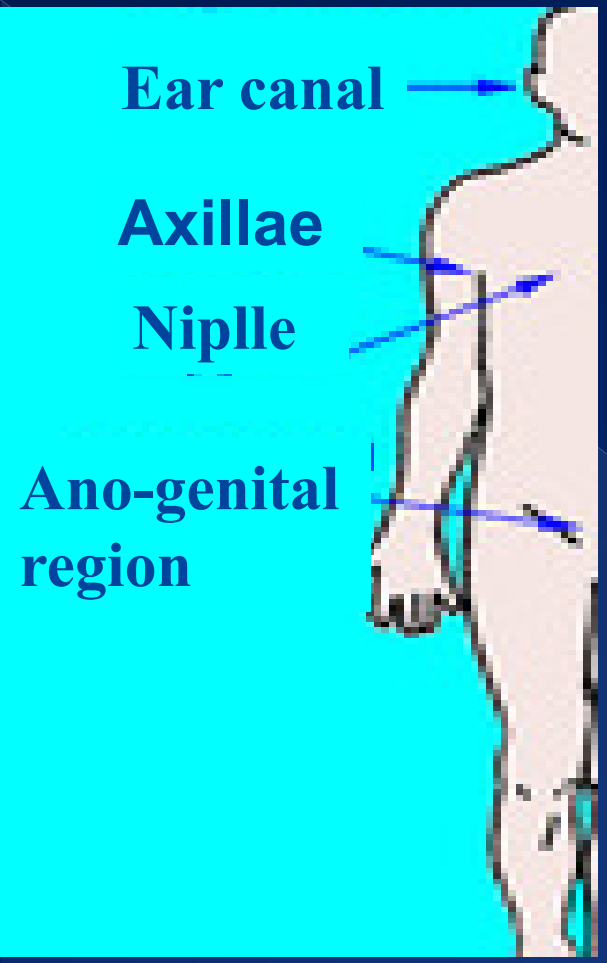
- secretory portion – fluid **similar to blood plasma**
- potassium, sodium and chloride ions resorbed by cells of ducts.
- Sweat contains: **water, ions, urea, lactic acid and some drugs**

Mechanizmes of secretion of exocrine glands

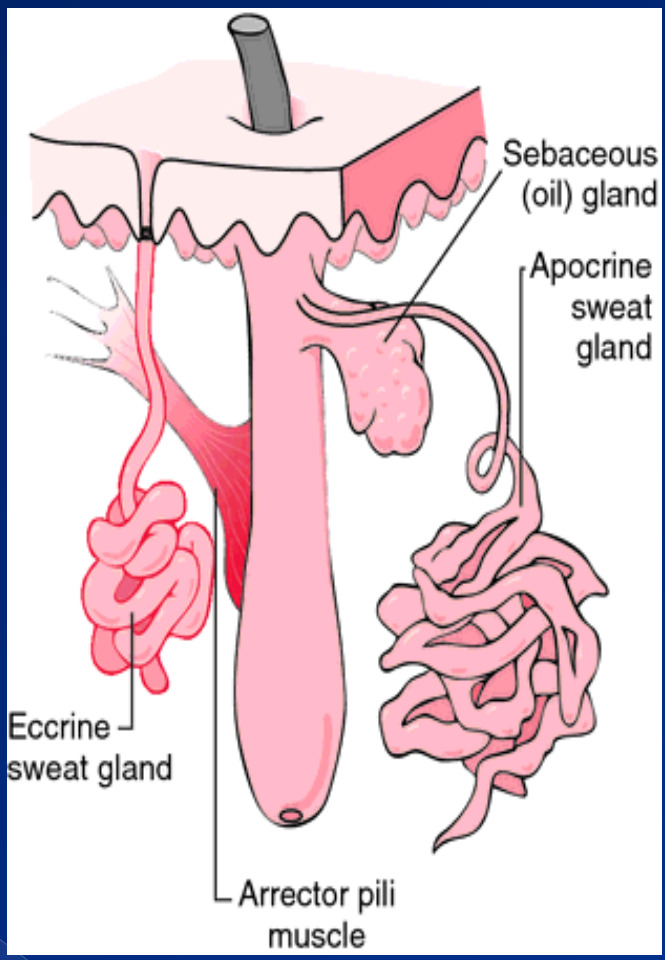




Merocrine gland – exocytosis – **sweat gland**
Apocrine gland – apical part of cytoplasm is released with the secretory product - **mammary gland**
Holocrine gland – secretory cell dies and becomes the secretory product **- sebaceous glands**

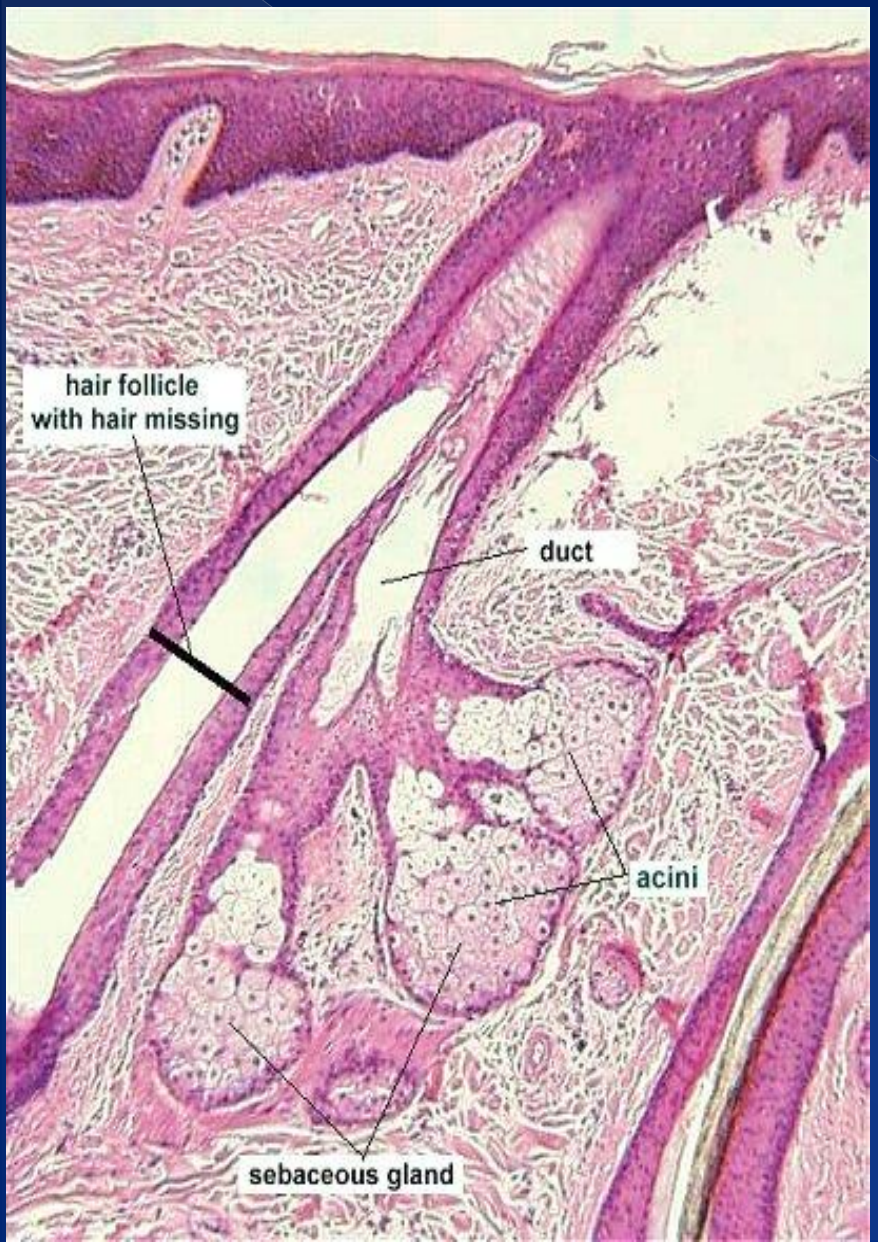


Apocrine sweat glands - vestigial scent glands



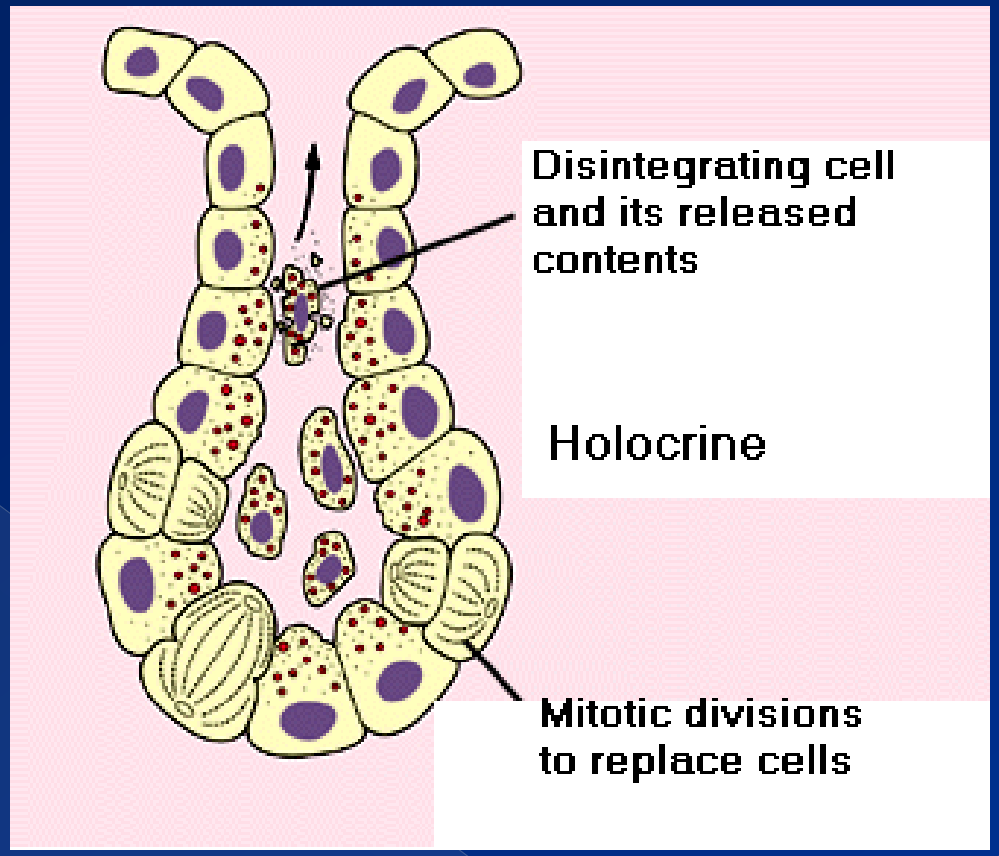
- in the **axilla**, **areola of the nipple** and **anal region**.
- **larger** than eccrine, ducts open into canals of hair follicles.
- secretion regulated by **sex hormones**, does not begin until puberty.

Sebaceous glands (holocrine glands) – absent in thick skin (on the palms and soles)



- **Acinar glands** - clusters of **acini** and short **duct** (**stratified squamous epithelium**).
- **sebum** – wax-like substance - flexibility.
- ducts open into the canal of hair follicles (**pilosebaceous unit**), in no hairy skin onto the surface of the skin.
- under the influence of **sex hormones** - increase activity after puberty.

Sebaceous glands (holocrine glands)

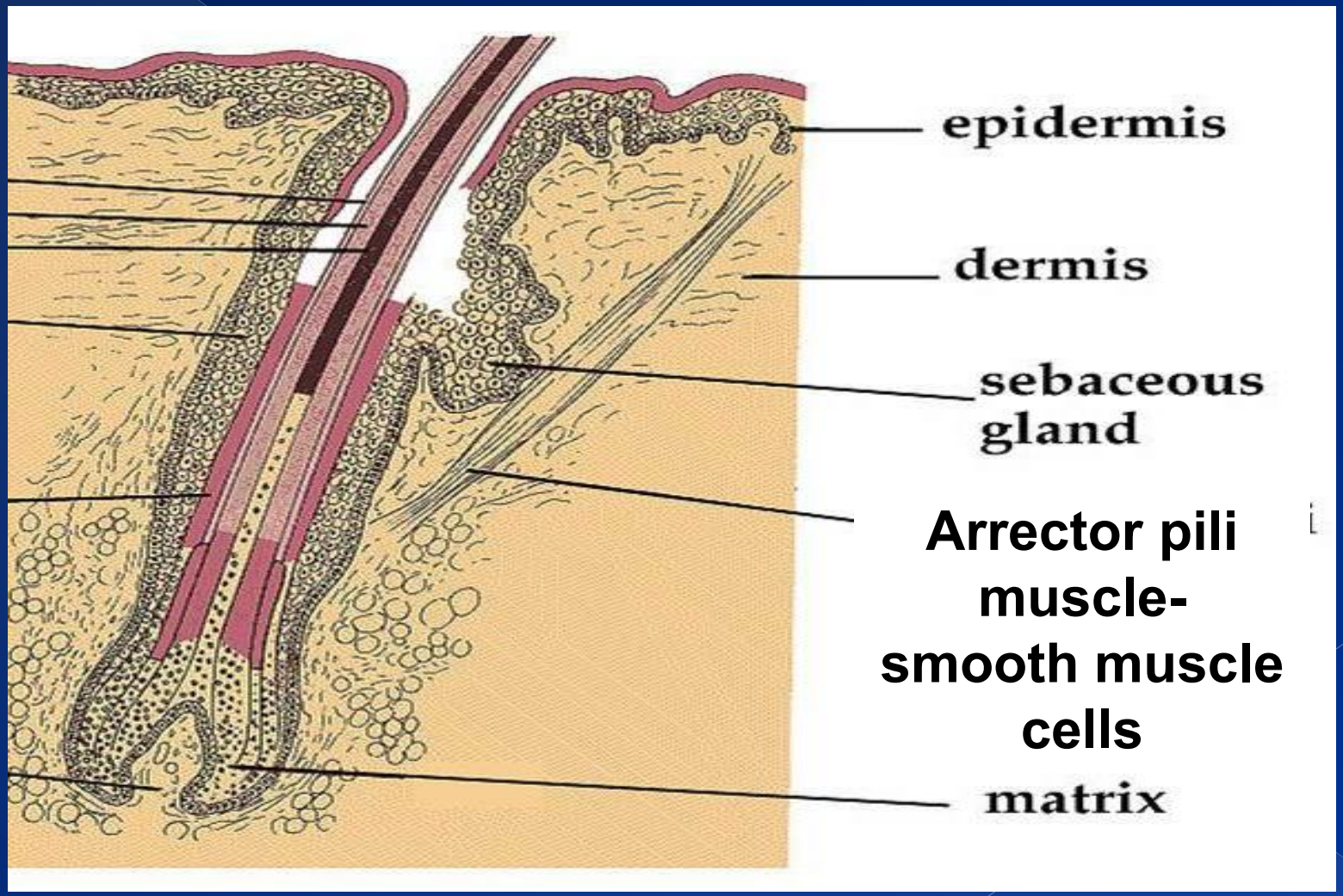


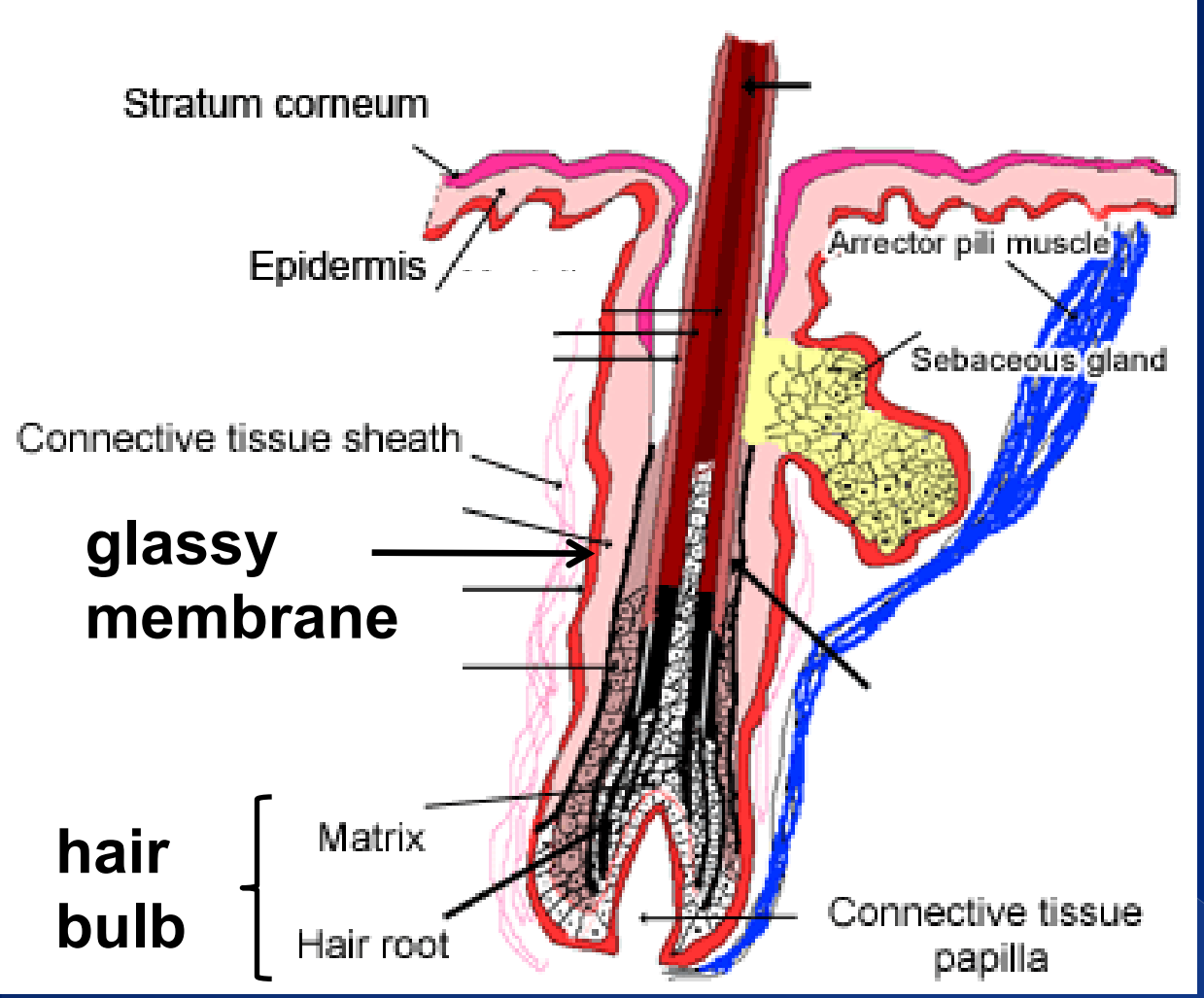
acinus

- **basal** cells (stem cells) and larger, **round** cells.
- round cells (**sebocytes**)- lipid droplets, undergo necrosis and lipid - cellular debris released

Hair follicles - a sack from which a hair develops

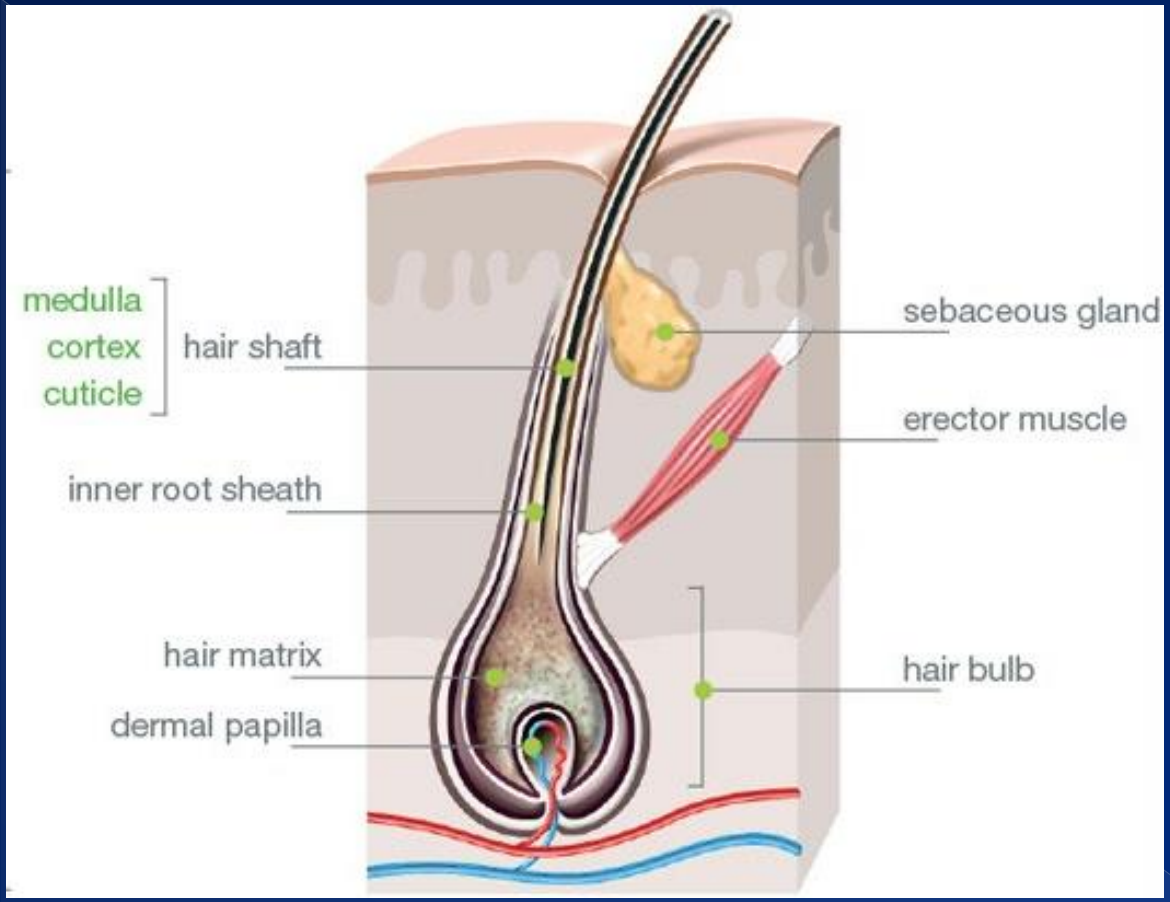
- invaginations of epidermis surrounded by connective tissue of dermis



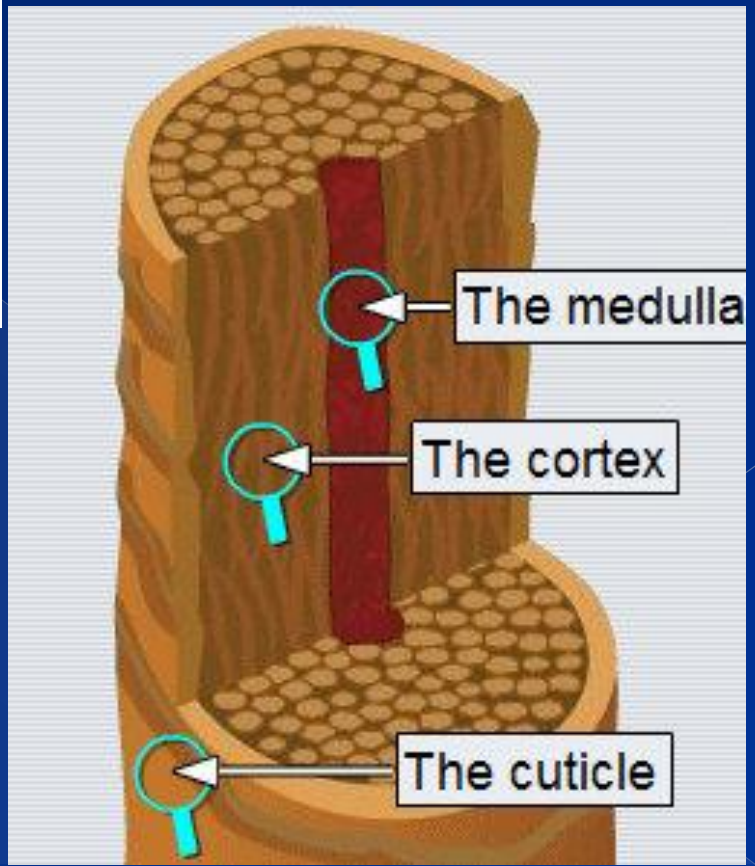


- basement membrane - **glassy membrane** separates epidermis from dermis.

- in the **hair root** – **dermal papilla** – blood vessels – nutrients, oxygen
- hair root – **matrix** – growth of hair.
- **hair root (with matrix)** and **dermal papilla - hair bulb**



Cells of matrix proliferate and differentiate to form **hair shaft**

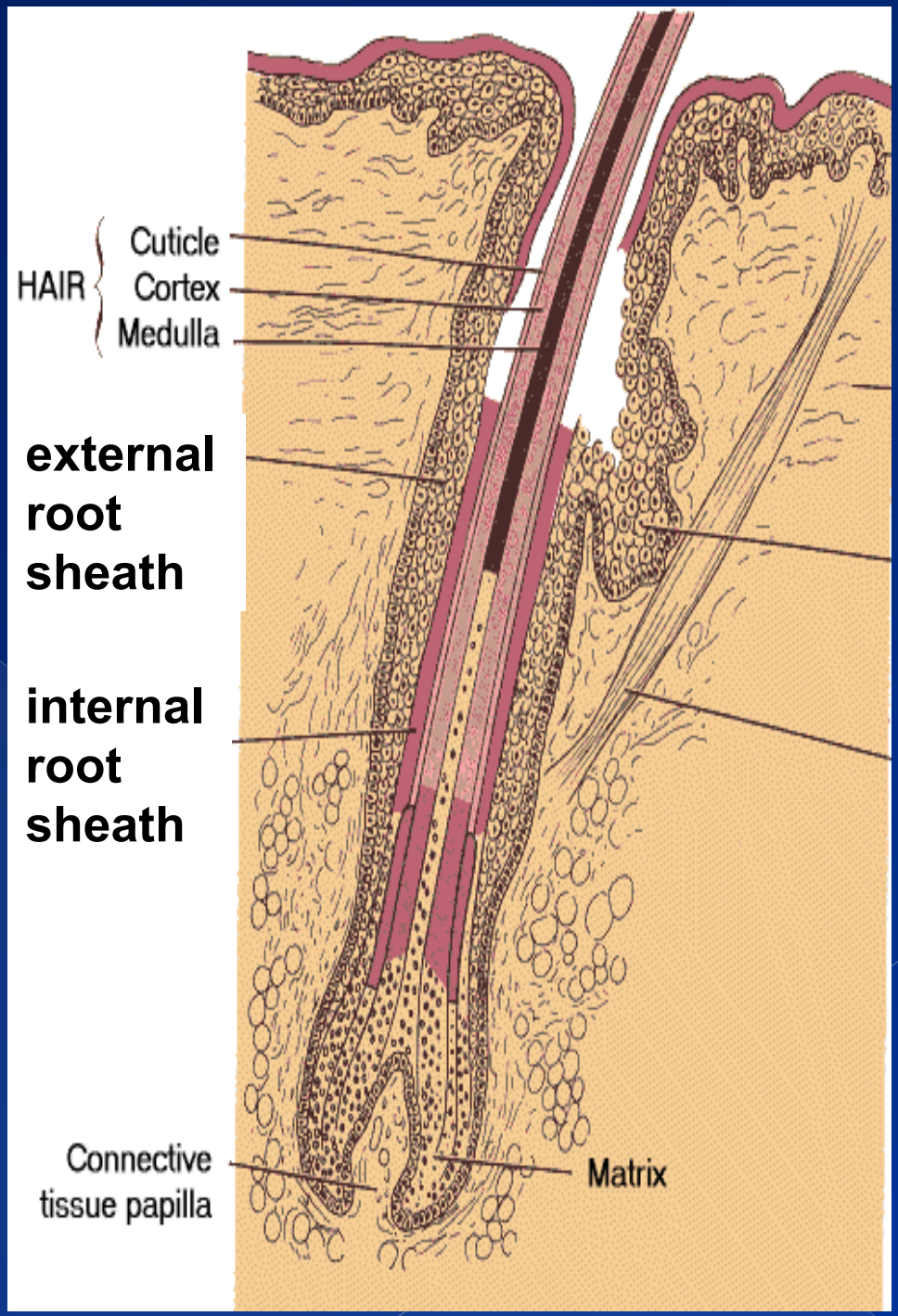


Hair shaft

- medulla (present only in thick hair)
- cortex
- hair cuticle.

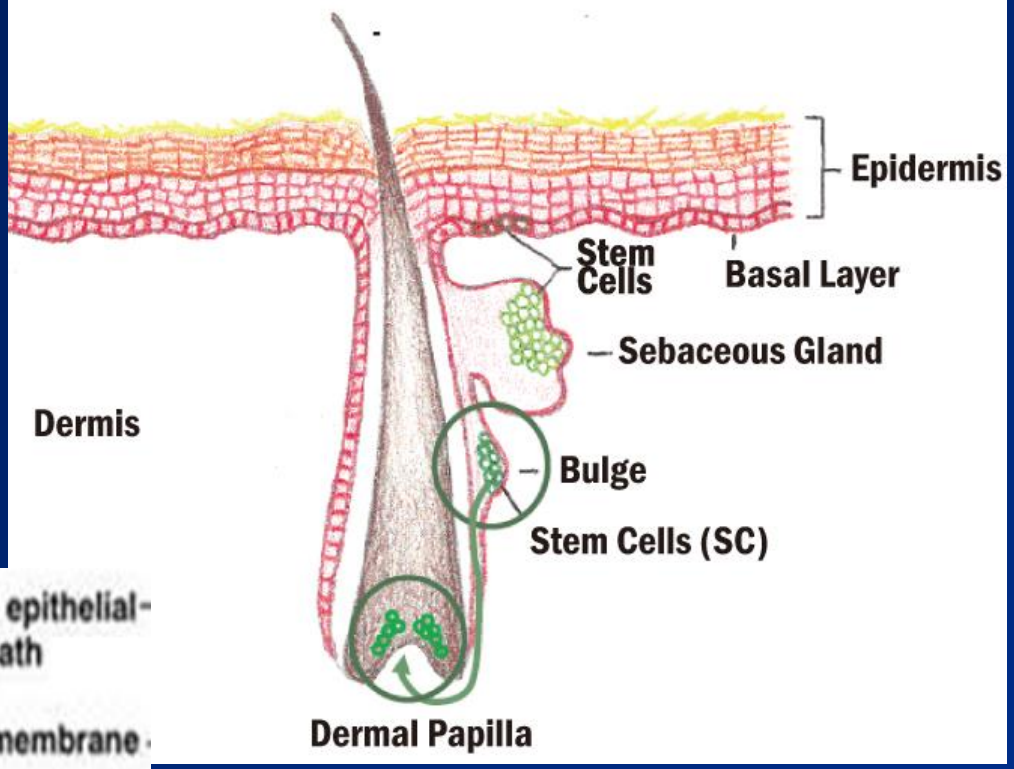
Hair shaft – surrounded by:
- external and internal root sheath - layers of epidermis

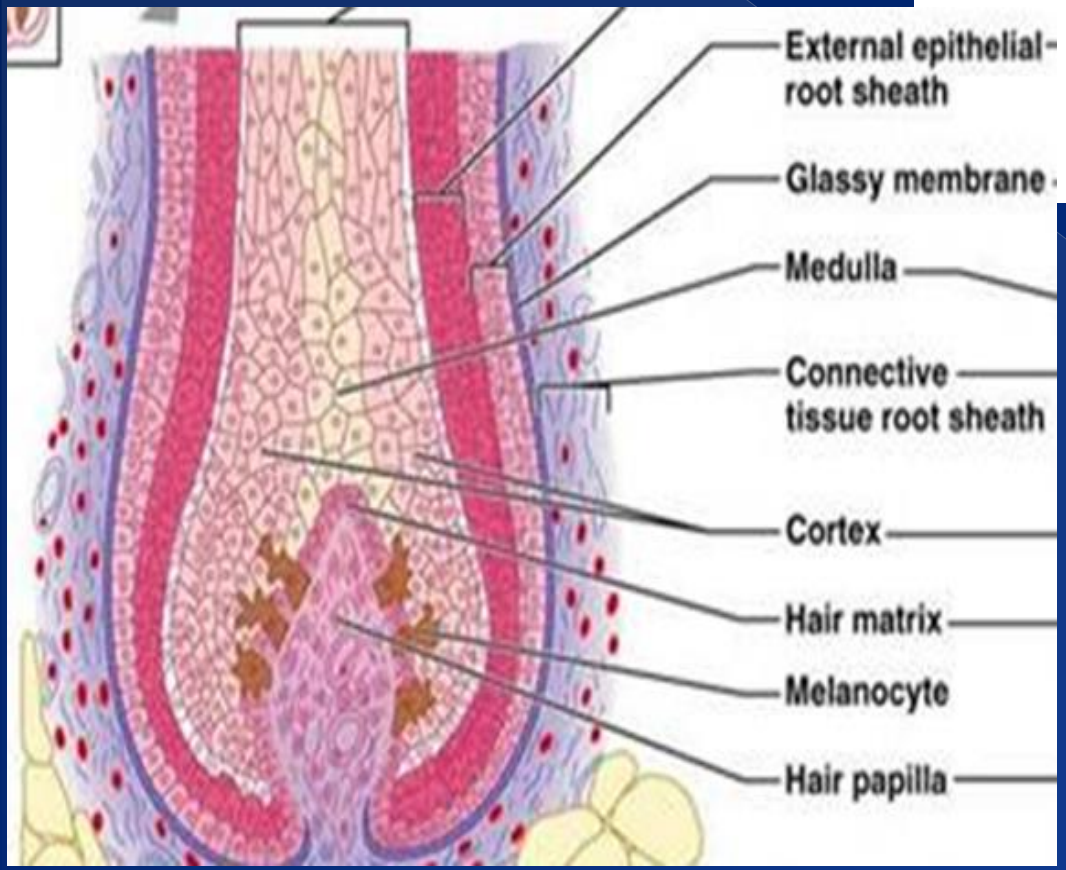
- **external root sheath** (single layer of cells at the hair bulb and several layers near the surface)
- external root sheath surrounds **internal root sheath**



Bulge – stem cells (continuation of stratum basale)

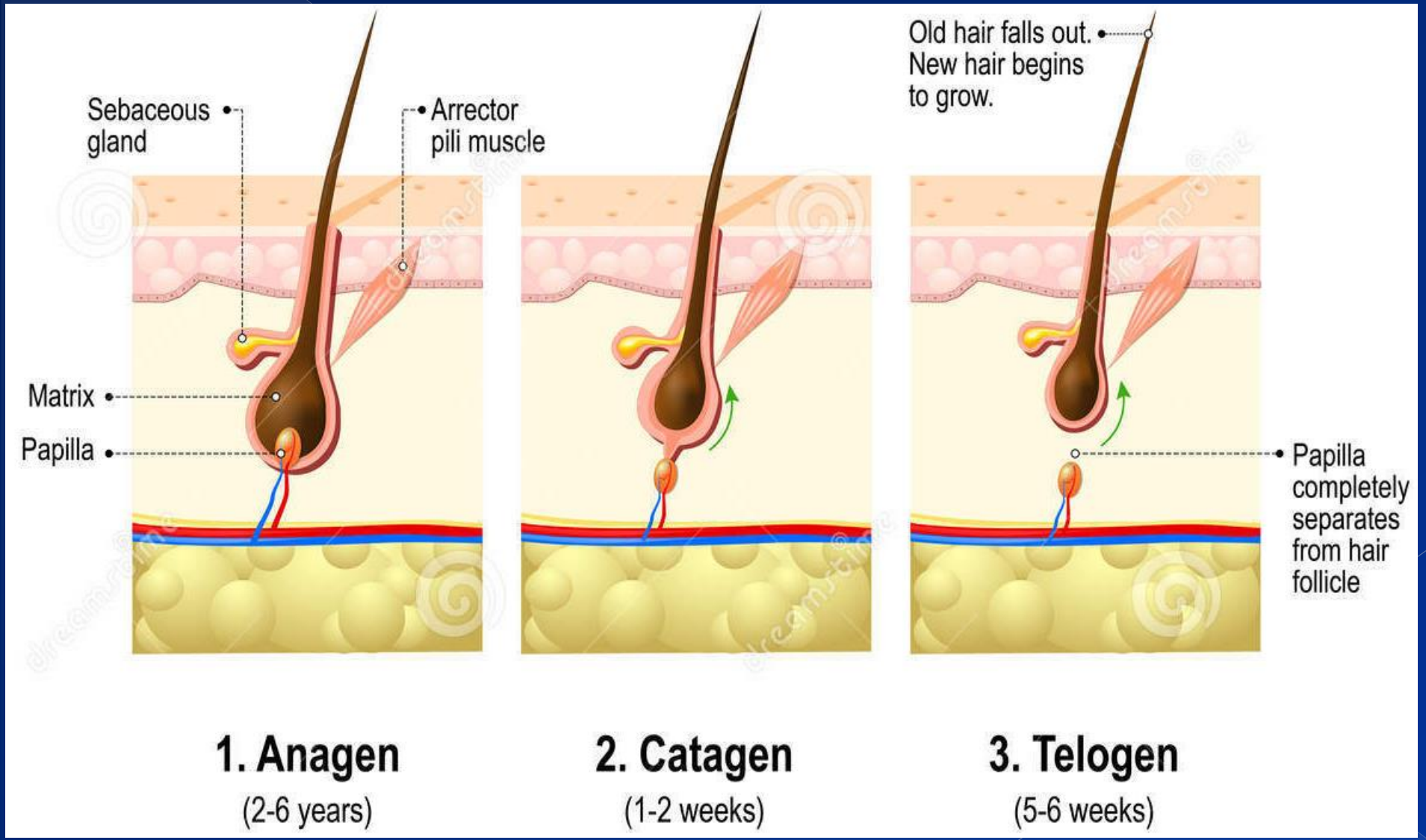
- stem cells – also in matrix





- melanocytes - present among cells of matrix (color of the hair).

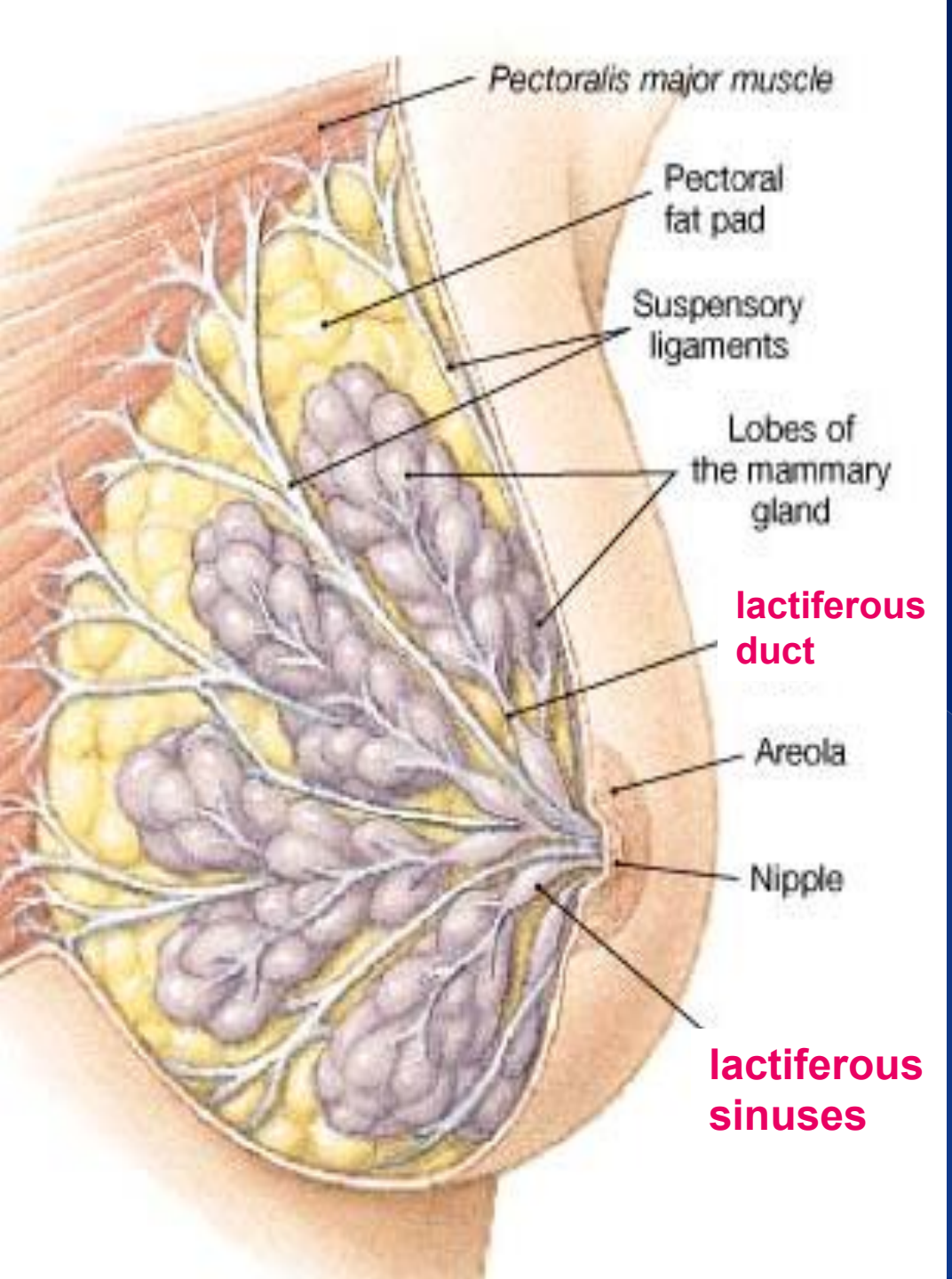
Hair grows in phases: **anagen** - the growth phase - active phase of growth - 2–7 years; **catagen** - the regressing phase; **telogen**



Mammary glands

Production:

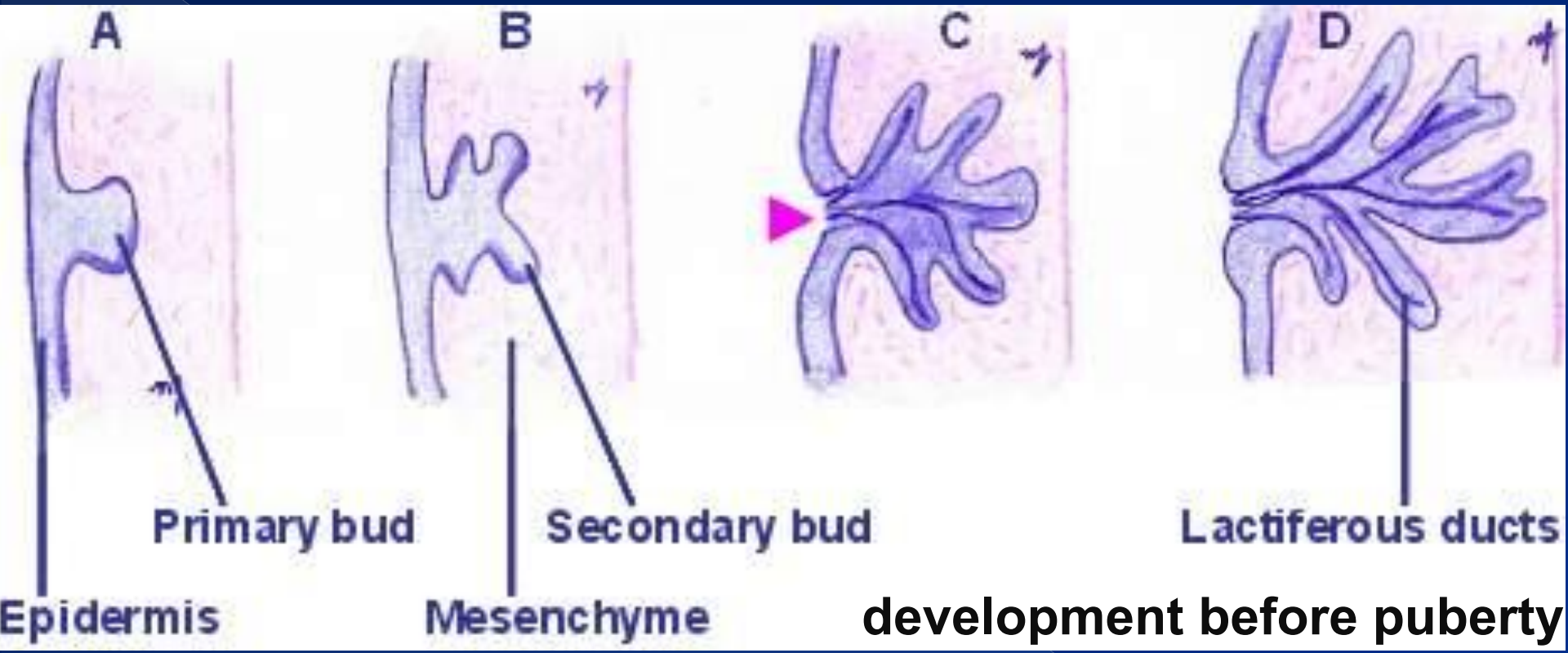
- **Colostrum -** just after birth (lower in fat and higher in protein than milk, antibodies)
- **milk** (proteins, lipids, lactose, IgA antibodies, minerals, vitamins)



Mammary glands

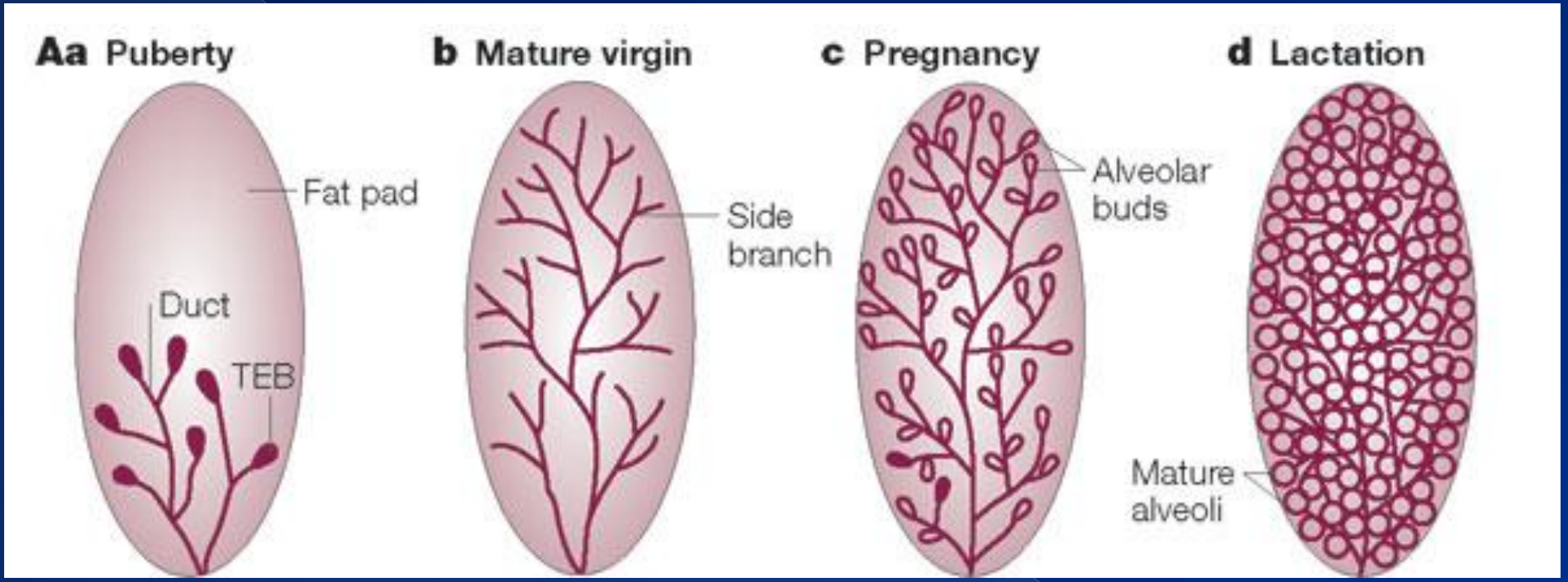
- **compound tubuloalveolar glands** (15-20 lobes), separated by adipose and connective tissue (stroma).
- **lactiferous duct** - to the nipple.
- ducts - dilated **lactiferous sinuses** for milk storage.

Development of mammary glands - invagination of epithelium



- primary bud, secondary bud
- lactiferous ducts and their branches .
- surrounded by mesenchyme that becomes connective tissue and fat.

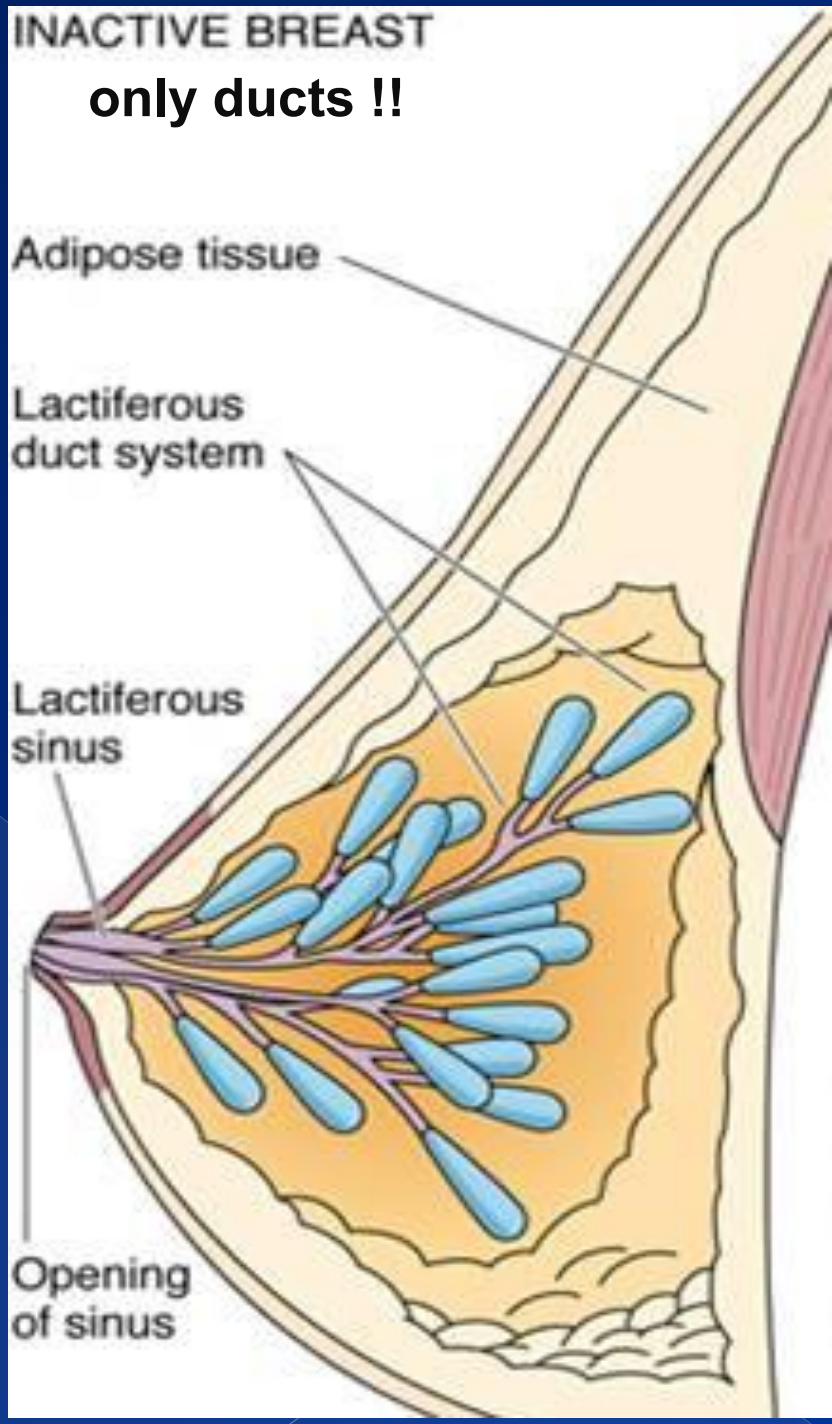
Mammary glands - develop in the same way in both sexes until puberty.



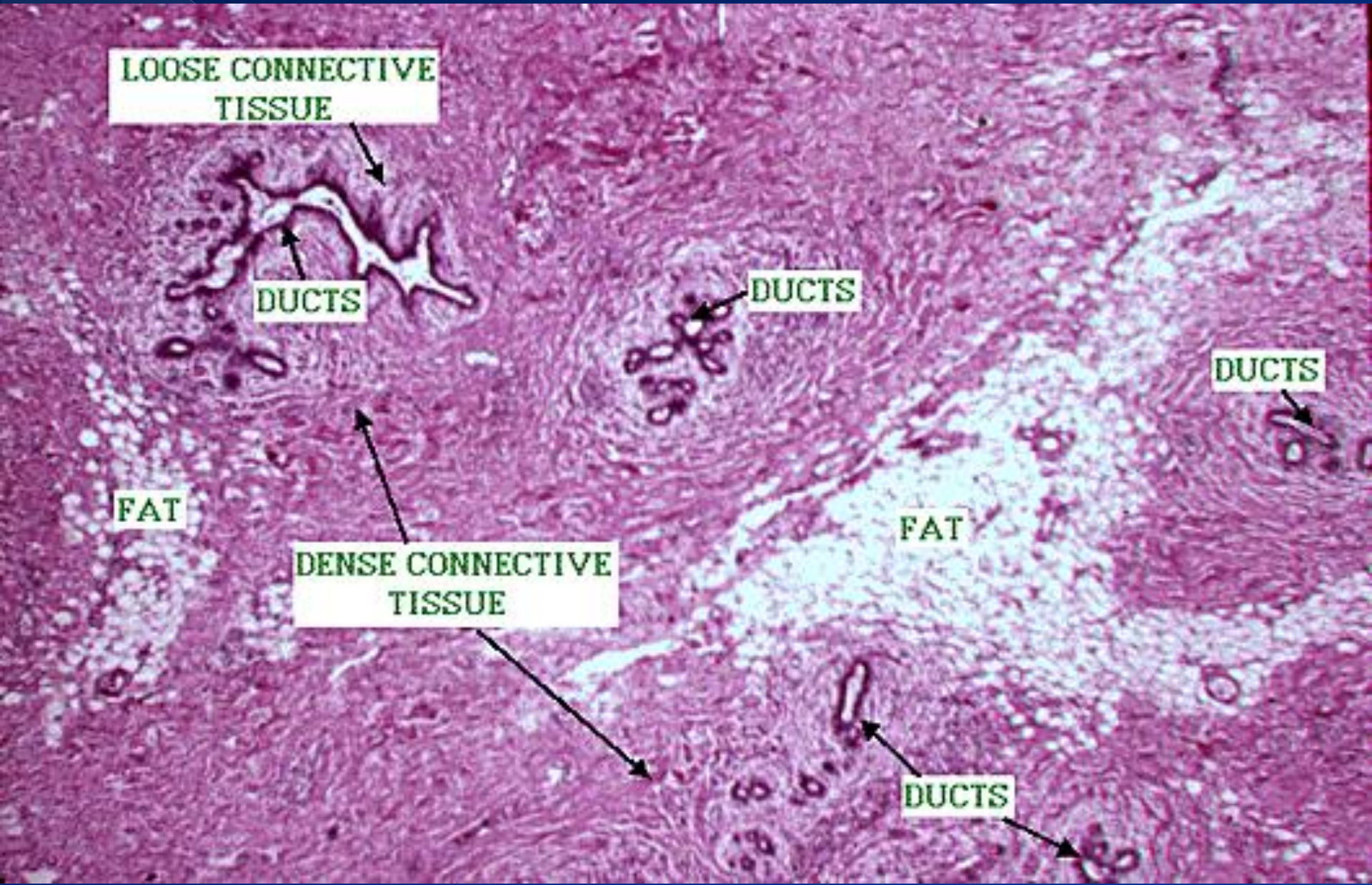
- in females - **estrogens**, **progesterone** and **prolactin** - development of lobules and terminal ductules.
- **pregnancy (estrogens, progesterone) - terminal portions of the ducts grow and branch, alveoli develop!.**

Resting (nonsecreting) mammary glands

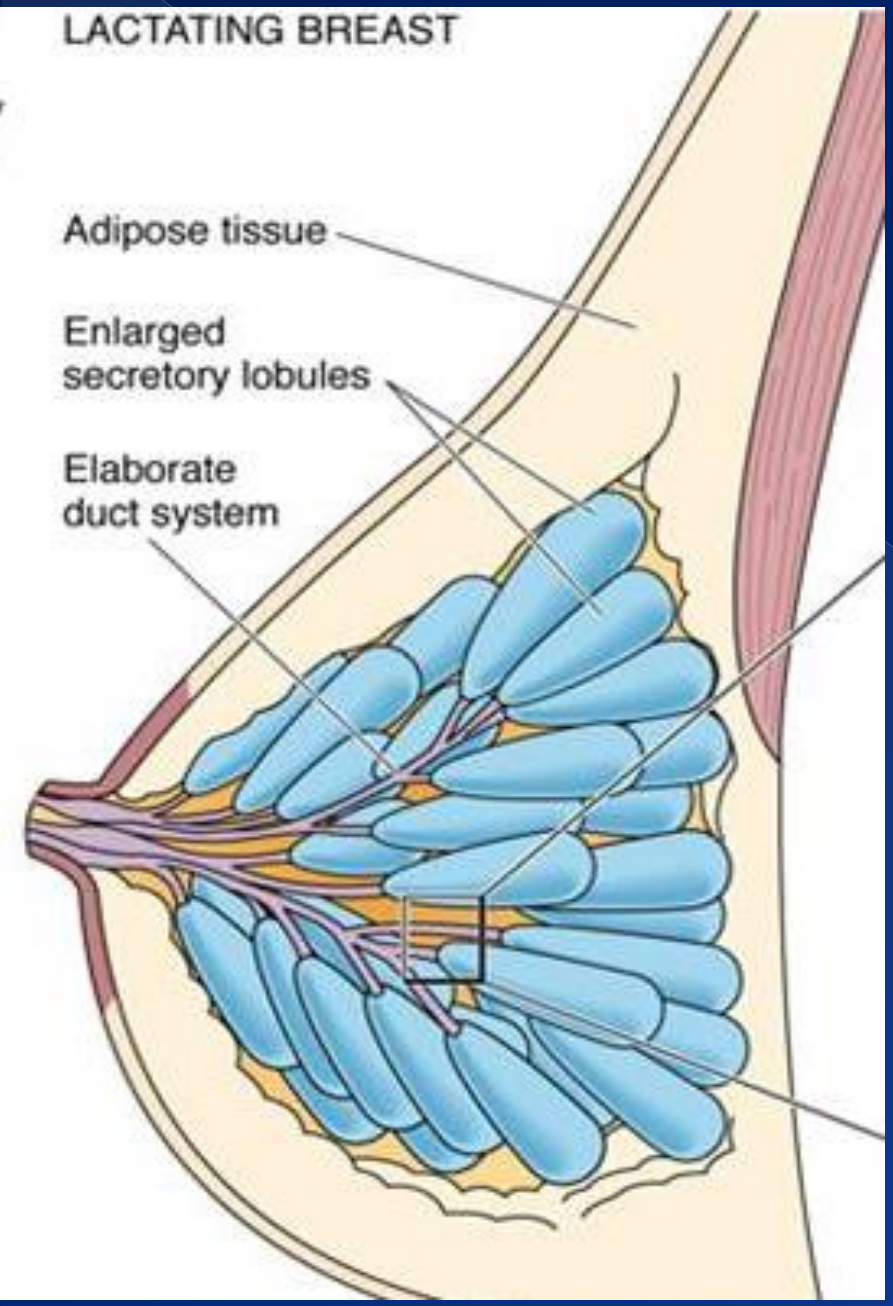
- **alveoli are not developed!**
- at the nipple - ducts lined by a **stratified squamous keratinized epithelium**.
- lactiferous sinuses and lactiferous ducts - **stratified cuboidal epithelium**
- smaller ducts - **simple columnar epithelium**



Inactive mammary gland of nulliparous woman



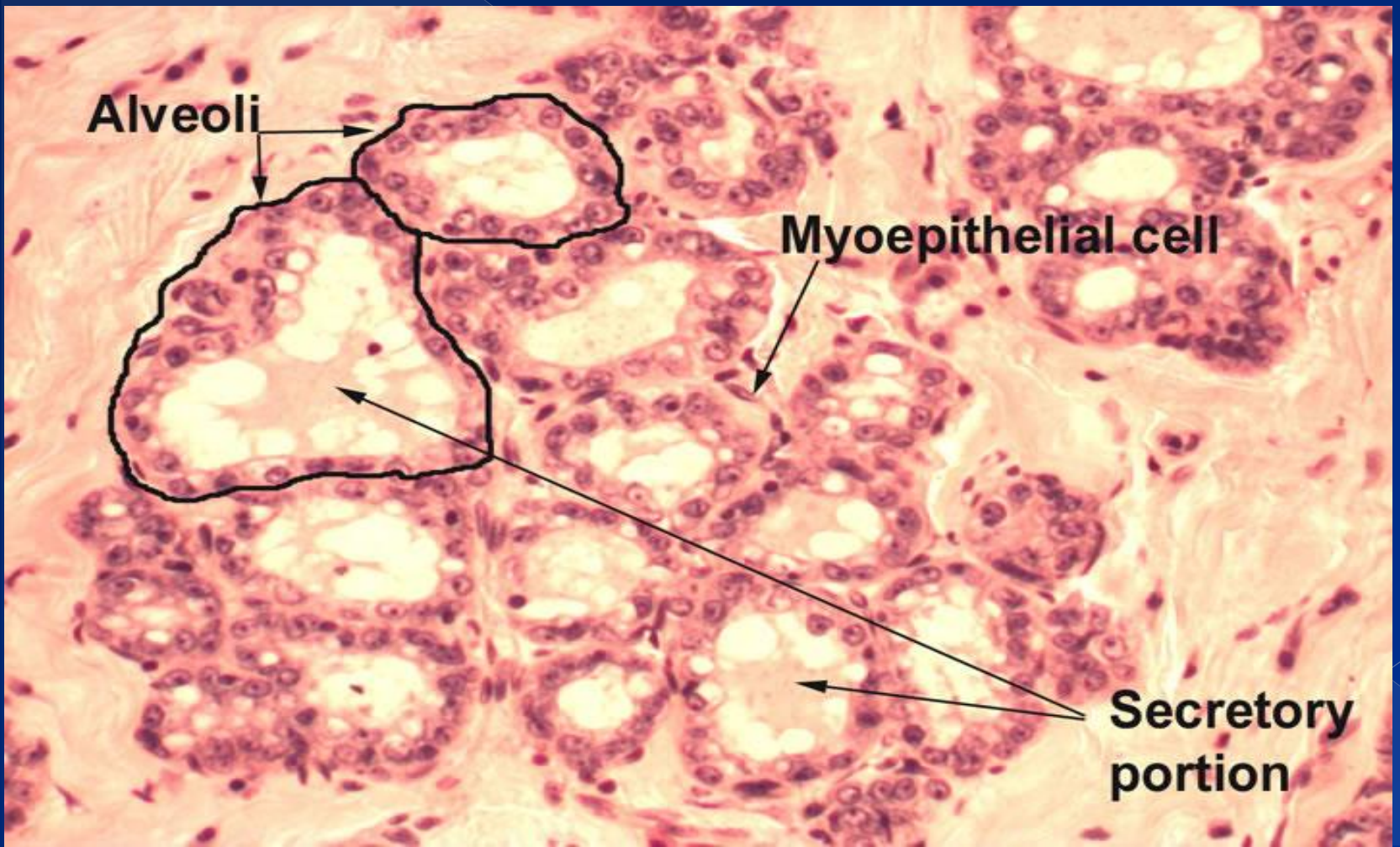
Active (lactating) mammary gland



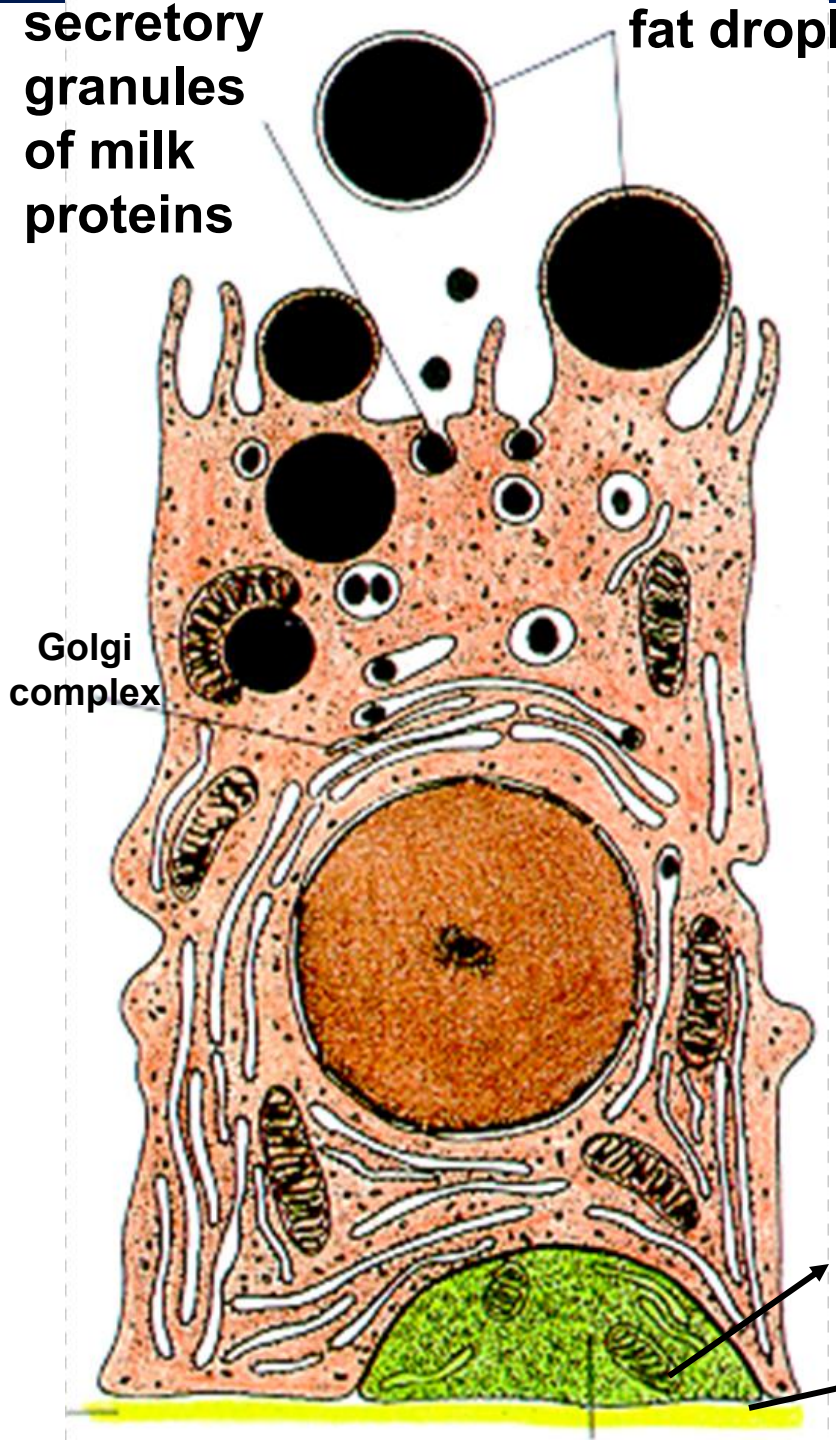
- **pregnancy** (hormones) - **alveoli development.**
- formation of colostrum
- after childbirth (estrogen and progesterone - replaced by **prolactin**) - colostrum replaced by milk.
- **oxytocin** - ejection reflex - contractions of the **myoepithelial cells** around alveoli and ducts.

Active mammary gland

Alveoli - a single layer of **cuboidal epithelium** surrounded by **myoepithelial cells.**

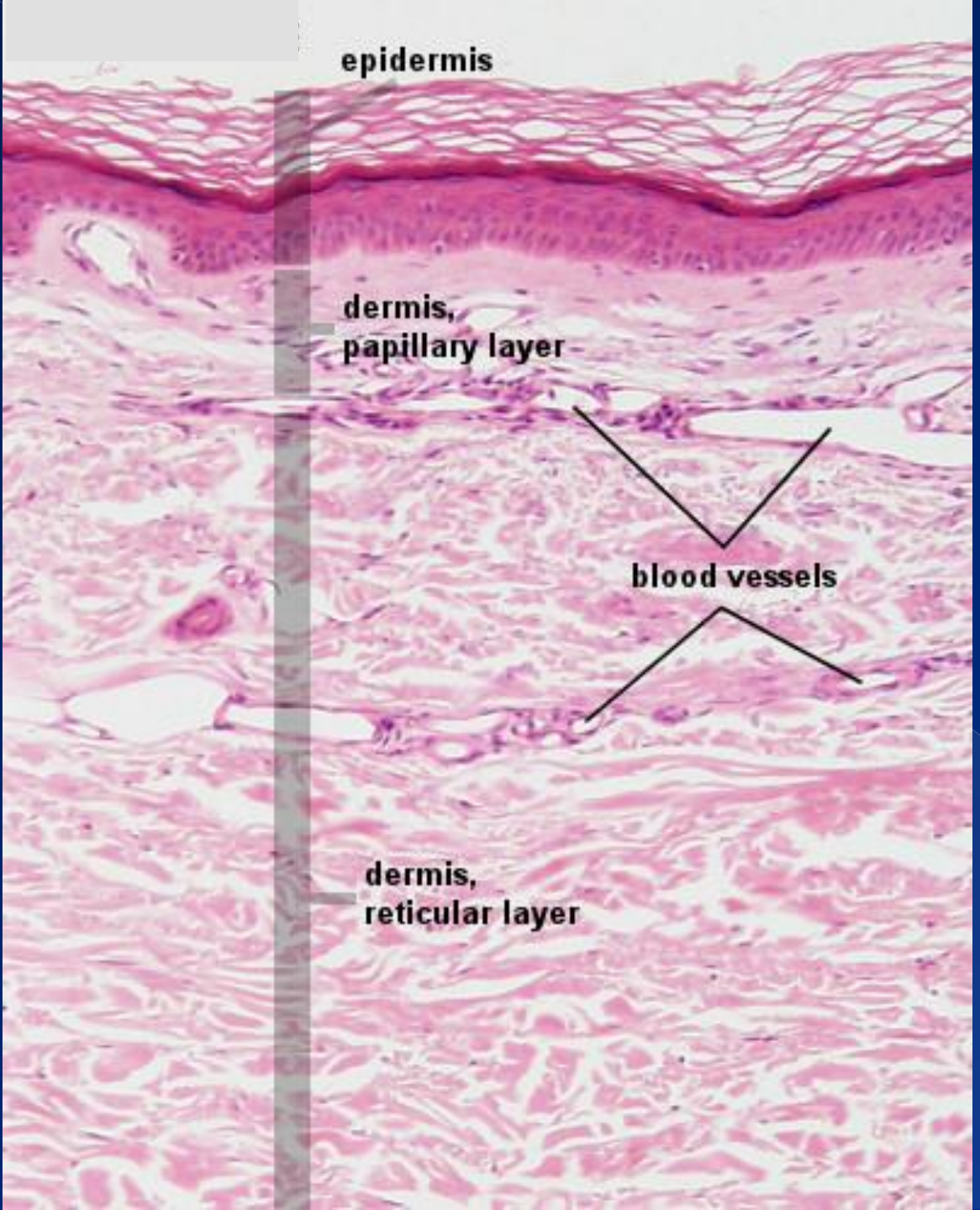


Secretion of milk



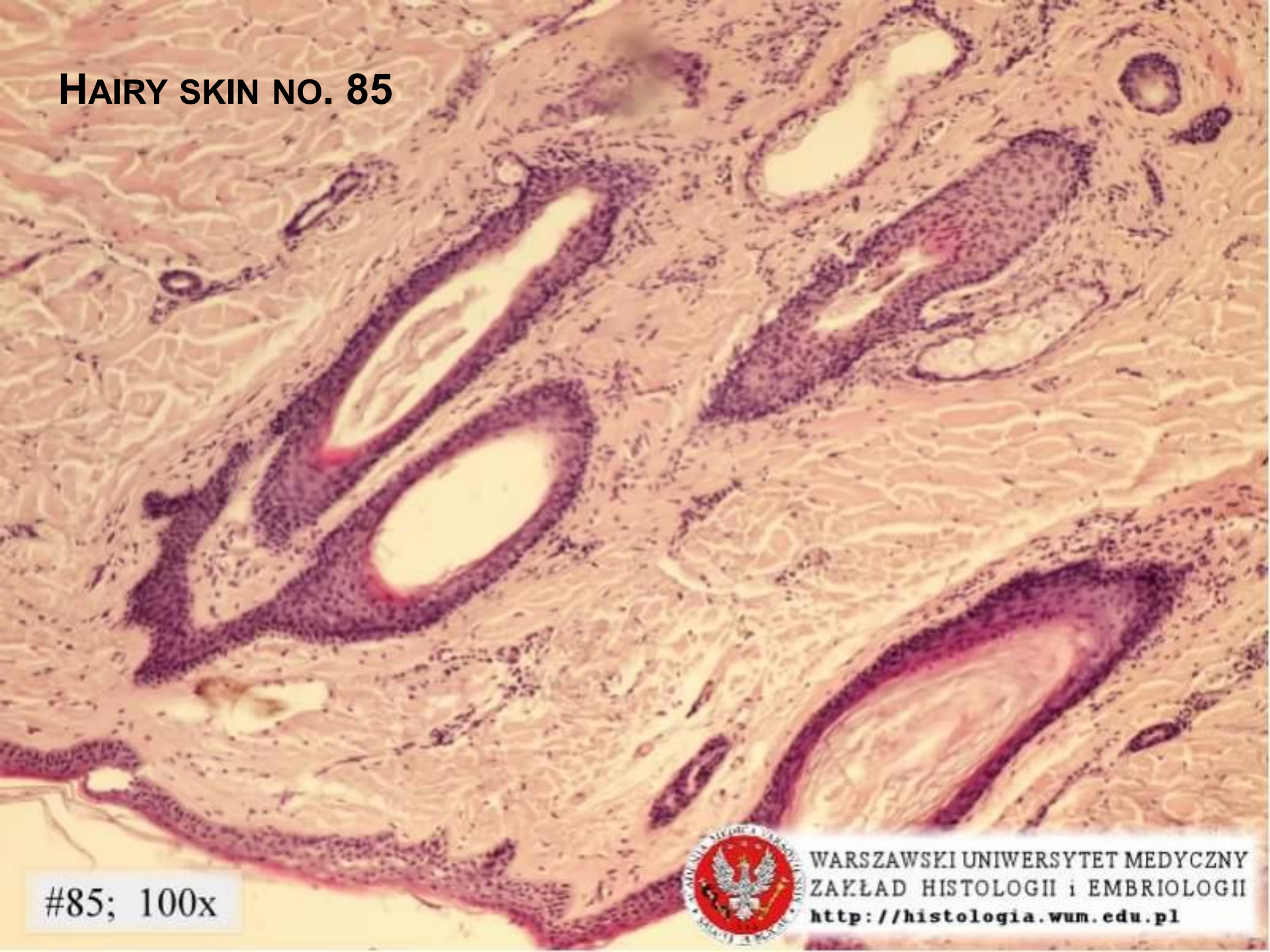
- **proteins** - secreted by exocytosis (**merocrine** secretion)
- **fat** - released as droplets surrounded by plasma membrane detached from the cell (**apocrine** secretion).
- **milk - IgA** antibodies produced by plasma cells present in mammary gland stroma.

NO HAIRY SKIN NO.83

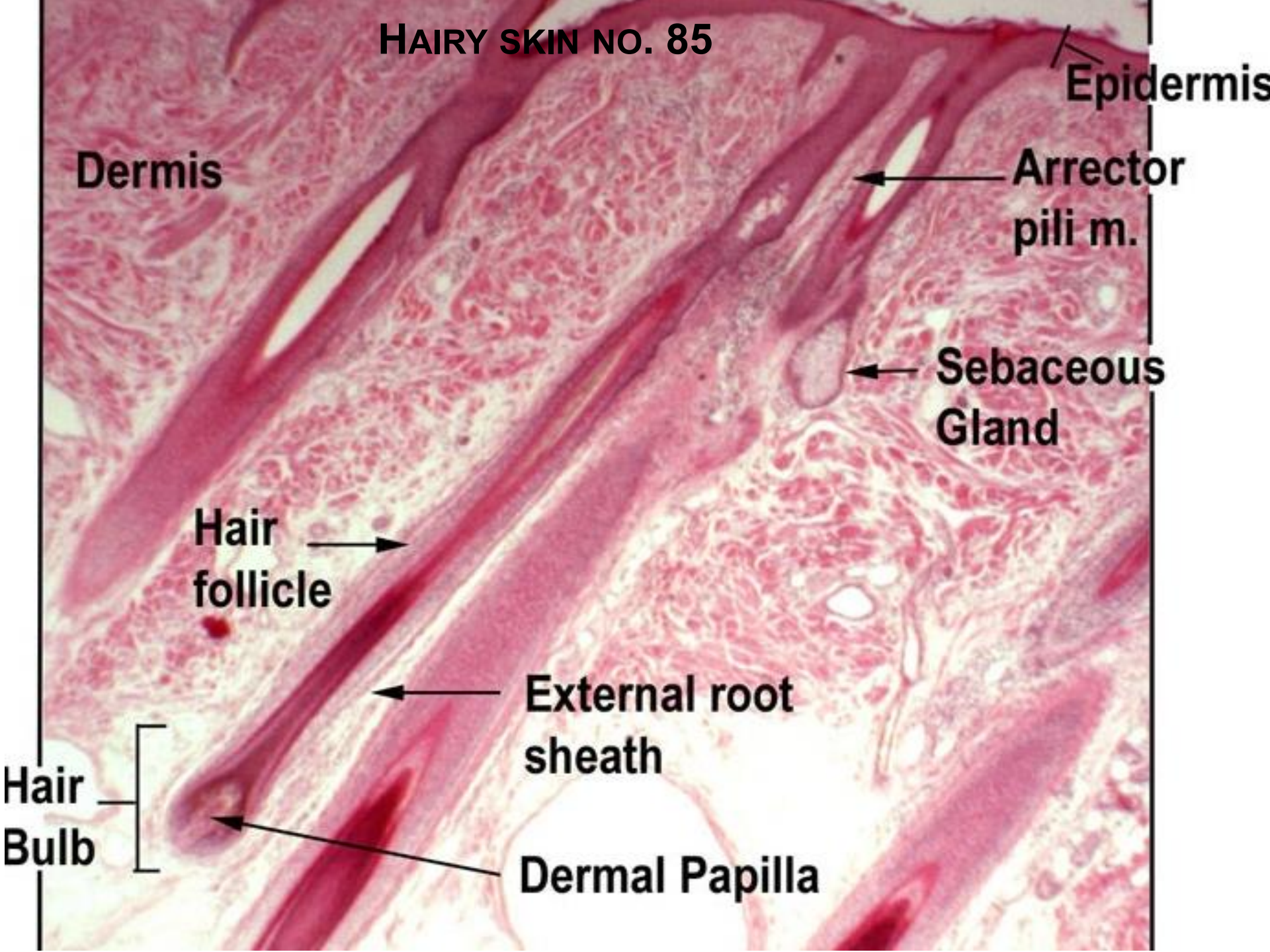


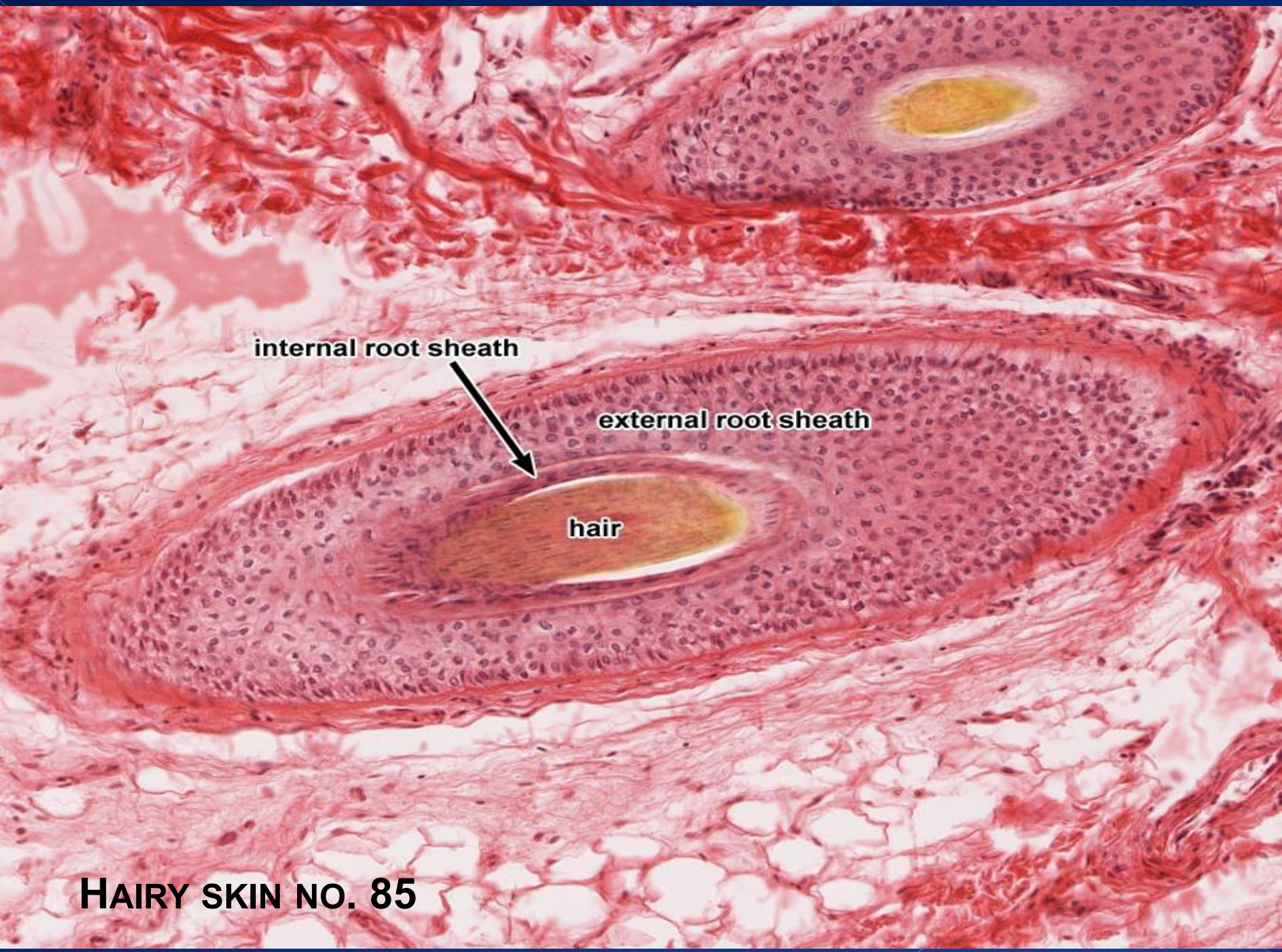
#83; 400x

HAIRY SKIN NO. 85



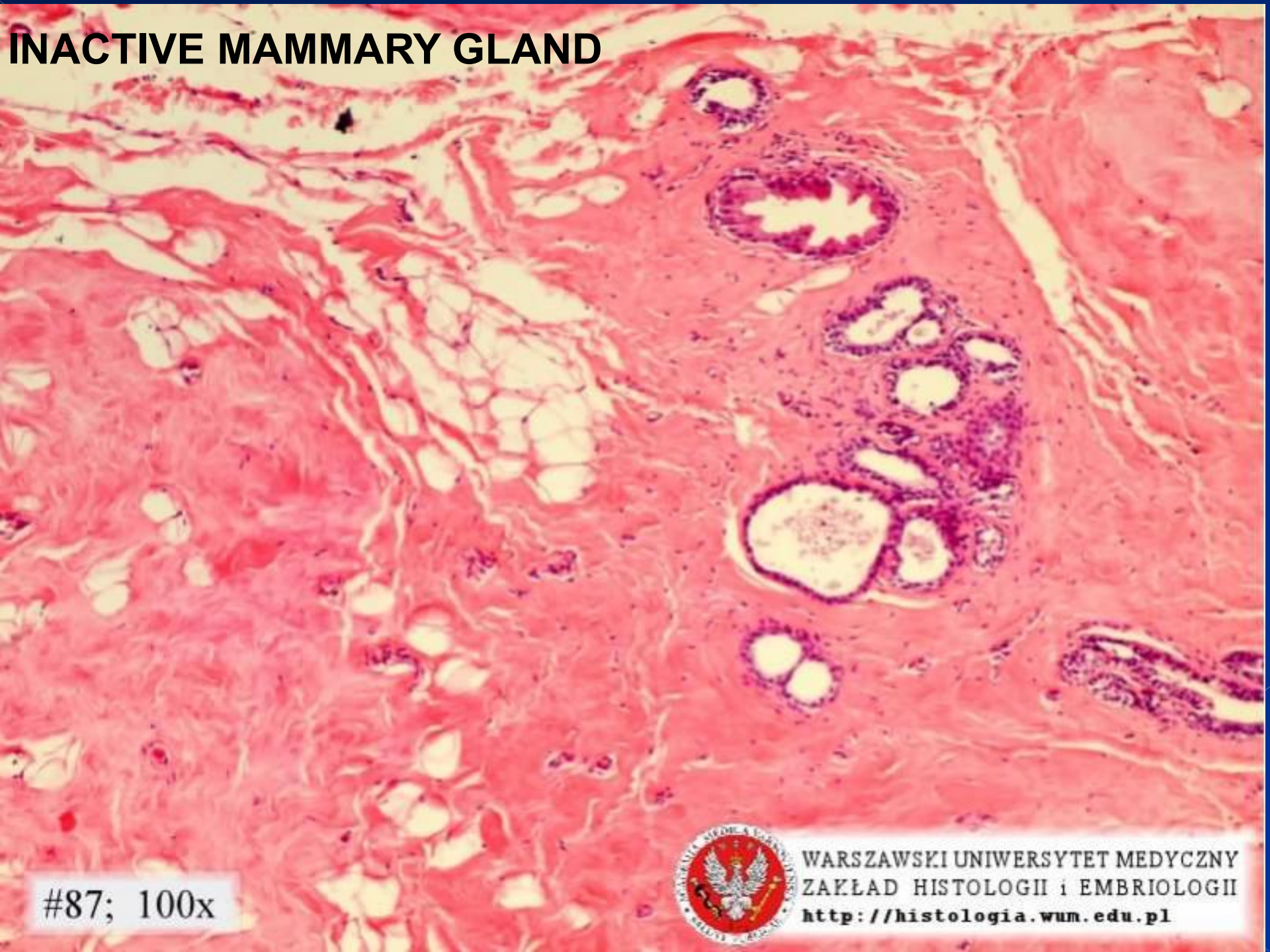
#85; 100x


HAIRY SKIN NO. 85
Epidermis
Dermis
Arrector
pili m.
Sebaceous
Gland
Hair
follicle
External root
sheath
Hair
Bulb
Dermal Papilla



HAIRY SKIN NO. 85

INACTIVE MAMMARY GLAND



#87; 100x

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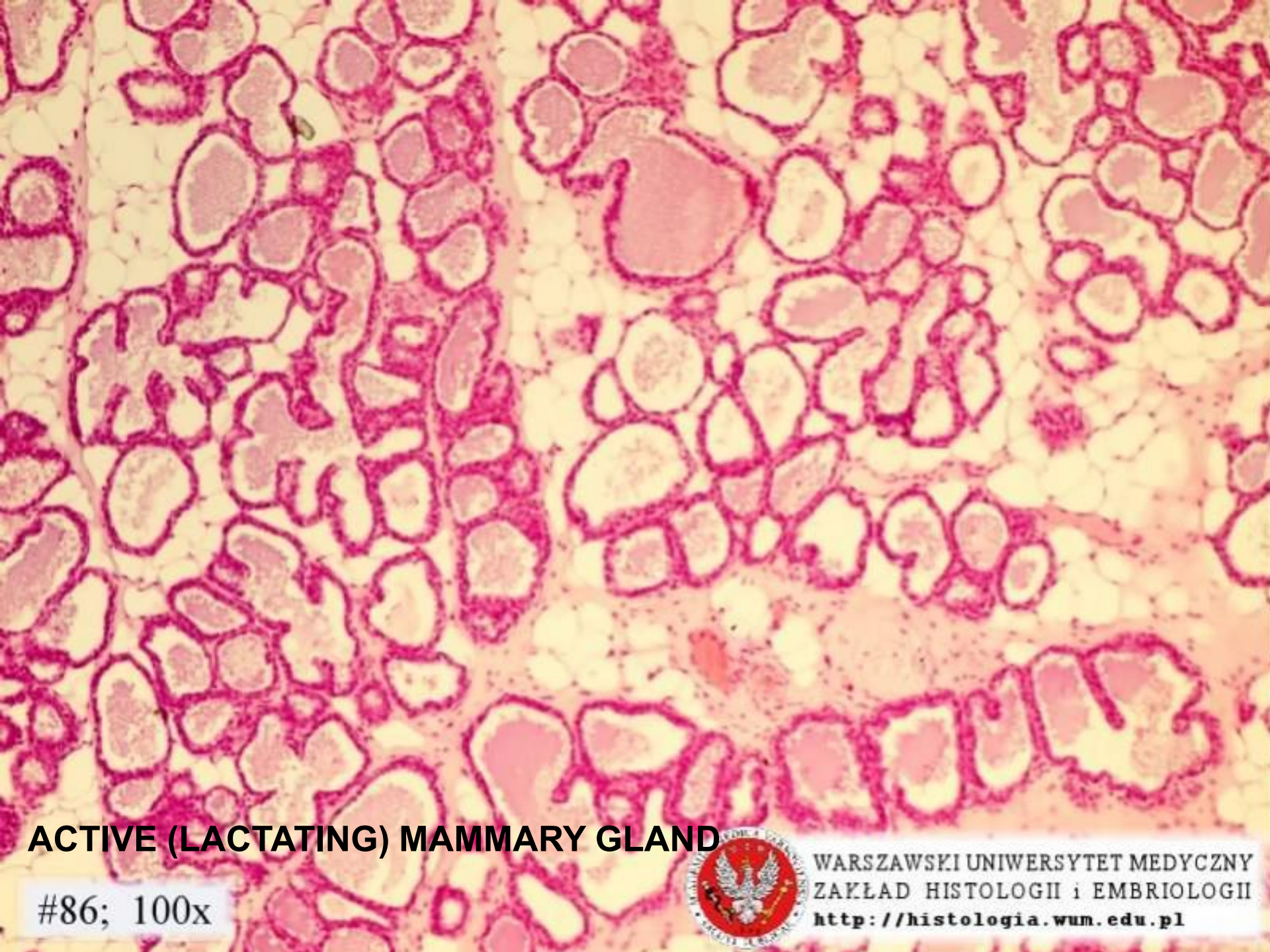

ACTIVE (LACTATING) MAMMARY GLAND

#86; 100x

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