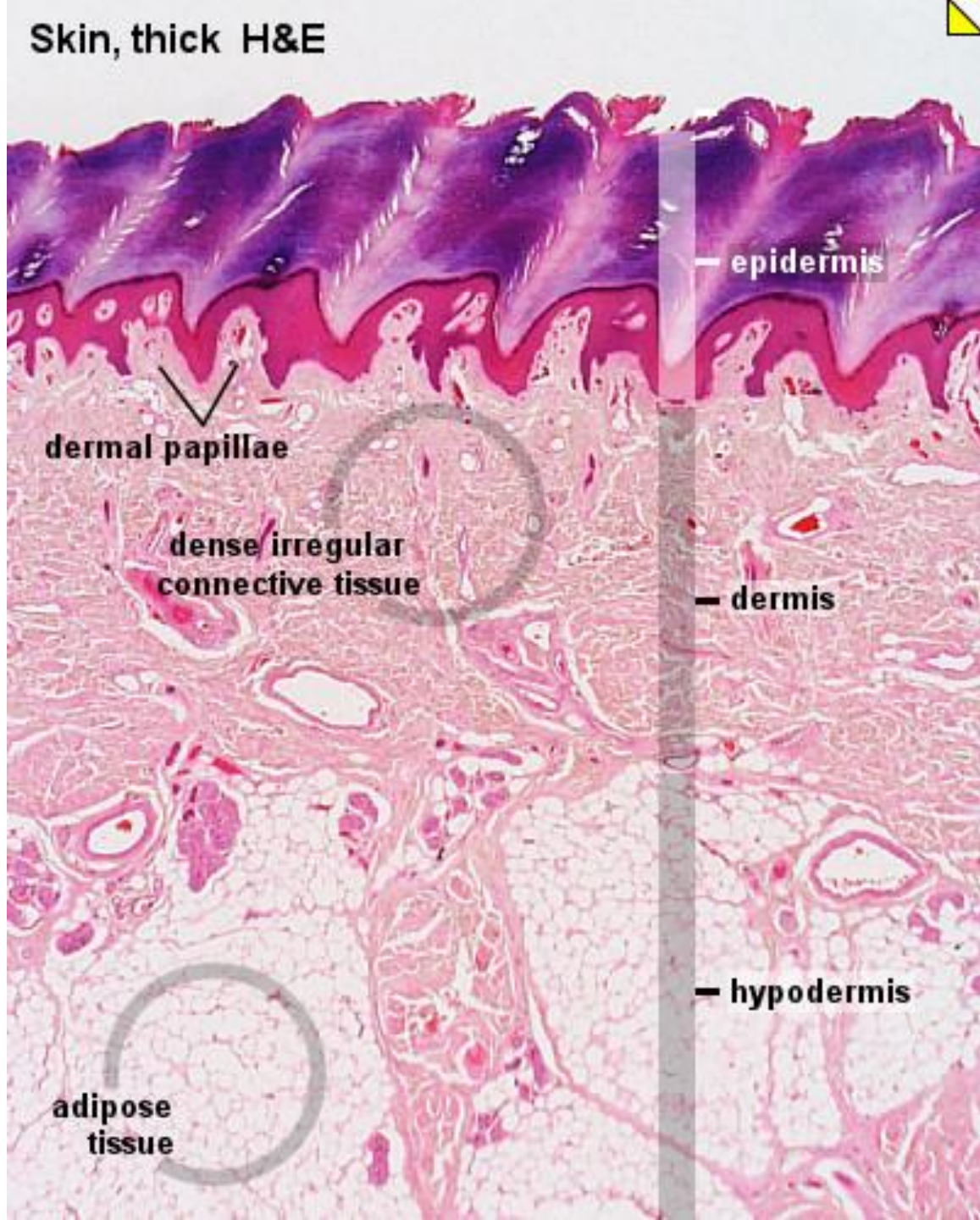


Integumentary system

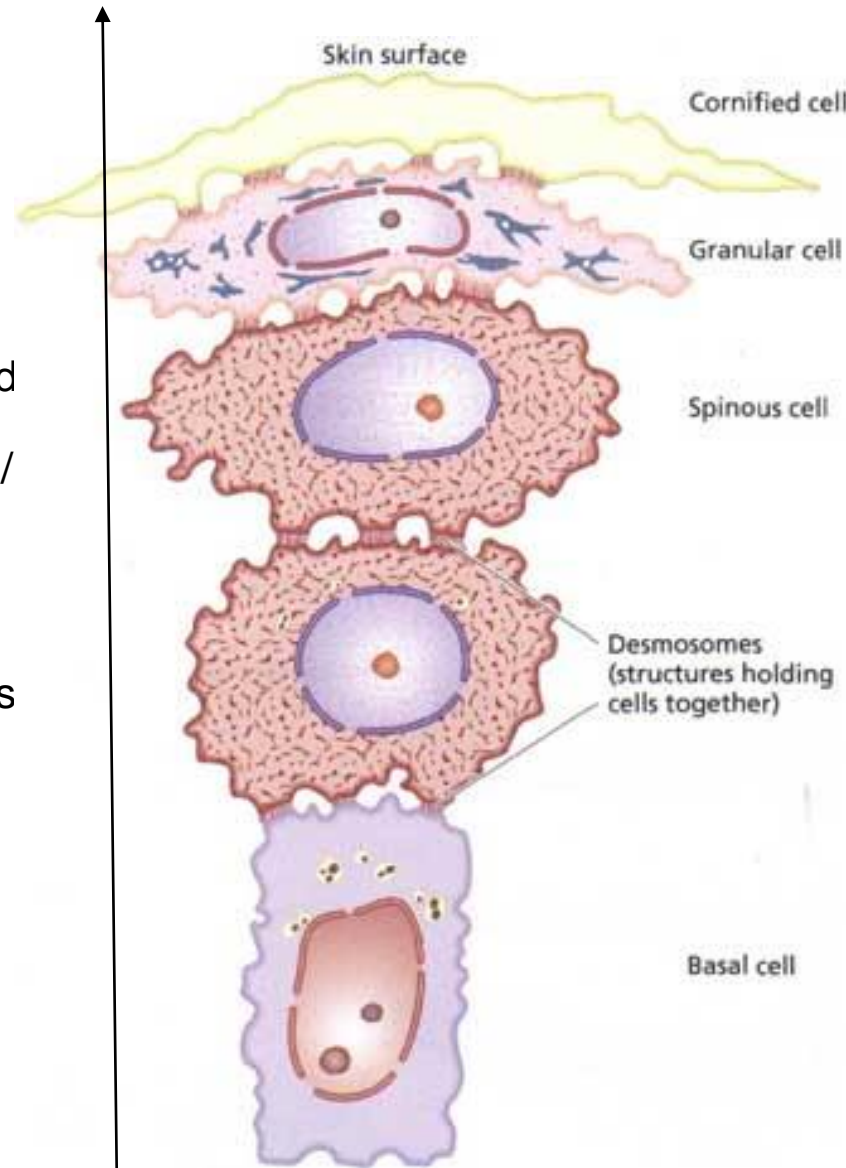
Skin

- the largest organ in the body (16-20% of body weight)
- thermal regulation, protection from outside environment, vapor barrier, mechanical barrier, excretion of some waste products, involved in vitamin D synthesis, sensory function (temperature and touch)
- epidermis
- dermis



Epidermis

- **Stratum basale**
- **Stratum spinosum**
- **Stratum granulosum**
 - thin skin (thick layer) – 1 (3-5) layer of cells
 - two types of granules
 - keratohyalin /large, without membrane, proteins, LM/
 - lamellar /smaller, with membrane, glycolipid only in EM, cells release contents of these granules and fill the entire interstitial space/
- **Stratum lucidum**
 - only in the thick skin
- **Stratum corneum**
 - cells are completely filled with keratin filaments which are embedded in a dense matrix of proteins
 - stratum disjunctum

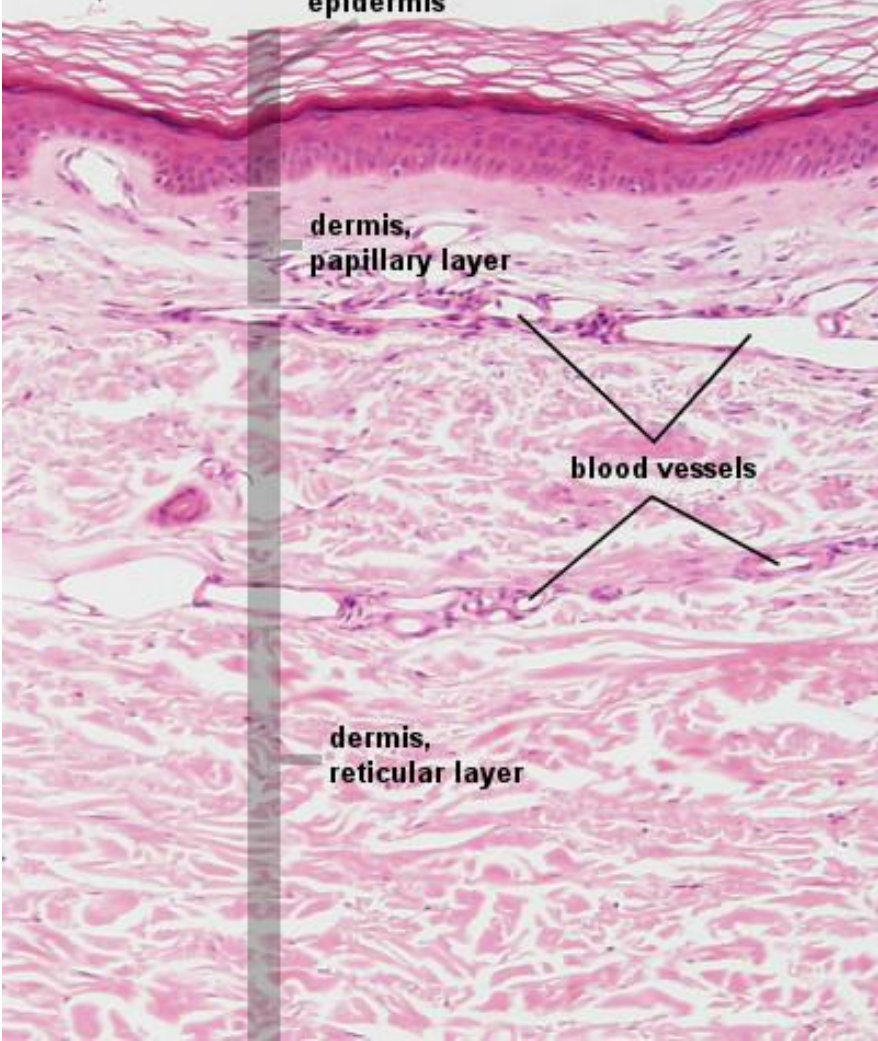


Skin thick x thin

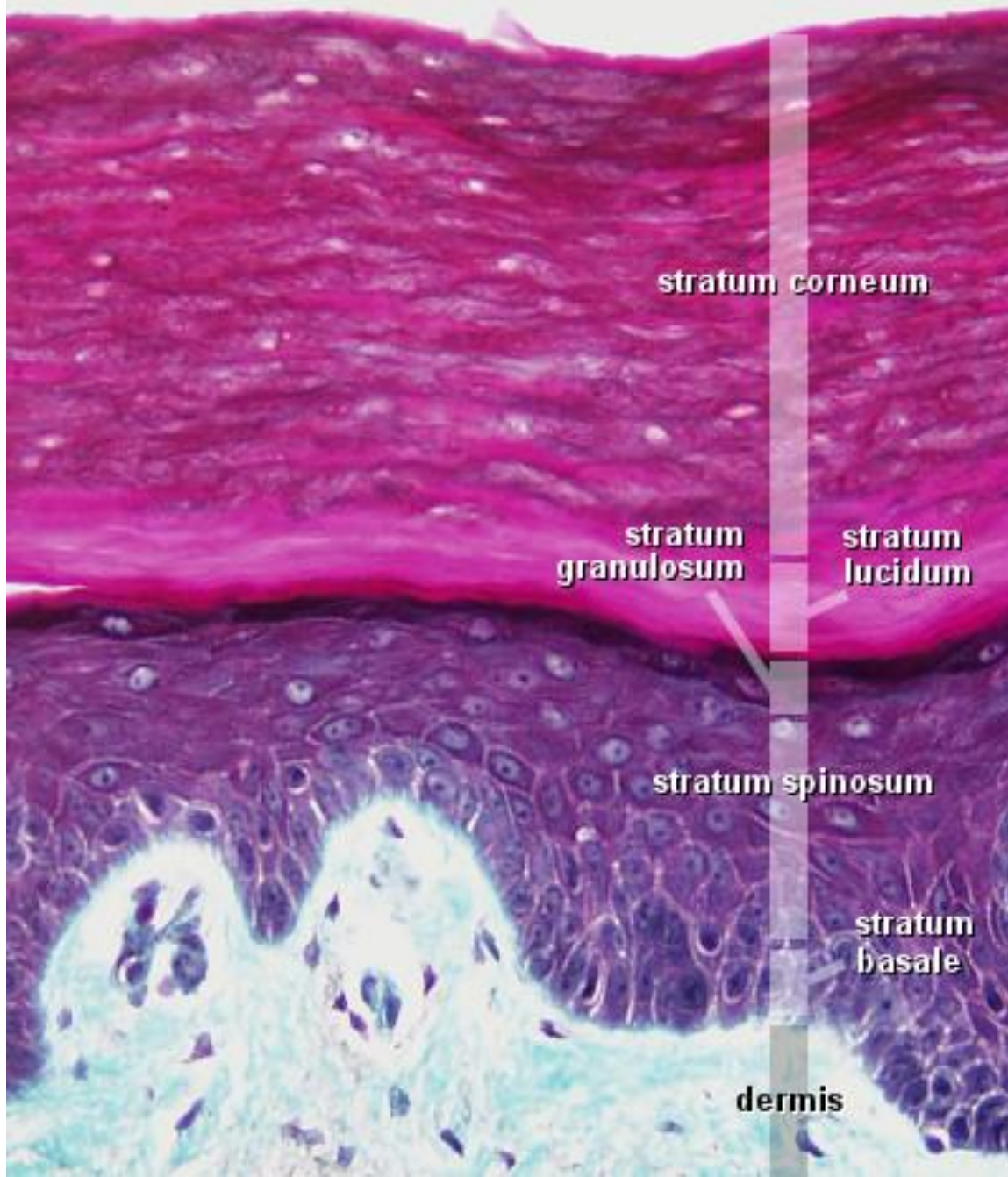
Skin, thick H&E



Skin, thin H&E



Skin, thick trichrome



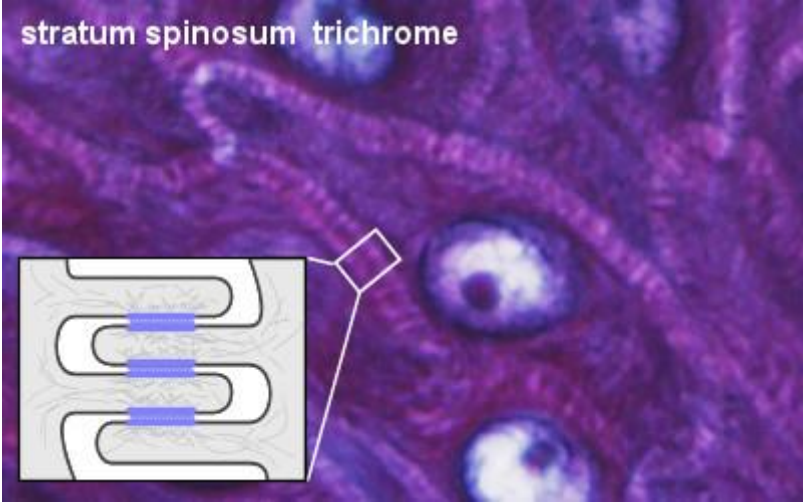
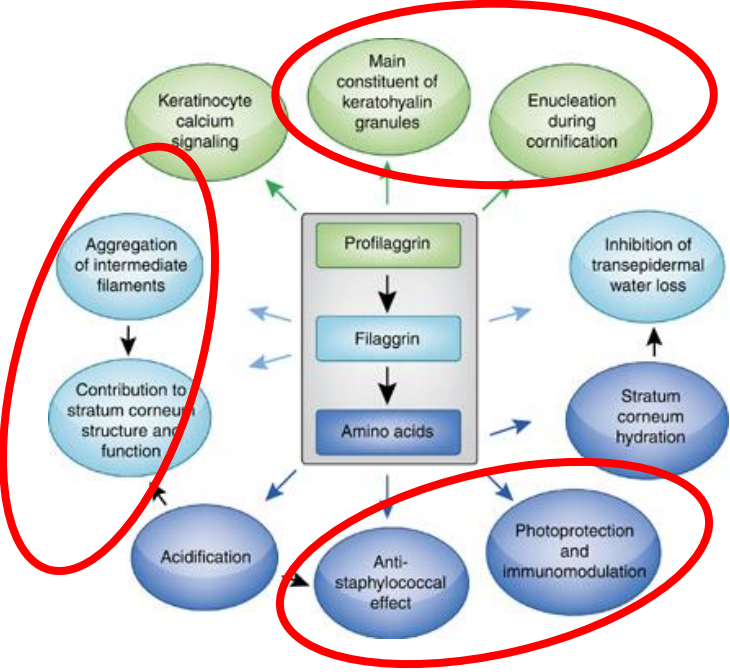
Skin as barrier

- Desmosomes, hemidesmosomes
- Intermediary cytokeratine fibers (tonofilaments, static), traction network – anchored to dermis (collagen)

Profilaggrin – initiation of keratohyalin granules (s. granulosum)

Filaggrin – aggregation of cytokeratin filaments (s. corneum)

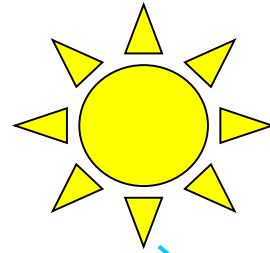
Keratin – from keratohyalin granules by action of filaggrin



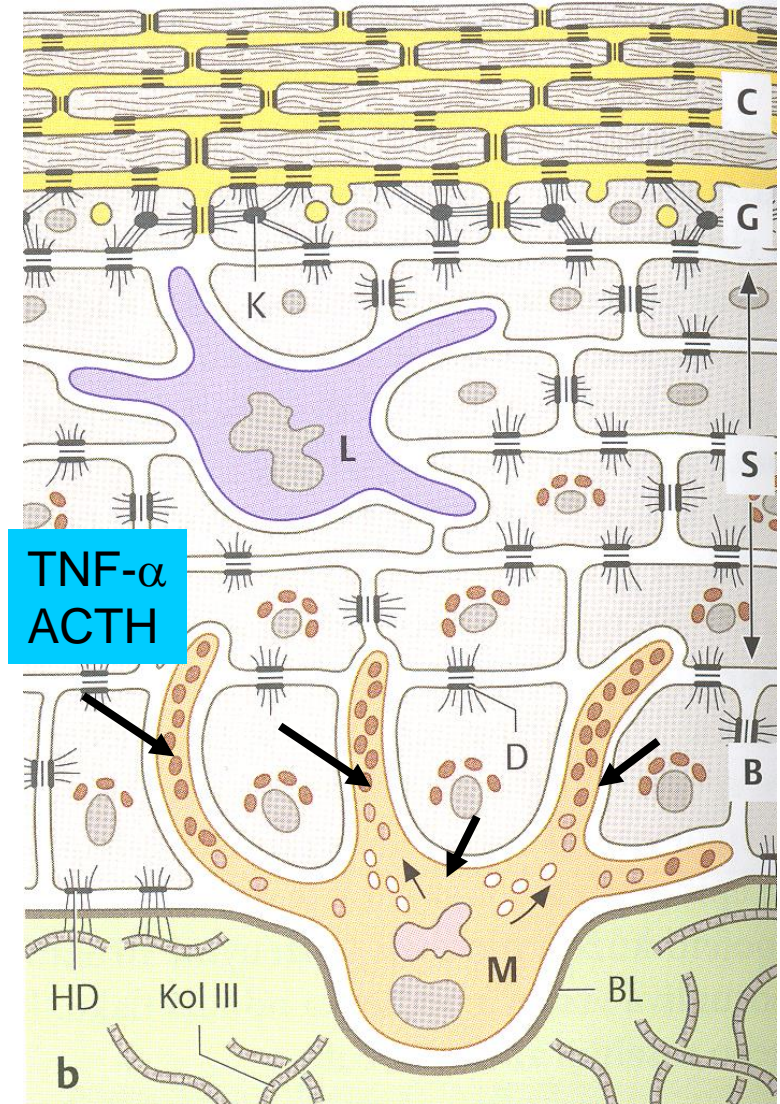
Ceramids – Odland bodies in stratum granulosum deposited extracellularly in stratum corneum

Other cells in epidermis

- **Keratinocytes**
- **Melanocytes**
 - stratum basale
 - pigment melanin in melanosomes
 - 1000-2000 / mm²
 - Thin processes among other cells
 - cytokrine secretion
- **Langerhans cell**
 - 2-8% of epidermal cells
 - APC, thin processes between keratinocytes
 - Antigen phagocytosis, migration to regional lymph nodes
- **Merkel cells**
 - mechanoreceptors

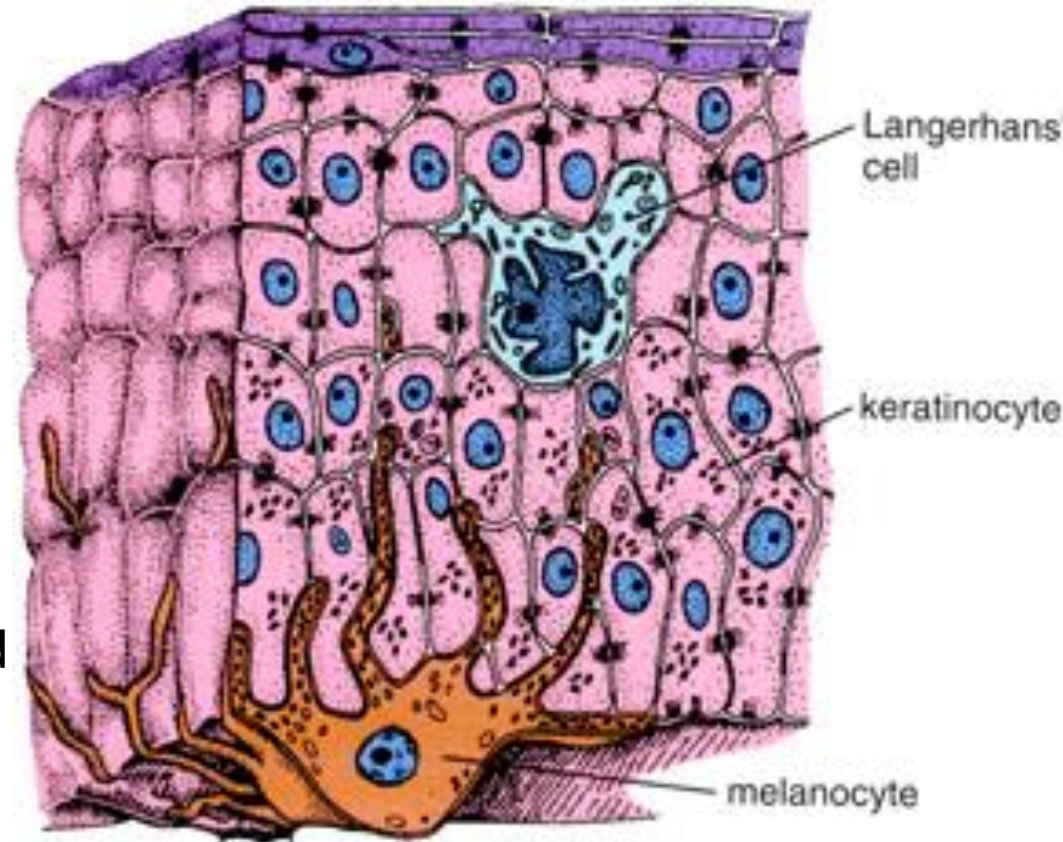


UV

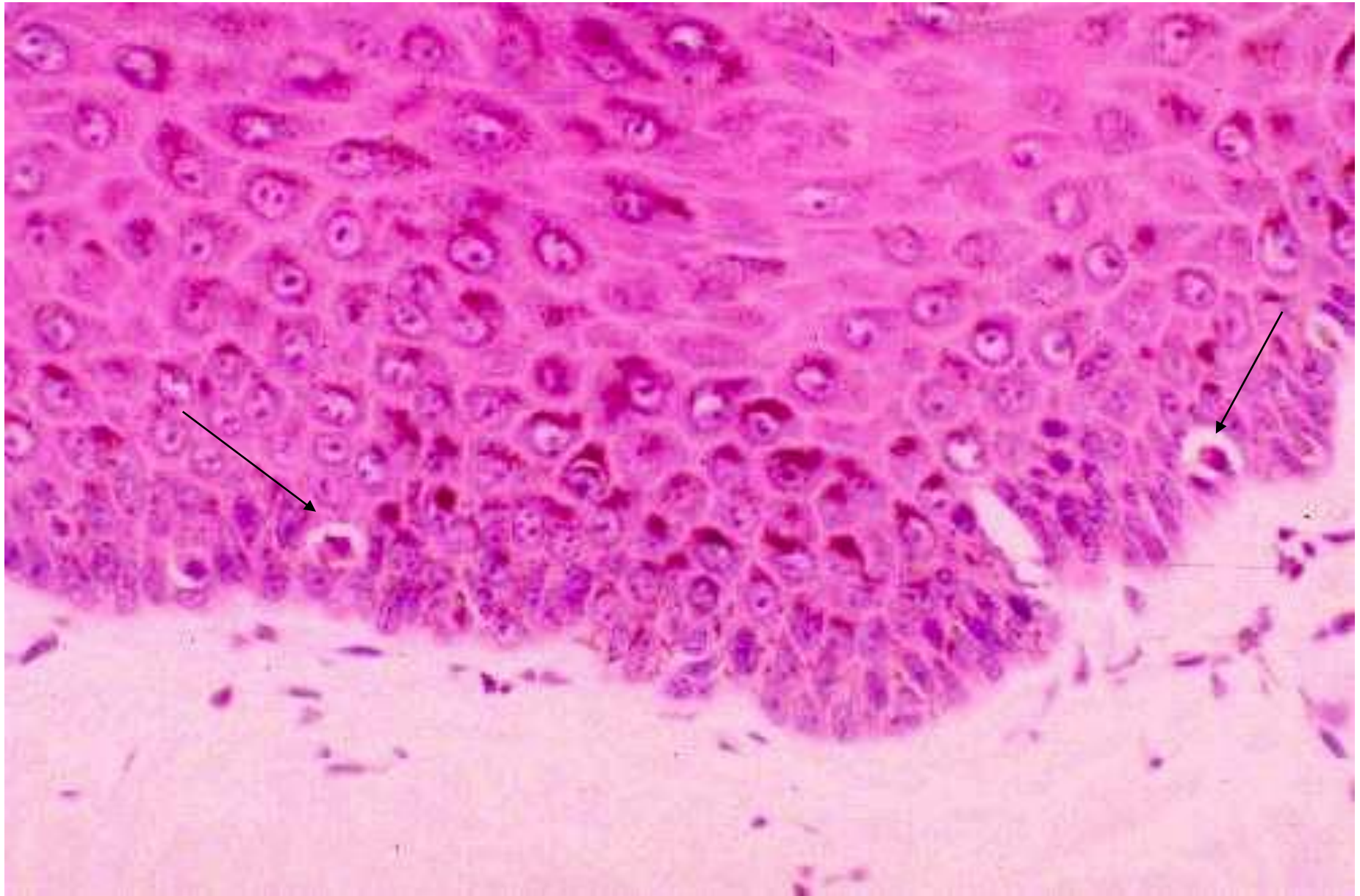


Epidermis - cells

- **Keratinocytes**
- **Melanocytes**
 - pigment melanin in melanosomes
 - 1000-2000 / mm²
 - send fine processes between the other cells
 - cytokine secretion
- **Langerhans cells**
 - 2-8% of the cells
 - M-M system, their fine processes form a network between the cells of the epidermis and phagocytose antigens
 - can migrate to regional lymph nodes
- **Merkel cells**
/mechanoreceptors/

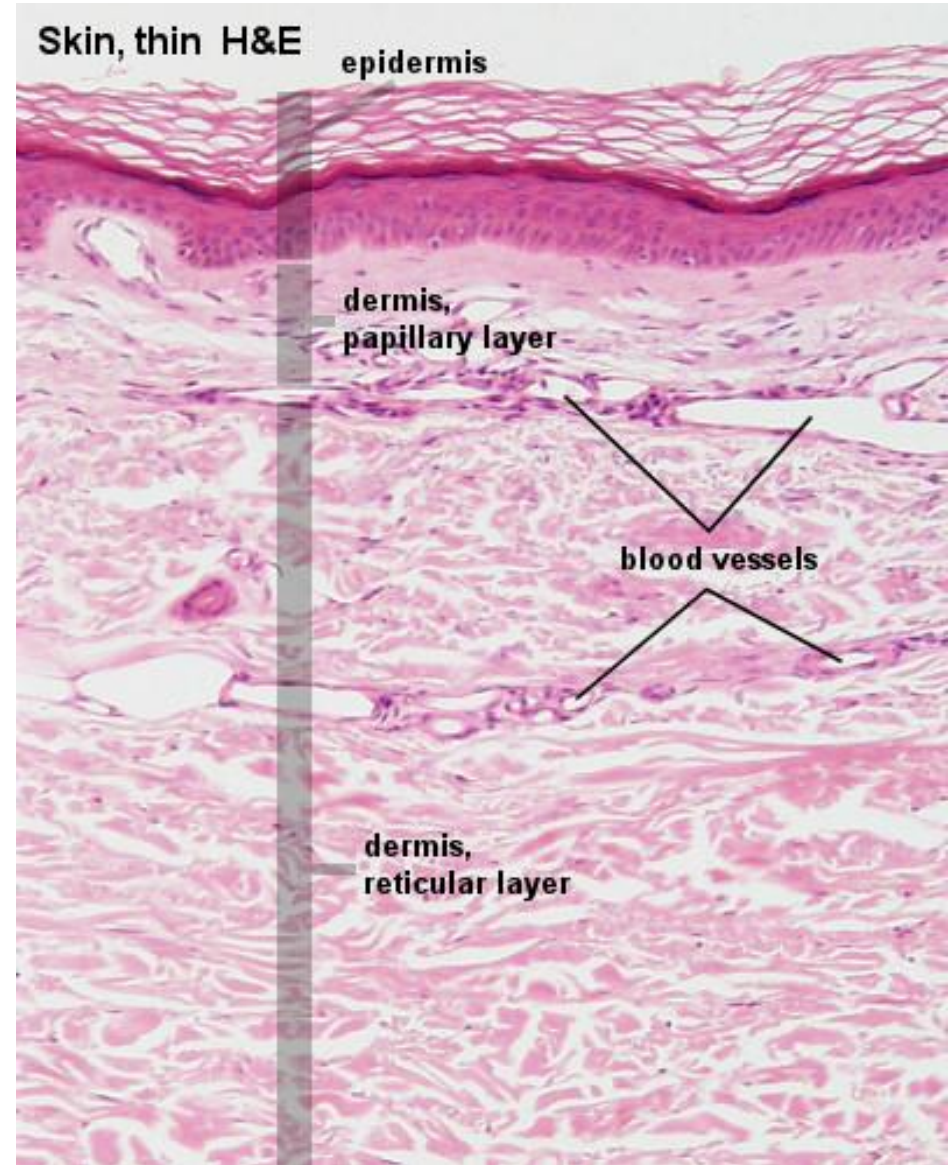


Epidermis - melanocytes

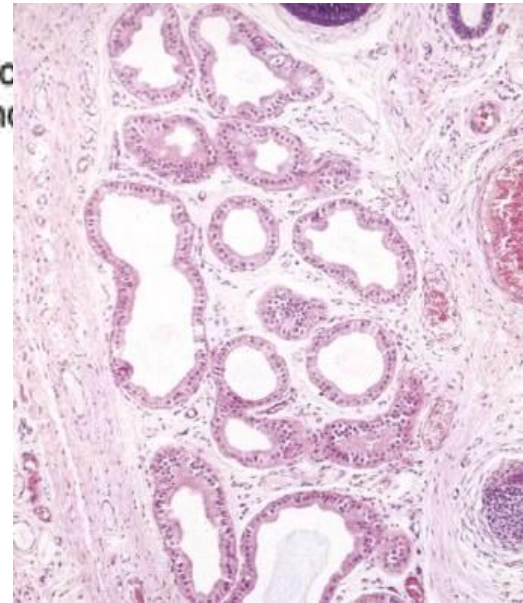
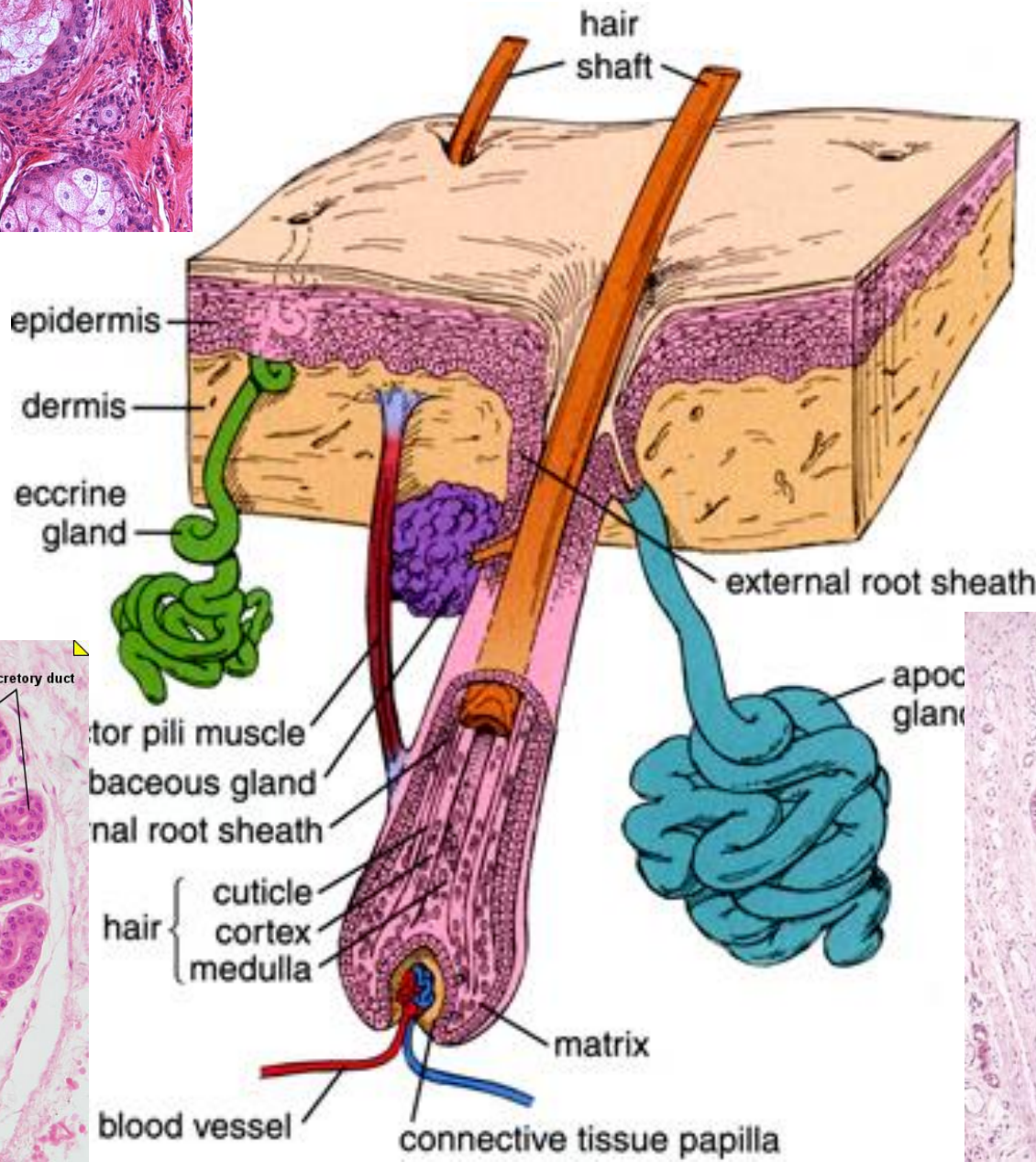
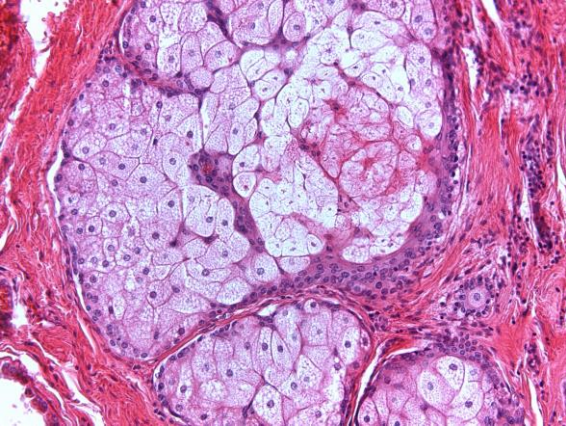


Dermis

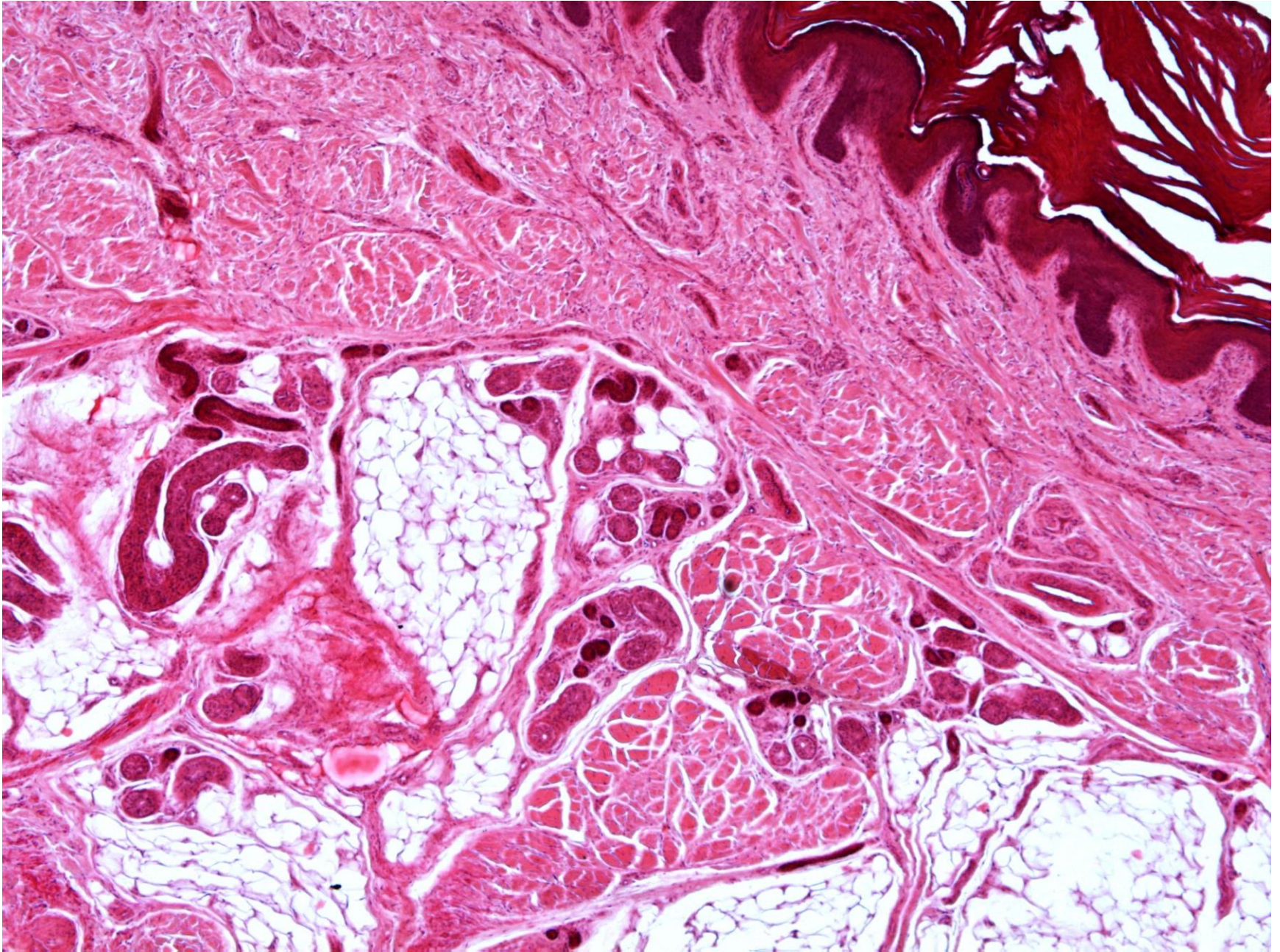
- **papillary layer** (*dermal papillae*)
 - loose, comparatively cell-rich, capillaries are frequent
- **reticular layer** appears denser and contains fewer cells /coarse collagen fibers and elastic fibers/
 - Thick collagen fibres (5-10 μm) often aggregate into bundles (up to 100 μm thick). The main orientation of the fibres differs in skin from different parts of the body - their main orientation will follow the "*lines of greatest tension*" in the skin (Kraissl lines) - surgical importance.
 - This layer contains also smooth muscle cells /more – skin of areola around nipple, tunica dartos scroti.. /



Appandages of the skin

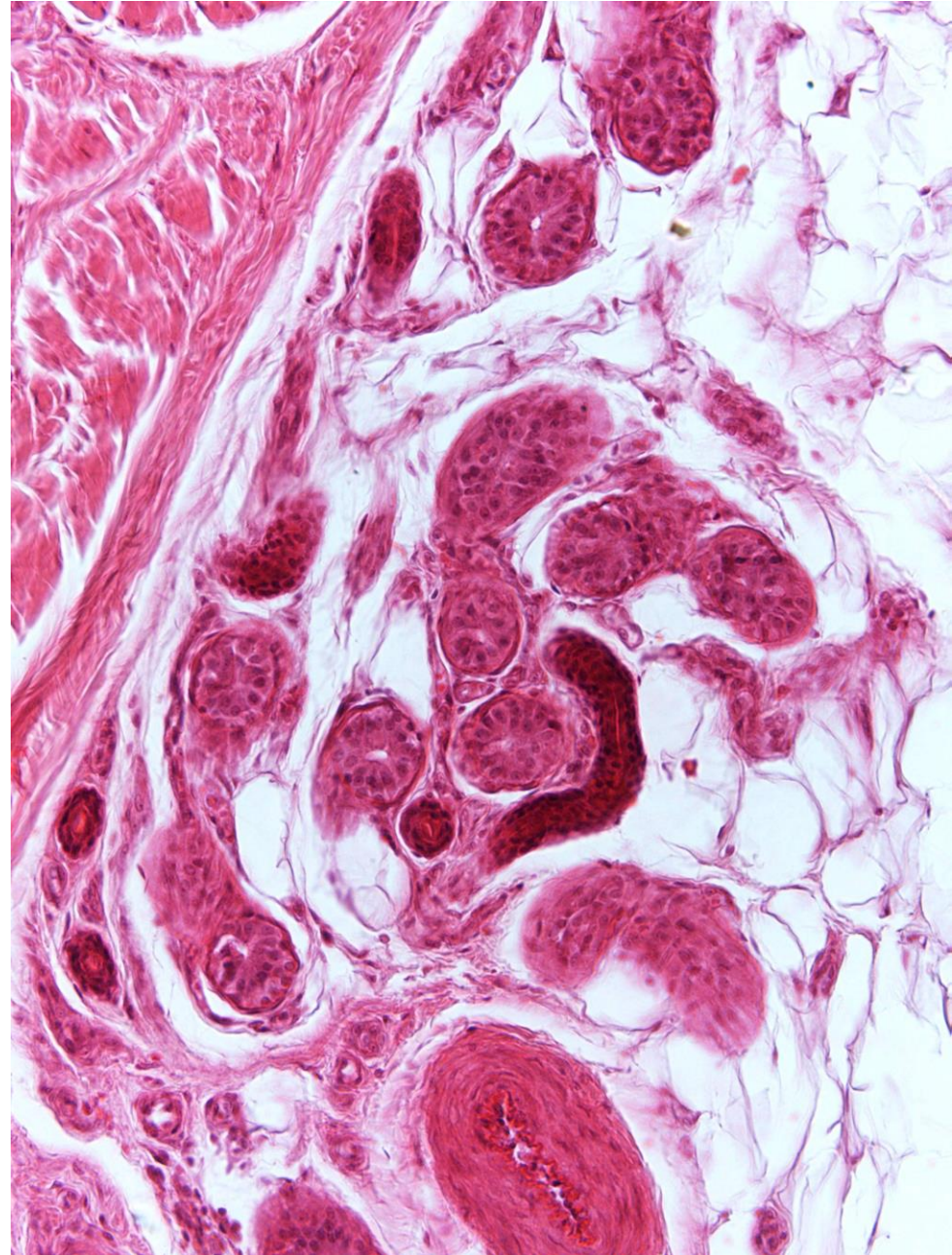


Gl. sudoriferae eccrinae



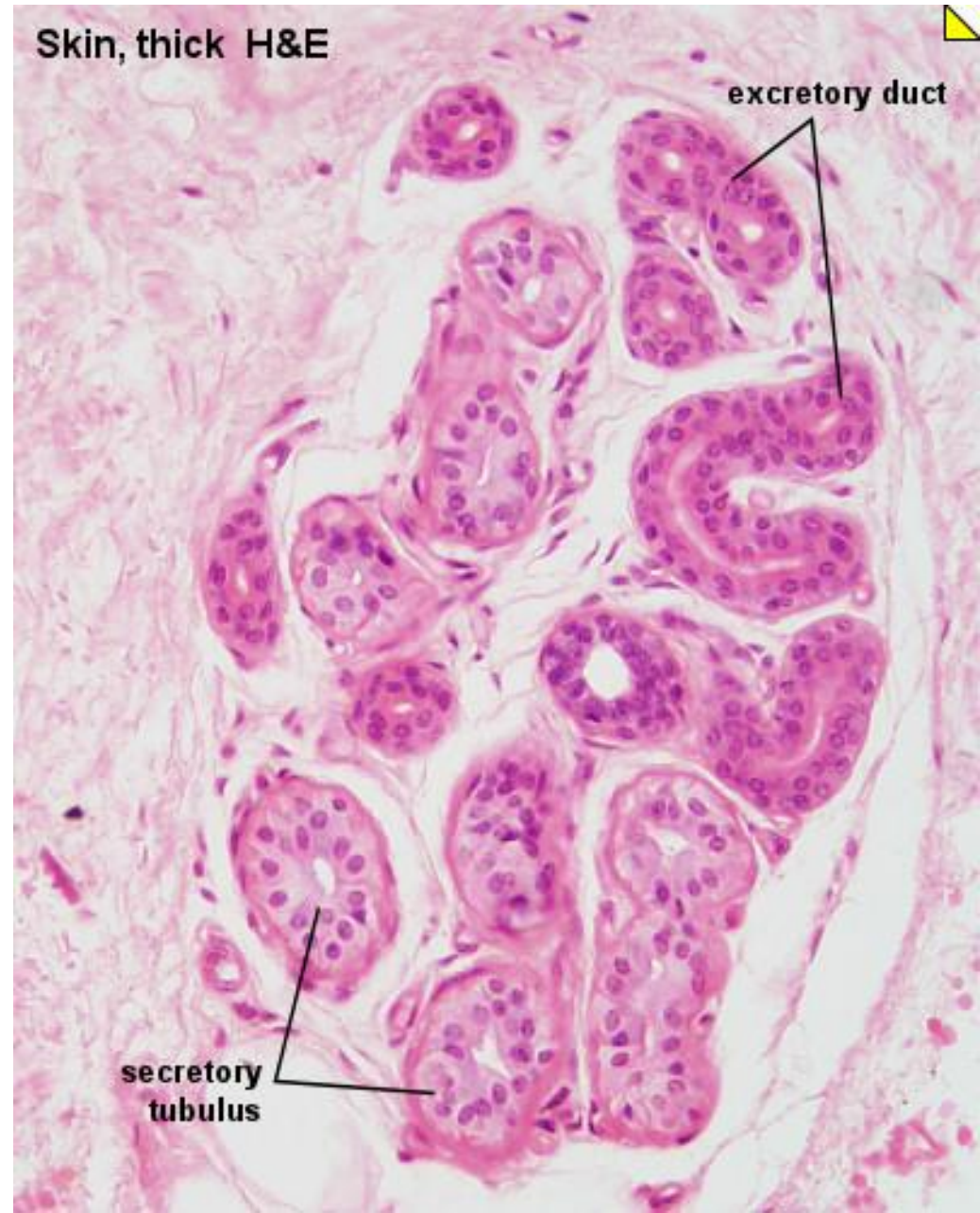
Eccrine sweat glands

- the regulation of body temperature
- the skin contains 2-3,000,000 sweat gland which are found all over the body - with the exception of parts of the external genitalia
- *simple tubular glands*
 - secretory portion
 - duct portion
 - excretory duct
 - intraepidermal duct
- the secretory tubulus and the initial part of the excretory duct are coiled into a roughly spherical ball



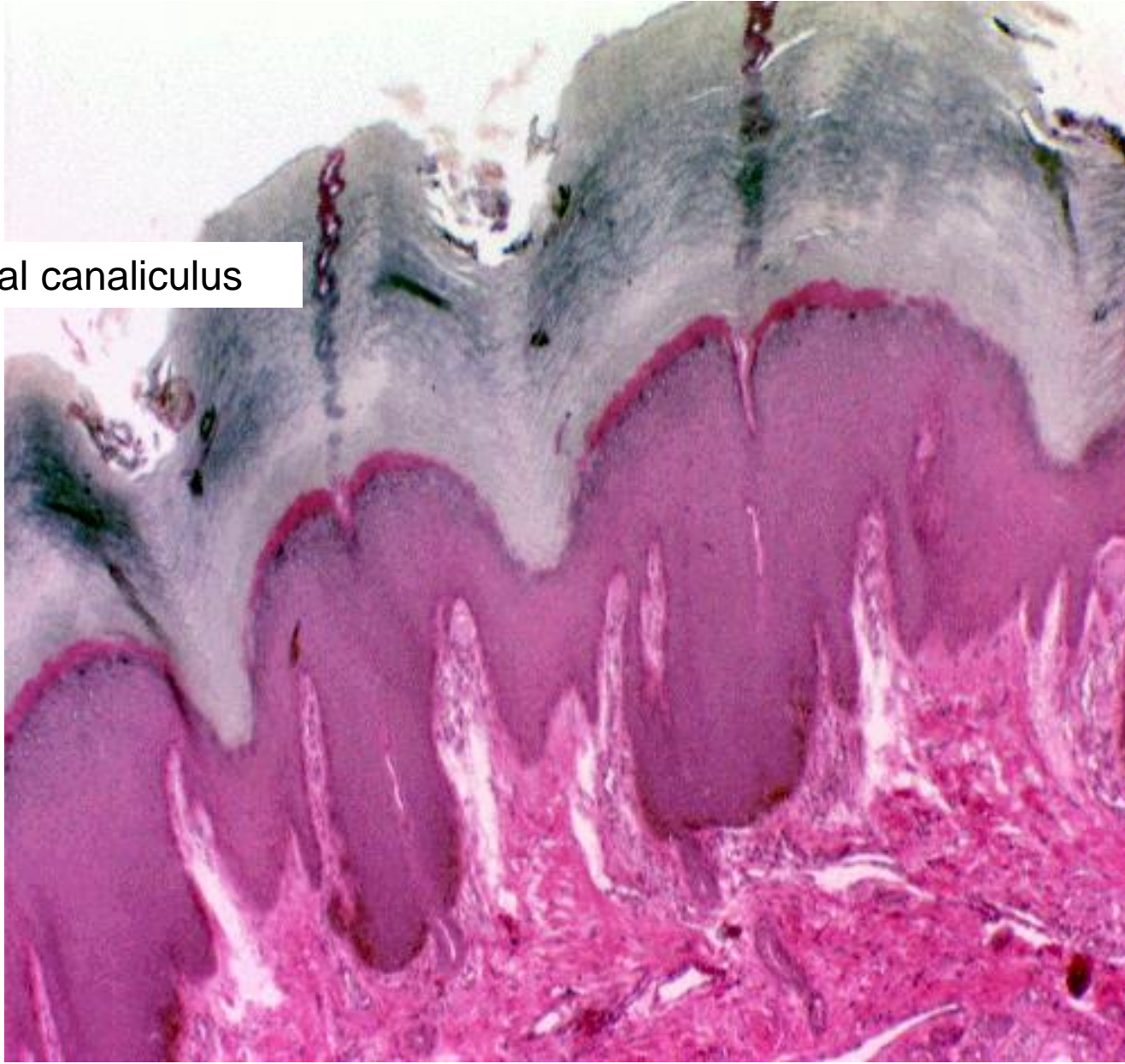
Eccrine sweat glands

- **The secretory part**
 - is cuboidal or low columnar /two types of cells - light and dark type/
 - a layer of myoepithelial cells
 - basement membrane
- **The excretory part**
 - proper duct - a stratified cuboidal epithelium (two layers of cells)
 - intraepidermal canaliculus

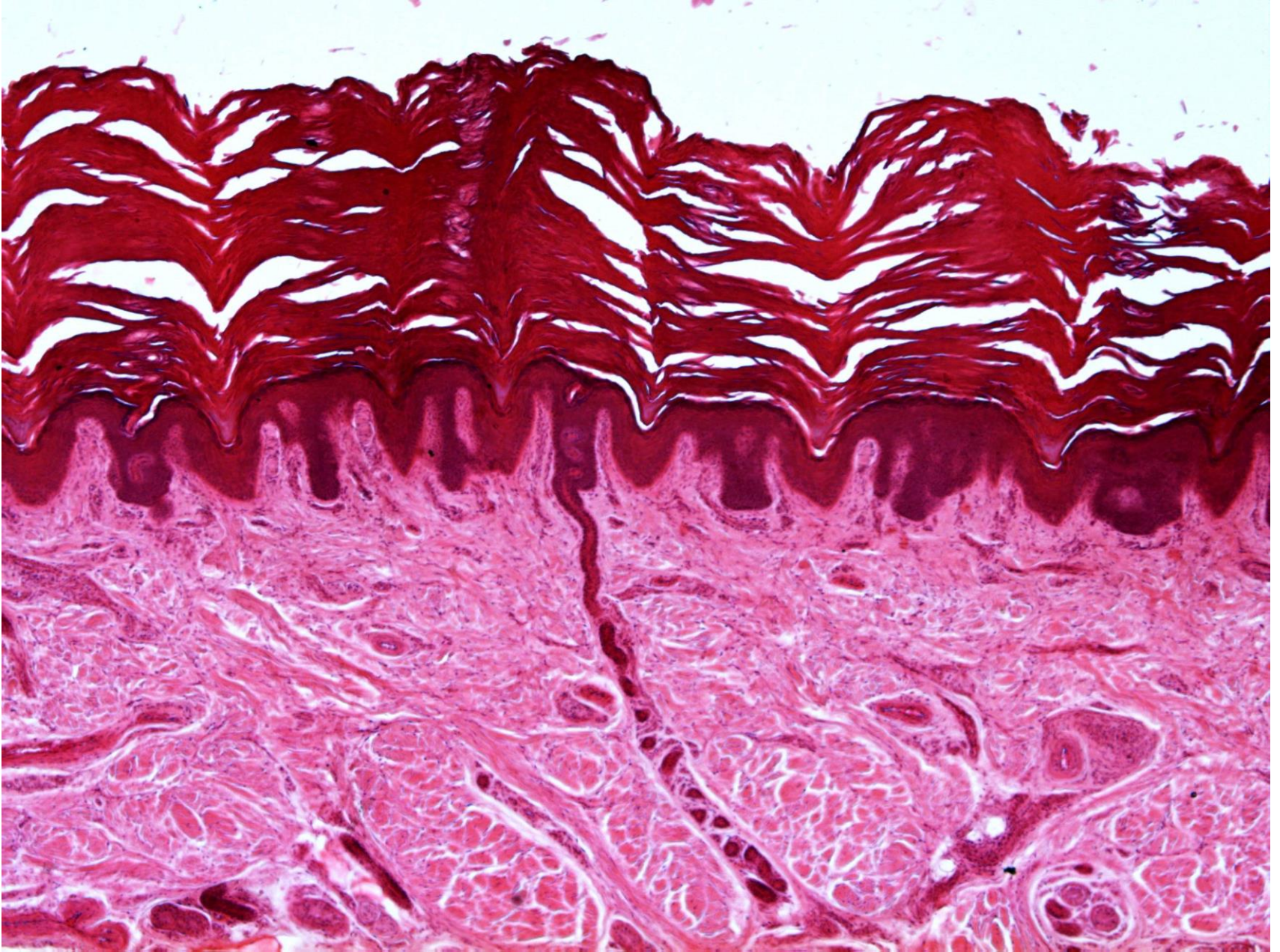


Eccrine sweat glands

intraepidermal canaliculus

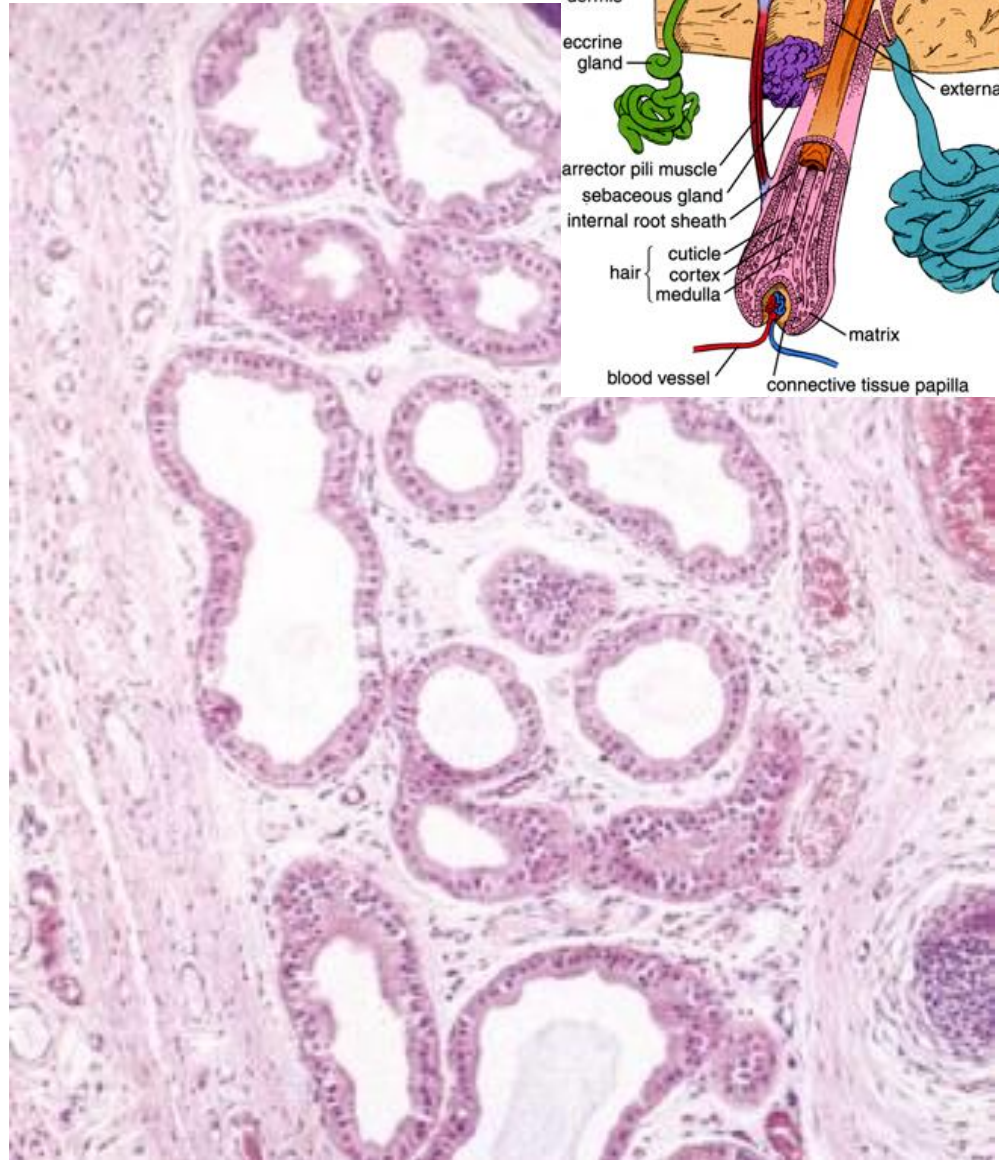


Eccrine sweat glands

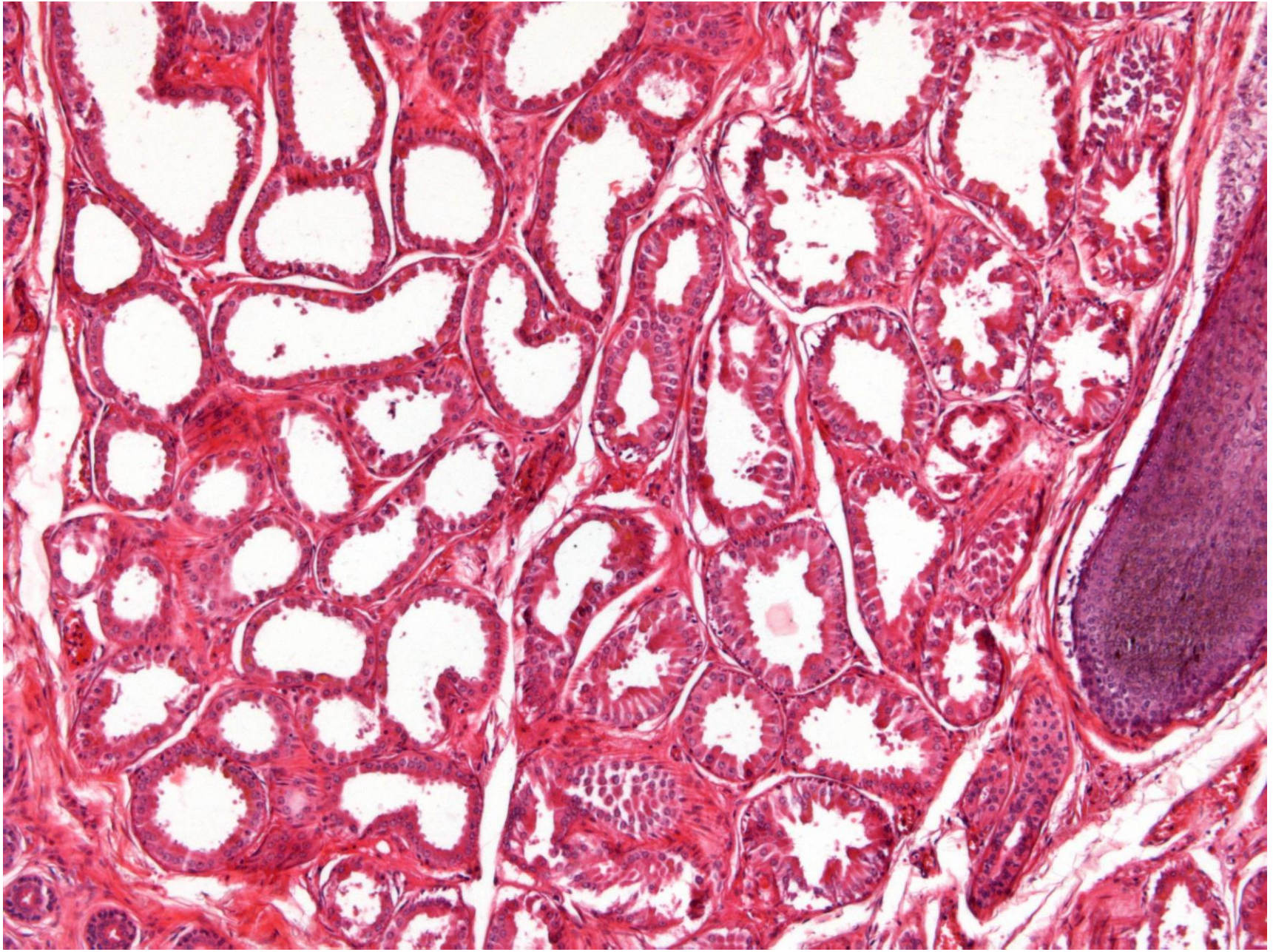


Apocrine sweat glands

- structure is similar to that of merocrine sweat glands
- the **lumen** of the secretory tubulus is much **larger**
- the secretory epithelium consists of only one major cell type /cuboidal or columnar/
- the excretory duct empties the sweat **into** the upper part of **the hair follicle**

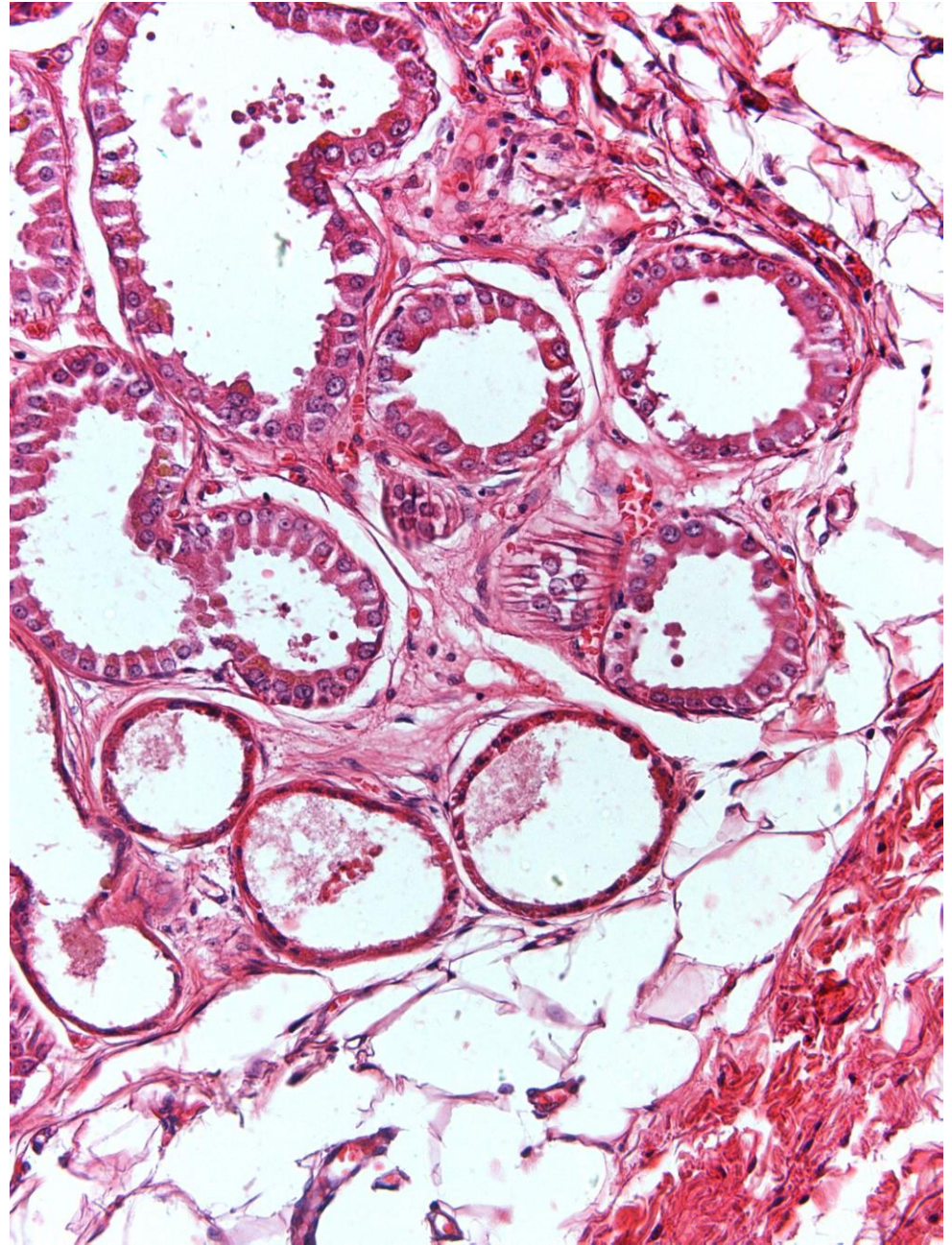


GII. sudoriferae apocrinae



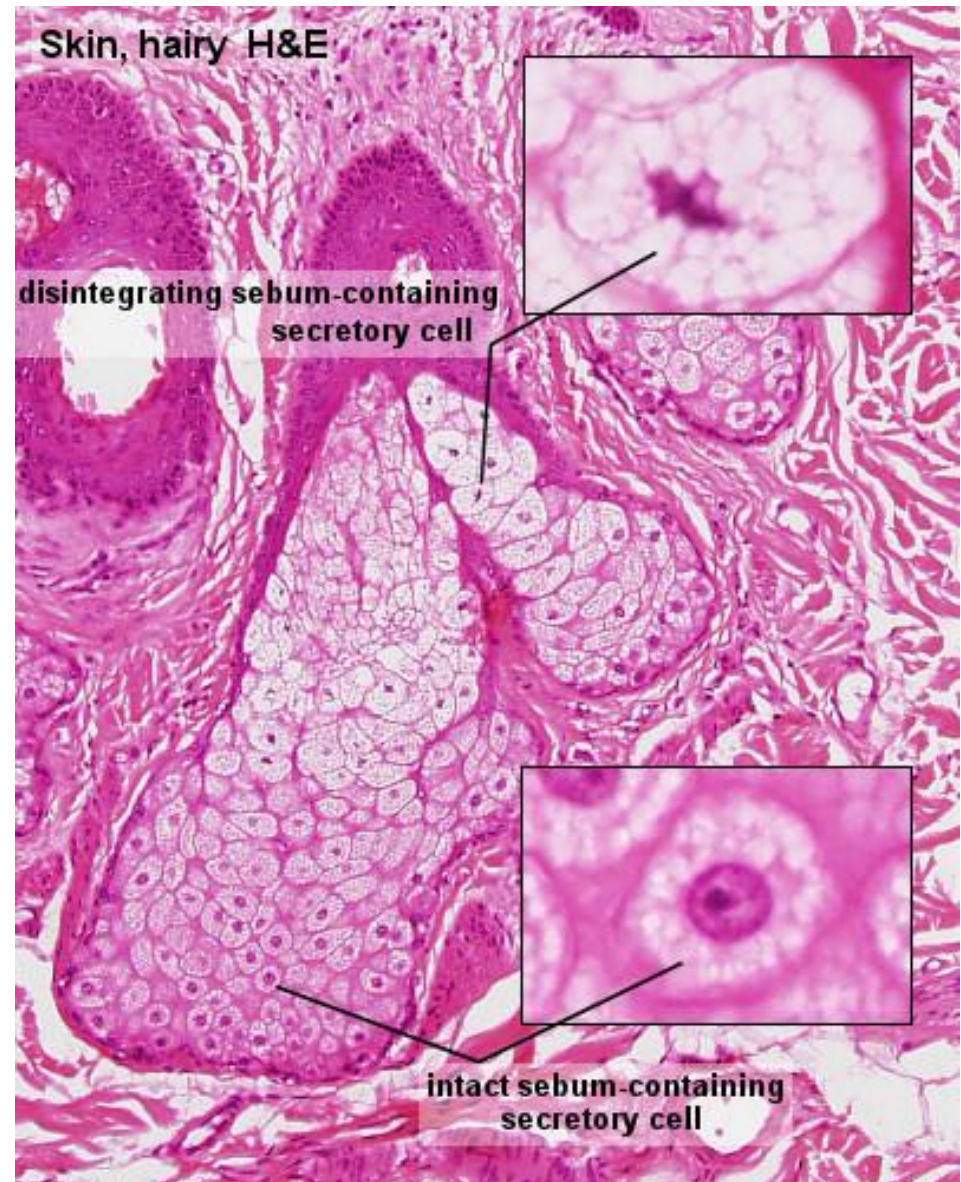
Apocrine sweat glands

- are much larger than merocrine sweat glands
- only in some parts – gll. sudoriferae **axillares**, gll. **areolares mammae** /Montgomery/, gll. sudoriferae circumanales..
- they are stimulated by sexual hormones
- apocrine **sweat** is a milky, proteinaceous /also steroids/ and **odourless** secretion, the odour is a result of bacterial decomposition



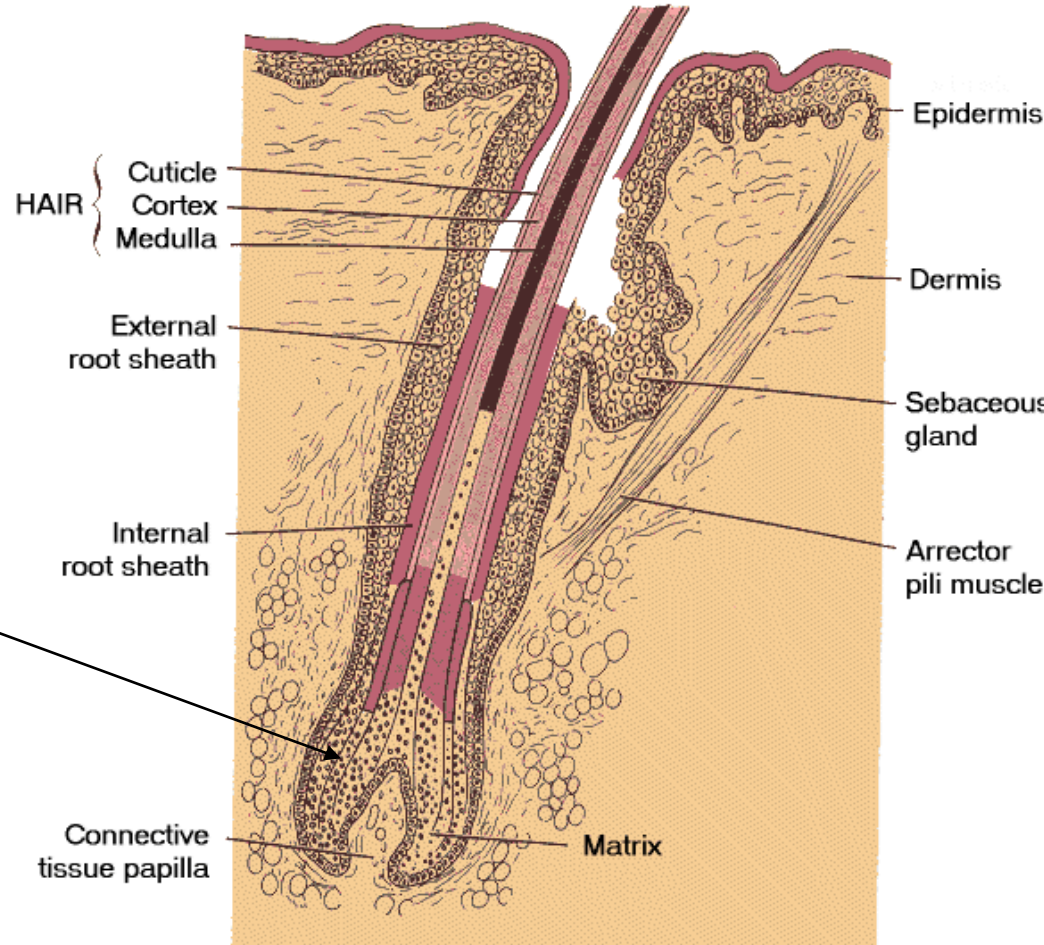
Sebaceous glands

- empty product into the upper parts of **the hair follicles** x are also found in some of the areas where no hair is present (lips, eyelids, external genitalia – labia minora)
- exception: palms and soles
- branched alveolar glands
 - alveoli full of cells, without lumen
- holocrine secretion
- duct – short, s.s.epi



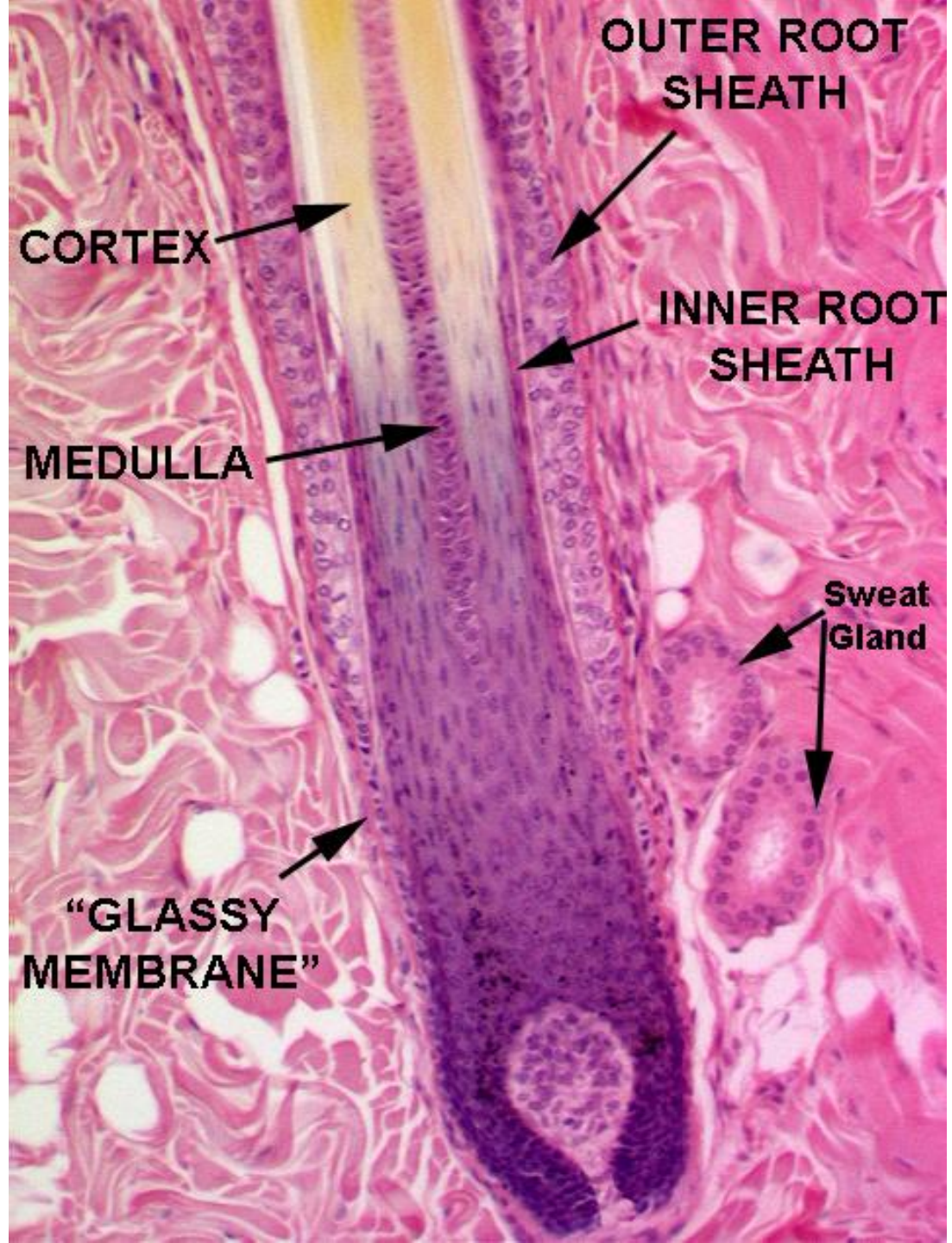
Hair

- The free part of each hair is called the *shaft*.
- The *root* of each hair is anchored in dermis and usually partly also in hypodermis.
- The deepest end of the hair root forms an enlargement, the *bulb*. Cells in the bulb are mitotically active. These cells differentiate into the cell types which form the hair and the cells that surround its root, the *root sheath*.

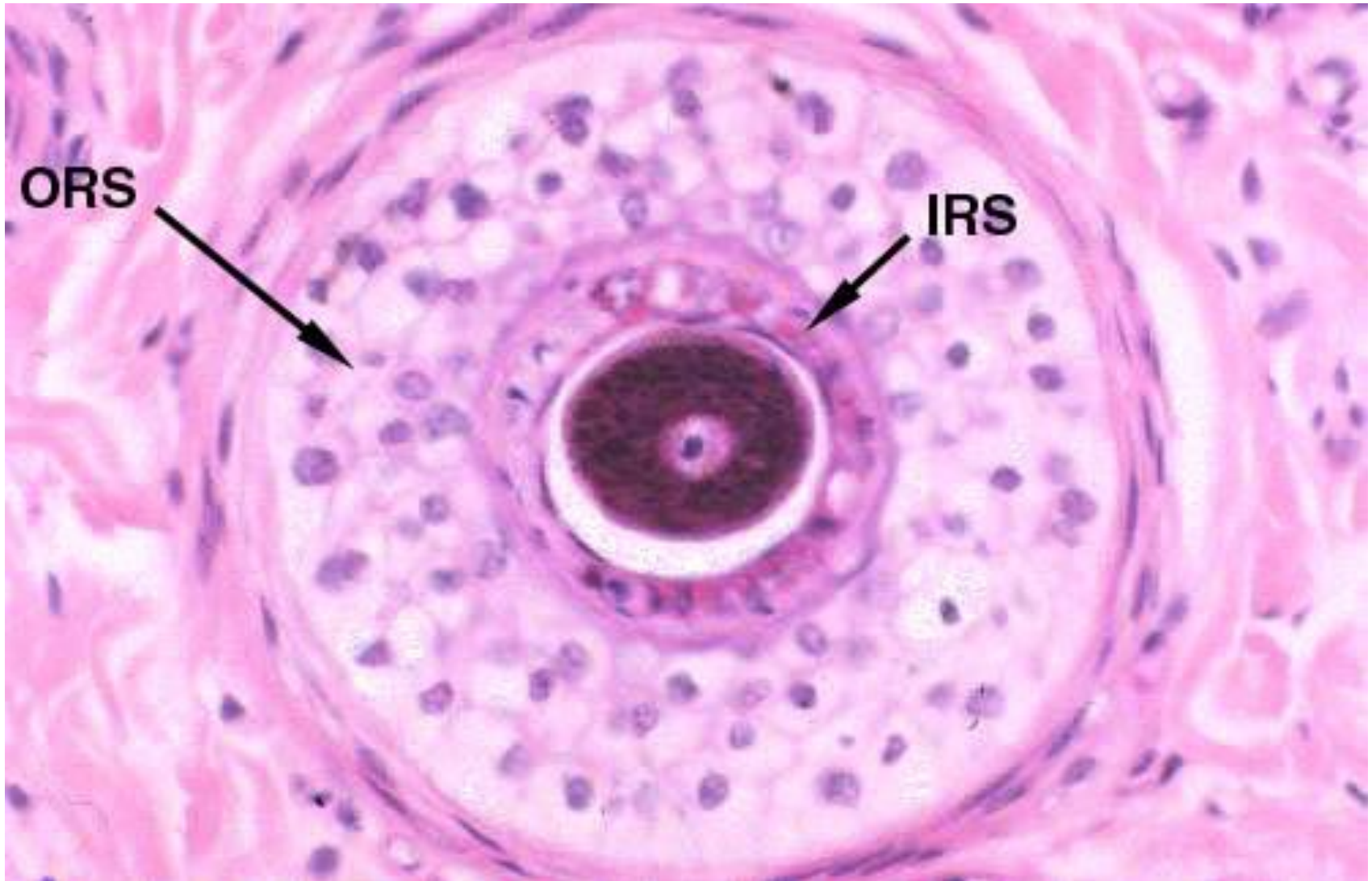


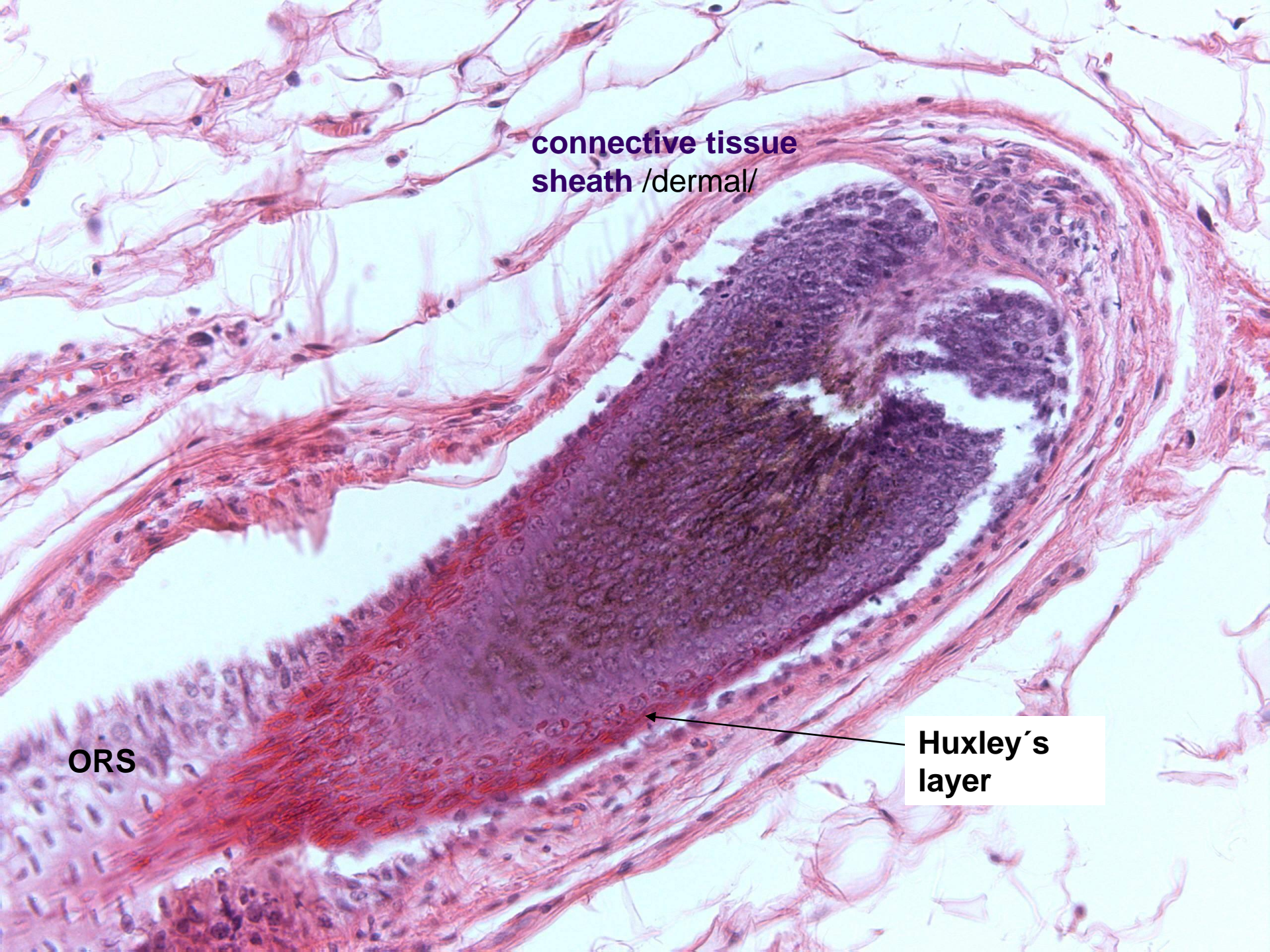
Hair

- ***Scapus and radix pili***
 - Medulla
 - Cortex
 - Cuticula pili
- ***Folliculus pili***
 - **Internal root sheath**
 - Cuticula vaginalis
 - Huxley's layer /1-3/
 - Henle's layer /1/
 - **External root sheath**
/=epidermis/
 - **Connective tissue sheath** /dermal/
 - Lamina vitrea
 - Inner-circular
 - Outer-longitudinal



Hair





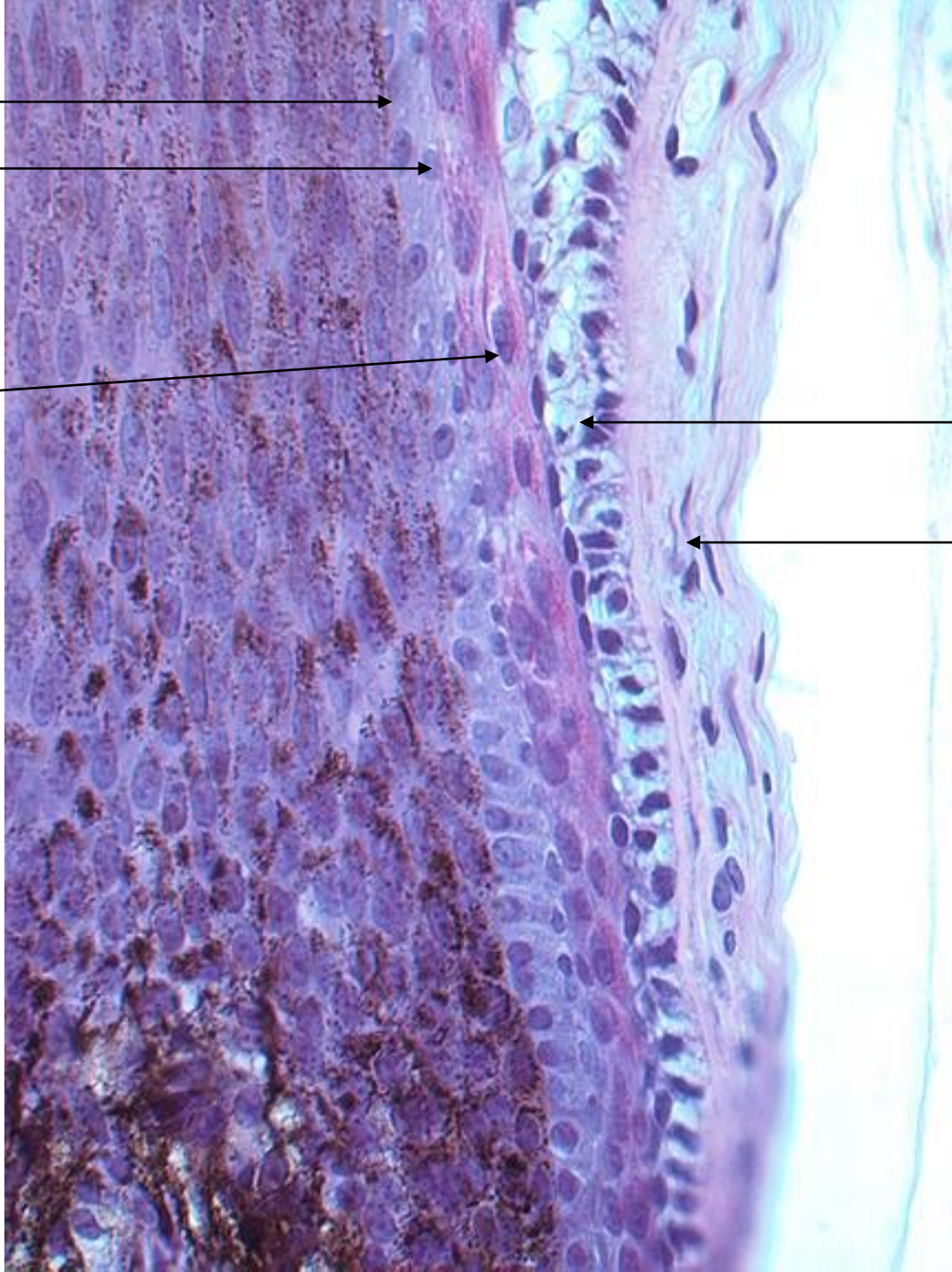
connective tissue
sheath /dermal/

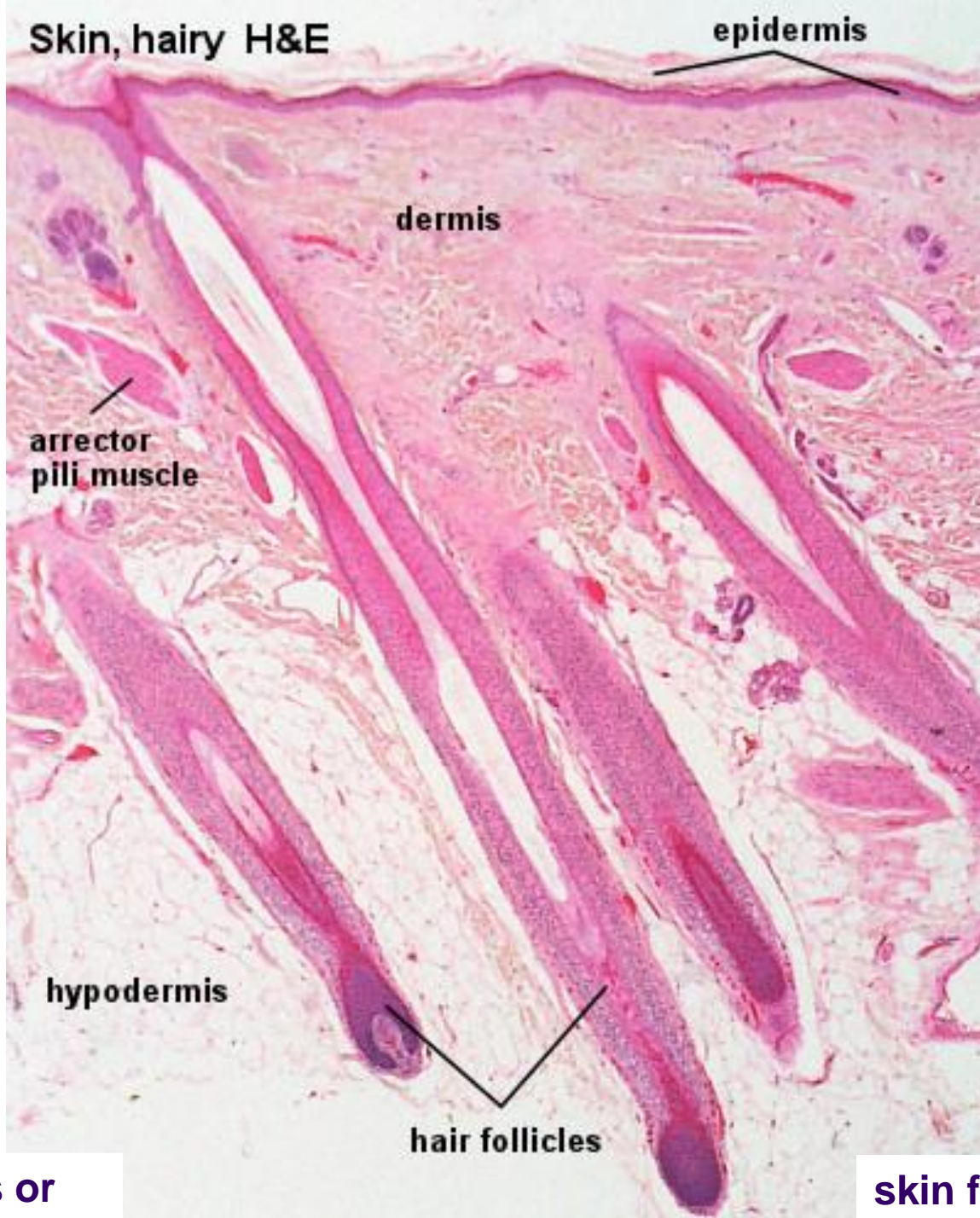
ORS

Huxley's
layer

Huxley's
layer

bulbus pili

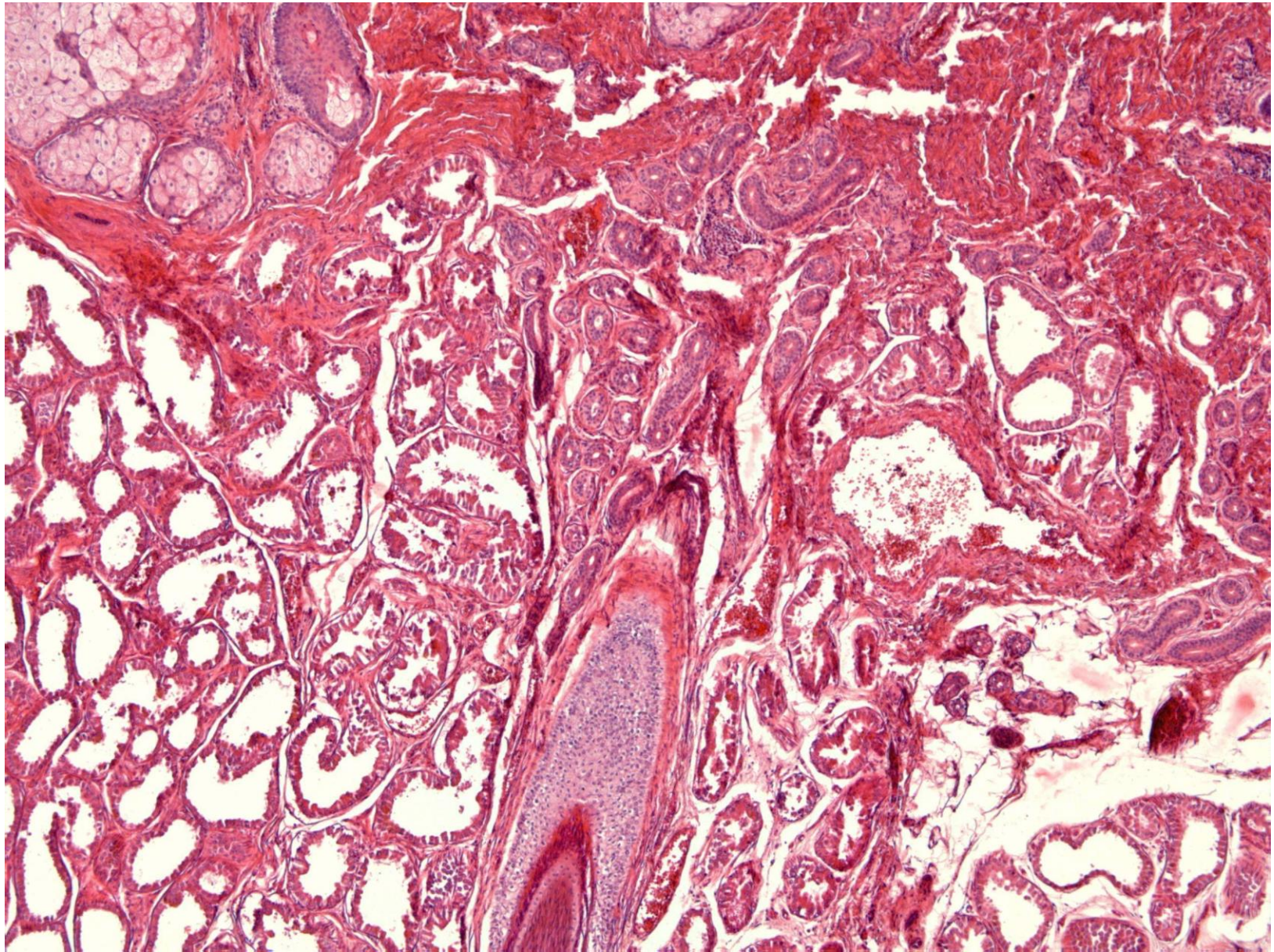




skin with hairs or

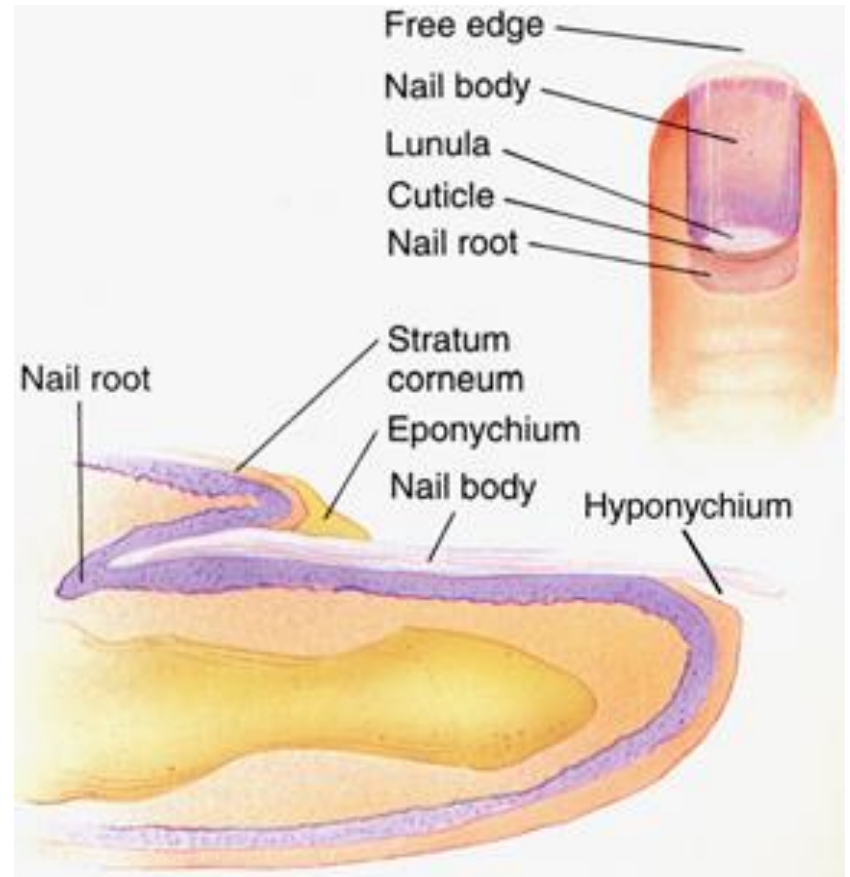
skin from the axilla ?

skin with hairs or skin from the axilla ?



Nails

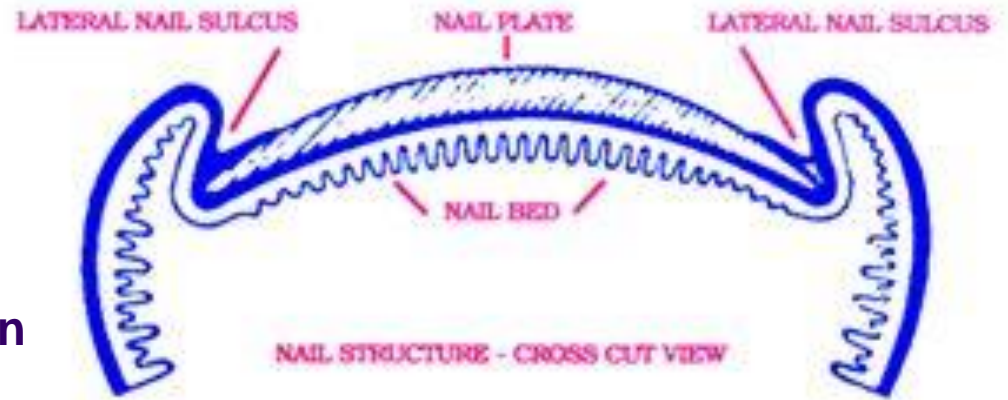
- **nail plate**
 - closely compacted, keratin enriched with hard interfibrillar material, it is the stratum corneum of the nail
- **nail root**
 - stratum basale and spinosum of epidermis are present here forming nail matrix cells which synthesize the nail plate
- **nail bed**
 - epithelial : stratum basale and stratum spinosum of nail, does not contribute to nail synthesis
 - dermal : corium /papillae – capillaries/
- eponychium: junction between skin stratum corneum and base of nail plate
- hyponychium: junction between the skin stratum corneum and the tip of the nail plate



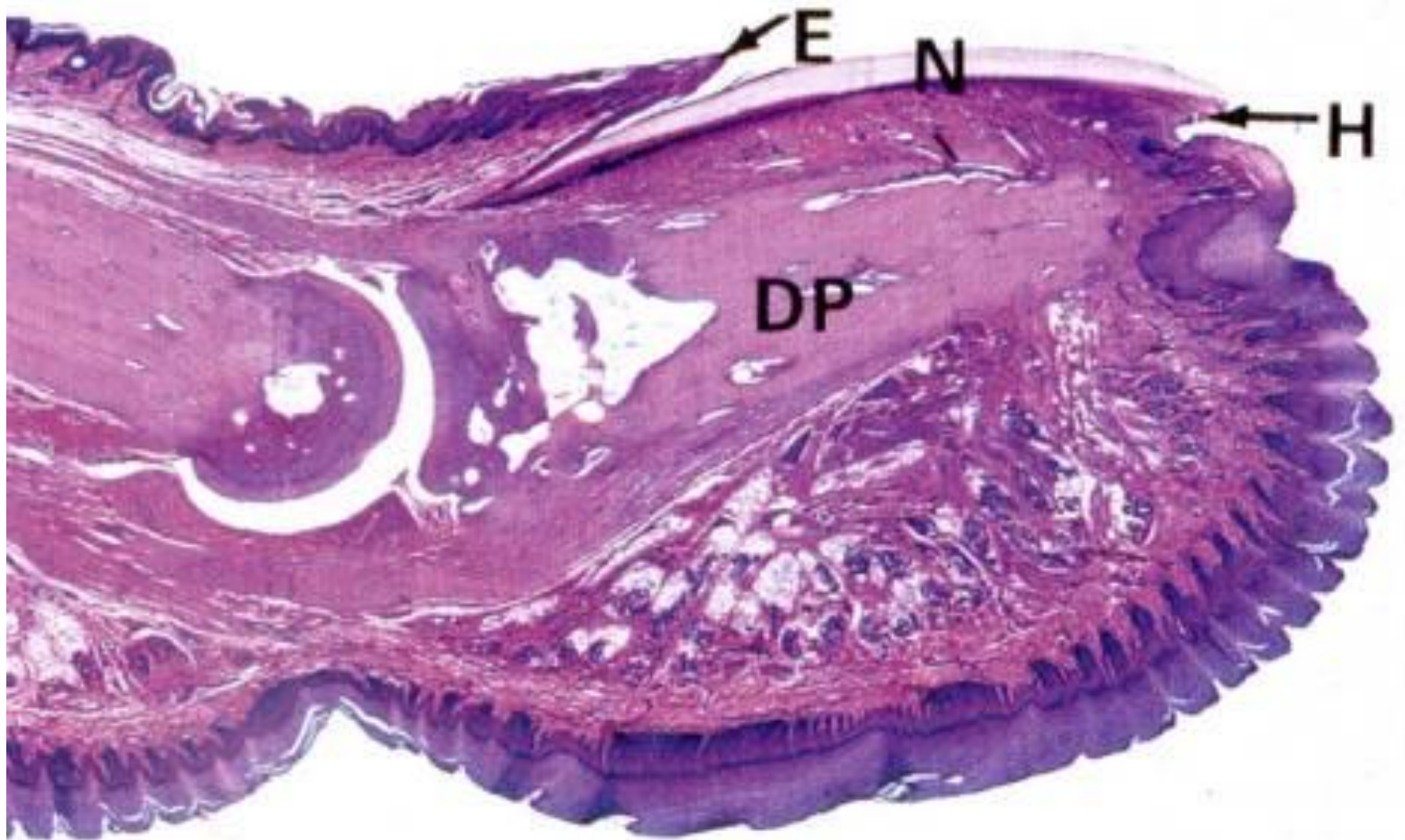
Nail

cross
section

longitudinal section

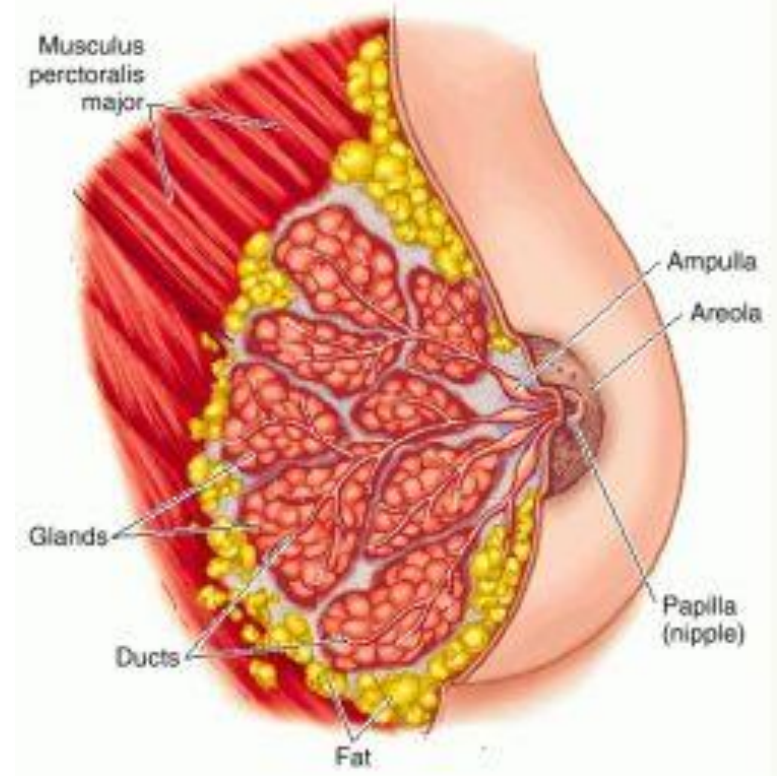


Nail



Glandulae mammae

- are modified **apocrine sweat glands** of the skin
- branched tuboalveolar glands, which consist of **15-25 lobes** separated by dense interlobar connective tissue and fat
- **each lobe contains an individual gland with the excretory duct** of each lobe, *lactiferous duct*, has its own opening on the nipple



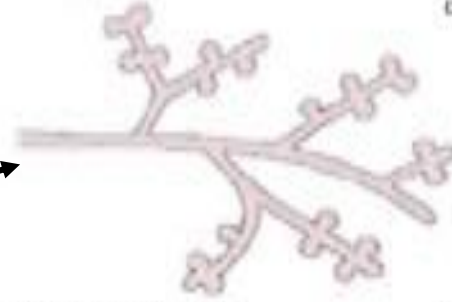
Mamma non lactans

Nonlactating Mammary Gland H&E



A Nonpregnant

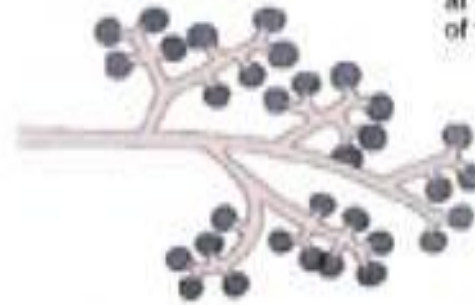
Inactive duct system



only ducts

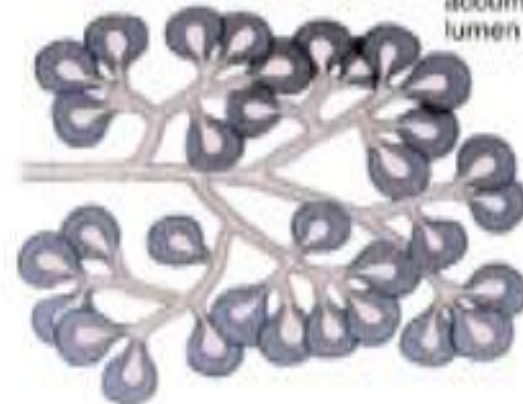
B During pregnancy

Alveoli proliferate at the ends of the ducts

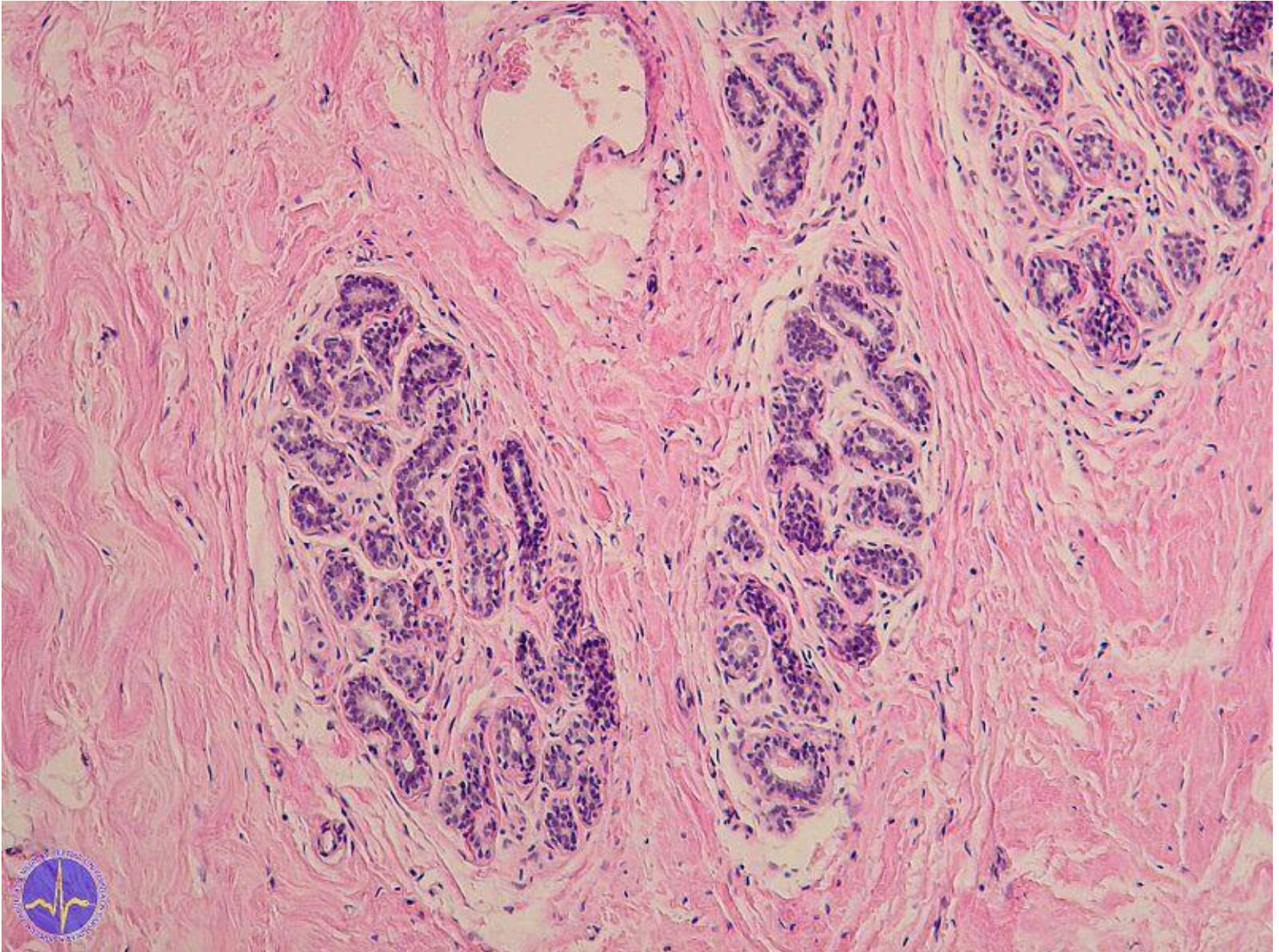


C Lactating

Milk secretion and accumulation in alveolar lumen



Mamma non lactans



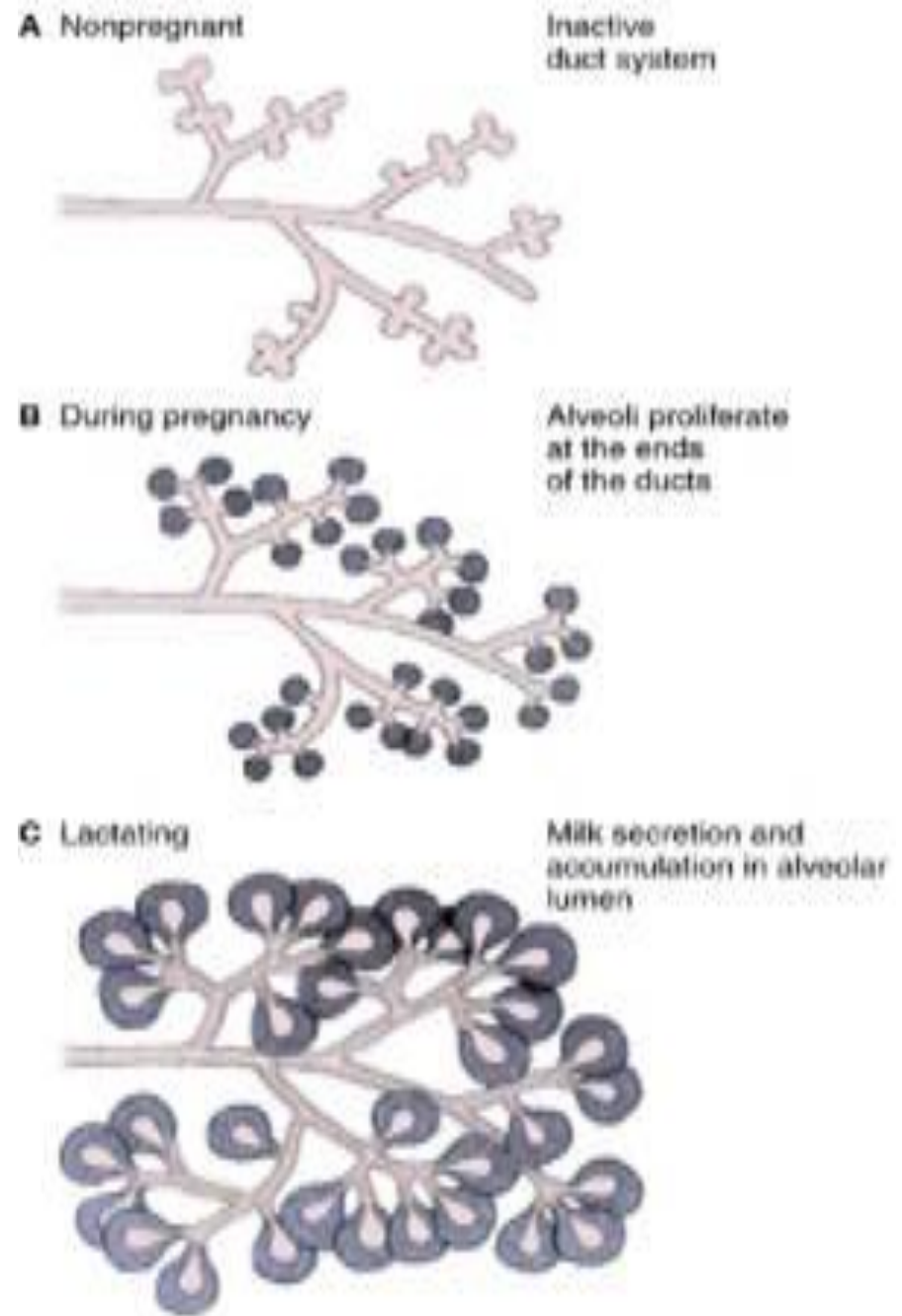
Mamma lactans

- **Alveoli**

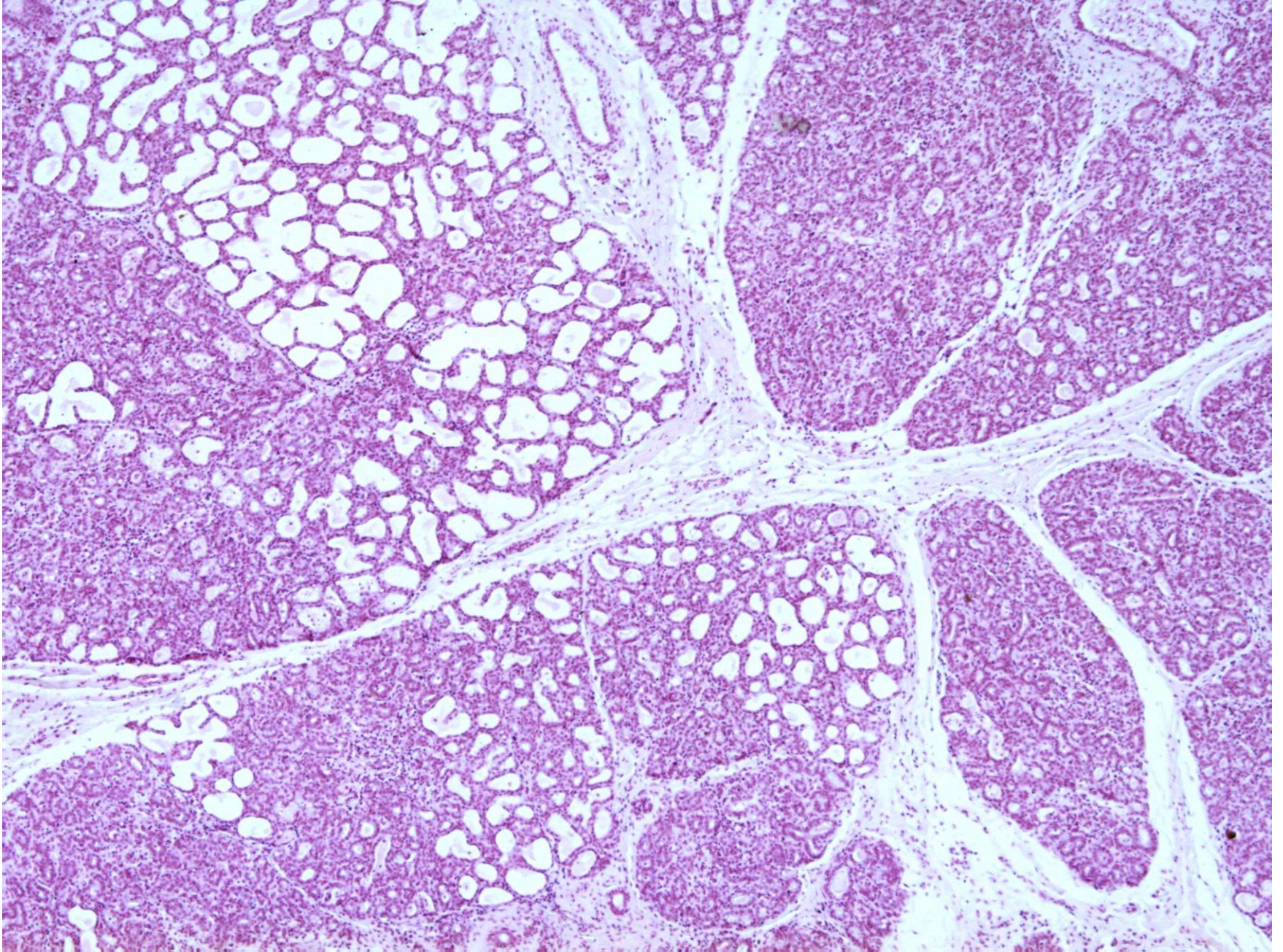
- *the basement membrane*
- *a layer of myoepithelial cells*
- *the epithelium*

- **Ducts**

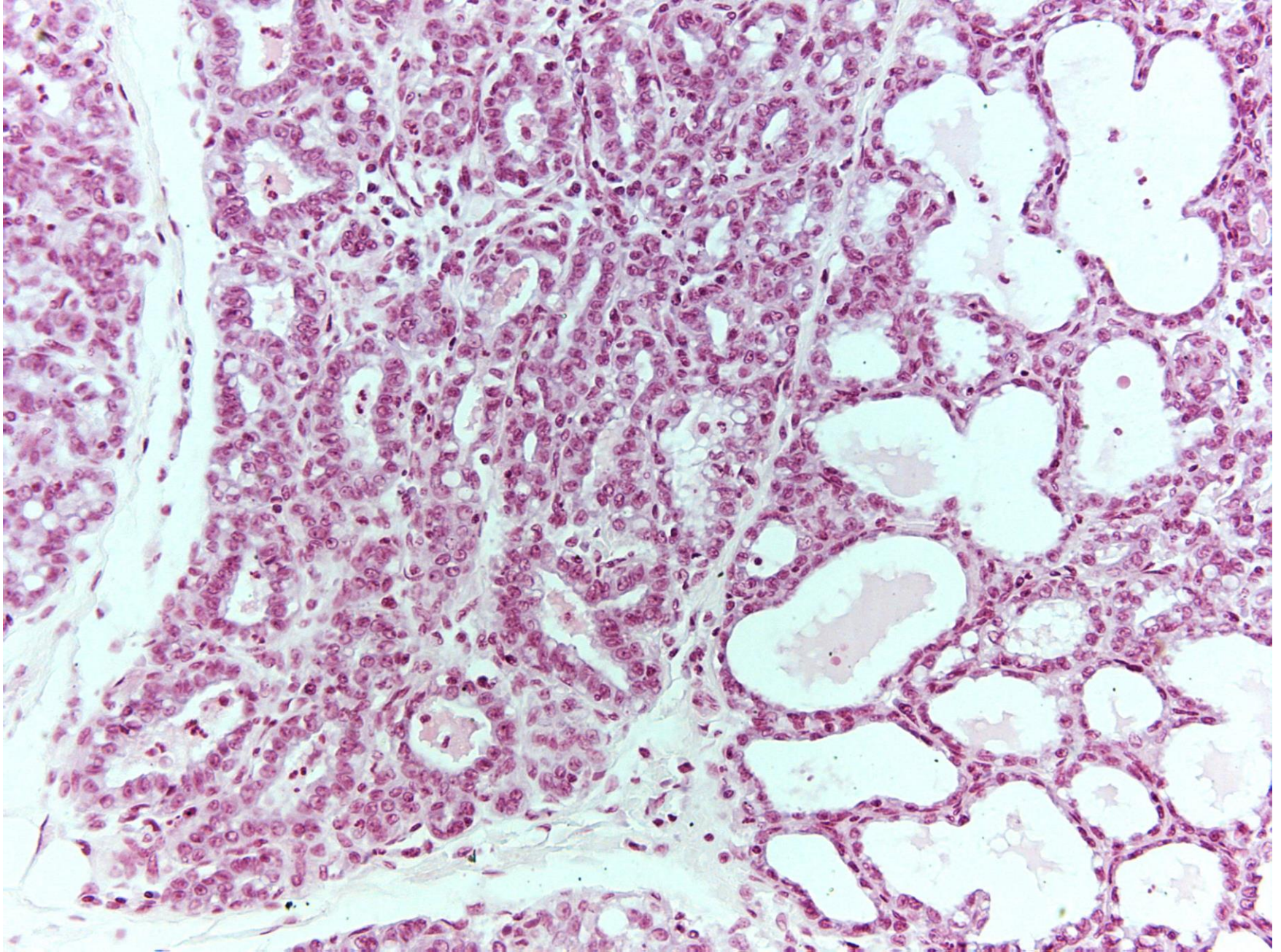
- **Intralobular** - small - cuboidal cells, than columnar cells
- **Lactiferous ducts** – *two layered epithelium* - basal cells are cuboidal whereas the superficial cells are columnar
- Beneath the nipple, the dilated lactiferous duct forms a **lactiferous sinus**, which functions as a reservoir for the milk /stratified squamous epi/



Mamma lactans



Mamma lactans



Skin - list of slides

- 69. Skin from the tip of the finger
- 70. Skin from the axilla
- 71. Skin with hairs
- 72. Nail
- 73. Mamma non lactans
- 74. Mamma lactans