Skin and skin appendages

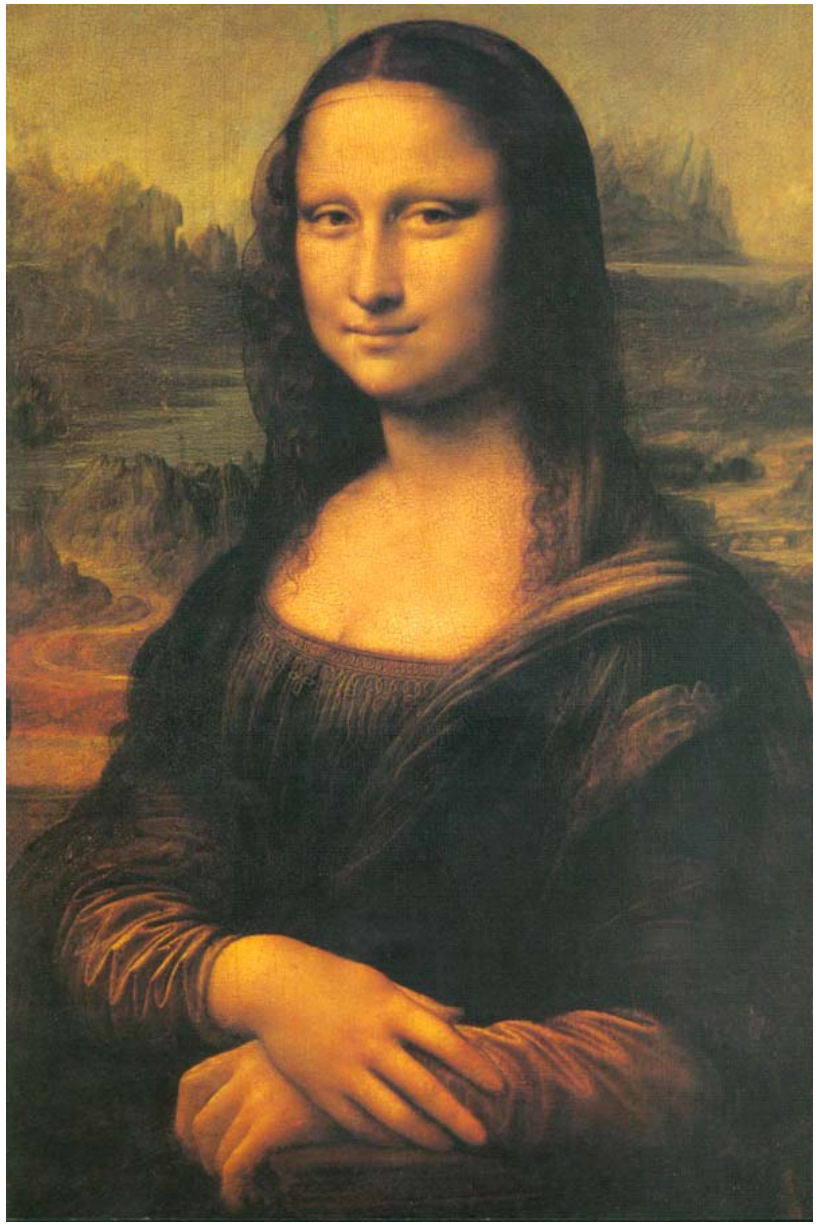
LIU ying
HISTOLOGY AND EMBRYOLOGY

The skin is the largest organ of the body.

Appendages include:

Functions include:

1. **Protective**
2. **Sensory**
3. **Exocrine**

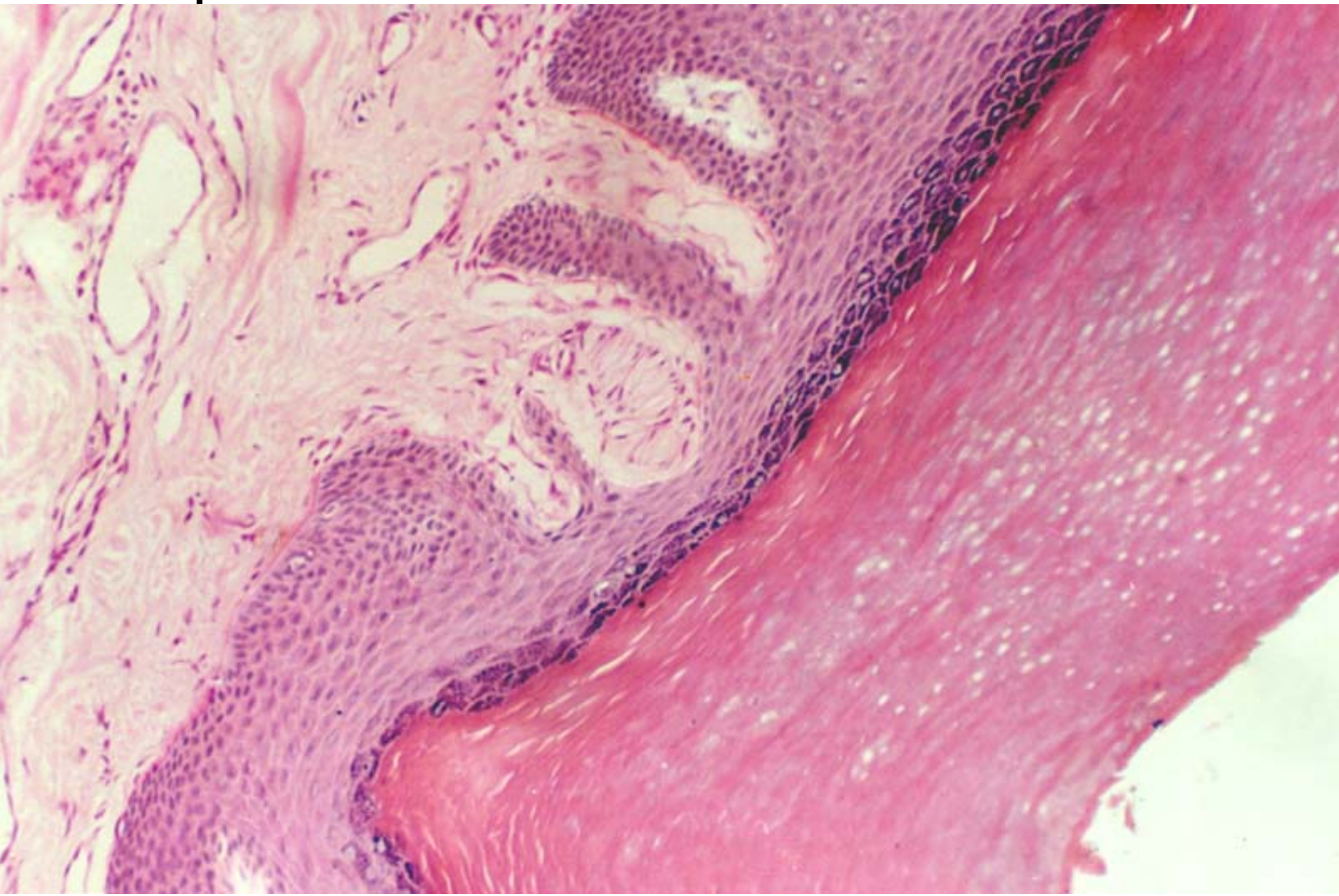


epidermis

- **It is the outer avascular epithelial layer.**
- **It consists of a keratinized stratified squamous epithelium.**
- **It consists of 5 layers from dermis outward.**
- **It is composed of keratinocytes and nonkeratinocytes.**

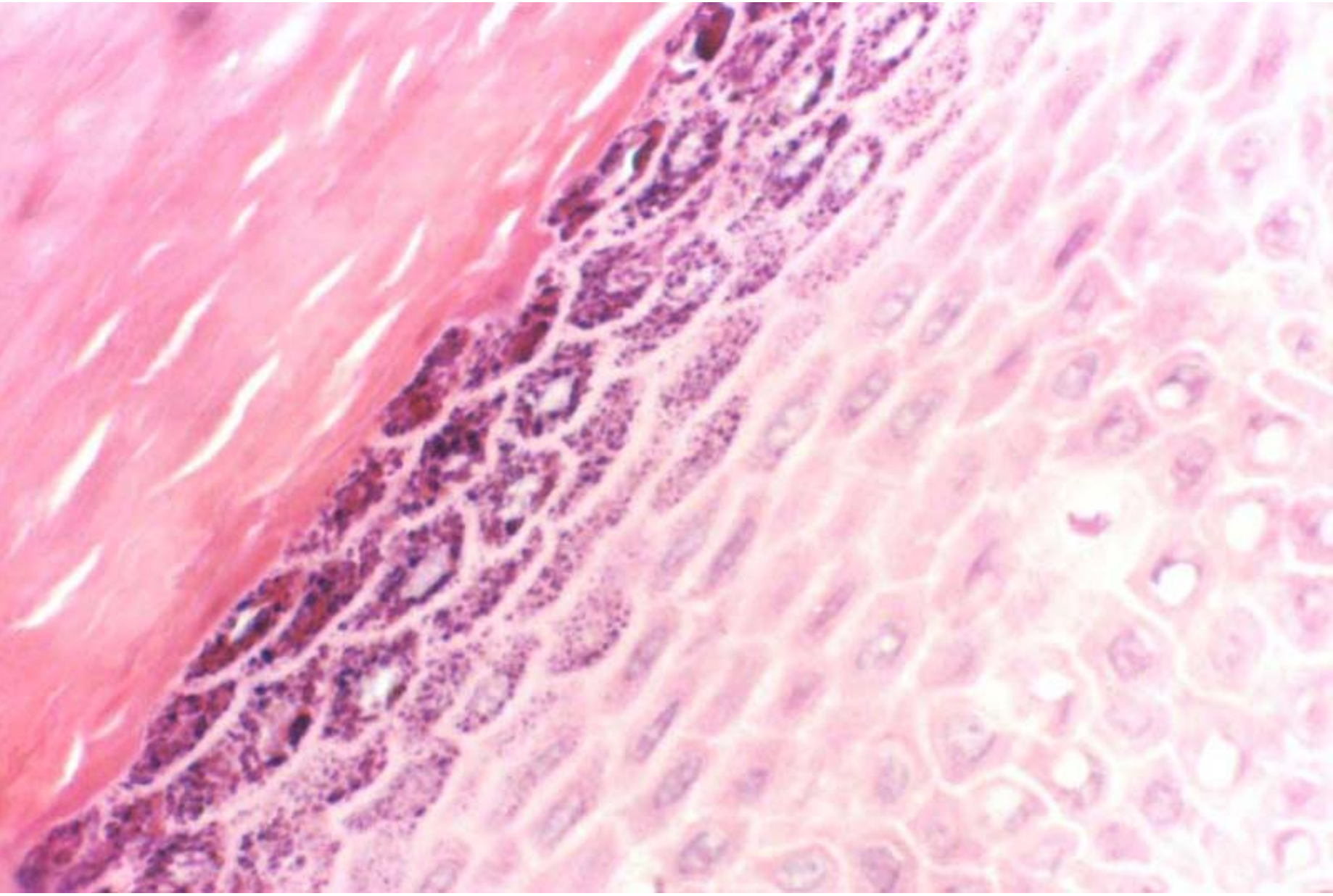
1. stratum basale

- **A layer of columnar or cuboidal cells**
- **Plasma is basophilic（lysosome）; keratin filament**
- **These cells are connected to one another by desmosomes, to the basal lamina by hemidesmosomes.**
- **They are stem cells; constant renewal of epithelial cell.**



2. stratum spinosum

- It is typically several cells thick
- **It is polygonal cells, cuboidal or slightly flattened, central nucleus, numerous ribosome**
- **Cytoplasm is pale basophilic, are filled with bundles of keratin filaments (tonofilament）.**
- **spines of adjacent cells attach each other by dosmosome.**



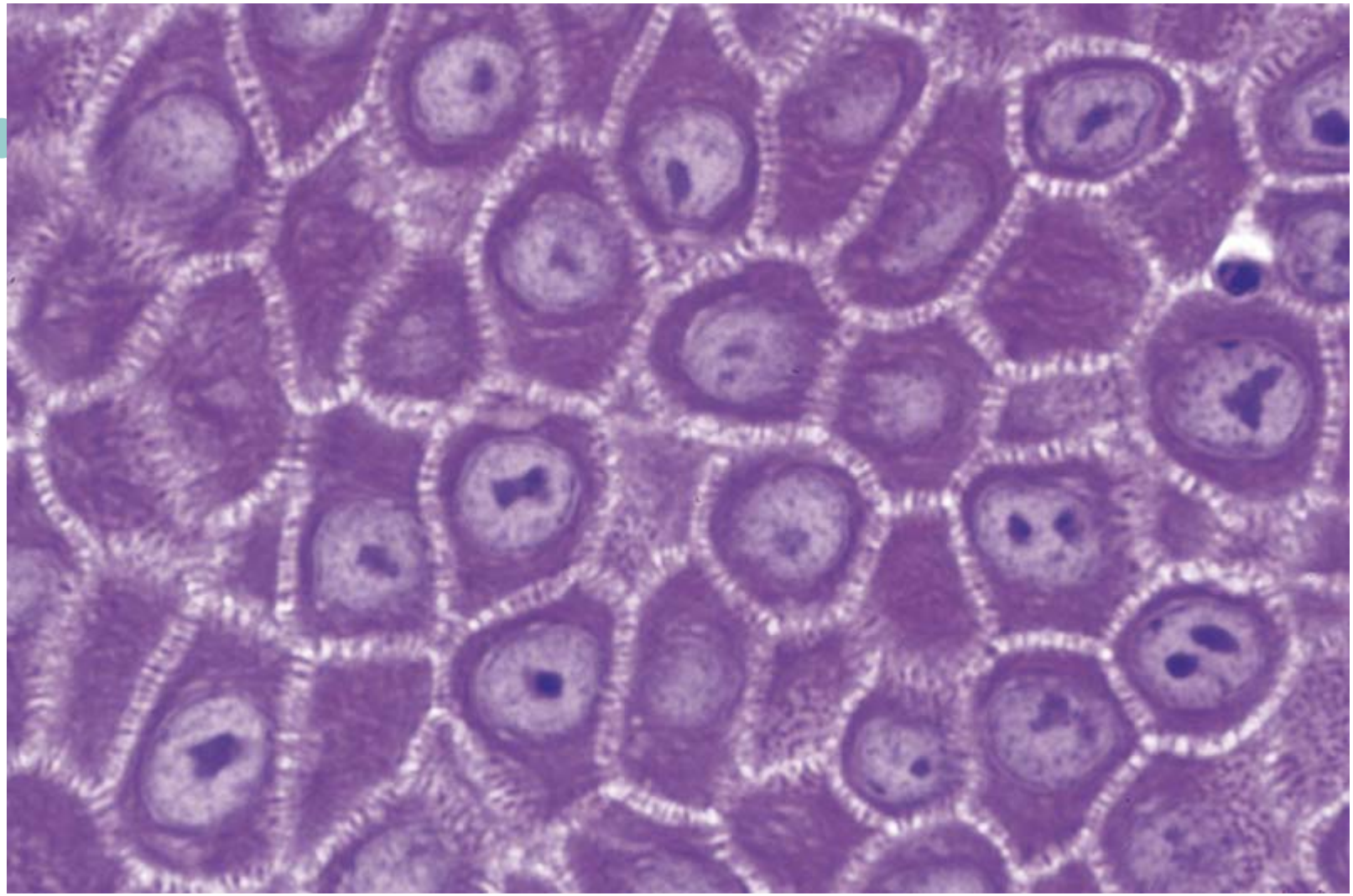
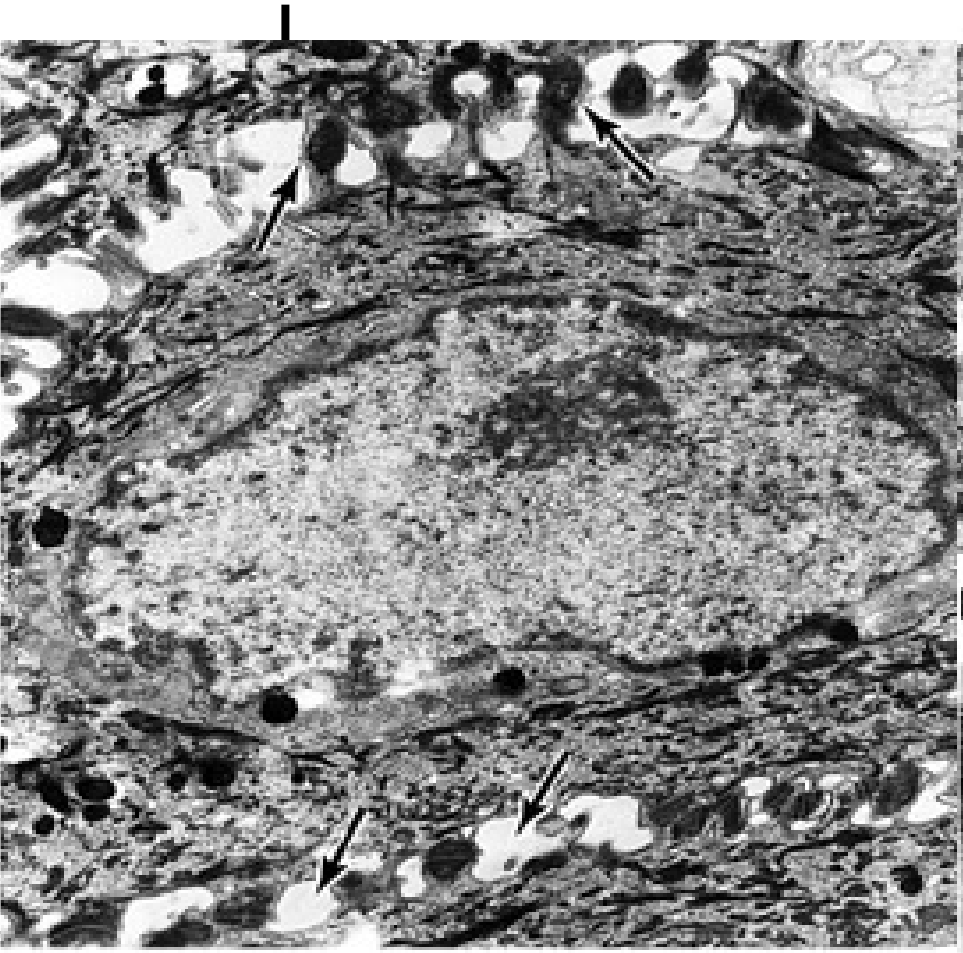
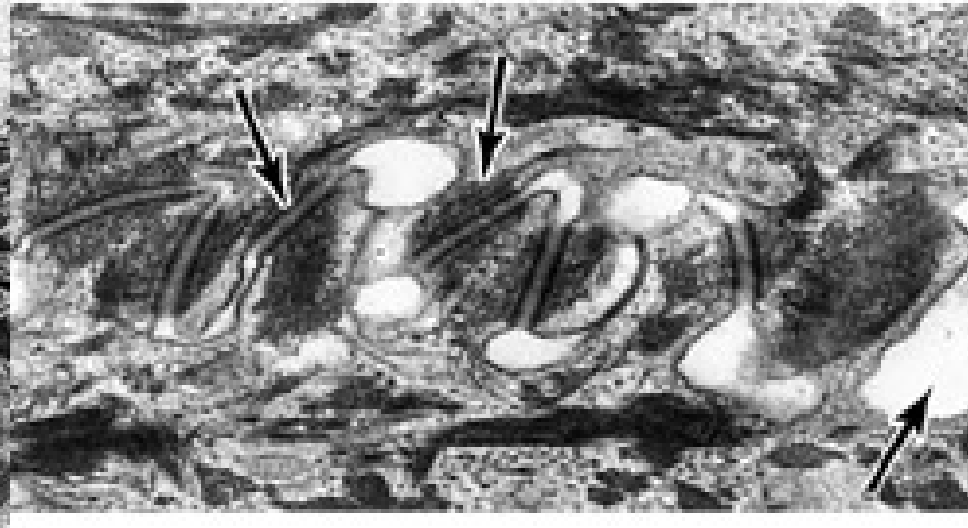


Figure 6 Stratum spinosum of the skin from the sole of the foot (thick skin) showing the spiny projections that strongly bind the cells of this layer together to resist abrasion. Pararosaniline-toluidine blue stain. Medium magnification.



A



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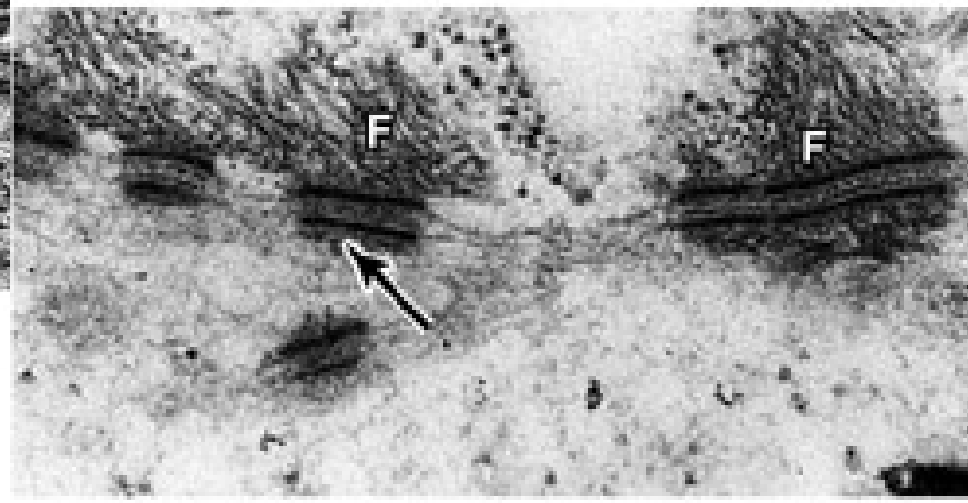
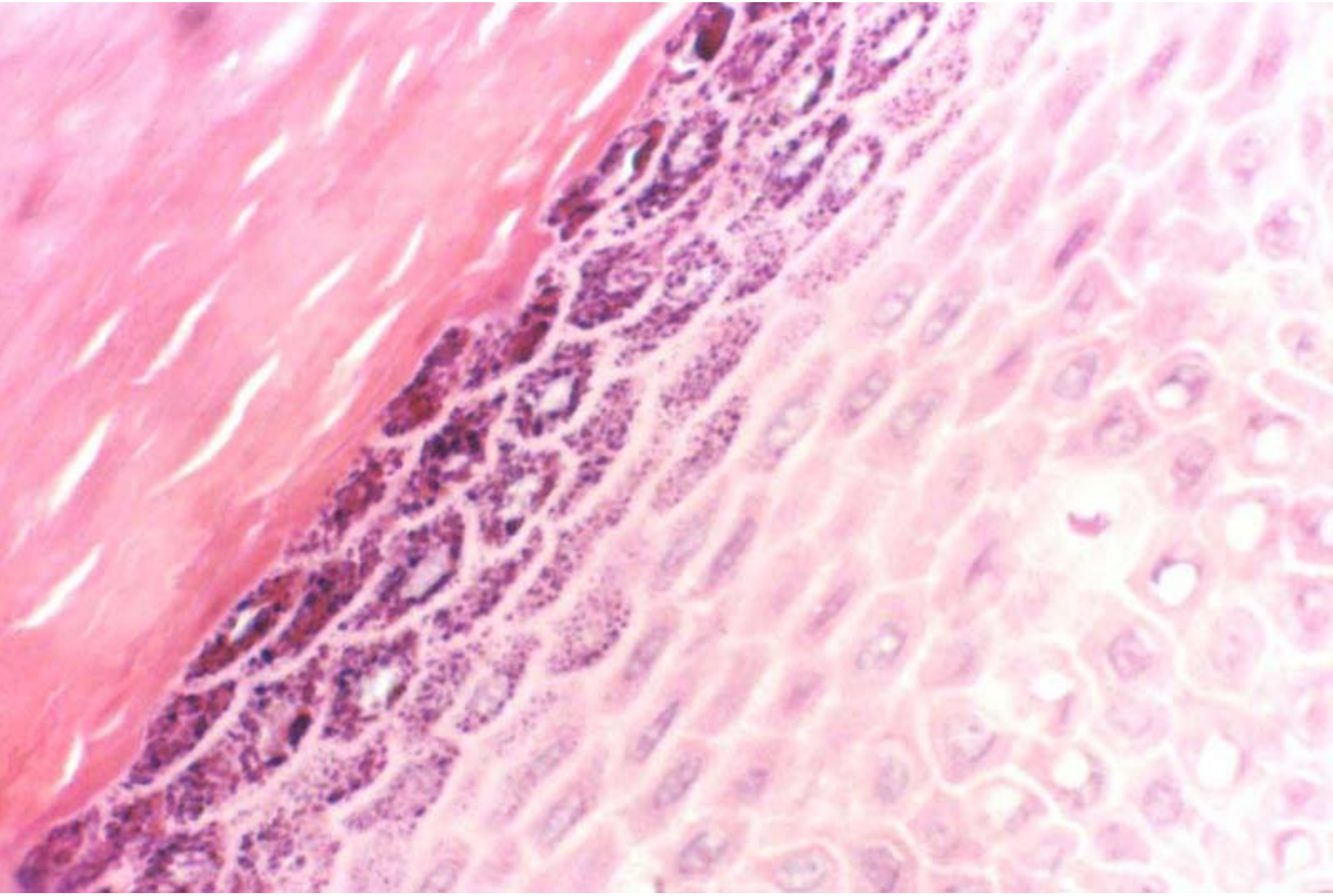
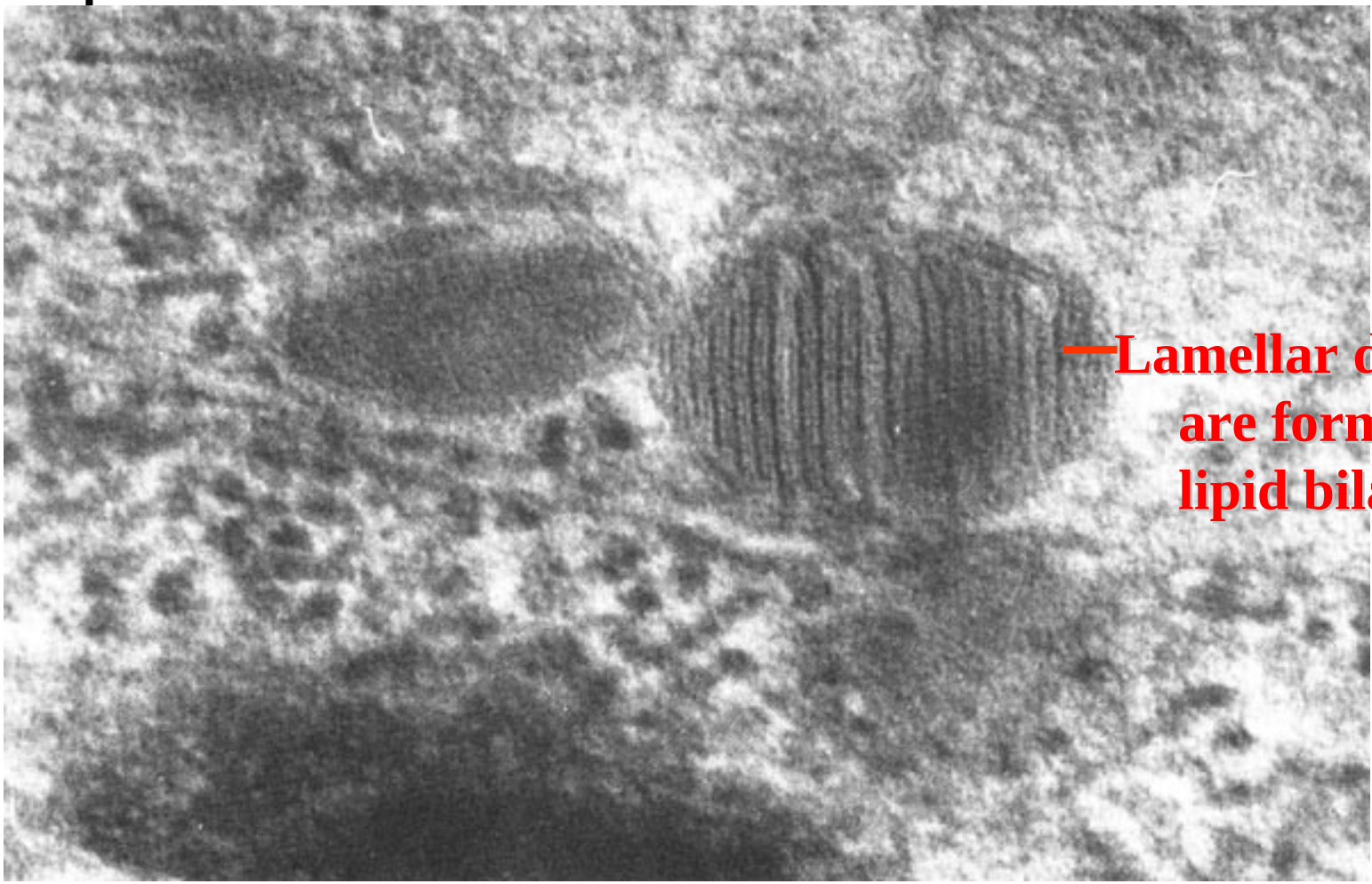


C

3. stratum granulosum

- **usually 3 ~ 5 layers thick**
- **Cells are flattendNuclei and organells have degenerated**
- **cytoplasm is filled with tonofilaments.**
- **is filled with coarse basophilic granules (keratohyalin granules, no membrane)----intracellular cement**
- **Membrane coated lamellar granules -------intercellular cement**




Lamellar disk
are formed by
lipid bilayer

4. stratum lucilum

- Characteristic of only thick skin, thin layer
- Cells are extremely flat.
- cytoplasm is eosinophilic.
- **Organells and nuclei are no longer evident.**
- **Desmosomes are still evident between adjacent cells.**

5. stratum corneum

- **15~20 layers**
- **Cells are flat, nonnucleated.**
- **Plasma is eosinophilic, filled with keratin.**
- **Tonofilaments are packed together in a matrix contributed by keratohyalin granules.**
- **Plasma membranes are coated with an extra-cellular lipid layer.**
- **Horny cells are continuously shed at the surface of the stratum corneum.**

CONCLUSION

The changes of the keratinized cells from basal layer to cornified layer show the process of the *keratinization*:

①Morphology: Columner→ polygonal→ spindle→ flattened; basophilic→acidophilic

② Nuclei./ Organelle: +→--;

③ Lamellar G: -- → ++ → -- (exocytosis)

④ plasma membrane: 6-10nm → 15-20nm;

⑤ keratin: -- → ++ → ++++

⑥ Filaments: less→many; scattered→bundle;

⑦ Desmosomes: + → --;

1. melanocyte

- **Found near the base of the epidermis**
- **Derived from neural crest cell**
- **LM dark nuclei，light cytoplasm dendritic processes extend into the stratum spinosum.**
- **EM contain numerous mitochondria, lysosome、RER、Golgi complex**
- **FUNCTIONS**

  Melanocytes synthesize melanin and distribute it to the keratinocytes to protect them from the mutagenic effect of UV radiation.

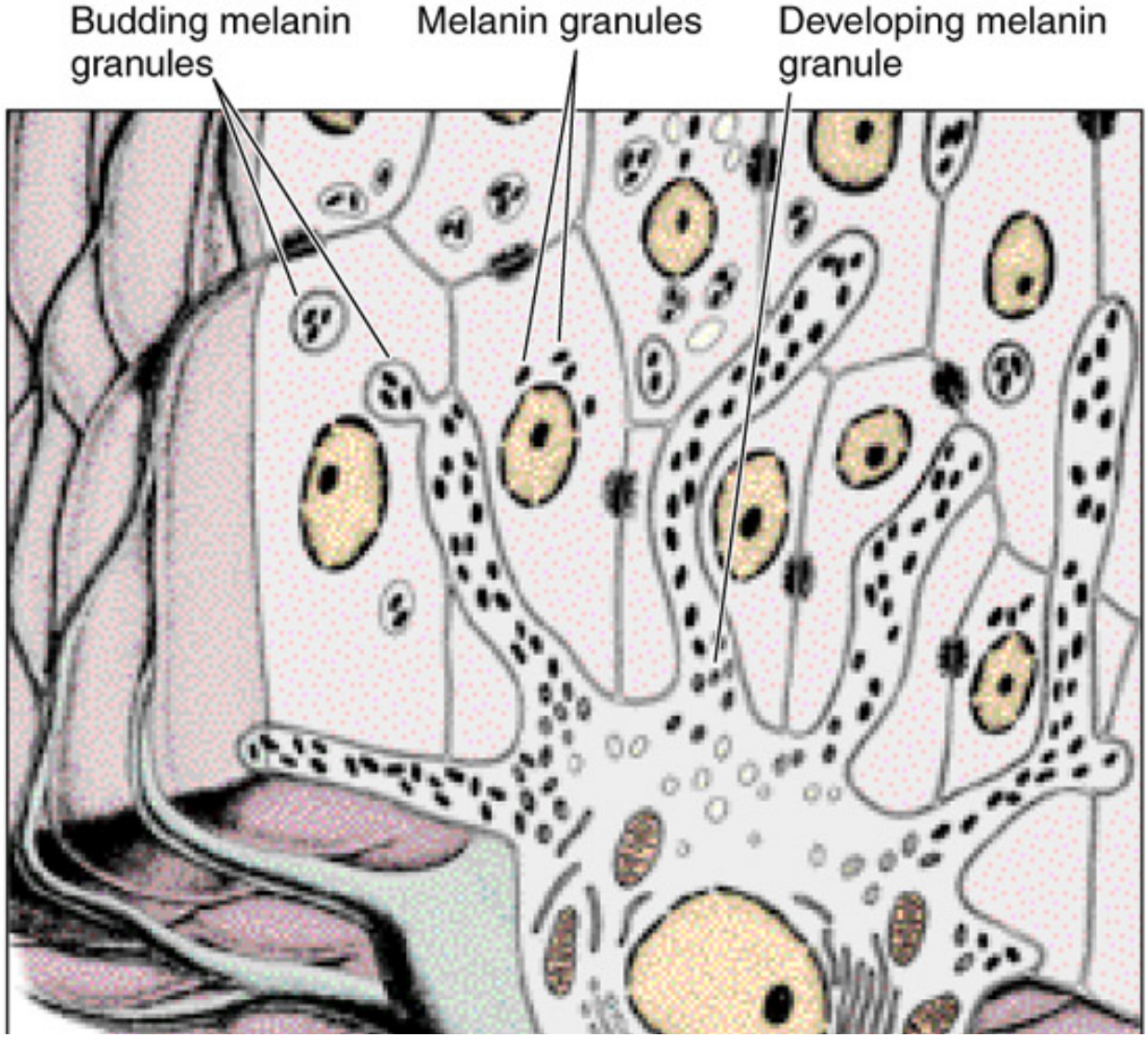
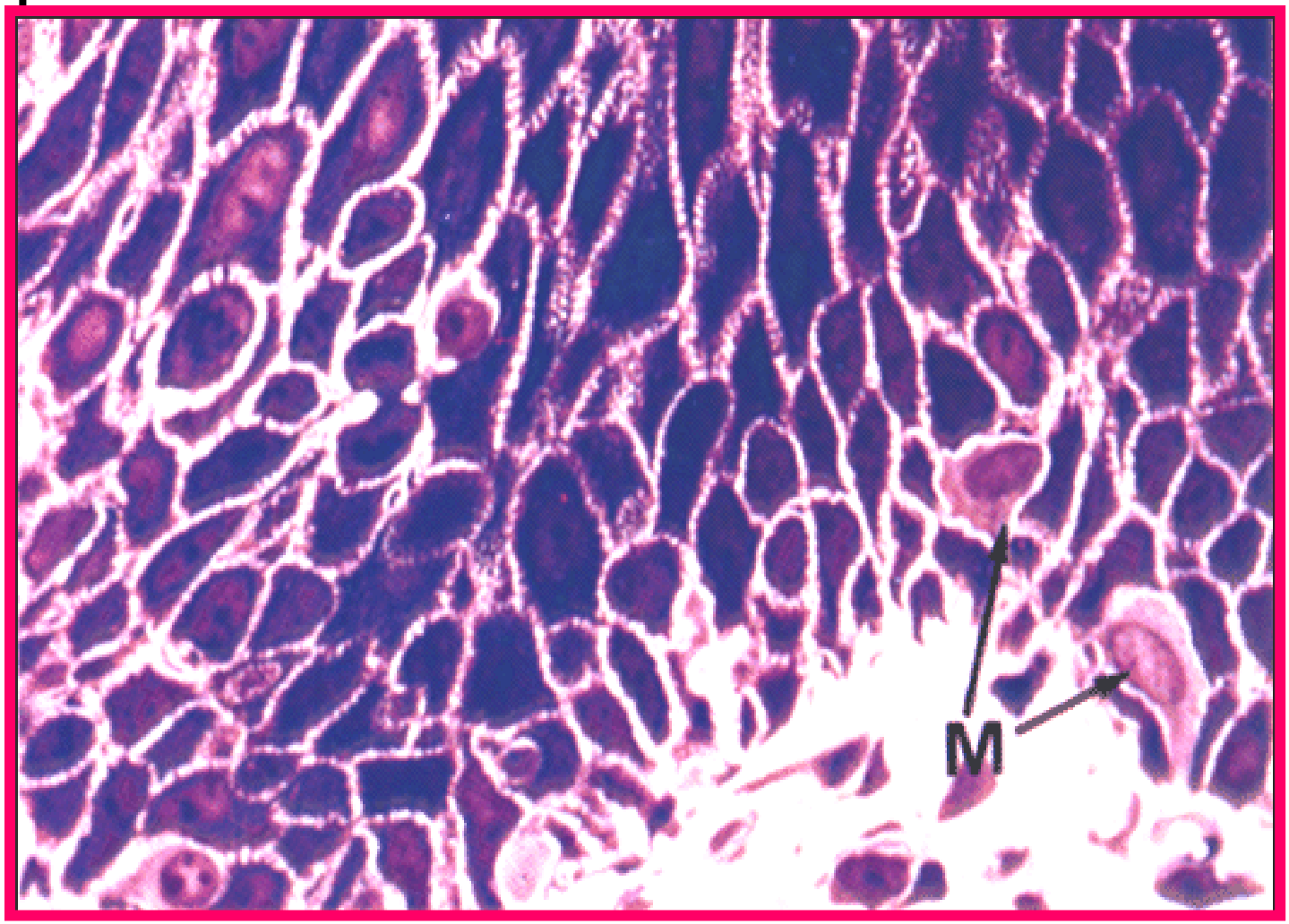


Fig.5 Diagram of a melanocyte. Its processes extend into the interstices between keratinocytes. The melanin granules are synthesized in the melanocyte, migrate to its processes, and are transferred into the cytoplasm of keratinocytes.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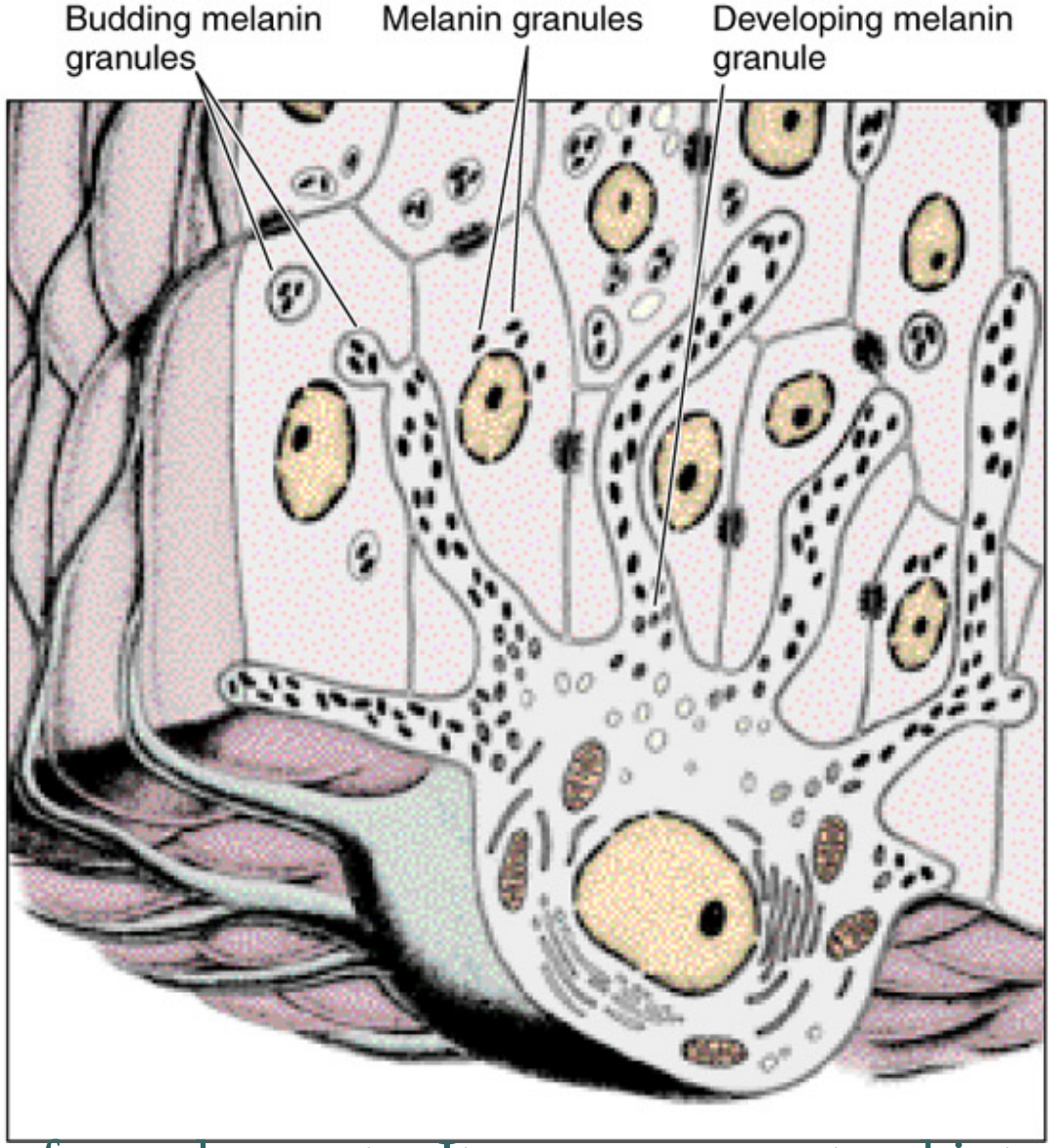
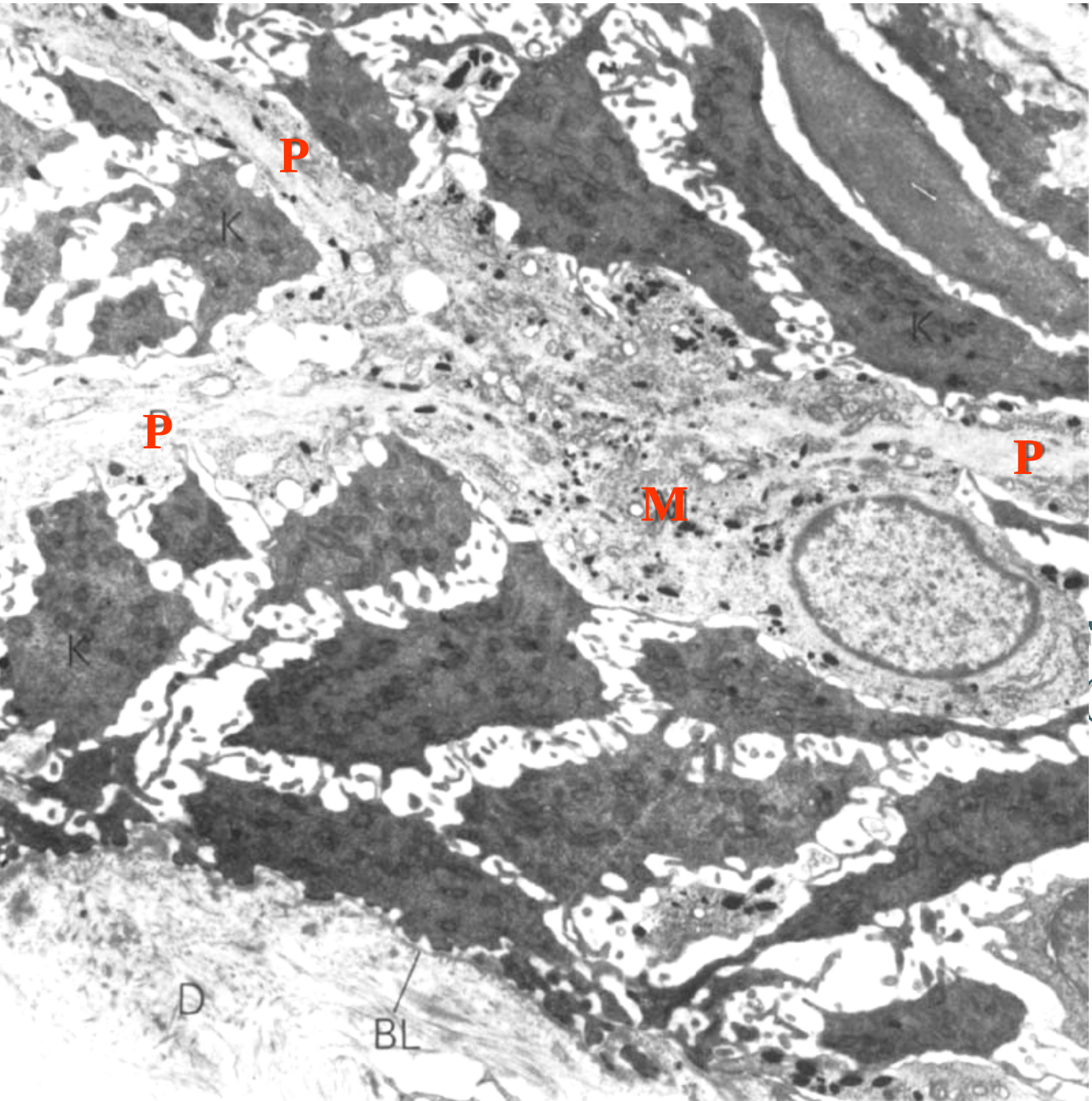


Fig.8 Diagram of a melanocyte. Its processes extend into the interstices between keratinocytes. The melanin granules are synthesized in the melanocyte, migrate to its processes, and are transferred into the cytoplasm of keratinocytes.



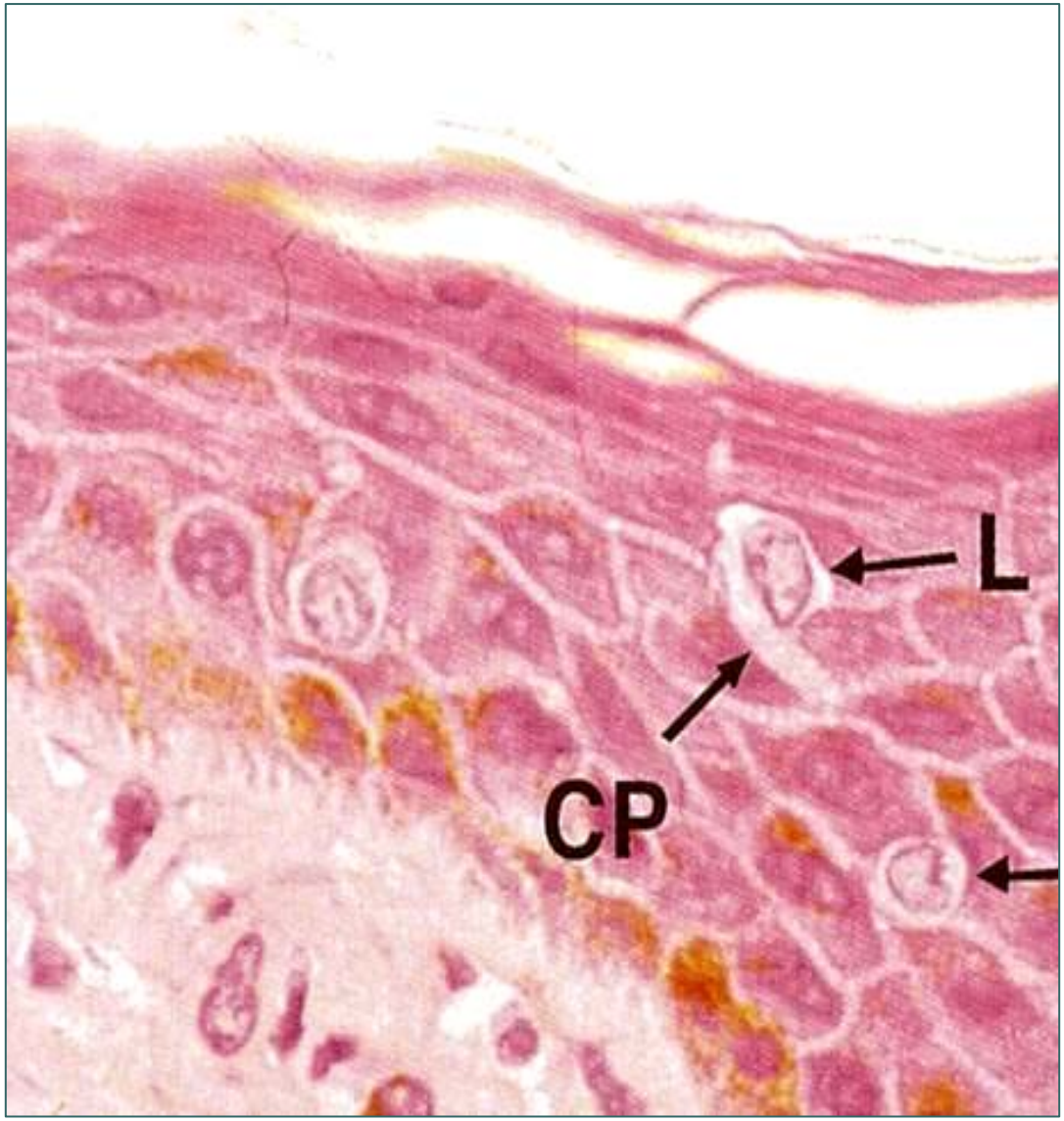
ig. 9 melanocyte
M melanin
granules
P processes
K kerotinocytes
BL basal lamina
D dermis)

2. Langerhans cell

- **Found mainly in the ST. spinosum.**
- **Derived from stem cells in the bone marrow**
- **LM Star-shaped，light cytoplasm**

  no desmosomes
- **FUNCTION**

  antigen-presenting cells, part of the mononuclear phagocytotic system (MPS). Bind,process.present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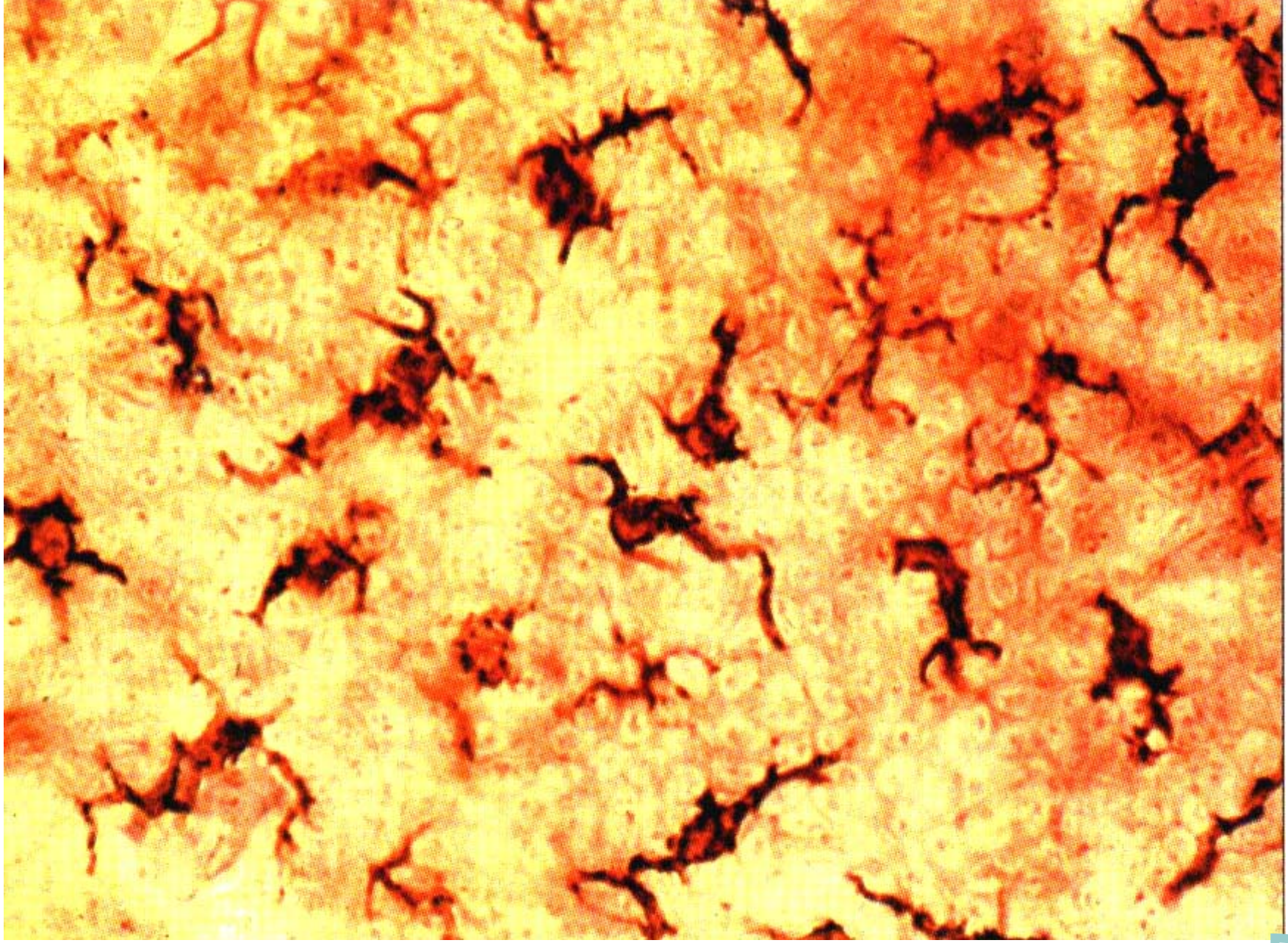


Fig. 10 Langerhans cells (ATPase stain)

3. Merkle's cell

- found in the stratum basale.
- Short processes, small dense granules, lobed nuclear, desmosomes
- In combination with sensory neuron endings in the basal lamina, Merkel cells form a mechanoreceptor, may be related to the diffuse neuro-endocrine system.

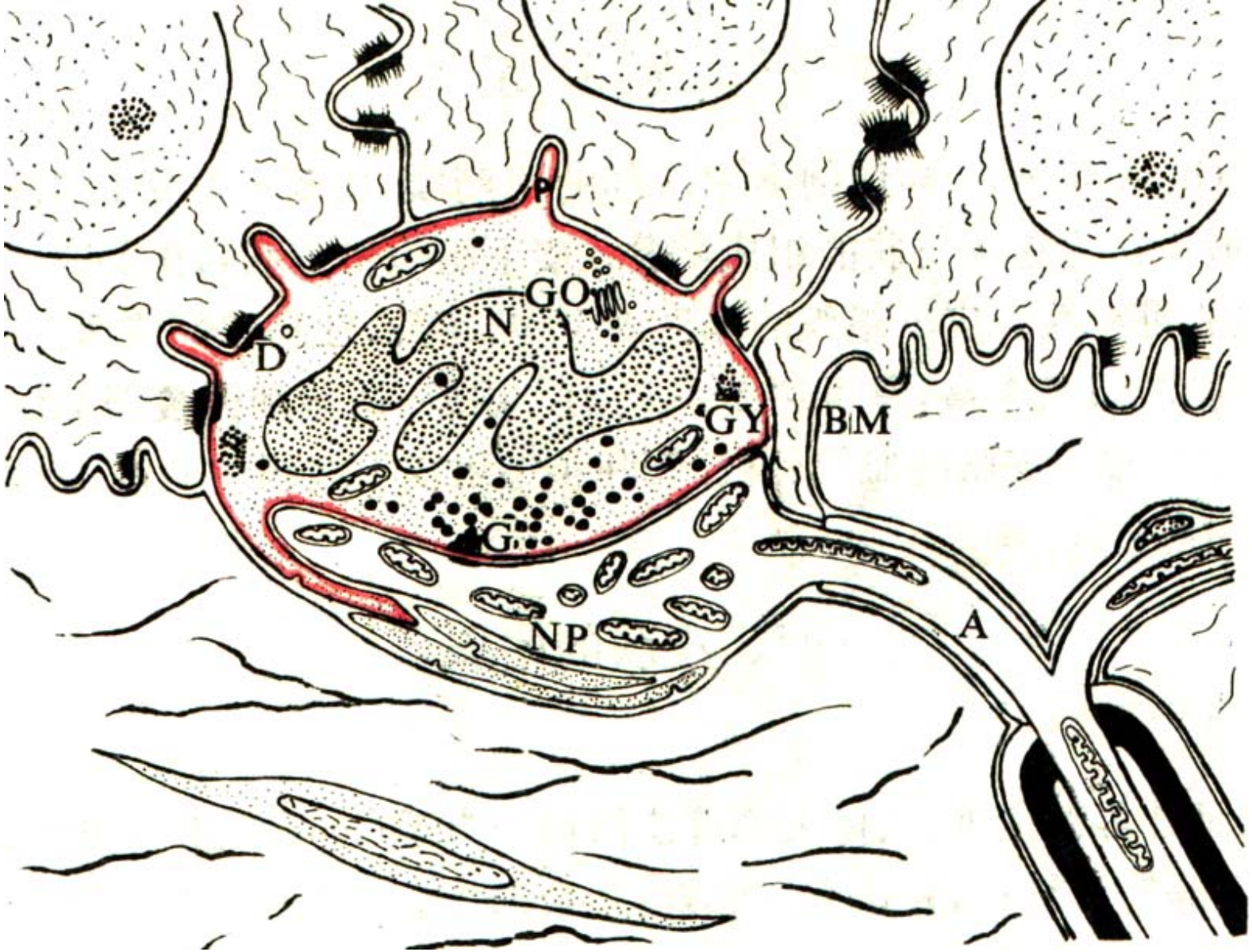


Fig.12 Merkel's cell与神经末梢超微结构模式图

（N 梅克尔细胞核,P 胞质突, D 桥粒,CY 糖原,GO 高尔基复合体 G 分泌颗粒,BM 基膜,A 轴突,NP 神经板）

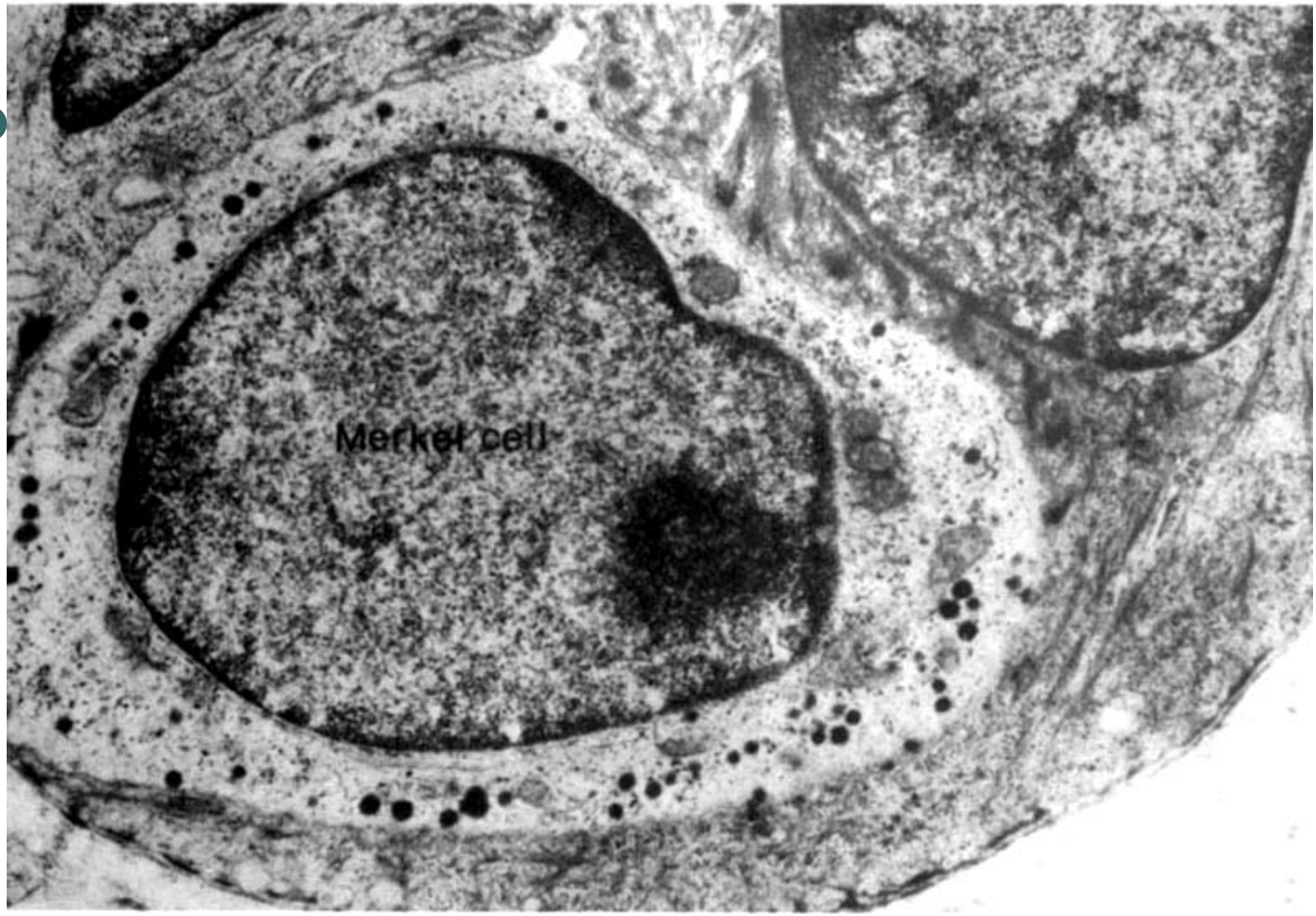


Fig.13 Merkel's cell

Dermis

papillary layer

- **The projections of the dermis into the epidermis are called dermal papillae.**
- **is comprised of a LCT, more cells, more cap.**
- **Tactile corpuscle**
- Function:

  strengthening connection;

  touch feeling; nourishment

2. **reticular layer**

- **lies deep to the papillary layer**
- **is typically thicker and fewer cells**
- **It has larger diameter type I collagen and elastic fibers.**
- **Sweat glands, Sebaceous glands, Hair folliciles**
- **lamellated corpuscles**

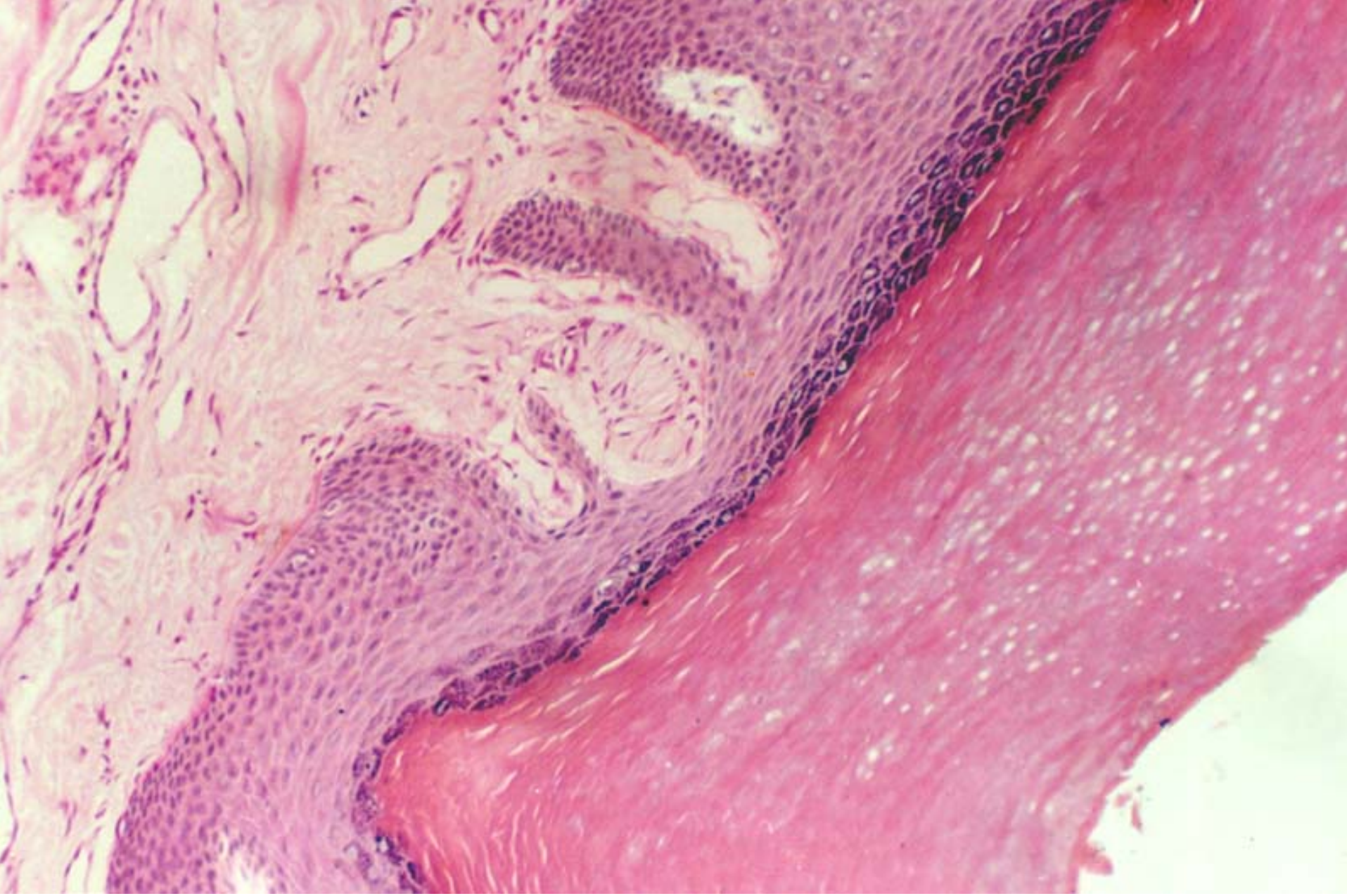


Fig. 14 papillary layer

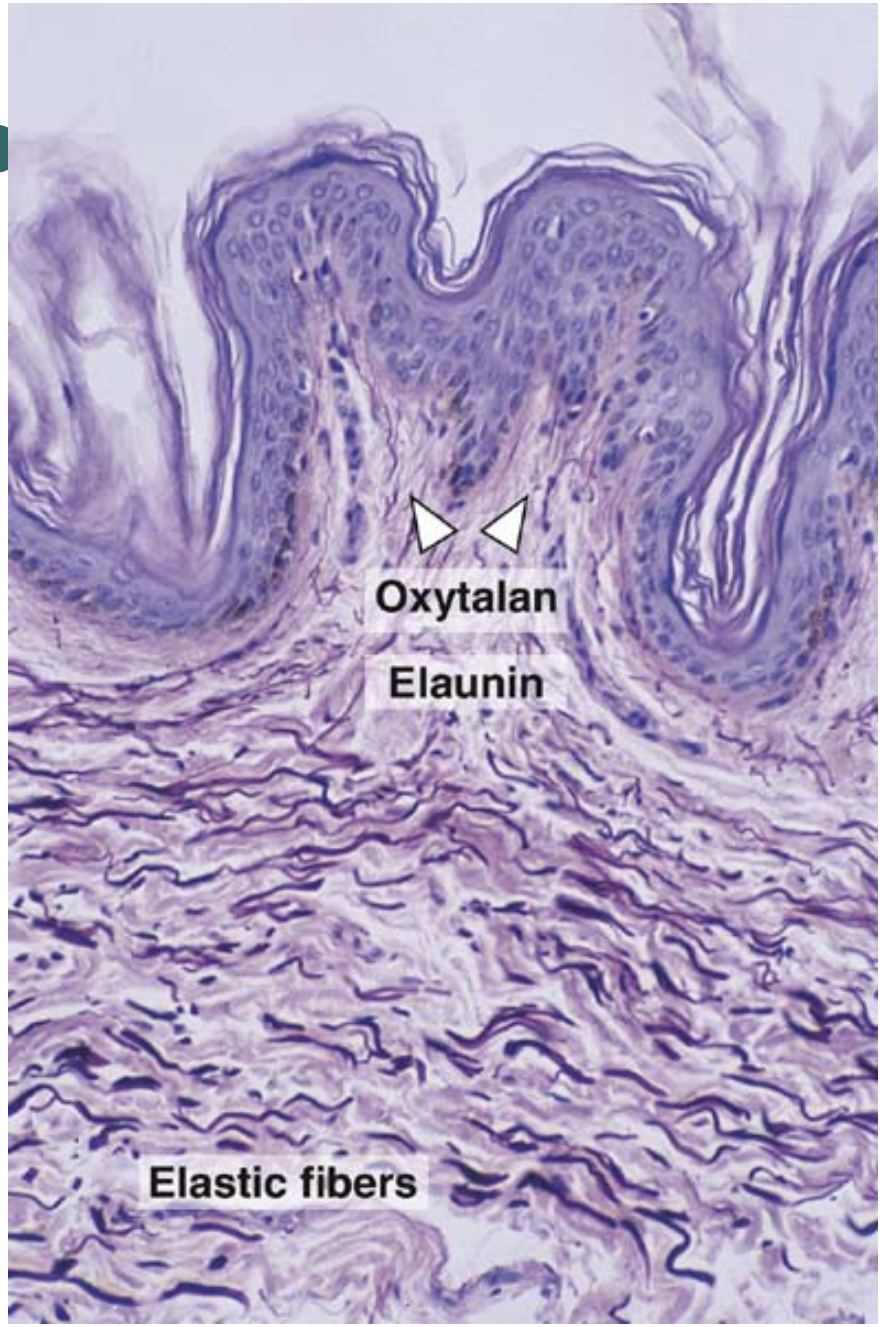


Fig.11. Photomicrograph of thin skin stained for fibers of the elastic system. Note the gradual decrease in the diameter of fibers as they approach the epidermis. The thick fibers are elastic fibers. Those with an intermediate diameter are elaunin fibers. The very thin superficial fibers are oxytalan fibers formed by microfibrils that insert into the basement membrane. Weigert stain. Medium magnification.

Hypodermis

- Beneath the dermis lies hypodermis.
- comprised of adipose and LCT.
- It is the principal area of fat storage, providing both energy reserves and insulation

1. **hairs**

- **Hair shaft**
- **hair root**
- **Hair follicle** **hair bulb** **Hair papilla**
  - **Hair matrix**
  - **root sheath**
    - **ep. root sheath(internal, external)**
      - periferal cells
    - **CT. root sheath**

- **hair bulb : The bulb is a proliferative zone formed by the epithelial matrix cells and dermal papilla.**
- **dermal papilla : At the base of the hair bulb, capillary network**
- **matrix cells: cover the dermal papilla and give rise to both the hair and root sheath**

root sheath

- **ep. root sheath**

  The outermost cells of dermal papilla give rise to the internal and external root sheath.

- **connective tissue sheath**

  dermis surrounding the follicle

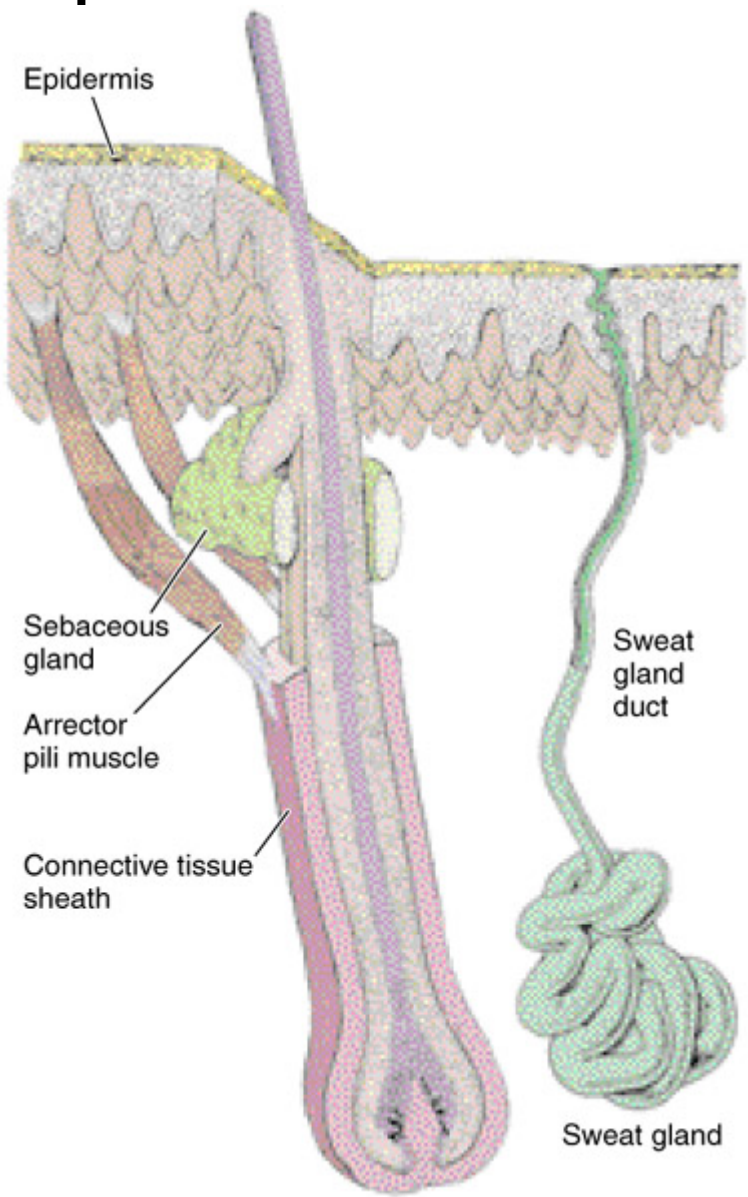


Fig.16 Relationships between the skin, hair follicle, arrector pili muscle, and sebaceous and sweat glands. The arrector pili muscle originates in the connective tissue sheath of the hair follicle and inserts into the papillary layer of the dermis, where it ends.

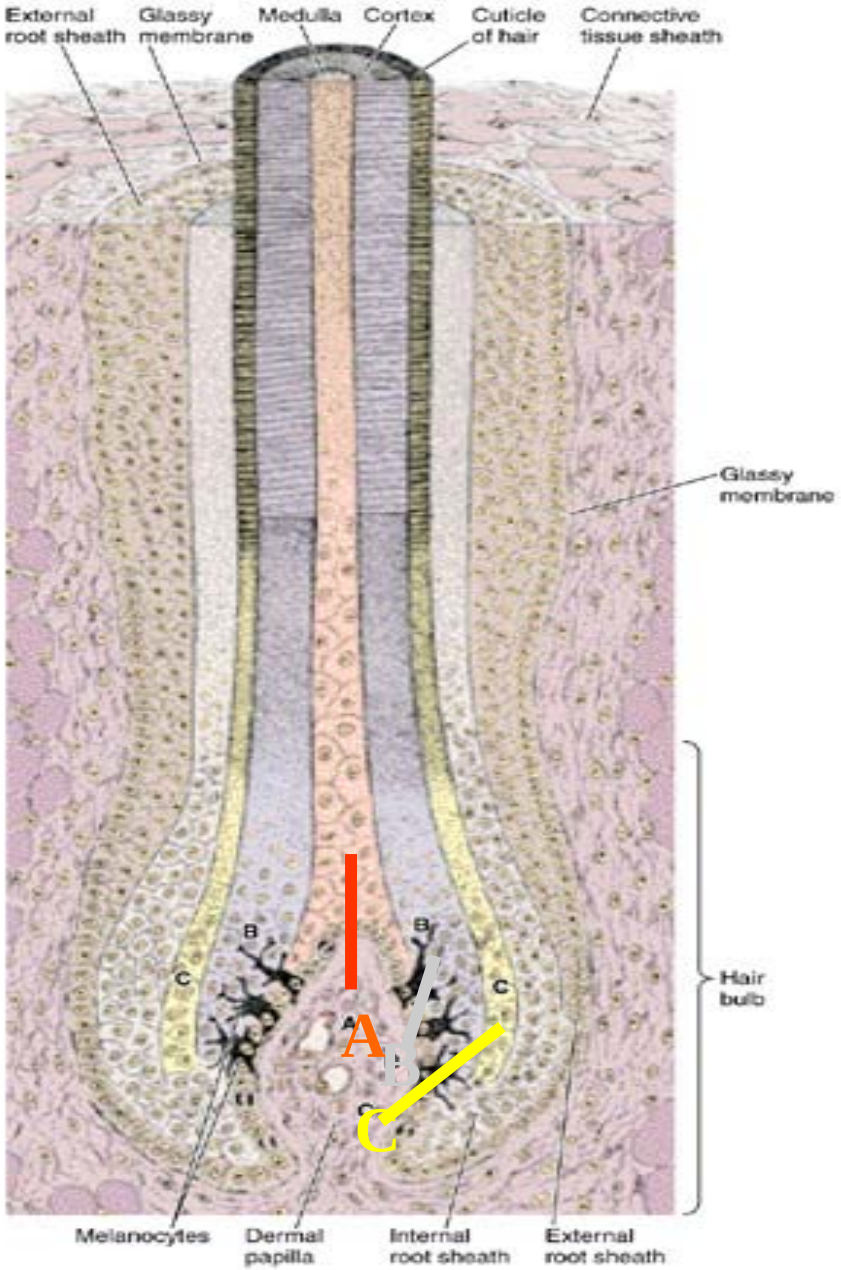


Fig.17 The follicle has a bulbous terminal expansion with a dermal papilla. The papilla contains capillaries and is covered by cells that form the hair root and develop into the hair shaft.

The central cells (A) form the medulla of the hair.

The cells that produce the cortex of the hair are located laterally (B).

Cells forming the hair cuticle originate in the next layer (C).

The peripheral epithelial cells develop into ep. root sheaths. The external root sheath is continuous with the epidermis, whereas the cells of the internal root sheath disappear at the level of the openings of the sebaceous gland

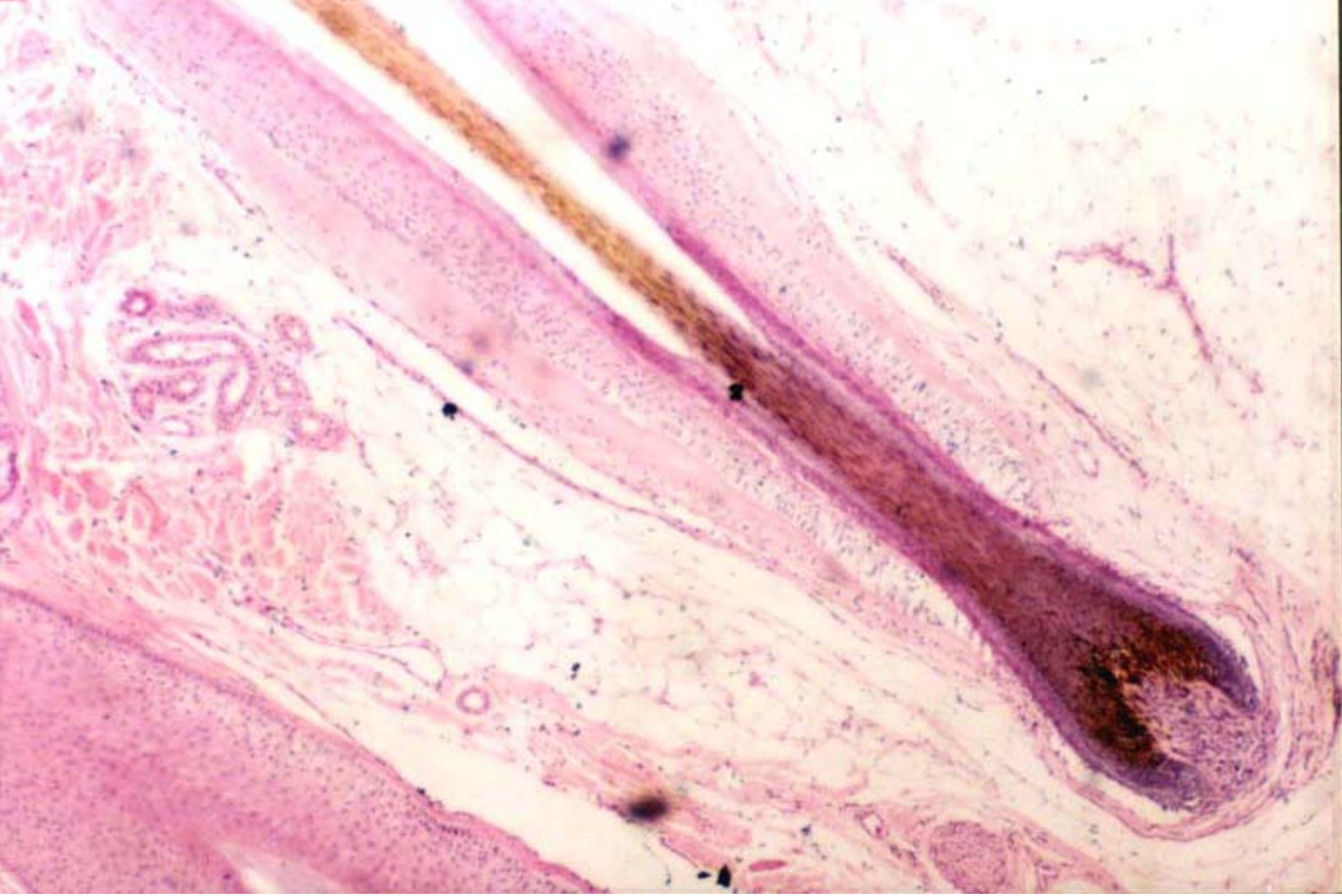
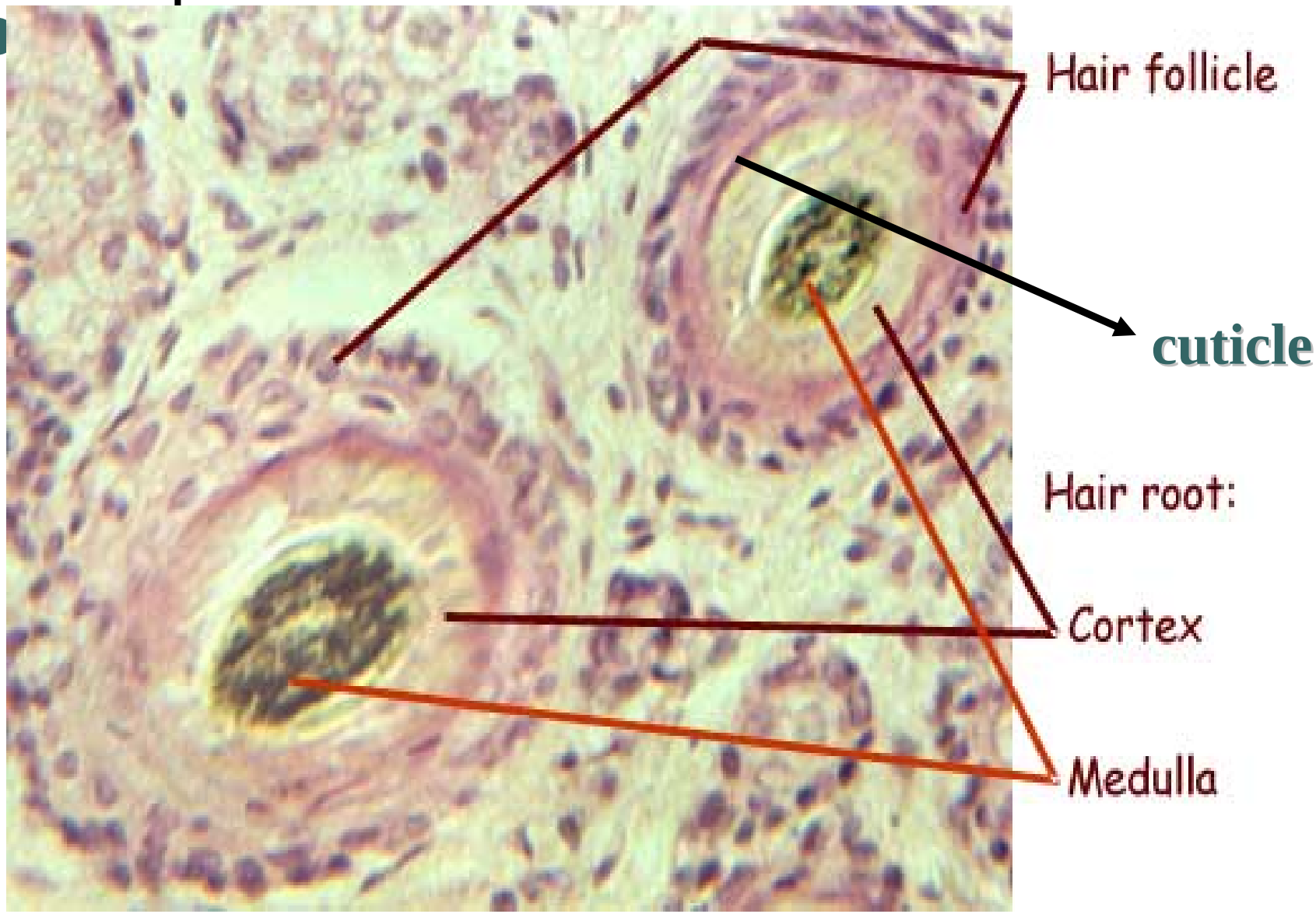


Fig.18 hair root、hair follicle、hair bulb、dermal papilla


Hair follicle
cuticle
Hair root:
Cortex
Medulla

arrector pili muscles :

bundles of smooth muscle cells.

disposed in an oblique direction.

Function:

1. contraction results in the erection of the hair shaft to a more upright position.

2.Contraction causes a depression in the skin where the muscles attach to the dermis. This contraction produces the "gooseflesh" of common parlance.

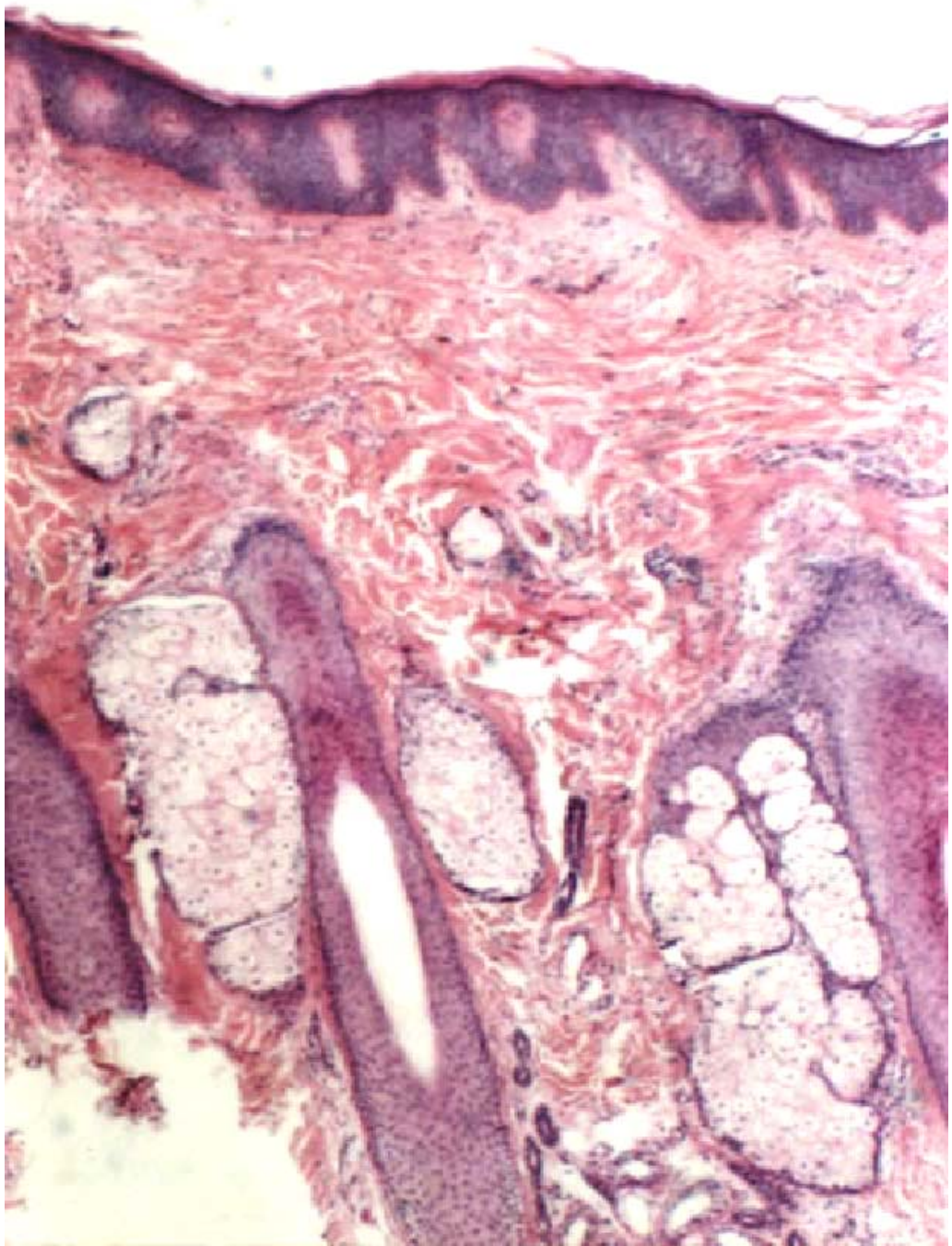


Fig.19 sebaceous gland and hair follicle

2. Sebaceous glands

- **secretory portion:**

  1.a basal layer of undifferentiated flattened epithelial cells at periphery

  2.rounded cells containing increasing amounts of fat droplets in center, Their nuclei gradually shrink,

- **duct: short, open**
- **Function: release sebum, soften skin and kill bacteria.**

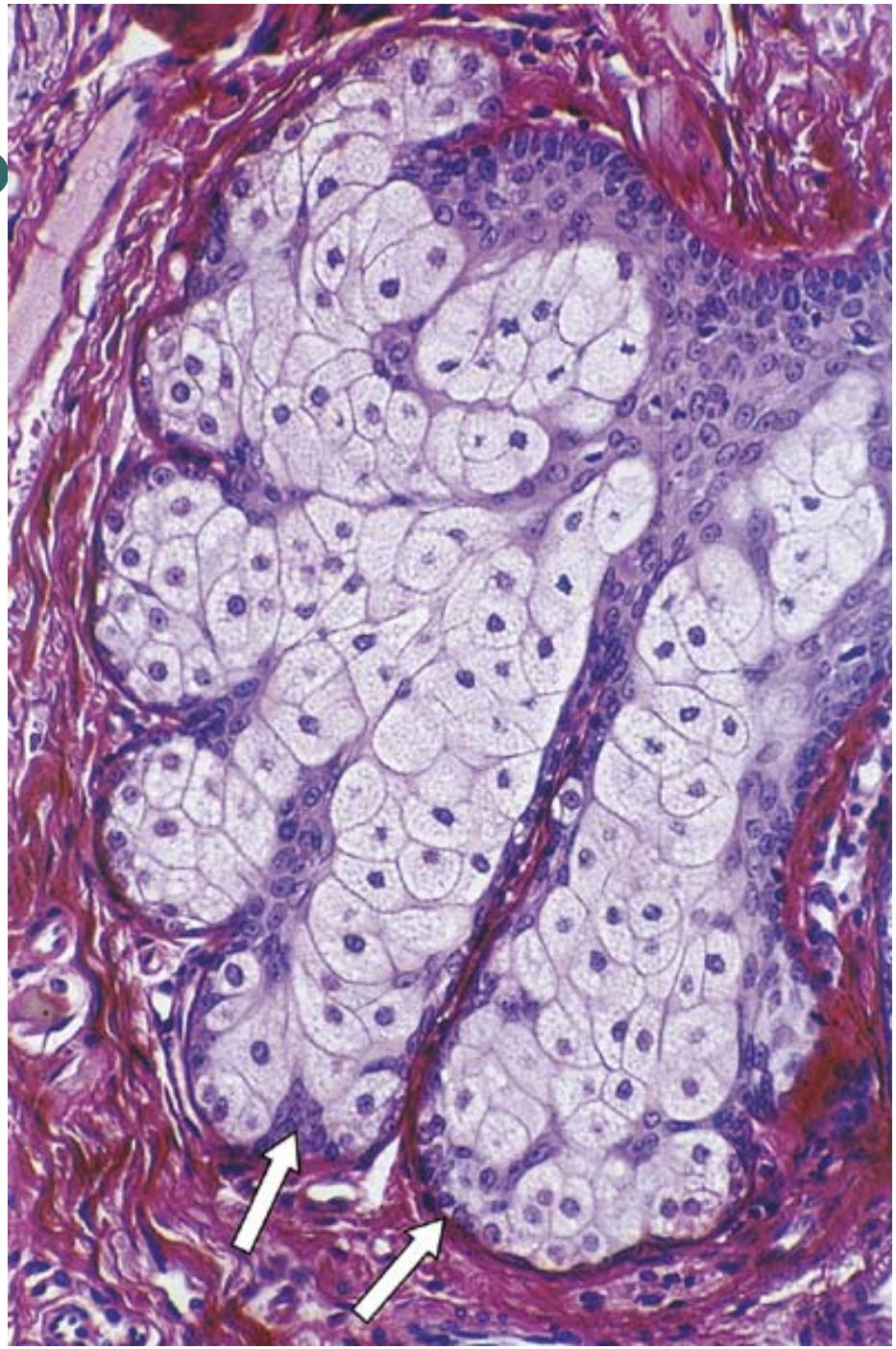


Fig.20 Sebaceous gland. This is a holocrine gland, because its product is secreted with the remnants of a dead cell. Stem cells (arrows) in the base of the gland proliferate to replace the lost cells. Collagen fibers are stained in red. PSP stain. Medium magnification.

3. Sweat glands

are simple, coiled tubular glands.

- **secretory portion : pyramidal cells , pale stain; surrounded by myoepithelial cells**
- **duct: two layers of pale basophilic cuboidal cells**
- **Function:**

  1.the excretion of nitrogenous waste.

  2.thermoregulation by means evaporative cooling.

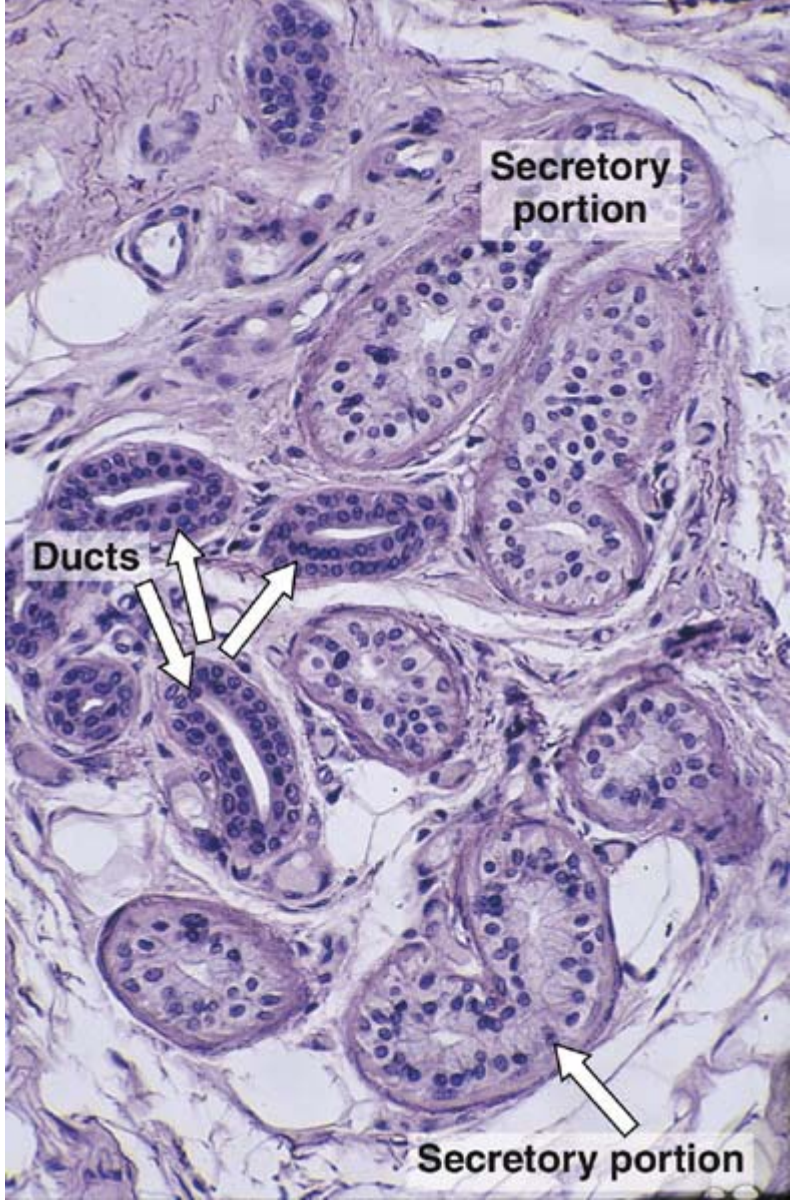


Figure21. Low-magnification photomicrograph of a section of sweat gland. This is a simple coiled tubular gland. H&E stain.

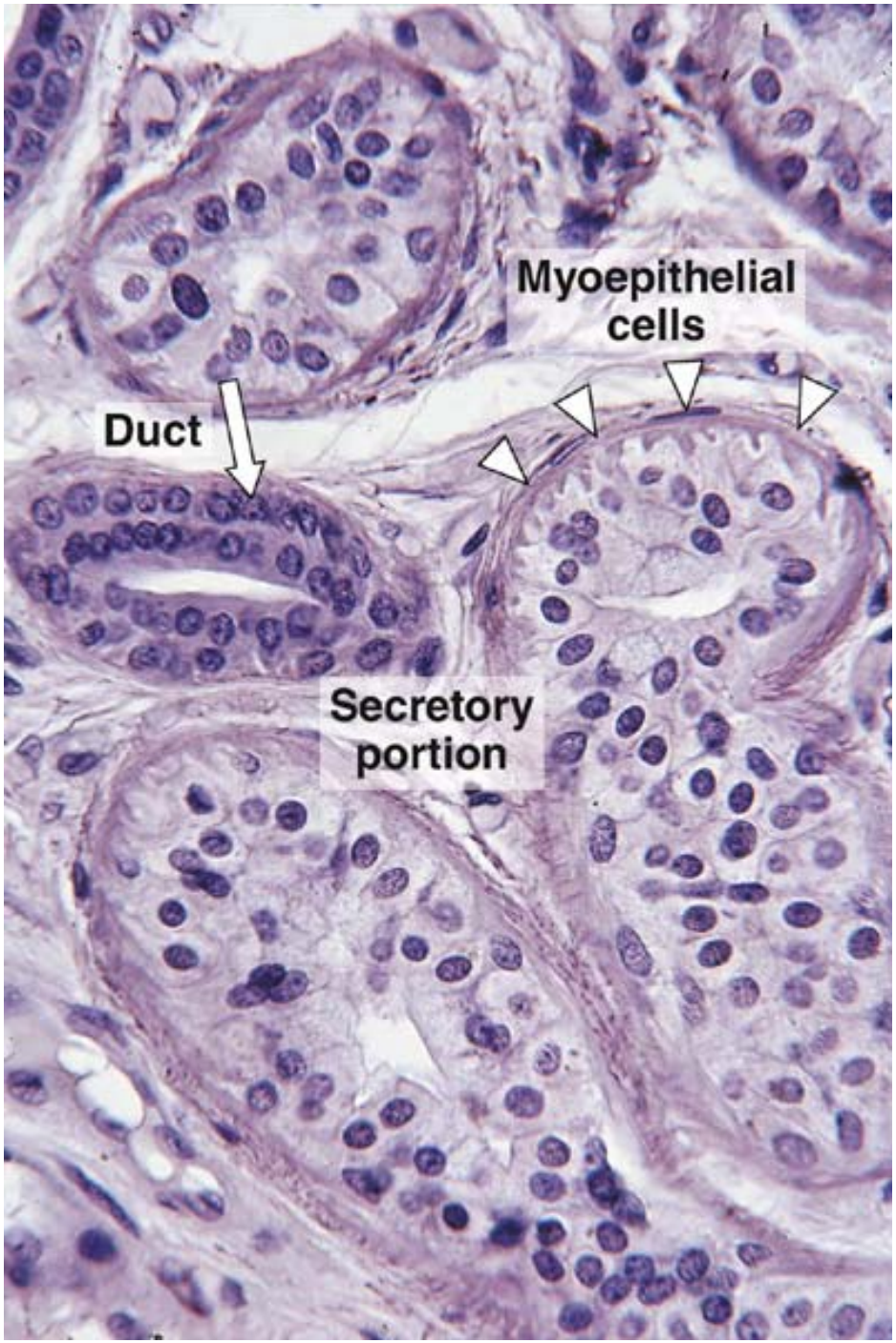
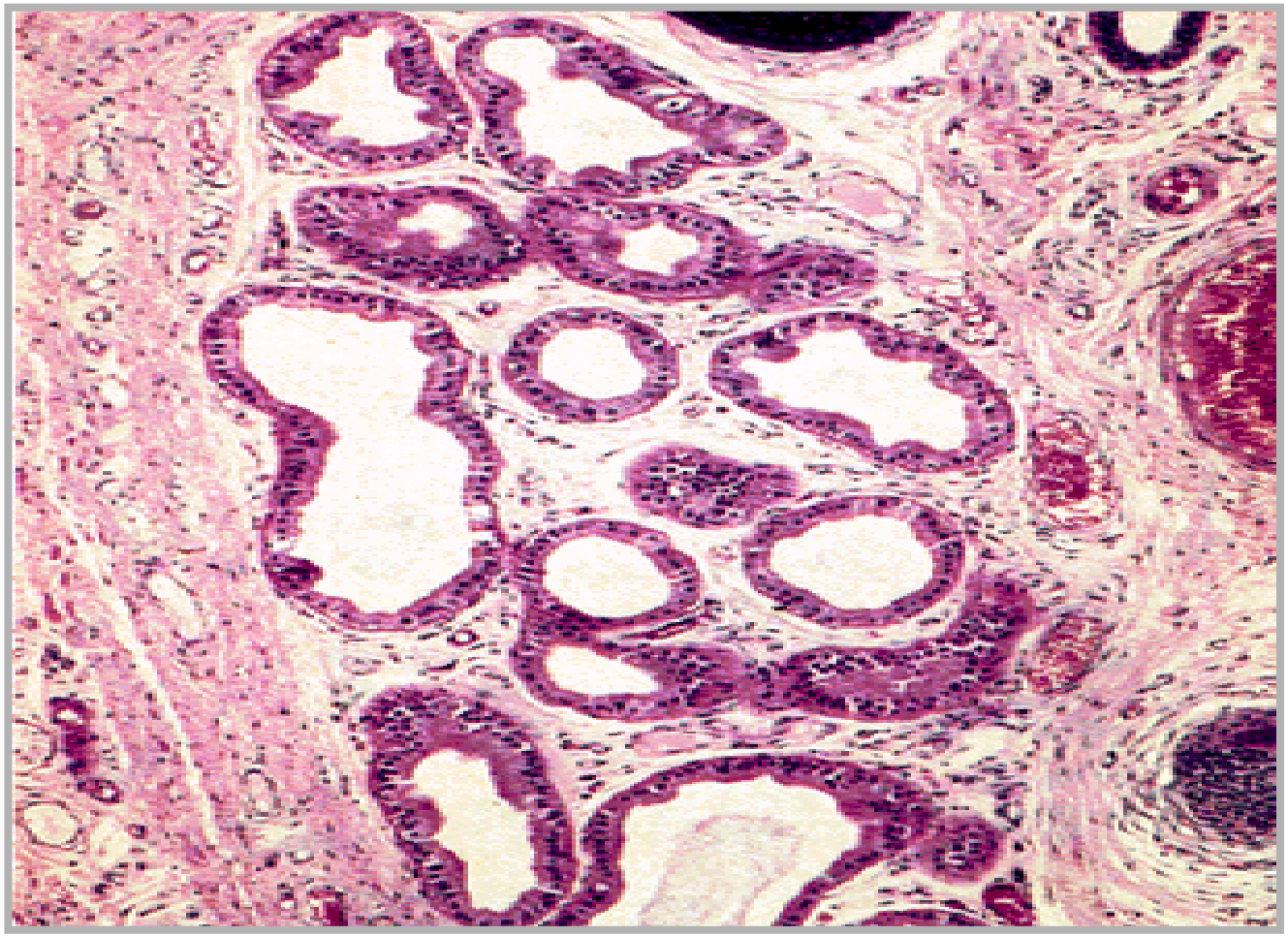


Figure 22. Section of sweat gland. Note the duct lined by stratified cuboidal epithelium. The myoepithelial cells, whose contraction helps to discharge the glandular secretion, surround the secretory portion. H&E stain. Medium magnification.



Summary

- Master the general structure of skin.
- Know sebaceous glands, sweat glands and hair generally.