



Skin

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Skin Lecture Objectives

- Describe the functions of skin.
- Describe the five layers of the epidermis.
- Describe the structure, location and function of the following cell types found in the epidermis: keratinocytes, melanocytes, Langerhans cells, and Merkel cells.
- Describe the structure and contents of the papillary dermis, reticular dermis, and hypodermis.

Skin Lecture Objectives

- Describe the structure and function of sebaceous glands, eccrine sweat glands, and apocrine sweat glands.
- Describe the structure of a hair follicle (including the hair itself) and explain how and why hair can become damaged.

Skin Lecture Outline

- Introduction
- Epidermis
- Dermis

Skin Lecture Outline

- Introduction

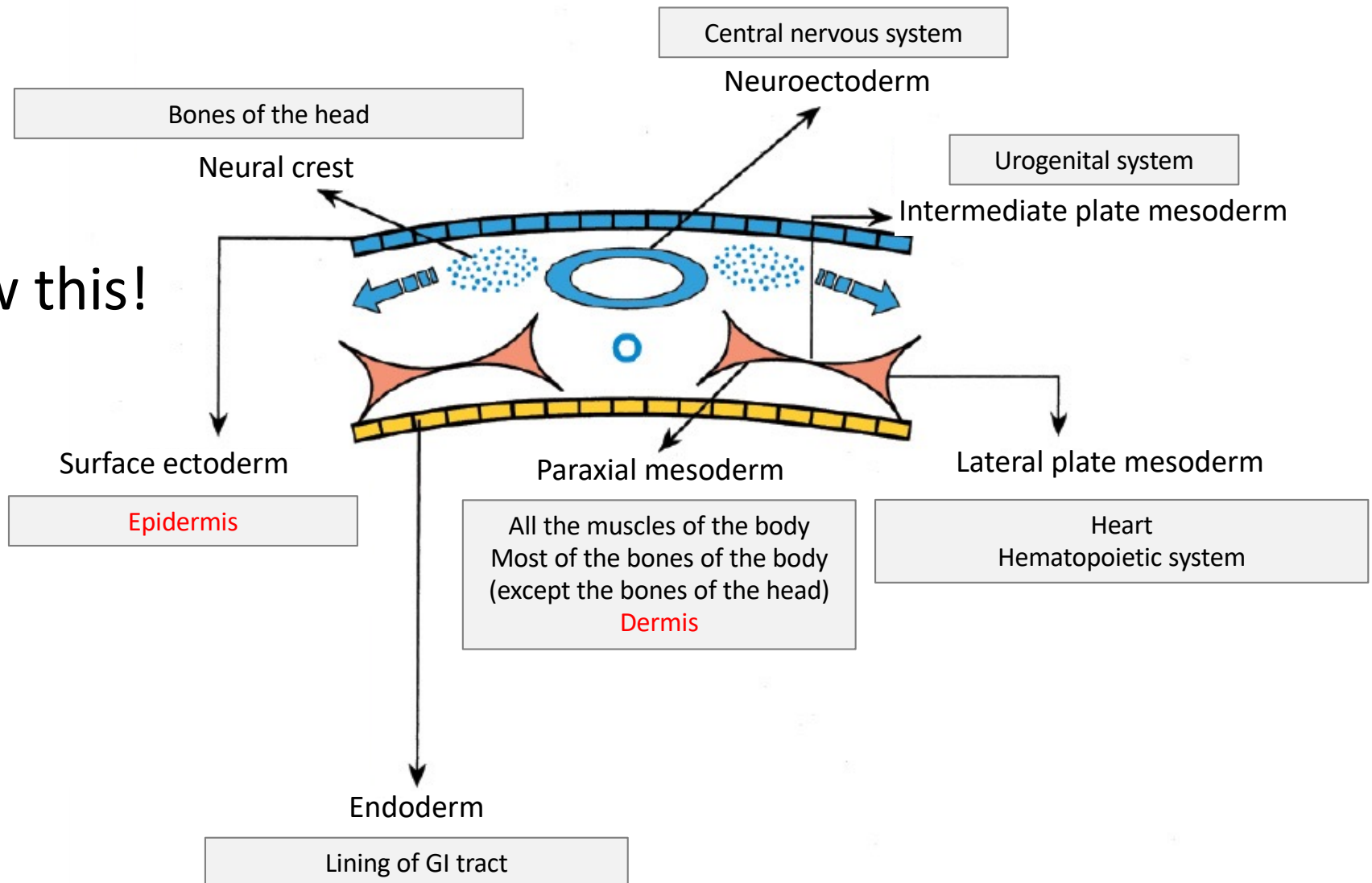
Functions of Skin

- Serves as a barrier protecting against physical and chemical injury and infection.
- Prevents water entry and loss.
- Helps regulate body temperature.
- Receptor organ for sensory stimuli.
- Involved in synthesis of vitamin D₃ from precursors in skin.
- Excretion of substances produced by glands.

Embryologic Origins of Skin

- Epidermis (the surface layer of skin) arises from ectoderm.
- Dermis (the layer of skin just under the epidermis) arises from somites of the paraxial mesoderm.

Know this!



Skin is composed of:

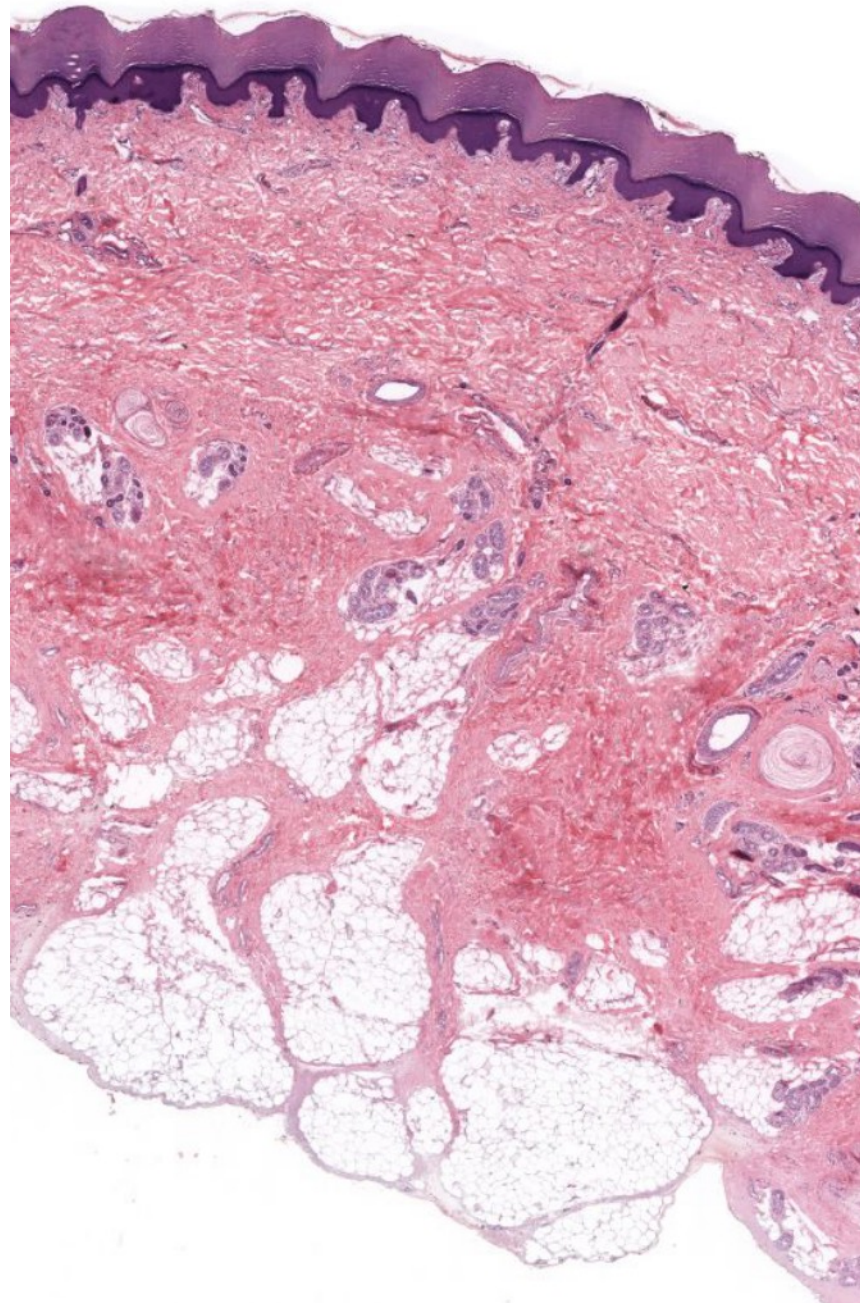
- **Epidermis:** a surface of keratinized stratified squamous epithelium
- **Dermis:** connective tissue
- **Skin appendages:** Merocrine (eccrine) sweat glands, apocrine sweat glands, sebaceous glands, hair follicles, nails.

Skin

Epidermis

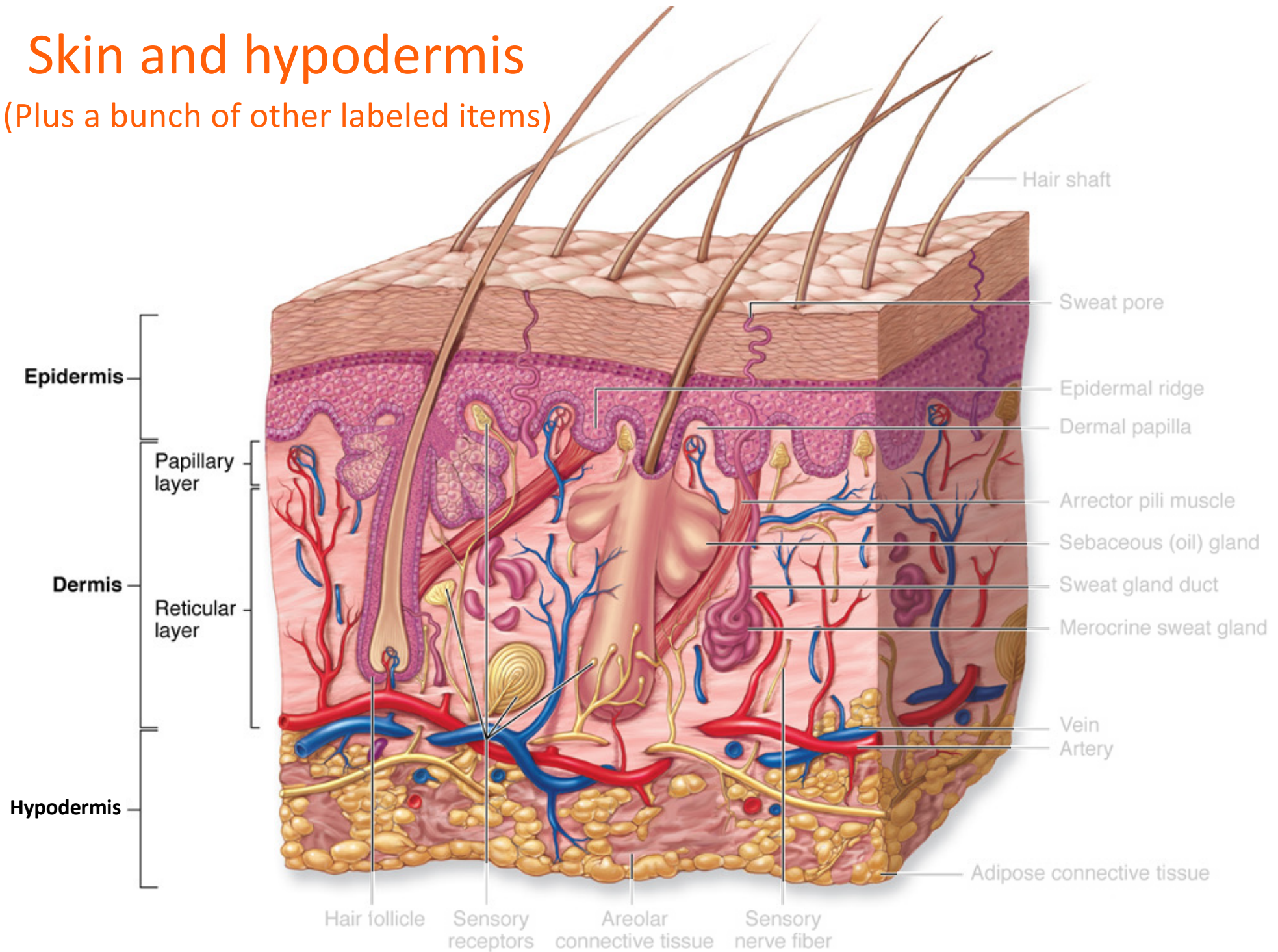
Dermis

Hypodermis
(Not technically
part of the skin)

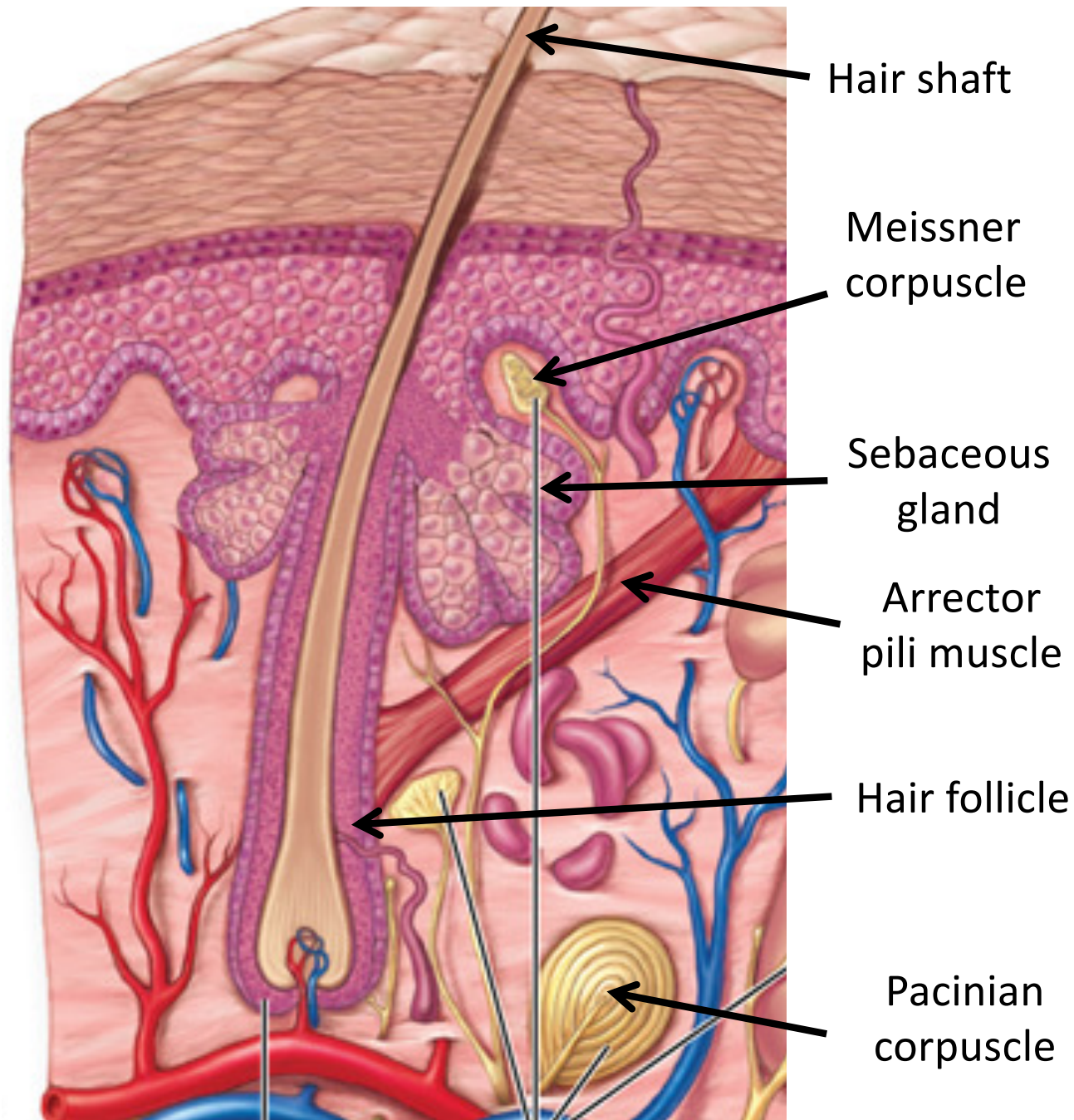


Skin and hypodermis

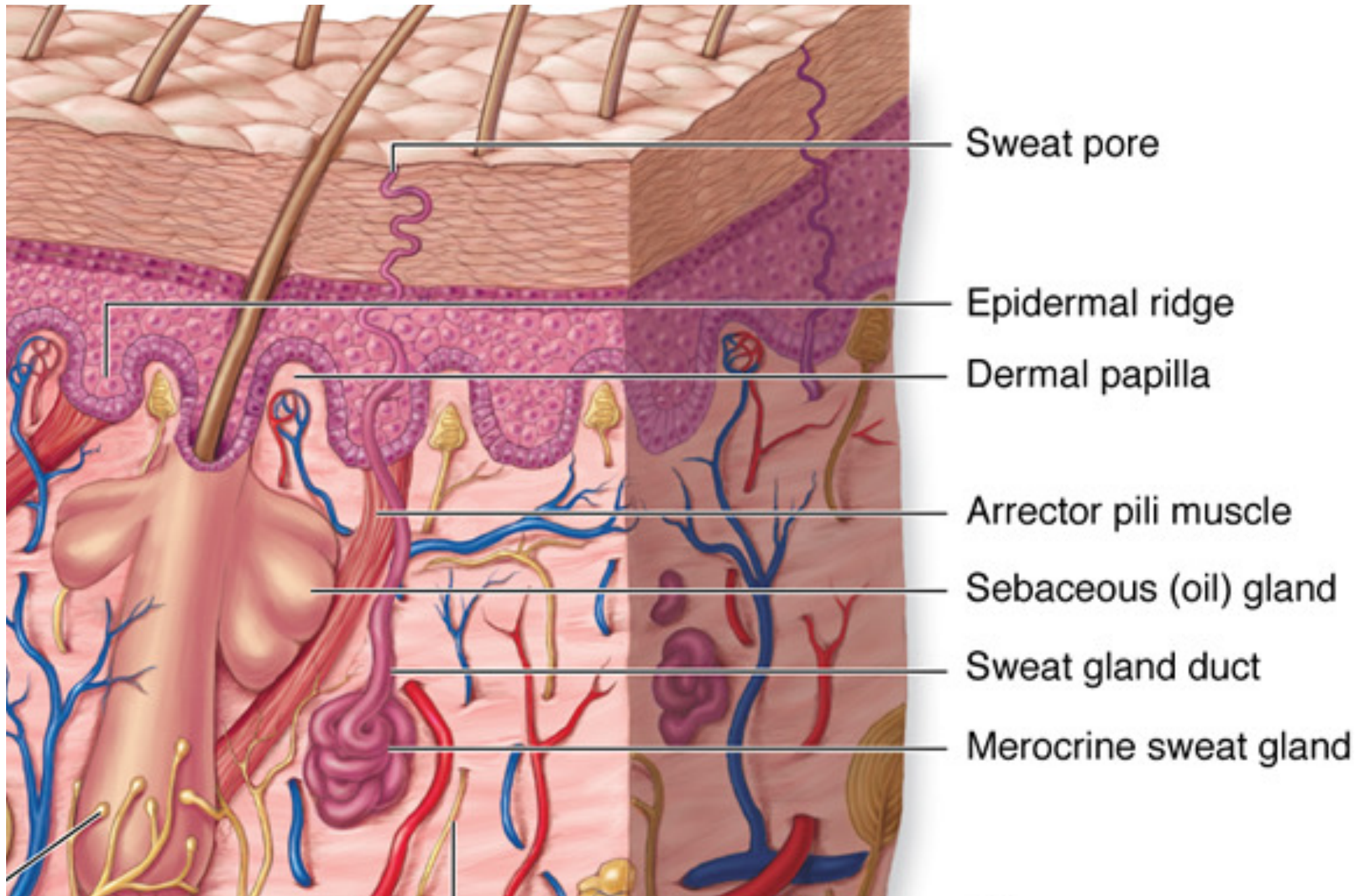
(Plus a bunch of other labeled items)



Skin appendages



More skin appendages



Hypodermis

- Also called subcutaneous tissue
- NOT considered part of the skin!
- Consists of loose connective tissue and adipose tissue
- Function: loosely binds the skin to underlying structures

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- Introduction
- Epidermis
 - Layers of the epidermis
 - Cells of the epidermis

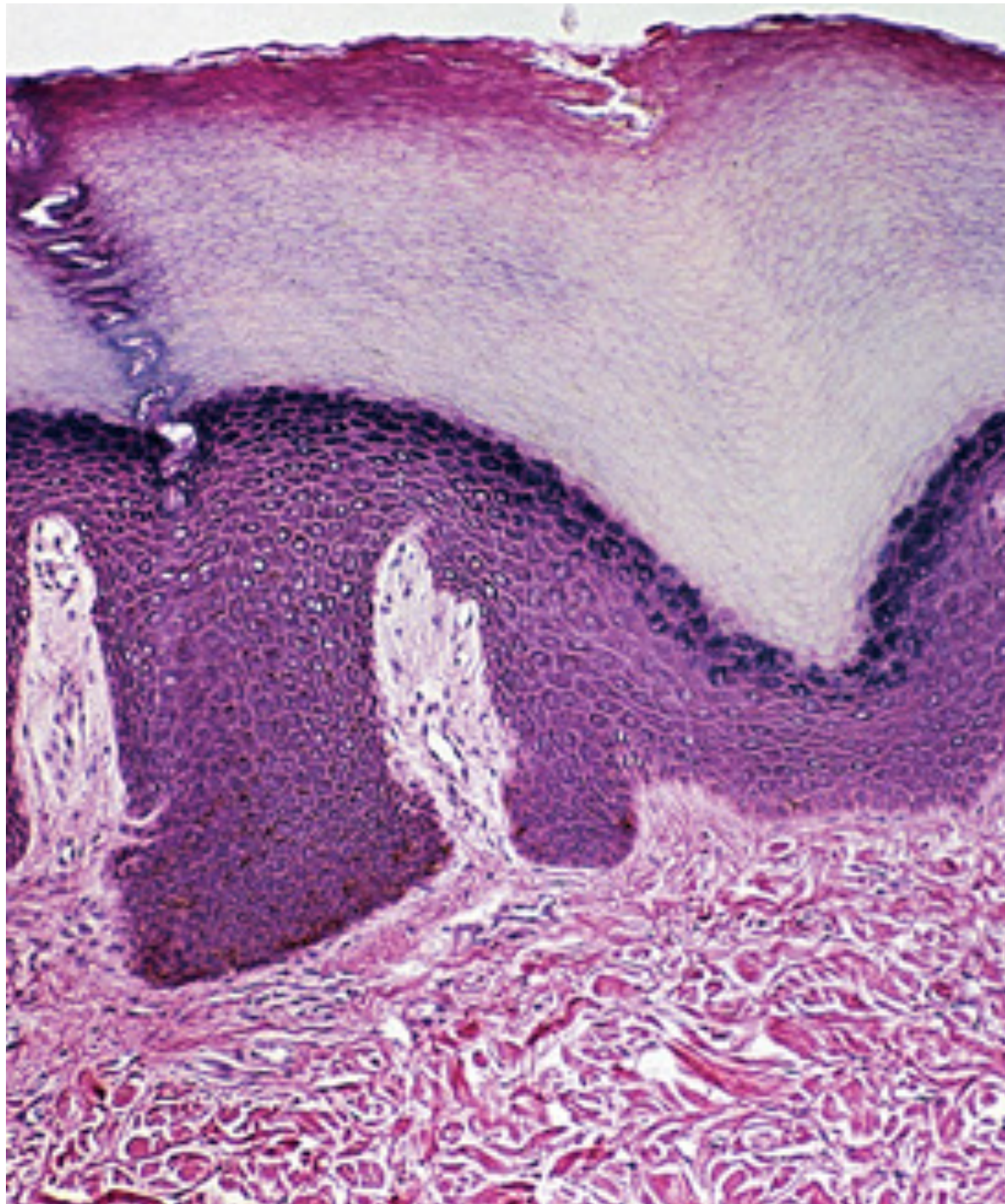
Skin Lecture Outline

- Introduction
- Epidermis
 - Layers of the epidermis

The Five Layers of the Epidermis

- Stratum corneum
- Stratum lucidum
- Stratum granulosum
- Stratum spinosum
- Stratum basale

Five layers of epidermis



← corneum

← lucidum

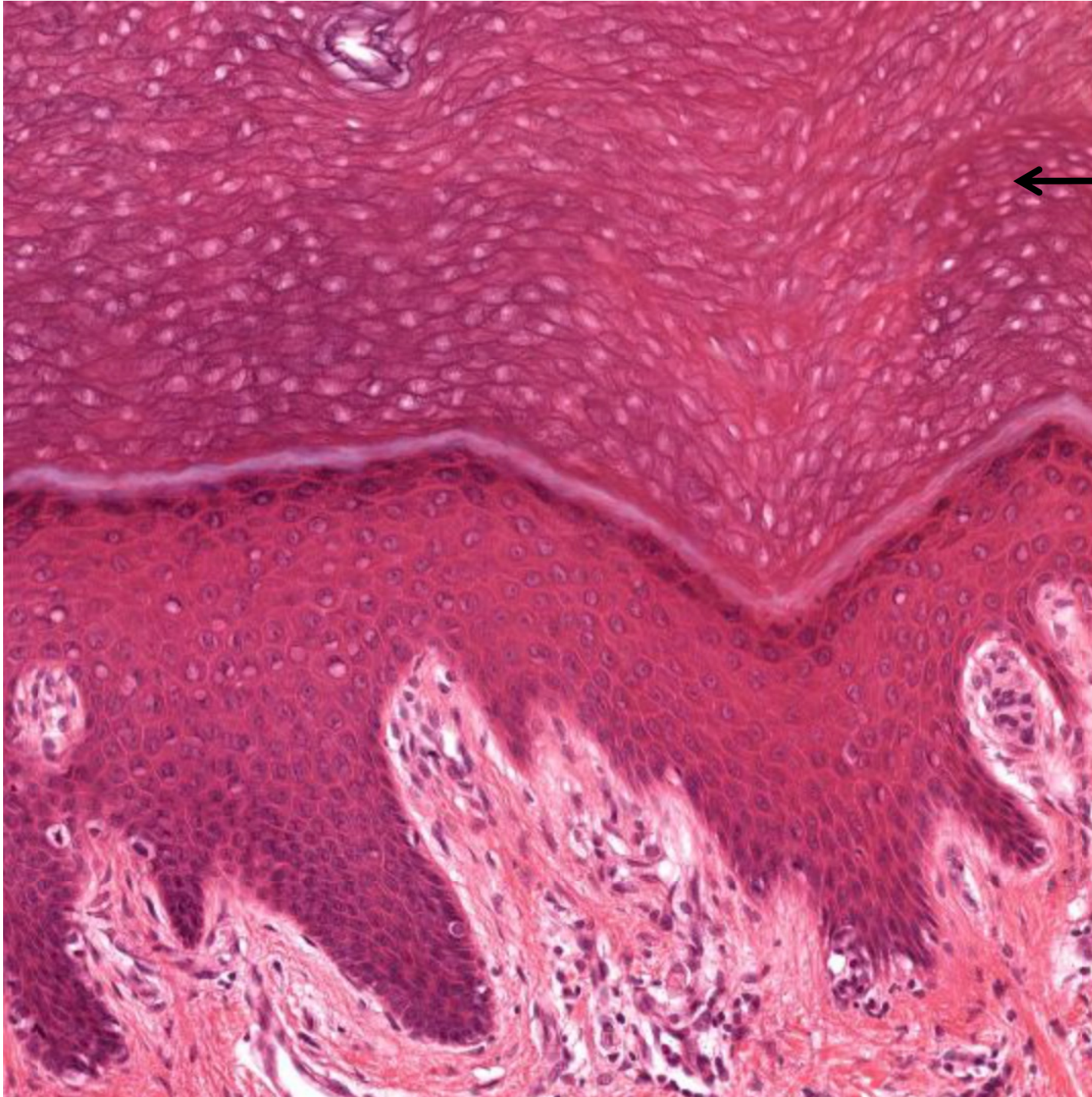
← granulosum

← spinosum

← basale

Stratum Corneum

- Most superficial layer.
- Consists of flat, dead cells – basically keratin scales - that are continuously shed.
- Keratin is composed of cytokeratin filaments (long intertwined protein chains) and keratohyalin (a substance that helps hold cytokeratin filaments together).

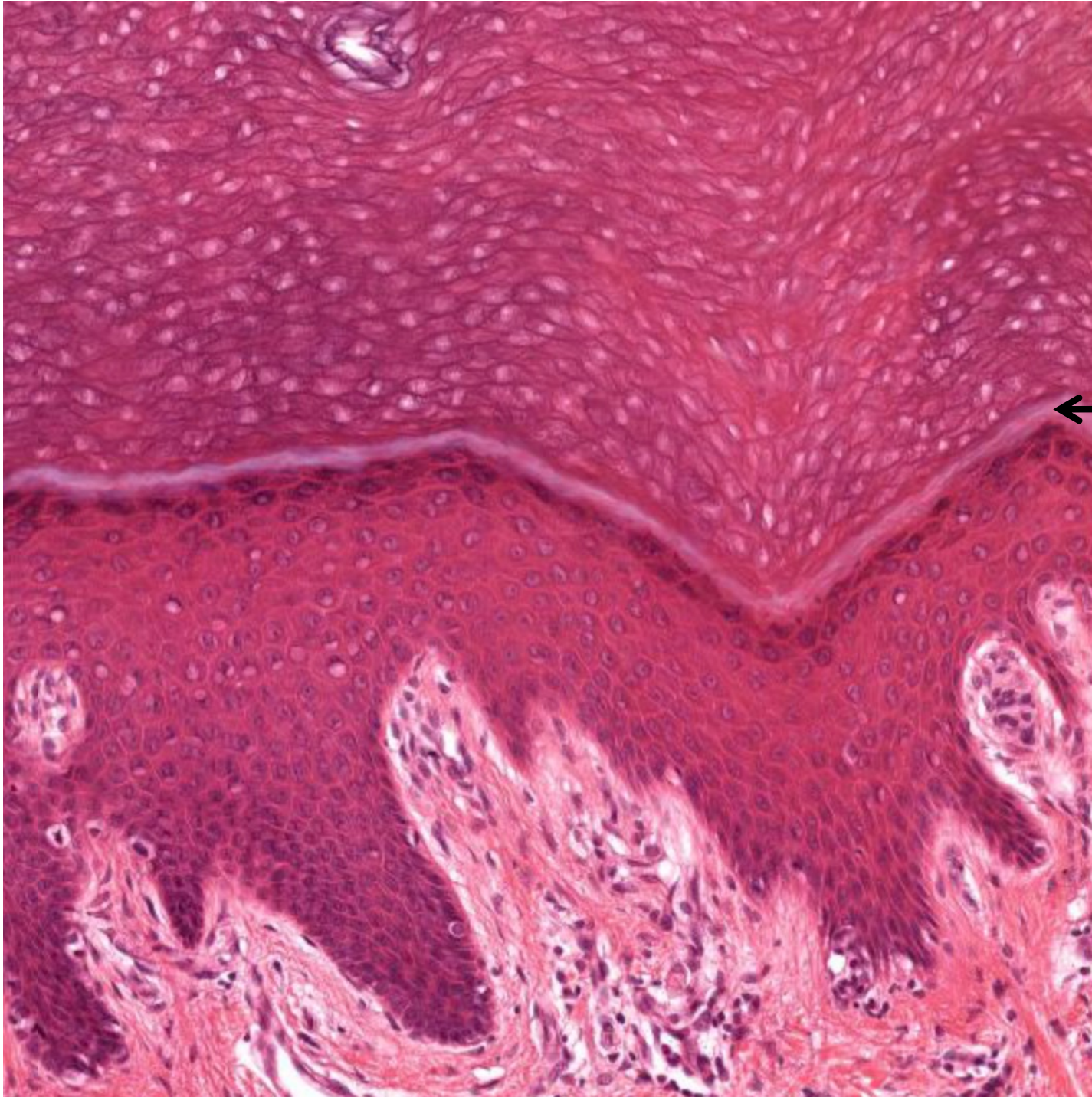


Stratum
corneum



Stratum Lucidum

- Below stratum corneum.
- Keratinocytes have lost nuclei and organelles and appear as homogeneous, translucent cells.
- Cells contain keratin.
- Present only in very thick skin.

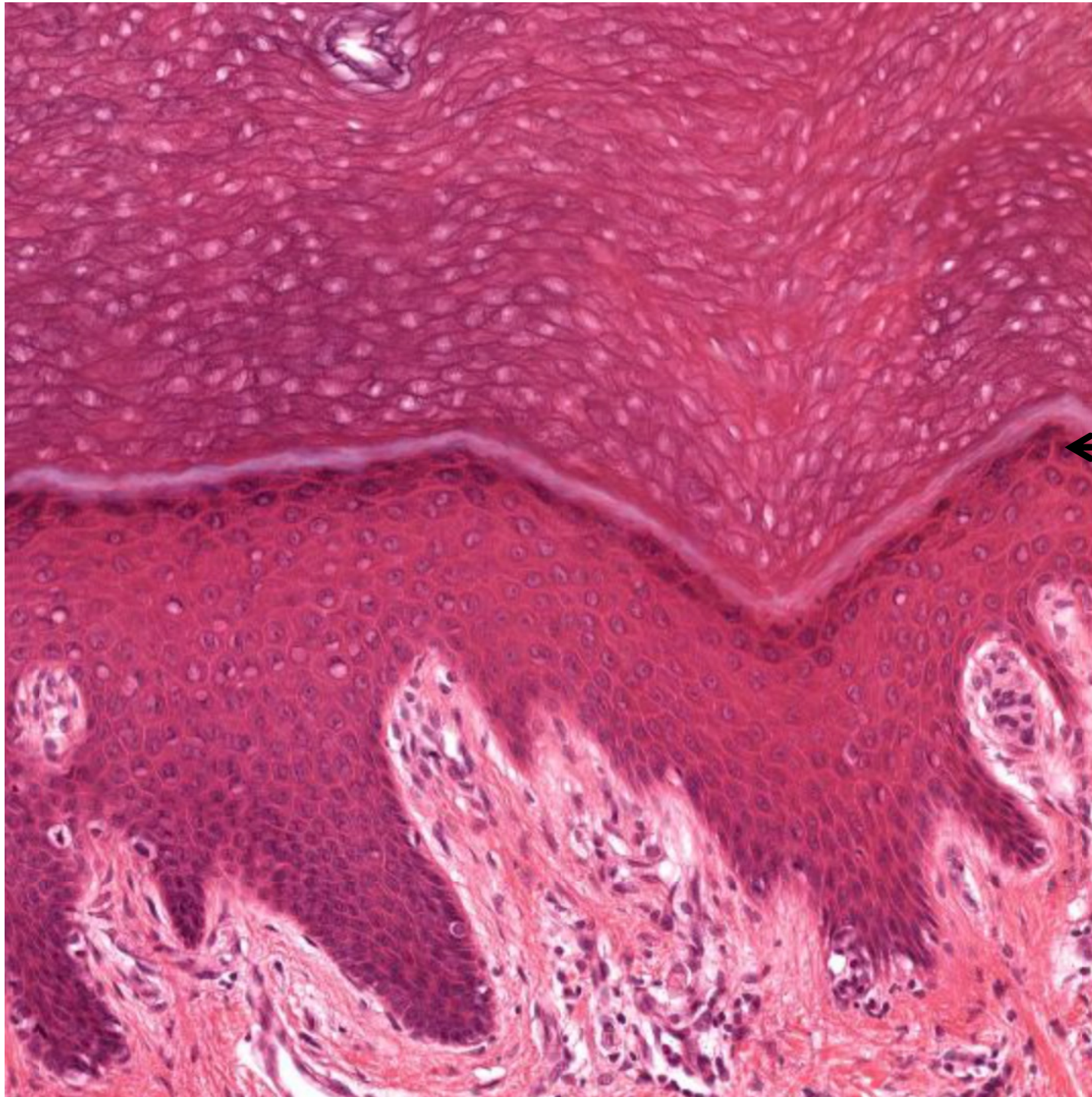


Stratum
lucidum



Stratum Granulosum

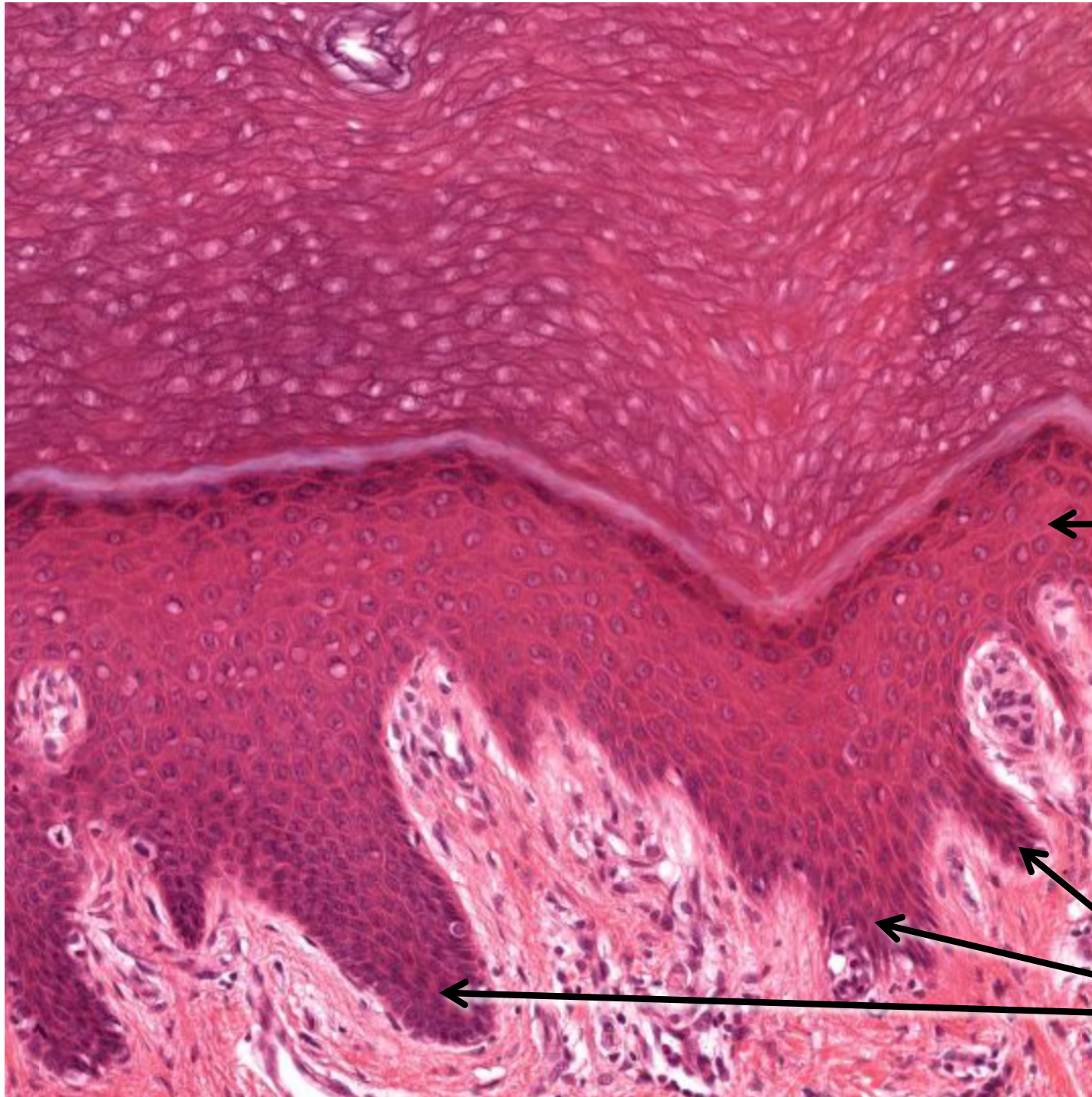
- Below stratum lucidum (in thick skin) or stratum corneum (in thin skin).
- Cells contain two types of granules.
- Keratohyaline granules: large, basophilic; bind cytokeratin molecules together to make keratin.
- Lamellar granules: small; contain lipid that is released into intercellular spaces (acts as a cement to prevent penetration of water and other materials).



Stratum
granulosum

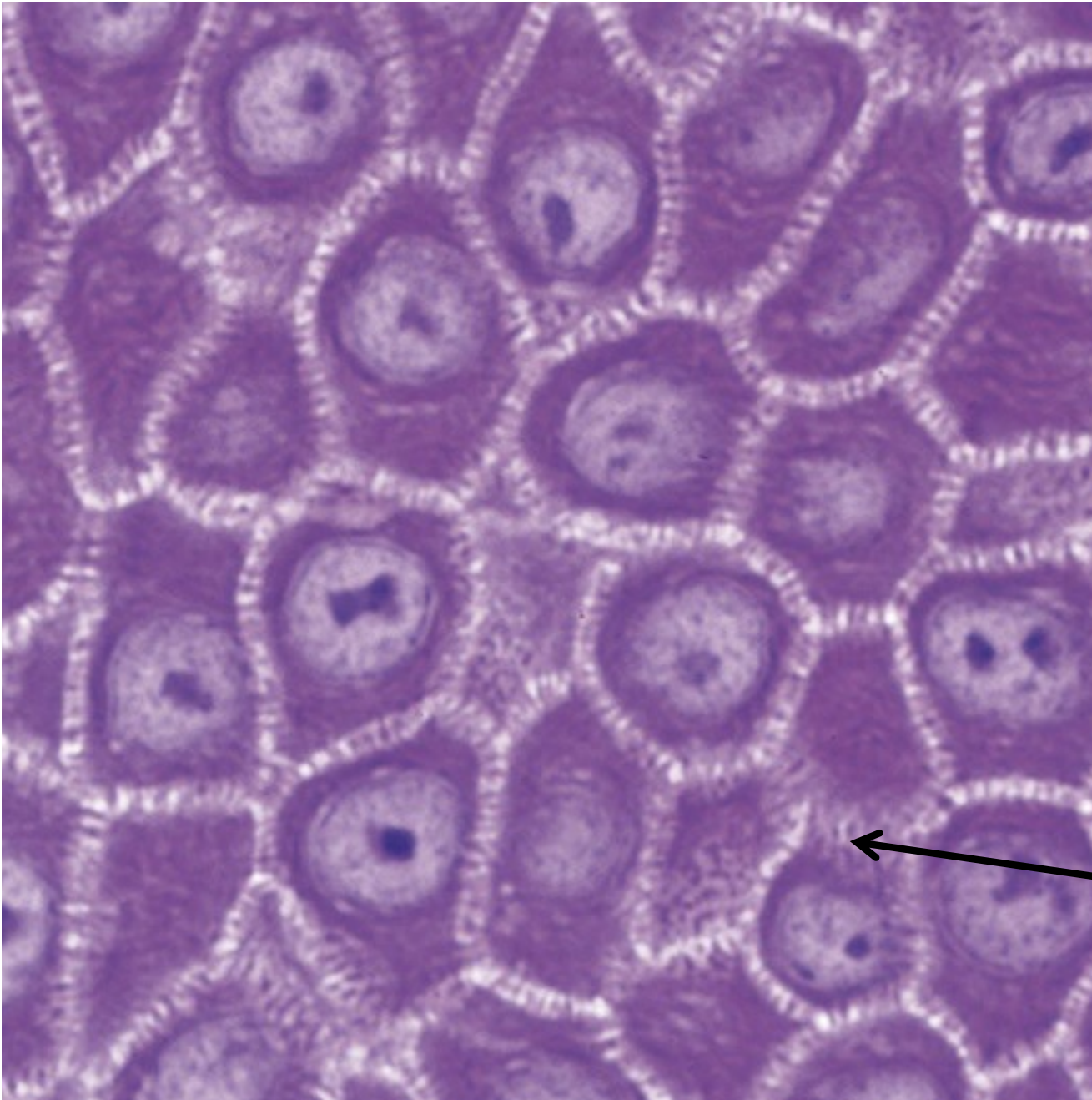
Stratum Spinosum

- Thick layer beneath stratum granulosum.
- Consists almost entirely of keratinocytes (with occasional Langerhans cells).
- Spot desmosomes connect cells.
- Cells shrink during processing but remain attached at desmosomes, and look “spiny” or prickly.
- Along with stratum basale, form “rete pegs” which dip down into the dermis.



Stratum
spinosum

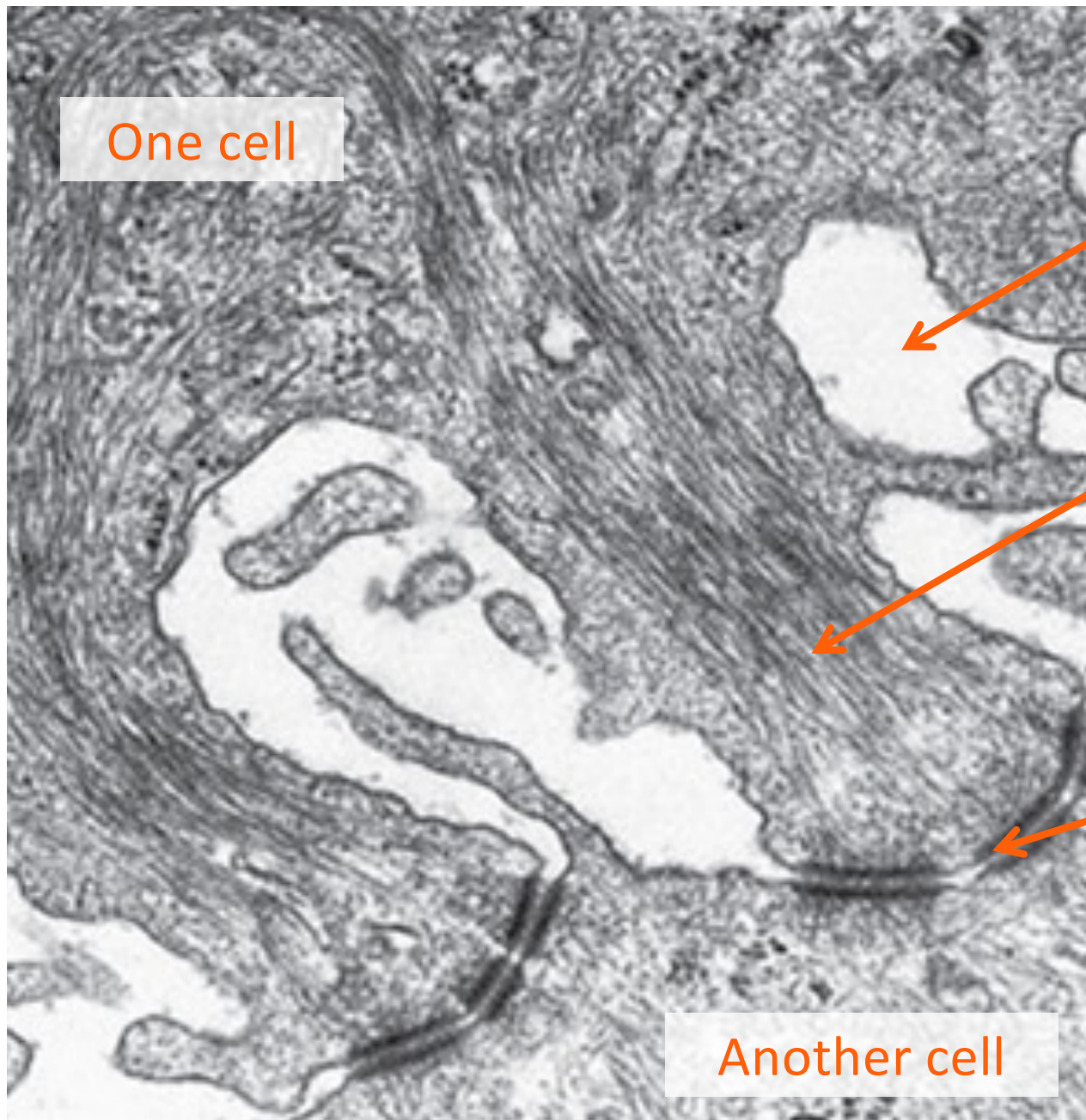
Rete pegs



Keratinocytes in
stratum
spinosum are
attached by spot
desmosomes.

Cells retract
during fixation
and appear to be
connected by
spines.





Artifactual
spaces

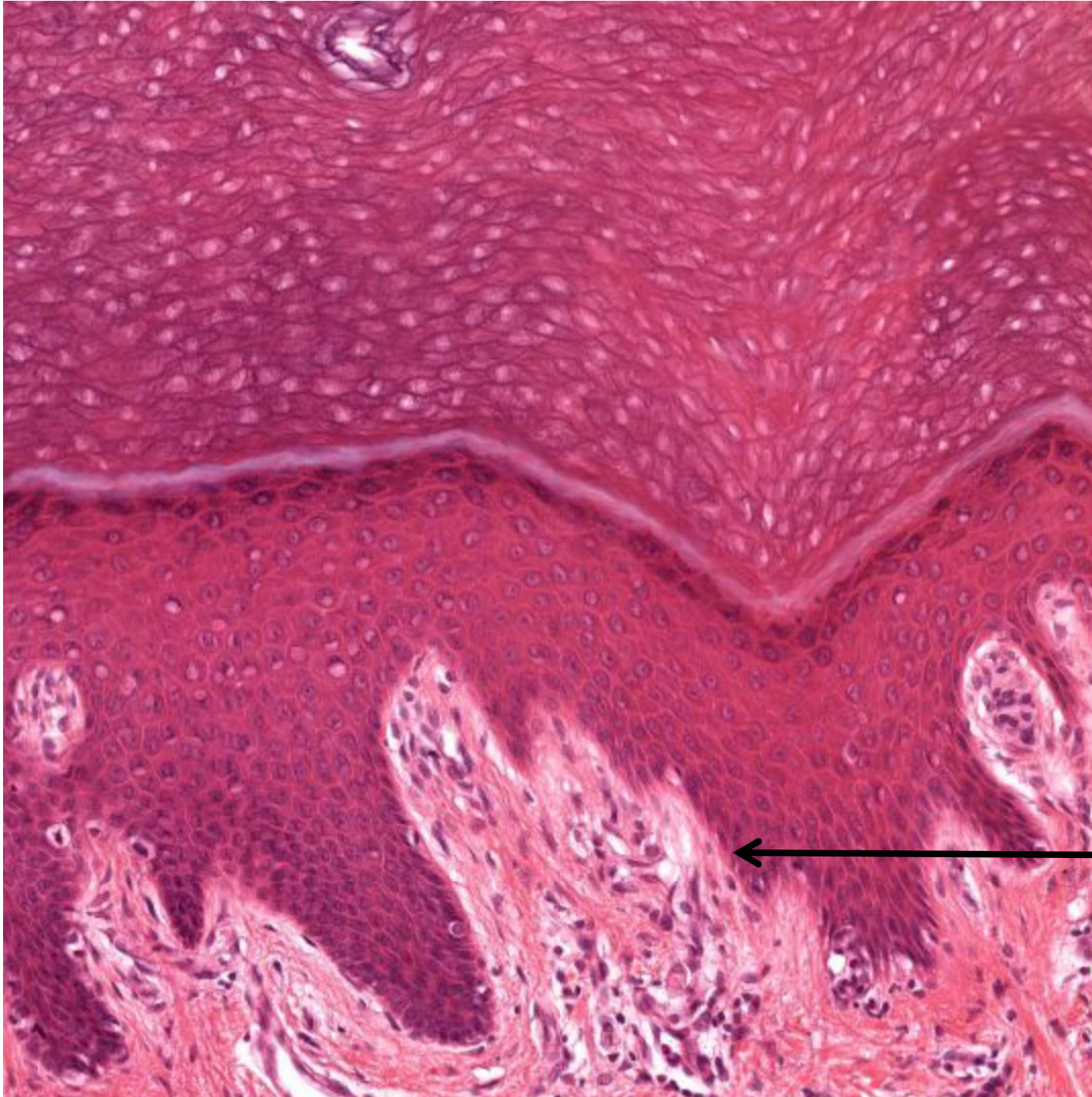
Cytokeratin
filaments

Spot
desmosomes

Stratum spinosum cells

Stratum Basale

- Bottom layer; below stratum spinosum.
- One layer thick. Consists mostly of keratinocytes.
- Keratinocytes are attached to each other by spot desmosomes and to basal lamina by hemidesmosomes.
- Also present are stem cells (which renew epidermis every 15-30 days), melanocytes and Merkel cells.



Stratum
basale



Thick vs. Thin Skin

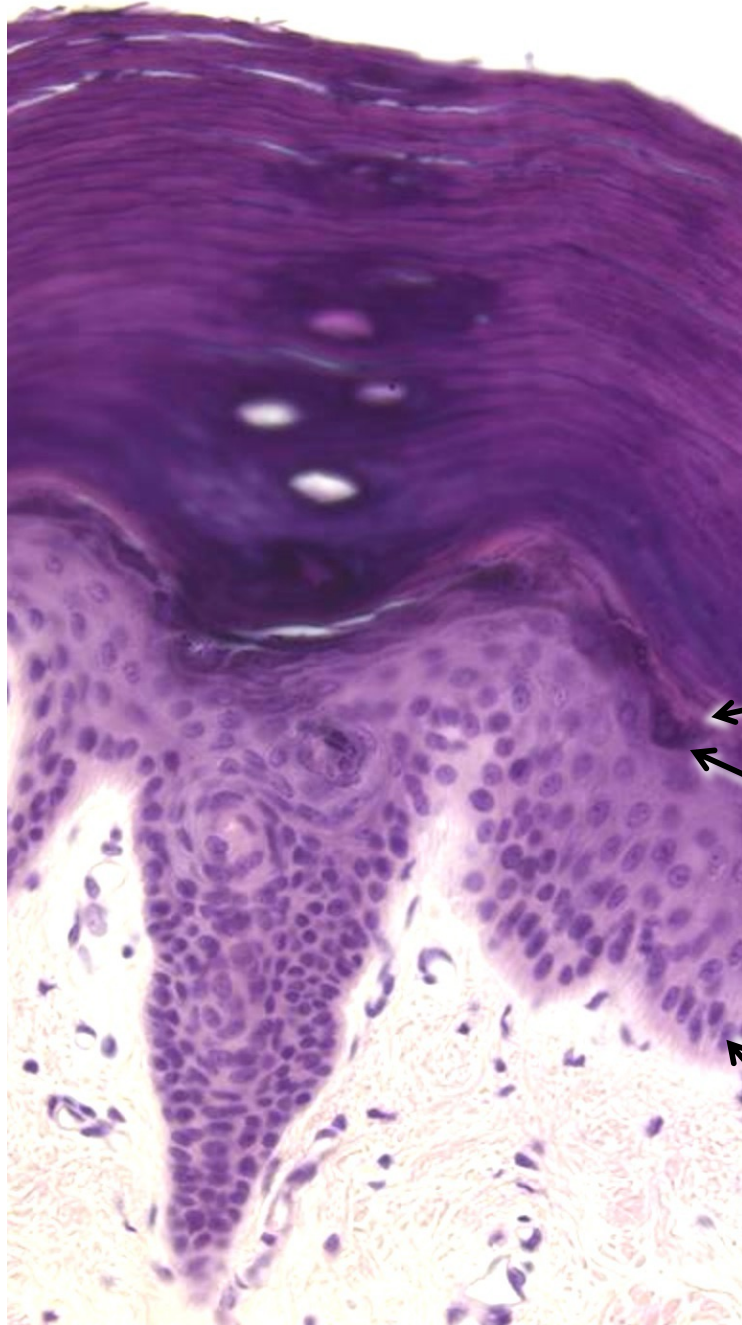
Thick skin is present on palms and soles

- Epidermis has five cell layers + thick keratin layer.
- Dermis does NOT contain hair follicles or sebaceous glands.

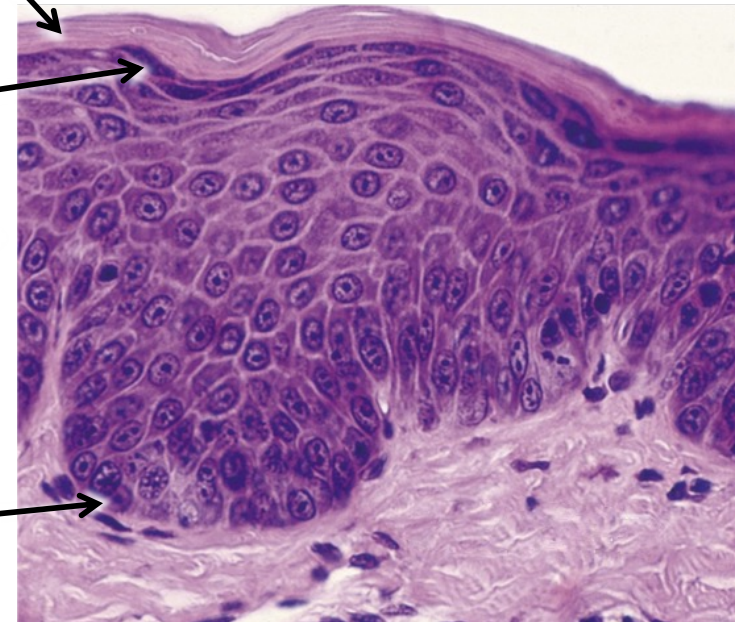
Thin skin is found everywhere else.

- Epidermis has four cell layers (no stratum lucidum), and the stratum corneum is much thinner.
- Dermis usually contains hair follicles and sebaceous glands.

Thick skin



Thin skin



← corneum

← lucidum

← granulosum

← spinosum →

← basale

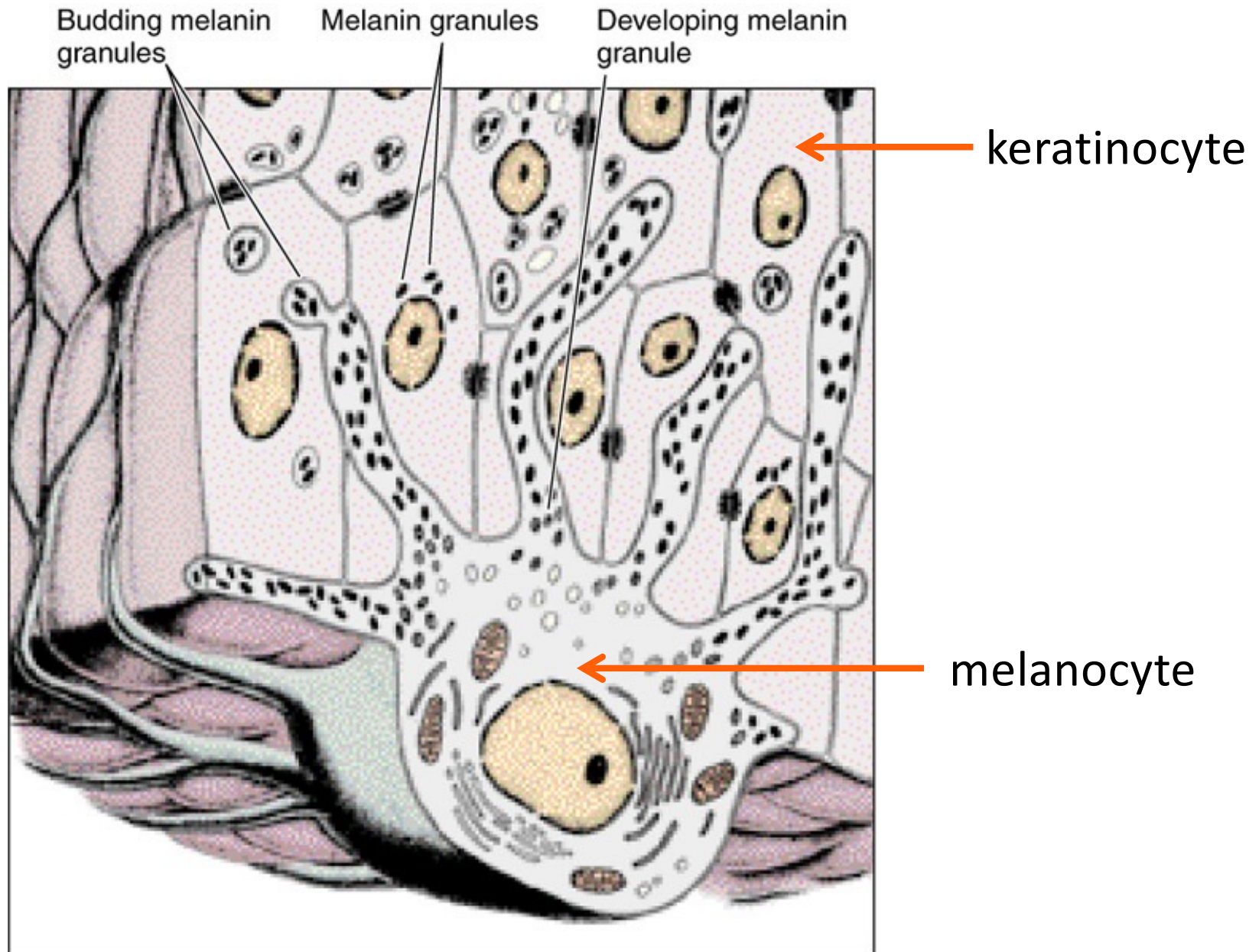
Skin Lecture Outline

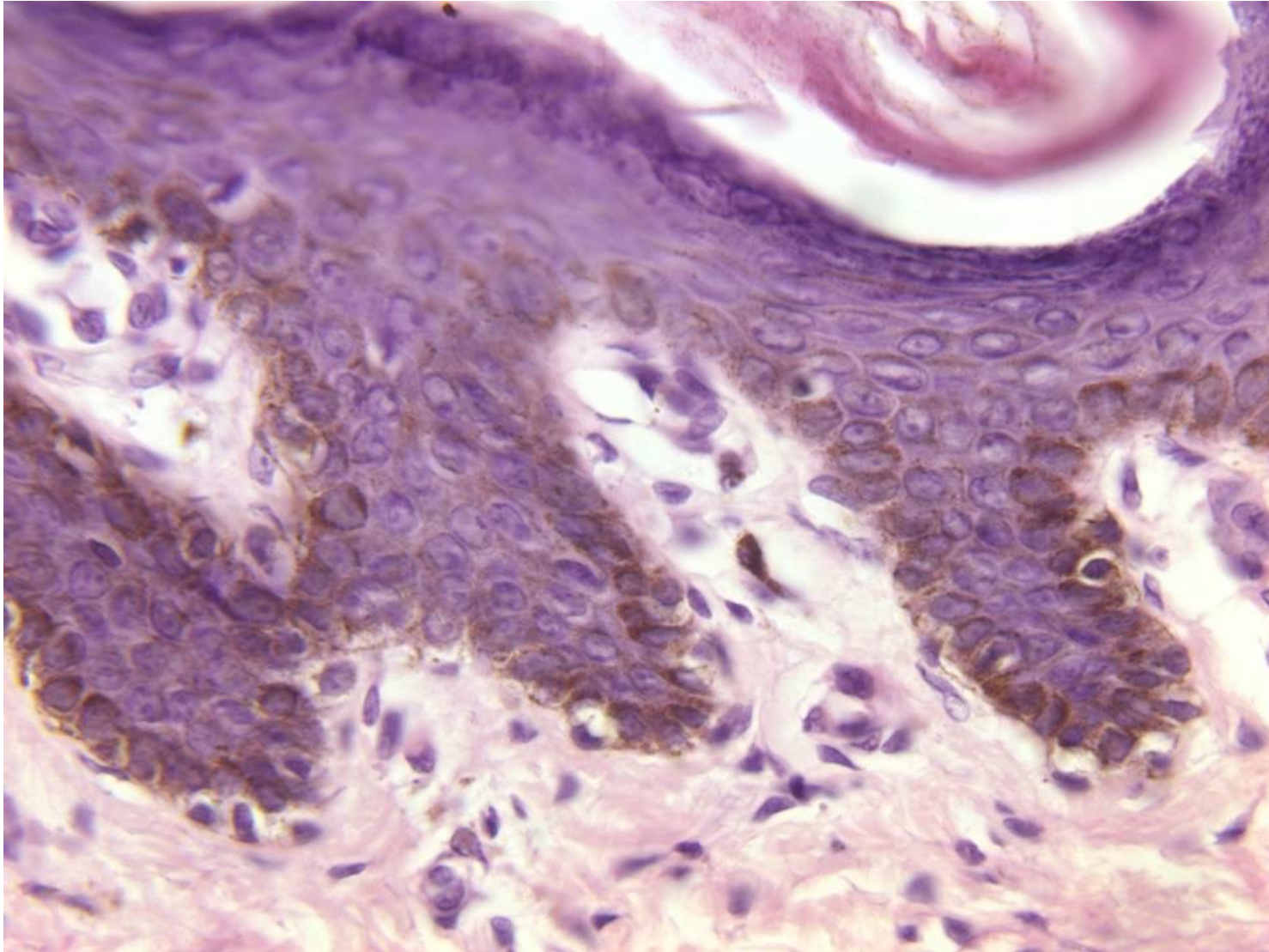
- Introduction
- Epidermis
 - Layers of the epidermis
 - Cells of the epidermis

Five Types of Cells in Epidermis

- **Keratinocytes** make up most of the epidermis. Most are stratified squamous epithelial cells (basal layer = cuboidal cells). Produce intermediate filaments called cytokeratins.
- **Langerhans cells** (in stratum spinosum) process antigen.
- **Melanocytes** (in stratum basale) produce melanin.
- **Merkel cells** (in stratum basale) are involved in touch sensation.
- **Stem cells** (in stratum basale) produce new keratinocytes.

More about melanocytes





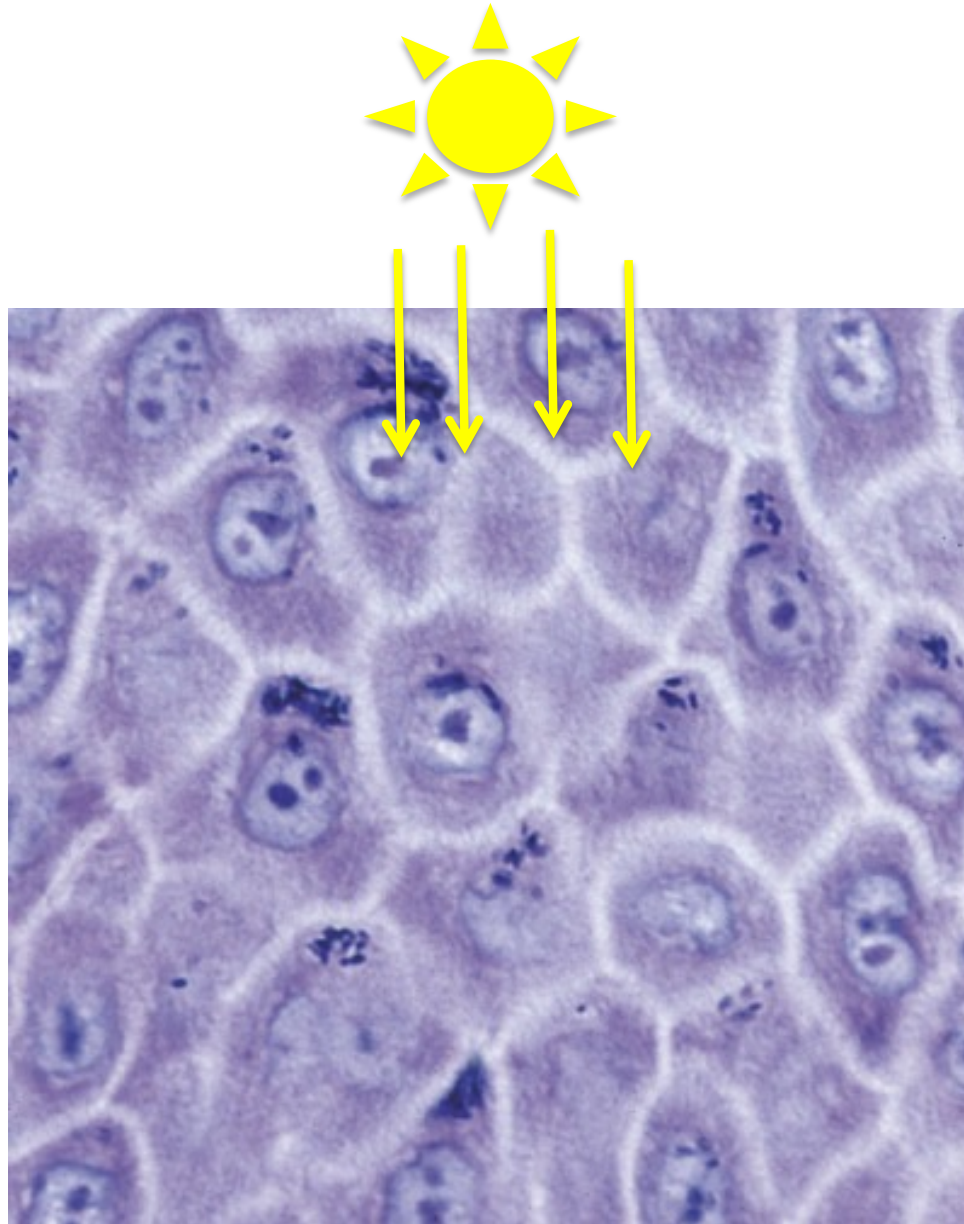
More melanin is present in keratinocytes
than in melanocytes!

Melanin and skin color

The number of melanocytes per unit area varies from one part of the body to another but is independent of race.

Differences in skin color are due to differing numbers of melanin granules in melanocytes!





Melanin granules accumulate above keratinocyte nuclei to protect genetic material from UV damage. Smart!

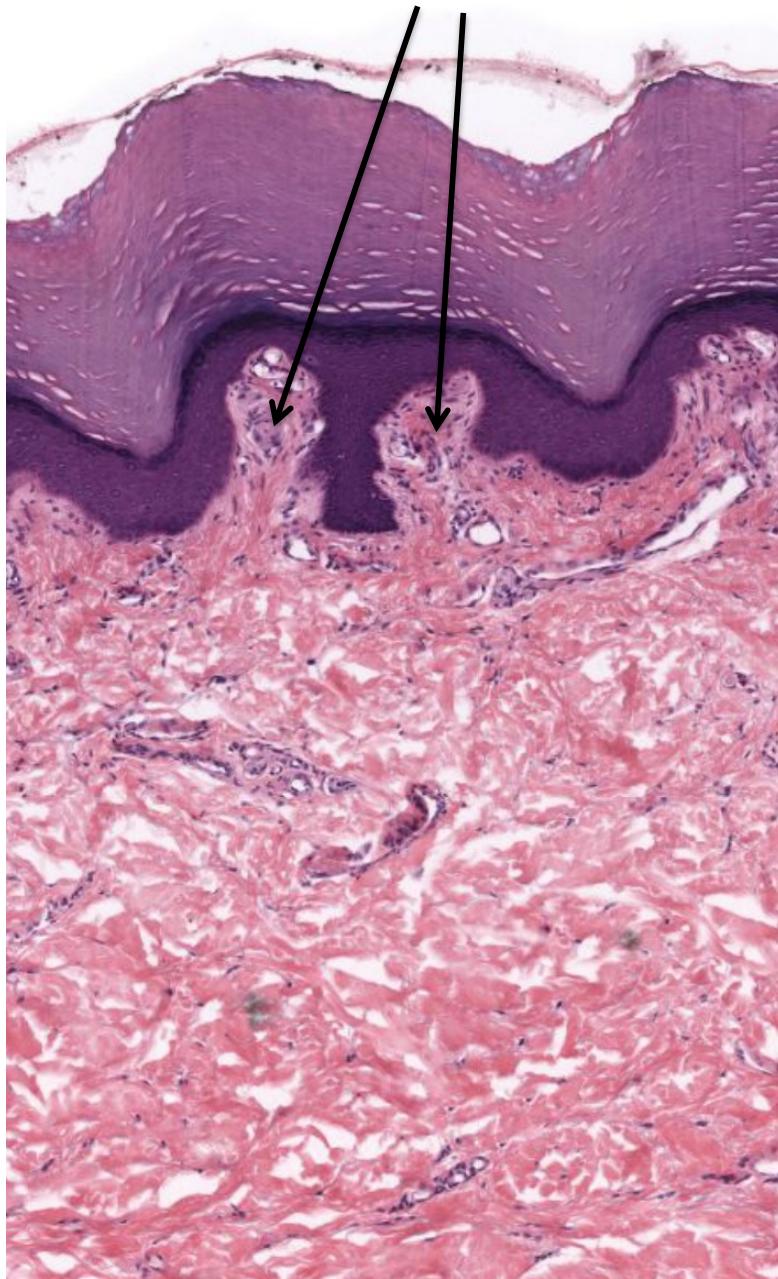
Skin Lecture Outline

- Introduction
- Epidermis
- Dermis
 - Basic structure
 - Specialized receptors and structures

Skin Lecture Outline

- Introduction
- Epidermis
- Dermis
 - Basic structure

Dermal papillae

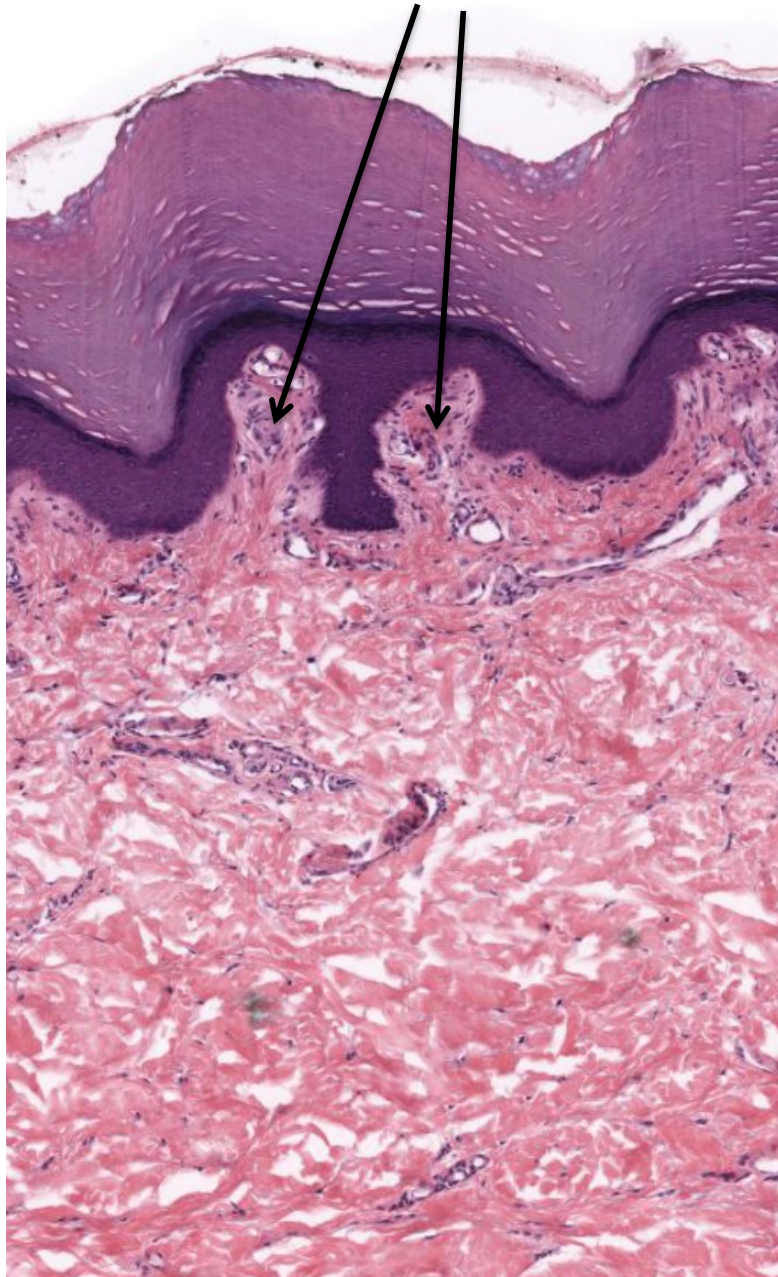


Papillary
dermis

Reticular
dermis

Loose connective
tissue with lots of
capillary loops and
thin elastic fibers

Dermal papillae



Papillary
dermis

Reticular
dermis

Dense connective
tissue with thick
collagen bundles and
elastic fibers, larger
blood vessels and
glands.

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 - Basic structure
 - Specialized receptors and structures

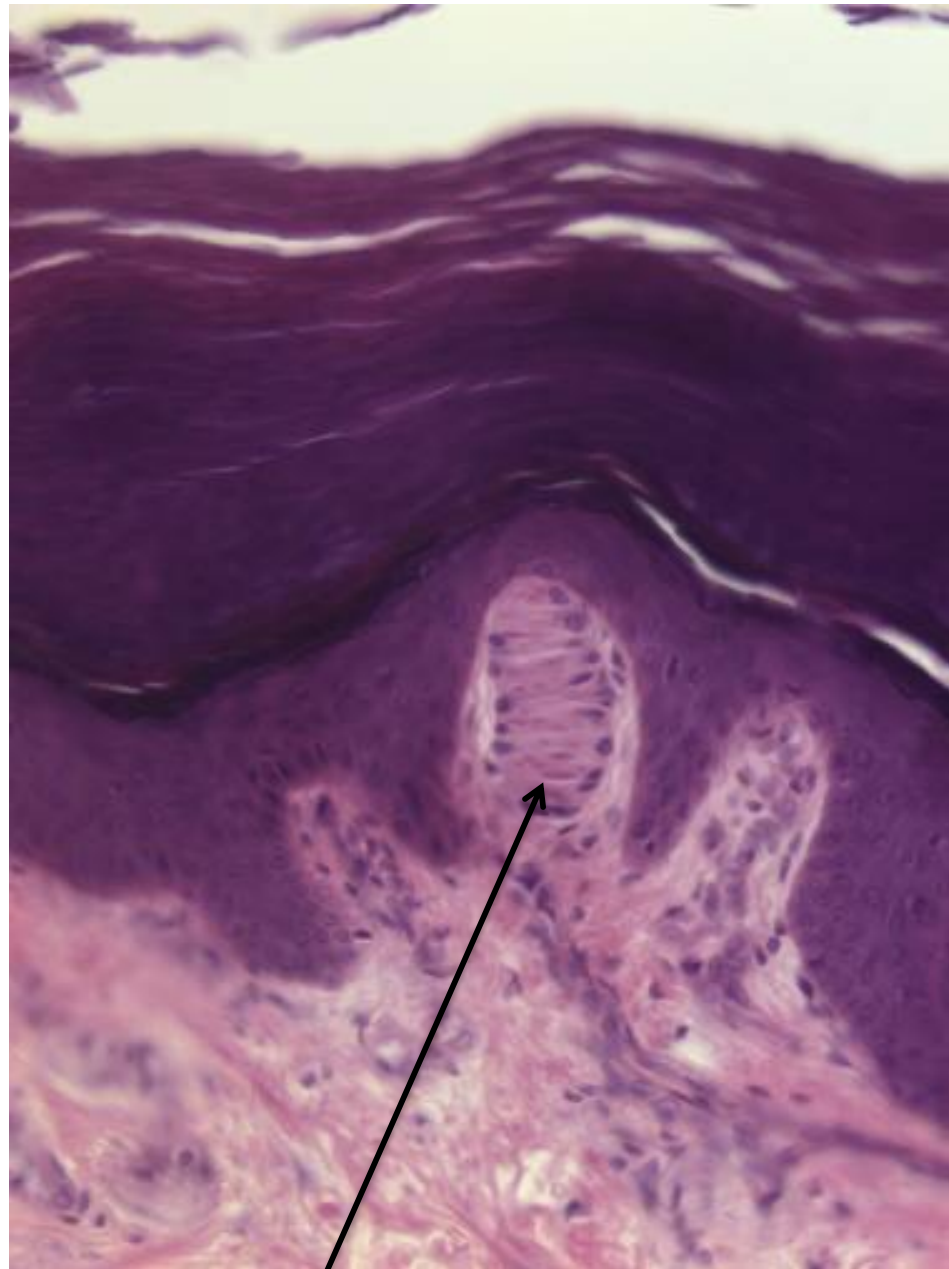
Meissner's and Pacinian Corpuscles

Meissner's corpuscle

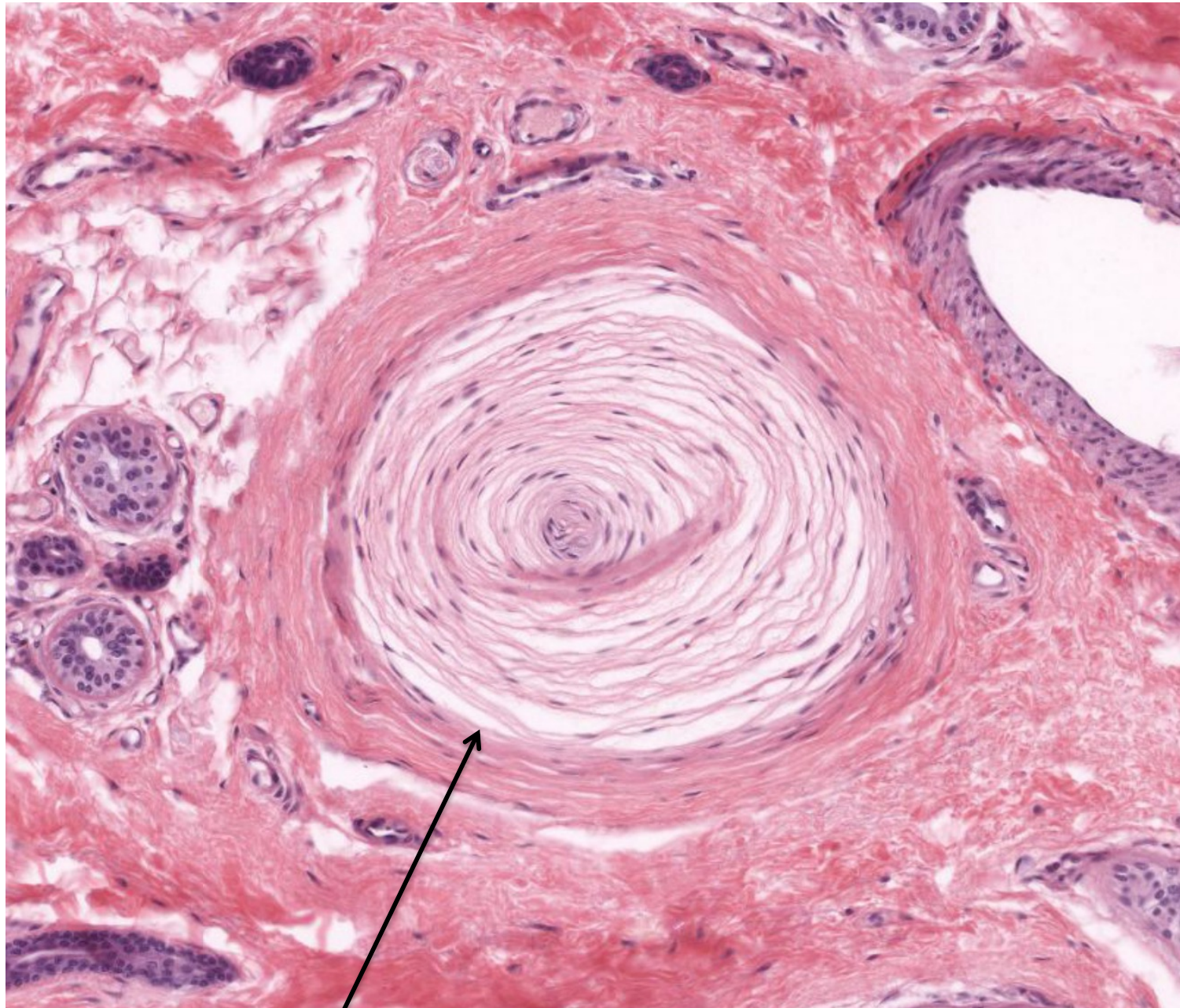
- Sensitive to light touch
- Consists of an unmyelinated axon meandering back and forth between flattened Schwann cells.

Pacinian corpuscle

- Sensitive to vibration and pressure.
- Consists of unmyelinated nerve terminal surrounded by layers of fibroblasts.



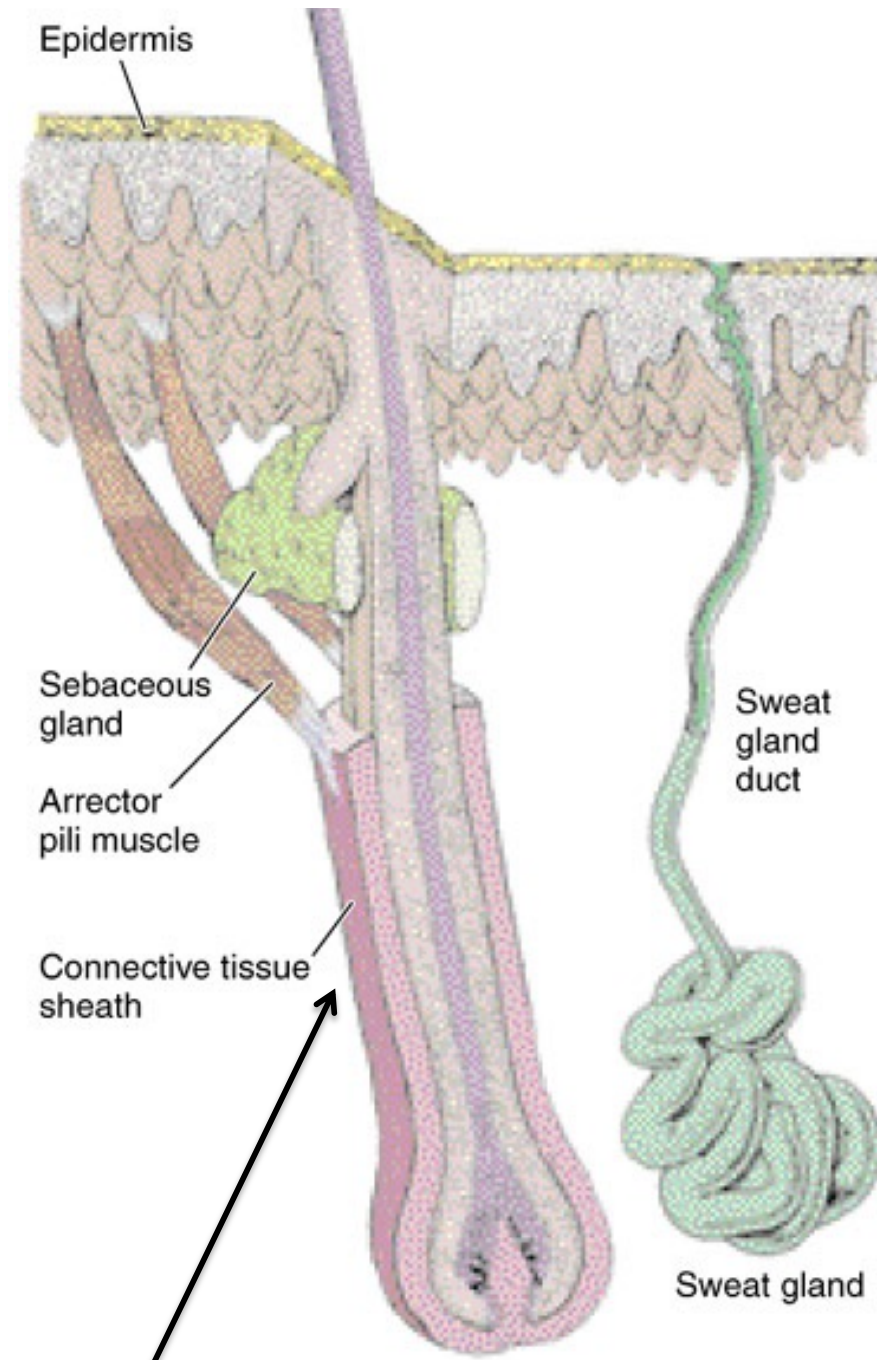
Meissner's corpuscle: sensitive to light touch



Pacinian corpuscle: sensitive to vibration, pressure

The Pilosebaceous Apparatus

- Hairs: hair follicle and shaft
- Sebaceous glands and ducts: empty into hair follicle
- Arrector pili muscles: cause erection of hair shaft
- Hairs and sebaceous glands derive from ectoderm



Pilosebaceous apparatus and sweat gland

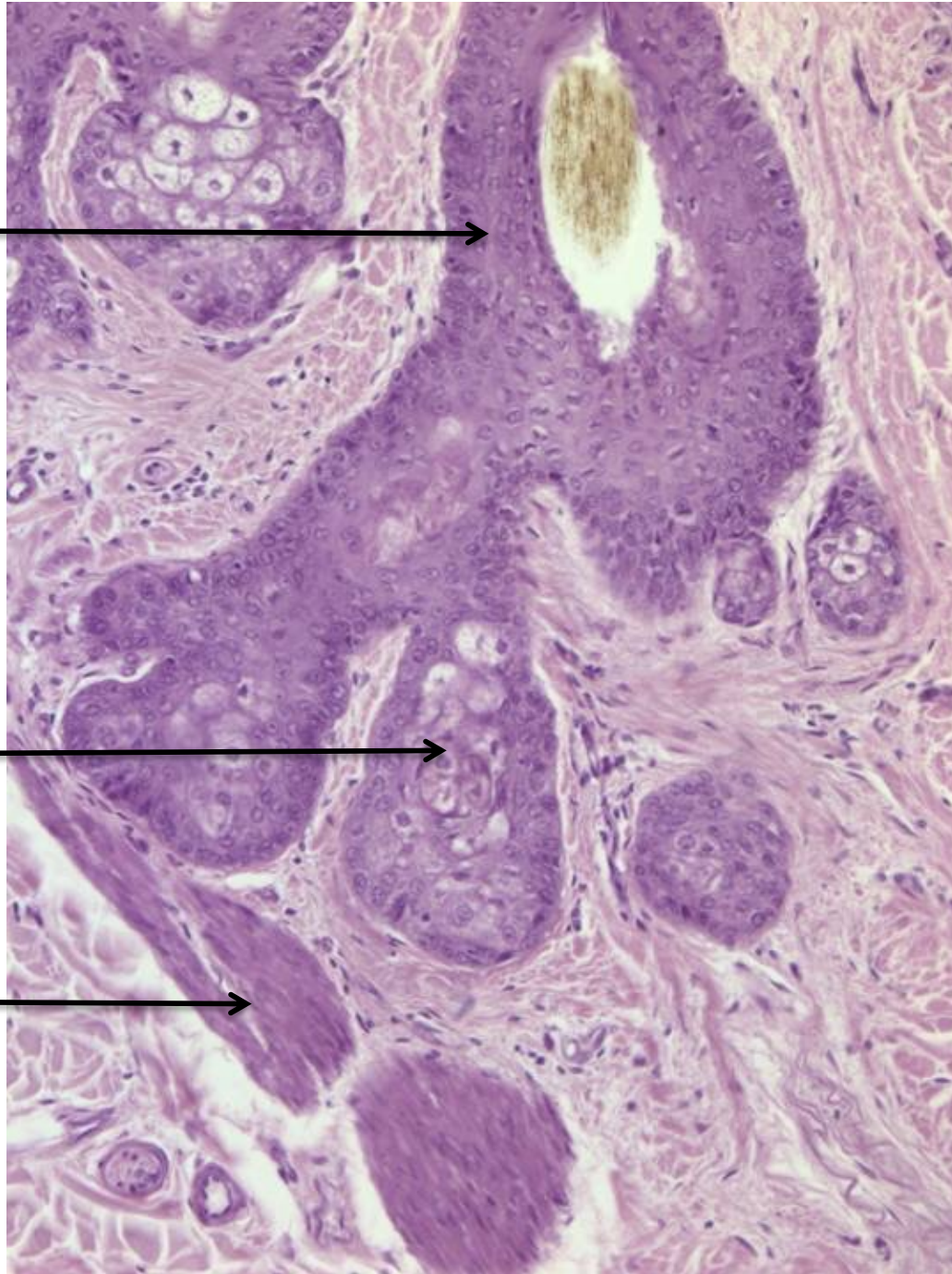
Hair follicle



Sebaceous
gland



Arrector pili
muscle



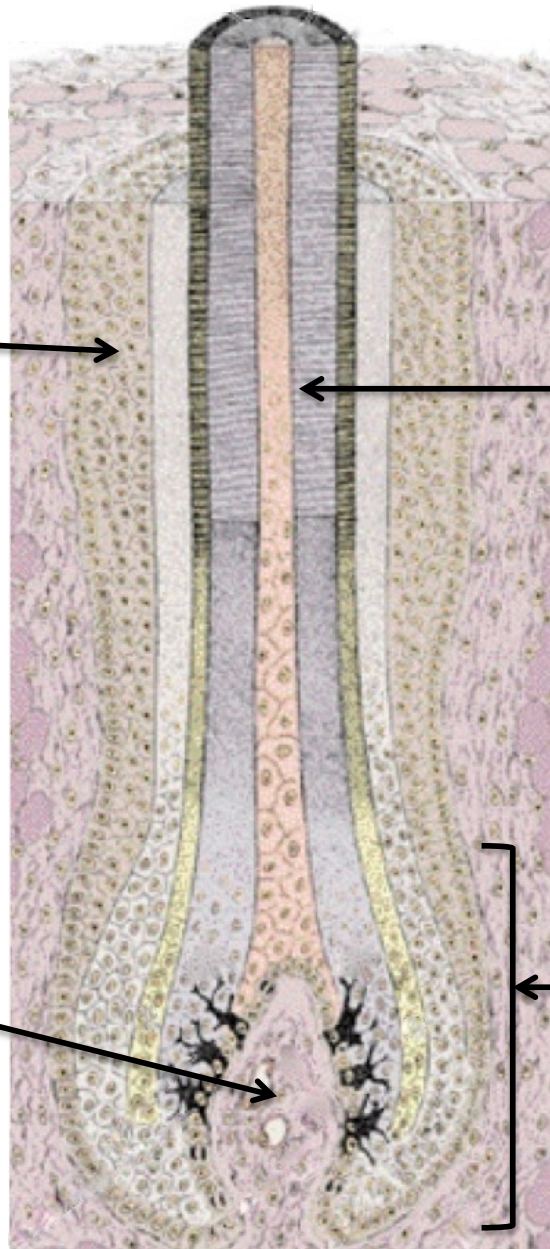
Pilosebaceous apparatus

The **hair follicle** is a tubular invagination of the epidermis extending deep into the dermis.

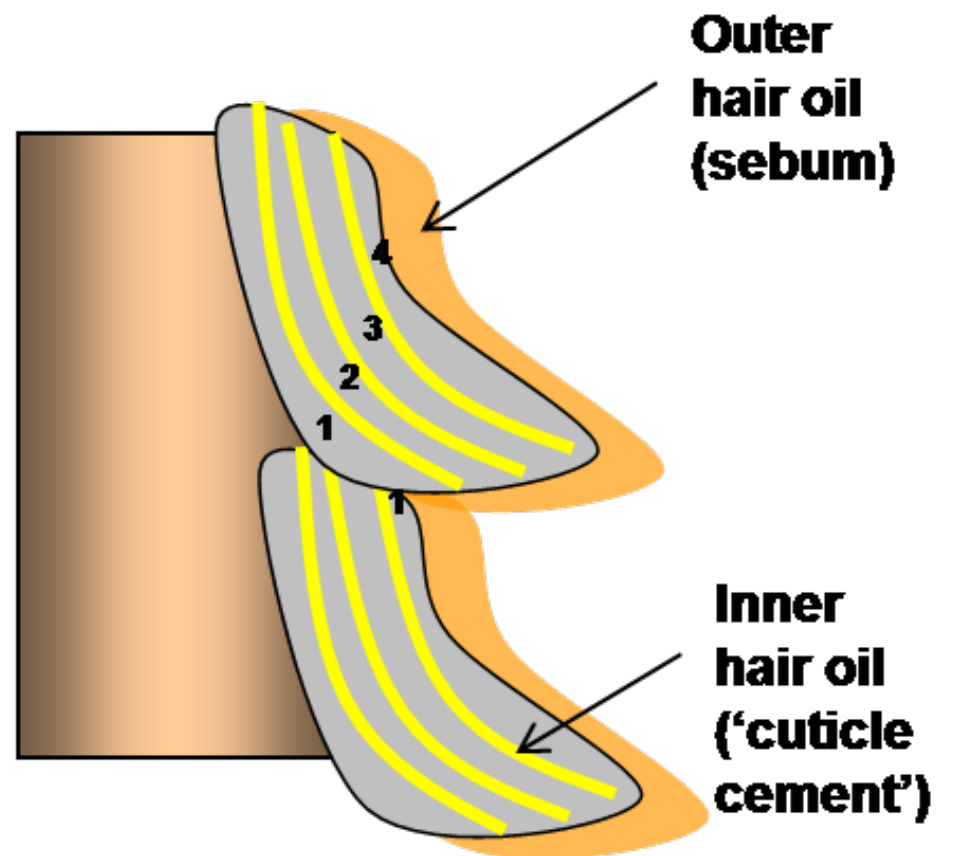
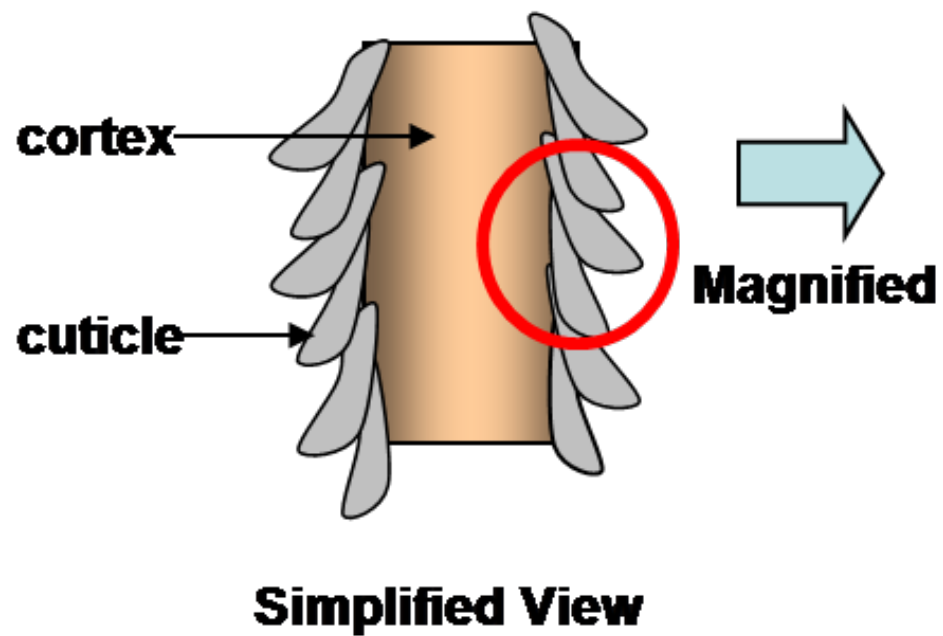
The **hair shaft** arises from the base of the follicle.

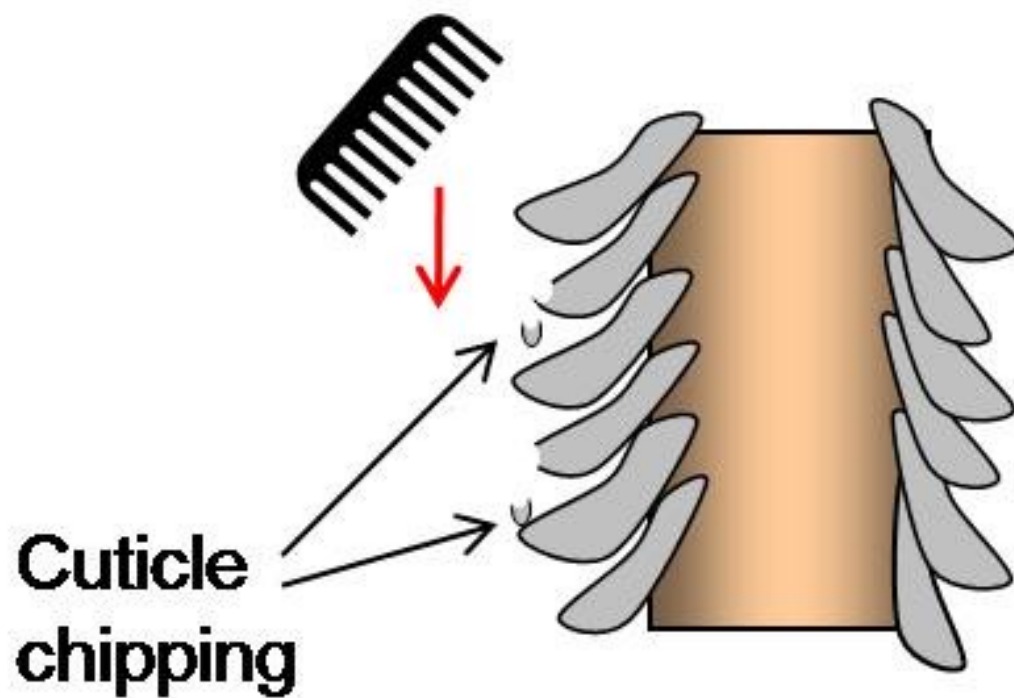
The **dermal papilla** contains numerous capillaries. It maintains the viability of the hair follicle.

The **hair bulb** is basically just the base of the hair follicle.



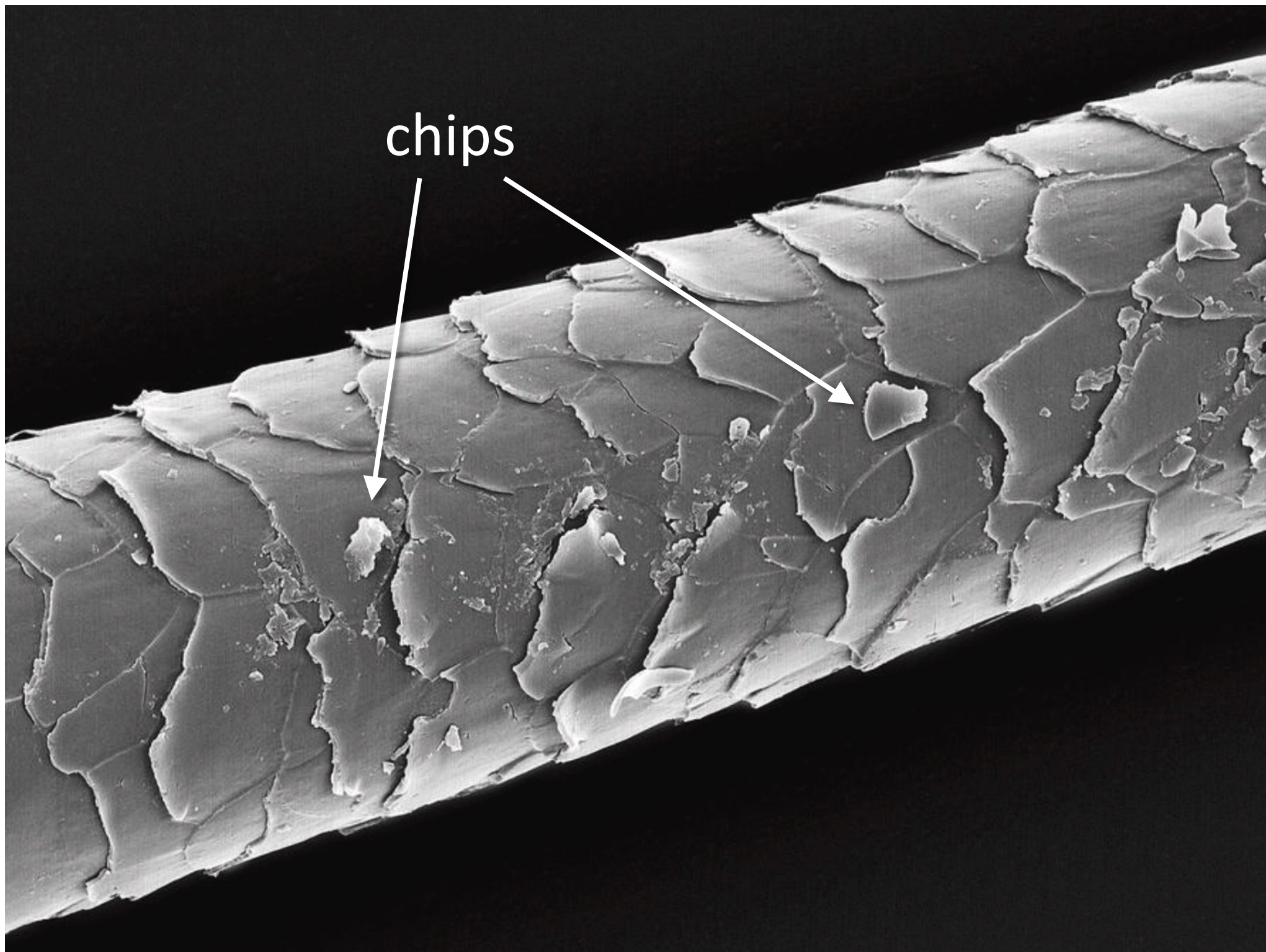
Main parts of the hair follicle



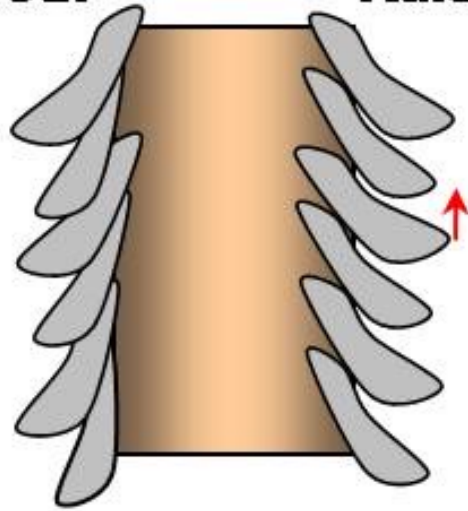


**Hair conditioner
smoothes down
the cuticle making
it less likely to chip**

**A raised cuticle is more
susceptible to chipping
when handled or combed**

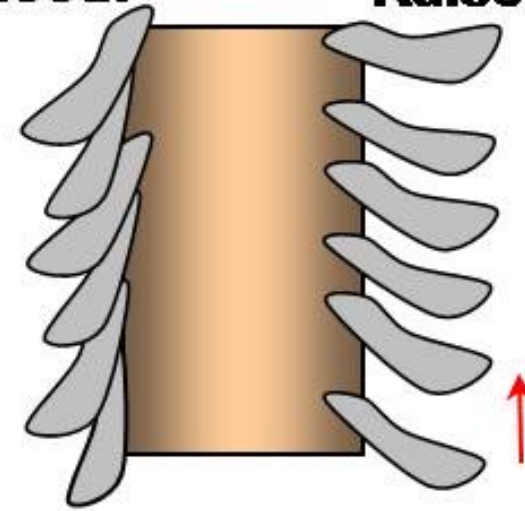


Smooth **Raised**

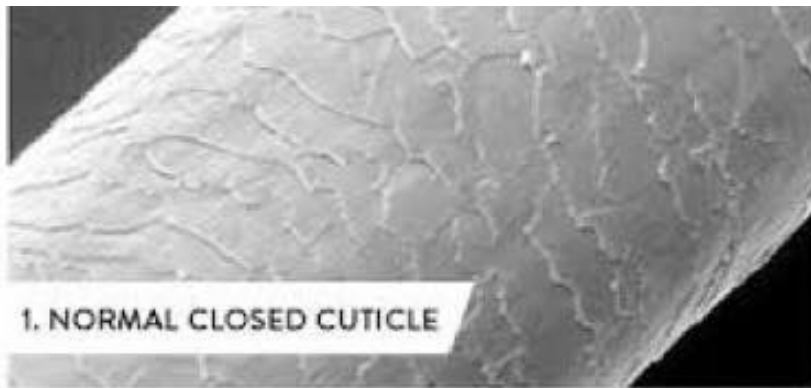


Wetting hair or using shampoo does ***slightly*** raise the cuticle (swelling)

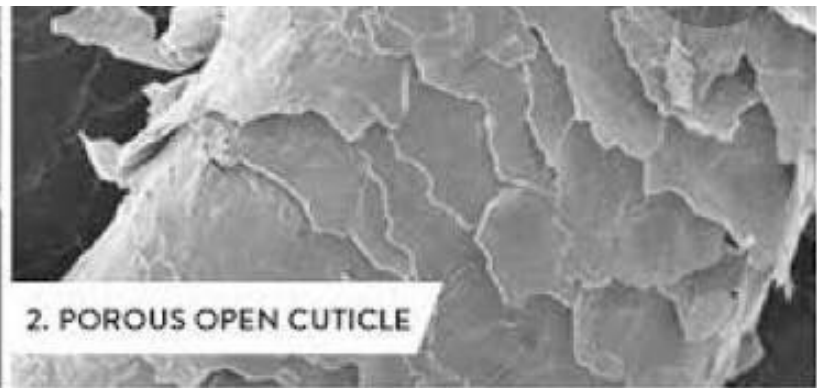
Smooth **Raised**



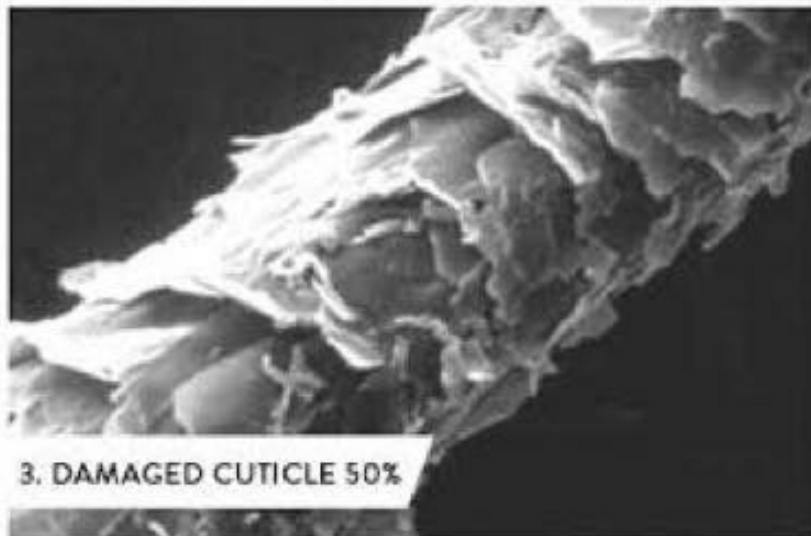
Bleaching or relaxing hair dramatically raises the cuticle (swelling)



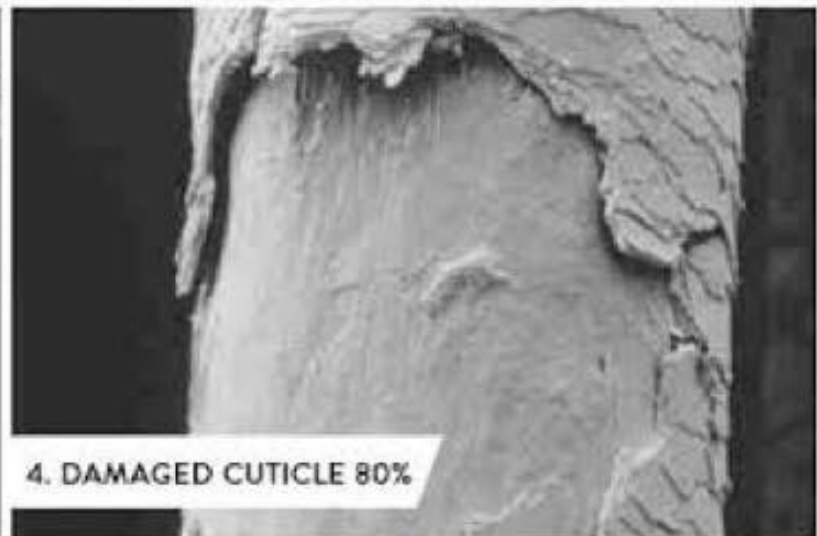
1. NORMAL CLOSED CUTICLE



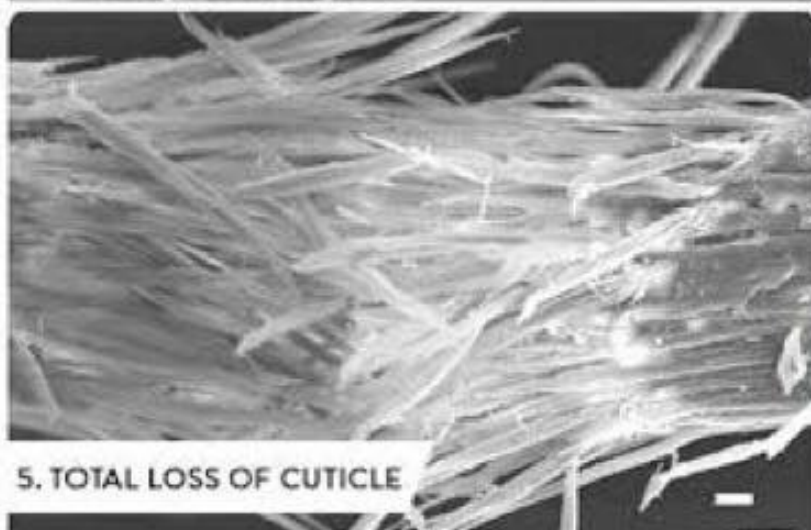
2. POROUS OPEN CUTICLE



3. DAMAGED CUTICLE 50%



4. DAMAGED CUTICLE 80%



5. TOTAL LOSS OF CUTICLE



6. HAIR BREAKAGE

Skin glands

- Three types: sebaceous glands, eccrine (merocrine) sweat glands, and apocrine sweat glands.
- Arise from ectoderm.
- Secretory portion of glands resides in the dermis.
- Three different types of secretion: holocrine, merocrine, and apocrine.

Sebaceous glands

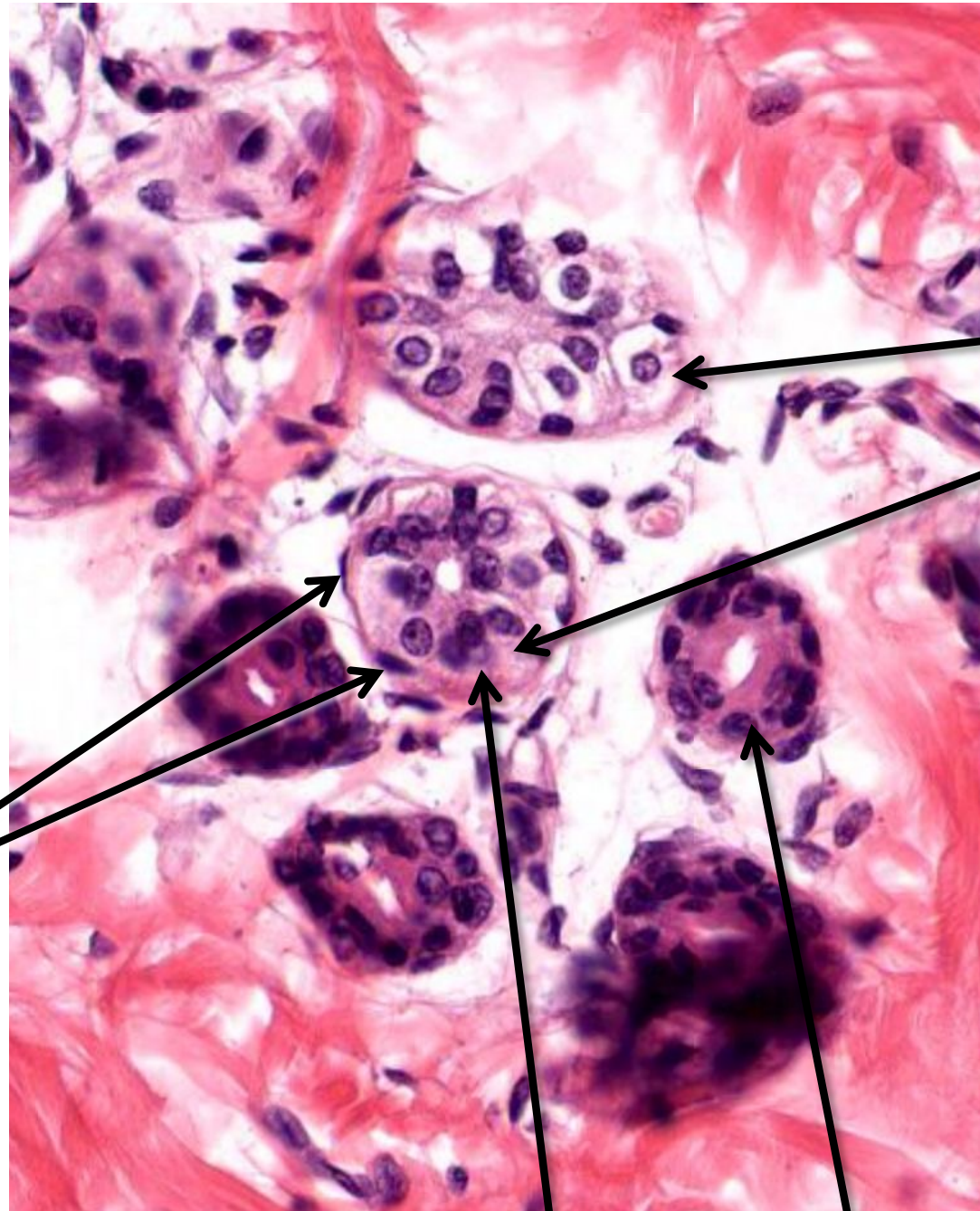
- Present everywhere except palms and soles.
- Secretory portion: peripheral, flattened undifferentiated cells. Central cells are large with foamy cytoplasm containing lipids.
- Cells burst, releasing sebum (holocrine secretion).
- Duct empties into hair follicle.
- Become functional at puberty.



Sebaceous glands with ducts emptying into hair follicle

Eccrine (Merocrine) Sweat Glands

- Secretory portion has three cell types:
 - Clear cells (contain glycogen, produce a watery substance)
 - Darker cells (produce a proteinaceous substance)
 - Myoepithelial cells (surround gland)
- Duct is lined by simple cuboidal epithelium and opens onto skin surface.



Secretory cells:

Clear

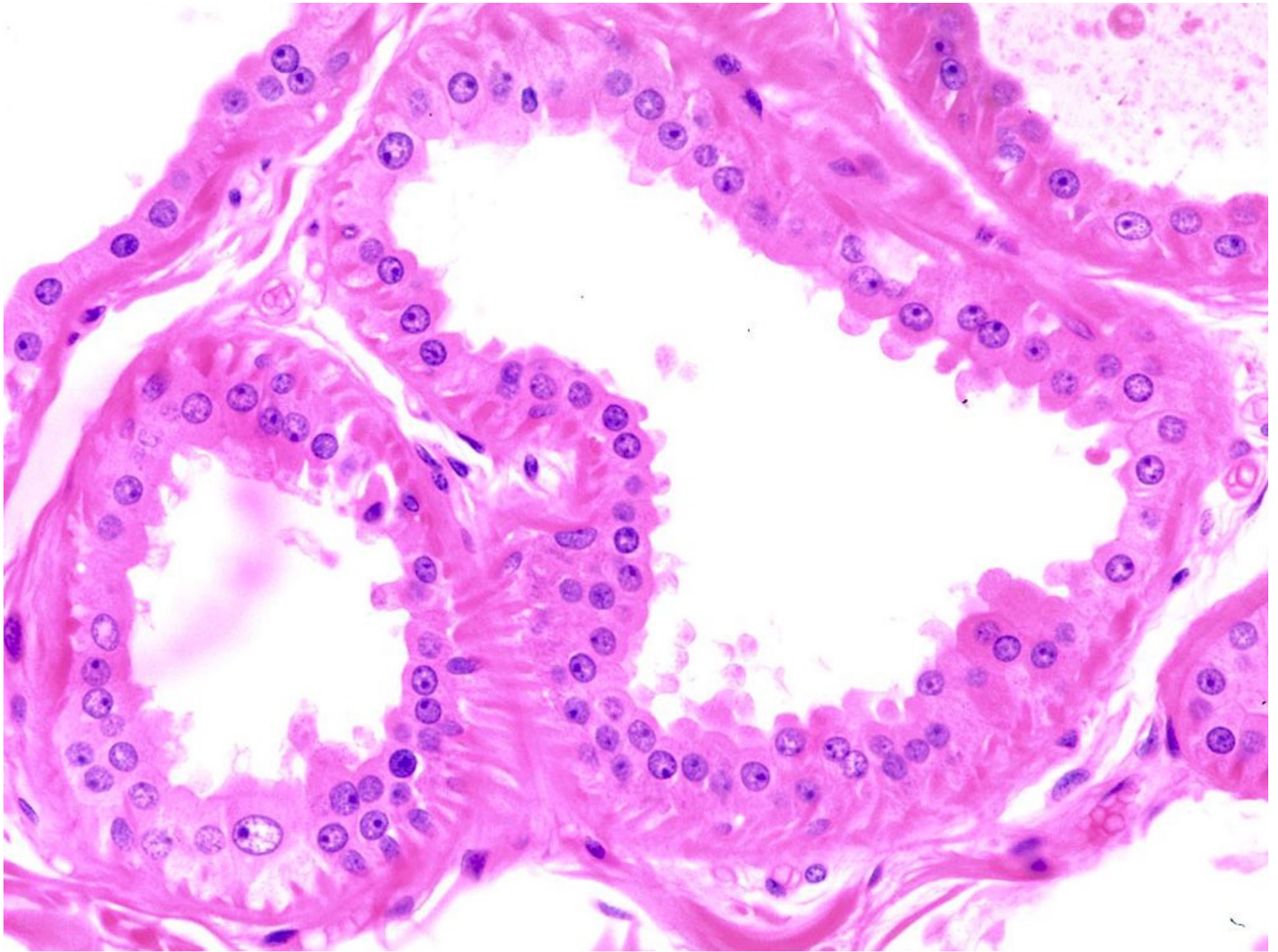
Darker

Myoepithelial
cells

Eccrine sweat glands and ducts

Apocrine Sweat Glands

- Located only in axilla, areola of breast, and anal canal.
- Have larger ducts and secretory units than eccrine sweat glands.
- Ducts open into hair follicles.
- Apocrine secretion is viscous and contains proteins, carbohydrates and lipids.



Apocrine sweat glands

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