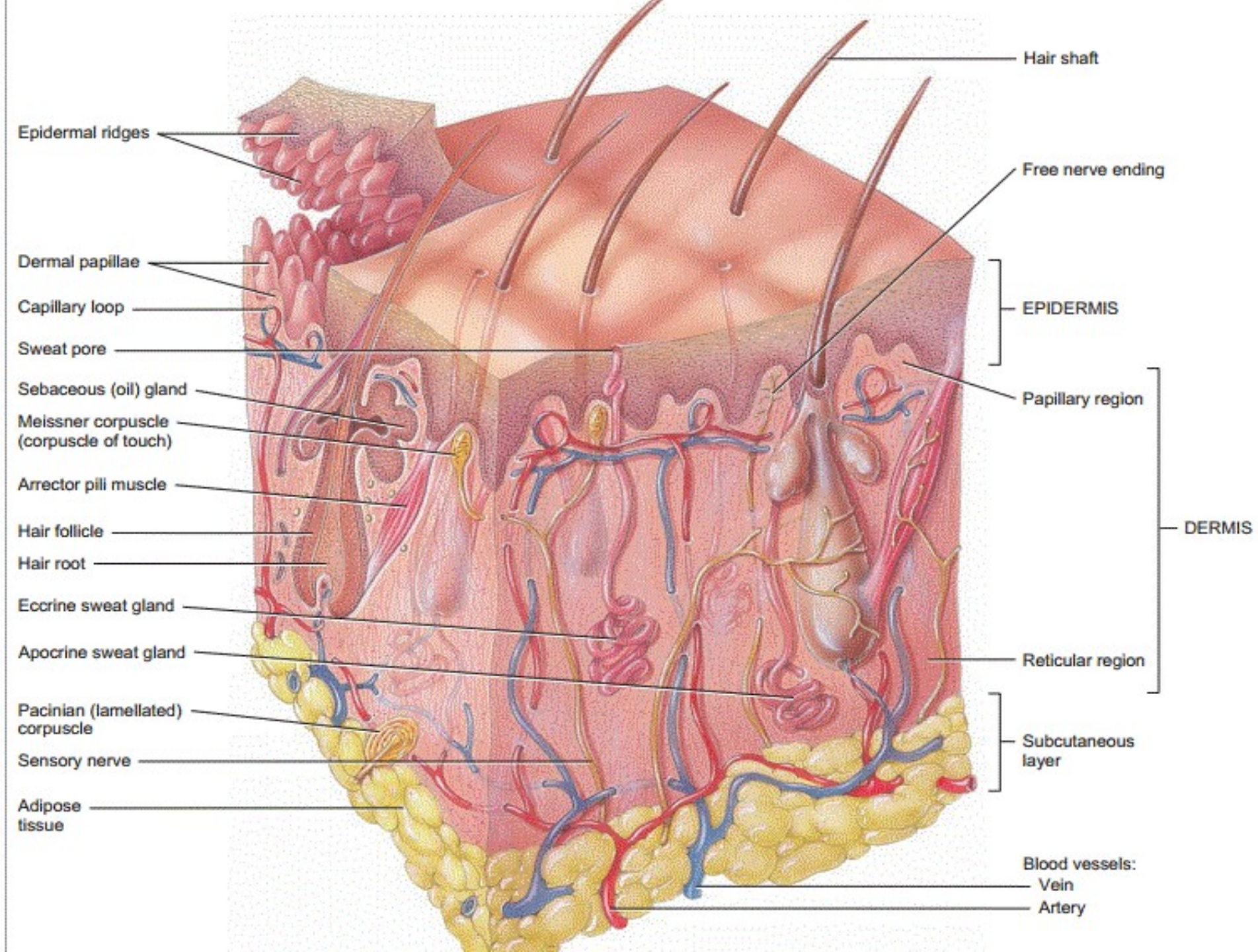


Integumentary System

Dr. Yared T.

Introduction

- **Integumentary system** (dermatology) consists of the **skin** and its **appendages**, **hair**, **nails**, and **sweat glands**.
- **Skin** (Latin, **integumentum**) means a **covering**
- The body's **largest** organ
- Consists of two layers, **epidermis** and **dermis**
- Constantly **regenerating**.
- A cell is **born** in the lower layer of the skin



Function

- One of the best indicators of general health

Skin provides

- **Protection**
- **Containment**
- **Heat regulation**
- **Sensation**
- **Synthesis and storage of vitamin D**

Epidermis

- **keratinized stratified squamous** epithelium
- **Tough, horny** superficial layer that provides a **protective** outer surface
- Contains **no** blood vessels or lymphatics
- Nourished by the underlying vascularized **dermis**
- 4 types of cells
- 5 distinct strata

Types of cell

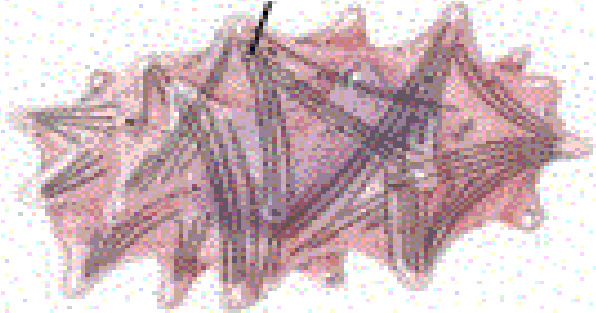
1. Keratinocytes

- **90%** of epidermis , 4 to 5 layers
- Produce, **keratin**, tough, fibrous protein, protect the skin and underlying tissue
- Produce **lamellar granules**, release a **water-repellent sealant** , decreases water entry and loss and inhibits the entry of **foreign** materials

2. Melanocytes

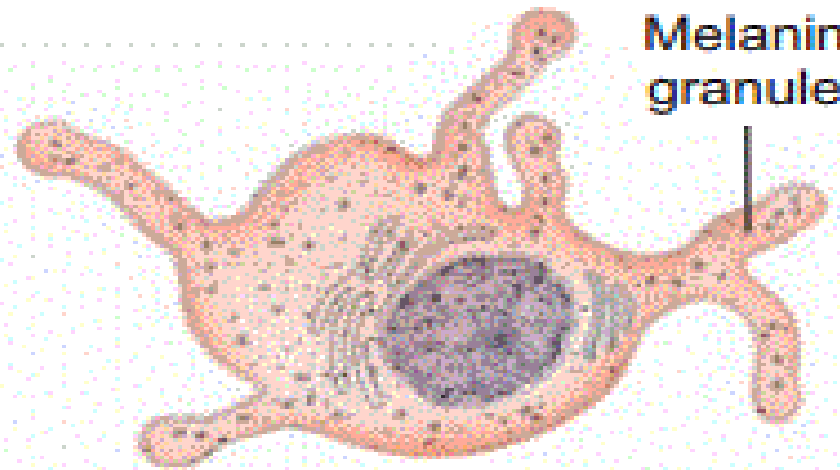
- 8 %, produces **melanin** pigment
- **Transferred** to other cells, **keratinocytes**, with thier long processes
- Melanin, a **yellow-red** or **brown-black** pigment, skin color
- Absorbs damaging ultraviolet (UV) light, protect **keratinocytes neuclus**

Intermediate
filament (keratin)

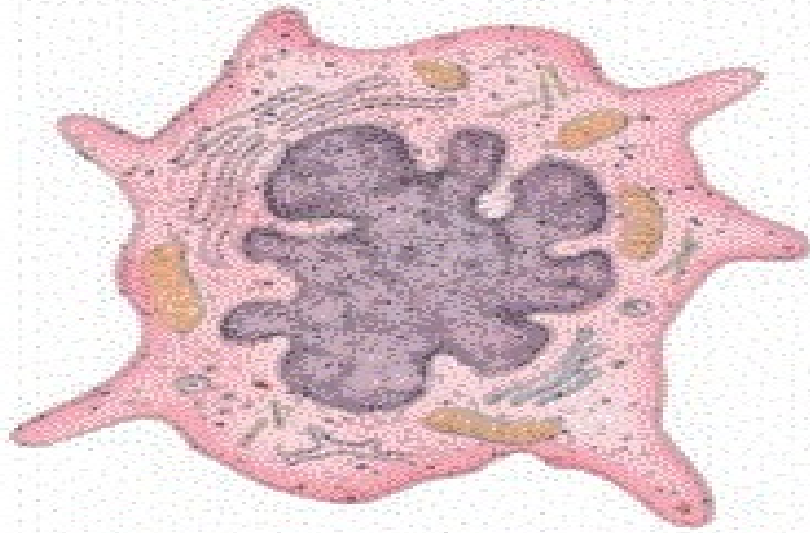


(a) Keratinocyte

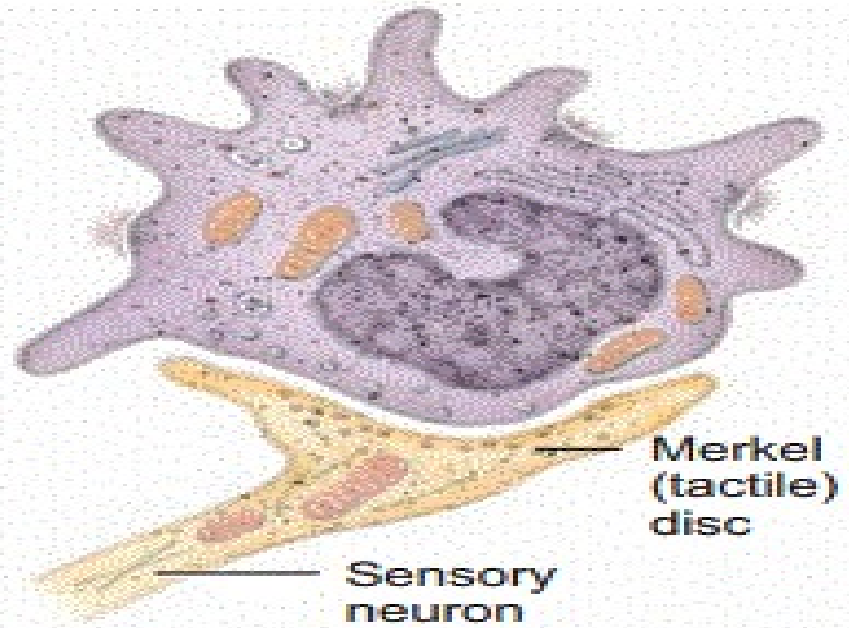
Melanin
granule



(b) Melanocyte



(c) Langerhans cell



(d) Merkel cell

3. Langerhan cells

- From red **bone marrow**
- Provide **immunity** against invading microbes

4. Merkel cells

- **Least** numerous, in deepest layer
- Contact with sensory neuron, form **touch receptor**

Layers of the Epidermis

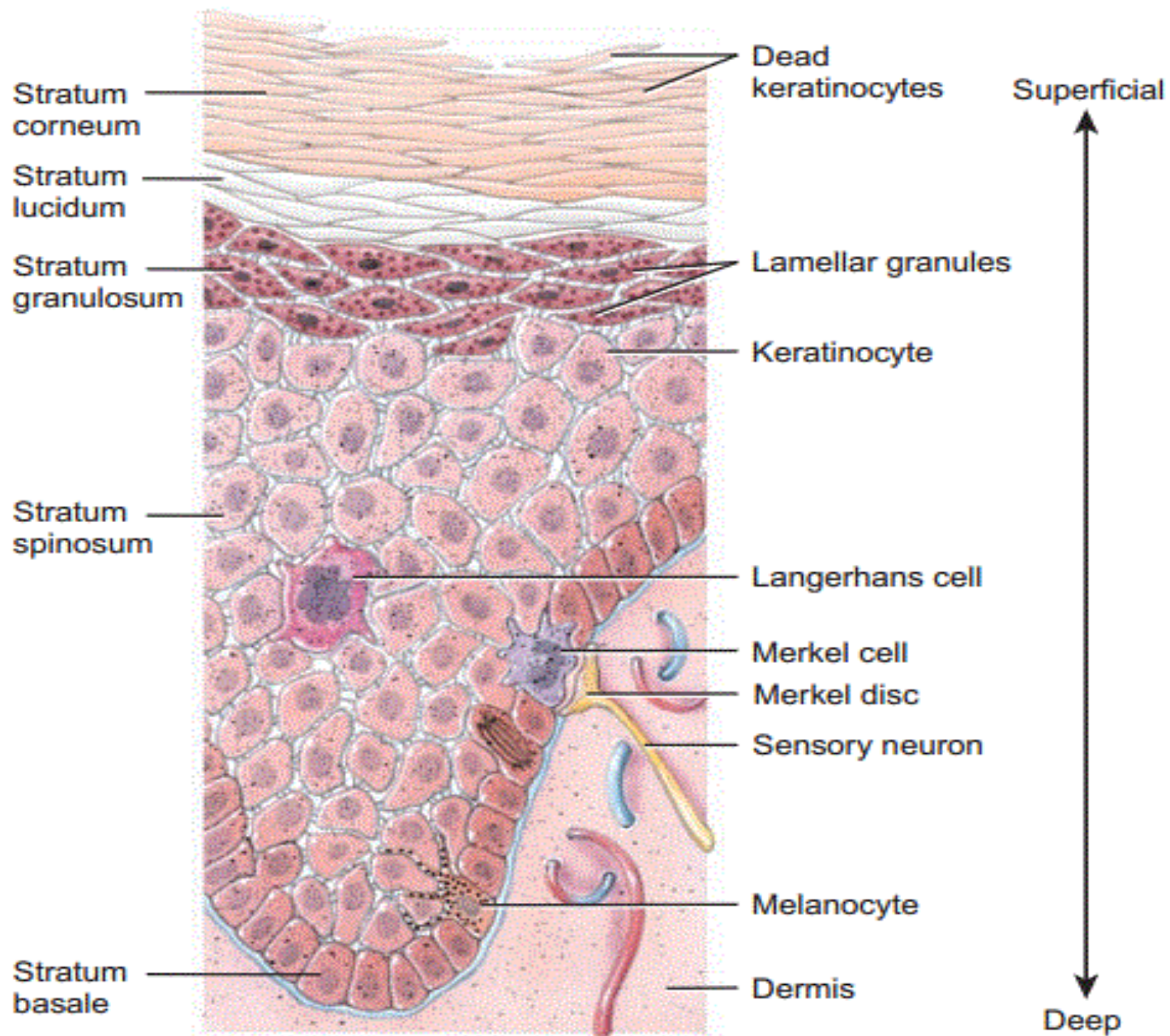
- In most regions of the body **four layers**, **stratum basale**, **stratum spinosum**, **stratum granulosum**, and a thin **stratum corneum**, **thin skin**.
- Where **friction** is greatest, **fingertips**, **palms**, and **soles**, **five** layers adding **stratum lucidum**, below stratum corneum

1. Stratum Basale

- **Deepest**, Called **stratum germinativum**
- **Stem cells**, undergo cell division to continually produce new keratinocytes

2. Stratum Spinosum

- **8 to 10** cell layers of keratinocytes
- Melanin taken in by **phagocytosis** from nearby melanocytes



(a) Four principal cell types in epidermis

3. Stratum Granulosum

- 3 - 5 layers of **flat** keratinocytes that are **undergoing apoptosis** (death) cells
- **Transitional zone**
- Contain **lamellar granules**

4. Stratum Lucidum

- Seen in **thick** skin
- Contain large amounts of **keratin** and thickened plasma membranes

5. Stratum Corneum

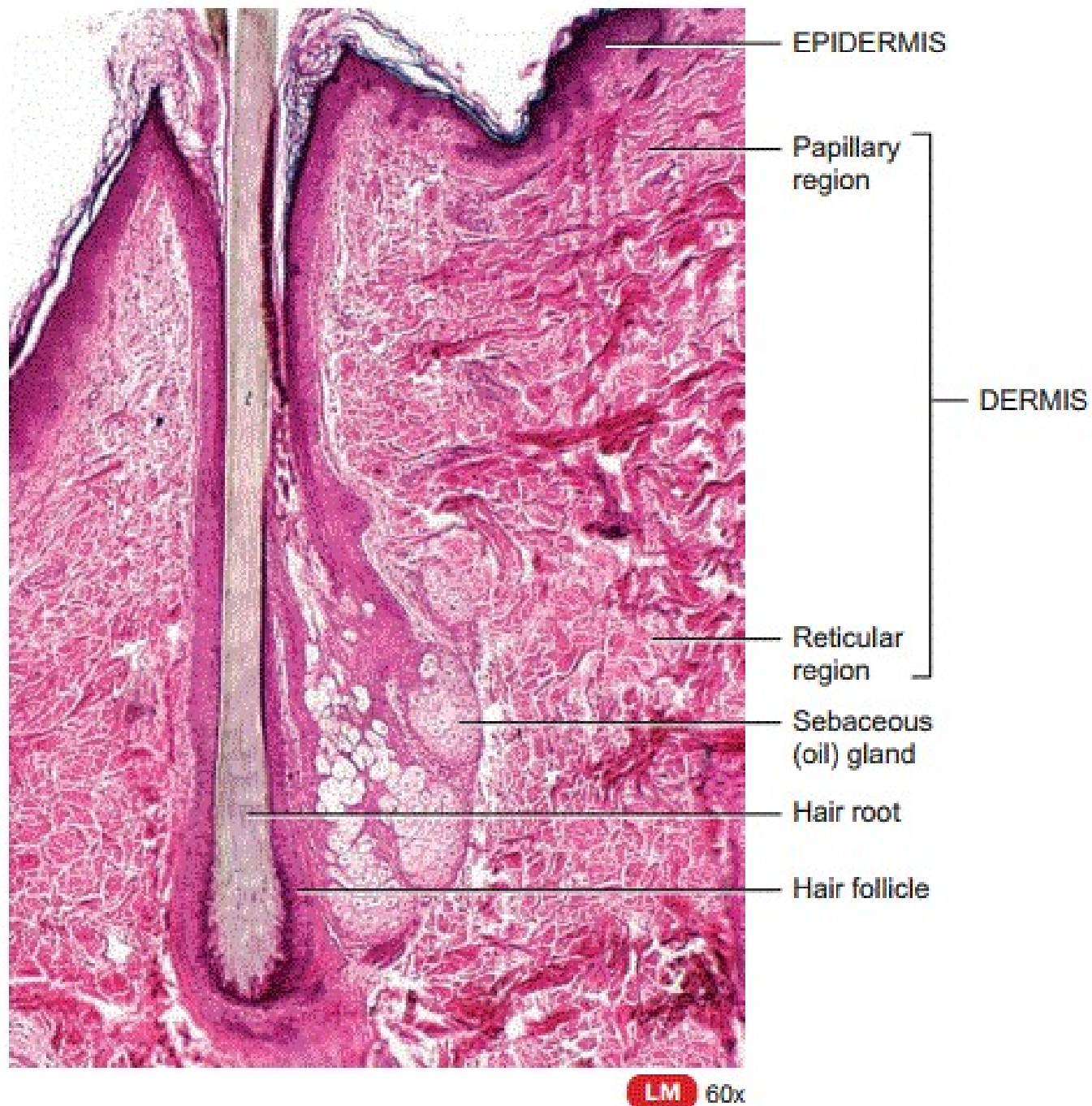
- **25 to 30 layers** of flat **dead** keratinocytes
- Continuously **shed**
- **Barrier** to **light, heat, water, chemicals & bacteria**
- Friction stimulates formation **callus**, **abnormal thickening** of the stratum corneum

Dermis

- Connective tissue layer composed of **strong** connective tissue **collagen & elastic fibers**
- Great **tensile** strength, can stretch and recoil easily
- Contains **hair follicles, glands, nerves & blood vessels**
- Major regions of dermis are, **papillary** region and **reticular** region

1. Papillary Region

- **Top 20%** of dermis
- Composed **areolar CT**, thin collagen and fine elastic fibers
- **Finger like** projections into epidermis, called **dermal papillae**, **anchors** epidermis to dermis, contains
 - **Capillaries** that feed epidermis
 - **Meissner's corpuscles** sense touch
 - **Free nerve** endings (pain and temperature)



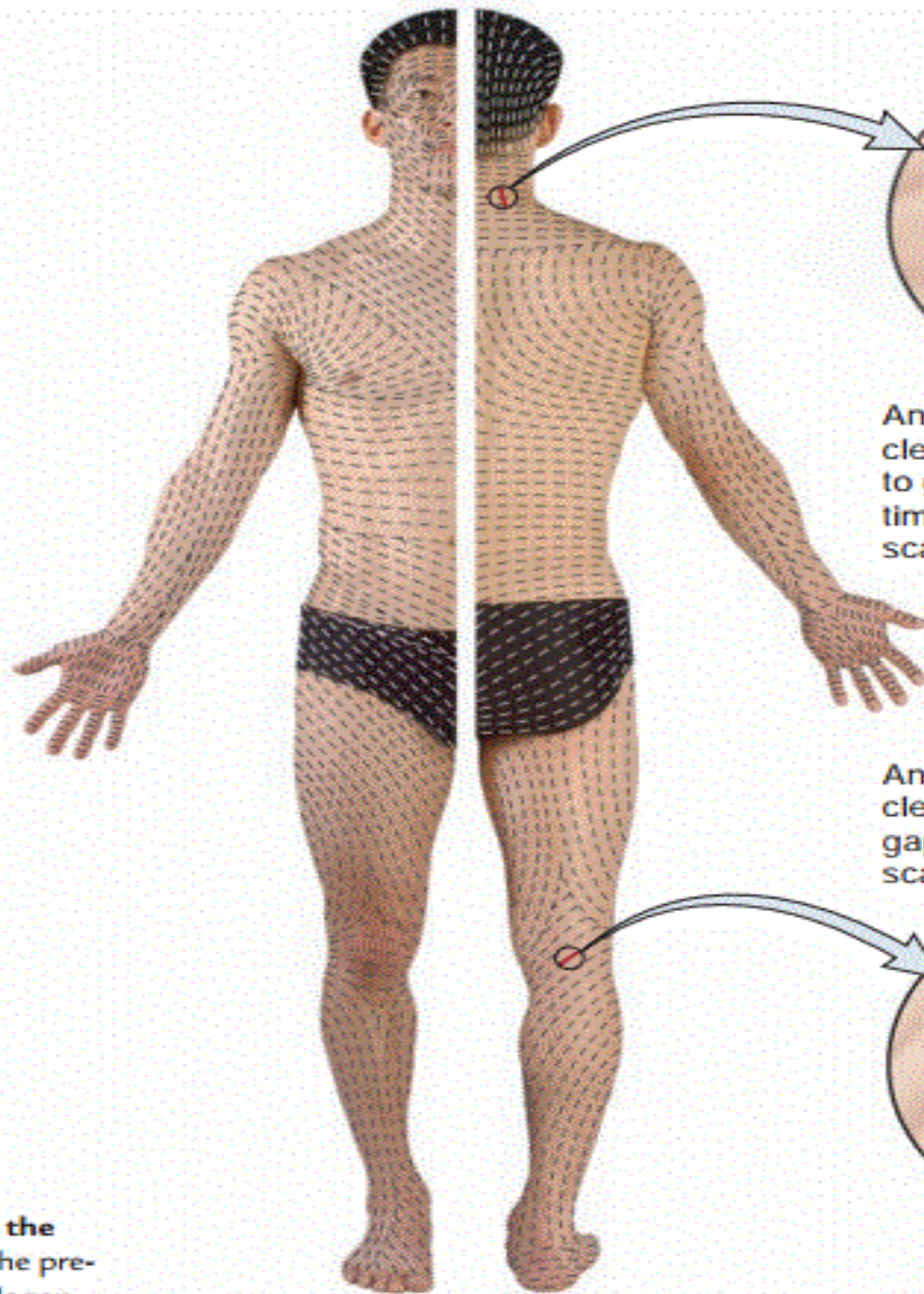
(b) Sectional view of skin

2. Reticular Region

- **Dense irregular** connective tissue
- Contains **interlacing** collagen (netlike manner) and **elastic fibers**, provides **strength, extensibility & elasticity**
- A few **oil glands, sweat gland ducts, fat & hair follicles**
- **Extreme stretching** may produce small **tears** in the dermis, causing **striae** or **stretch marks**, red or silvery white

- **Epidermal ridges**

- A series of **ridges** and **grooves** on epidermis of **palms, fingers, soles, and toes**
- **Fingerprints** formed by the ridges and sweat from **sweat glands** ducts opening on ridges
- The predominant **pattern** of **collagen** fibers determines the characteristic **tension** and **wrinkle lines** in the skin



An incision made across the cleavage lines is more likely to gape, increasing healing time, and result in increased scar tissue.

An incision made parallel to the cleavage lines results in less gaping, faster healing, and less scar tissue.

in the
the pre-
collagen

Anterior view

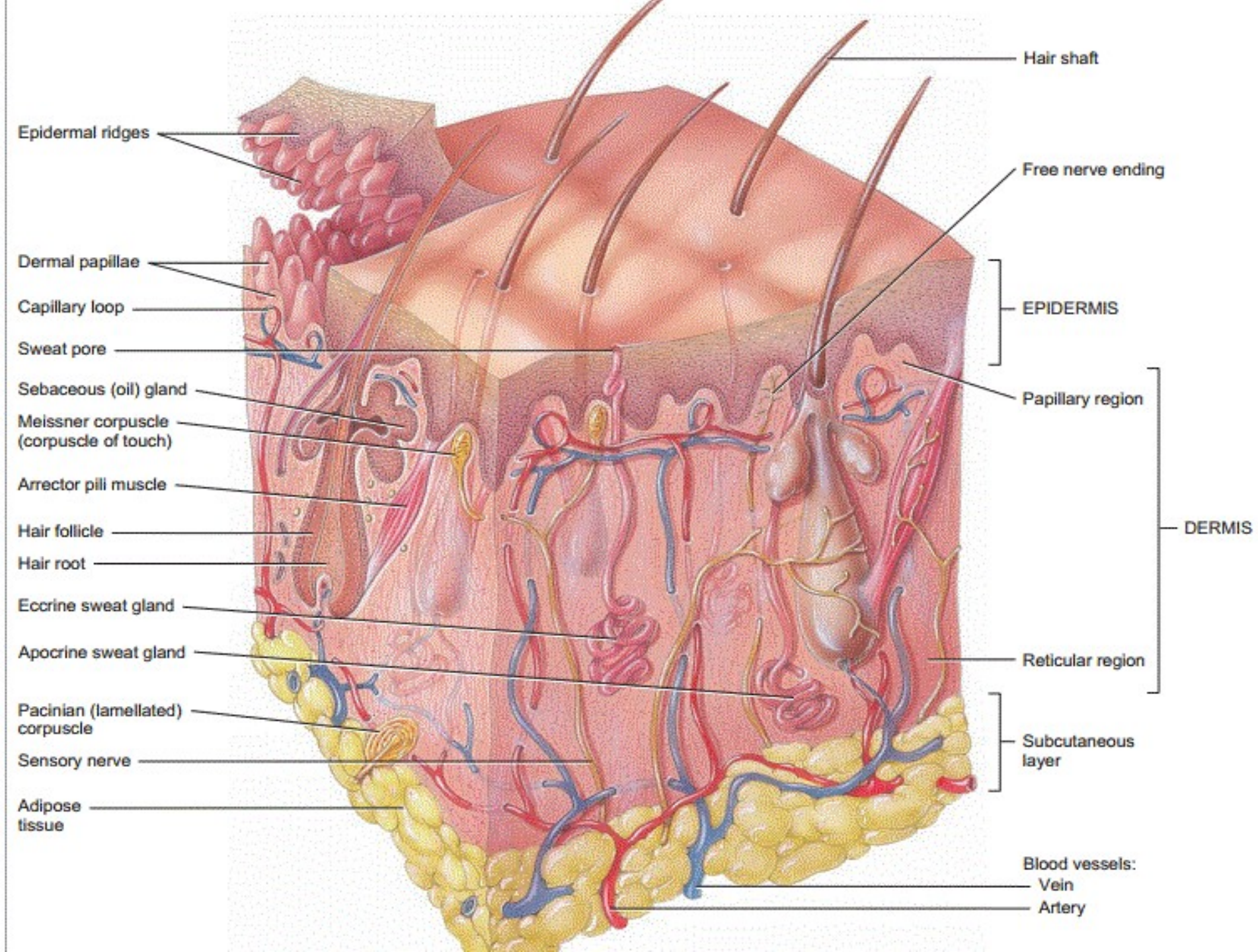
Posterior view

Skin Color Pigments

- **Melanin:** vary from **yellow** to **tan** to **black** color
- **Same number**, but **differing amounts** of pigment produced
- **UV** in sunlight **increases** melanin production
- **Carotene:** In dermis, **Yellow-orange** pigment (**vitamin A**)
- **Hemoglobin:** **Red**, oxygen-carrying pigment in blood cells

Subcutaneous tissue

- Also called **hypodermis**
- Located between **dermis** and underlying **deep fascia**
- Store **fat, sweat glands, blood vessels, lymphatic vessels, and cutaneous nerves**
- **Thickness** depending on **nutritional** state
- **Thermoregulation**, retaining heat in the body's core.
- **Padding, protects** the skin from bony prominences (buttocks)



Hair

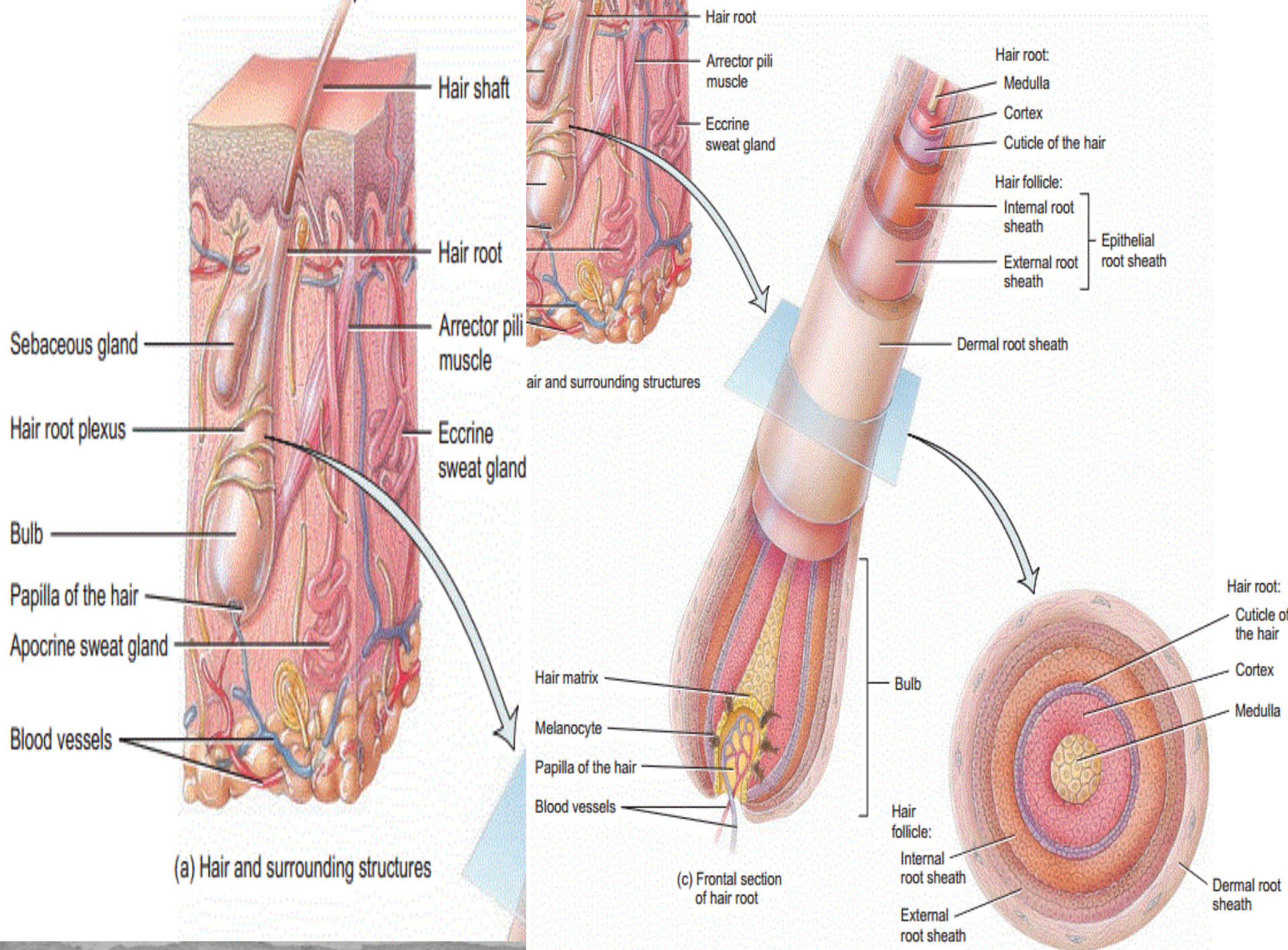
- Present on most skin surfaces, **absent** in **palms** and **soles**
- **Heavily** at **scalp**, **eyebrows**, **axillae** and around the external **genitalia**.
- Composed of columns of **dead**, **keratinized** epidermal cells
- **Bonded** together by **extracellular proteins**

Function of hair

- **Guards** the **scalp** from injury and the sun's rays.
- **Decreases heat loss** from the scalp.
- Protect from **foreign particles**, (eyelash, nostrils and external ear canal)
- **Touch receptors**, light touch

Parts of hair

- **Shaft: Visible** part, Contain **medulla, cortex & cuticle**
- **Root: Below** the surface
- **Follicle : Surrounds root**, Made of **epithelial root sheath**
- **Bulb: Base** of follicle is, has **germinal** cell layer (**hair matrix**)
- **Hair matrix:** arise from the **stratum basale**



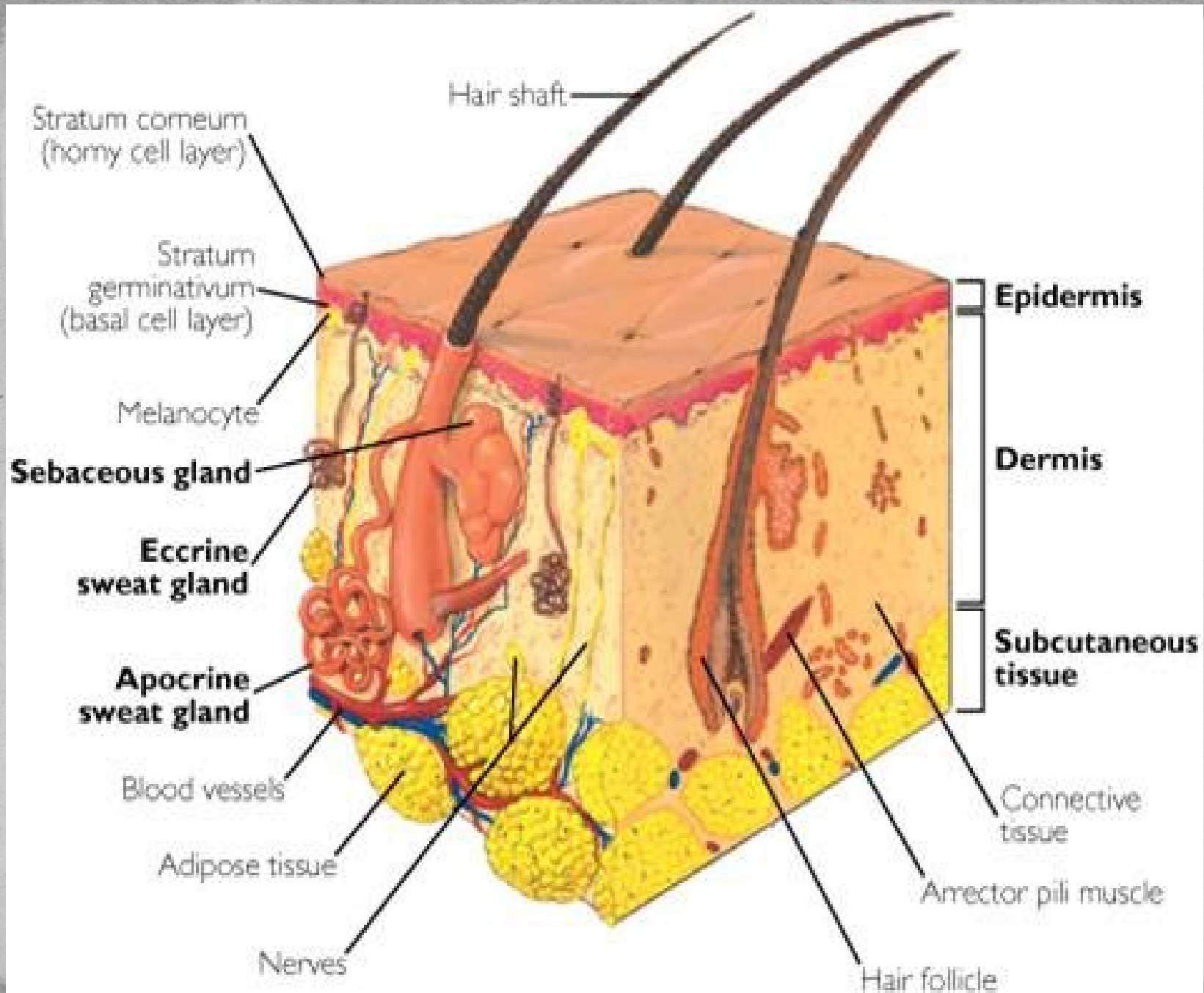
- **Shaft and root** consist of three concentric layers, **Medulla, Cortex** and **Cuticle**
- **Arrector pili: Smooth muscle** in dermis **contracts** with **cold** or **fear**, and errect hair , **goosebumps**
- **Hair root plexus:** Detect hair **movement**
- Hair grow in two **growth cycle**, growth stage & resting stage
- **Hair Color:** Result of melanin produced in **melanocytes** in **hair bulb**

Skin Glands

- Specialized **exocrine** glands found in **dermis**

1. Sebaceous (oil) glands

- Most **open** onto **hair shafts**
- In **lips, glans penis, labia minora, and eyelids**, open in to **skin**
- **Absent** in the **palms** and **soles**, **Large** in **breasts, face, neck, and superior chest**
- **Sebum: make skin and hair soft & pliable and Inhibits** growth of **bacteria & fungi**



2. Sudoriferous (sweat) glands

- **Two types**
- **Eccrine sweat glands: in forehead, palms, and soles**
- Regulate body **temperature** with **perspiration**
- **Apocrine glands: Armpit, pubic region, breast and beard**
- Secretions contain additional **lipids** and **proteins**.
- **Odorless**, but with interacts with **bacteria** on the surface of the skin, **body odor**.

3. Ceruminous glands

- **Modified** sweat glands produce **waxy secretion** in **ear** canal
- **Cerumin** contains secretions of **oil** and **wax glands**
- Helps form **barrier** for entrance of **foreign bodies**

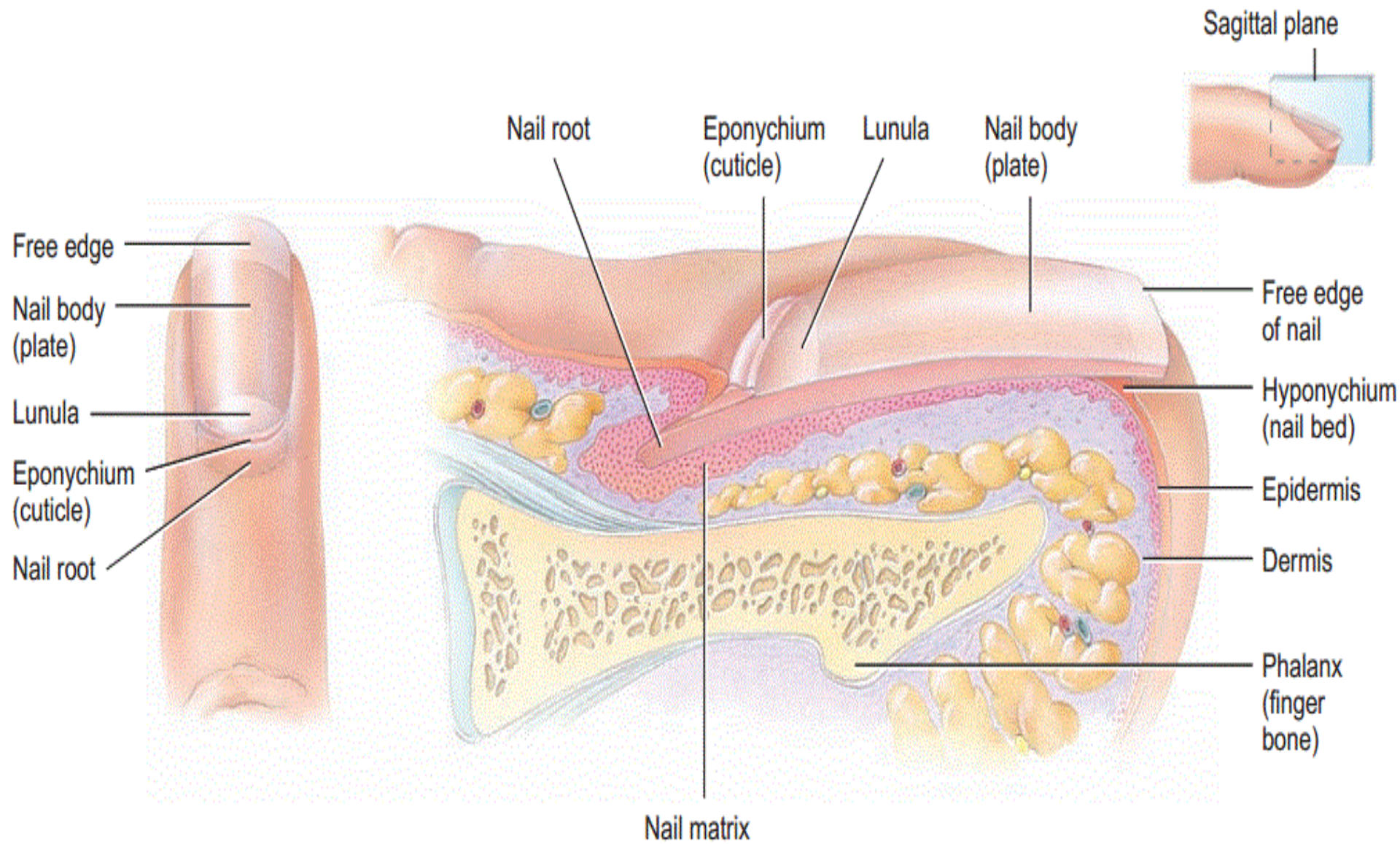
Nails

- **Tightly packed, hard, dead, keratinized epidermal cells**

Nail structures

- **Nail body:** Visible portion, have **Lunula**
- **Nail root: Buried** under skin layers
- **Hyponychium (nail bed):** Beneath the **free edge**
- **Eponychium (Cuticle): stratum corneum, Adheres** nail to the **margin** (lateral border) of the nail wall
- **Nail matrix:** nail **growth** occurs

Nail cells arise by transformation of epidermal cells of the nail matrix.



(a) Dorsal view

(b) Sagittal section showing internal detail

Thank You!