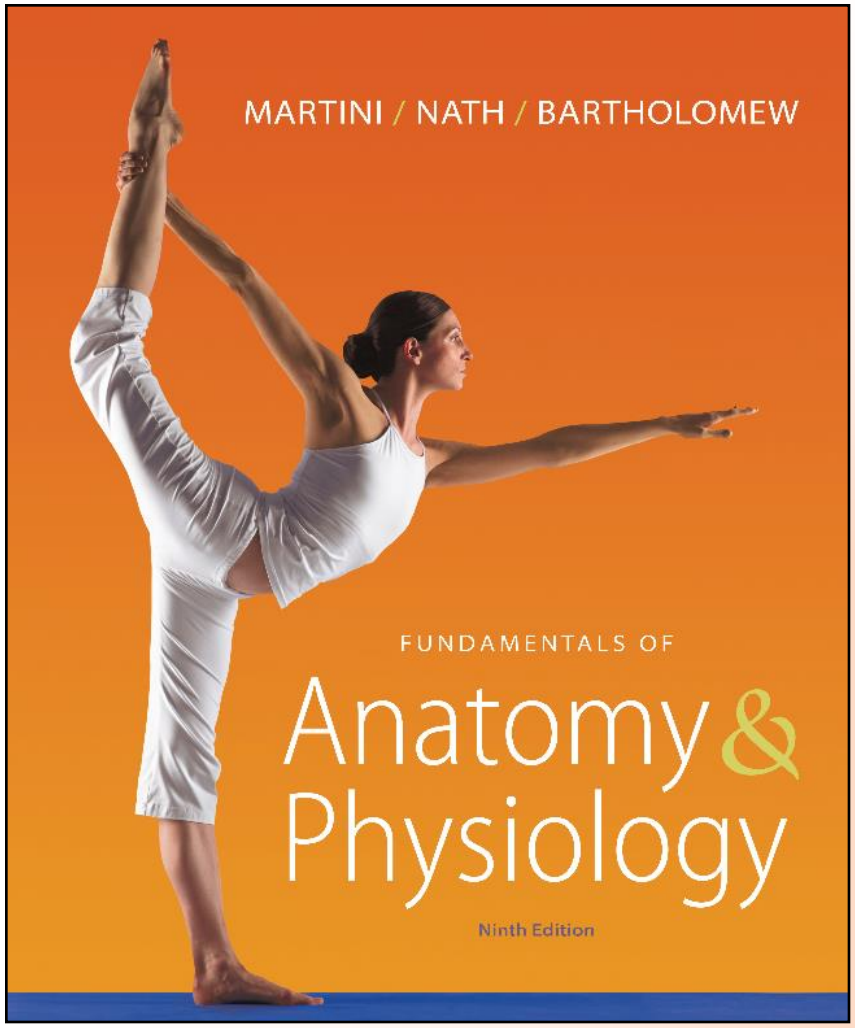


5

The Integumentary System

PowerPoint® Lecture Presentations prepared by Jason LaPres

Lone Star College—North Harris

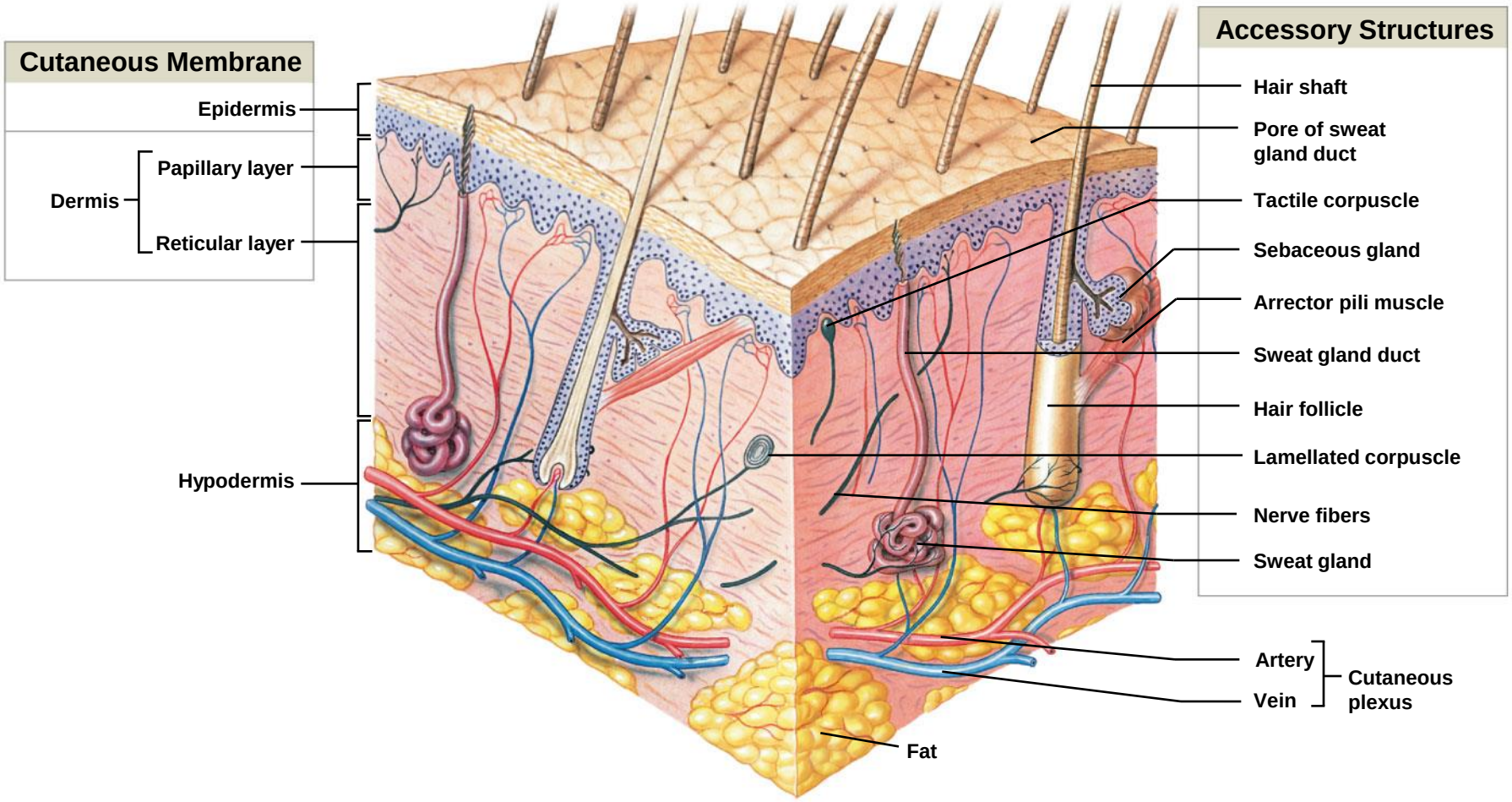
An Introduction to the Integumentary System

- The **Integument**
  - **Is the largest system of the body**
    - 16% of body weight
    - 1.5 to 2 m^2 in area
    - The integument is made up of two parts
      1. **Cutaneous membrane** (skin)
      2. **Accessory structures** (hair/nails)

An Introduction to the Integumentary System

- Two Components of the Cutaneous Membrane
  1. Outer **epidermis**
     - Superficial epithelium (epithelial tissues)
  2. Inner **dermis**
     - Connective tissues

Figure 5-1 The Components of the Integumentary System



An Introduction to the Integumentary System

- **Accessory Structures**
  - Originate in the dermis
  - Extend through the epidermis to skin surface
    - Hair
    - Nails
    - Multicellular exocrine glands

THINK PAIR SHARE….

- What is gangrene of the skin?
- How do pain relieving creams work?

An Introduction to the Integumentary System

- Connections
  - Cardiovascular system
    - Blood vessels in the dermis
  - Nervous system
    - **Sensory receptors** for pain, touch, and temperature
      - Receptors “receive/sense the message” for pain, touch, and temperature and convert that mechanical or chemical message into an electrical signal that is sent to the brain and processed.

Do capsaicin pain relieving creams really work?

The capsaicin in red pepper fools your brain into sensing heat when there is not any.

- Capsaicin acts like a neurotransmitter and binds to a nerve receptor called the TRPV1 channel and temporarily changes the shape of the receptor so the channel gate opens.
- Heat above 42 degrees Celsius/ 108 degrees Fahrenheit also changes its shape and opens the nerve cell's gates to charged particles called ions.
- Ions then flood into the nerve cell producing an electrical signal to a second nerve.
- The signal travels from nerve to nerve to reach the brain, and pain, perceived as heat, is felt.
- So when you eat hot chili peppers or put capsaicin creams on your skin, you think you are hot, but you are not.
- You even respond as if you are hot, for example, it makes you sweat.

TRP channels are key players in mediating pain signaling

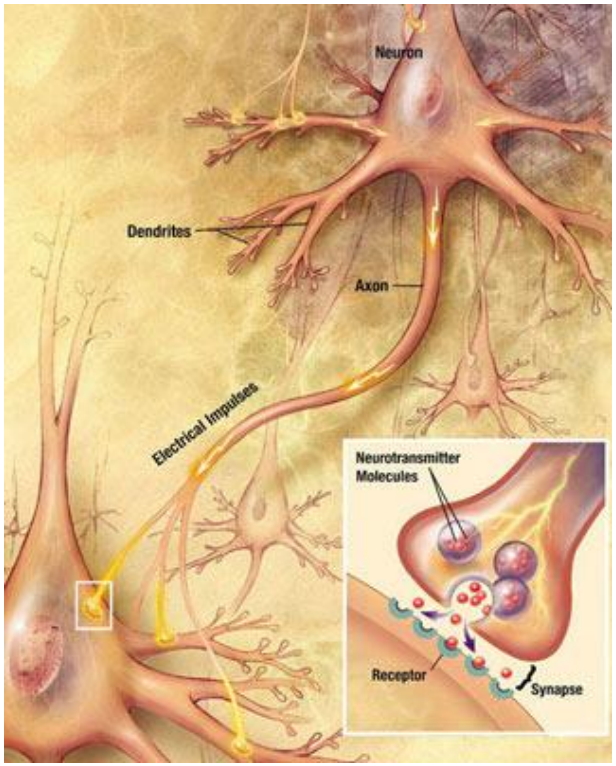
Chemical Signal (capsaicin)

↓

TRP Channel

↓

Electrical Signal



http://dsc.discovery.com/tv-shows/curiosity/topics/nervous-system-pictures.htm

An Introduction to the Integumentary System

- **Hypodermis** (Superficial Fascia or *Subcutaneous Layer*) NOT PART OF THE SKIN! This is below the cutaneous layer.
  - Loose connective tissue
  - Below the dermis

Figure 5-1 The Components of the Integumentary System

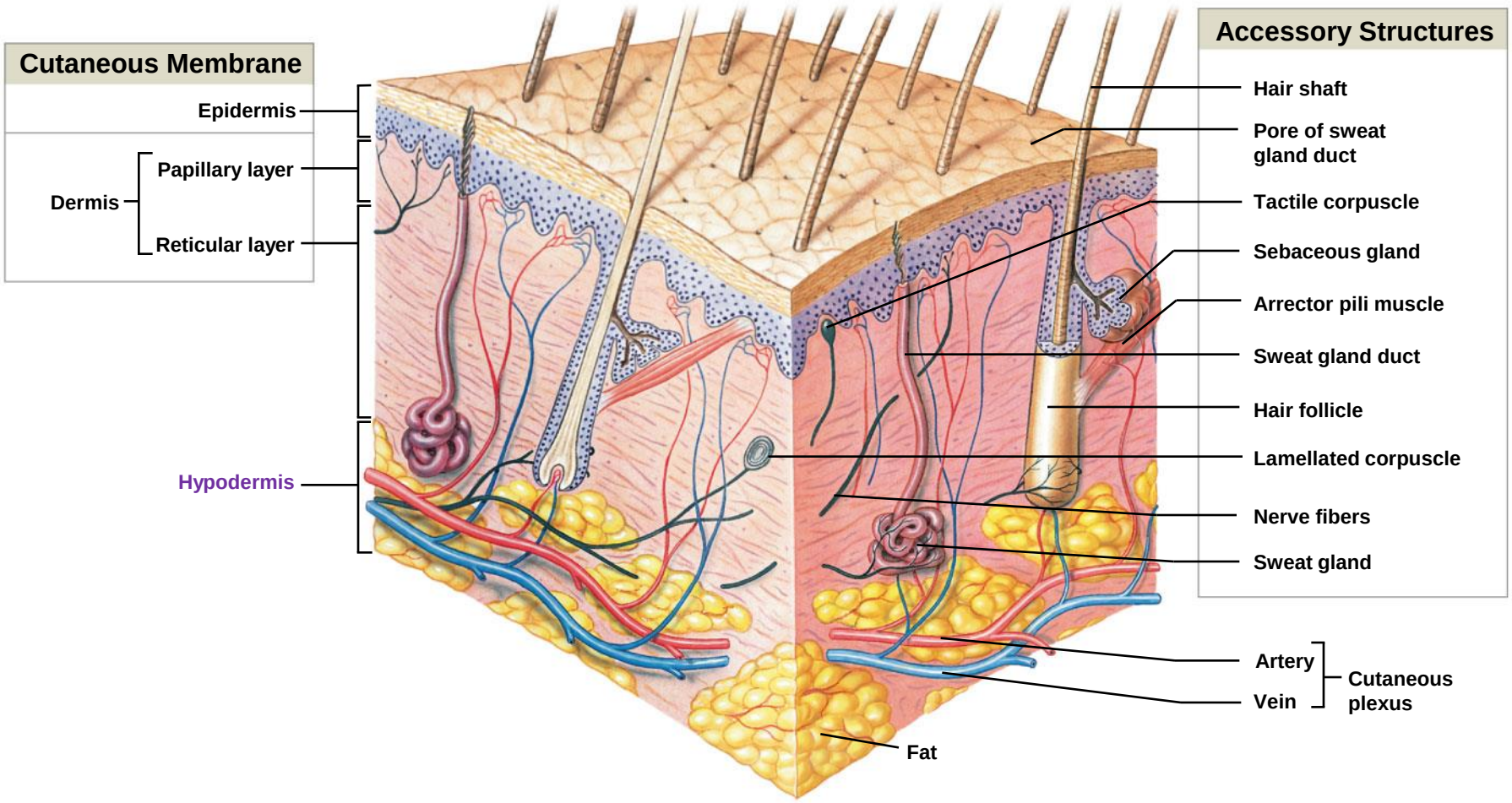
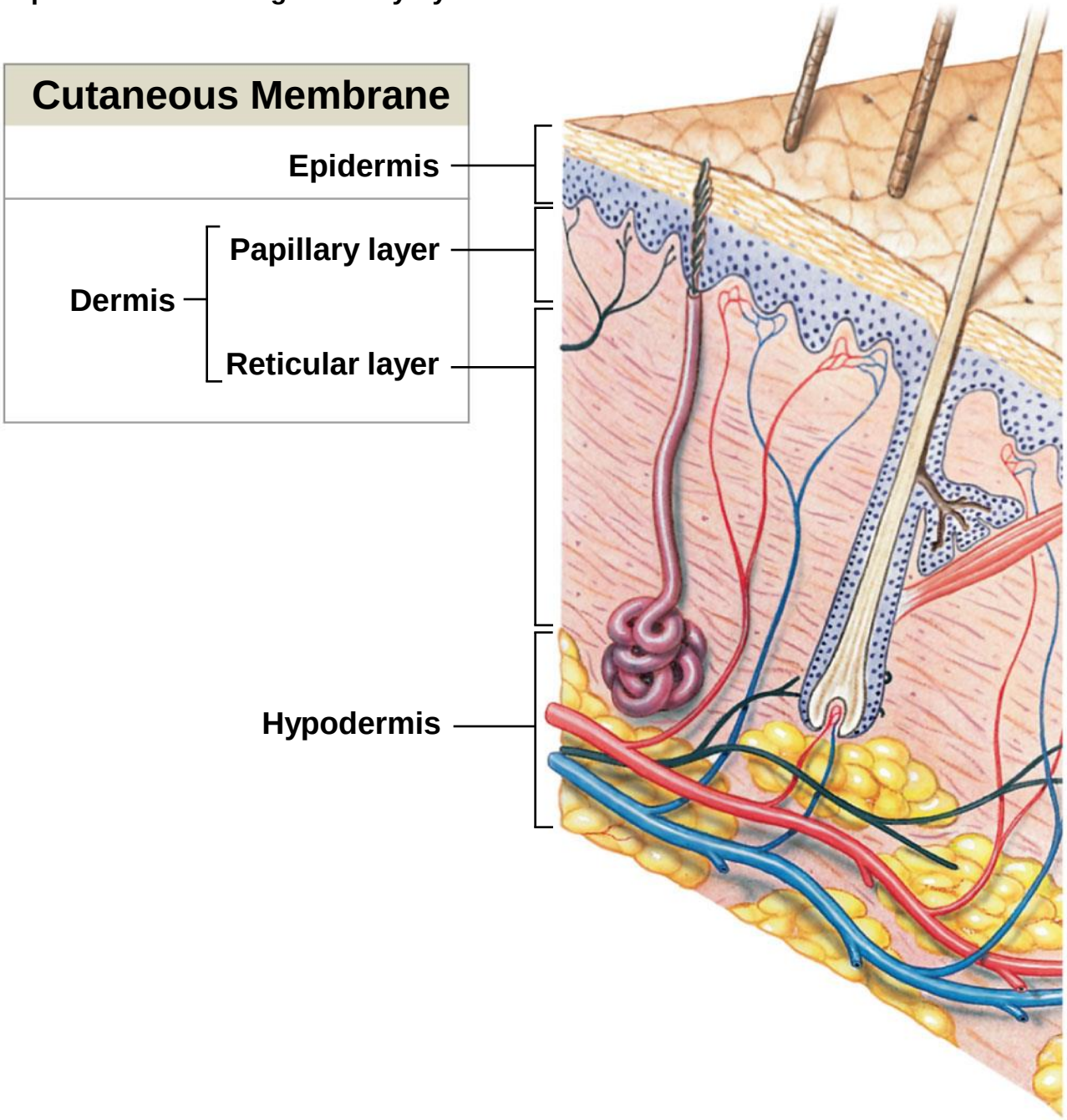


Figure 5-1 The Components of the Integumentary System



An Introduction to the Integumentary System

- Functions of Skin
  - *Protection* of underlying tissues and organs
  - *Excretion* of salts, water, and organic wastes (glands)
  - *Maintenance* of body temperature (insulation and evaporation)
  - *Production* of melanin

An Introduction to the Integumentary System

- Functions of Skin
  - *Production* of keratin
  - *Synthesis* of vitamin D_3
  - *Storage* of lipids
  - *Detection* of touch, pressure, pain, and temperature

5-1 Epidermis

- The Epidermis (top layer)
  - **Is avascular stratified squamous epithelium**
    - Nutrients and oxygen diffuse from capillaries in the dermis

What does avascular mean?

What do stratified squamous epithelium cells look like?

Figure 5-2 The Basic Organization of the Epidermis

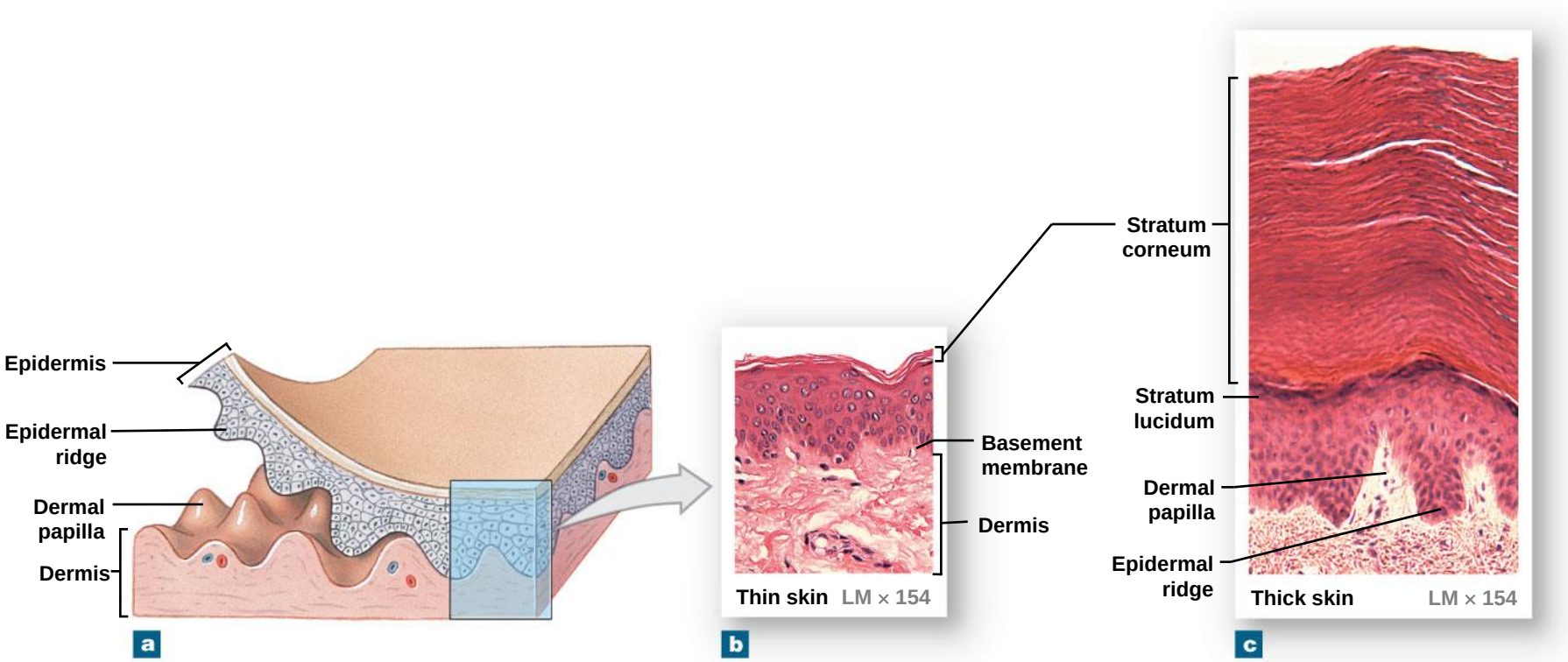
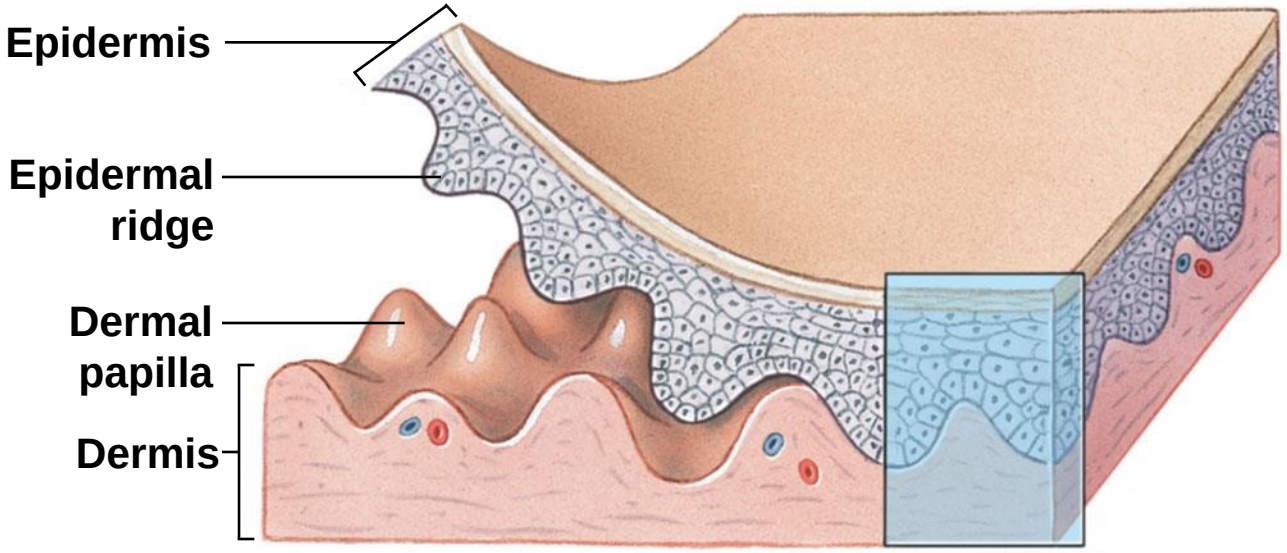


Figure 5-2a The Basic Organization of the Epidermis



a **The structural relationship and interface between the epidermis and underlying dermis. The proportions of the various layers differ with the location sampled.**

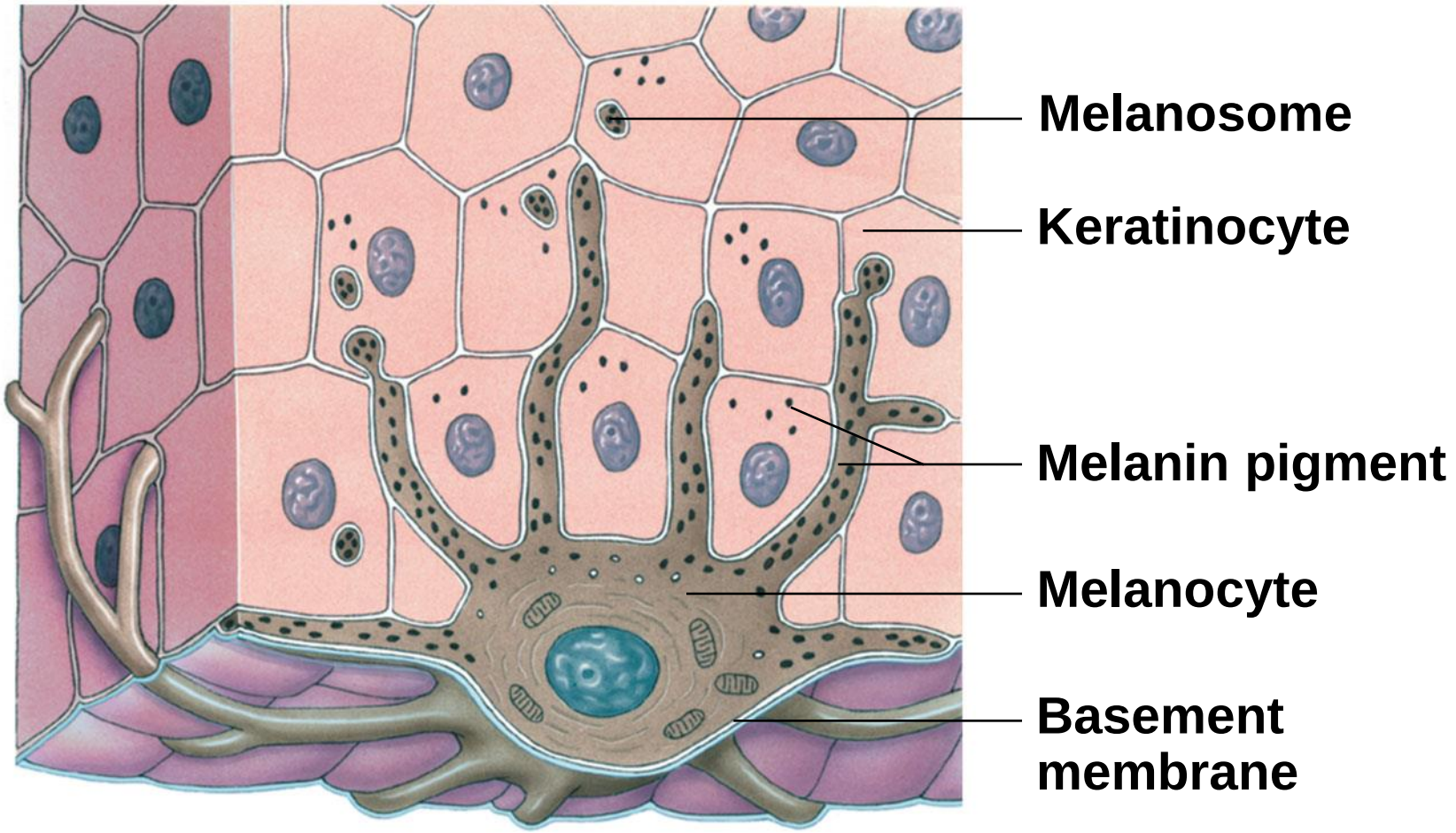
5-1 Cells of the Epidermis

- **Keratinocytes**-produce keratin, a protein that hardens and waterproofs the skin. Mature keratinocytes at the skin surface are dead and filled almost will all keratin.
- **Melanocytes**-produce melanin, a pigment that protects cells from UV rays. Transferred to keratinocytes.
- **Langerhans cells**-phagocytic macrophages that interact with white blood cells during an immune response
- **Merkel cells**-found at the epidermal-dermal boundary. Sense touch and pressure
  - Disc shaped

5-1 Epidermis

- Cells of the Epidermis
  - **Keratinocytes**
    - Contain large amounts of keratin
    - Are the most abundant cells in the epidermis

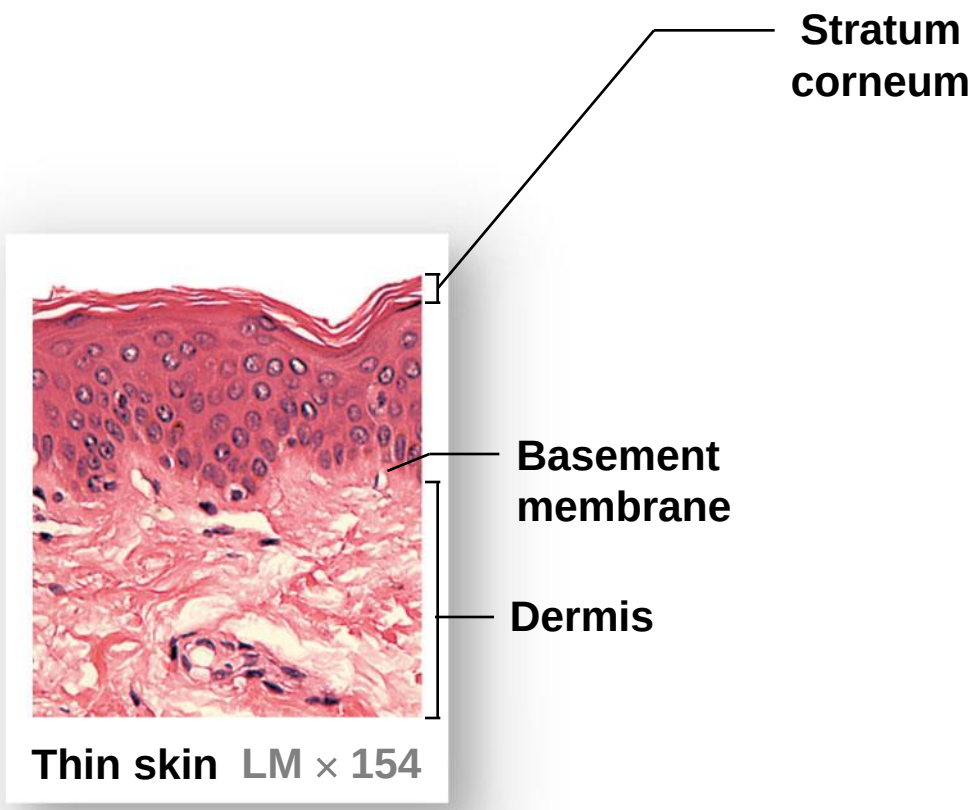
Figure 5-5 Melanocytes



5-1 Epidermis

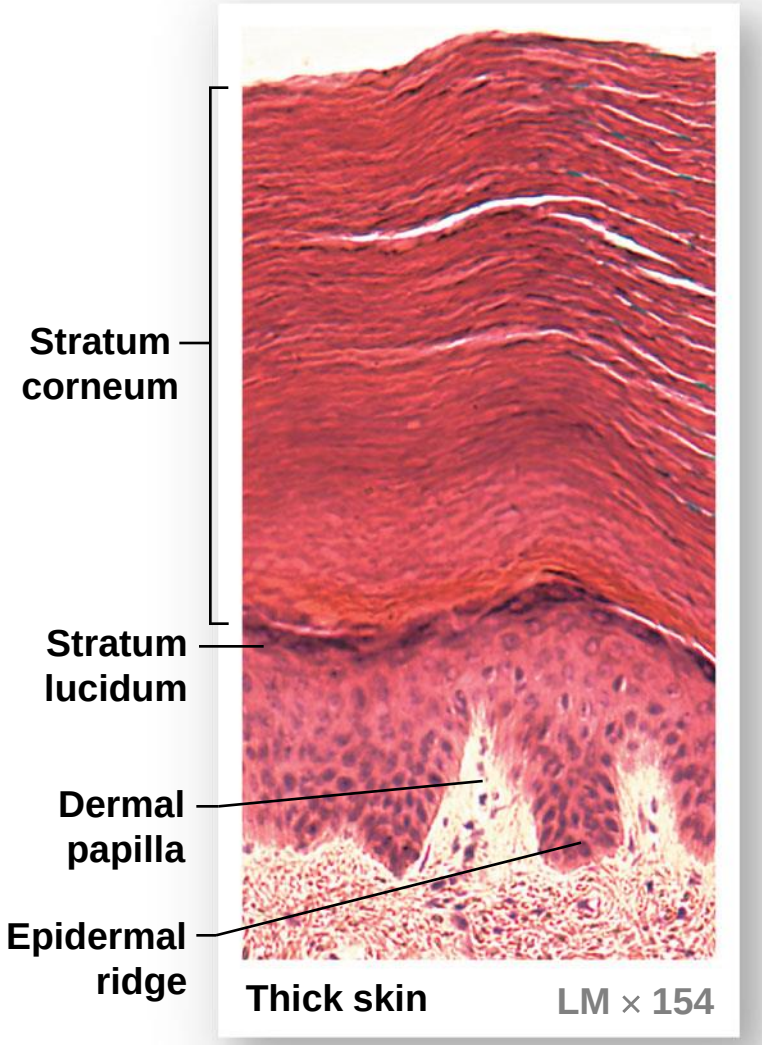
- **Thin Skin**
  - Covers most of the body
  - Has **four** layers of keratinocytes
- **Thick Skin**
  - Covers the palms of the hands and soles of the feet
  - Has **five** layers of keratinocytes

Figure 5-2b The Basic Organization of the Epidermis



b A micrograph of thin skin, which covers most of the exposed body surface.

Figure 5-2c The Basic Organization of the Epidermis

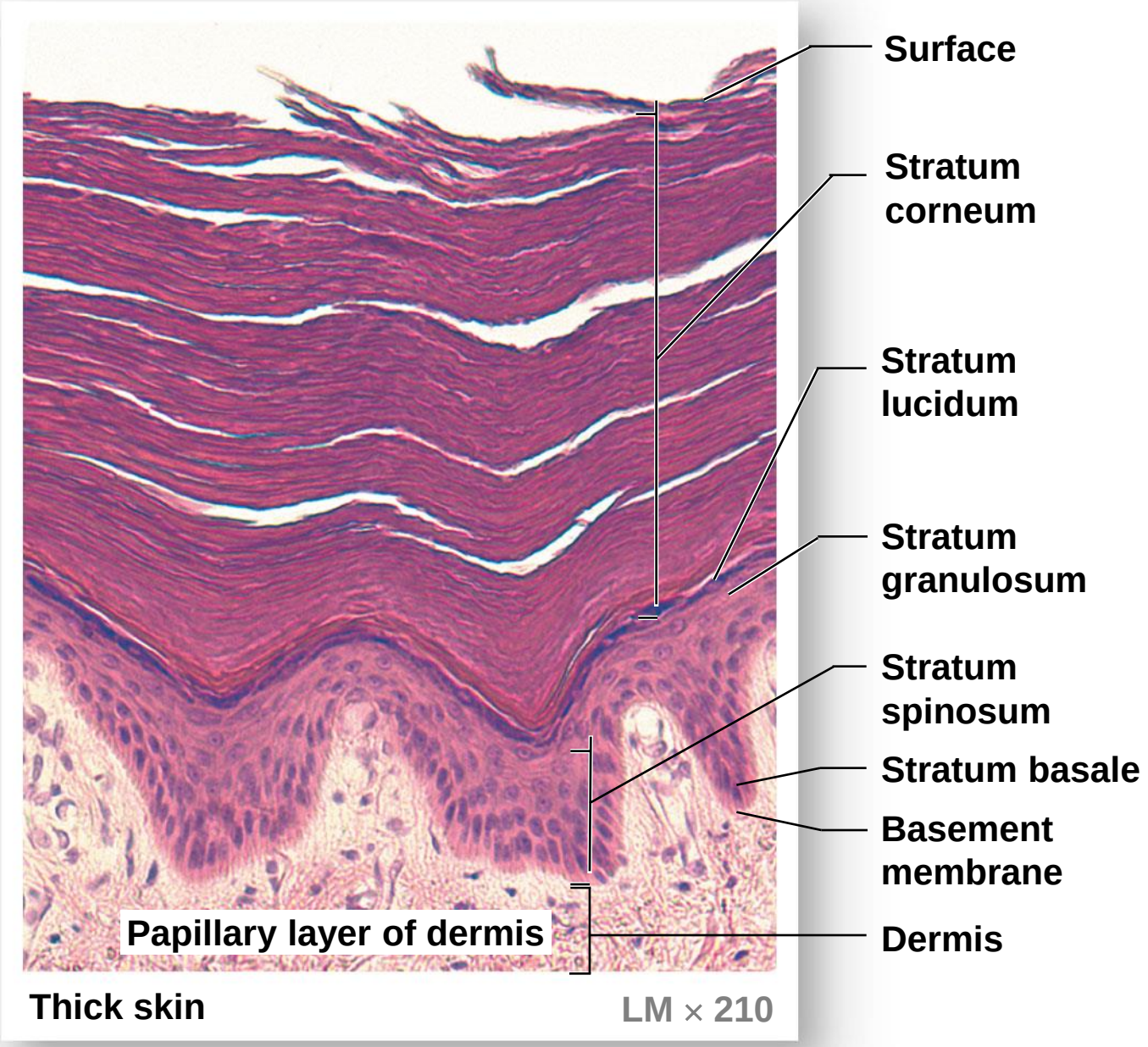


c A micrograph of thick skin, which covers the surface of the palms and the soles of the feet.

5-1 Epidermis

- Structures of the Epidermis
  - The five *strata* of keratinocytes in thick skin
  - From basal lamina to free surface
    1. **Stratum basale (bottom, basal = basement)**
    2. **Stratum spinosum**
    3. **Stratum granulosum**
    4. **Stratum lucidum—found only in thick skin**
    5. **Stratum corneum (Top)**

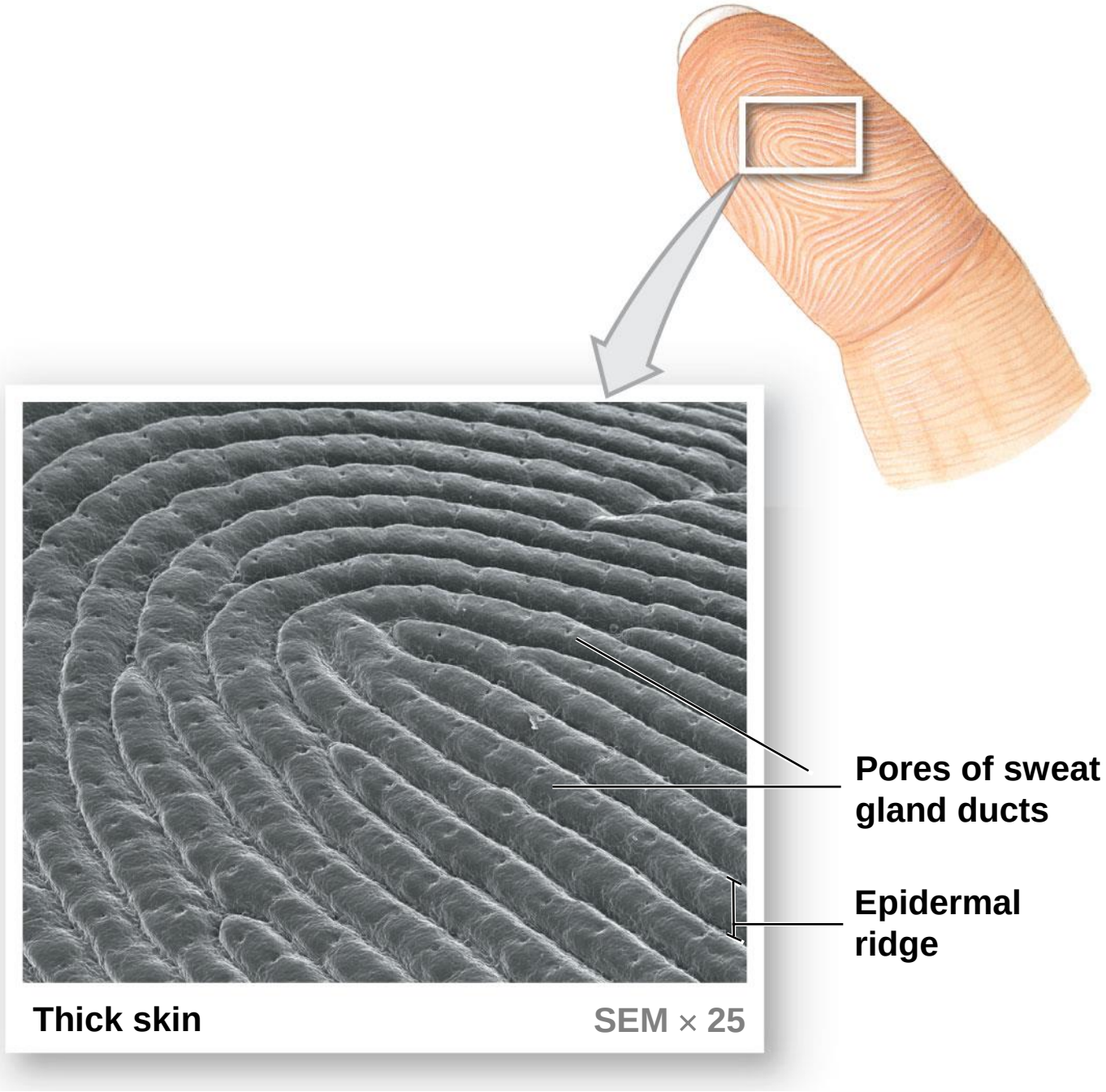
Figure 5-3 The Structure of the Epidermis



5-1 Epidermis

- **Stratum Basale (bottom)**
  - Is attached to basement membrane
  - Forms a strong bond between epidermis and dermis
  - Forms **epidermal ridges** (e.g., fingerprints)
  - **Dermal papillae** (tiny mounds)
    - Increase the area of basement membrane
    - Strengthen attachment between epidermis and dermis

Figure 5-4 The Epidermal Ridges of Thick Skin



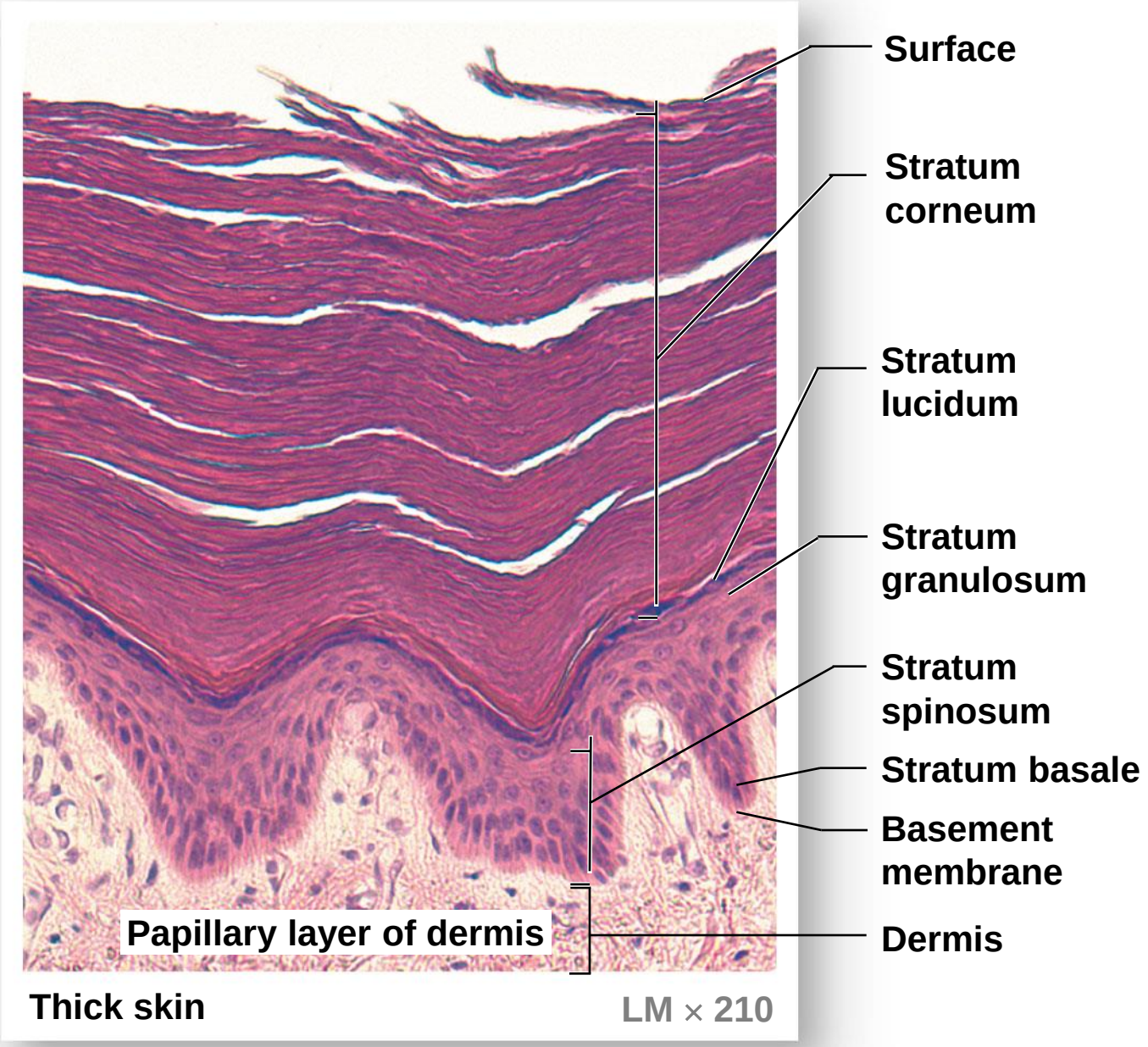
5-1 Epidermis

- Specialized Cells of Stratum Basale
  - *Merkel cells*
    - Found in hairless skin
    - Respond to touch (trigger nervous system)
  - *Melanocytes*
    - Contain the pigment melanin
    - Scattered throughout stratum basale

5-1 Epidermis

- **Stratum Spinosum** — the “spiny layer”
  - Produced by division of stratum basale
  - Eight to ten layers of keratinocytes
  - Cells shrink until cytoskeletons stick out (spiny)
  - Continue to divide, increasing thickness of epithelium
  - Contain *dendritic (Langerhans) cells*, active in immune response

Figure 5-3 The Structure of the Epidermis



5-1 Epidermis

- **Stratum Granulosum** — the “grainy layer”
  - Stops dividing, starts producing
    - **Keratin**
      - A tough, fibrous protein
      - Makes up hair and nails
    - **Keratohyalin**
      - Dense granules
      - Cross-link keratin fibers

5-1 Epidermis

- Cells of Stratum Granulosum
  - Produce protein fibers
  - Dehydrate and die
  - Create tightly interlocked layer of keratin surrounded by keratohyalin

5-1 Epidermis

- **Stratum Lucidum** — the “clear layer”
  - Found only in thick skin
  - Covers stratum granulosum

5-1 Epidermis

- **Stratum Corneum** — the “horn layer” Top layer
  - Exposed surface of skin
  - 15 to 30 layers of keratinized cells
  - Water resistant
  - Shed and replaced every 2 weeks

5-1 Epidermis

- **Keratinization**
  - The formation of a layer of dead, protective cells filled with keratin
  - Occurs on all exposed skin surfaces except eyes
  - Skin life cycle
  - It takes 15–30 days for a cell to move from stratum basale to stratum corneum

5-1 Epidermis

- Perspiration
  - **Insensible perspiration**
    - Interstitial fluid lost by evaporation through the stratum corneum
  - **Sensible perspiration**
    - Water excreted by sweat glands
    - Dehydration results:
      - From damage to stratum corneum (e.g., burns and *blisters* [insensible perspiration])
      - From immersion in hypertonic solution (e.g., seawater [osmosis])

5-1 Epidermis

- Hydration
  - Results from immersion in hypotonic solution (e.g., freshwater [osmosis])
  - Causes swelling of epithelial cells, evident on the palms and soles

5-2 Skin Color

- Skin Color is Influenced by Two Pigments
    1. **Carotene**
    2. **Melanin**
    - Blood circulation (red blood cells)

5-2 Skin Color

- **Carotene**
  - Orange-yellow pigment
  - Found in orange vegetables “carrot”
  - Accumulates in epidermal cells and fatty tissues of the dermis
  - Can be converted to vitamin A
  - Why are eating carrots good for your vision?

5-2 Skin Color

- **Melanin**
  - Yellow-brown or black pigment
  - Produced by **melanocytes** in stratum basale
  - Stored in transport vesicles (*melanosomes*)
  - Transferred to keratinocytes

Figure 5-5 Melanocytes

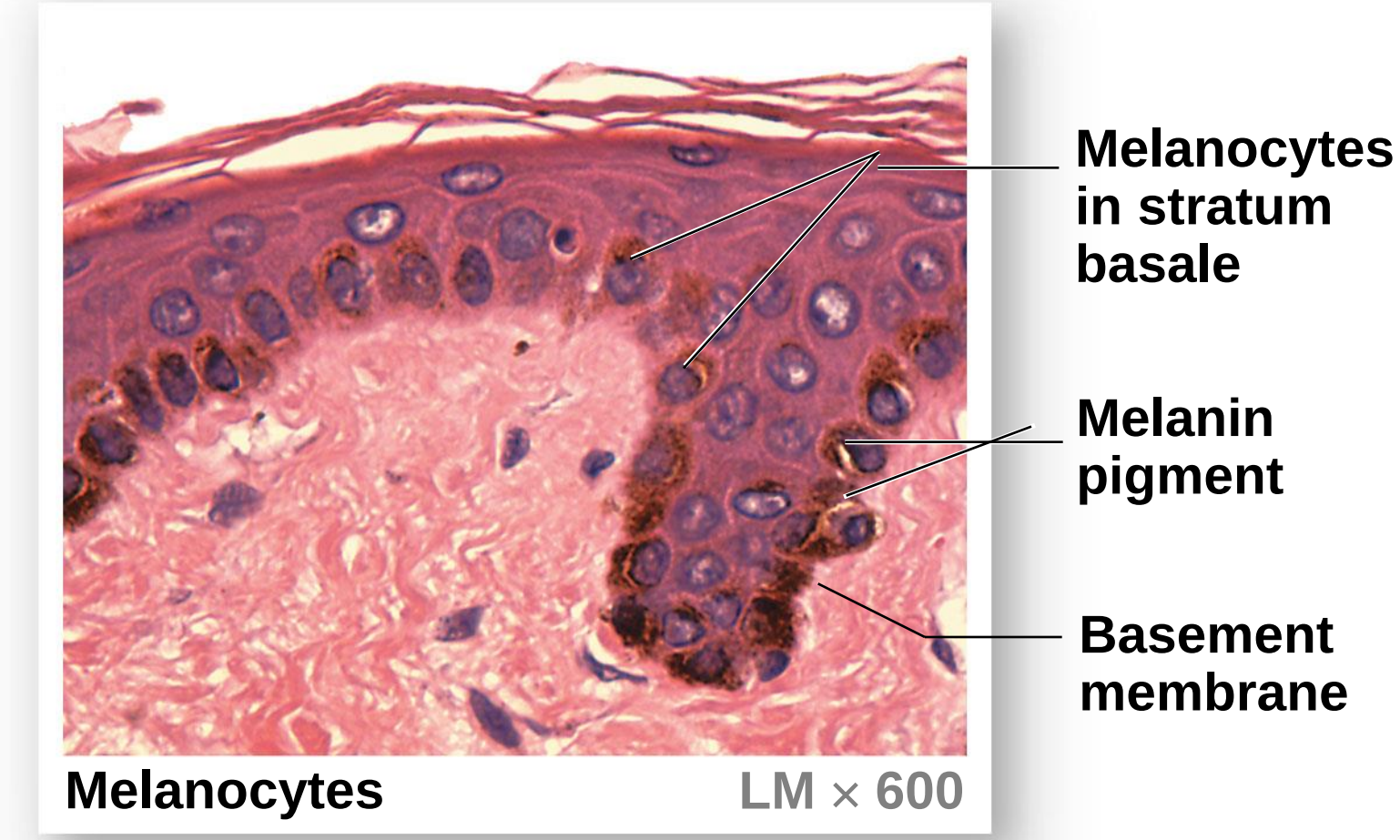


Figure 5-5 Melanocytes

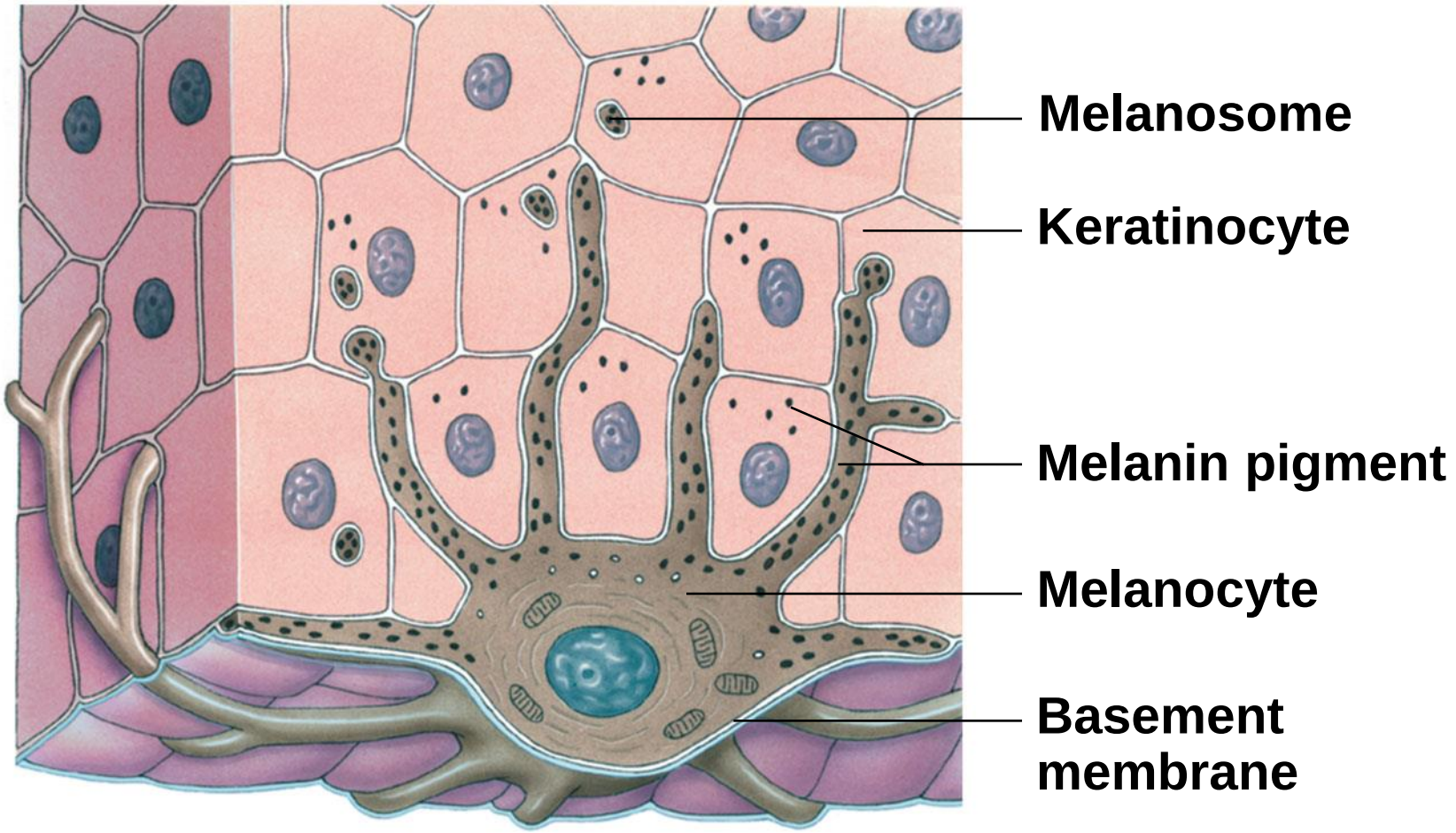
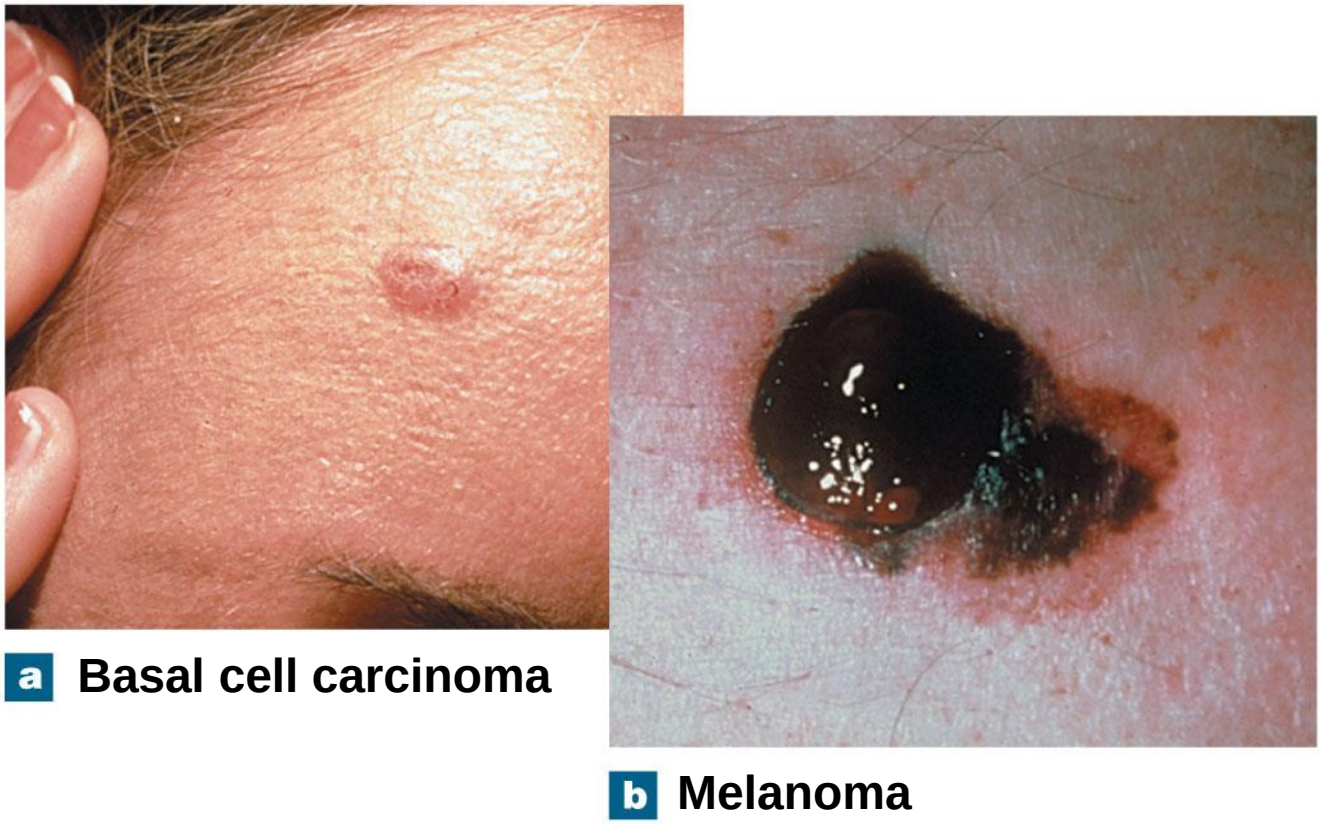


Figure 5-6 Skin Cancers



a Basal cell carcinoma

b Melanoma

5-2 Skin Color

- Function of Melanocytes
  - Melanin protects skin from sun damage
  - **Ultraviolet (UV) radiation**
    - Causes DNA mutations and burns that lead to cancer and wrinkles (http://www.cdc.gov/cancer/skin/basic_info/indoor_tanning.htm)
  - Skin color depends on melanin production, not number of melanocytes

5-2 Skin Color

- Capillaries and Skin Color
  - Oxygenated red blood contributes to skin color
    - Blood vessels dilate from heat, skin reddens
    - Blood flow decreases, skin pales
  - **Cyanosis**
    - Bluish skin tint
    - Caused by severe reduction in blood flow or oxygenation

5-2 Skin Color

- Illness and Skin Color
  - *Jaundice*
    - Buildup of bile produced by liver
    - Yellow color

  - *Vitiligo*
    - Loss of melanocytes
    - Loss of color

5-3 Vitamin D_3

- **Vitamin D_3**
  - Body can also synthesize it (from cholesterol) when sun exposure is adequate
  - Epidermal cells produce **cholecalciferol** (vitamin D_3)
    - In the presence of UV radiation
  - Liver and kidneys convert vitamin D_3 into **calcitriol**
    - Aids absorption of calcium and phosphorus
  - Insufficient vitamin D_3
    - Can cause *rickets*

Figure 5-7 Rickets

In the absence of vitamin D, dietary calcium is not properly absorbed, resulting in hypocalcaemia (low calcium), leading to skeletal and dental deformities and neuromuscular symptoms.

5-4 Epidermal Growth Factor (EGF)

- **Epidermal Growth Factor (EGF)**
  - Powerful peptide growth factor
  - Produced by glands (salivary and duodenum)
  - Used in laboratories to grow skin grafts
- Functions of EGF
  - Promotes division of germinative cells
  - Accelerates keratin production
  - Stimulates epidermal repair
  - Stimulates glandular secretion

5-5 The Dermis (underneath the epidermis)

- The Dermis
  - Located between epidermis and subcutaneous layer
  - Anchors epidermal accessory structures (hair follicles, sweat glands)
  - Two components
    1. Outer **papillary layer**
    2. Deep **reticular layer**

5-5 The Dermis

- The **Papillary Layer (outer)**
  - Consists of areolar tissue
  - Contains smaller capillaries, lymphatics, and sensory neurons
  - Has dermal papillae projecting between epidermal ridges

5-5 The Dermis

- The **Reticular Layer (deep)**
  - Consists of dense irregular connective tissue
  - Contains larger blood vessels, lymphatic vessels, and nerve fibers
  - Contains collagen and elastic fibers
  - Contains **connective tissue proper**

5-5 The Dermis

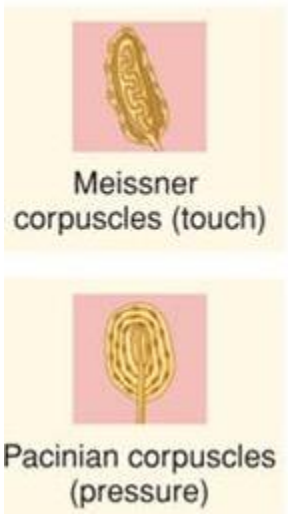
- **Dermatitis (itis=inflammation)**
  - An inflammation of the papillary layer
  - Caused by infection, radiation, mechanical irritation, or chemicals (e.g., poison ivy)
  - Characterized by itch or pain

5-5 The Dermis

- Dermal Strength and Elasticity
  - Presence of two types of fibers
    1. *Collagen fibers*
       - Very strong, resist stretching but bend easily
       - Provide flexibility
    2. *Elastic fibers*
       - Permit stretching and then recoil to original length
       - Limit the flexibility of collagen fibers to prevent damage to tissue
  - *Skin turgor*
    - Properties of flexibility and resilience

Dermis Cells

- Meissner's (tactile) corpuscles- respond to touch
  - Look like flattened discs
- Lamellated (pacinian)-responds to deep pressure
  - Look like onions



5-5 The Dermis

- Skin Damage
  - Sagging and wrinkles (reduced skin elasticity) are caused by:
    - Dehydration
    - Age
    - Hormonal changes
    - UV exposure

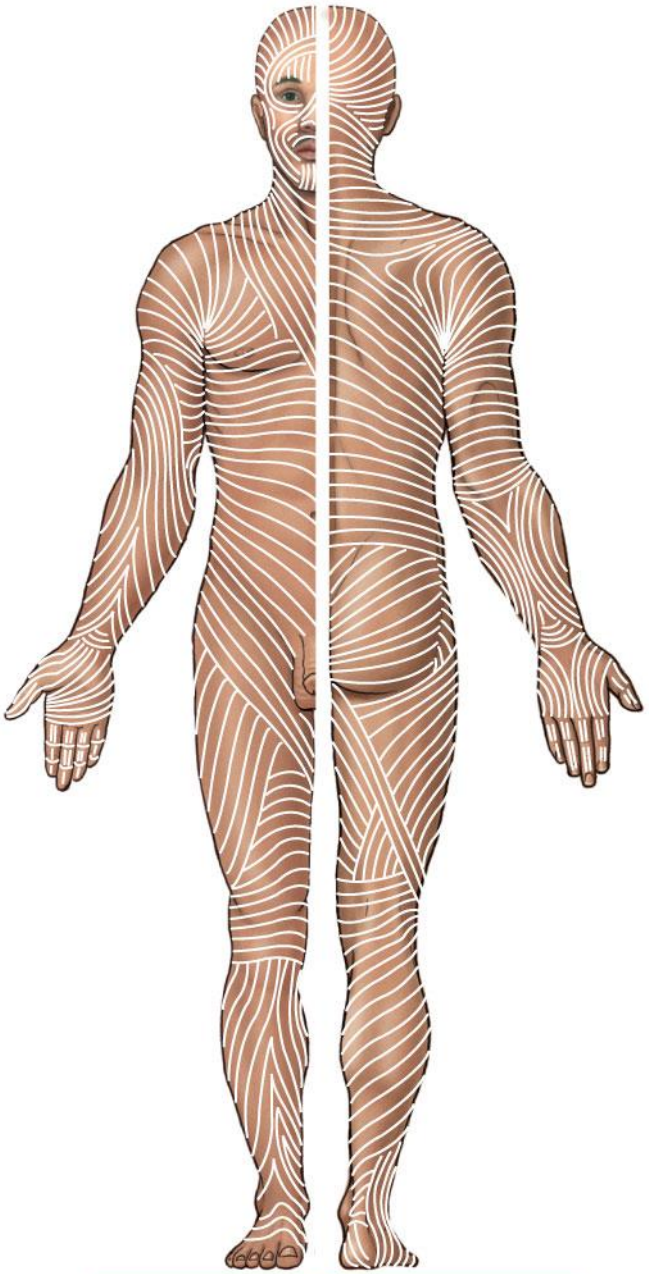
5-5 The Dermis

- Skin Damage
  - **Stretch marks**
    - Thickened tissue resulting from excessive stretching of skin due to:
      - Pregnancy
      - Weight gain

5-5 The Dermis

- Cleavage Lines
  - Collagen and elastic fibers in the dermis
    - Arranged in parallel bundles
    - Resist force in a specific direction
  - **Cleavage (tension) lines** establish important patterns
    - A parallel cut remains shut, heals well
    - A cut across (right angle) pulls open and scars

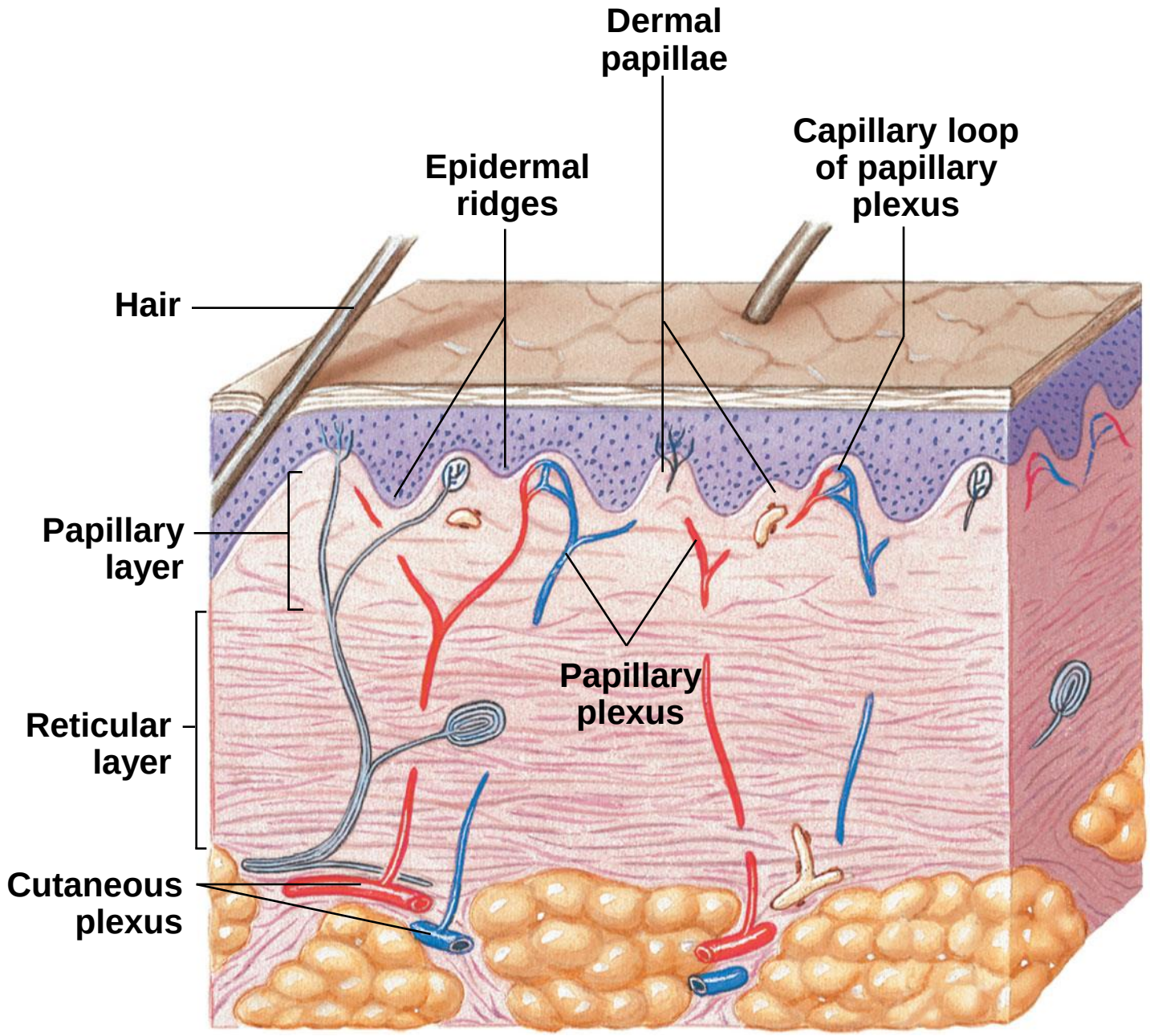
Figure 5-8 Cleavage Lines of the Skin



5-5 The Dermis

- The Dermal Blood Supply
  - *Cutaneous plexus*
    - A network of arteries along the reticular layer
  - *Papillary plexus*
    - Capillary network from small arteries in papillary layer
  - *Venous plexus*
    - Capillary return deep to the papillary plexus
  - *Contusion*
    - Damage to blood vessels resulting in “black-and-blue” bruising

Figure 5-9 Dermal Circulation



5-5 The Dermis

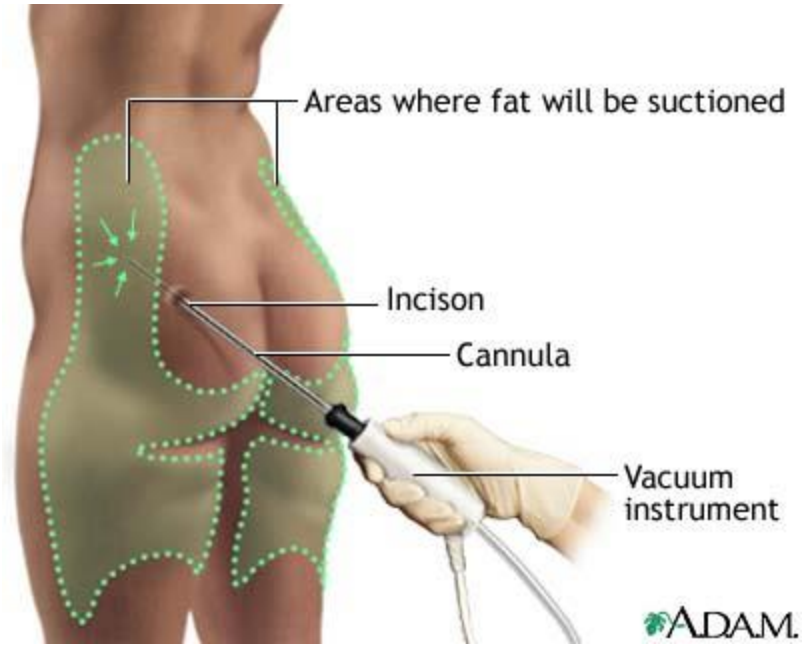
- In**nerv**ation of the Skin
  - Nerve fibers in skin control:
    - Blood flow
    - Gland secretions
    - Sensory receptors
      - Light touch—*tactile corpuscles,* located in dermal papillae
      - Deep pressure and vibration—*lamellated corpuscles,* in the reticular layer

5-6 The Hypodermis- NOT SKIN!

- The **Hypodermis** (Subcutaneous Layer=below the cutaneous layer)
  - Lies below the integument
  - Stabilizes the skin
  - Allows separate movement
  - Made of **elastic areolar and adipose tissues**
  - Connected to the reticular layer of integument by connective tissue fibers
  - Few capillaries and no vital organs
  - **Stores fat and anchors skin**
  - The site of **subcutaneous injections** using **hypodermic needles. WHY??**

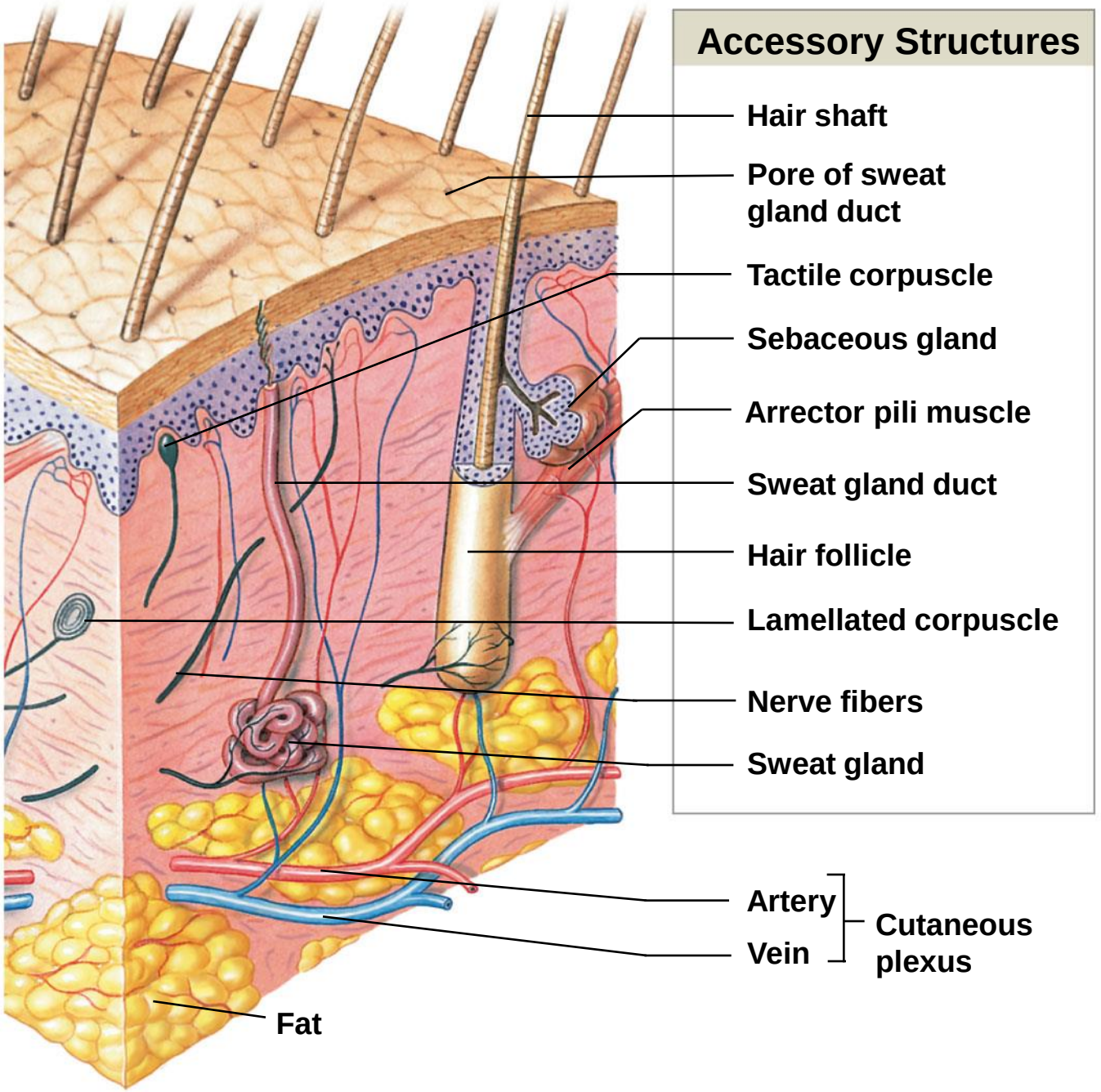
5-6 The Hypodermis

- Deposits of Subcutaneous Fat
  - Distribution patterns determined by hormones
  - Reduced by cosmetic **liposuction** (**lipoplasty**)



http://health.howstuffworks.com/wellness/cosmetic-treatments/liposuction2.htm

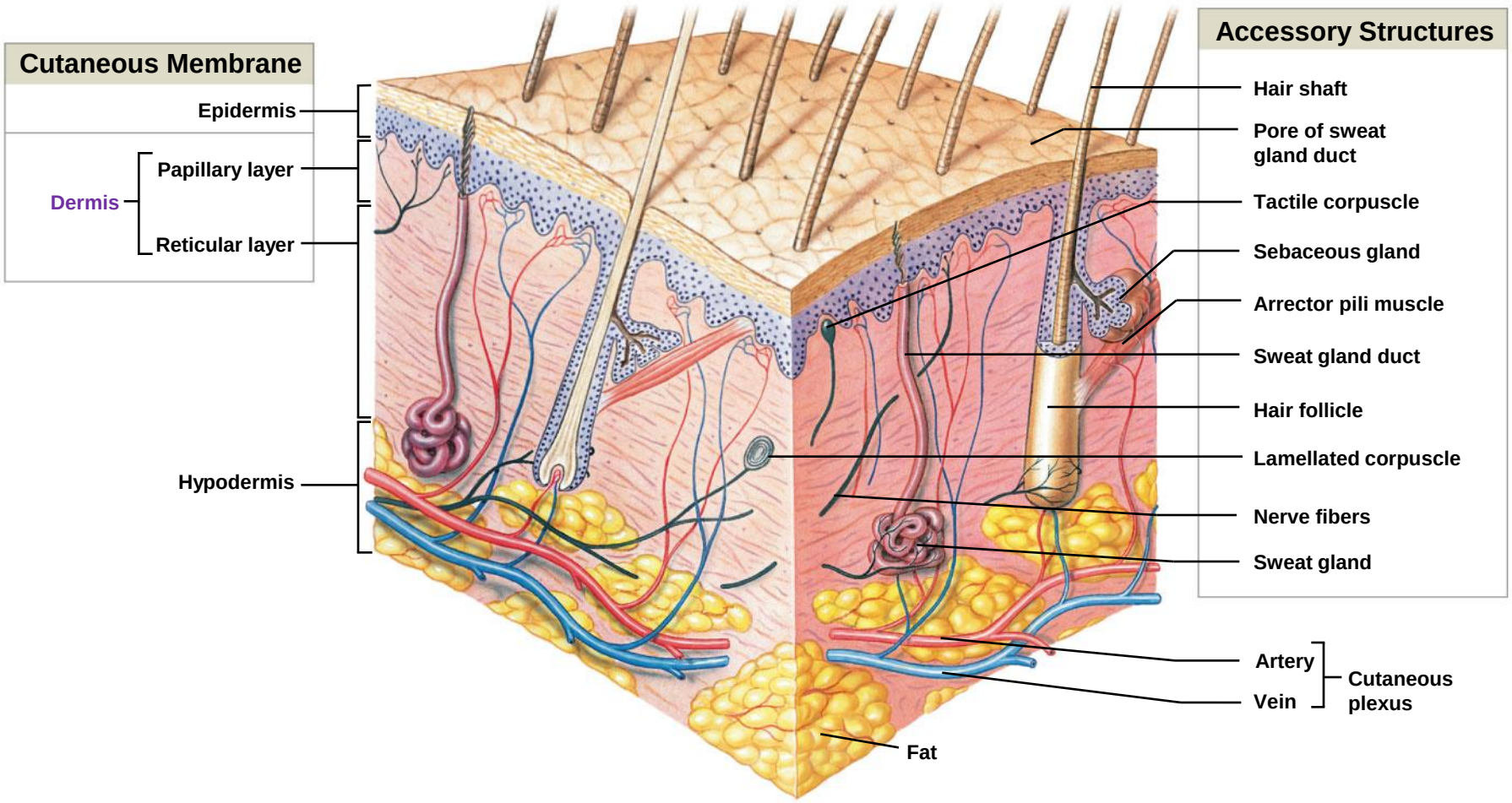
Figure 5-1 The Components of the Integumentary System



5-7 Hair

- **Hair, Hair Follicles, Sebaceous Glands, Sweat Glands**, and **Nails**
  - Integumentary accessory structures
  - Located in dermis
  - Project through the skin surface

Figure 5-1 The Components of the Integumentary System



5-7 Hair

- Human Body
  - The human body is covered with hair, *except:*
    - Palms
    - Soles
    - Lips
    - Portions of external genitalia

5-7 Hair

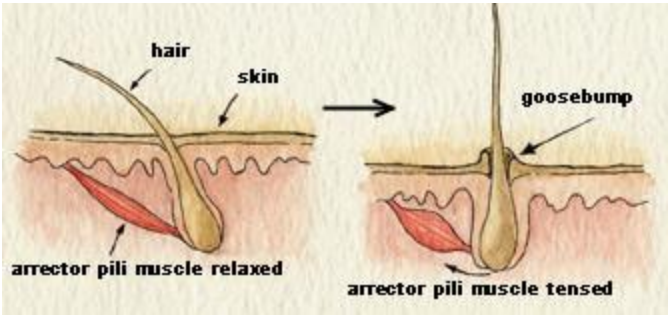
- Functions of Hair
  - Protects and insulates
  - Guards openings against particles and insects
  - Is sensitive to very light touch

Why do we have eyelashes?

5-7 Hair

What does this mean?

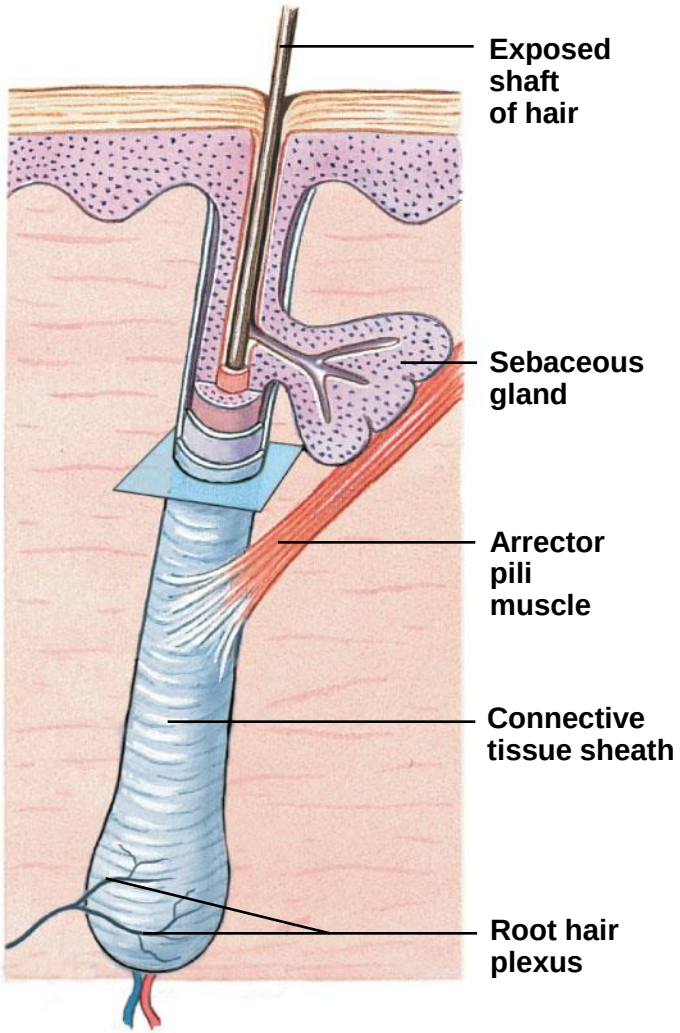
- Accessory Structures of Hair
  - **Arrector pili**
    - **Involuntary** smooth muscle
    - Causes hairs to stand up
    - Produces **“goose bumps”**
  - Sebaceous glands
    - Lubricate the hair
    - Control bacteria. HOW??



5-7 Hair

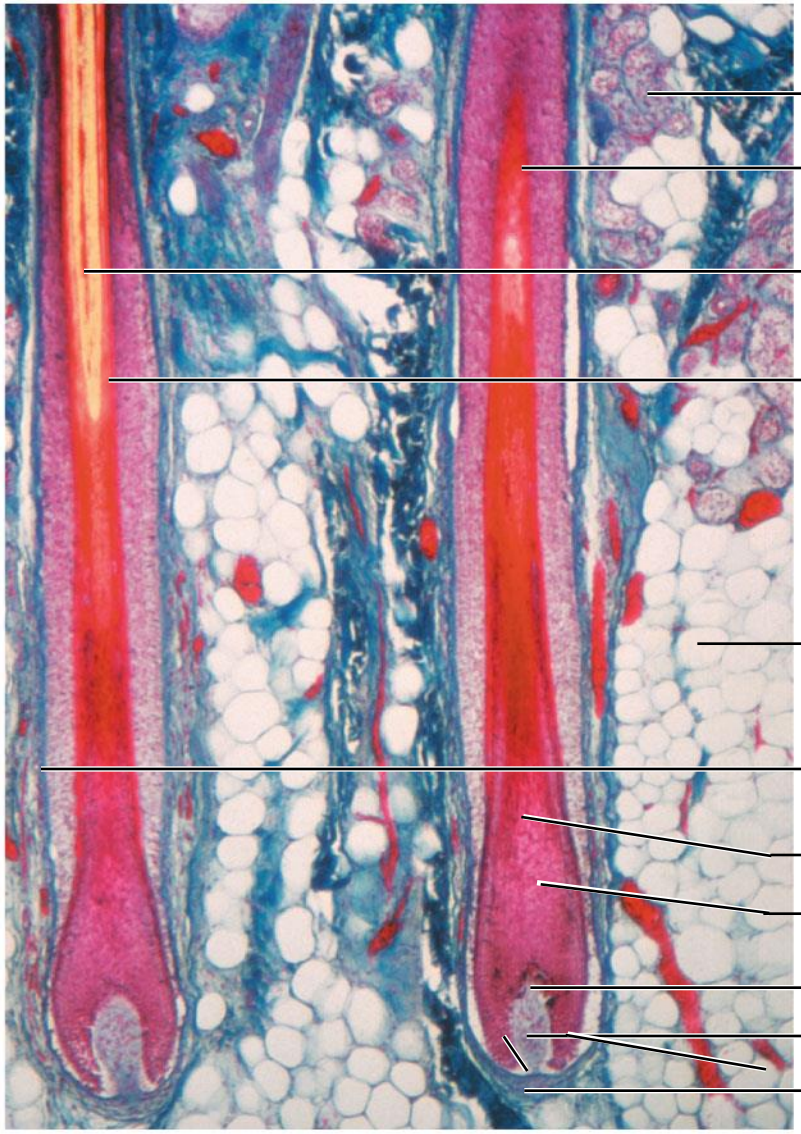
- Regions of the Hair
  - **Hair root**
    - Lower part of the hair
    - Attached to the integument
  - **Hair shaft**
    - Upper part of the hair
    - Not attached to the integument

Figure 5-10a Hair Follicles and Hairs



a Single hair follicle, showing the associated accessory structures; a superficial view of the deeper portions of the follicle illustrates the connective tissue sheath and the root hair plexus.

Figure 5-10d Hair Follicles and Hairs

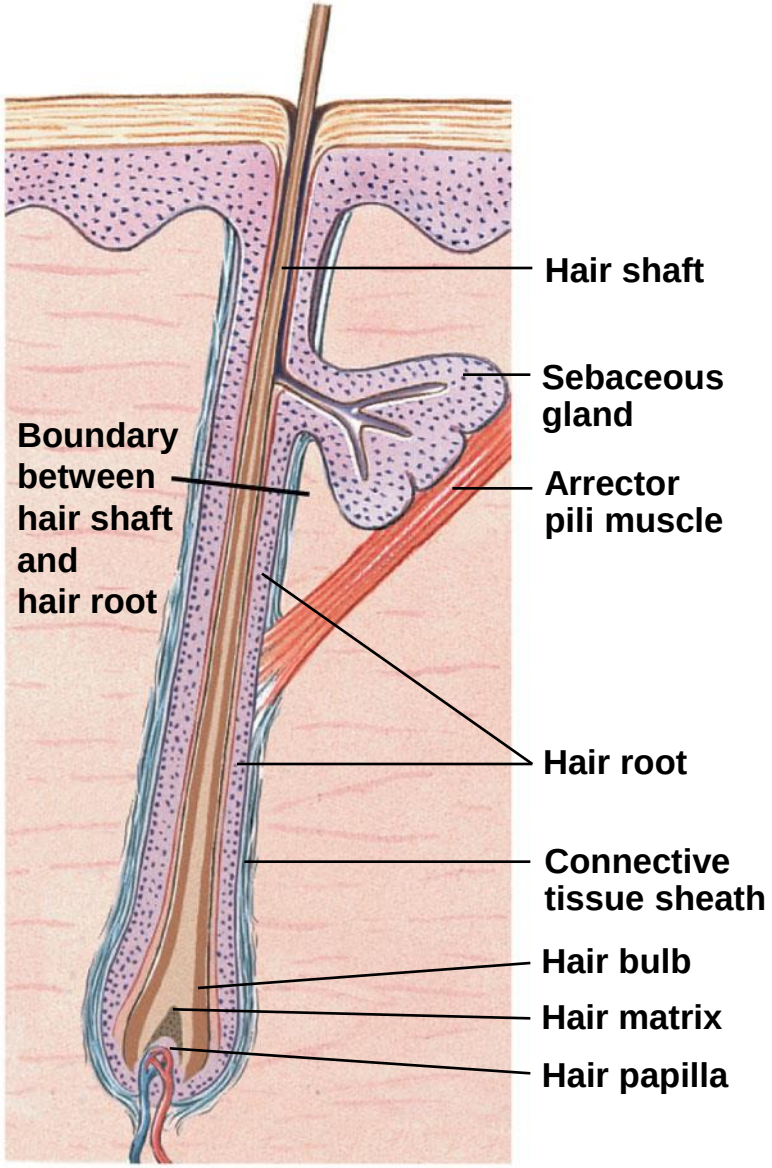


d **Longitudinal section through two hair follicles, showing the base of the follicle and the matrix and papilla at the root of the hair.**

5-7 Hair

- Hair Production
  - Begins at the base of a hair follicle, deep in the dermis
    - The **hair papilla** contains capillaries and nerves
    - The **hair bulb** produces **hair matrix**
      - A layer of dividing basal cells
      - Produces hair structure
      - Pushes hair up and out of skin

Figure 5-10c Hair Follicles and Hairs



c **Diagrammatic sectional view along the long axis of a hair follicle.**

5-7 Hair

- Hair Shaft Structure
  - **Medulla**
    - The central core
  - **Cortex**
    - The middle layer
  - **Cuticle**
    - The surface layer

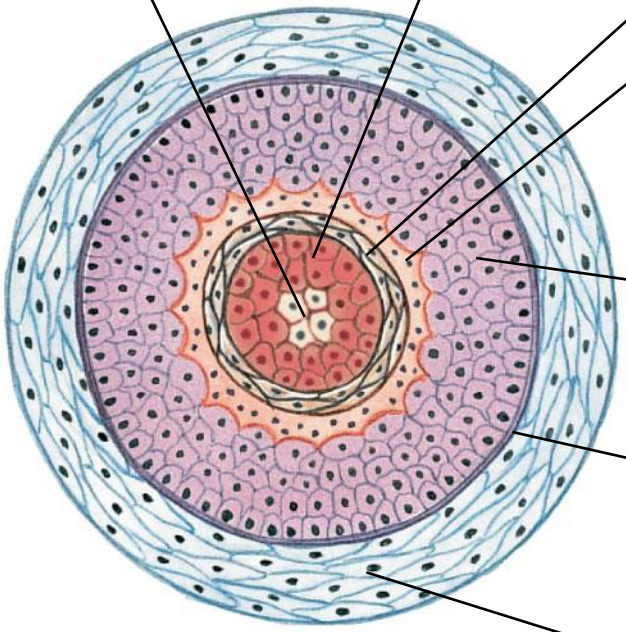
Figure 5-10b Hair Follicles and Hairs

Hair Structure

The medulla, or core, of the hair contains a flexible soft keratin.

The cortex contains thick layers of hard keratin, which give the hair its stiffness.

The cuticle, although thin, is very tough, and it contains hard keratin.



Follicle Structure

The internal root sheath surrounds the hair root and the deeper portion of the shaft. The cells of this sheath disintegrate quickly, and this layer does not extend the entire length of the hair follicle.

The external root sheath extends from the skin surface to the hair matrix.

The glassy membrane is a thickened, clear layer wrapped in the dense connective tissue sheath of the follicle as a whole.

Connective tissue sheath

b Cross section through a hair follicle and a hair, near the junction between the hair root and hair shaft.

5-7 Hair

- Keratin
  - As hair is produced, it is keratinized
    - Medulla contains flexible **soft keratin**
    - Cortex and cuticle contain stiff **hard keratin**

5-7 Hair

- Layers in the Follicle
  - **Internal root sheath**
    - The inner layer
    - Contacts the cuticle in lower hair root
  - **External root sheath**
    - Extends from skin surface to hair matrix
  - **Glassy membrane**
    - A dense connective tissue sheath
    - Contacts connective tissues of dermis

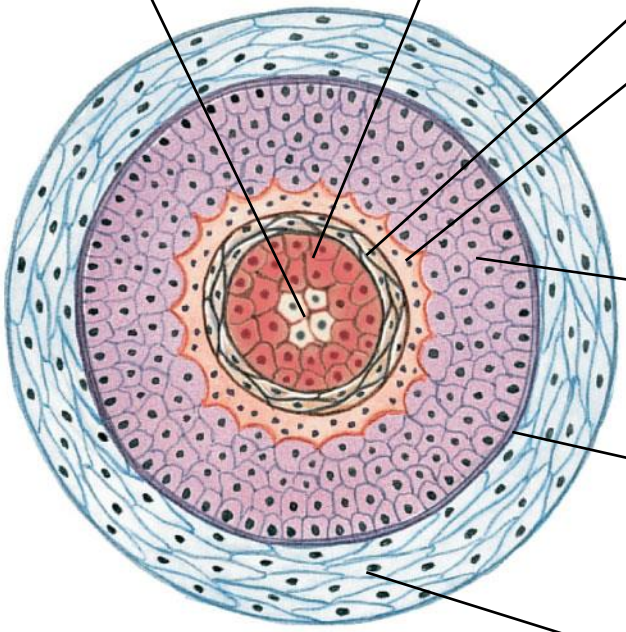
Figure 5-10b Hair Follicles and Hairs

Hair Structure

The medulla, or core, of the hair contains a flexible soft keratin.

The cortex contains thick layers of hard keratin, which give the hair its stiffness.

The cuticle, although thin, is very tough, and it contains hard keratin.



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Connective tissue sheath

b Cross section through a hair follicle and a hair, near the junction between the hair root and hair shaft.

Why is hair sampled for diagnostic purposes?

5-7 Hair

- **Hair Growth Cycle**
  - Growing hair
    - Is firmly attached to matrix
    - **Root absorbs nutrients and incorporates them into the hair structure.**
  - At the end of the growth cycle, the follicle becomes inactive and the hair stops growing.
    - **Club hair**
    - Follicle gets smaller, and over time the connections between the hair matrix and the club hair root break down.
  - When another cycle begins, the follicle becomes active, produces a new hair, and the old club hair is pushed to the surface and shed.

Figure 5-10b Hair Follicles and Hairs

Hair Structure

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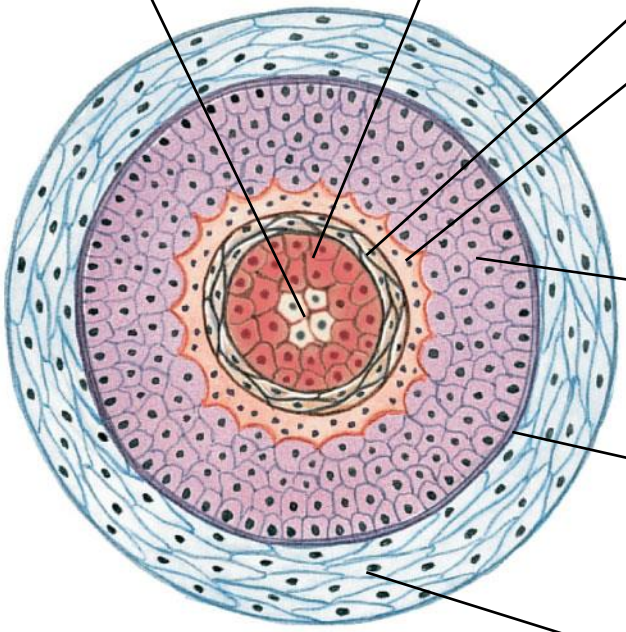

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Connective tissue sheath

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5-7 Hair

- Types of Hairs
  - **Vellus hairs**
    - Soft, fine
    - Cover body surface
  - **Terminal hairs**
    - Heavy, pigmented
    - Head, eyebrows, and eyelashes
    - Other parts of body after puberty

5-7 Hair

- Hair Color
  - Produced by melanocytes at the hair papilla
  - Determined by genes

5-8 Sebaceous Glands and Sweat Glands

- Exocrine Glands in Skin
  - **Sebaceous Glands** (oil glands)
    - Holocrine glands
    - Secrete **sebum**
  - Two Types of **Sweat Glands**
    1. Apocrine glands
    2. Merocrine (eccrine) glands
       - Watery secretions

5-8 Sebaceous Glands and Sweat Glands

- Types of **Sebaceous** (Oil) **Glands**
  - Simple branched alveolar glands
    - Associated with hair follicles
  - **Sebaceous follicles**
    - Discharge directly onto skin surface
    - **Sebum**
      - Contains lipids and other ingredients
      - Lubricates and protects the epidermis
      - Inhibits bacteria

Figure 5-11 The Structure of Sebaceous Glands and Sebaceous Follicles

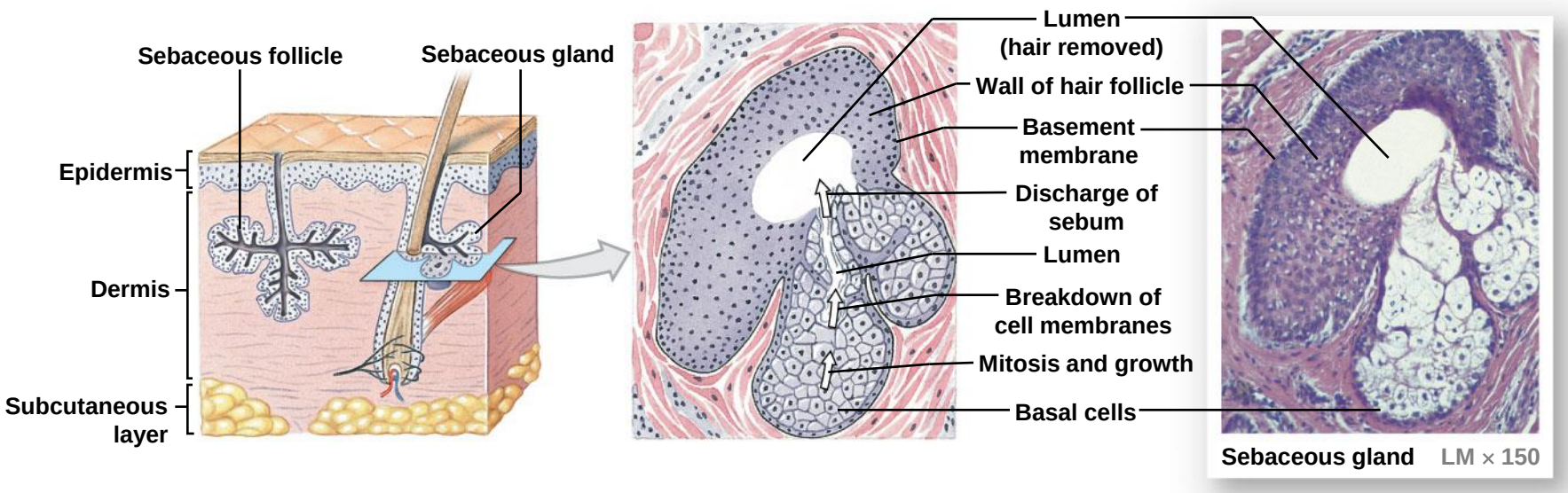


Figure 5-11 The Structure of Sebaceous Glands and Sebaceous Follicles

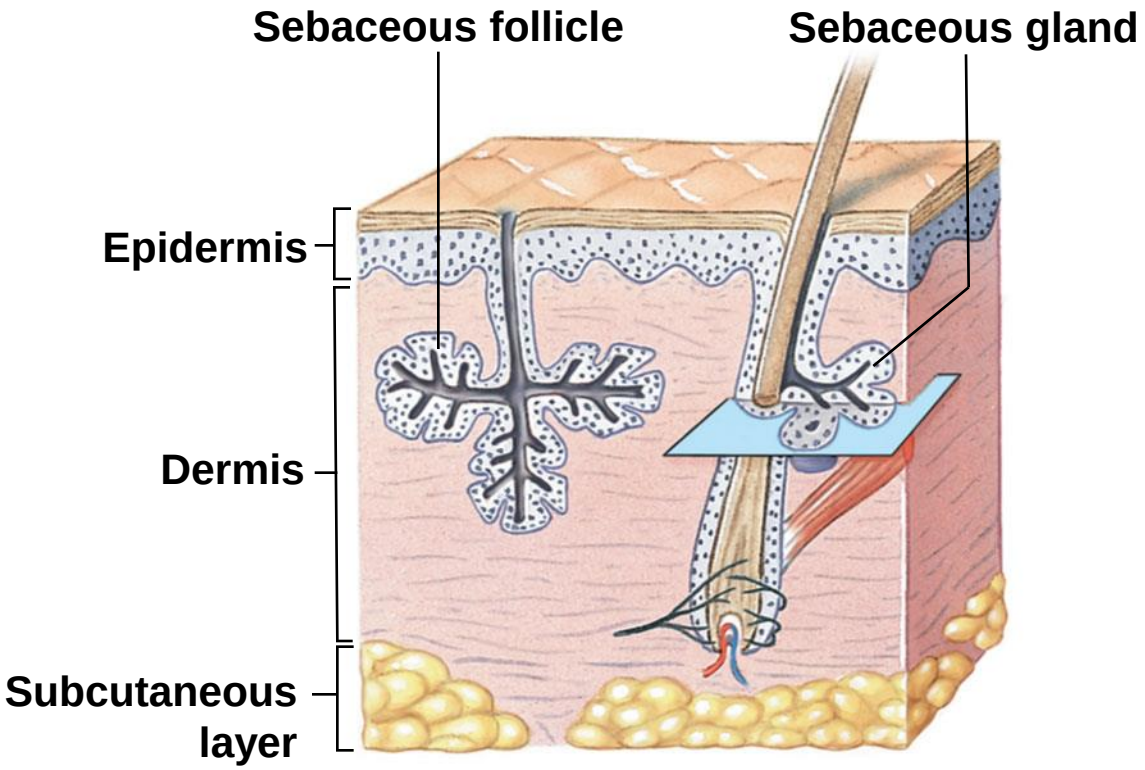
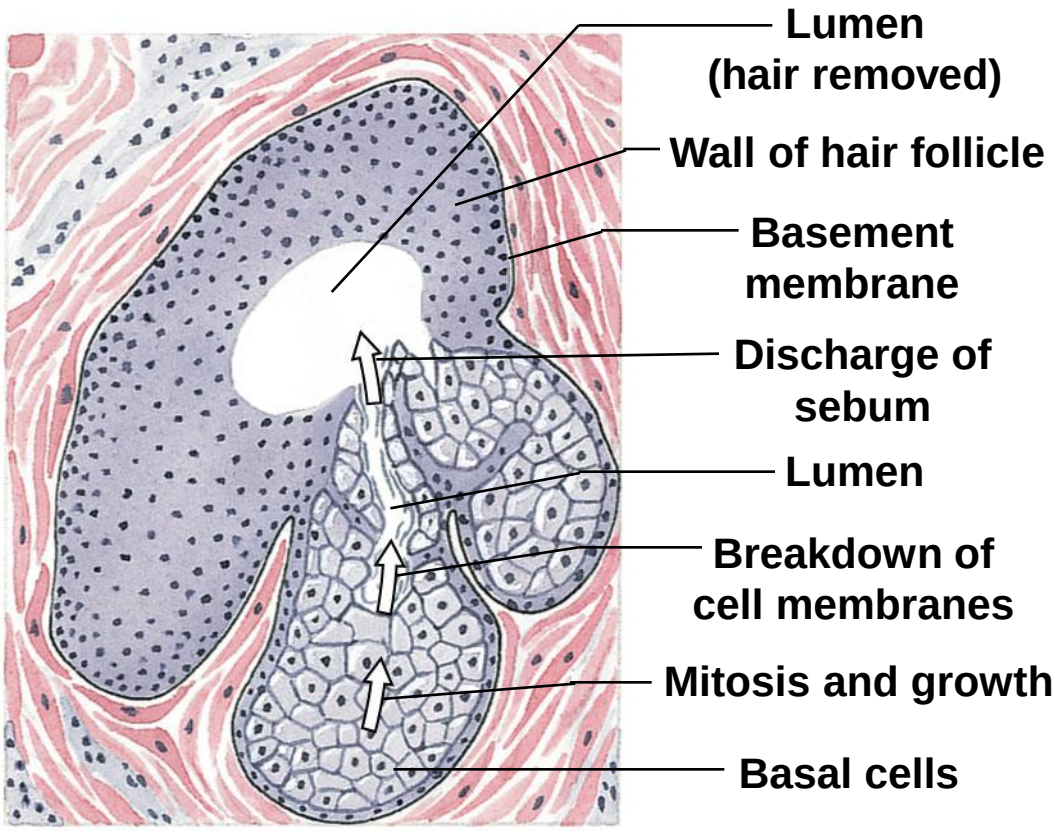


Figure 5-11 The Structure of Sebaceous Glands and Sebaceous Follicles



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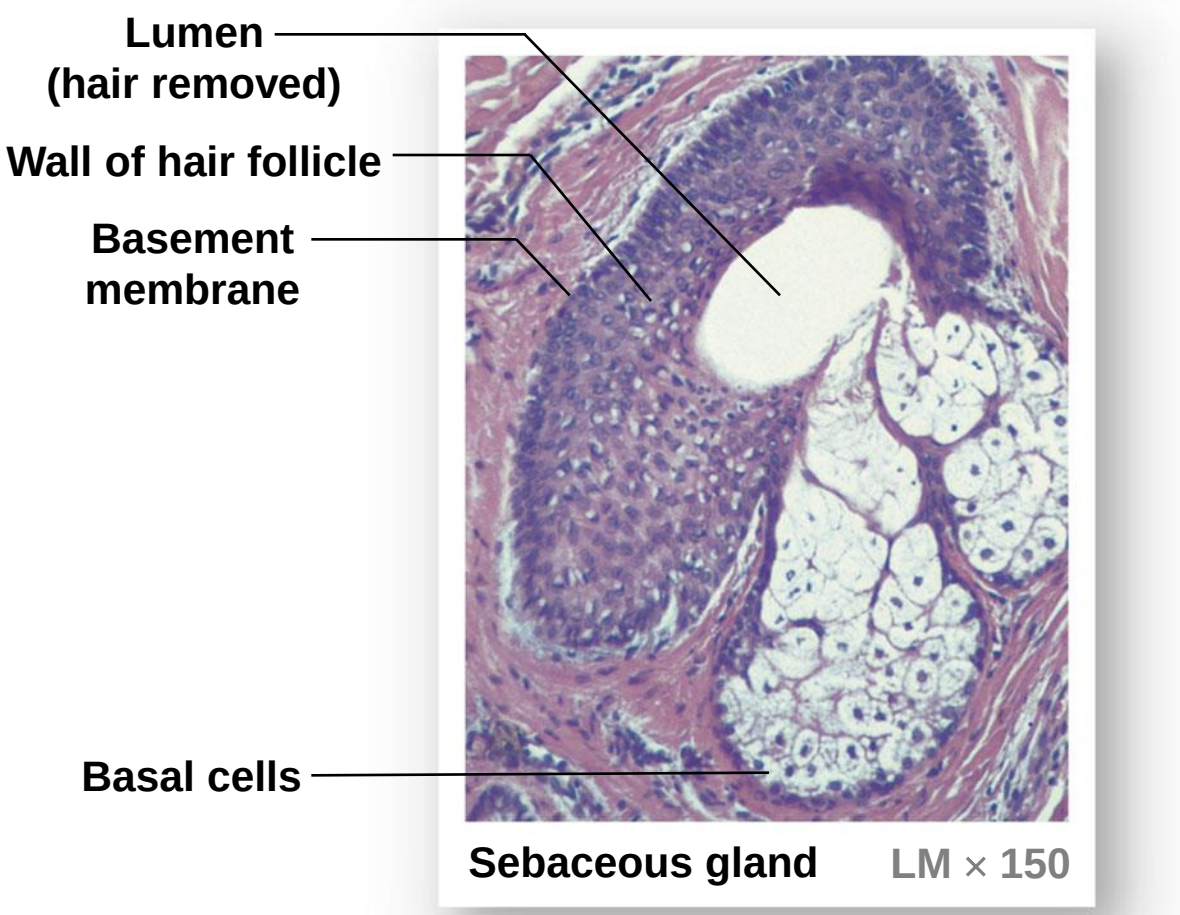
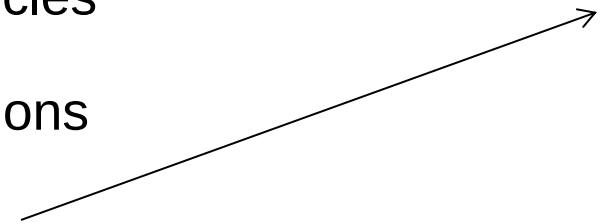


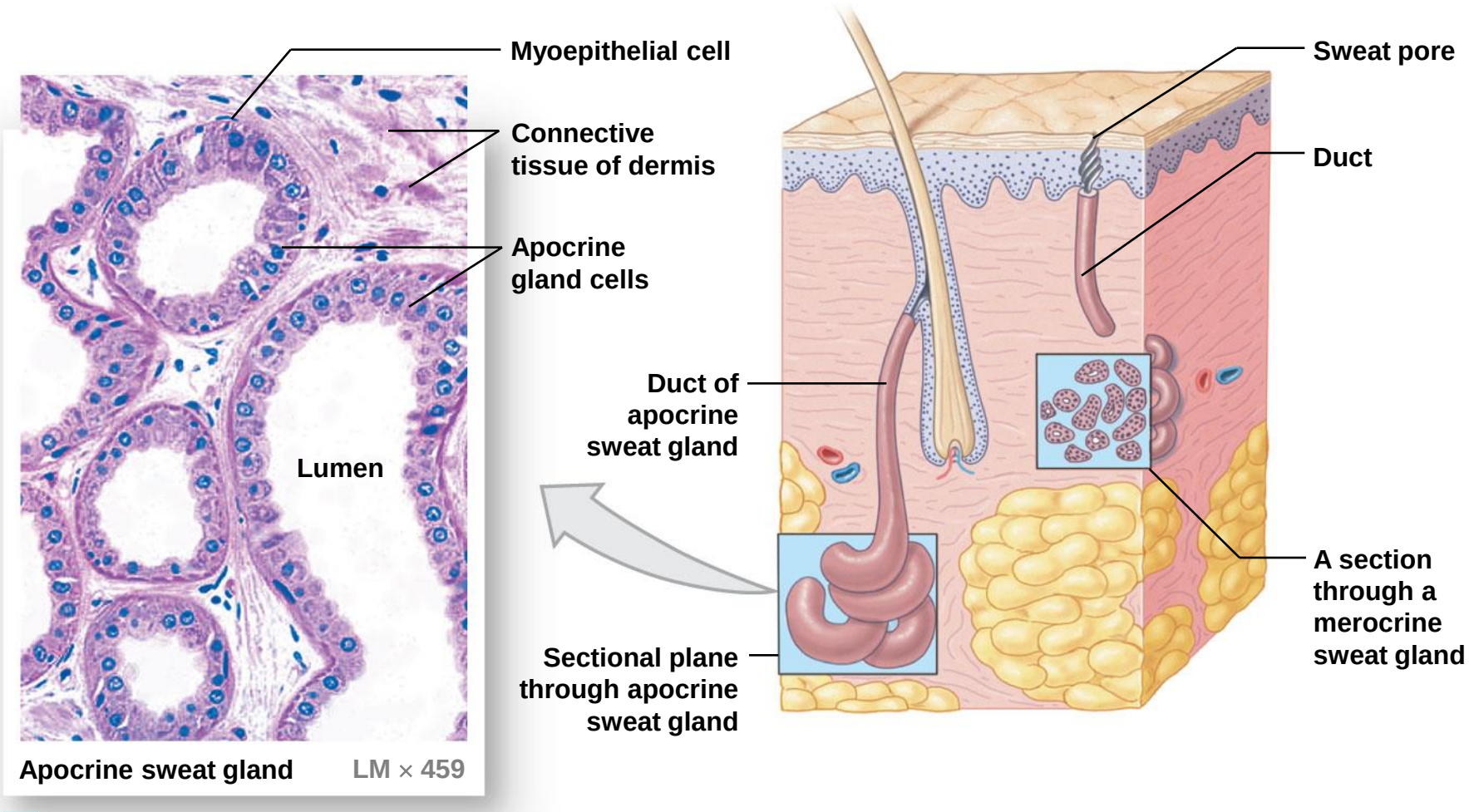
5-8 Sebaceous Glands and Sweat Glands

- **Apocrine Sweat Glands**
  - Found in armpits, around nipples, and groin
  - Secrete products into hair follicles
  - Produce sticky, cloudy secretions
  - Break down and cause odors
  - Surrounded by **myoepithelial cells**
    - Squeeze apocrine gland secretions onto skin surface
    - In response to hormonal or nervous signal



What causes the odor?

Figure 5-12a Sweat Glands

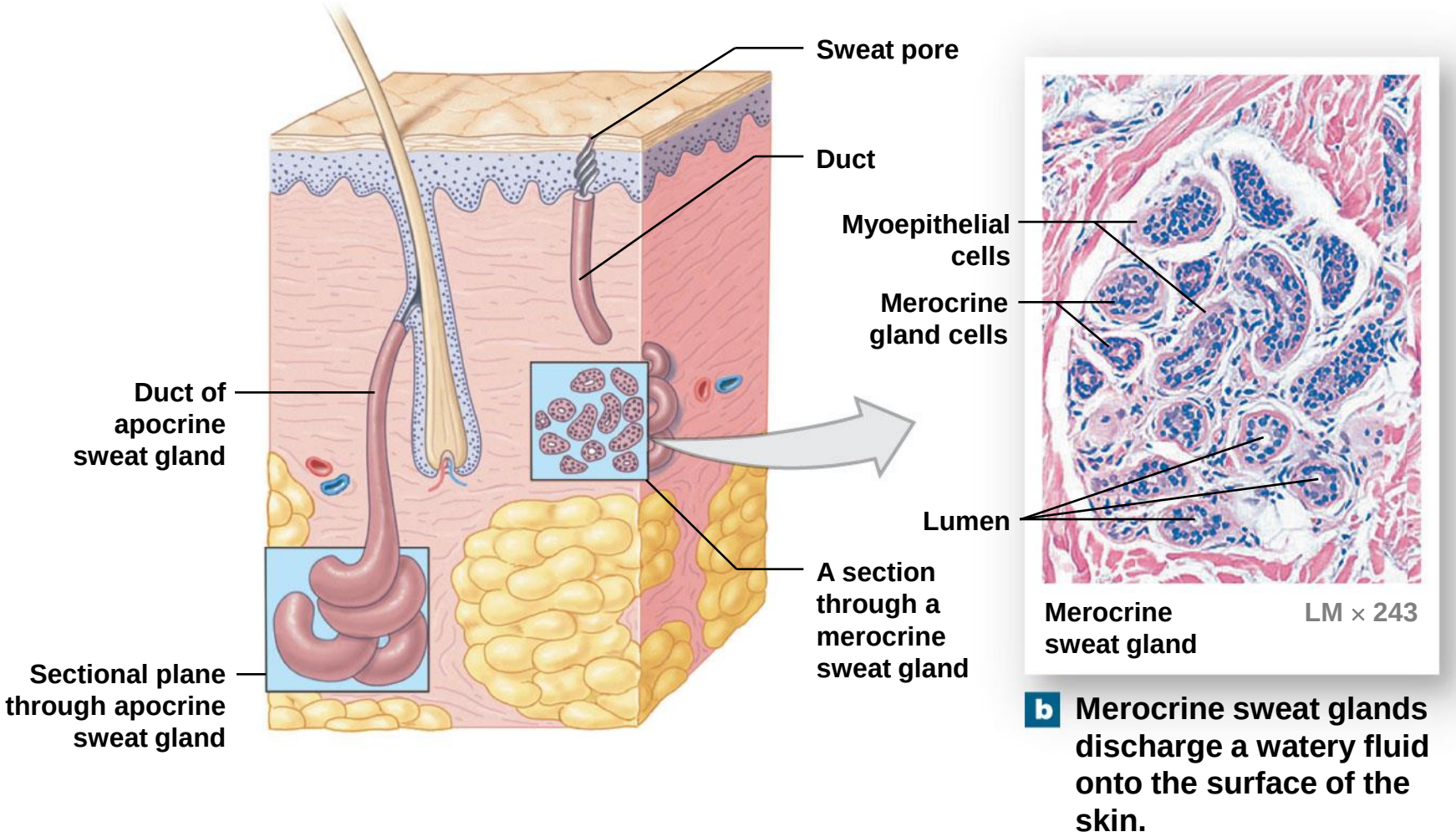


a Apocrine sweat glands secrete a thick, odorous fluid into hair follicles.

5-8 Sebaceous Glands and Sweat Glands

- **Merocrine (Eccrine) Sweat Glands**
  - Widely distributed on body surface
  - Especially on palms and soles
  - Coiled, tubular glands
  - Discharge directly onto skin surface
  - Sensible perspiration
  - Water, salts, and organic compounds
  - Functions of merocrine sweat gland activity
    - Cools skin
    - Excretes water and electrolytes
    - Flushes microorganisms and harmful chemicals from skin

Figure 5-12b Sweat Glands



5-8 Sebaceous Glands and Sweat Glands

- Other Integumentary Glands

1. **Mammary glands**
    - Produce milk
2. **Ceruminous glands**
    - Produce **cerumen** (earwax)
    - Protect the eardrum

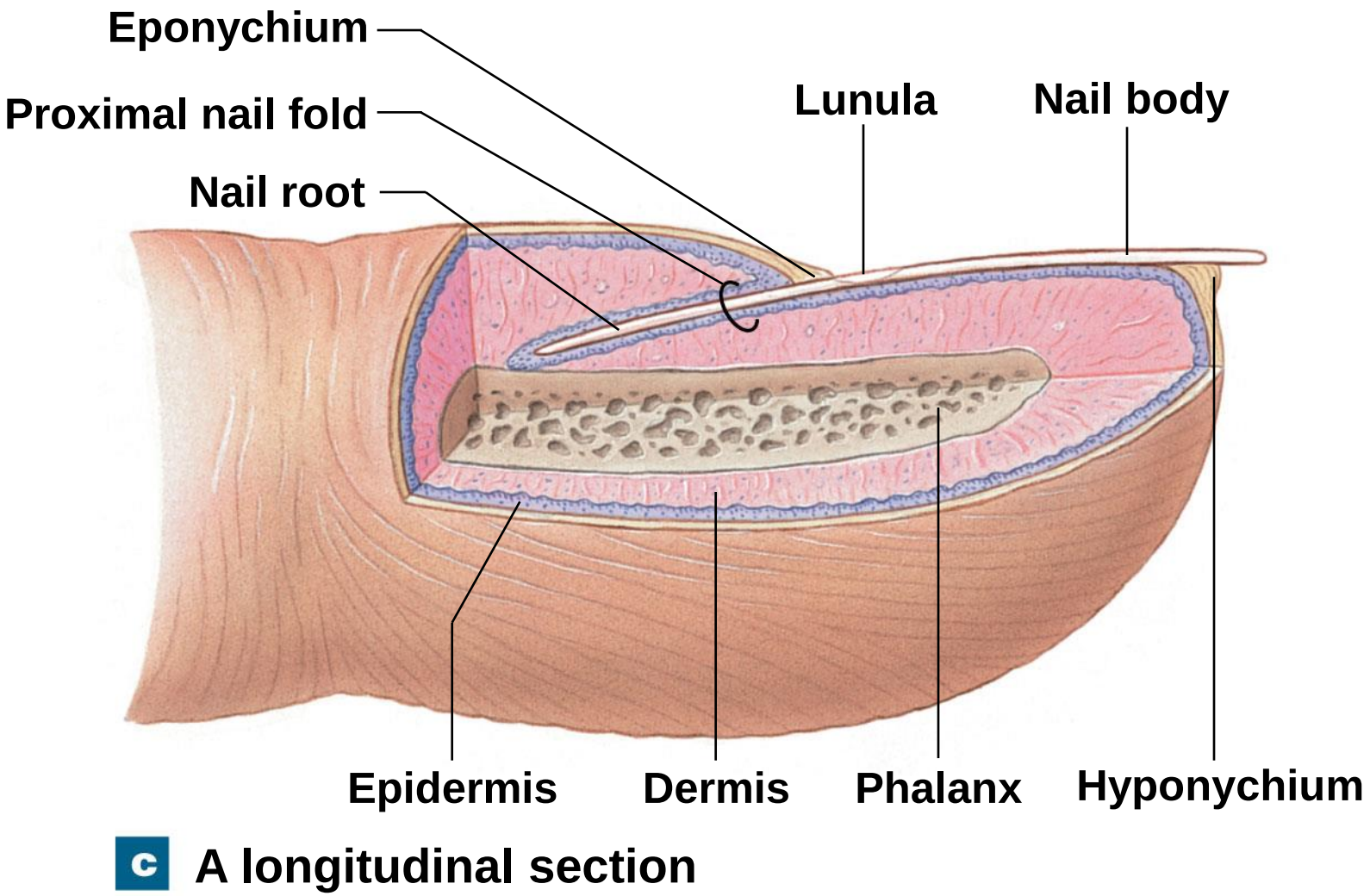
5-8 Sebaceous Glands and Sweat Glands

- Control of Glands
  - Autonomic nervous system (ANS)
    - Controls sebaceous and apocrine sweat glands
    - Works simultaneously over entire body
  - Merocrine sweat glands
    - Controlled independently
    - Sweating occurs locally
  - ***Thermo****regulation*
    - The main function of sensible perspiration
    - Works with cardiovascular system
    - Regulates body **temperature**

5-9 Nails

- **Nails**
  - Protect fingers and toes
  - Made of dead cells packed with keratin
  - Metabolic disorders can change nail structure
- Nail Production
  - Occurs in a deep epidermal fold near the bone called the **nail root**

Figure 5-13c The Structure of a Nail



5-9 Nails

- Structure of a Nail
  - **Nail body**
    - The visible portion of the nail
    - Covers the **nail bed**
  - **Lunula**
    - The pale crescent at the base of the nail
  - Sides of nails
    - Lie in **lateral nail grooves**
    - Surrounded by **lateral nail folds**

Figure 5-13c The Structure of a Nail

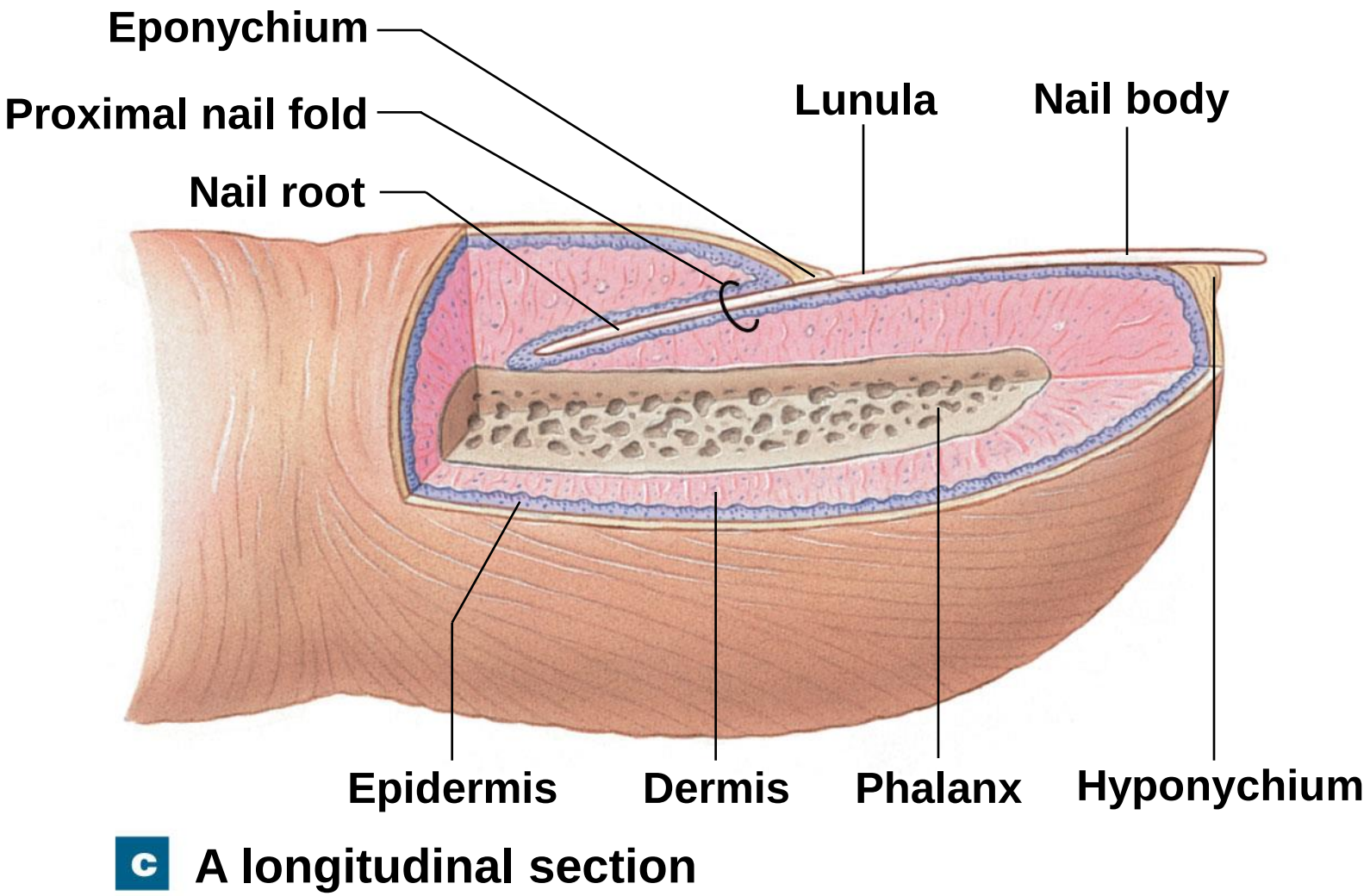
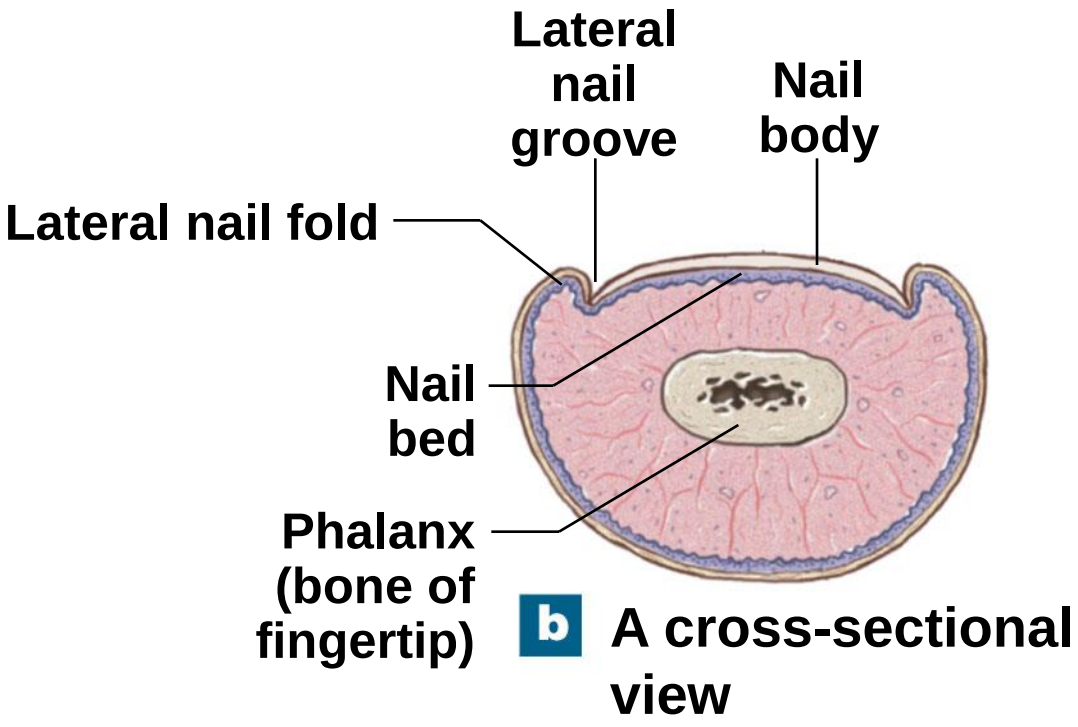


Figure 5-13b The Structure of a Nail



5-9 Nails

- Structure of a Nail
  - Skin beneath the distal **free edge** of the nail
    - Is the **hyponychium** (onyx = nail)
  - Visible nail emerges:
    - From the **eponychium** (**cuticle**)
    - At the tip of the proximal nail fold

Figure 5-13 The Structure of a Nail

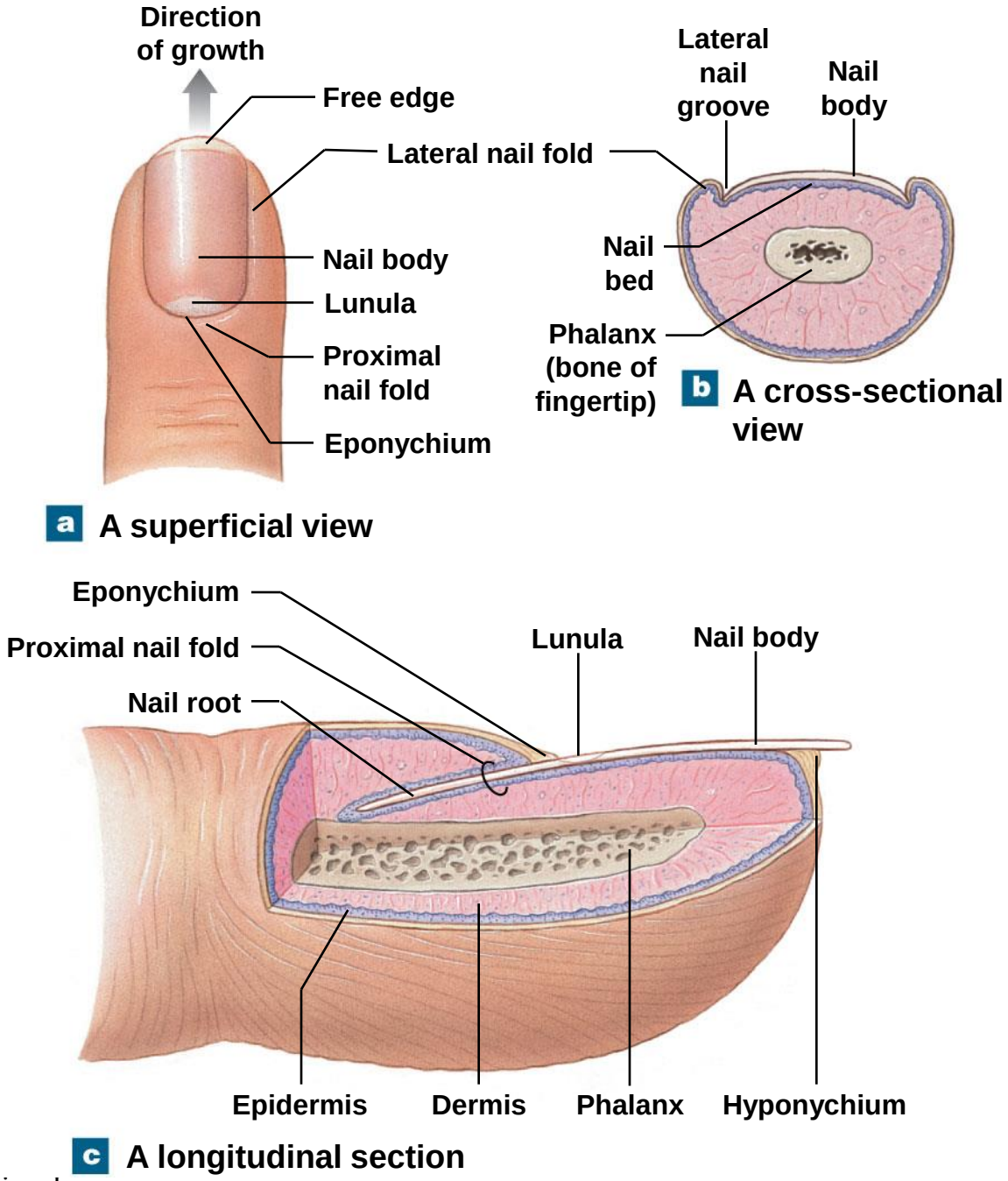
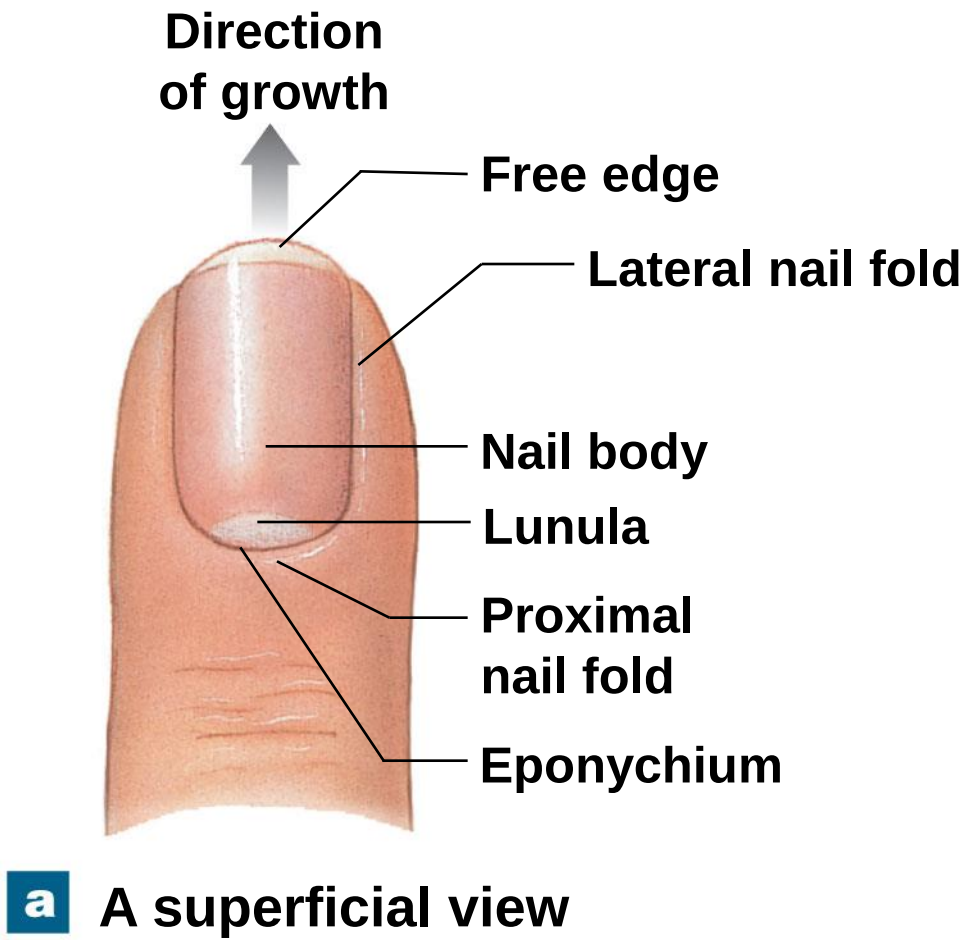


Figure 5-13a The Structure of a Nail



5-10 Repair of the Integument

- Repair of the Integument Following an Injury
  - Bleeding occurs
  - Mast cells trigger inflammatory response
  - A **scab** stabilizes and protects the area
  - Germinative cells migrate around the wound
  - Macrophages clean the area
  - Fibroblasts and endothelial cells move in, producing **granulation tissue**

Figure 5-14 Repair of Injury to the Integument

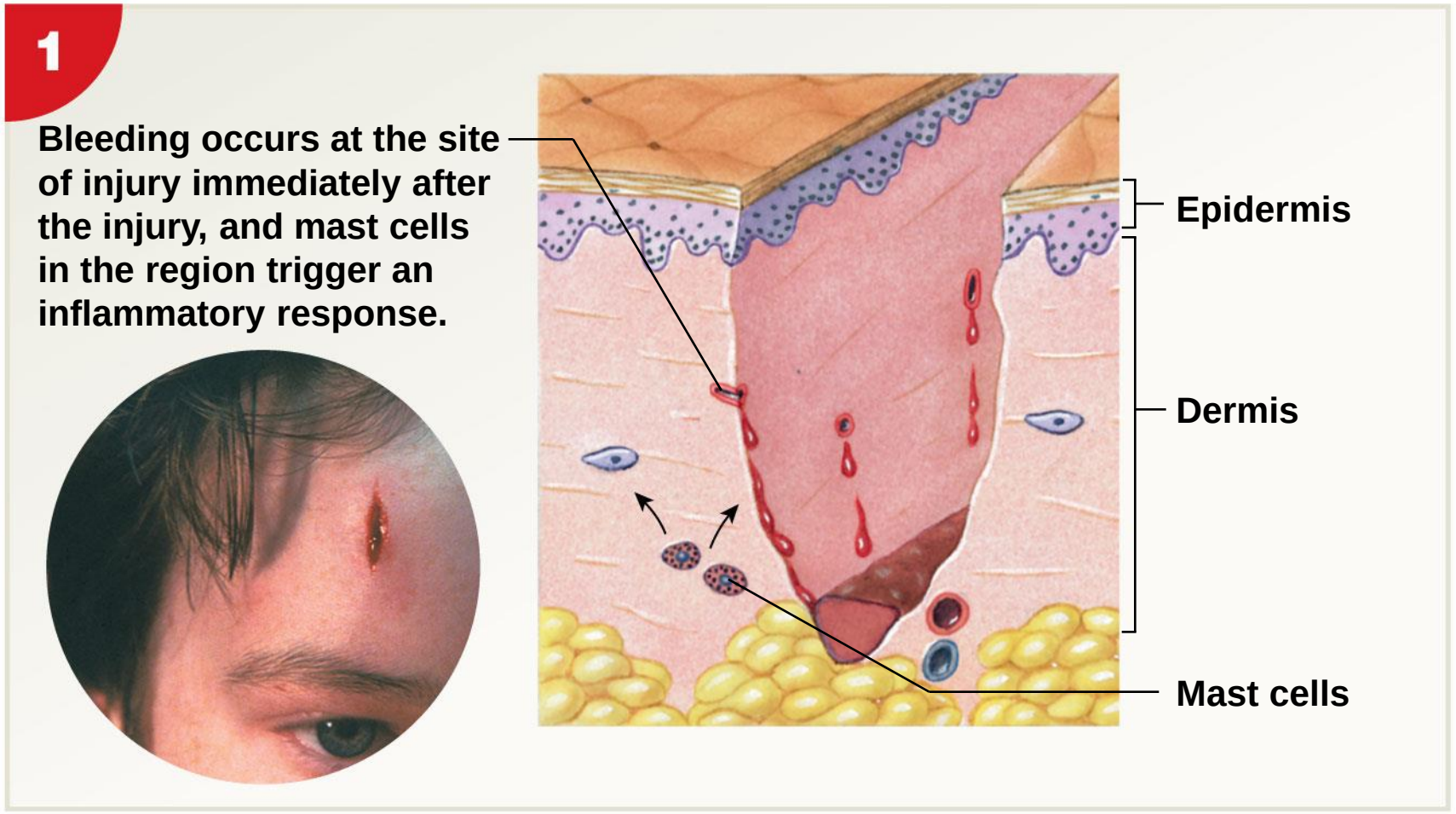
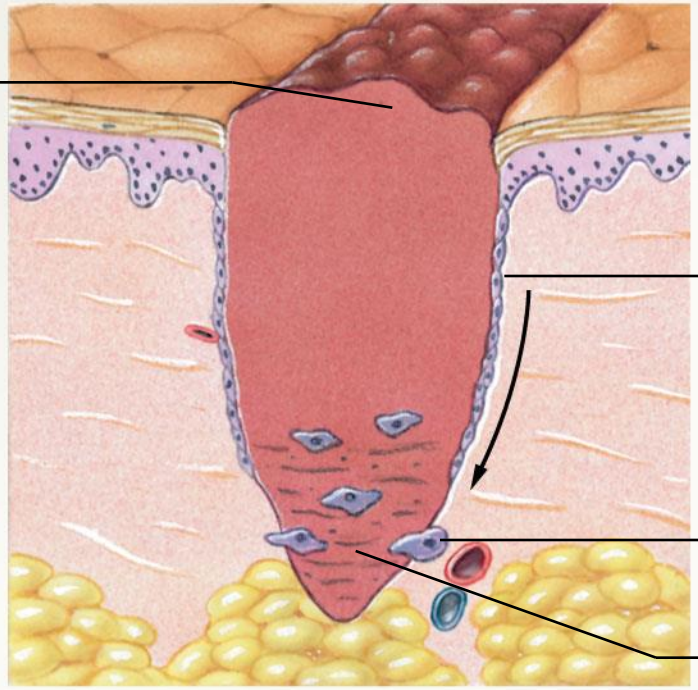


Figure 5-14 Repair of Injury to the Integument

2

After several hours, a scab has formed and cells of the stratum basale are migrating along the edges of the wound. Phagocytic cells are removing debris, and more of these cells are arriving via the enhanced circulation in the area. Clotting around the edges of the affected area partially isolates the region.



Migrating epithelial cells

Macrophages and fibroblasts

Granulation tissue

Figure 5-14 Repair of Injury to the Integument

3

One week after the injury, the scab has been undermined by epidermal cells migrating over the meshwork produced by fibroblast activity. Phagocytic activity around the site has almost ended, and the fibrin clot is breaking up.

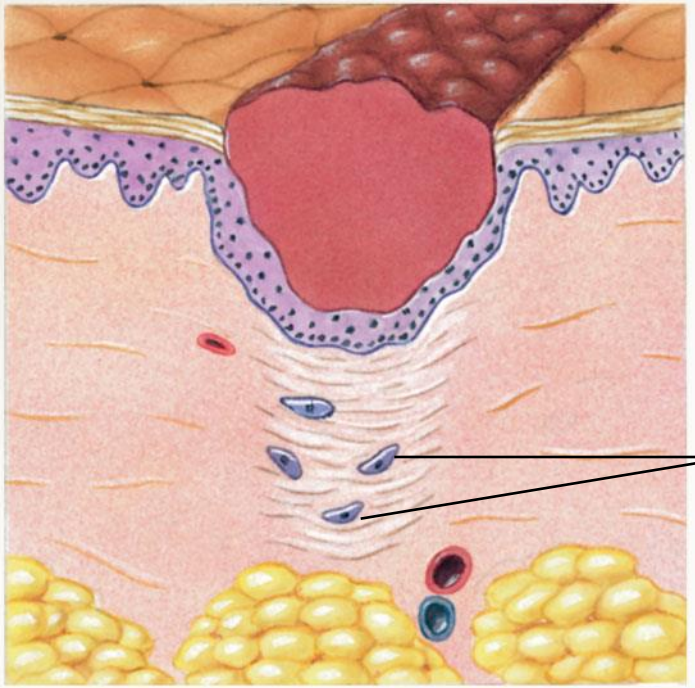
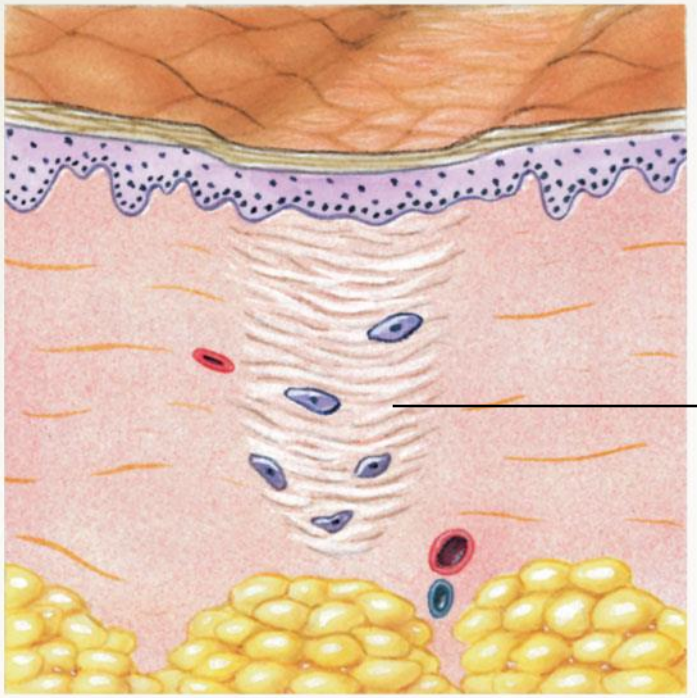


Figure 5-14 Repair of Injury to the Integument

4

After several weeks, the scab has been shed, and the epidermis is complete. A shallow depression marks the injury site, but fibroblasts in the dermis continue to create scar tissue that will gradually elevate the overlying epidermis.



5-10 Repair of the Integument

- Repair of the Integument Following an Injury
  - Fibroblasts produce **scar tissue**
    - Inflammation decreases, clot disintegrates
    - Fibroblasts strengthen scar tissue
    - A raised **keloid** may form

Figure 5-15 A Keloid

5-11 Effects of Aging on the Integumentary System

- Effects of Aging
  - Epidermal thinning
  - Decreased numbers of dendritic (Langerhans) cells
  - Decreased vitamin D_3 production
  - Decreased melanocyte activity
  - Decreased glandular activity (sweat and oil glands)

5-11 Effects of Aging on the Integumentary System

- Effects of Aging
  - Reduced blood supply
  - Decreased function of hair follicles
  - Reduction of elastic fibers
  - Decreased hormone levels
  - Slower repair rate

5-11 Importance of the Integumentary System

- Importance of the Integumentary System
  - Protects and interacts with all organ systems
  - Changes in skin appearance are used to diagnose disorders in other systems