

A black and white photograph of a pair of hands buried in sand. The hands are positioned with fingers spread, and a shadow is cast on the sand to the left. The background is a bright, overexposed sky with a faint silhouette of a bird in flight.

Chapter 8

The Integumentary System: The Protective Covering

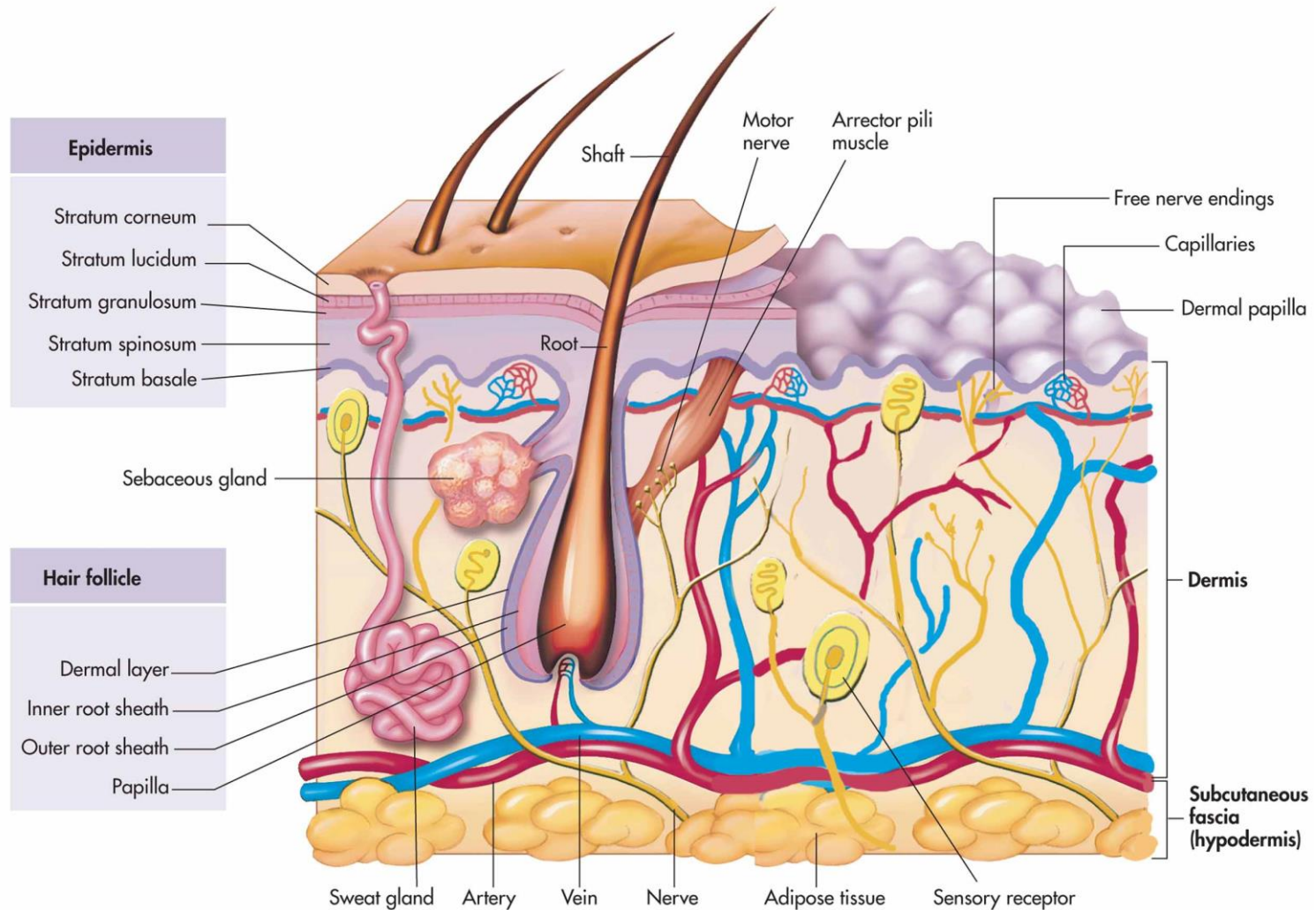
The Integumentary System

- **The Integumentary System** is comprised of the skin and its accessory components, including hair, nails, and associated glands
- The integumentary system performs several **vital functions**:
 - Protection from pathogens
 - Balances fluid levels
 - Stores fatty tissue for energy supply
 - Produces vitamin D (with help from the sun)
 - Provides sensory input
 - Helps to regulate body temperature

The Skin

- **The Skin** is the largest organ, weighing approximately 20 pounds and covering an area about 20.83 square feet on an adult.
- A cross section of skin reveals three layers:
 1. Epidermis
 2. Dermis
 3. Subcutaneous Fascia

The Skin: Three Layers

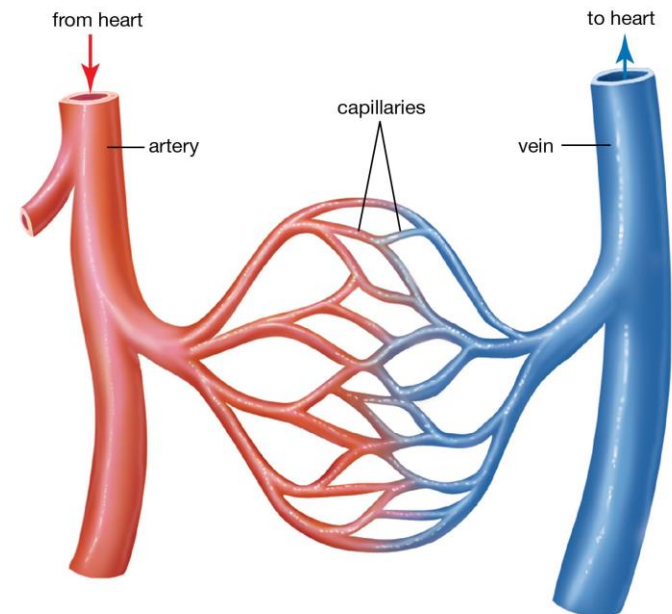


Epidermis

- **The Epidermis** is the outside layer of skin that we normally see, and is made up of five sub-layers
 - **No blood vessels**
 - Deepest layer: new cells born every 2 to 4 weeks
 - Surface layer:
 - Dead cells—flat, scaly, keratinized epithelial cells
 - Sloughed off
 - Replaced by cells from deeper layers
 - **Melanocytes** make pigment melanin

Dermis

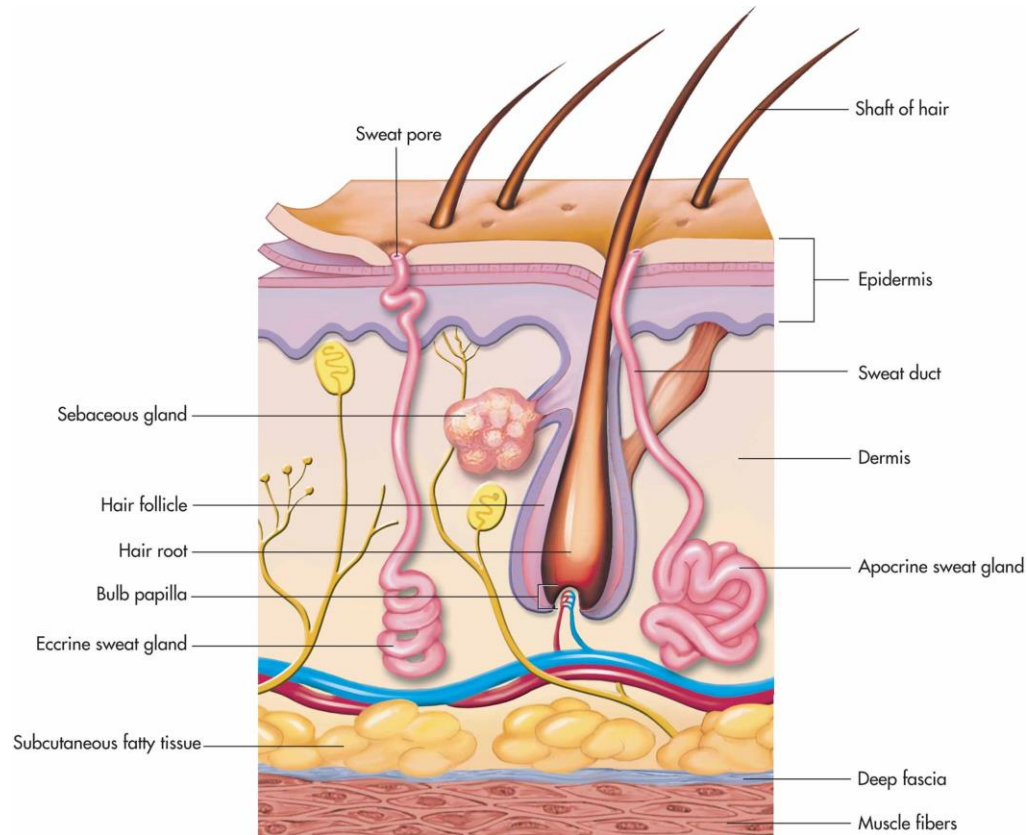
- **The Dermis** is inferior to the epidermis. It is thicker and made up of irregular, connective tissue.
 - Contains the following accessory structures:
 - **Capillaries**
 - Involuntary muscles
 - Lymph vessels
 - **Hair follicles**



Dermis

- Also contains the following accessory structures:
 - **Sudoriferous (sweat) glands**
 - Body has 3 million sweat glands
 - Sweat has no odor, but bacteria degrade the substances in the sweat over time into chemicals that give off strong smells commonly known as body odor
 - **Sebaceous (oil) glands**
 - Secrete sebum (oil)
 - Sebum keeps skin from drying out and (because of its acid nature) helps destroy some pathogens on skin's surface

The Dermis: Sweat Glands



Apocrine Sweat Gland (nervous sweating) Eccrine Sweat Gland (hot sweating)

Subcutaneous Fascia

- **Subcutaneous Fascia** is the **deepest layer of skin**. It is composed of elastic and fibrous connective tissue and fatty tissue
 - Provides padding to protect the deeper tissues of the body
 - Acts as insulation for temperature regulating
 - The layer of skin that is attached to the muscles of your body.

The Skin: Skin Color

- 1. Melanocytes** are located deep in the epidermis
 - Produce melanin skin pigment
 - Skin color determined by distribution and abundance of melanin
- 2. Carotene** is another form of pigment that gives a yellowish hue to skin.
- 3.** A pinkish hue derives from the **hemoglobin** in the blood

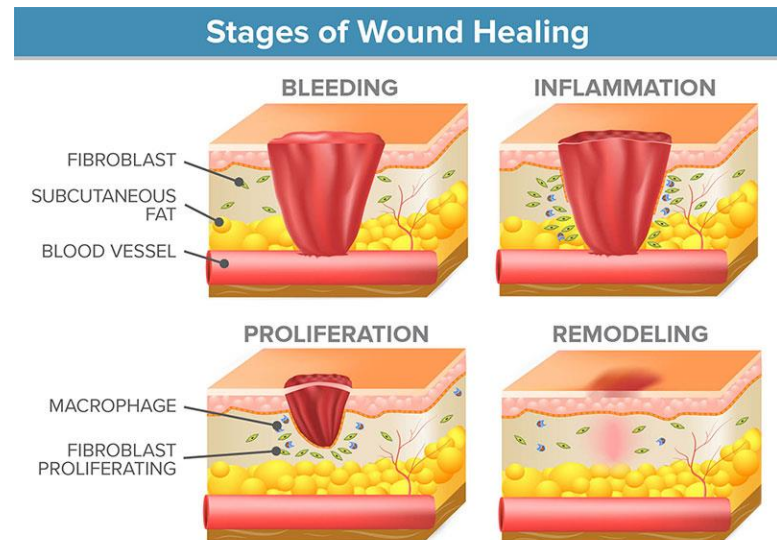
The Skin: Skin Color

4. The **Affect of Disease** on skin color

- When **liver** disease occurs, the skin turns a yellow color.
- Malfunctioning **adrenal gland** can cause the skin to turn bronze because of excessive melanin.
- **Excessive bruising** could indicate skin, blood, or circulatory problems.
- **Cyanosis** (a blue coloring) results from a drop in oxygenation.

How Skin Heals

- A. Blood clots on skin surface – The top part of the clot that is exposed to air hardens to form a scab.
- B. Repair progresses in same way as generalized tissue repair
- C. The wound ideally starts to heal from the inside out.



Burns to the Skin

- **Burns** can be caused by heat, chemicals, electricity, and radiation
- When assessing the damage caused by burns, there are two factors to consider: **the depth of the burn** and the **size of the area damaged** by the burn



Burns to the Skin: Classification/Depth

- **First-Degree Burns**

- Damage only the outer layer, or epidermis.
- Redness, pain, no blister
- No scarring

- **Second-Degree Burns**

- Entire epidermis, portion of dermis
- Blistering
- Scarring
- Often need medical attention

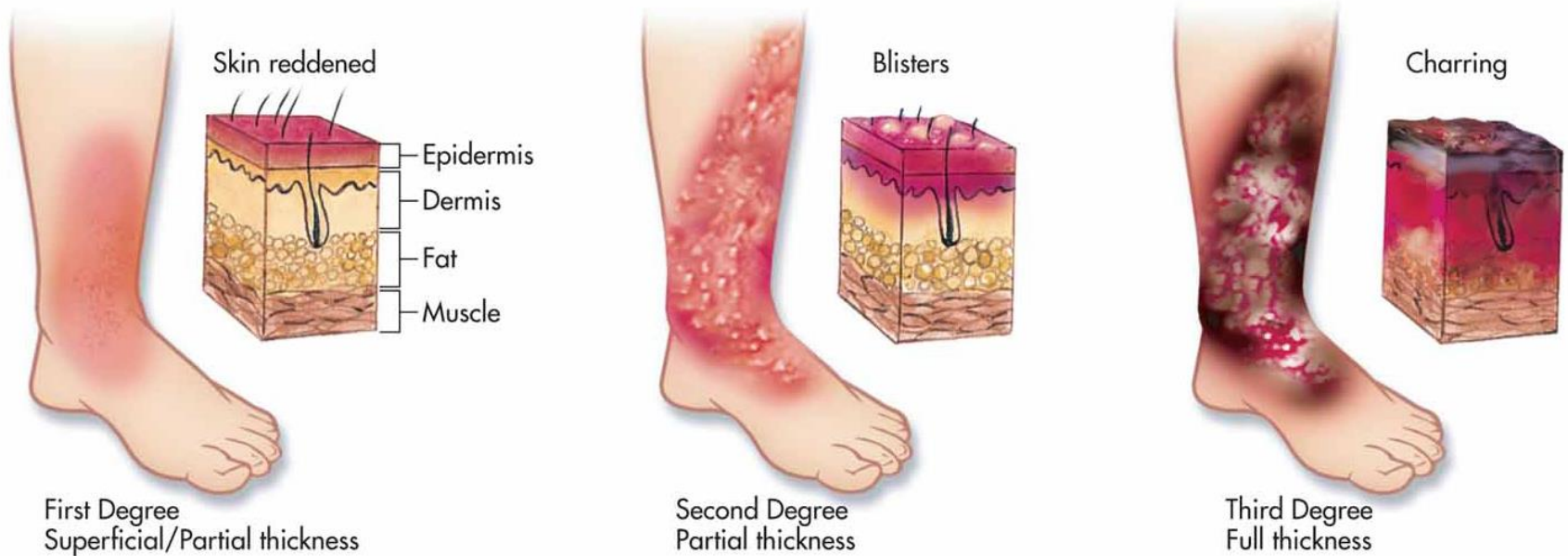
- **Third-Degree Burn**

- All three layers
- Black, brown, tan, or white
- Little pain initially
- Destroys accessory structures
- Must have medical attention

- **Fourth-Degree Burns**

- Most severe
- Penetrates to bone

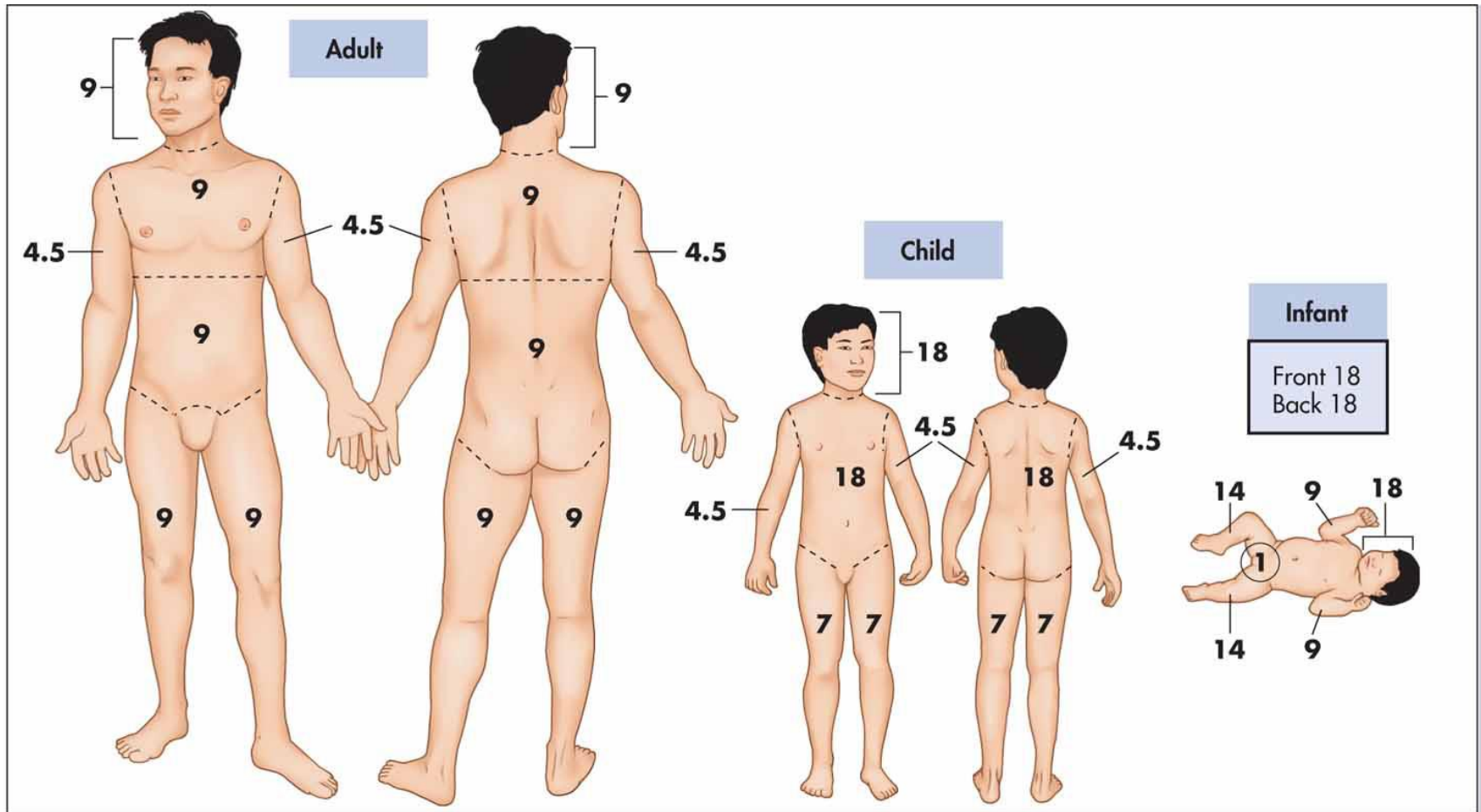
Burns to the Skin: Classification



Burns to the Skin

- The amount of area damaged follows **the rule of nines**
- The body is divided into the following regions, each given a percentage of body surface area value:
 - Head and neck – 9%
 - Each upper limb – 9% ($2 \times 9 = 18\%$)
 - Front of trunk – 18%
 - Back of trunk and buttocks – 18%
 - Perineum (including anus and urogenital region) – 1%
 - Each lower limb – 18% ($2 \times 18 = 36\%$)

Burns to the Skin: Assessing the Degree of the Burn

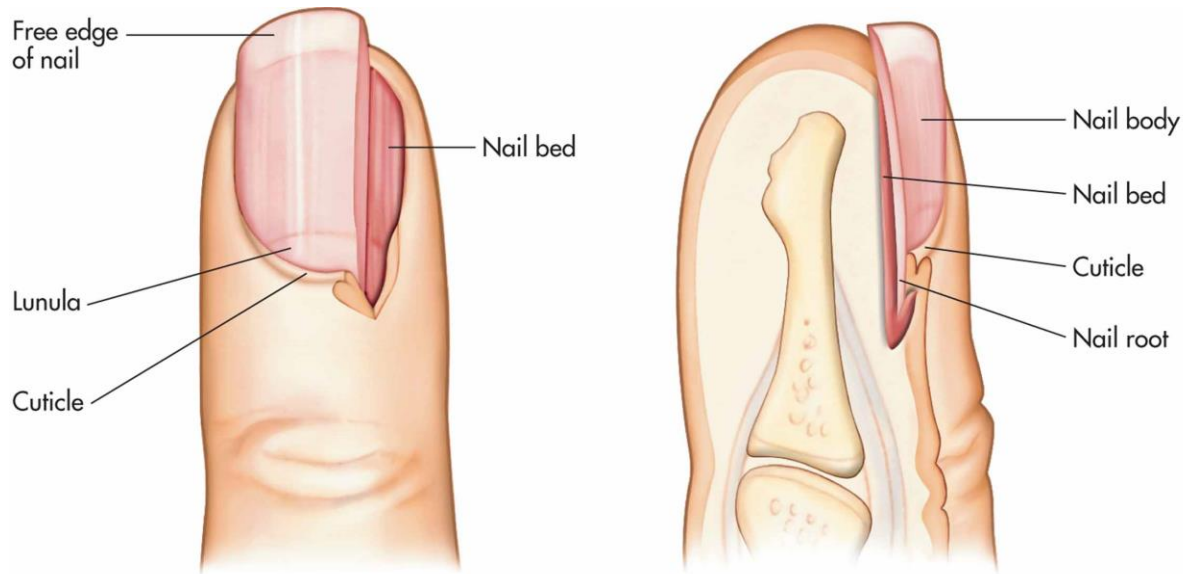


Burns to the Skin

- The **clinical concerns** for burn victims relate to the functions of the skin already discussed, including:
 - Bacterial infections
 - Fluid loss
 - Heat loss
- **Treatment** for severe burns
 - Damaged skin must be removed.
 - Skin grafting

Nails

- **Nails** are specialized epithelial cells originating from the nail root
 - Keratinized
 - The cuticle: fold of tissue that covers the nail root
 - Nail body; visible portion of nail



Nails

- Nails can be used to assess **peripheral perfusion**.
 - If you pinch one of your fingers, the pink color should return within **FIVE seconds** (usually within 3 seconds) if you have good perfusion, after you release the pressure.
 - If the normal color takes longer to return, it may indicate a problem.
 - **Blood clots or vascular spasm** can decrease blood flow, as can hypothermia, making peripheral refill slower.
 - Reduced levels of oxygen can cause a blue color to nail beds.

Nails



Figure 8-5 Clinician performing capillary refill assessment.

Hair

- **Purpose of Hair**

- Body **temperature** regulation
- Sensor
- Protect eyes and nose from foreign objects

- **Anatomy of a Hair**

- Hair is made up of **keratin**
- Shaft: visible portion of hair; dead cells
- Root extends down into the dermis to the follicle
- **Follicle**: where cells grow and divide
- A sebaceous gland is associated with each hair follicle.
- Sebum production decreases with age.

Hair

- **Hair Color and Texture**

- Dependent on the amount of **melanin** you produce
- The more melanin, the darker the hair
- **White hair** occurs in the absence of melanin.
- **Red hair** is the result of hair that has melanin with iron in it.

- Flat hair shafts produce curly hair, whereas round hair shafts produce straight hair.

- The life span of hair is dependent on location: Eyelashes last 3 to 4 months; hair on the head lasts 3 to 4 years.

Hair

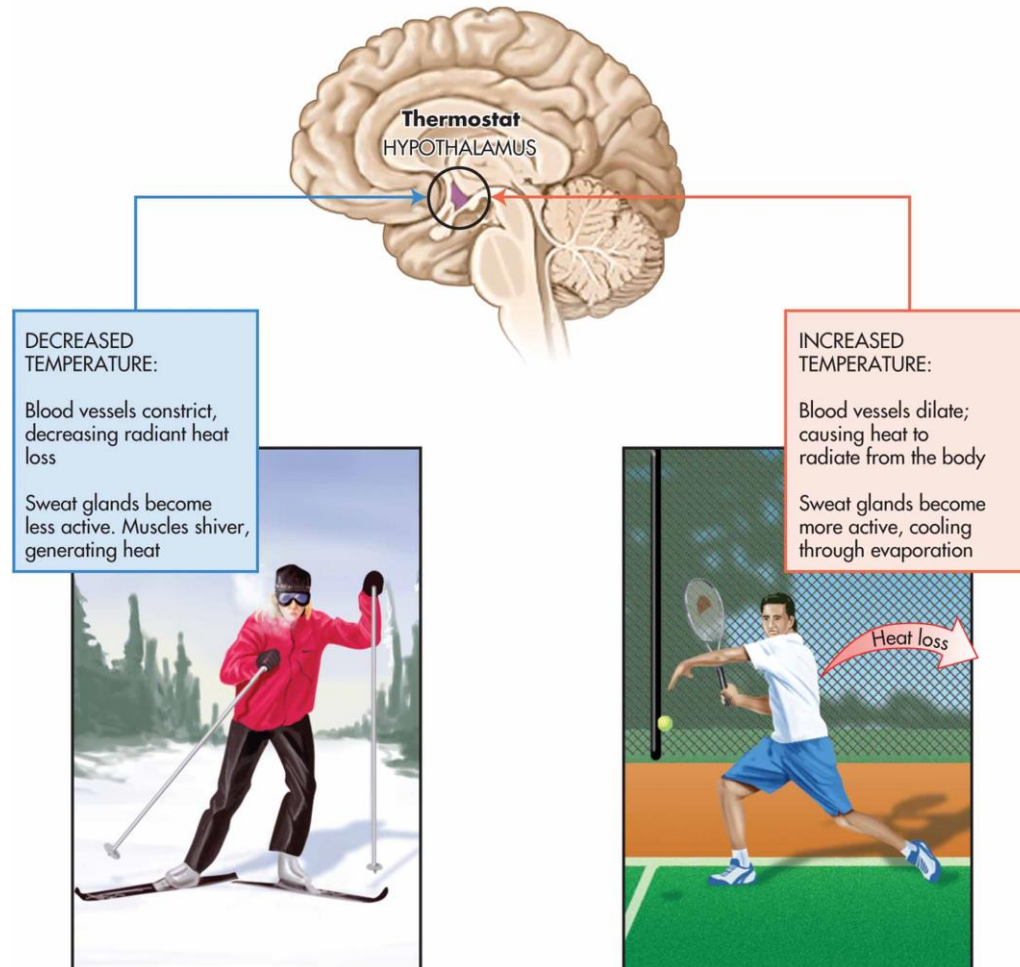
- **Forensics and Hair**

- Hair can reveal to a **pathologist** if an individual ingested certain drugs or other substances, such as lead or arsenic.
- Trace amounts of **ingested substances** can become part of the hair's composition.
- Analysis of a hair sample can reveal what and how long ago toxins or drugs were ingested.
- The longer the length of hair, the longer the record of what was consumed by that individual.

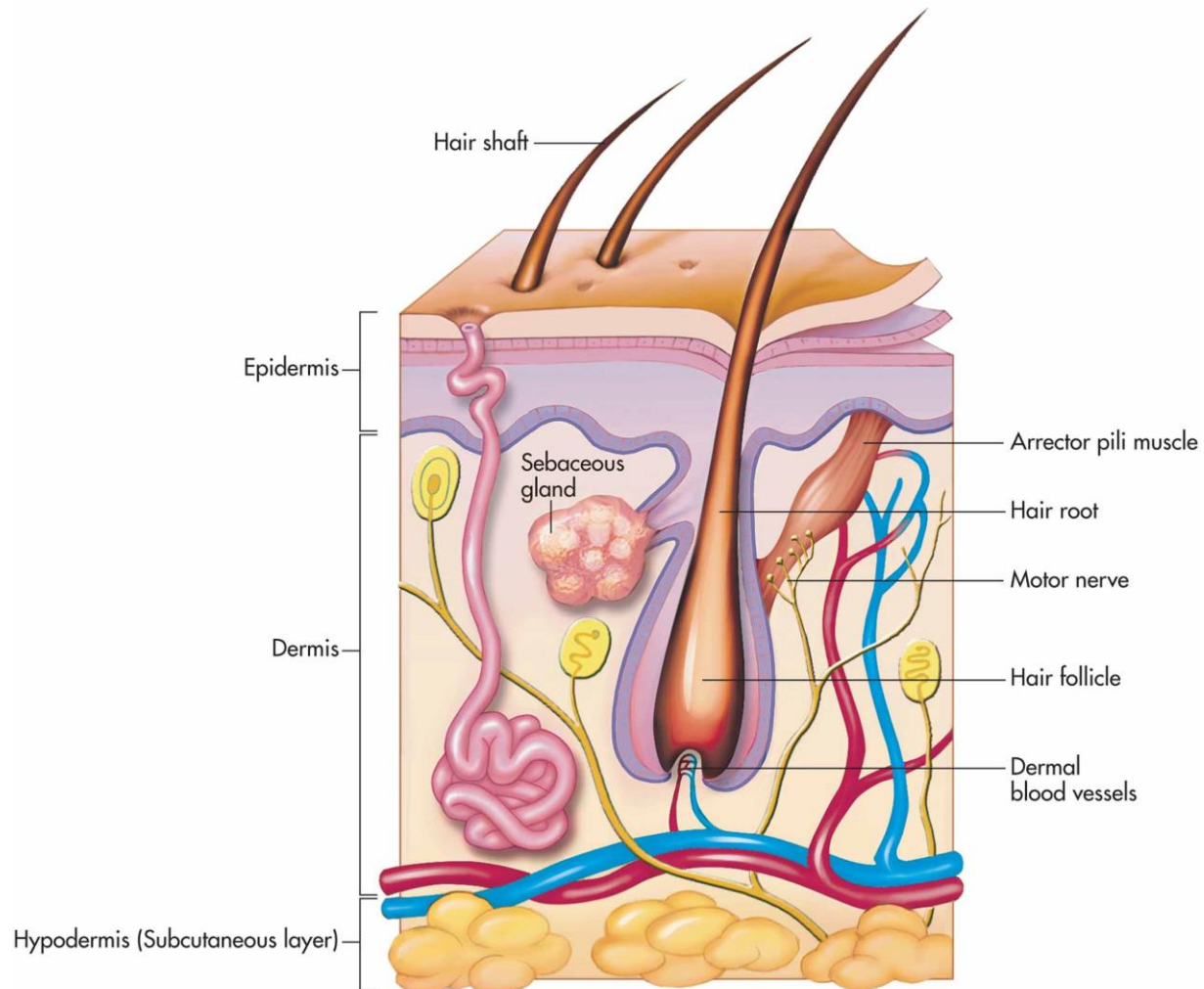
Temperature Regulation

- Change in size of blood vessels
 - **Vasodilation** exposes heated blood to external cooling air.
 - **Vasoconstriction** keeps cooling of blood to a minimum in cold temperatures.
- **Sweat glands** excrete water onto the skin's surface, allowing cooling through evaporation.
- **Shivering** happens when muscle contractions produce heat.
- Hairs on your skin stand erect, causing goose bumps; these hairs insulate you from cooler surroundings.

Temperature Regulation



Hair Follicle



Diseases of the Skin

- There are whole sections of medical libraries dedicated to diseases of the skin.
- **Melanoma:** deadliest form of skin cancer
- **Lesion:** any pathological change in skin

Diseases of the Skin



A.

Figure 8-9 Various types of integumentary conditions. (A) Urticaria (hives).
(*Courtesy of Jason L. Smith, MD.*)

Diseases of the Skin



B.

Figure 8-9 Various types of integumentary conditions. (B) Erythema infectiosum (fifth disease). (Courtesy of Jason L. Smith, MD.)

Diseases of the Skin



C.

Figure 8-9 Various types of integumentary conditions. (C) Acne.
(*Courtesy of Jason L. Smith, MD.*)

Diseases of the Skin



D.

Figure 8-9 Various types of integumentary conditions. (D) Poison ivy (dermatitis).
(Courtesy of Jason L. Smith, MD.)

Diseases of the Skin



E.

Figure 8-9 Various types of integumentary conditions. (E) Herpes simplex.
(*Courtesy of Jason L. Smith, MD.*)

Diseases of the Skin



F.

Figure 8-9 Various types of integumentary conditions. (F) Burn, second degree.
(Courtesy of Jason L. Smith, MD.)