

Chapter 6

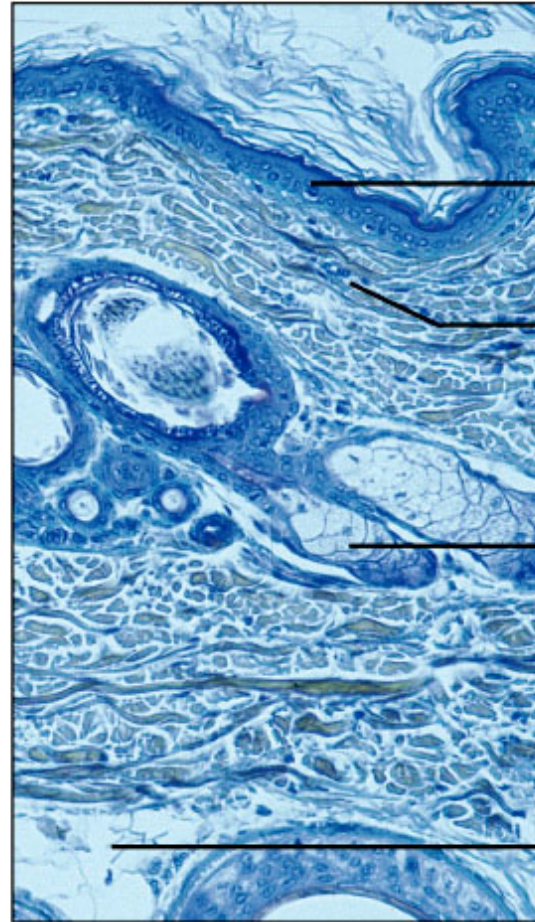
Skin and the Integumentary System

- **Composed of several tissues**
- **Maintains homeostasis**
- **Protective covering**
- **Retards water loss**
- **Regulates body temperature**
- **Houses sensory receptors**
- **Contains immune system cells**
- **Synthesizes chemicals, including Vitamin D**
- **Excretes small amounts of waste**

Layers of Skin

- **Epidermis**
- **Dermis**
- **Subcutaneous layer**

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Stratified squamous epithelium

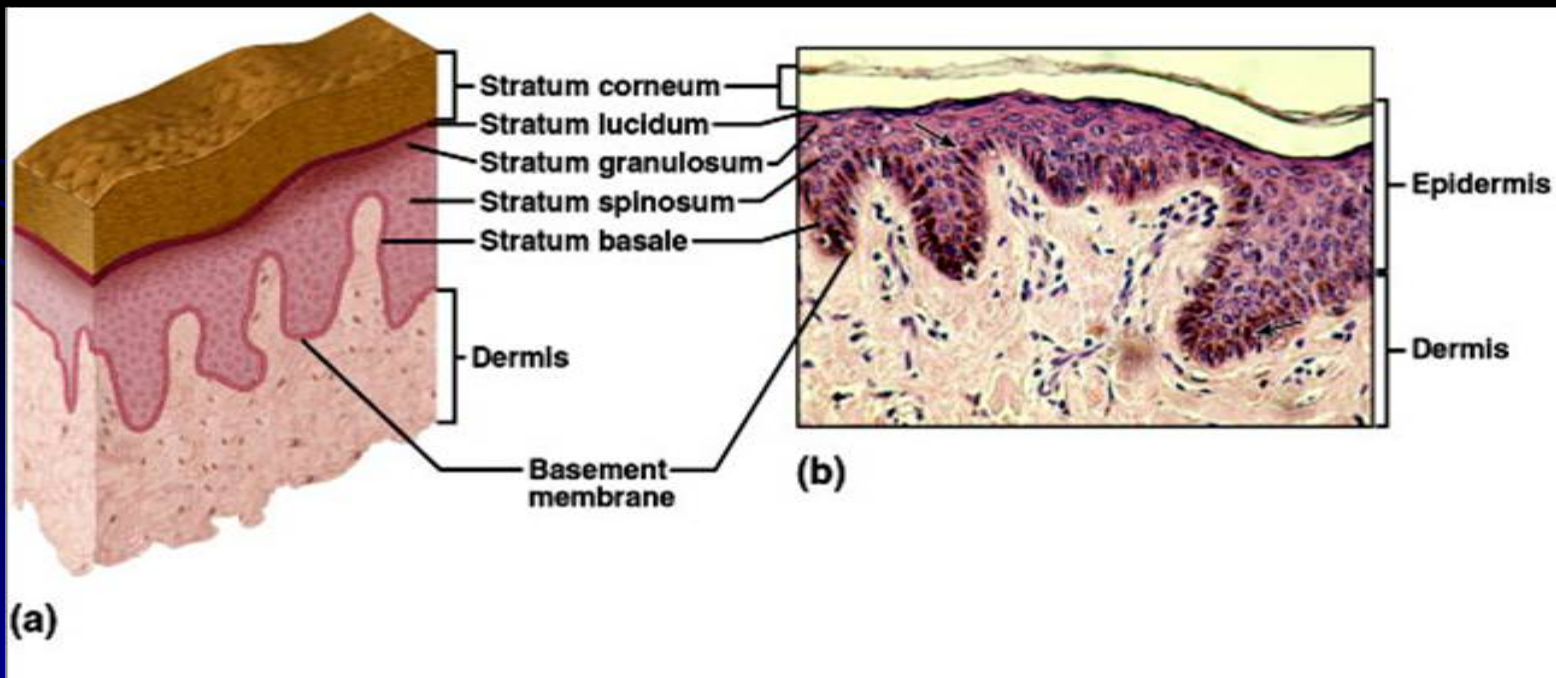
Irregular dense connective tissue

Glandular epithelium

Adipose tissue

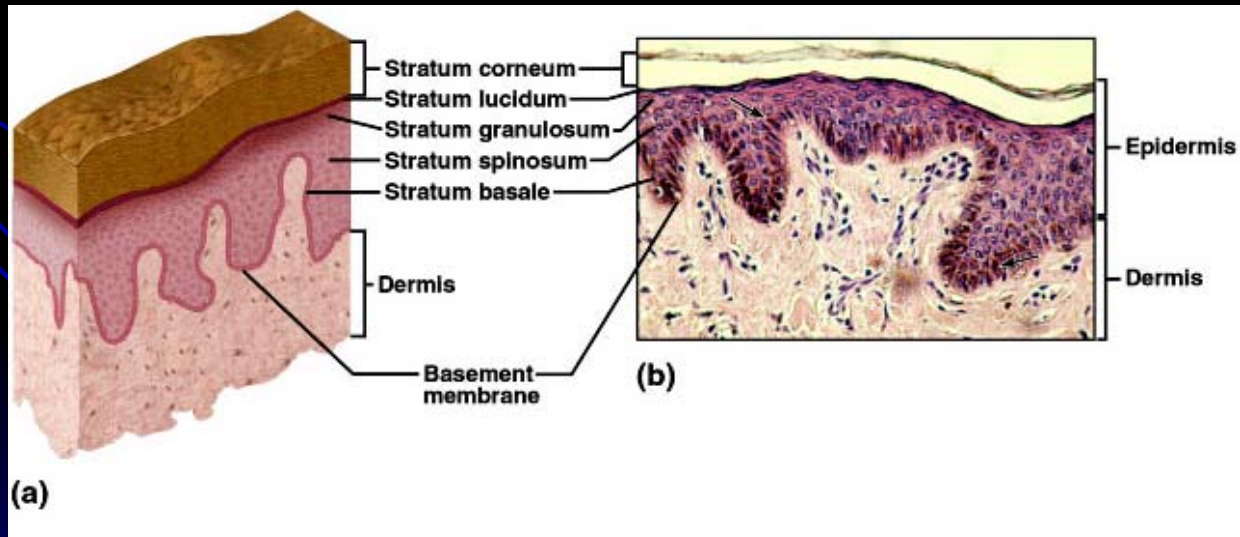
Epidermis, Dermis, & Basement Membrane

- Epidermis is subdivided into layers of stratified squamous epithelium
- Dermis is made up of connective tissue, epithelial tissue, smooth muscle tissue, nervous tissue, and blood.
- Basement membrane is anchored to the dermis by short fibrils and separates these two layers of skin



Epidermis

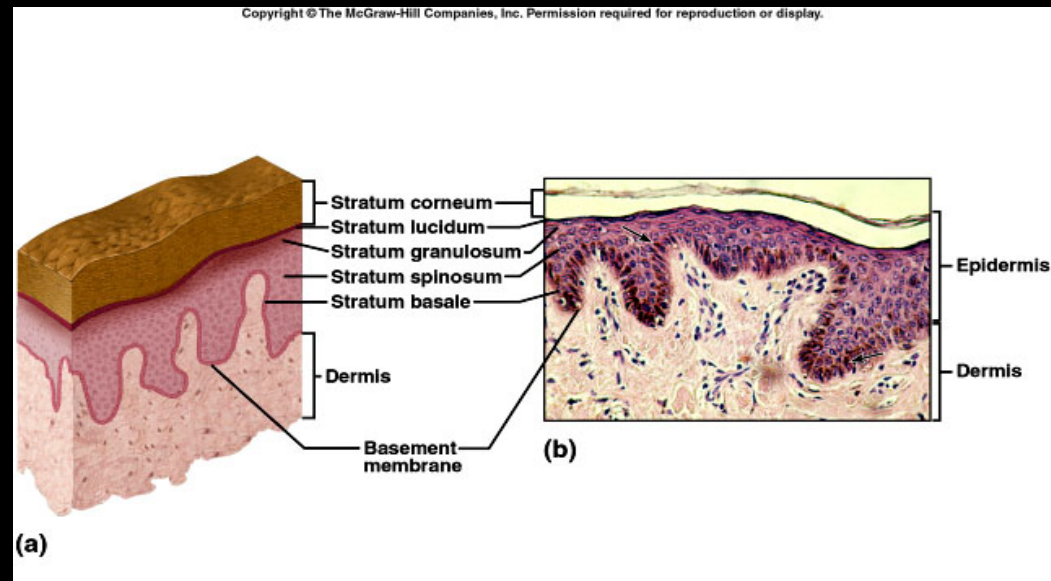
- lacks blood vessels
- keratinized
- thickest on palms and soles (0.8-1.4mm)
- melanocytes provide melanin
- rests on basement membrane
- stratified squamous

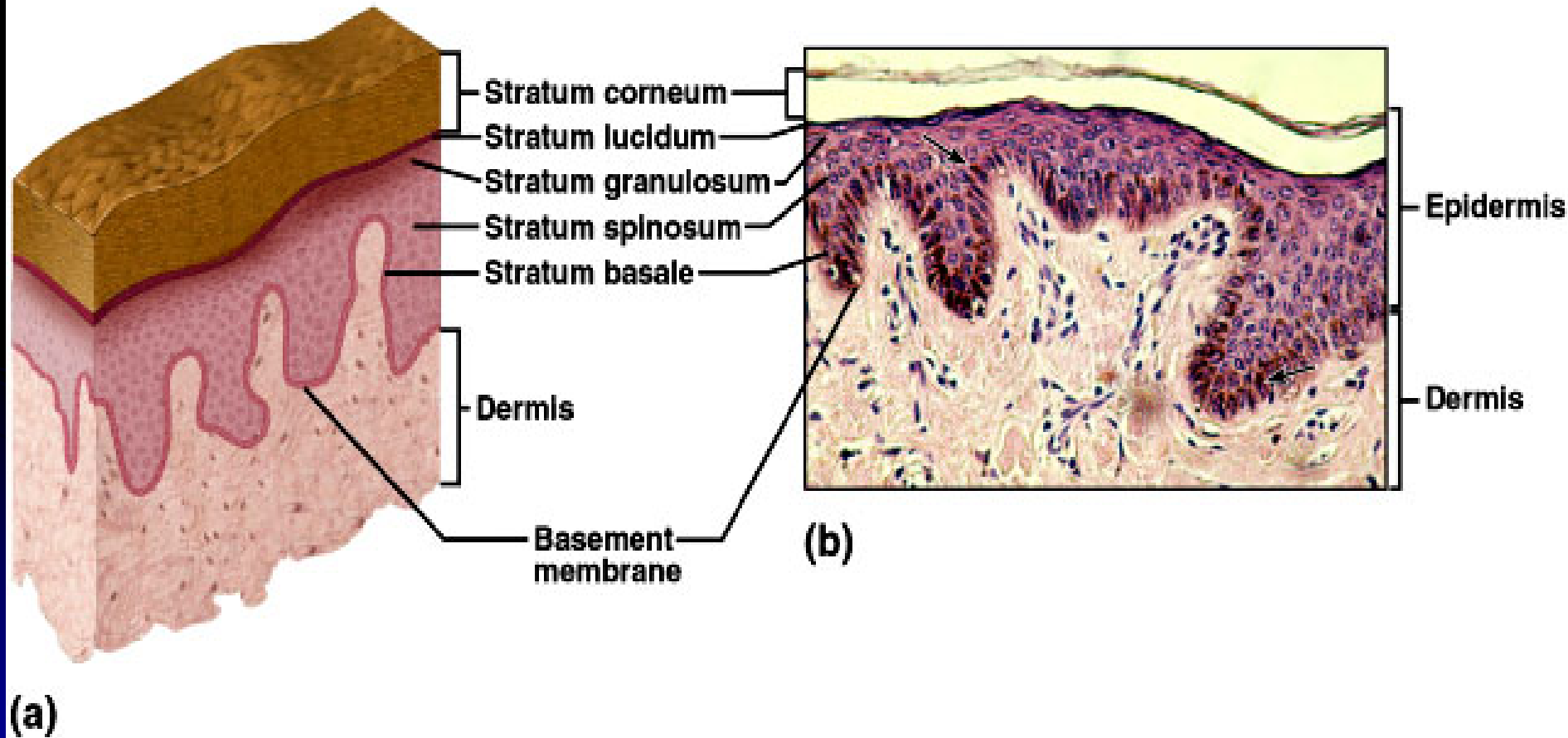


Epidermis

Layers of Epidermis

- stratum corneum
- stratum lucidum
- stratum granulosum
- stratum spinosum
- stratum basale





Layers of the Epidermis

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TABLE 6.1 Layers of the Epidermis

Layer	Location	Characteristics
Stratum corneum	Outermost layer	Many layers of keratinized, dead epithelial cells that are flattened and nonnucleated
Stratum lucidum	Between stratum corneum and stratum granulosum on soles and palms	Cells appear clear; nuclei, organelles, and cell membranes are no longer visible
Stratum granulosum	Beneath the stratum corneum	Three to five layers of flattened granular cells that contain shrunken fibers of keratin and shriveled nuclei
Stratum spinosum	Beneath the stratum granulosum	Many layers of cells with centrally located, large, oval nuclei and developing fibers of keratin; cells becoming flattened
Stratum basale (basal cell layer)	Deepest layer	A single row of cuboidal or columnar cells that divide and grow; this layer also includes melanocytes

Skin Changes: Rashes

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TABLE 6.2 Rashes

Illness	Description of Rash	Cause
Chicken pox	Tiny pustules start on back, chest, or scalp and spread for three to four days. Pustules form blisters, then crust, then fall away.	<i>Herpes varicella</i>
Fifth disease	Beginning with “slapped cheek” appearance, then red spots suddenly cover entire body, lasting up to two days.	<i>Human parvovirus B19</i>
Impetigo	Thin-walled blisters and thick, crusted lesions appear.	<i>Staphylococcus aureus, Streptococcus pyogenes</i>
Lyme disease	Large rash resembling a bull’s-eye usually appears on thighs or trunk.	<i>Borrelia burgdorferi</i>
Rosacea	Flushing leads to sunburned appearance in center of face. Red pimples and then wavy red lines develop.	Unknown, but may be a microscopic mite living in hair follicles
Roseola infantum	Following high fever, red spots suddenly cover entire body, lasting up to two days.	<i>Herpesvirus 6</i>
Scarlet fever	Rash resembling sunburn with goose bumps begins below ears, on chest and underarms, and spreads to abdomen, limbs, and face. Skin may peel.	<i>Group A Streptococcus</i>
Shingles	Small, clear blisters appear on inflamed skin. Blisters enlarge, become cloudy, crust, then fall off.	The virus that causes chicken pox stays in peripheral nerves, affecting the area where the nerve endings reach the skin.

Chicken Pox



Shingles



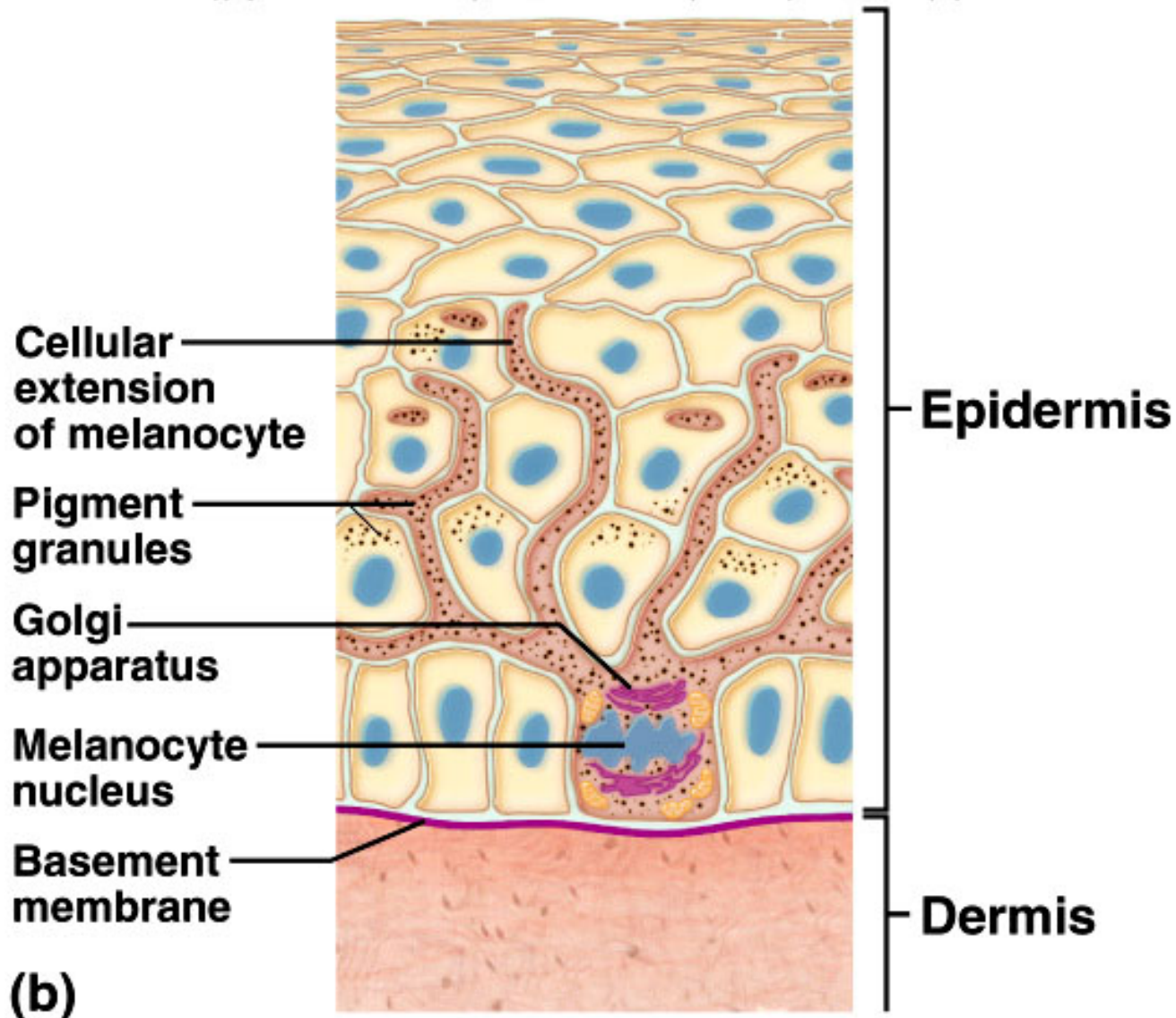
Lyme Disease



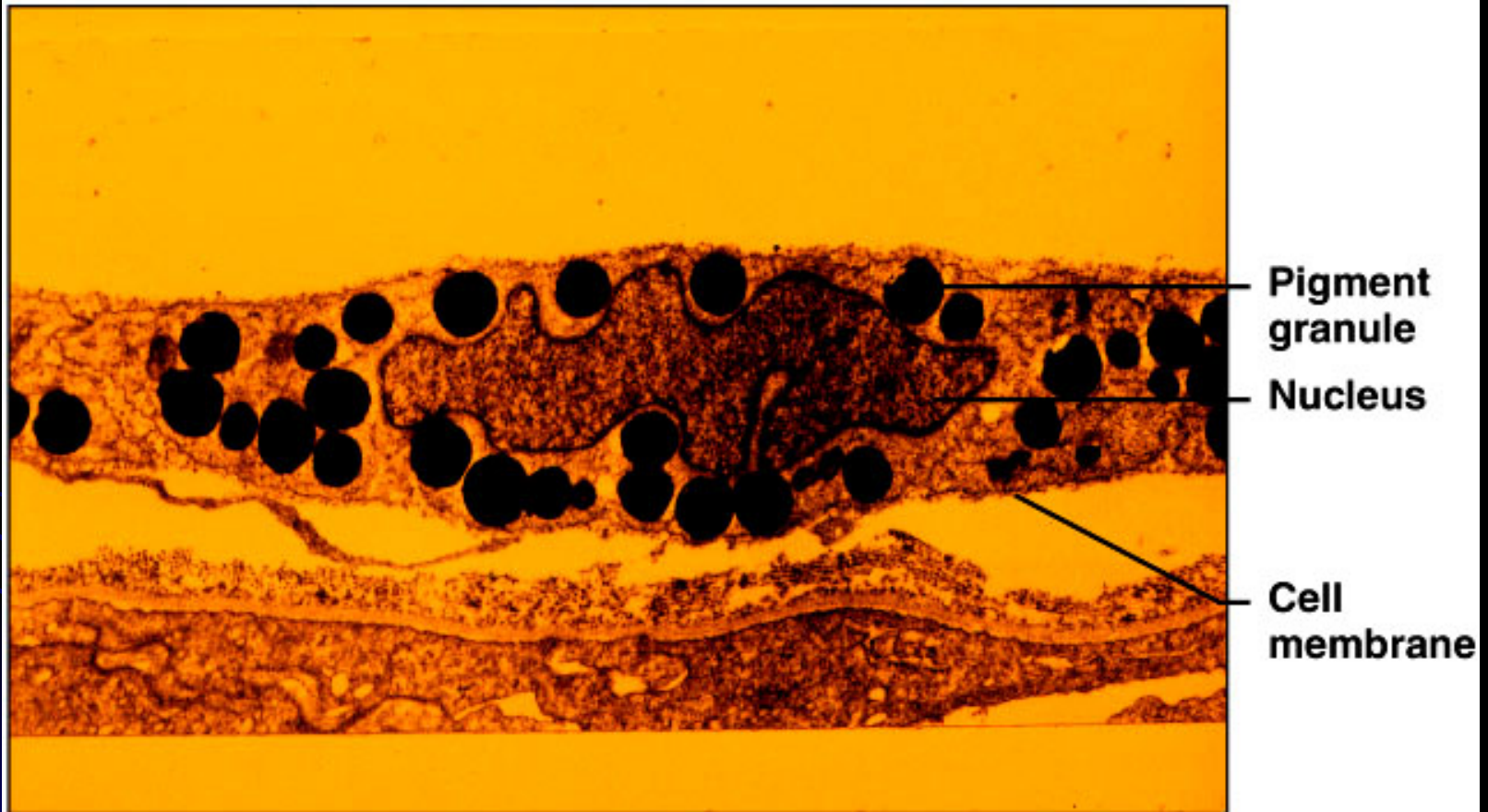
Impetigo

Melanocytes and Pigment Granules

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All people have the same number of melanocytes in their skin



(a)

Albinism: Lack of Melanin

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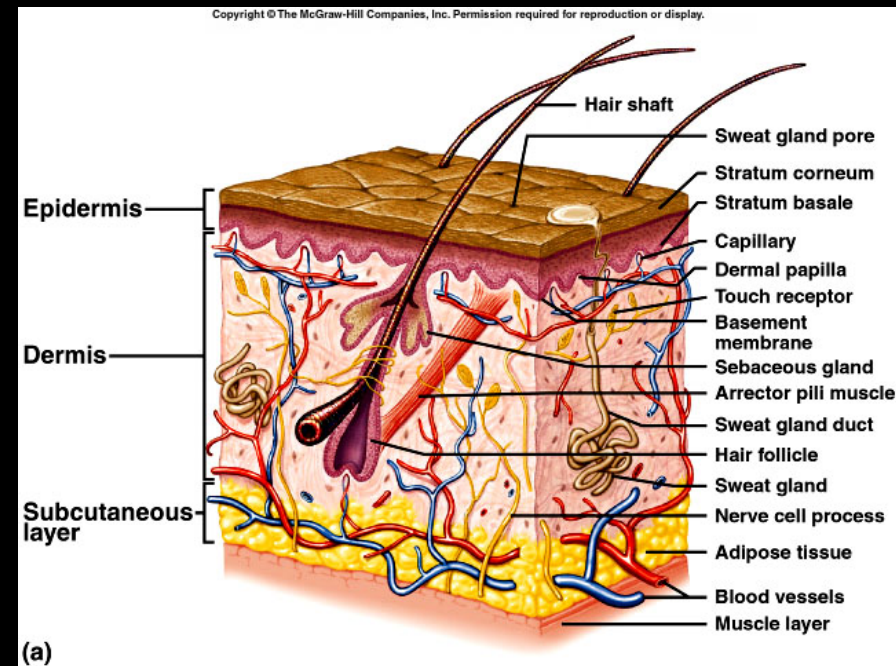
Paul Bettany in Columbia Pictures' The Da Vinci Code - 2005

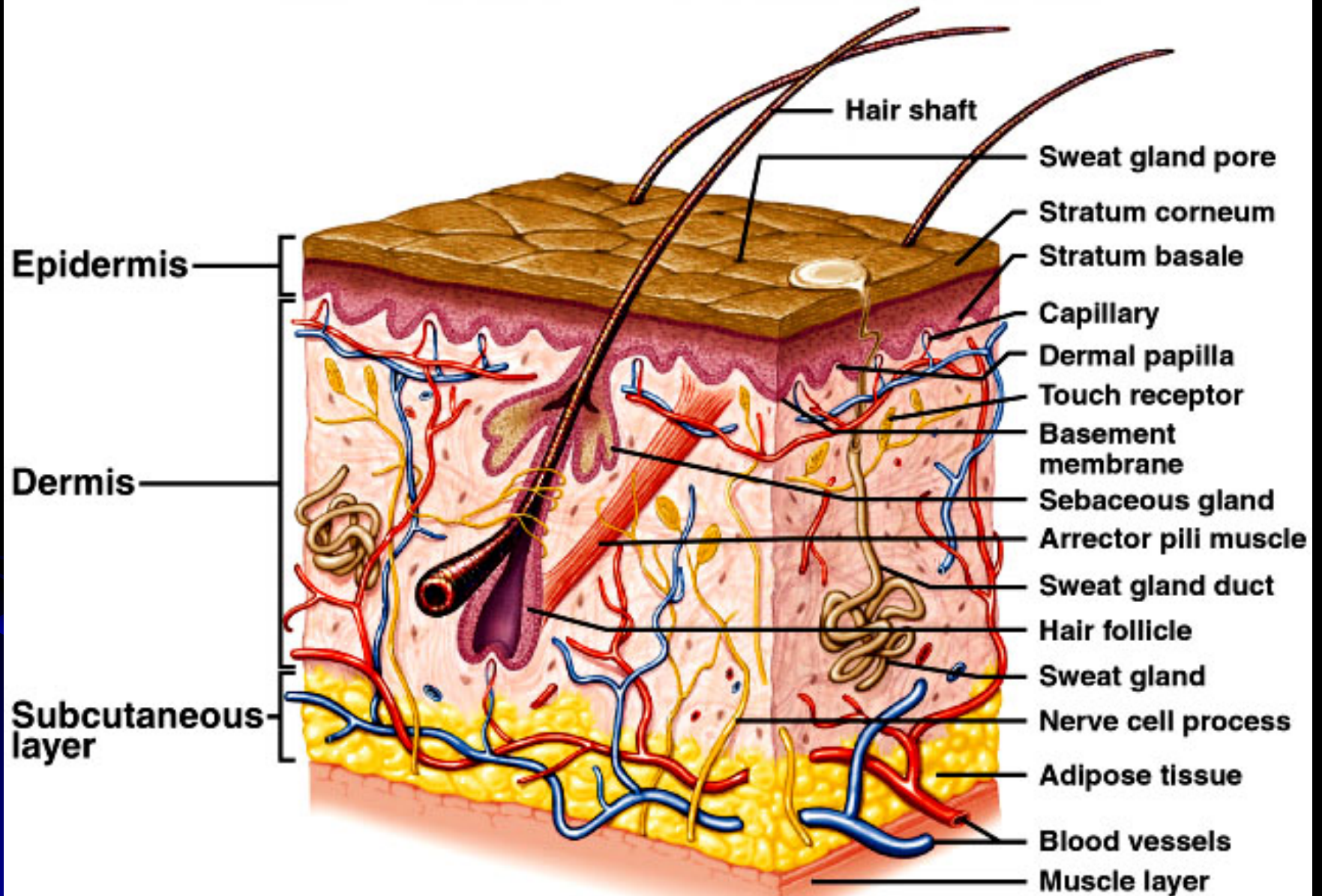


THE ALBINO MONK?

Dermis

- on average 1.0-2.0mm thick
- dermal papillae
- binds epidermis to underlying tissues
- irregular dense connective tissue
- muscle cells
- nerve cell processes
- blood vessels
- hair follicles
- glands

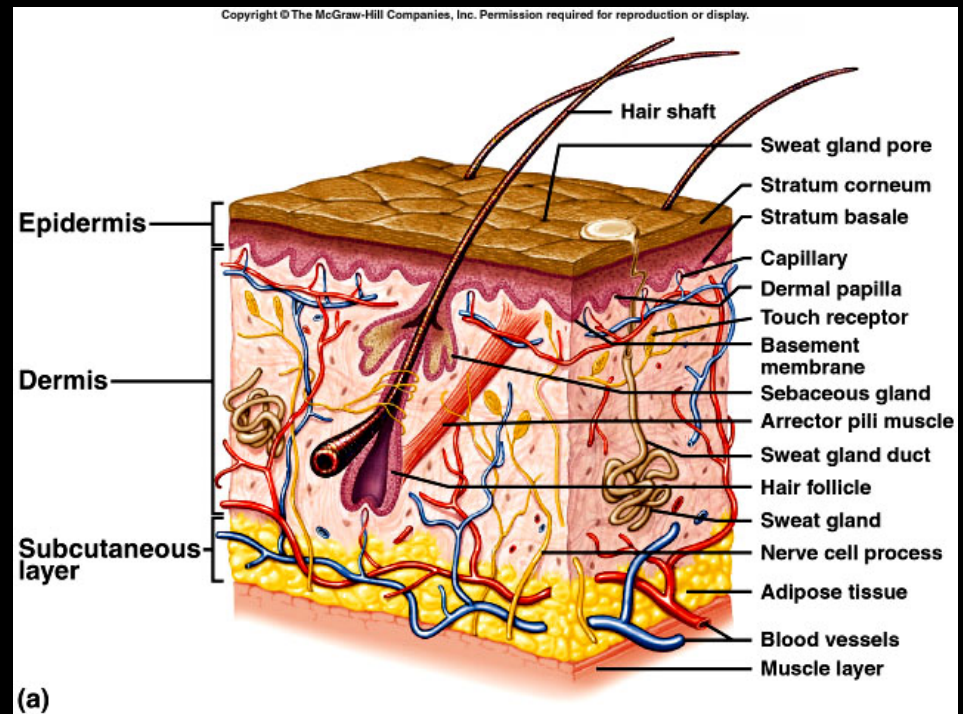




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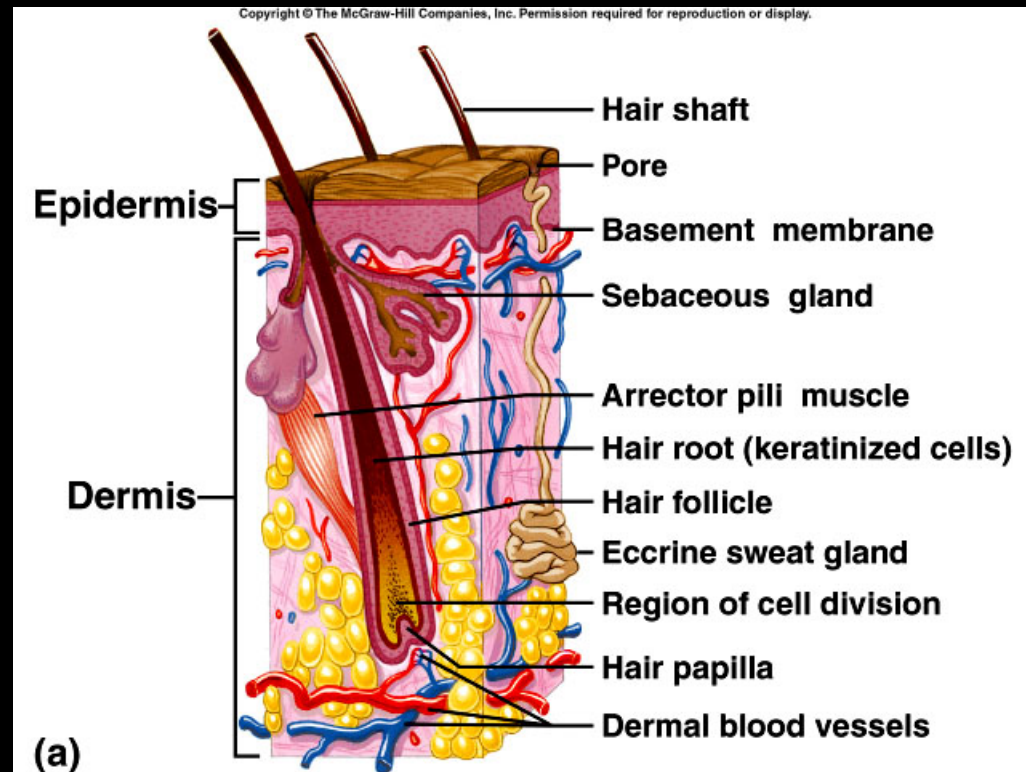
Subcutaneous Layer

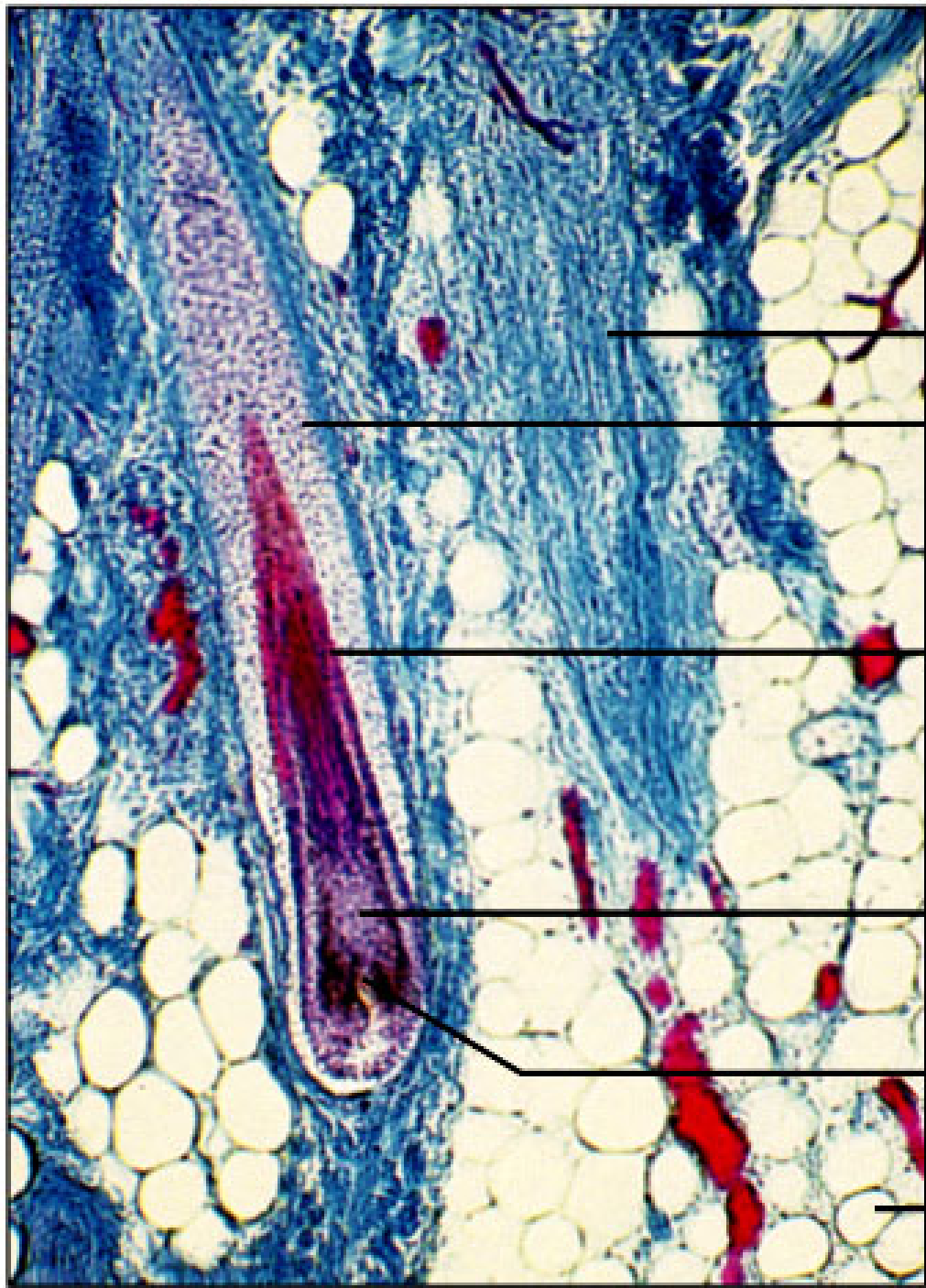
- hypodermis
- loose connective tissue
- adipose tissue
- insulates
- major blood vessels



Hair Follicles

- epidermal cells
- tube-like depression
- extends into dermis
- hair root
- hair shaft
- hair papilla
- dead epidermal cells
- melanin
- arrector pili muscle





Dermal tissue

Hair follicle

Hair root

**Region of
cell division**

Hair papilla

Adipose tissue

(b)



**Keratinized cells
of hair shaft**

**Keratinized squamous
cells of epidermis**

Grey's Anatomy



With age, a loss of melanin in hair can lead to grayness.



EXAMPLES OF HAIR COLOR VARIATION



Red Heads have iron pigment (trichosiderin)



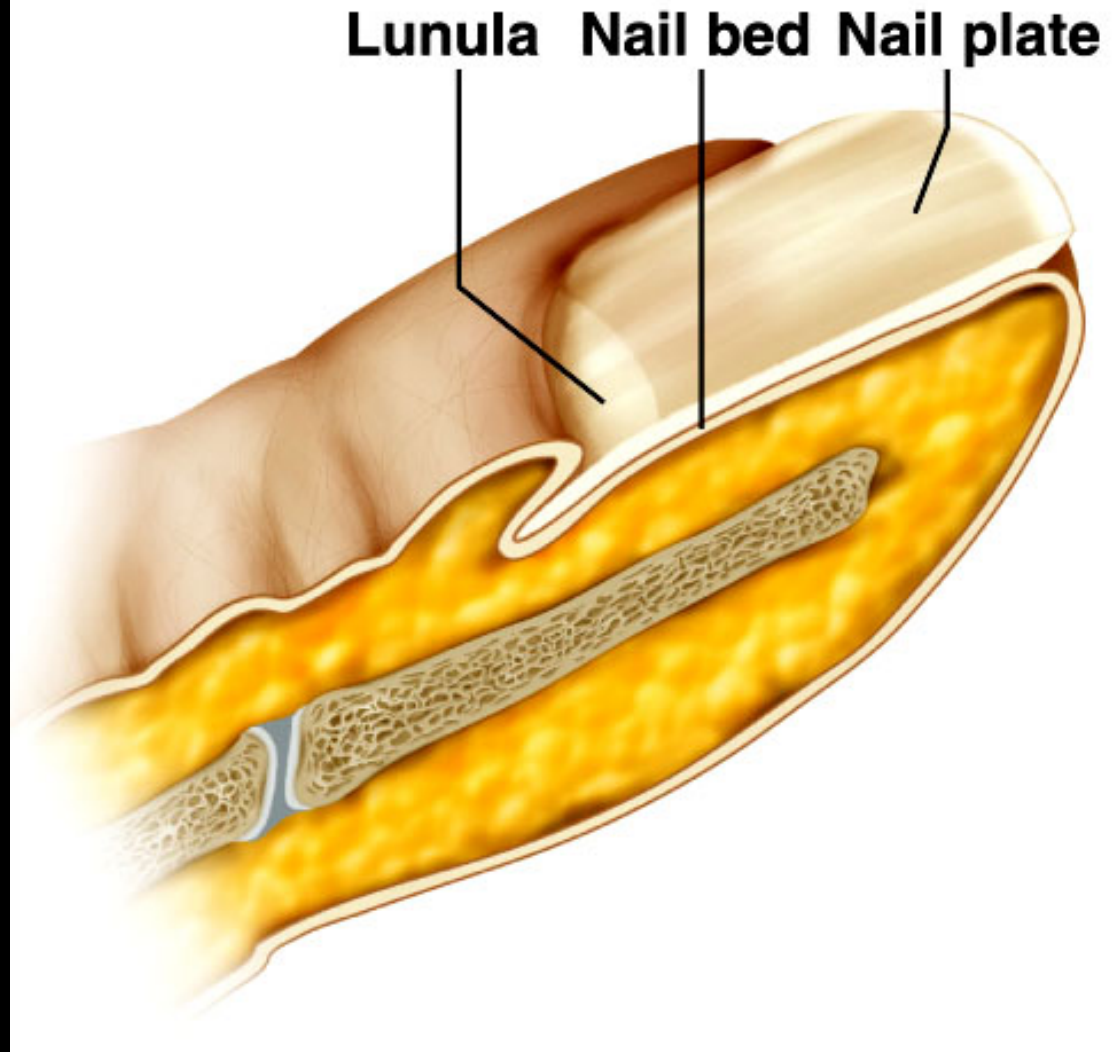
Everyone except albinos have various amounts of melanin in their hair.



Nails

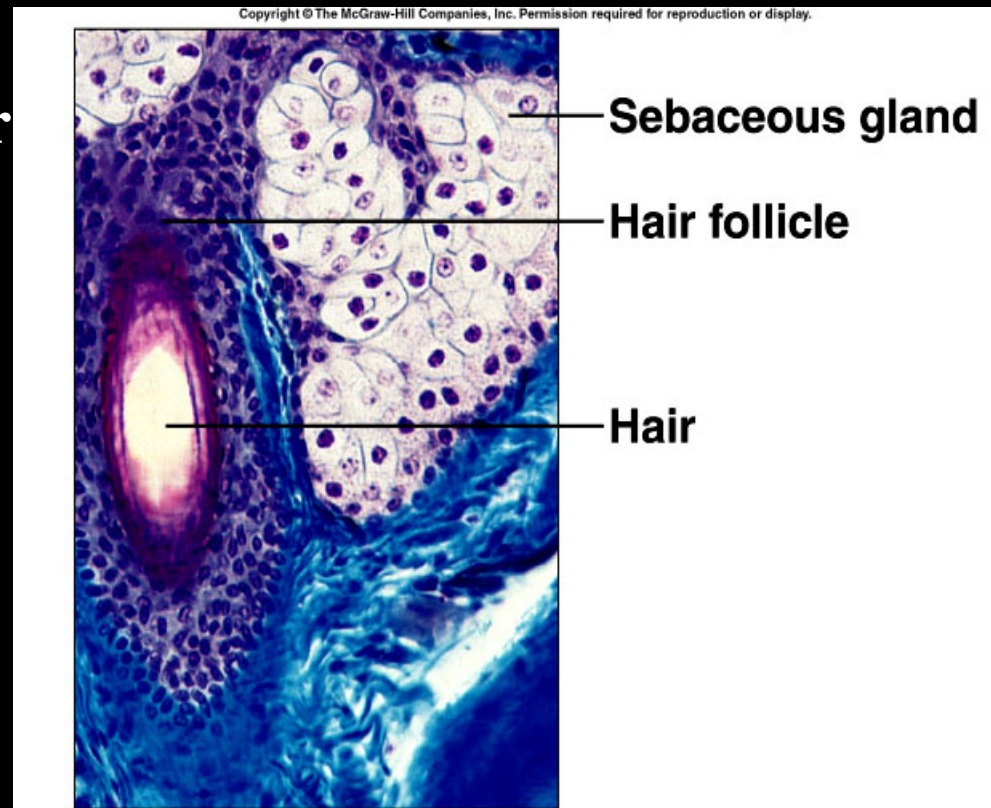
- protective coverings
- nail plate
- nail bed
- lunula

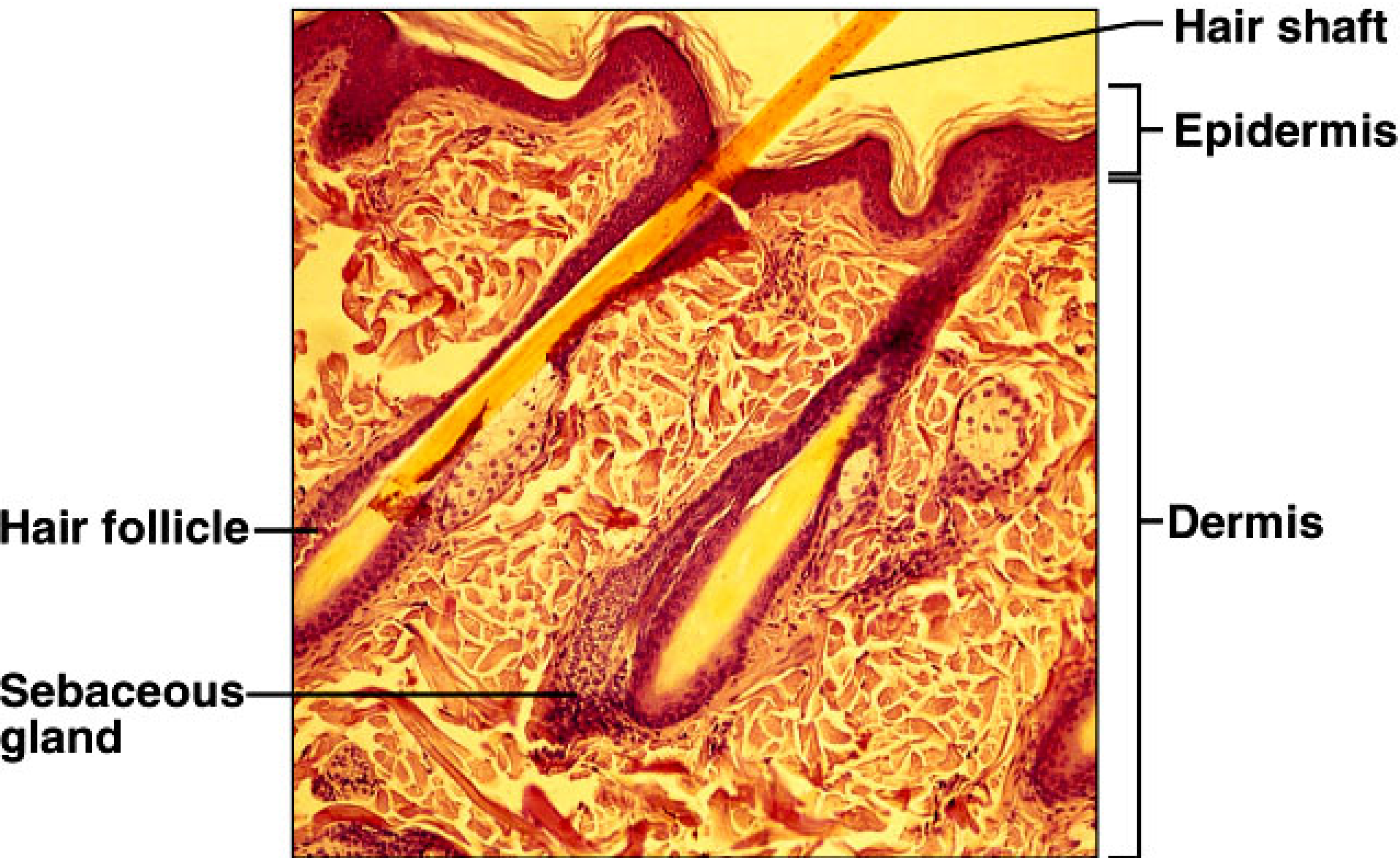
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Sebaceous Glands

- usually associated with hair follicles
- holocrine glands – disintegrating cell and its contents for the secretion
- secrete sebum
- absent on palms and soles





(b)

Sweat or Sudoriferous Glands

- widespread in skin
- deeper dermis or hypodermis
- eccrine glands – types of merocrine gland that secrete fluid (sweat) product released through the cell membrane
- apocrine sweat, ceruminous (wax), & mammary (milk) glands – types of apocrine glands that secrete cellular product and portion of the free ends of cells

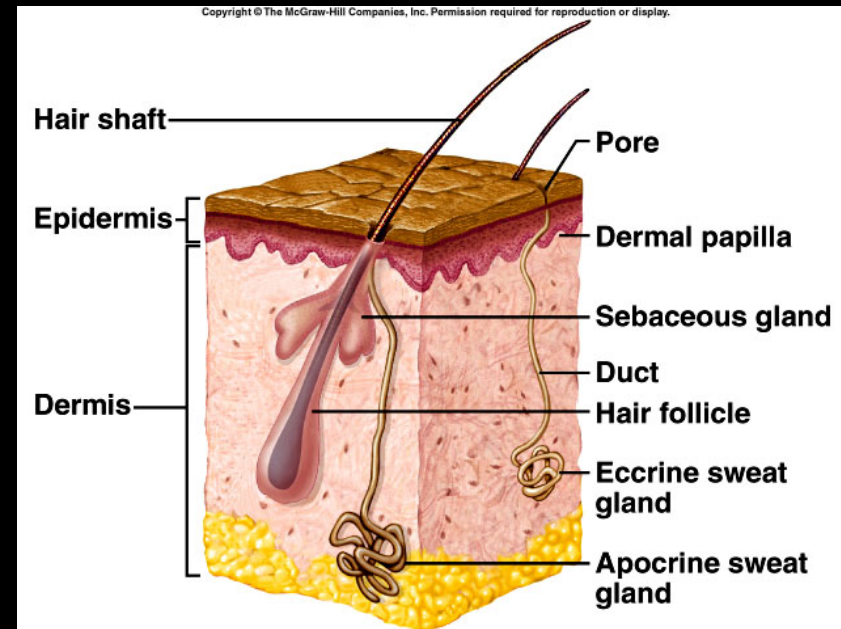
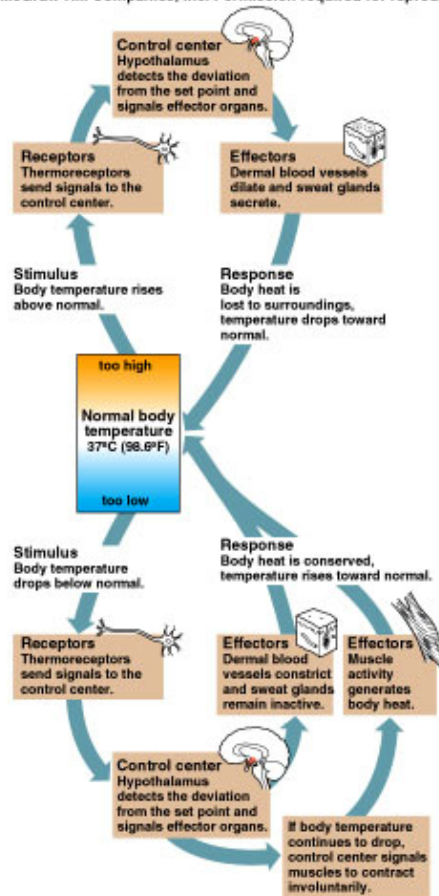


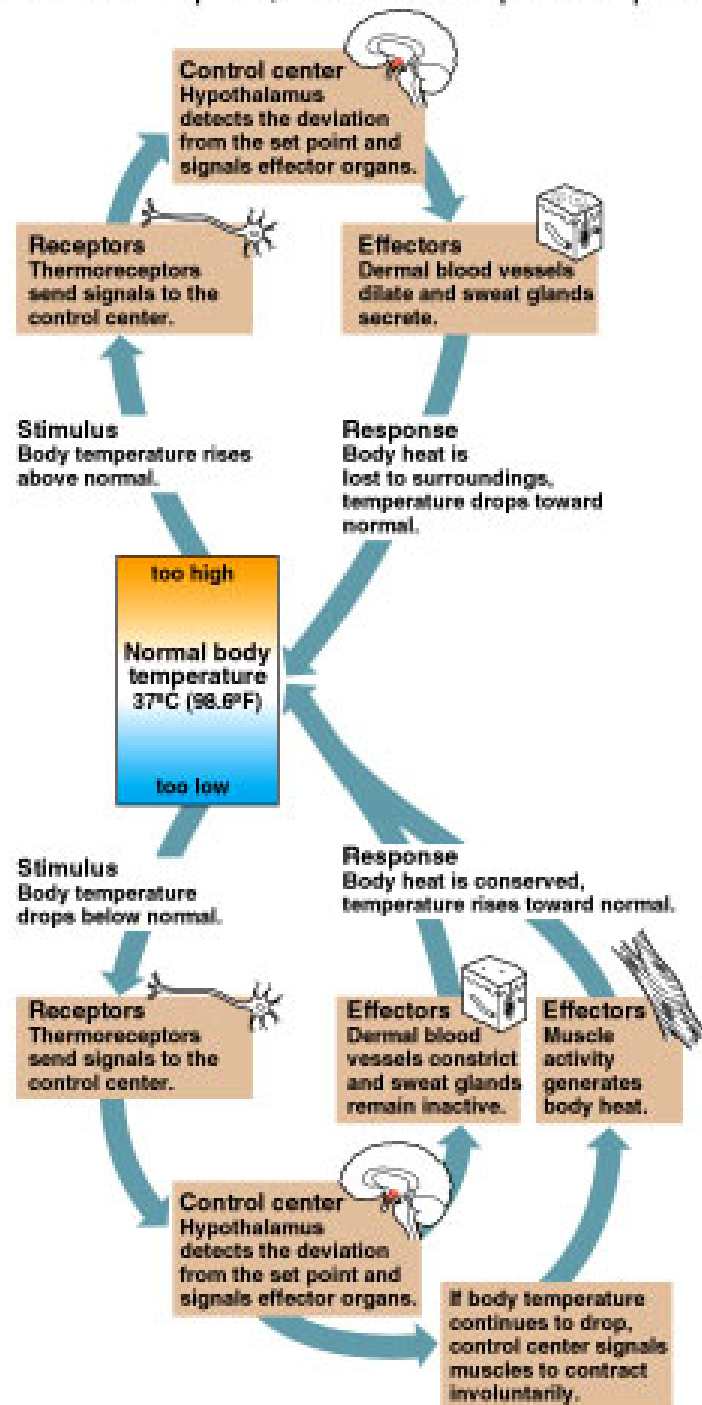
TABLE 6.3 Skin Glands

Type	Description	Function	Location
Sebaceous glands	Groups of specialized epithelial cells	Keep hair soft, pliable, waterproof	Near or connected to hair follicles, everywhere but on palms and soles
Eccrine sweat glands	Abundant sweat glands with odorless secretion	Lower body temperature	Originate in deep dermis or subcutaneous layer and open to surface on forehead, neck, and back
Apocrine sweat glands	Less numerous sweat glands with secretions that develop odors	Wet skin during pain, fear, emotional upset, and sexual arousal	Near hair follicles in armpit, groin, around nipples
Ceruminous glands	Modified sweat glands	Secrete earwax	External ear canal
Mammary glands	Modified sweat glands	Secrete milk	Breasts

Regulation of Body Temperature

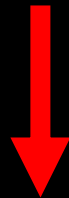
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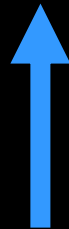


Problems in Temperature Regulation

Hyperthermia – abnormally high body temperature



Human Body
Temperature = 37°C
or 98.6°F .



Hypothermia – abnormally low body temperature

Skin Color

Genetic Factors

- varying amounts of melanin
- varying size of melanin granules
- albinos lack melanin

Physiological Factors

- dilation of dermal blood vessels
- constriction of dermal blood vessels
- carotene
- jaundice

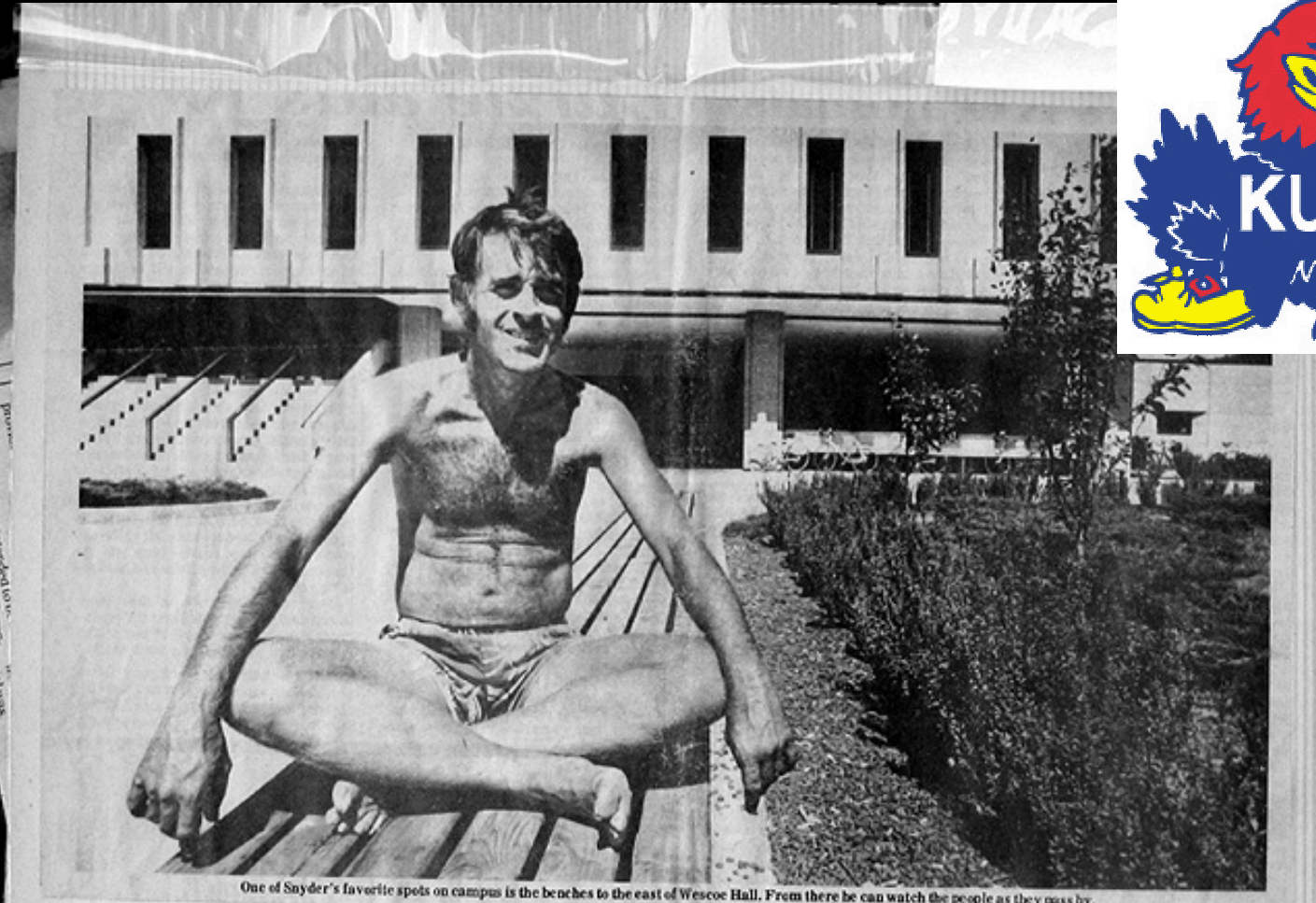
Environmental Factors

- sunlight
- UV light from sunlamps
- X rays



George Hamilton – sun worshiper?

The Tan Man at The University of Kansas

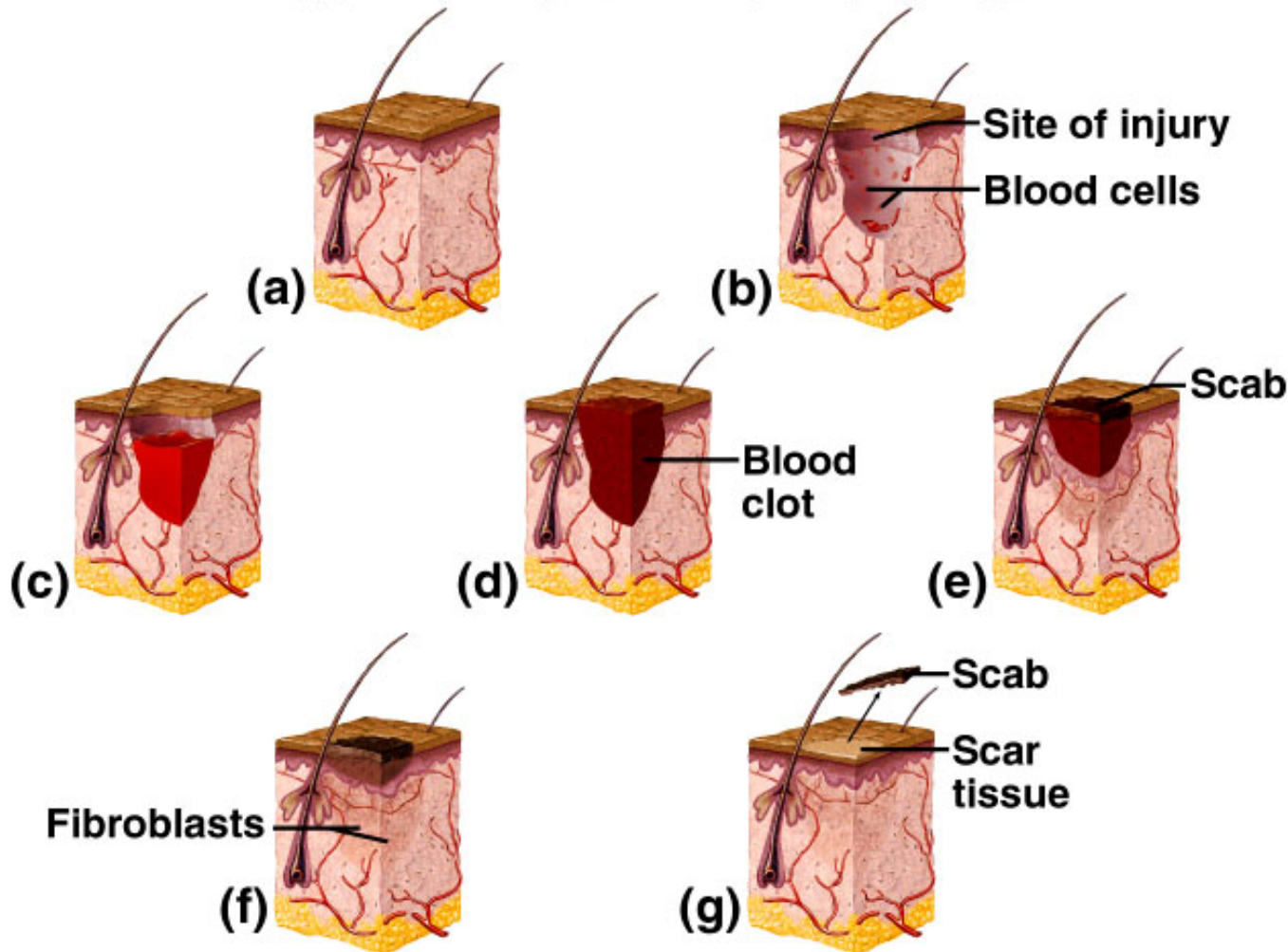


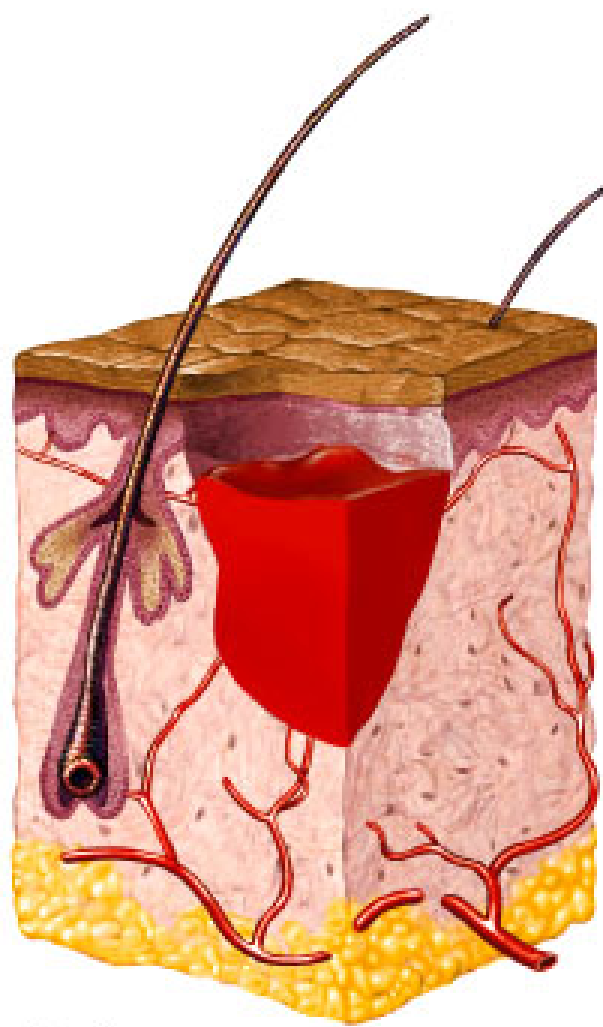
One of Snyder's favorite spots on campus is the benches to the east of Wescoe Hall. From there he can watch the people as they pass by.

http://www2.ljworld.com/news/2006/may/03/hes_still_tan_after_all_these_years/?city_local

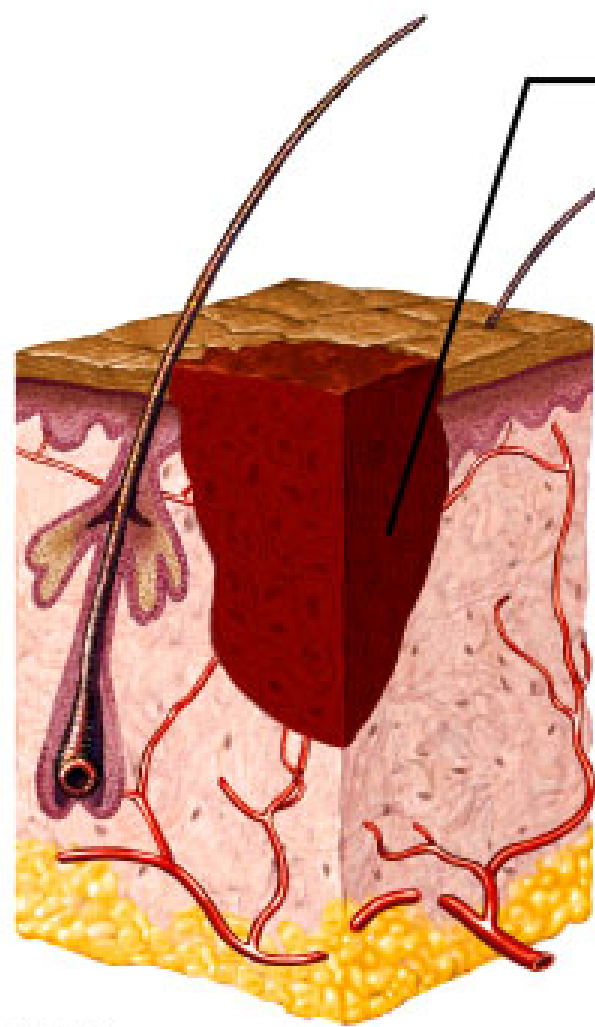
Healing of Cuts

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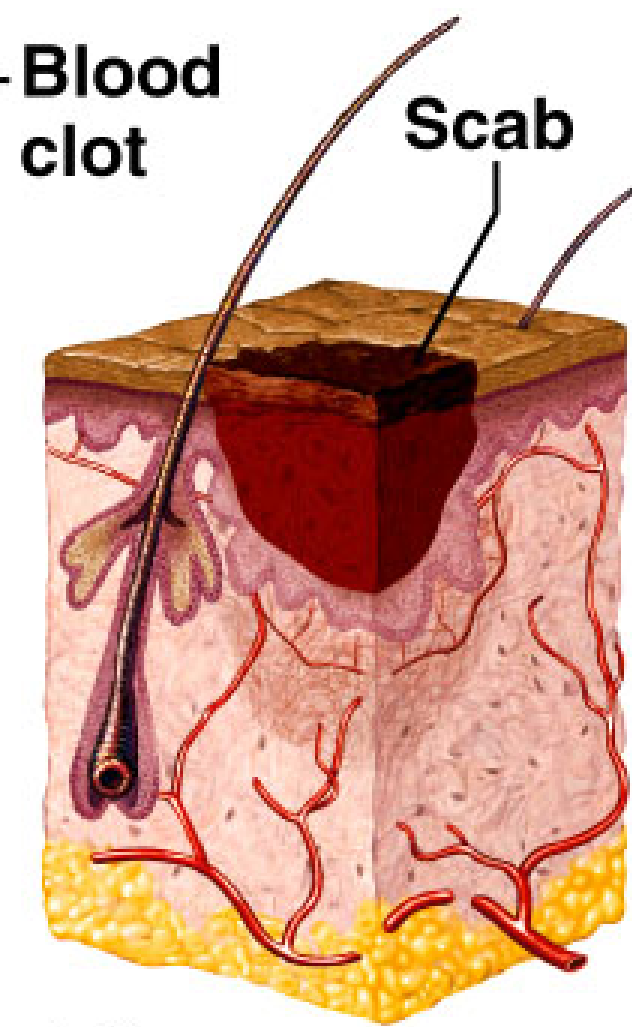




(c)



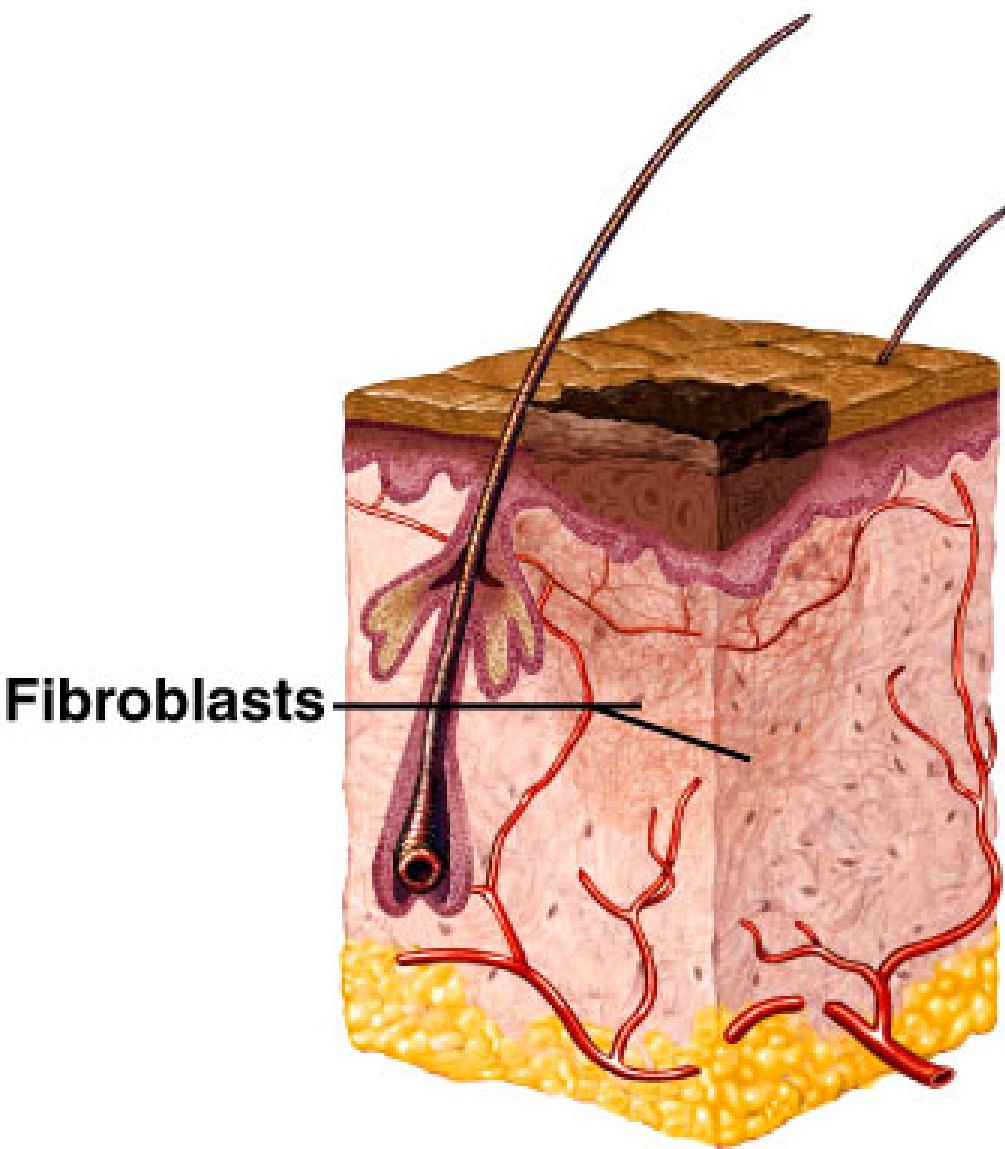
(d)



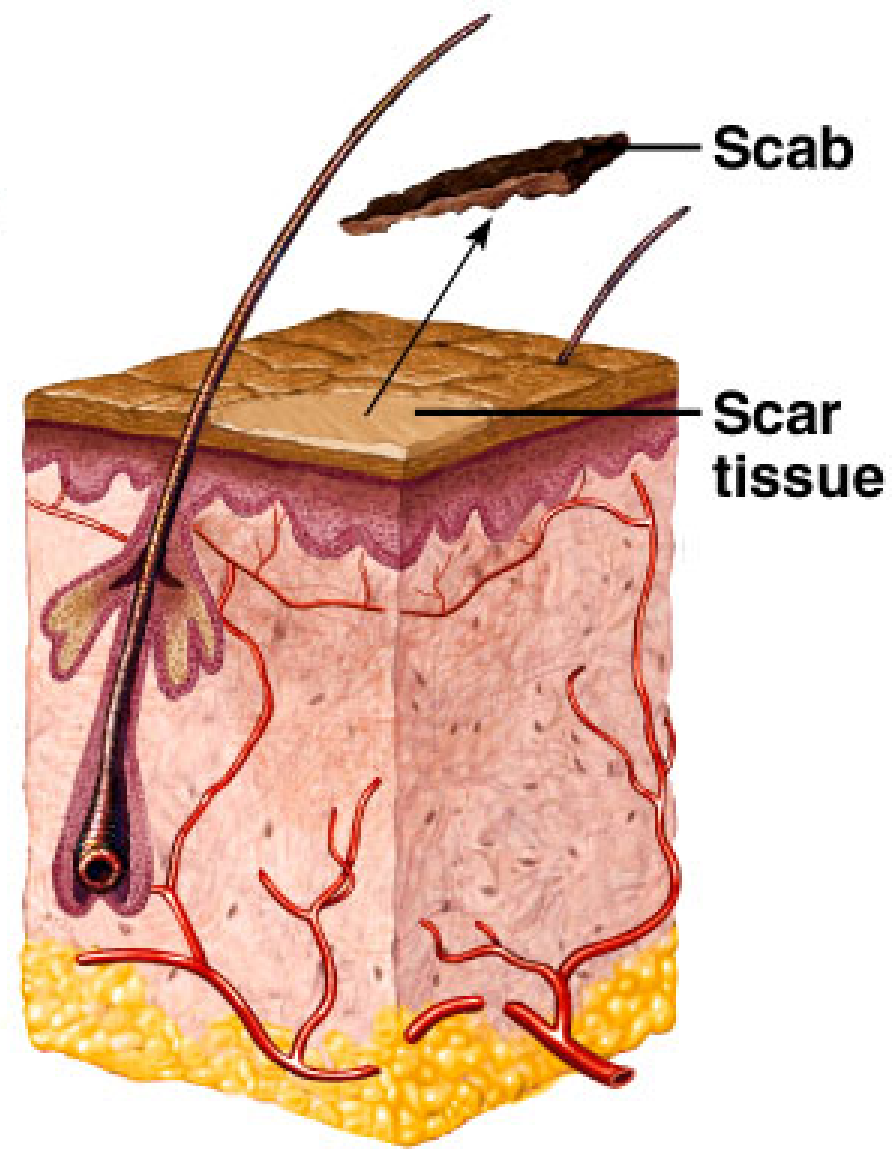
(e)

**Blood
clot**

Scab



(f)



(g)

Healing of Burns

First degree burn – superficial partial-thickness (epidermis damaged)

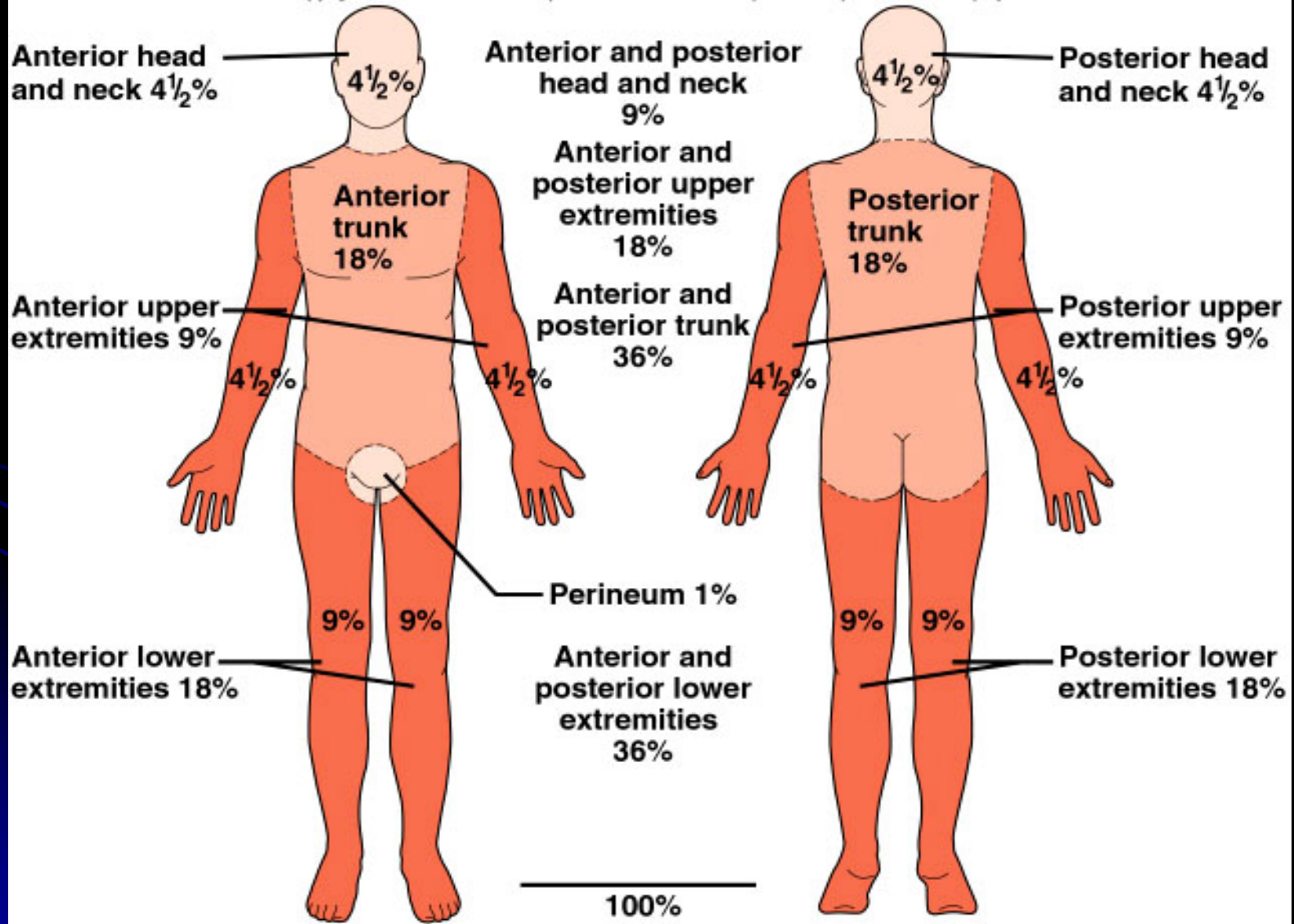
Second degree burn – deep partial-thickness (epidermis & dermis damaged)

Third degree burn – full-thickness (epidermis, dermis, & accessory skin structures)

- autograft (self-transplant)
- homograft (temporary transplant from donor)
- various skin substitutes
- extensive scars

Rule of Nines

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Life Span Changes

- **Scaly skin**
- **Age spots**
- **Dermis becomes reduced**
- **Loss of fat**
- **Wrinkles**
- **Sagging**
- **Sebaceous glands secrete less oil**
- **Melanin production slows**
- **Hair thins**
- **Number of hair follicles decrease**
- **Impaired nail growth**
- **Sensory receptors decline**
- **Inability to control body temperature**
- **Less vitamin D production**

Life Span Changes - Skin

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Clinical Application

Acne Vulgaris

- **most common skin disorder**
- **sebum and epithelial cells clog glands**
- **produces whiteheads and blackheads (comedones)**
- **anaerobic bacteria trigger inflammation (pimple)**
- **largely hormonally induced**
- **androgens stimulate sebum production**
- **treatments include antibiotics, topical creams, birth control pills**



TABLE 6A

Acne Treatments (By Increasing Severity)

Condition	Treatment
Noninflammatory comedonal acne (blackheads and whiteheads)	Topical tretinoin or salicylic acid
Papular inflammatory acne	Topical antibiotic
Widespread blackheads and pustules	Topical tretinoin and systemic antibiotic
Severe cysts	Systemic isotretinoin
Explosive acne (ulcerated lesions, fever, joint pain)	Systemic corticosteroids

Common Skin Disorders

- Athlete's foot – tinea pedis or ringworm fungal infection of the foot.
- Birthmark – congenital blemish or spot on the skin.
- Boil – bacterial infection of the skin produced when bacteria enter a hair follicle.
- Carbuncle – bacterial infection, similar to a boil, that spreads into the subcutaneous tissues.
- Cyst – fluid-filled capsule.
- Eczema – noncontagious skin rash.
- Erythema – reddening of the skin due to dilation of dermal blood vessels in response to injury or inflammation.
- Herpes – characterized by a recurring formation of small clusters of vesicles; usually caused by herpes simplex virus; contagious.
- Keloid – elevated enlarging fibrous scar usually initiated by an injury.
- Mole – fleshy skin tumor that is usually pigmented.
- Pediculosis – disease produced by an infestation of lice.
- Pruritus – itching of the skin.
- Pusule – elevated, pus-filled area.

Xeroderma Pigmentosum

- Extreme freckling and skin cancer due to lack of DNA repair enzymes.



Types of Skin Cancer



(a) Squamous cell carcinoma – derived from epithelial tissue



(b) Basal cell carcinoma – derived from epithelial tissue



(c) Malignant melanoma – derived from melanocytes