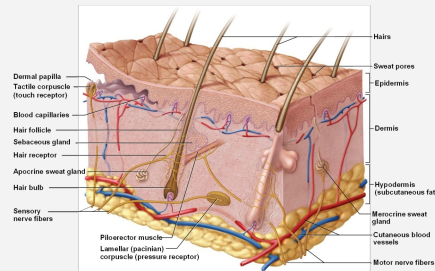


### Structure of the Skin & Subcutaneous Tissue



#### Terms

<b>Integumentary System</b>	Consists of the skin, hair, nails, and associated glands
<b>Dermatology</b>	Scientific study and medical treatment of the integumentary system

#### Functions of the Skin

<b>Resistance to trauma and infection</b>	Keratin - Acid mantle
<b>Other barrier functions</b>	Waterproofing, UV radiation, Harmful chemicals
<b>Vitamin D synthesis</b>	Skin first step, Liver and kidneys complete process
<b>Sensation</b>	Skin is our most extensive sense organ
<b>Thermoregulation</b>	Thermoreceptors, Vasoconstriction/vasodilation
<b>Nonverbal communication</b>	Acne, birthmark, or scar
<b>Transdermal absorption</b>	Administration of certain drugs steadily through thin skin via adhesive patches

#### Functions of the Skin (cont)

**Epidermis** Keratinized stratified squamous epithelium

- Dead cells at the surface packed with tough protein called **keratin**
- Lacks blood vessels
- Depends on the diffusion of nutrients from underlying connective tissue
- Sparse nerve endings for touch and pain

#### Sweat Glands

Two kinds of sweat (**sudoriferous**) glands, **Merocrine (eccrine)** sweat glands

- **Apocrine sweat glands** - Develop at **puberty**

- Bromhidrosis—disagreeable body odor produced by bacterial action on fatty acids
- Diaphoresis—sweating with wetness of the skin

#### SEBACEOUS GLANDS

- Sebum—oily secretion produced by sebaceous glands

**CERUMINOUS GLANDS** - only in external ear canal

**MAMMARY GLANDS** —milk-producing glands that develop only during pregnancy and lactation

#### SKIN COLOR

- **Melanin**—most significant factor in skin color
- Produced by melanocytes released by exocytosis
- Accumulate in the keratinocytes
- Eumelanin—brownish black
- Pheomelanin—a reddish yellow sulfur-containing pigment
- People of different skin colors have the same number of melanocytes

#### Dark-skinned people

- Produce greater quantities of melanin
- Melanin granules in keratinocytes more spread out than tightly clumped
- Melanin breaks down more slowly
- Melanized cells seen throughout the epidermis

#### Light-skinned people

- Melanin clumped near keratinocyte nucleus
- Melanin breaks down more rapidly
- Little seen beyond stratum basale
- Amount of melanin also varies with exposure to (UV) rays of sunlight

**Hemoglobin**—red pigment of red blood cells - Adds reddish to pinkish hue to skin

**Carotene**—yellow pigment acquired from egg yolks and yellow/orange vegetables **will turn skin yellow if consumed in large quantities.** - Concentrates in stratum corneum and subcutaneous fat



### Burns

- leading cause of accidental death
- Debridement:** removal of **eschar** (burned tissue)
- Classified according to the depth of tissue involvement
- **First-degree burn:** partial-thickness burn; involves only the epidermis
- Marked by redness, slight edema, and pain
- **Second-degree burn:** partial-thickness burn; involves the epidermis and part of the dermis
- **Third-degree burn:** full-thickness burn; the epidermis and all of the dermis, and often some deeper tissues (muscles or bones) are destroyed
- Often requires skin grafts
- Needs fluid replacement and infection control

### SKIN:

- The body's largest and heaviest organ
- Covers area of 1.5 to 2.0 m<sup>2</sup>
- 15% of body weight
- Most skin is 1 to 2 mm thick

### Two Layers: Epidermis & Dermis

- **Epidermis-**
- **Dermis—connective tissue layer beneath the epidermis**
- Ranges from 0.2 mm (eyelids) to 4 mm (palms, soles)
- Composed mainly of collagen with elastic fibers, reticular fibers, and fibroblasts
- Well supplied with blood vessels, sweat glands, sebaceous glands, and nerve endings

### SKIN: (cont)

- Hypodermis**—another connective tissue layer below the dermis
- Subcutaneous** tissue
- More areolar and adipose than dermis
- Pads body
- Binds skin to underlying tissues
- Thick skin**— on palms and sole, and corresponding surfaces on fingers and toes - Has sweat glands, but no hair follicles or sebaceous (oil) glands - Epidermis 0.5 mm thick
- Thin Skin-** covers rest of the body - Epidermis about 0.1 mm thick - Possesses hair follicles, sebaceous glands, and sweat glands

### Five Types of Cells of the Epidermis

- Stem Cells** Undifferentiated cells that give rise to keratinocytes  
In deepest layer of epidermis (stratum basale)
- Keratinocytes** Majority of epidermal cells  
Synthesize keratin  
**very tough protein**
- Melano cytes** Occur only in Stratum Basale  
Synthesize pigment melanin that shields DNA from ultraviolet radiation  
melanin accumulates in the keratinocytes
- Tactile Cells** receptors for touch

### Five Types of Cells of the Epidermis (cont)

- Dendritic Cells** Macrophage (modified white blood cell)  
originating in bone marrow that guard against pathogens  
Guard against toxins, microbes, and other pathogens that penetrate skin

### The Life History of a Keratinocyte

**Keratinocytes** produced deep in the epidermis by stem cells in stratum Basale

**Mitosis requires an abundant supply of oxygen and nutrients**

Deep cells acquire oxygen from blood vessels in nearby dermis

Newly formed keratinocytes push the older ones toward the surface

- In **30 to 40 days** a keratinocyte makes its way to the skin surface and flakes off
- Slower in old age - Faster in injured or stressed skin

**Calluses\corns**—thick accumulations of dead keratinocytes on the hands or feet

**Waterproofing is Achieved By:**

- Lipids** secreted by keratinocytes
- Tight junctions** between keratinocytes- thick layer of **insoluble protein** on the inner surfaces of the keratinocyte plasma membranes
- Critical to retaining water in the body and **preventing dehydration**

Cells above the water barrier quickly die



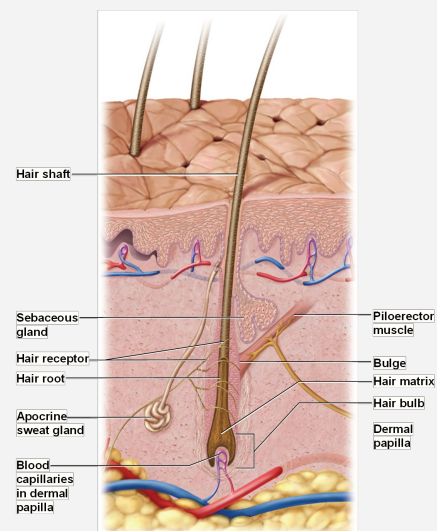
### The Life History of a Keratinocyte (cont)

- Barrier cuts them off from nutrients below
- Dead cells **exfoliate (dander)**
- Dandruff:** clumps of dander stuck together by sebum (oil)

### Colors of Diagnostic Value

<b>Cyanosis</b>	blueness of the skin
<b>Erythema</b>	abnormal redness of the skin
<b>Pallor</b>	pale or ashen color
<b>Albinism</b>	genetic lack of melanin that results in white hair, pale skin, and pink eyes - Have inherited recessive, nonfunctional tyrosinase allele
<b>Jaundice</b>	yellowing of skin
<b>Hematoma (Bruise)</b>	mass of clotted blood showing through skin

### Structure of Hair



### Hair & Nails

- Hair/nails are made of mostly dead, keratinized cells**
- Pliable soft keratin makes up stratum corneum of skin
- Compact hard keratin makes up hair and nails
- Tougher and more compact due to numerous cross-linkages between keratin molecules

### Hair: Pilus

- Pilus— Hair —a slender filament of keratinized cells that grows from an oblique tube in the skin called a hair follicle
- **Three kinds of hair grow over the course of our lives**
- Lanugo:** fine, downy, unpigmented hair that appears on the fetus in the last 3 months of development not all infants are born with lanugo
- Vellus:** fine, pale hair that replaces lanugo by time of birth
- Terminal:** longer, coarser, and usually more heavily pigmented

### Hair is divisible into three zones along its length

- Bulb:** a swelling at the base where hair originates in dermis or hypodermis - Only living hair cells are in or near bulb
- Root:** the remainder of the hair in the follicle
- Shaft:** the portion above the skin surface

- Hair receptors – goosebumps - Piloerector muscle (arrector pili)

– Extends from dermal collagen to connective tissue root sheath Hair Texture and Color

### Hair: Pilus (cont)

- Texture—related to differences in cross-sectional shape
- **Straight hair:** round - **Wavy:** hair oval
- Curly hair:** relatively flat
- Color—due to pigment granules in the cells of the cortex
- Brown & black hair rich in **eumelanin**
- Red hair high concentration of **pheomelanin**
- Blond hair has an intermediate amount of **pheomelanin** and **very little eumelanin**
- Gray and white hair results from scarcity or **absence of melanin** in the cortex and the presence of air in the medulla
- Testosterone causes terminal hair in scalp to be replaced by vellus hair
- Hirsutism**—excessive or undesirable hairiness in areas that are not usually hairy

### Three types of skin cancer

- named for the epidermal cells in which they originate
- Basal cell carcinoma, squamous cell carcinoma, and malignant melanoma**
- Person with metastatic melanoma lives only 6 months from diagnosis, 5% to 14% survive 5 years