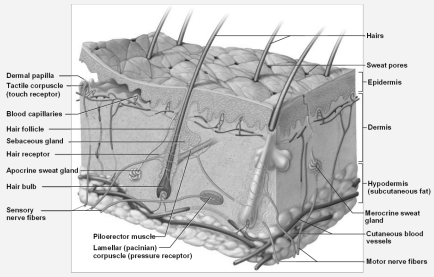
Structure of the Skin & Subcutaneous Tissue



Terms

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

Functions of the Skin

Resistance to trauma and infection	Keratin - Acid mantle
Other barrier functions	Waterproofing, UV radiation, Harmful chemicals
Vitamin D synthesis	Skin first step, Liver and kidneys complete process
Sensation	Skin is our most extensive sense organ
Thermoregulation	Thermoreceptors, Vasoconstriction/vasodilation
Nonverbal communication	Acne, birthmark, or scar
Transdermal absorption	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

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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 m2
–15% of body weight
–Most skin is 1 to 2 mm thick

Two Layers: Epidermis & Dermis

• **Epidermus**-

• **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**
Melanocytes	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)

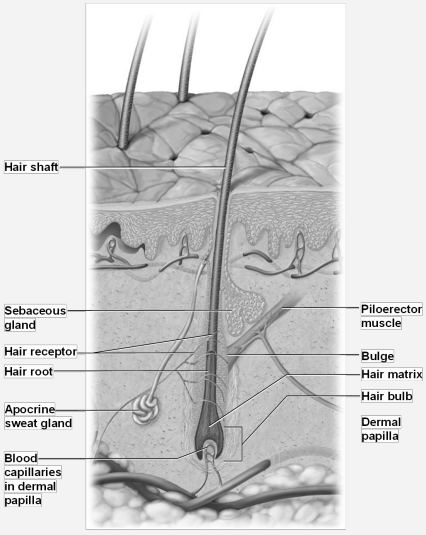
-Barrier cuts them off from nutrients below

-Dead cells **exfoliate (dander)**
Dandruff: clumps of dander stuck together by sebum (oil)

Colors of Diagnostic Value

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

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