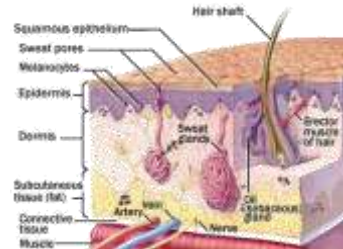


Skin and Integumentary System

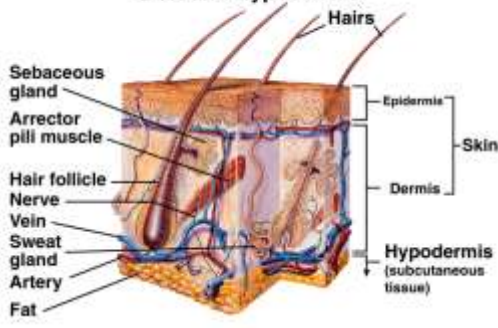


Integumentary system

- Includes the skin, hair follicles, sebaceous (oil) glands, nails and sweat glands



Skin and Hypodermis



Physiology

Physiology

1. Protection
 - Prevents water loss (lipids)
 - Prevents entry of microorganisms/foreign substances (secretions & skin)
 - Protects against abrasion (stratified squamous epithelium)
 - Protects against UV light damage (melanin)
 - Hair: insulation (head), keeps foreign objects/microorganisms/sweat out (eyelashes, eyebrows, nose & ear hairs)
 - Damage protection/defense (nails)

Physiology

2. Sensation
 - Nervous receptors in dermis & epidermis
 - 2 point touch
 - Continuous touch or pressure
 - Vibration
 - Light touch
 - Pain
 - Temperature, itch, joint movement

Physiology

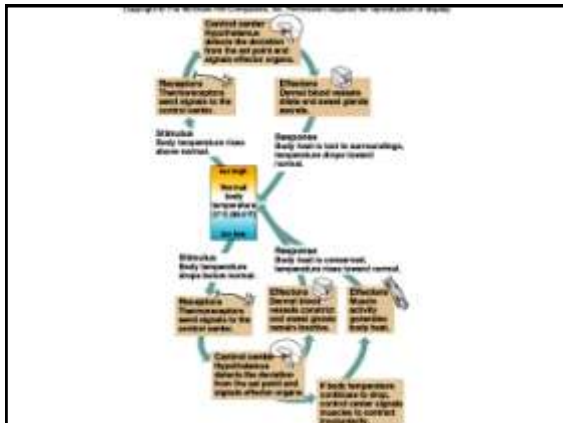
3. Vitamin D Production

- Vitamin D precursor made in skin
- Requires UV exposure
- Required for calcium & phosphate absorption in intestines

Physiology

4. Temperature Regulation

- Blood vessels (arterioles) in dermis dilate to lose heat, constrict to keep it in
 - Allows blood to get to upper layers to release heat
- Glands within the skin release water that helps release heat through evaporation.



Physiology

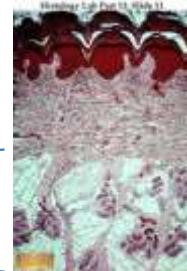
5. Excretion

- Removal of waste products from the body – small role
- Sweat: water, salts, urea, uric acid, ammonia

Anatomy

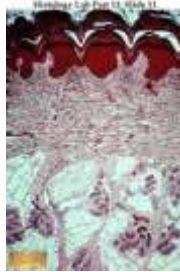
Hypodermis (Subcutaneous)

- Function
 - Attaches skin to underlying bone and muscle
 - Supplies skin with blood vessels & nerves
 - Not part of the skin
 - Site of subcutaneous injections
 - Padding & insulation



Hypodermis (Subcutaneous)

- Composition
 - loose connective & adipose tissues
 - Sex differences
 - Total body fat estimates made from pinching hypodermis



Skin

- Dermis
 - layer of dense connective tissue
- Epidermis
 - layer of epithelial tissue resting on dermis

Dermis

- Function
 - Connects epidermis to underlying connective tissue
 - Part of animal hide used in making leather
 - Site of injections like TB test

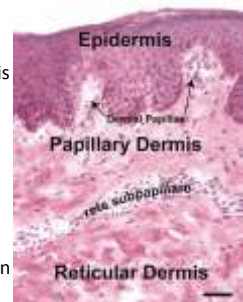


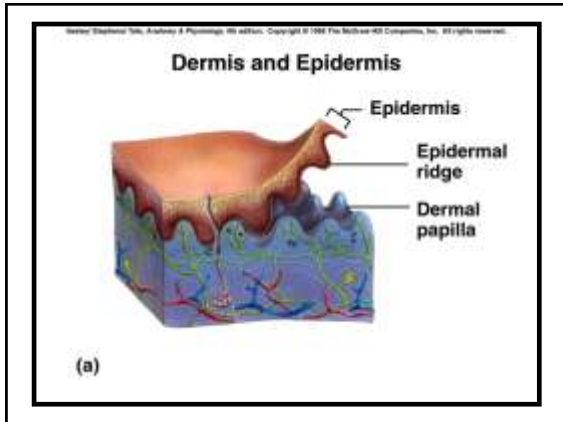
Dermis

- Composition
 - Collagen
 - Orientation can either resist or be susceptible to stretching
 - Elastic fibers
 - Fibroblasts
 - Fat cells
 - Macrophages
 - Fewer fat cells & blood vessels than hypodermis
 - Nerve endings, hair follicles, smooth muscle, glands, lymphatic vessels

Dermis

- Dermal papillae
 - projections into upper dermis
 - contain many blood vessels
 - Supply epidermis with nutrients
 - Remove wastes
 - Regulate body temperature
 - Found in hands & feet – fingerprints/ridges for friction and grip





Epidermis

- Function
 - Prevents water loss
 - Prevents injury
 - Prevents entrance of harmful chemicals and organisms

Epidermis

- Composition
 - stratified squamous epithelium
 - Mitosis in deepest layers pushes older cells to surface where they slough off
 - Outermost cells protect those underneath

Epidermis

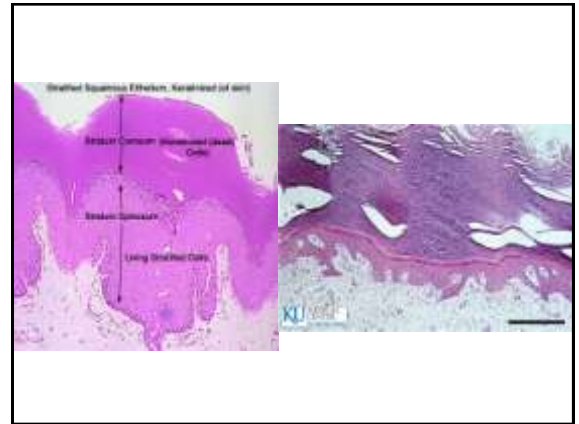
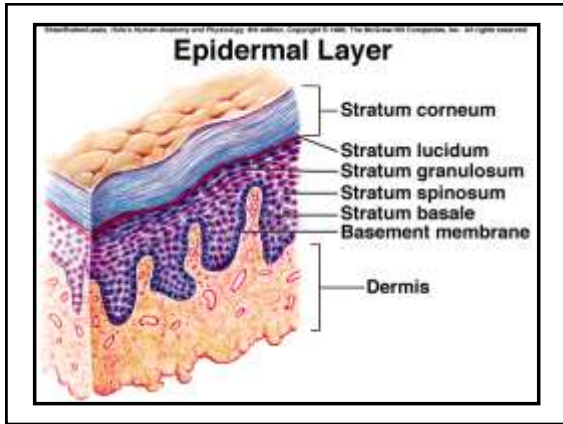
- During migration from “deep” to “superficial” cells change in shape and chemical composition
 - Keratinization = cells fill with keratin
 - Cells die and form protective layer resisting abrasion & forming permeability layer

Epidermis

- stratified (strata = layer)
 - Stratum basale = base layer
 - Cuboidal or columnar cells – mitosis every 19 days
 - Stratum spinosum
 - Stratum granulosum
 - Stratum lucidum
 - Not present in all areas

Epidermis

- stratified (strata = layer)
 - Stratum corneum = horny layer
 - Most superficial
 - Dead, squamous cells filled with keratin
 - Coated/surrounded by lipids, prevent fluid loss
 - 25+ layers of dead cells joined by desmosomes
 - Calluses (hard skin) = increase in number of layers in stratum corneum due to friction
 - Corn = similar reaction as callus, just over a bony prominence



Skin Color

- Determined by
 - pigments in skin – melanin and others
 - blood circulating in skin
 - thickness of stratum corneum

Melanin

- group of pigments determining color of skin, hair, and eyes
- Usually brown to black, sometimes yellowish or reddish
- Absorbs UV light

Melanocyte with melanin granules

Keratinocyte with melanin granules near the nucleus

Melanin

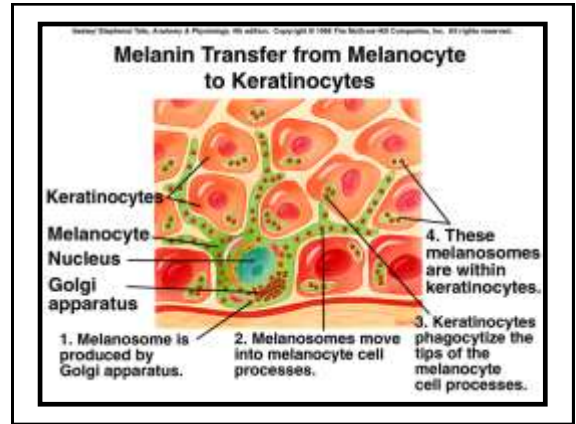
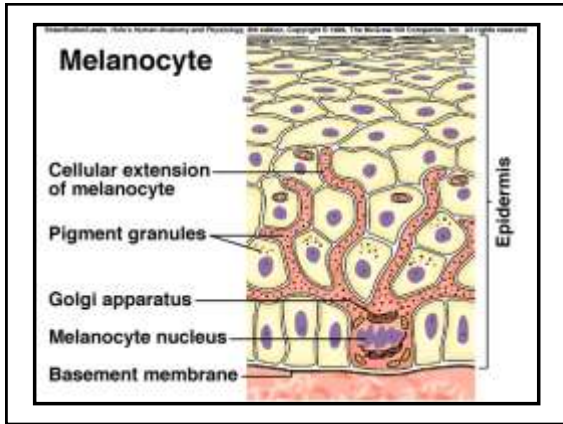
- Melanocytes
 - Golgi bodies in melanocytes package melanin into melanosomes, then phagocytized by epithelial cells

Melanocyte with melanosomes

Keratinocyte with melanin granules near the nucleus

Melanin

- Large amounts in freckles, moles, genitalia, nipples, areolas
- Less in lips, palms, soles
- Racial variations – due to amount, kind, and distribution of melanin
- All races have ~same number of melanocytes




Melanin

- Melanin production determined by genetic factors, light exposure, hormones
 - Albinism - recessive gene for deficiency/absence of melanin
 - UV exposure stimulates melanin production → suntan
 - Pregnancy – darker nipples and areolas, genitalia, cheekbones, forehead, chest, midline

Skin color

- Cyanosis (dark blue color)
 - decrease in blood oxygen
- Birthmarks
 - congenital disorders of capillaries in the dermis
- Carotene
 - yellow pigment in carrots and squash, lipid soluble – Vitamin A
 - Accumulates in lipids of stratum corneum & fat in dermis and hypodermis = yellow tinted skin



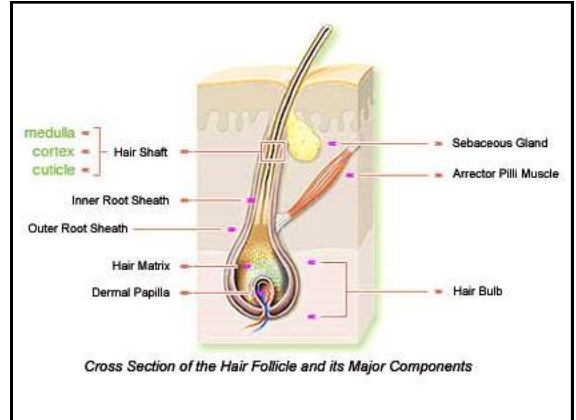
Accessory Skin Structures

Hair

- Anatomy:
 - Hair shaft
 - portion of hair above skin surface
 - Hair root
 - portion of hair below skin surface
 - Hair bulb
 - base of hair root
 - Medulla
 - center of hair

Hair

- Anatomy:
 - Cortex (bark)
 - surrounds the medulla
 - Cuticle (skin)
 - single layer of overlapping cells holding hair follicle
 - Hair follicle
 - extension of epidermis deep into dermis
 - Plays role in tissue repair



Hair Growth

- Cyclic: growth stage + resting stage
 - Hair bulb produces hair; nourished by blood vessels
 - Epithelial cells undergo keratinization in hair bulb; cells are added to base of hair → hair "growth"
 - Growth stops during resting stage

Hair Growth

Hair Type	Growth Stage	Resting Stage
Eyelash	30 days	105 days
Scalp	3 years	1-2 years

- Next growth stage causes hair to fall out
- Pattern baldness
 - permanent loss of hair

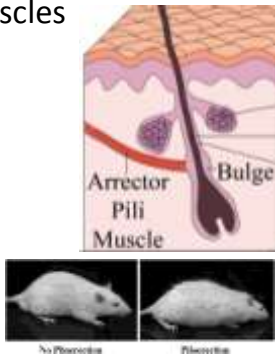
Hair Color

- determined by varying amounts & types of melanin
 - Melanin production decreases with age
 - gray/white



Muscles

- Arrector pili
 - Contraction causes hair to “stand on end”... goosebumps ☺
 - Composed of smooth muscle
 - Evolutionary advantage in mammals
 - traps air (heat) for insulation
 - look larger - intimidation



Glands

- Sebaceous glands
 - Simple, branched acinar/alveolar
 - Produce sebum
 - oily substance lubricating hair & skin surface
 - prevents drying out & bacterial infection



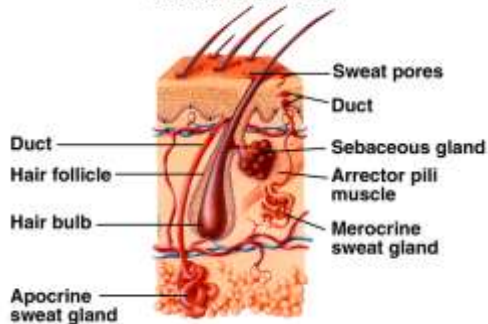
Glands

- Sweat glands (sudoriferous glands)
 1. Eccrine glands (merocrine)
 - Simple, coiled tubular w/ ducts opening to skin surface
 - Every part of skin, most abundant in palms/soles
 - Produce sweat: slightly salty water-based secretion
 - Evaporative cooling
 - Emotional stress produces sweat in palms, soles, axillae (used in lie detector tests!)

Glands

- Sweat glands (two types):
 2. Apocrine glands
 - Simple, coiled tubular with ducts opening into hair follicles of axillae & genitalia
 - Become active at puberty due to sex hormone influence
 - Secretes thick organic substances
 - Broken down by bacteria = body odor

Glands of the Skin



Nails

- thin, horny plate at end of fingers and toes
- consisting of several layers of dead epithelial cells (stratum corneum) containing a hard keratin



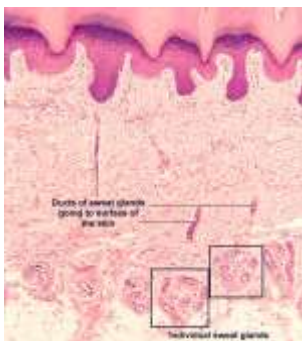
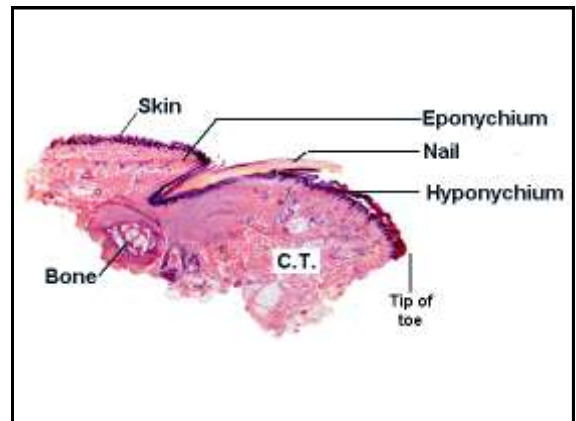
Nail Anatomy

- Nail body
 - visible part of nail
- Nail root
 - part of nail covered by skin
- Eponychium or cuticle (upon + nail)
 - stratum corneum extending onto nail body
- Nail bed
 - nail root and nail body attach to this



Nail Anatomy

- Nail matrix
 - proximal portion of nail bed w/o nail root attached
 - Produces cells that result in nail growth
 - Nails grow continuously
- Lunula
 - whitish, crescent-shape at base of nail



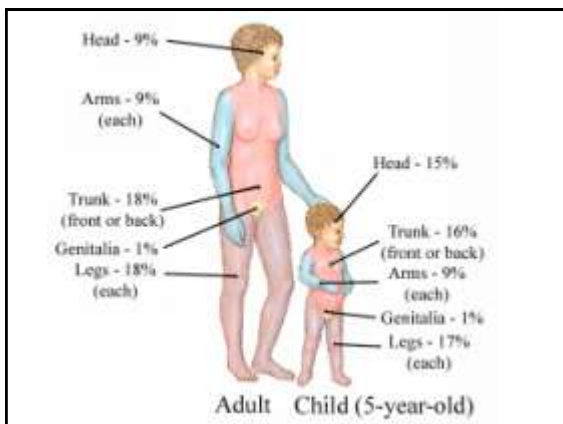
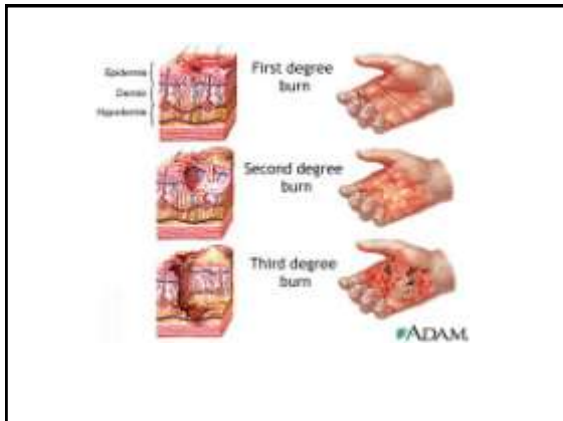
Skin Damage/Changes

Burns

- Partial-thickness burns – part of stratum basale viable
 - First-degree burns
 - involves epidermis, red, painful, edema
 - Sunburn, quick exposure to hot/cold
 - No scarring, heal quickly
 - Second-degree burns
 - destruction of epidermis and dermis
 - recovery happens from edge of burn

Burns

- Full-thickness or third-degree burns
 - Painless b/c nervous tissue destroyed
 - White, tan, brown, black, or deep cherry red
 - Scarring with disfiguration, extended healing time
 - Skin grafts (self, cadavers, pigs, lab-grown?)



Skin Cancer


- Most common type of cancer
 1. Basal cell carcinoma
 - stratum basale to dermis forming an open ulcer
 - Treatment: surgery or radiation
 2. Squamous cell carcinoma
 - cells immediately superficial to stratum basale
 - Produce tumors – continue dividing, can be fatal
 3. Malignant melanoma
 - arise from melanocytes (moles)
 - Can be fatal (will metastasize)

ABCD Rule



Malignant melanoma

NAACAM

Benign	Malignant	
		A symmetry
		B order
		C olor
		D iameter

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