

Integumentary System

MED 164

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Objectives

- Identify different levels of the skin
- Identify functional differences of the various levels
- Describe the function of skin derivatives
- Describe homeostatic regulation of temperature
- Identify risks of sunlight exposure
- Be able to recognize risk factors for melanoma
- Understand the role of DNA repair

Integumentary System

- Includes skin and derivatives
- Cutaneous Membrane
- The Largest Organ in the body
 - Interconnected with all systems
 - Microorganisms must cross integument to enter the body
- The system is composed of skin and its accessory organs: hair, glands, receptors, and nails



Functions

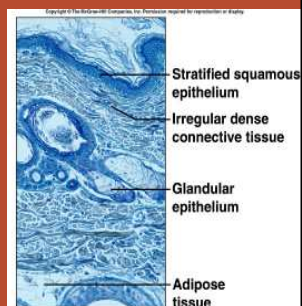
- Protection: Covering to protect deeper tissues from dehydration, trauma and germ invasion
- Regulate Body Temperature
 - Controls heat loss. Evaporation of water from the skin, in the form of perspiration, helps rid the body of excess heat.
- Helps manufacture the sunshine vitamin, Vitamin D
 - The ultraviolet light on the skin is necessary for the first stages of vitamin D

Functions

- Skin is the site of many receptors and nerve endings necessary for sensory information.
- Storage of Fat, Glucose, Water, and Salt
- Screens out harmful ultraviolet radiation and eliminates wastes
- Absorption
 - Can absorb certain medications and chemicals

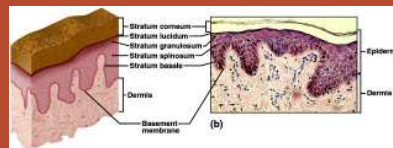
Layers of Skin

- Epidermis
- Dermis
- Subcutaneous Membrane



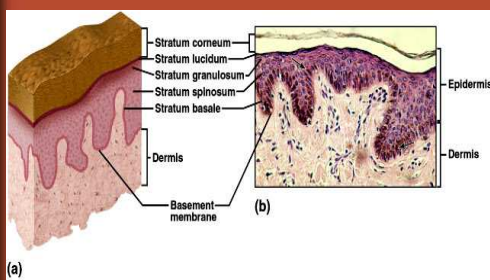
Epidermis

- Outer most layer
- Five functional layers of tissue
- Thickest on palms and soles of feet (.8-1.4mm)
- Protective layer
 - Forms first line of defense against bacteria
- Composed of a stratified squamous epithelium
- Cells in epidermis are born in lower epidermis and are pushed superficially



Epidermis

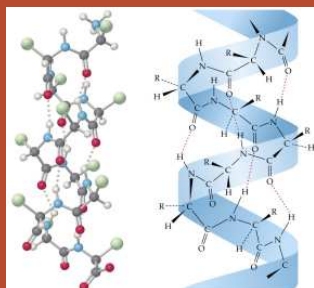
- Life span of an epidermal cell is approx. 2 weeks
- Cells are undergo desquamation (shed) from the surface



Stratum Corneum

- Outermost layer
- Contains keratinized cells (dead cells) from the layers below
 - Made of dead keratinocytes
- These cells are worn off by friction
- Serves as a barrier to pathogens and chemicals
- Contain Keratin

Keratin



Keratin

- Acts as a waterproof barrier
 - Hydrophobic chemical
- Prevents evaporation of body water
 - Water does not move into or out of body
- Slightly acidic to defend against pathogens.

Stratum Lucidum

- Found only in the palms of the hands and soles of the feet.



Stratum Granulosum

- Layer of epidermis where cells begin process of keratinization (death)
- Important characteristic of wound healing
- If you see granular tissue, you know the tissue underneath is alive

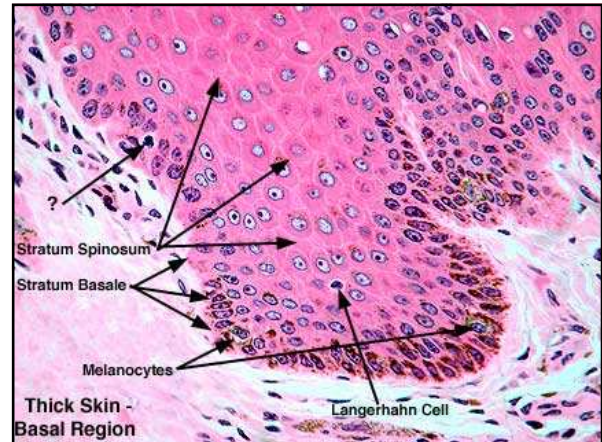


Stratum Spinosum

- Cells in the stratum spinosum are held together tightly by junctions
- Macrophages are found in this layer and phagocytize bacteria that migrate into the epidermis and survive the migration through the stratum corneum

Stratum Basale/ Germinativum

- Contains 2 cell types in various levels of this layer
- Melanocytes
 - Protect the mitotic cells in the lower layer
- Mitotic cells (Germ cells)
 - Can be considered stem cells



Skin Color

- Produced by interactions of 3 proteins
 - Melanin
 - Carotene
 - Hemoglobin
- Controlled by genetics, environment, and metabolism

Melanin

- Protects skin from damaging effects of ultraviolet light
- Located inside of cells in the stratum germinativum and corneum
- Melanin is also a term that describes the black pigment that determines skin color

Hemoglobin

- The red pigment found in red blood cells
- O₂ combines with
 - Hemoglobin= **bright red color**
 - Bright red color of oxygenated blood gives a **pinkish** undertone to light skinned people ie. Color Pink

Carotene

- Yellow/ orangish pigment found in persons of asian influence
- Found naturally in carrots

Factors Affecting Color

- Genetics
 - Affect level of melanin and size of melanin granules
- Physiology
 - Deposition of pigments in skin change coloration
- Environment
 - Exposure to sunlight increases melanin production

Mongolian Spot



Chimera



Vitiligo



Vitiligo

- Some cells do not produce melanin or melanocytes die
 - Possible environmental causes or inflammatory process



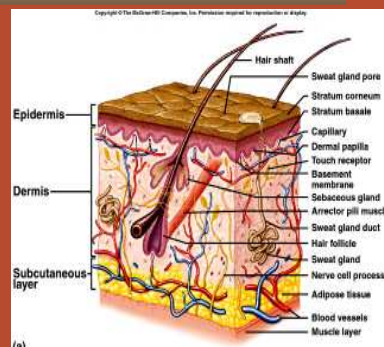
Albinism

- Melanocytes produce ineffective damaged melanin
- Mutation of Oculocutaneous Albinism Gene (OCA 1)
- Causes replacement of single amino acid in protein

Dermis

Made up of fibrous connective tissue, collagen, and elastic fibers

Contains all accessory structures- nerve receptors, glands, hair follicles, nails, blood vessels



Hair Follicles

Composed of keratinized cells

Shaft-visible dead portion above the skin
Root-portion of hair below the skin surface=Mitosis

Function-Protection
Scalp hair-sunlight insulation
Eyelashes, eyebrows-protect eyes.

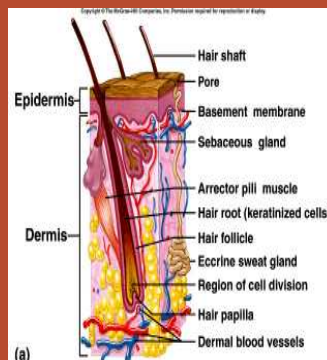


Hair Follicles

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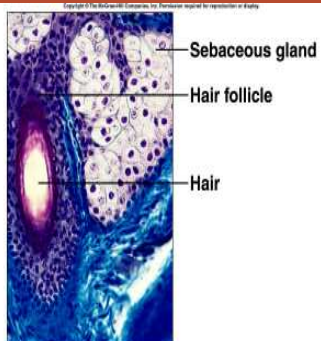
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Sebaceous Glands

Keeps skin soft and hair glossy
Prevents Drying of the scalp
Helps waterproof top layer of epidermis
Sebo- word meaning sebum or oil

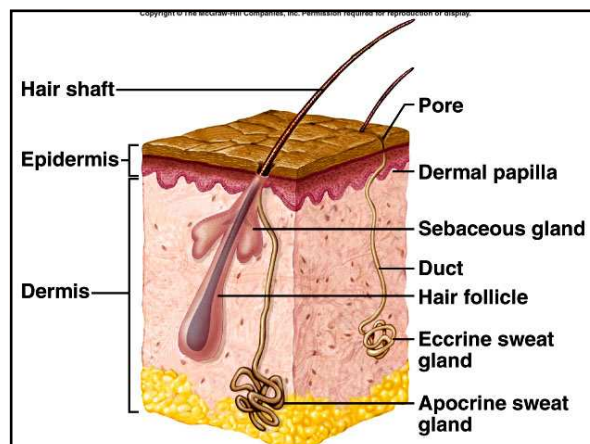


Ceruminous glands

- Found in the skin of the external auditory canal
- Function-Prevents drying and protects the eardrum
- Makes cerumen-ear wax

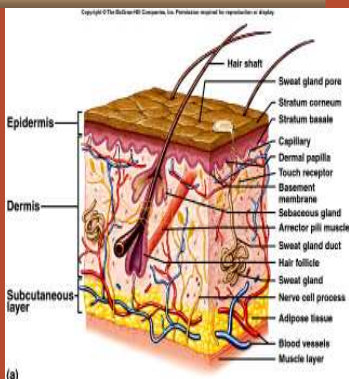
Sweat Glands

- Produce sweat to decrease body temperature
- Factors that activate sweat glands
 - Increased temperature
 - Pain
 - Fever
 - Stress
- Sweat is
 - 99% water
 - 1% waste products
- Glands distributed across body
 - Greater numbers in axillae and genitalia



Subcutaneous Layer

- Lies below the dermis
- Consists of loose CT
- Attaches the dermis to the underlying muscle
- Forms and stores adipose tissue for stored energy
- Cushions and protects deeper tissues
- Heat insulator

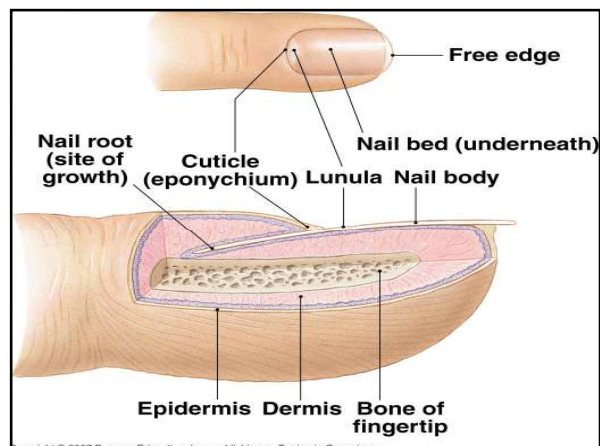


Nerve Receptors

- Function to provide the CNS with incoming information from the environment
- Specific receptors for the cutaneous senses- touch, pressure, heat, cold, pain.
- Pain receptors are located at nerve endings.

Nails

- Function- To protect the tips of the toes and fingers and to assist in picking up objects
- Formed in the nail bed or matrix located under the cuticle
- Cuticle-band of epidermis that covers the nail bed made of keratinized cells



Blood Vessels and Temperature Control

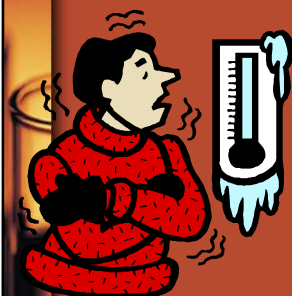
- Blood Vessels found in the dermis

Hot Weather

- Vasodilation occurs, sweat glands active
- Increases blood flow to the surface
- Excess heat radiates out of the body

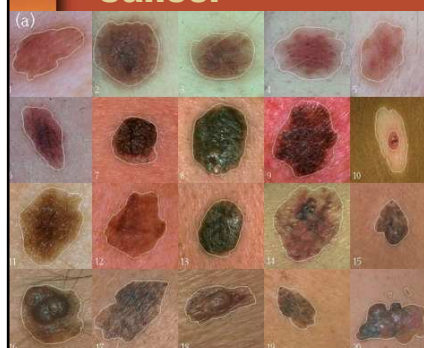


Cold Weather



- Vasoconstriction occurs, sweat glands are inactive
- Decreased amount of heat is lost
- This response may also occur during stress
- Shivering-helps reduce heat loss

Skin Pathology Cancer



Skin Cancer

- Most common form of cancer
- Over 1 million cases each year
- Two basic types
 - Non-melanoma
 - Basal cell carcinoma
 - 90% of skin cancers are basal cell
 - Squamous cell carcinoma
 - Melanoma
 - Deadly form of cancer
 - Metastasizes to liver readily!


Risk Factors

- Sun exposure!
- Age
- UV radiation exposure in tanning booths
- Therapeutic radiation

A Mole Hunt!!!

- ABCDE of moles
- A = assymetry
- B = border
- C = color
- D = diameter
- E = evolving

Xeroderma Pigmentosum



- Autosomal recessive disorder
- Unable to repair UV induced DNA damage
- Die from melanoma and skin cancer
- Few make it past 20 years of age!

