• The Integumentary System

• Components
  – Skin (cutaneous membrane)
  – Hair
  – Nails
  – Glands
    • Sudoriferous (sweat)
    • Sebaceous (oil)

• The Skin

• Has two distinct regions
  – Epidermis
    • Superficial layer
  – Dermis
    • Deep layer
  – Hypodermis or subcutaneous tissue
    • Region deep to the dermis
    • Not considered part of the skin
    • Consists of connective tissue and adipose tissue

• Epidermis

• Sheet of stratified squamous epithelium (Keratinized type)

• Made up of four to five layers depending on the body part
  – Stratum basale
  – Stratum spinosum
  – Stratum granulosum
– Stratum Lucidum
– Stratum Corneum

(Boys Say Girls Like Candy)

• **Epidermal Cell Types**
  
  • Keratinocytes
    • Make up 90% of skin cells
    • Primary function is to produce keratin
    • Keratin strengthens the skin and forms physical barrier that offers protection
    • Lamellar granules give skin its water resistant properties
  
  • Melanocytes
    • Synthesize a pigment called melanin
    • Melanin is transferred to keratinocytes
    • Accumulates and provides a barrier against UV radiation
  
  • Langerhans’ cells
    • A class of macrophages
    • Plays a role in body defense
    • Develops from bone marrow
  
  • Merkel cells
    • Touch receptors

• **Epidermal Layers**
  
  • Stratum Basale (stratum germinativum)
    • Deepest layer
    • Contains large stem cells called basal cells
    • Stem cells divide to form keratinocytes, glands, and hair follicles
• Merkel cells are present and cell bodies of melanocytes also present
• Epidermal ridges extend into the underlying dermis
• Dermal papillae extend upward from dermis
• Epidermal Layers
  • Stratum spinosum
    • Newly formed keratinocytes predominate
    • Langerhans cells found primarily in this layer
    • Cytoplasmic extensions extend into the layer and transfer melanin to keratinocytes
  • Stratum granulosum
    • Contains mature keratin producing keratinocytes
    • Cells flatten out and die as the ascend to occupy a more superficial layer in this region
  • Epidermal Layers
  • Stratum Lucidum
    • Region of keratinized tissue
    • Present only in thick skin
    • Palms, fingers, soles, and toes
  • Stratum Corneum
    • Outermost layer
    • Composed of dead keratinocytes rich in keratin
    • Provides protection against abrasion, penetration and water loss
      • 4 weeks is the approximate time frame for a cell produced in the basal layer to reach the stratum corneum
• Dermis
  • Consists of connective tissue
  • CT rich in collagen, elastic and reticular fibers
• It is strong, flexible and extensible

• Consists of two layer
  • Papillary layer
  • Reticular layer

• Layers of the Dermis

  • Papillary layer
    • Primarily made up of areolar tissue
    • Dermal papillae extend upward into the epidermal ridges
    • Contains blood vessels, lymphatic vessels and sensory receptors

  • Reticular layer
    • Varies in thickness but much thicker than papillary layer
    • Consists of dense irregular CT and bundles of collagen fibers

• Skin Color

  • Determined primarily by pigments
    • Melanin
      • Most important
      • Similar amounts of melanocytes exist in dark and light skinned individuals
      • Dark skinned people produce more melanin
      • Melanin production is stimulated by expose to sunlight
      • Protects skin from UV radiation
    • Carotene
      • Yellow/orange in color
      • Same pigment in carrots
    • Hemoglobin
• Gives a pinkish color to fair skin

• Appendages of the Skin

  • Sweat glands

    • Eccrine sweat glands

      • Occurs in most parts of the body
      • Most abundant in palms and soles
      • Have ducts and empty on skin surface
      • Secretion is thin and watery
      • Functions primarily in temperature regulation
      • Primarily under ANS control (sympathetic division)

    • Appendages of the Skin

  • Apocrine sweat glands

    • Located in axillary and pubic region
    • Functional at puberty
    • Empty in hair follicles
    • Secretion is more viscous and function is unclear
    • Most active at puberty (associated with elevated sex hormones) also activated by sympathetic division of ANS

  • Appendages of the Skin

  • Ceruminous glands

    • Modified apocrine gland
    • Located in the external ear canal
    • Secrete wax

  • Mammary glands

    • Milk producing
• Appendages of the Skin

• Sebaceous glands (oil glands)
  • Located next to hair follicles
  • Produce and oily secretion called sebum
  • Sebum is composed of triglycerides, cholesterol, proteins and electrolytes
  • Inhibits bacteria growth, lubricates hair shaft, conditions the skin
  • Also influenced by sex hormones

• Appendages of the Skin

• Hair and hair follicles
  • Forms from densely packed keratinocytes
  • Develop on deep invaginations of the epidermis called follicles
  • Each hair is associated with a smooth muscle called the arrector pili muscle that raises
    the hair when it contracts
  • Hair is made up of hard keratin (more durable and does not flake)

• Appendages of the Skin

• Hair papilla:
  • Nipple-like projection of dermis into the base of hair bulb
  • Contain vessels that help nourish hair cells

• Hair Matrix:
  • Layer of cells at base of hair follicle (next to papilla)
  • Actively mitotic cells responsible for hair growth

• Appendages of the Skin

• Nail
  • Derived from epidermis
• Made of hard keratin
• Protect posterior aspects of distal end of digits (fingers and toes)
• Enables us pick up small objects

**Functions of the Integumentary System**

• **Protection**
  • Physical barrier, UV radiation, Dehydration, Langerhans cells, sweat and sebum
  • Temperature regulation
    • Fat, sweat glands, and blood vessels

• **Cutaneous sensation**
  • Merkel cell – soft touch
  • Meissner’s corpuscle – soft touch
  • Pacinian corpuscle – deep pressure
  • Root hair plexus – hair movement
  • Bare or free nerve endings (nocieceptors) - Pain
    • Functions of the Integumentary System

• **Metabolic functions**
  • Vit. D production from UV radiation
  • Vit D is activated to calcitrol, the hormone that enhances the absorption of calcium and phosphorus in the gut

• **Blood reservoir**

• **Excretion**
  • Urea and salts in sweat