Chapter 5
The Integumentary System

- Skin and its accessory structures
- Objectives:
  - structure
  - function
  - growth and repair
  - development
  - aging

General Anatomy

- A large organ composed of all 4 tissue types
- Square feet?
- Thickness?
- Weight?

Functions of the Skin

- Thermoregulation (sweat - blood vessels)
- Protection as physical barrier (cells junctions, cancer prevent, dehydration)
- Sensory receptors  (sensation)
- Excretion and absorption
- Synthesis of vitamin D (calcitrol)

Overview

- 2 Types: thick & thin
- 2 Major layers of skin (aka: cutaneous layer)
  1) epidermis is epithelial tissue
  2) dermis is all tissues
     – AKA: Intradermal layer
- Subcutaneous layer (aka: subQ or hypodermis) (adipose & connective tissue)

Overview of Epidermis

- Stratified squamous epithelium
- Blood vessels?
- 4 types of cells
- 5 distinct strata (layers) of cells

Cell types of the Epidermis

- Keratinocytes--90%
  - produce keratin
- Melanocytes-----8 %
  - produce melanin pigment
- Langerhans cells
  (Dendritic cells)
  – From WBCs
  – provide immunity
- Merkel cells
  – deepest layer
  – form touch receptor
Layers (Strata) of the Epidermis

- **Stratum corneum**
- **Stratum lucidum**
- **Stratum granulosum**
- **Stratum spinosum**
- **Stratum basale**

**Stratum Basale**

- Deepest layer - single row of cells (AKA: stratum germinativum)
- Combination of merkel cells, melanocytes, keratinocytes - stem cells that divide repeatedly
- Attached to basement membrane
- Scattered protein forms keratin higher up (tonofilaments)

**Stratum Spinosum**

- 8 to 10 cell layers
- Keratinocytes
- Melanin taken in by phagocytosis
- Slides look spiny

**Stratum Granulosum**

- 3 - 5 layers of flat dying cells (apoptosis!)
- Keratohyalin granules: (converts protein to keratin)
- Lamellar granules: release lipids that repels water

**Stratum Lucidum**

- Only in thick skin: palms, fingers, & soles
- 3 - 5 layers of clear, flat, dead cells
- Dead keratinocytes w/ lots of keratin

**Stratum Corneum**

- 25 to 30 layers of flat dead cells – lots of keratin and surrounded by lipids
- Continuously shed
Keratinization & Epidermal Growth

- Stem cells (stratum basale) produce keratinocytes and other cells
- Cells are pushed towards surface (mitosis), filling with keratin (keratinization)
- ~4 week journey

Dermis: 2nd layer of skin

- Connective tissue layer composed of collagen & elastin, extracellular matrix
- Macrophages & fat cells
- Hair follicles, glands, nerves & blood vessels
- 2 major regions of dermis
  1. Papillary region
  2. Reticular region

Papillary Region

- Top 20% of dermis
- Composed of CT (w/ elastic fibers)
  - Areolar tissue
- Finger like projections called dermal papillae
  - Epidermal ridges downward
Functions:
  - Anchor epidermis to dermis
  - Contains capillaries
  - Contains Meissner’s corpuscles (touch) & free nerve endings (pain and temperature)

Reticular Region

- Connective tissue
  (collagen and elastic fibers)
  - Strength, stretch, & return to shape
  - Packed with oil glands, sweat gland ducts, fat cells, hair follicles, blood vessels, nerves

Hypodermis – subcutaneous fat!

Skin Color

- Melanin – most significant factor in skin color
  - Produced by melanocytes
  - Accumulate in the keratinocytes
- Eumelanin – brownish black
- Pheomelanin - a reddish yellow sulfur-containing pigment
- Hemoglobin
- Carotene (pigment)
Abnormal Skin Colors
- cyanosis – bluish hue - from O2 deficiency
- erythema – abnormal redness: dilated cutaneous vessels
- pallor – pale or ashen color: little blood flow so collagen shows through
  - emotional stress, low blood pressure, circulatory shock, cold, anemia
- 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 and sclera due to excess bilirubin in blood
  - cancer, hepatitis, cirrhosis, other compromised liver function
- hematoma – (bruise) mass of clotted blood showing through skin

Accessory Structures of Skin
- hair
- oil glands
- sweat glands
- nails

Functions of Hair?
- Prevents heat loss
- UV Protection
- Protect eyes
- Touch receptors

Structure of Hair
- Dead keratinized cells
- Shaft – visible
  - medulla, cortex & cuticle
- Root = below the surface
- Follicle surrounds root
- Blood vessels
- Germinal cell layer
Hair Related Structures

- **Arrector pili**
  - smooth muscle in dermis
- **Hair root plexus**
  - (nerves detect hair movement)

The Hair Cycle.

Glands of the Skin

- **Specialized exocrine** glands found in dermis
- Sebaceous (oil) glands
- Sudiferous (sweat) glands
- Ceruminous (wax) glands
- Mammary (milk) glands

Sebaceous (oil) glands

- Secretory portion in the dermis
- Most open onto hair shafts
- Sebum (oily substance)
  - keeps hair and skin soft & pliable
  - inhibits growth of bacteria/fungi

Sudoriferous (sweat) glands (2 types)

1. **Eccrine (sweat) glands**
   - most areas of skin
   - secretory portion in dermis with **duct to surface**
   - perspiration/evaporation
2. **Apocrine (sweat) glands**
   - axillary and pubic regions
   - secretory portion in dermis with **duct to hair follicle**
Ceruminous glands

- Modified sweat glands produce waxy secretion in ear canal
- Cerumin (earwax = oil and wax glands)
- ??? Function

Fingernail Structure

Degrees of Burn Injuries

Figure 6.13

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Figure 6.13