Integumentary System

Bio 250

Remember:

- **Tissue**: Group of cells that are similar in appearance and perform similar function
- **Organ**: Two or more tissues grouped together and performing a specialized function
- **Membrane**: Thin, sheetlike structure, composed of an epithelium and connective tissue that cover surfaces or line cavities

Types of Membranes:

- **Serous membrane**: secrete slippery, lubricating serous fluid. Found lining cavities with no openings to the outside of the body, e.g. peritoneum, pleura

- **Mucous membrane**: secrete thick, sticky protective mucus fluid. Found lining cavities with openings to the outside of the body, e.g. nasal cavity, urinary tract.
Types of Membranes:

- **Synovial membrane** - lines joint cavities of diarthrotic (synovial) joints.
- **Cutaneous membrane** - covers the outside of the body as the skin

Cutaneous membrane (Skin)

- Forms largest organ in the body
- Functions:
  - Protection against damage
    - Mechanical and Chemical
    - Bacterial damage
      - Human body contains between 50 and 106 trillion cells
      - Humans harbor about 750 trillion bacteria in the body and on its surface
    - Sun damage (UV radiation)
  - Excretes wastes
  - Regulation of body temperature
  - Makes several chemical substances, e.g. Vitamin D3
  - Detection of skin senses
  - Storage of nutrients; main lipids in adipose tissue found primarily under the skin in the subcutaneous layer

Skin is composed of two layers:

- **Epidermis**
- **Dermis**
Epidermis

- Composed of a layer of stratified squamous epithelium (lacks blood vessels)
- Layers from basement lamina to the free surface
  - Stratum basale (germinativum)
  - Stratum spinosum
  - Stratum granulosum
  - Stratum lucidum (thick skin: soles and palms)
  - Stratum corneum
**Epidermis**

- Takes 15-30 days for cells to move from S. basale to S. corneum
- Spend additional 2 weeks in S. corneum before being shed
- Melanocytes produce melanin which is transferred to nearby epithelial cells
  - Melanin may be some shade of yellow, reddish brown or black
  - Quantity of melanin in skin can vary with heredity and exposure of the skin to the sun and certain hormones (e.g. estrogen)
- Sunlight (UV) causes skin cancer, loss of folic acid but aids in the production of vitamin D
- Melanin helps to protect the skin from damage and folate loss.
- Amount of melanin in skin of different populations relate to amount of UV exposure.

**Dermis**

- Composed largely of fibrous connective tissue that binds dermis to underlying tissues (subcutaneous layer)
- Contains blood vessels
- Contains extracellular fibers
- Contains muscle fibers
- Contains nerve fibers
Subcutaneous layer (hypodermis)
- Composed of loose (areolar) connective tissue and adipose tissue
- About 50% of the body’s fat is stored in the hypodermis
- Amount of adipose tissue here varies with:
  - Age
  - Sex
  - Diet
- Adipose layer helps conserve body heat and pad underlying structures
- Contains blood vessels that supply dermis

Accessory Organs of the Skin
- Hair Follicles
  - Occur in most regions of skin
  - Develops from tube-like follicle
  - Shape of hair due to its cross sectional shape which is under genetic control
    - Straight hair is round
    - Wavy hair is oval
    - Kinky hair is flattened
  - Growth and rest periods
Baldness

- Hair grows fastest from teens to 40’s, then slows down.
- With aging, the growth periods are shorter and the rest periods longer.
- This results in thinning in both sexes.
- Male pattern baldness is genetic and causes some of the hair follicles to react to dihydrotestosterone (DHT) levels by reducing growth periods so that hairs may stop before they immerse from the skin or they change from terminal hairs to vellus hairs.

Accessory Organs of the Skin

- Hair Follicles
  - Color determined by type and amount of pigment (eumelanin and pheomelanin)
    » Blonde, brown and black due to increasing eumelanin
    » Red due to primarily pheomelanin
  - Arrector pili muscle
  - Sebaceous gland (sebum)
Nails

- Protective covers on the ends of fingers and toes
- Produced by epithelial cells that undergo keratinization
Sweat Glands
- Located in most regions of the skin
- Consists of coiled tube
- Types of sweat glands
  - Apocrine usually open into hair follicles
  - Apocrine respond to emotional stress
  - Apocrine associated with body odor
  - Eccrine (merocrine) respond to elevated body temperature

Regulation of Body Temperature
- Temperature affects rate of metabolism:
  Each degree rise (C) = +10% metabolic rate
- Normal body temp: 37 C or 98.6 F
- Normal range: 36.1-37.2 C or 97-99 F
- Core vs. Shell temperature
- Skin is major “player” in body temperature regulation (95% of heat lost through skin)
Heat Balance  
(Heat Production = Heat Loss)

- Heat is product of metabolism
- When body temp rises, more blood sent to dermal blood vessels

Mechanisms of Heat Loss via Skin

- Heat lost from skin by:
  - Radiation (55%)
  - Conduction *
  - Convection *
  - Evaporation (25%)
  - *15%

Heat Balance

- Sweat gland activity increases heat loss by evaporation (high heat of vaporization)
- If body temp drops below normal, dermal blood vessels constrict and sweat glands become inactive
- Note: if the skin temperature drops below 15 C or 59 F) dermal blood vessels will dilate to keep skin from being damaged by excessively low temperature.
Problems with Heat Regulation

- Conduction, convection and radiation require cooler surroundings to cool the body
- Air holds a limited amount of water vapor
- When air is saturated, sweat may fail to evaporate and body temperature may remain elevated