The Skin and the Hypodermis

- Skin—our largest organ
  - Accounts for 7% of body weight
  - Varies in thickness from 1.5–4.4mm
  - Divided into two distinct layers
    - Epidermis
    - Dermis
  - Hypodermis—lies deep to the dermis
    - Composed of areolar and adipose tissues

The Skin and Hypodermis

- Functions
  1. Protection—cushions organs and protects from bumps, chemicals, water loss, UV radiation
  2. Regulation of body temperature—Capillary network and sweat glands regulate heat loss
  3. Excretion—urea, salts, and water lost through sweat
  4. Production of vitamin D—Epidermal cells use UV radiation to synthesize vitamin D
  5. Sensory reception—Contains sense organs associated with nerve endings

Epidermis

- Is composed of keratinized stratified squamous epithelium
- Contains four main cell types
  - Keratinocytes
    - Location—stratum spinosum; produce keratin, a fibrous protein
  - Melanocytes
    - Location—basal layer; manufacture and secrete the pigment melanin
  - Tactile epithelial cells (Merkel cells)
    - Location—basal layer; attached to sensory nerve endings
  - Dendritic cells (Langerhans cells)
    - Location—stratum spinosum; part of immune system; macrophage-like
Layers of the Epidermis

- Stratum basale (stratum germinativum)
- Stratum spinosum
- Stratum granulosum
- Stratum lucidum (only in thick skin)
- Stratum corneum

Figure 5.3a

Epidermal Cells and Layers of the Epidermis

Figure 5.3b

Layers of the Epidermis

- Stratum basale
  - Deepest layer of epidermis
  - Attached to underlying dermis
  - Cells actively divide
  - Stratum basale contains:
    - Tactile epithelial cells/Merkel cells—associated with sensory nerve ending
    - Melanocytes—secrete the pigment melanin
- Stratum spinosum (spiny layer)
  - "Spiny" appearance caused by:
    - Artifacts of histological preparation
    - Contains thick bundles of intermediate filaments (tonofilaments)
    - Resist tension
    - Contains protein prekeratin
    - Contains star-shaped dendritic cells
    - A type of macrophage
    - Function in immune system
Layers of the Epidermis

- **Stratum granulosum**
  - Consists of keratinocytes and tonofilaments
  - Tonofilaments contain:
    - Keratohyaline granules—help form keratin
    - Lamellated granules—contain a waterproofing glycolipid
- **Stratum lucidum** (clear layer)
  - Occurs only in thick skin
  - Locations: thick skin—palms and soles
  - Composed of a few rows of flat, dead keratinocytes
- **Stratum corneum** (horny layer)
  - Thick layer of dead keratinocytes and thickened plasma membranes
  - Protects skin against abrasion and penetration

Dermis

- Second major layer of the skin
- Strong, flexible connective tissue
- Richly supplied with blood vessels (important role in temperature control) and nerves
- Has two layers
  - **Papillary layer**—includes dermal papillae
  - **Reticular layer**
    - Deeper layer—80% of thickness of dermis
- **Flexure lines**
  - Creases on palms

Dermal Modifications

- Friction ridges
  - Openings of sweat gland ducts
- Cleavage lines in the reticular dermis
- Flexion creases on the palm

Hypodermis

- Deep to the skin—also called superficial fascia or subcutaneous layer
- Contains areolar and adipose CT
- Anchors skin to underlying structures
- Helps insulate the body
- Has different distribution in males and females
**Skin Color**

- Three pigments contribute to skin color
  - **Melanin**
    - Most important pigment—made from tyrosine
  - **Carotene**
    - Yellowish pigment from carrots and tomatoes
  - **Hemoglobin**
    - Caucasian skin contains little melanin
    - Allows crimson color of blood to show through

**Nails**

- **Nails**—scalelike modification of epidermis
  - Made of hard keratin
  - Parts of the nail
    - Free edge
    - Body
    - Root
    - Nail folds
    - Eponychium—cuticle

**Structure of a Nail**

- Components of a nail
  - Free edge of nail
  - Body of nail
  - Eponychium (cuticle)
  - Root of nail
  - Nail bed

**Appendages of the Skin**

- **Hair**
  - Flexible strand of dead, keratinized cells
  - Hard keratin—tough and durable
  - Chief parts of a hair
    - **Root**—imbedded in the skin
    - **Shaft**—projects above skin's surface

**Appendages of the Skin**

- **Hair** has three concentric layers of keratinized cells
  - **Medulla**—central core
  - **Cortex**—surrounds medulla
  - **Cuticle**—outermost layer
- **Hair follicles**
  - Extend from epidermis into dermis
- **Hair bulb**
  - Deep, expanded end of the hair follicle
- **Root plexus**
  - Knot of sensory nerves around hair bulb

**Cross Section of a Hair**

- Components of a hair
  - Hair root
  - Hair shaft
  - Arrector pili
  - Sebaceous gland
  - Connective tissue root sheath
  - Follicle wall
  - Cuticle
  - Glassy membrane
  - Cortex
  - Medulla
  - Root sheath

Figure 5.7
Figure 5.8a, b
Appendages of the Skin

- **Arrector pili** muscle
  - Bundle of smooth muscle
  - Hair stands erect when arrector pili contracts

- **Vellus hairs**
  - Body hairs of women and children

- **Terminal hairs**
  - Hair of scalp
  - Axillary and pubic area (at puberty)
  - Hair thinning and baldness
  - Due to aging
  - Male pattern baldness

Sebaceous Glands

- Occur over entire body
  - Except palms and soles

- Secrete sebum—an oily substance
  - Simple alveolar glands
  - Holocrine secretion—entire cell breaks up to form secretion
  - Most are associated with a hair follicle

- Functions of sebum
  - Collects dirt; softens and lubricates hair and skin

Sweat Glands

- Sweat glands (sudoriferous glands) widely distributed on body

- Sweat—is a blood filtrate
  - 99% water with some salts
  - Contains traces of metabolic wastes
  - About 2% urea
Sweat Glands

- Two types of sweat gland
  - Eccrine gland (merocrine)
    - Most numerous—these produce true sweat
  - Apocrine gland
    - Confined to axillary, anal, and genital areas
    - Produce a special kind of sweat
      - Musky odor—attracts a mate
      - Signal information about a person’s immune system, MHC
    - Ceruminous glands and mammary glands
      - Modified apocrine glands

Burns

- Classified by severity
  - First-degree burn—only upper epidermis is damaged
  - Second-degree burn—upper part of dermis is also damaged
    - Blisters appear
    - Skin heals with little scarring
  - Third-degree burn
    - Consumes thickness of skin
    - Burned area appears white, red, or blackened
    - loss of body fluids, infection, loss of temperature control

Estimating Burns Using the Rule of Nines

- Rule of nines; used to estimate extent of burns
  - Anterior and posterior head and neck, 9%
  - Anterior and posterior upper limbs, 18%
  - Anterior and posterior lower limbs, 36%
  - Anterior trunk, 18%
  - Anterior trunk, 9%
  - Perineum, 1%

Skin Cancer

- The most common type of cancer
  - Basal cell carcinoma
    - Least malignant and most common
  - Squamous cell carcinoma
    - Arises from keratinocytes of stratum spinosum
  - Melanoma
    - A cancer of melanocytes
    - The most dangerous type of skin cancer
The Skin Throughout Life

• **Middle to old age**
  • Skin thins and becomes less elastic
  • Shows harmful effects of environmental damage
  • Skin inflammations become more common