SKIN AND SUBCUTANEOUS TISSUE (HYPODERMIS)

The Skin and the Hypodermis

- Skin – our largest organ
  - Accounts for 7% of body weight
  - Divided into two distinct layers
    - Epidermis
    - Dermis
  - Hypodermis – lies deep to the dermis
Function of The Skin and the Hypodermis

- **Protection**
  - Cushions and insulates deeper organs
  - Protects body from bumps, scrapes, and cuts
  - Protects body from chemicals, heat, and cold
  - Screens out UV rays from the sun
- **Body temperature regulation**
- **Excretion** - Acts as a mini-excretory system
- **Production of vitamin D**
- **Sensory Reception** - Contains sensory receptors associated with nerve endings
The epidermis

- Provides mechanical protection
- Prevents fluid loss
- Keeps microorganisms from invading the body

Epidermis

- Contains four main cell types
  - Keratinocytes
  - Melanocytes
  - Merkel cells (tactile)
  - Langerhans (dendritic) cells

Epidermis

- Keratinocytes – most abundant cell type in epidermis
  - Arise from deepest layer of epidermis
  - Produce keratin – a tough fibrous protein
  - Produce antibodies and enzymes
  - Keratinocytes are dead at skin's surface
The epidermis is composed of layers of keratinocytes
- Thin skin = four layers (strata)
- Thick skin = five layers

### Layers of the Epidermis
- Stratum corneum
- Stratum lucidum (only in thick skin)
- Stratum granulosum
- Stratum spinosum
- Stratum basale (stratum germinativum)

### Epidermal Cells and Layers of the Epidermis
**Layers of the Epidermis**

- **Stratum corneum (horny layer)**
  - Thick layer of dead keratinocytes and thickened plasma membranes
  - Protects skin against abrasion and penetration

- **Stratum lucidum (clear layer)**
  - Occurs only in thick skin
  - Composed of a few rows of flat, dead keratinocytes

**Layers of the Epidermis**

- **Stratum granulosum**
  - Consists of keratinocytes and tonofilaments
  - Tonofilaments contain
    - Keratohyaline granules – help form keratin
    - Lamellated granules – contain a waterproofing glycolipid

**Layers of the Epidermis**

- **Stratum spinosum (spiny layer)**
  - "Spiny" appearance caused by artifacts of histological preparation
  - Contains thick bundles of intermediate filaments (tonofilaments)
  - Contains star-shaped Langerhans cells
Layers of the Epidermis

- **Stratum basale**
  - Deepest layer of epidermis
  - Attached to underlying dermis
  - Cells actively divide
  - Stratum basale contains
    - Merkel cells – associated with sensory nerve ending
    - Melanocytes – secrete the pigment melanin

Epidermal characteristics:

- Cells accumulate keratin and eventually are shed
- Epidermal ridges are interlocked with dermal papillae
  - Fingerprints
  - Improve gripping ability
- Dendritic cells (immunity) in stratum spinosum
- Tactile cells (sensitivity) in stratum germinativum

Dermal Modifications

![Diagram of friction ridges, cleavage lines, and flexion creases](image)
Dermis
- Second major layer of the skin
- Strong, flexible connective tissue
- Richly supplied with blood vessels and nerves
- **Has two layers**
  - Papillary layer – includes dermal papillae
  - Reticular layer – deeper layer – 80% of thickness of dermis

Hypodermis
- Deep to the skin – also called superficial fascia
- Contains areolar and adipose connective tissues
- Anchors skin to underlying structures
- Helps insulate the body

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
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** – three concentric layers keratinized cells
  - Medulla – central core
  - Cortex – surrounds medulla
  - Cuticle – outermost layer
Appendages of the Skin

- 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
- Wall of hair follicle
  - Connective tissue root sheath
  - Epithelial root sheath
- Arrector pili muscle – bundle of smooth muscle
  - Hair stands erect when arrector pili contracts
Types and Growth of Hair

- **Vellus hairs** – body hairs of women and children
- **Terminal hairs** – hair of scalp; axillary and pubic area (at puberty)
- **Lanugo** – delicate hair, shed by 7th month after birth
- **Hair thinning and baldness**
  - Due to aging (everyone - by 60 to 65 years)
  - True Baldness (male pattern baldness)
    - Changes hair response to androgens

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

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**Figure 5.9a**

[a Photomicrograph of a sectioned sebaceous gland (140x)](a Photomicrograph of a sectioned sebaceous gland (140x))
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

Sweat Glands

- Two types of sweat gland
  - Eccrine gland (merocrine sweat gland)
    - Most numerous – produce true sweat
  - Apocrine gland
    - Confined to axillary, anal, and genital areas
    - Produce a special kind of sweat
Nails

- Nails – scale-like modification of epidermis
  - Made of hard keratin
  - Parts of the nail
    - Free edge
    - Body
    - Root
    - Nail folds
    - Eponychium – cuticle

Structure of a Nail

![Structure of a Nail](Figure 5.7)

DISORDERS OF THE INTEGUMENTARY SYSTEM
**Burns**

- Classified by severity
  - **First degree burn** – only epidermis is damaged
  - **Second degree burn** – upper part of dermis is also damaged
    - Blisters appear
    - Skin heals with little scarring
  - **Third degree burn** – consume thickness of skin
    - Burned area appears white, red, or blackened

**Estimating Burns Using the Rule of Nines**

- Divides the body surface into 11 regions.
- Each region accounts for 9% or a multiple of 9% of total body area.

**Skin 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

The Skin Throughout Life

- Fetal skin is well formed after the fourth month
- At 5-6 months, the fetus is covered with lanugo (downy hairs)
- Fetal sebaceous glands produce vernix caseosa
The Skin Throughout Life
- In middle to old age
  - Skin thins and becomes less elastic
  - Shows harmful effects of environmental damage
  - Skin inflammations become more common