

I. The Skin (pp. 149–155; Figs. 5.1–5.4)

A. The hypodermis is subcutaneous tissue beneath the skin consisting mostly of adipose tissue that anchors the skin to underlying muscle, allows skin to slide over muscle, and acts as a shock absorber and insulator (p. 149; Fig. 5.1).

B. Epidermis (pp. 150–152; Fig. 5.2)

1. The epidermis is a keratinized stratified squamous epithelium.
2. Cells of the Epidermis
 - a. The majority of epidermal cells are keratinocytes that produce a fibrous protective protein called keratin.
 - b. Melanocytes are epithelial cells that synthesize the pigment melanin.
 - c. Epidermal dendritic cells or Langerhans cells, are macrophages that help activate the immune system.
 - d. Tactile cells are associated with sensory nerve endings.
3. **Layers of the Epidermis**
 - a. The stratum basale (basal layer) is the deepest epidermal layer and is the site of mitosis.
 - b. The stratum spinosum (prickly layer) is several cell layers thick and contains keratinocytes, melanin granules, and the highest concentration of epidermal dendritic cells.
 - c. The stratum granulosum (granular layer) contains keratinocytes that are undergoing a great deal of physical changes, turning them into the tough outer cells of the epidermis.
 - d. The stratum lucidum (clear layer) is found only in thick skin and is composed of dead keratinocytes.
 - e. The stratum corneum (horny layer) is the outermost protective layer of the epidermis composed of a thick layer of dead keratinocytes.

C. Dermis (pp. 152–153; Figs. 5.3–5.4)

1. The dermis is composed of strong, flexible connective tissue.
 2. The dermis is made up of two layers: the thin, superficial papillary layer is highly vascularized areolar connective tissue containing a woven mat of collagen and elastin fibers; and the reticular layer, accounting for 80% of the thickness of the dermis, is dense irregular connective tissue.
- D. Skin color is determined by three pigments: melanin, hemoglobin, and carotene (pp. 154–155).

II. Appendages of the Skin (pp. 155–160; Figs. 5.5–5.7)

A. Sweat (Sudoriferous) Glands (pp. 155–156; Fig. 5.5)

1. Eccrine sweat glands, or merocrine sweat glands, produce true sweat, are the most numerous of the sweat glands, and are particularly abundant on the palms of the hands, soles of the feet, and forehead.
2. Apocrine sweat glands are confined to the axillary and anogenital areas and produce true sweat with the addition of fatty substances and proteins.
3. Ceruminous glands are modified sweat glands found lining the ear canal that secrete earwax, or cerumen.
4. Mammary glands are modified sweat glands found in the breasts that secrete milk.

B. Sebaceous (Oil) Glands (pp. 156–157; Fig. 5.5)

1. Sebaceous glands are simple alveolar glands found all over the body except the palms of the hands and soles of the feet that secrete sebum, an oily secretion.
2. The sebaceous glands function as holocrine glands, secreting their product into a hair follicle or to a pore on the surface of the skin.
3. Secretion by sebaceous glands is stimulated by hormones.

C. Hairs and Hair Follicles (pp. 157–159; Fig. 5.6)

1. Hairs, or pili, are flexible strands produced by hair follicles that consist of dead, keratinized cells.
 - a. The main regions of a hair are the shaft and the root.
 - b. A hair has three layers of keratinized cells: the inner core is the medulla, the

middle layer is the cortex, and the outer layer is the cuticle.

c. Hair pigments (melanin of different colors) are made by melanocytes at the base of the hair follicle.

2. Structure of a Hair Follicle

a. Hair follicles fold down from the epidermis into the dermis and occasionally into the hypodermis.

b. The deep end of a hair follicle is expanded, forming a hair bulb, which is surrounded by a knot of sensory nerve endings called a hair follicle receptor, or root hair plexus.

c. The wall of a hair follicle is composed of an outer connective tissue root sheath, a thickened basement membrane called a glossy membrane, and an inner epithelial root sheath.

d. Associated with each hair follicle is a bundle of smooth muscle cells called an arrector pili muscle.

3. Types and Growth of Hair

a. Hairs come in various sizes and shapes, but can be classified as vellus or terminal.

b. Hair growth and density are influenced by many factors, such as nutrition and hormones.

c. The rate of hair growth varies from one body region to another and with sex and age.

4. Hair Thinning and Baldness

a. After age 40 hair is not replaced as quickly as it is lost, which leads to hair thinning and some degree of balding, or alopecia, in both sexes.

b. Male pattern baldness, which is a type of true, or frank, balding, is a genetically determined, sex-influenced condition.

D. Nails (p. 160; Fig. 5.7)

1. A nail is a scalelike modification of the epidermis that forms a clear, protective covering.

2. Nails are made up of hard keratin and have a free edge, a body, and a proximal root.

III. Functions of the Integumentary System (pp. 160–162)

A. Protection (pp. 160–161)

1. Chemical barriers include skin secretions and melanin.

2. Physical or mechanical barriers are provided by the continuity of the skin, and the hardness of the keratinized cells.

3. Biological barriers include the epidermal dendritic cells, the macrophages of the dermis, and the DNA itself.

B. The skin plays an important role in body temperature regulation by using the sweat glands of the skin to cool the body, and constriction of dermal capillaries to prevent heat loss (p. 161).

C. Cutaneous sensation is made possible by the placement of cutaneous sensory receptors, which are part of the nervous system, in the layers of the skin (p. 161).

D. The skin provides the metabolic function of making vitamin D when it is exposed to sunlight (p. 161).

IV. Homeostatic Imbalances of Skin (pp. 162–165; Figs. 5.8–5.10)

A. Skin Cancer (pp. 162–163; Fig. 5.8)

1. Basal cell carcinoma is the least malignant and the most common skin cancer.

2. Squamous cell carcinoma tends to grow rapidly and metastasize if not removed.

3. Melanoma is the most dangerous of the skin cancers because it is highly metastatic and resistant to chemotherapy.

B. Burns (pp. 163–165; Figs. 5.9–5.10)

1. A burn is tissue damage inflicted by intense heat, electricity, radiation, or certain chemicals, all of which denature cell proteins and cause cell death to infected areas.
2. The most immediate threat to a burn patient is dehydration and electrolyte imbalance due to fluid loss.
3. After the first 24 hours has passed, the threat to a burn patient becomes infection to the wound site.
4. Burns are classified according to their severity.
 - a. First-degree burns involve damage only to the epidermis.
 - b. Second-degree burns injure the epidermis and the upper region of the dermis.
 - c. Third-degree burns involve the entire thickness of the skin.

Developmental Aspects of the Integumentary System (p. 165)

1. The epidermis develops from embryonic ectoderm; the dermis (and hypodermis) develops from mesoderm.
2. The fetus exhibits a downy lanugo coat.
Fetal sebaceous glands produce vernix caseosa, which helps protect the fetus's skin from its watery environment.
3. A newborn's skin is thin. During childhood the skin thickens and more subcutaneous fat is deposited.
At puberty, sebaceous glands are activated and terminal hairs appear in greater numbers.
4. In old age, the rate of epidermal cell replacement declines and the skin and hair thin. Skin glands become less active. Loss of collagen and elastic fibers and subcutaneous fat leads to wrinkling; delayed-action genes cause graying and balding.