Chapter 5

LECTURE OUTLINE

A. Introduction (p. 121)

1. Tissues are organized to form an organ, and organs are organized to form systems.
2. The organs of the integumentary system include the skin and its accessory structures including hair, nails, and glands, as well as muscles and nerves.

B. Structure of the Skin (p. 122)

1. The skin (**cutaneous membrane)** covers the body and is the largest organ of the body.
2. It consists of two major layers:
    i. outer, thinner layer called the **epidermis**
    ii. inner, thicker layer called the **dermis**
3. Beneath the dermis is **a subcutaneous (subQ) layer** (also called **hypodermis**) which attaches the skin to the underlying tissues and organs; the subcutaneous layer contains **lamellated (Pacinian) corpuscles** that detect pressure.
4. The **epidermis** has a number of important characteristics:
    i. the epidermis is composed of keratinized stratified squamous epithelium
    ii. it contains four major types of cells:
        a. 90% of the cells are **keratinocytes**, which produce **keratin**
        b. **melanocytes**, which produce the pigment **melanin**
        c. **Langerhans cells**, which are involved in immune responses
        d. **Merkel cells**, which function in the sensation of touch
    iii. the epidermis contains four or five major layers (see Table 5.1):
        a. **stratum basale** (deepest layer) or **stratum germinativum**, where continuous cell division occurs which produces all the other layers
        b. **stratum spinosum**
        c. **stratum granulosum**
        d. **stratum lucidum** is present only in the skin of the fingertips, palms, and soles
        e. **stratum corneum** (surface layer), composed of many sublayers of flat, dead keratinocytes that are continuously shed and replaced by cells from deeper strata
    iv. **keratinization**, the accumulation of more and more protective keratin, occurs as cells move from the deepest layer to the surface layer
5. The **dermis** has several important characteristics:
    i. the dermis is composed of connective tissue containing collagen and elastic fibers
    ii. the dermis contains two layers (see Table 5.2):
        a. the outer **papillary region** consists of areolar connective tissue containing fine elastic fibers, **dermal papillae, corpuscles of touch (Meissner's corpuscles)**, and **free nerve endings**
        b. the deeper **reticular region** consists of dense, irregular connective tissue containing collagen and elastic fibers (which provide strength, extensibility, and elasticity to the skin), adipose cells, hair follicles, nerves, sebaceous (oil) glands, and sudoriferous (sweat) glands

6. **Epidermal ridges** reflect contours of the underlying dermal papillae and form the basis for fingerprints; their function is to increase firmness of grip by increasing friction.
7. Variations in skin color arise from variations in the amounts of three pigments:
    i. **melanin** (located mostly in the epidermis, where it absorbs UV radiation)
        - **albinism** is an inherited inability to produce melanin
    ii. **carotene** (found in the stratum corneum, dermis, and subcutaneous layer)
    iii. **hemoglobin** (located in erythrocytes flowing through dermal capillaries)

C. Accessory Structures of the Skin (p. 125)

1. Accessory structures of the skin are organs that develop from the embryonic epidermis.
2. These organs include hair, skin glands, and nails.
3. **Hair (pili)** have a number of important characteristics:
    i. hair is composed of dead, keratinized epidermal cells
    ii. each hair consists of:
        a. **shaft** which projects above the surface of the skin
        b. **root** which penetrates into the dermis
        c. **hair follicle** which surrounds the root
    iii. hair grows due to cell division occurring in the matrix of the **bulb**, located at the base of a hair follicle; there is a growth cycle that includes a **growth stage** and **resting stage**
    iv. associated with hairs are sebaceous (oil) glands, **arrector pili** muscles, and **hair root plexuses**
    v. the color of hair is determined primarily by the amount and type of melanin
    vi. the primary functions of hair are protection, reduction of heat loss, and sensing light touch

4. **Sebaceous (oil) glands** have several important characteristics:
    i. they are typically connected to hair follicles
    ii. they secrete an oily substance called **sebum** which prevents dehydration of hair and skin, and inhibits growth of certain bacteria
5. **Sudoriferous (sweat) glands** produce sweat (perspiration) which helps to cool the body by evaporating, and also eliminates small amounts of wastes; there are two types of sweat glands (see Table 5.3):
    i. numerous **eccrine sweat glands** which have an excretory duct that opens at a pore at the surface of the epidermis
    ii. **apocrine sweat glands** which are located mainly in the skin of the axilla, groin, areolae, and bearded facial regions of adult males; their excretory ducts open into hair follicles
6. **Ceruminous glands** are modified sweat glands located in the ear canal; they are involved in producing a waxy secretion called **cerumen** (earwax) which provides a sticky barrier that prevents entry of foreign bodies into the ear canal**.**
7. **Nails** are composed of hard, keratinized epidermal cells located over the dorsal surfaces of the ends of fingers and toes.
    i. Each nail consists of:
        a. **free edge**
        b. transparent **nail body** with a whitish **lunula** at its base
        c. **nail root** embedded in a fold of skin
    ii. Associated with a nail are:
        a. **hyponychium** (located under the free edge) attaches the nail to the fingertip

b. **eponychium (cuticle)** attaches the margin of nail wall to neighboring epidermis
c. **nail matrix** in which cell division occurs resulting in growth of the nail

iii. The functions of nails include helping to grasp and manipulate objects, providing protection against trauma to the ends of the digits, and scratching various body parts.

D. Types of Skin (p. 133)

1. There are two major types of skin (see Table 5.4):
   i. **thin skin** covers all body regions except the palms, palmar surfaces of digits, and soles
   ii. **thick skin** covers the palms, palmar surfaces of digits, and soles

E. Functions of the Skin (p. 134)

1. Functions of the skin include:
   i. regulation of body temperature
   ii. blood reservoir
   iii. protection
   iv. cutaneous sensations
   v. excretion and absorption
   vi. synthesis of vitamin D

F. Blood Supply of the Integumentary System (p. 135)

1. The epidermis is avascular.
2. The dermis receives blood from:
   i. branches of arteries supplying skeletal muscles
   ii. arteries that supply the skin directly, including:
      a. cutaneous plexus
      b. papillary plexus
3. Venous plexuses drain blood from the dermis into larger subcutaneous veins.

G. Development of the Integumentary System (p. 135)

1. The epidermis develops from the ectoderm; nails, hair, and skin glands are epidermal derivatives.
2. The dermis develops from the mesoderm.

H. Aging and the Integumentary System (p. 137)

1. The skin of a fetus is protected by a fatty substance called **vernix caseosa**.
2. Adolescents may develop **acne**.
3. Pronounced aging effects do not typically occur until people reach their late forties.
4. The effects of aging include wrinkling, decrease of skin's immune responsiveness, dehydration and cracking of the skin, decreased sweat production, decreased numbers of functional melanocytes resulting in gray hair and atypical skin pigmentation, loss of subcutaneous fat, a general decrease in skin thickness, and an increased susceptibility to pathological conditions.
5. Growth of hair and nails decreases during the second and third decades of life; nails may also become more brittle with age.

I. Key Medical Terms Associated with the Integumentary System (p. 140)

1. Students should familiarize themselves with the glossary of key medical terms.