Chapter 5 Integumentary System

I. Introduction to integument
   A. The integumentary system consist of the skin and accessory structures such as hair, nails and glands.
   B. Integument means covering
   C. Interesting Facts:

   D. Clinical importance of appearance

   E. Functions

II. Hypodermis (sometimes called subcutaneous tissue or superficial fascia)
   A. The skin rests on the hypodermis

   B. Consists of loose connective tissue with collagen and elastic fibers. Cell types include fibroblasts, adipose cells and macrophages.

   C. Function:

III. Skin
   A. Made up of two major tissue layers: Dermis and epidermis
      1. Dermis (meaning skin) layer
         a. deep layer of dense connective tissue
         b. connected to hypodermis
      2. Epidermis (meaning on the dermis) layer
         a. superficial layer of epithelial tissue
         b. rests on the dermis.
B. Dermis
1. Composed of Dense irregular connective tissue with fibroblasts, a few adipose cells (blood vessels are scarce)
2. Nerve endings, hair follicles, smooth muscles, glands and lymphatics extend from the hypodermis into the dermis.
3. Dermis is responsible for the structural strength of skin.
4. Two distinct layers: reticular and papillary layers.
   a. Reticular layer (deeper) (stratum reticularosum)
   b. Papillary layer (superficial) (stratum papillarosum)

C. Epidermis
1. Epidermis is stratified squamous epithelium separated from dermis by a basement membrane.
   a. Not as thick as the dermis
   b. No blood vessels - nourished by diffusion from capillaries in papillary layer
2. Functions:

3. Most cells of epidermis are keratinocytes
   a. produce a protein mixture called keratin.
   b. responsible for the structural strength and permeability of epidermis
4. Other cells include melanocytes (skin color) and Langerhans cells (immune system).
5. Cells are produced in deepest layers of epidermis by mitosis
a. Older cells are pushed to surface where they desquamate
b. Outer cells protect inner cells.
c. Deeper replicating cells replace cells lost from the surface.
   (1) As cell move outward the change in shape and chemical composition
   (2) Keratinization - cells become filled with keratin

6. Distinct transitional stages of epidermins
a. epidermis divided into 5 regions or strata.
b. Deep to superficial: Stratum Basale, Spinosum Granulosum, Luididum, Corneum

7. Stratum Basale
a. Deepest portion of epidermis
b. Single layer of cuboidal or columnar cells with a basement membrane that attaches to the dermis below.
c. Function:
   d. Structural strength from hemidesmosomes

e. Keratinocytes
   (1) produce keratin which toughens and waterproofs the cell.
   (2) held together by desmosomes
   (3) strengthened by keratin fibers (intermediate filaments) that insert into desmosomes of other keratinocytes
   (4) Divides every 19 days - daughter cells push to surface and become keratinized
   (5) 45-56 days to reach surface and desquamate.

8. Stratum Spinosum (Stratum Spinosum + Stratum Basale = Stratum Germinatium)
a. Superficial to stratum basale
b. 8-10 layers of many sided cells
9. Stratum Granulosum
   a. 2-5 layers of flattened-diamond shaped cells
      (1) oriented parallel to surface
   b. The cells in this layer produce keratohyalin protein granules.

10. Stratum Lucidum (only apparent in thick skin)
    a. 3-5 layers of dead cells with indistinct boundaries
    b. Appears as a Thin clear zone above stratum granulosum
       (1) Cells appear somewhat transparent

11. Stratum Corneum
    a. Most superficial layer
    b. 25 or more layers of dead squamous cell.
    c. Function:
       d. Layer consists of cornified cells

D. Thick and Thin Skin
   1. Skin is classified as thick or thin based on the structure of the epidermis.
   2. Thick skin:
      3. Thin skin
E. Skin color
   1. Determined by

2. Melanin: group of pigments primarily responsible for skin, hair and eye color. Functions and Location:

3. In the production of melanin the amino acid tyrosine is converted to dopaquinone

4. Melanin is produced by melanocytes

5. Melanin production is determined by genetic factors, hormones and exposure to light.
   a. Genetic factors

   b. Hormonal factors

   c. Exposure to ultraviolet light
F. Hair
   1. Location:
   
   2. Function:
   
   3. Two types of hair: **terminal hair and vellus hair**
   
   4. Hair Structure
      a. Two parts: shaft and root
         (1) **Shaft** is visible dead portion of the hair that protrudes above surface.
         (2) **Root** is the located below the skin surface
         (a) **Bulb** is the enlarged portion of root within the hair follicle.
         (3) The **root and shaft** are composed of columns of dead keratinized epithelial cells. Arranged in three layers:

<table>
<thead>
<tr>
<th>Layers Inside to outside -</th>
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<tbody>
<tr>
<td><strong>Hair</strong> (medulla, cortex, cuticle):</td>
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<tr>
<td><strong>Follicle</strong> (internal epithelial root sheath, external epithelial root sheath, dermal root sheath)</td>
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b. **Hair follicle** - the hair is generated by the hair follicle.
   (1) consists of **dermal root sheath** and **epithelial root sheath**
   
   (2) **Matrix** is the germinal layer of the hair
3) Pappilae

c. Hair color
(1) is the result of varying amounts and types of melanin.

(2) With age the amount of melanin in the hair decreases causes fading or graying of hair.

5. Hair growth
a. Hair develops from the stratum basale cells (matrix) within the bulb of the hair.

b. Hair grows in cycles: growth phase and resting phase
(1) Growth phase - hair is produced by matrix cells.

(2) Resting phase - eventually hair stops growing

(3) After the resting cycle a new hair replaces the one that fell out.

G. Muscles
1. Each hair follicle has a muscle associated with it called the *Arrector pili*
(1) smooth muscle
(2) extends from the dermal root sheath to the papillary layer of the dermis.
H. Glands
   1. Major glands of skin are sebaceous glands and sweat glands.
   2. **Sebaceous glands**

3. **Sweat glands**: two types - named originally for their process of secretion.
   a. **Merocrine** -
   
   b. **Apocrine** (release their products in a merocrine fashion.)

   c. **Mammary glands**

   d. Other skin glands include the ceruminous glands of the external auditory meatus

I. Nails
   1. **Function:**
2. Nail Structure:
   a. Formed of compressed outer layer (stratum corneum) of the epidermis.
   
b. nail root
   
c. nail body
   
d. nail fold
   
e. nail groove
   
f. The nail root and nail body attach to the nail bed

IV. Functions of the Integumentary System
   A. Protection

   B. Hydroregulation

   C. Thermoregulation
D. Vitamin D production

E. Sensory Reception

F. Excretion

V. Effects of Aging on the Integumentary System

VI. Clinical considerations
   A. Inflammatory conditions
B. Neoplasms
   Skin cancer
   1. Basal cell carcinoma - most common type of skin cancer

   2. Squamous cell carcinoma

   3. Malignant melanoma

C. Burns (Classified according to depth)

D. Frostbite, Skin Grafts, Wound healing