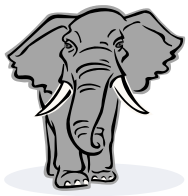
Anatomy & Physiology I Dr. L. Bacha
Chapter Outline (Marieb & Hoehn 2013)

Chapt. 5: The Integumentary System



The integumentary system is composed of skin and structures that are derived from the skin during development (such as hair, sweat glands, sebaceous glands, nails, etc.)

THE SKIN (Cutis, Integument)

Is the skin an organ?
Yes, because it consists of various tissues joined together to perform specific activities; in fact, it is the largest organ of the body!

Structure of the Skin (see Fig. 5.1)

List and describe the two layers (regions) that form skin:

Which layer is vascularized?

How do nutrients reach the epidermis?

hypodermis

※ the hypodermis is a layer of loose CT deep to the dermis of the skin; it joins skin to underlying structures such as bone and muscle.

※ the hypodermis is also referred to as the subcutis, subcutaneous layer, subQ, and superficial fascia

※ list functions of the hypodermis:

EPIDERMIS

◦ what type of epithelium is the epidermis?

Cells of the Epidermis:

◦ **keratinocytes**
- by far the most numerous
- what is their chief role?
- what is **keratin**?
- what connects keratinocytes tightly to one another?
- the keratinocytes undergo a process called **keratinization**:
  - what do the keratinocytes arise in?
  - as cells of the epidermis are pushed upward by the production of new cells they make the keratin
  - by the time the keratinocytes reach the free surface of the skin, what are they like?

◦ **melanocytes**
- melanocytes are cells that synthesize the pigment called what?
- the melanin granules accumulate on the superficial side of the keratinocyte nucleus and form what?

◦ **dendritic cells**
- are also called what?
- what is their function?

Layers of the Epidermis:

First, a few words about two categories of skin based on the thickness of skin:

Thick skin:
- hairless
- has a thicker epidermis & dermis
- the keratinocytes form 5 layers of the epidermis
- where is thick skin found?

Thin skin:
- has hairs
- has a thinner epidermis & dermis
- the keratinocytes form 4 layers of the epidermis
- covers most of the body

Examine Fig. 5.2 and locate the epidermis, its layers, and the dermis.

1. **Stratum Basale**
   - is the deepest layer; it consists of a single row of what kind of cells?

   ✶cell division occurs in the stratum basale
   - each time a basal cell divides, what happens to the two new daughter cells?

   - the basal cells are cuboidal to columnar and rest on the basement membrane, which separates the epidermis from the underlying dermis

2. **Stratum Spinosum**
   - several to numerous layers of polyhedral cells with spine-like processes

3. **Stratum Granulosum**
   - more flattened cells filled with purple-staining granules
   - name and describe the function of the two types of granules that the cells accumulate:

   - what happens to the plasma membrane of these cells (of the stratum granulosum) and what do these events produce?

   - the epidermis relies on capillaries in the underlying connective tissue for nutrients; why do the epidermal cells above the stratum granulosum die?

4. **Stratum Lucidum**
   · present only in thick skin; consists of clear flat, dead cells

5. **Stratum Corneum**
   · consists of layers of flat, scale-like, dead cells filled with a protein called **keratin**
   · what is the function of keratin and the thickened plasma membranes of the cells of the stratum corneum?

   · what does the glycolipid between the cells do?

DERMIS

◦ a strong, flexible layer of CT

Two Layers of the Dermis:

1. **papillary layer (superficial layer)**
   ∗ the thin, superficial layer just below the epidermis
   ∗ describe the type of connective tissue that forms the papillary layer:

   - what does the looseness of the papillary layer allow?

   ∗ has an extensive capillary network to nourish the epidermis and for heat regulation
   ∗ includes peglike projections called dermal papillae that interdigitate with the epidermal pegs of the epidermis; these are especially prominent in thick skin, where they help to anchor the dermis and epidermis together
   - what do the dermal papillae contain?

   ∗ in thick skin, the papillary layer has larger mounds of connective tissue called what?

   - these cause the overlying epidermis to form what?
   - what is thought to be the functions of the epidermal ridges (friction ridges)?

2. reticular layer (deep layer)

∗ accounts for about what percent of the thickness of the dermis?

∗ formed by what type of CT?

∗ what is the **cutaneous plexus** and where is it located?

∗ the collagen fibers of the dermis give skin what properties and what does collagen bind?

∗ elastic fibers provide what?

SKIN COLOR

List the three pigments that contribute to skin color:

∗ **melanin**:

- melanin ranges in color from what to what?
- name the cells that synthesize melanin:
- melanin synthesis depends on what enzyme?
- exposure to UV light increases the activity of tyrosinase
- are differences in skin color due to the number of melanocytes that people have or due to the amount and kind of melanin they produce?
- what is the function of a buildup of melanin?

∗ **carotene**:

- what color does carotene impart to skin?

∗ **hemoglobin**:

- what color does hemoglobin impart to skin?

ACCESSORY STRUCTURES (APPENDAGES) OF SKIN

- name examples of accessory structures of the skin that are derived from the epidermis:

- accessory structures arise from **epidermal buds** that develop in the embryo

HAIRS AND HAIR FOLLICLES

- list functions of hair:

Structure of a Hair:

◦ what is another term for "hairs"?

◦ hairs consist largely of what?

◦ name the type of keratin that forms hairs and nails and what are its two advantages over soft keratin:

◦ distinguish between the **shaft** and the **root** of a hair:

- which part projects from the skin and extends about halfway down the follicle?

- which part is deep within the follicle?

- what is the hair like if the shaft of the hair in cross section is flat and ribbonlike?

- what is the hair like if the shaft of the hair in cross section is oval?

- what is the hair like if the shaft of the hair in cross section is perfectly round?

◦ list the three concentric layers of keratinized cells that a hair has, and locate the layers in Fig. 5.6:

- the **cuticle** is formed from what?

◦ hair pigment:
- hair pigment is made by what cells at the base of the hair follicle?
- various proportions of what combine to produce hair color?
- what happens when hair turns gray or white

Structure of a Hair Follicle:

◦ hair follicles surround the portion of the hair below the surface of the skin

◦ name the deep, expanded end of a follicle:

- are there **sensory nerve endings** associated with the hair bulb?
- what stimulates these nerve endings?

◦ describe a **hair papilla**:

- this papilla contains a knot of capillaries that does what?

◦ a hair follicle is formed by a **connective tissue sheath** and an **epithelial root sheath**. The epithelial root sheath is derived mainly from what?

- name the two parts of the epithelial root sheath (and locate them on Fig. 5.5):

◦ the **hair matrix**, formed by actively dividing cells of the hair bulb, produces what?

◦ define **arrector pili**:

- this muscle is attached in such a way that its contraction does what?
- what does it contract in response to?
- how is this "hair-raising" response useful to animals (other than humans)?

Types and Growth of Hair:

◦ distinguish between the texture and location of vellus hairs and terminal hairs:

◦ list the phases of the growth cycle of a follicle:

NAILS

◦ what is a **nail?**

◦ in contrast to soft keratin of the epidermis, nails (and hairs) contain what type of keratin?

◦ define the following parts of a nail and locate them on Fig. 5.6:

- **free edge:** - the unattached portion that projects beyond the digit
- **nail plate** (or **nail body**):
- **nail root**:
- **nail bed**:
- **nail matrix**:
- **eponychium** (or **cuticle**

SWEAT GLANDS

◦ what is another name for sweat glands?

◦ sweat glands consists of a secretory portion and a duct that empties either into a hair follicle or directly onto the surface of the skin

◦ the secretory cells of sweat glands are associated with cells called what?

- what causes myoepithelial cells to contract?
- their contraction forces what to happen?

Eccrine (Merocrine) Sweat Glands

◦ are far more numerous (than apocrine sweat glands) and are particularly abundant where?

◦ sweat produced by eccrine glands is 99% water; it also contains what?

◦ what division of the autonomic nervous system regulates sweating?

Apocrine Sweat Glands

◦ apocrine sweat glands are largely confined to what areas of the body?

◦ they are larger than eccrine gland

◦ their secretion contains the same basic components as sweat produced by eccrine glands, plus what?

◦ how is the secretion of apocrine sweat glands responsible for the basis of body odor?

◦ when do they begin functioning?

◦ ceruminous glands are modified apocrine glands found where?

◦ mammary glands are modified apocrine glands that secrete what?

SEBACEOUS GLANDS

◦ what is another name for sebaceous glands?

◦ sebaceous glands are holocrine glands; most secrete into hair follicles; some open directly onto the surface of the skin

◦ name the oily substance that sebaceous glands secrete:

- list the substances that constitute sebum:

◦ describe the functions of sebum**:**

FUNCTIONS OF THE INTEGUMENTARY SYSTEM

List, read about, and briefly describe the 6 major functions of skin and its derivatives:

Homeostatic Imbalances of Skin

Read about skin cancer and burns, but you will not be responsible for this section.

The End!