Musculoskeletal system

Histology

SKIN HISTOLOGY

- The skin is considered the largest organ of the body.
- It's a part of the integumentary system.

- **Basic skin histology:**
  - The skin is composed of two layers: the outer epidermis and the deeper dermis rests on the hypodermis.

(Skin is an important subject to know no matter what clinical field you want get into).

  - Major skin functions:
    - Protection.
    - Sensory perception.
    - Temperature regulation .
    - Excretion.
    - Formation of vitamin D.
  - Hypodermis = Superficial facia = Subcutaneous tissue = Subdermal fat.
  - The dermal papillae are nipple like extensions of the dermis into the epidermis.
  - The epidermis conforms to the contours of the underlaying dermal papillae forming epidermal ridges. ➡️ **prevents the two layers of skin from separating.**

- **Note:** the basement membrane follows the contour of the interdigitations between epidermis and dermis .. **Epidermal-dermal junction.**
- Epidermal-dermal junctions are more prominent in palms and soles.
- These interdigitations form distinctive patterns unique for each individual (fingerprints and footprints).
- These interdigitations are called **friction ridges** for grasping with our hands and for walking barefoot.

(go back to slide 9 to see the blisters).

- **Epidermis:**
  - Is the outermost layer of the skin
  - It is composed of four or five layers, depending on the type of skin.
  - It is rich in a tough protein called keratin.
  - Contains four different cell types:
    - Keratinocytes.
    - Melanocytes.
    - Langerhans cells.
    - Merkel cells.
  - Avascular.
  - The epidermis forms a waterproof barrier between the body and the external environment, which resists friction and microbial invasion and prevents water loss.

- Is derived from ectoderm

1. **Stratum basale**
   - Is the deepest layer in the epidermis.
   - Consists of a single layer of basophilic columnar to cuboidal cells that rest on a basement membrane.
   - The cells are attached to one another by desmosomes, and to the underlying basement membrane by hemidesmosomes.
   - Cells are characterized by intense mitotic activity.
   - As cells of the outer surface of the epidermis are continually being sloughed off, some cells in the stratum basale divide continuously, replenishing the epidermis.
2. **Stratum spinosum**
   - Is the layer above the stratum basale.
   - Consists of 8-10 rows of cells
   - Cells synthesize keratin filaments that become assembled into tonofilaments
   - During histologic preparation, cells shrink and intercellular spaces appear as spines
   - Spines represent sites of desmosome attachments to keratin tonofibrils
   - Stratum basale along with the deepest part of stratum spinosum is called **Stratum germinativum**

3. **Stratum granulosum**
    - Cells above the stratum spinosum
    - Consists of 3-5 cell layers of flattened cells
    - Cells filled with dense basophilic keratohyalin granules and membrane- bound lamellar granules
    - Keratohyalin granules are intensely basophilic, non membranous bound masses of filaggrin cross-links with keratin tonofibrils
    - Intermediate filaments= keratin
    - Tonofilaments ➡️ Tonofibrils
    - Lamellar granules discharge lipid material between cells and waterproof the skin

4. **Stratum Lucidum**
    - In thick skin only
    - Is translucent and barely visible
    - The tightly packed cells (desmosomes) lack nuclei or organelles and are dead.

5. **Stratum corneum**
    - Most superficial layer of the skin.
    - Consists of dead, flattened cells with no nuclei and cell organelles.
    - The dead cells contain much keratin filaments with plasma membranes surrounded by lipid-rich layer.

- The cells from this layer are continually shed, or desquamated, and are replaced by new cells arising from the deep stratum basale.
- During the keratinization process, the hydrolytic enzymes disrupt the nucleus and all cytoplasmic organelles, which disappear as the cells fill with keratin.
- This layer acts to waterproof the skin surface.
- Keratin is a tough and fibrous protein that serves to protect the skin.
- ***go back to the slides (slide 20) to see the calluses and corns.**
- By the end of keratinization, the cells contain only keratin with plasma membranes surrounded by lipid rich layer.
- Keratinocytes move up as they age and dead cells flacking off at the skin surface.

***psoriasis:** Is a common skin condition that speeds up the life cycle of skin cells. It causes cells to build up rapidly on the surface of the skin. The extra skin cells form scales and red patches that are itchy and sometimes painful.

- **Types of skin**
  - Thin skin:
    - Dominant and lines most of the body surface.
    - (The skin of the back is thin, the skin of the eyelids too).
    - Hairy skin.
    - 0.1 mm
    - 4 layers.

- Less prominent stratum corneum.
- Less developed stratum granulosum.
- Dominant and lines most of the body surface.
- Thicker dermis.
- Hair and subaceous glands.

- Thick skin:
  - Palms of the hands and soles of the feet.
  - Thick skin resists the abrasion and friction.
  - Non-hairy skin.
  - 1.5 mm
  - 5 layers.
  - Prominent stratum corneum.
  - Well developed stratum granulosum.
  - Palms of the hands and soles of the feet.
  - Thinner dermis.
  - No hair and sebaceous glands.

***Note:** that the thin and thick refer to the thickness of **epidermal layer**.

- **Types of epidermal cells**

1. **Keratinocytes:**
    - Approximately 90% of epidermal cells are keratinocytes.
    - Produce **keratin**.
    - Produce **lamellar granules** that helps waterproof the skin.
    - Keratinocytes continuously shed and regenerate every 2-4 weeks.
    - **Note:** the structure of keratinocytes changes dramatically as they mature: they change from square-shaped cells to flat cells.
    - Throughout their life the become engorged with keratin before eventually dying, losing all of their internal structures.

2. **Melanocytes**
    - Melanocytes are our natural **SPF**. (sun protection factor)
    - Are derived from the neural crest cells.
    - Have protrusions that transfer melanin granules to the keratinocytes.
    - Are located in the stratum basale.
    - Synthesize the dark brown pigment melanin.
    - Melanin protects the skin from damaging effects of ultraviolet radiation.
    - Melanin imparts a dark color to the skin, and exposure of the skin to sunlight promotes increased synthesis of melanin.
    - 1 melanocyte for every 10 basal keratinocytes.

- (Go back to slide 32 to see the **Albinism**).

3. **Langerhans cells:**
   - Originate from bone marrow (monocytes), they are monocyte derived cells.
   - Mainly in the stratum spinosum.
   - Langerhans cells recognize, phagocytose, and process foreign antigens.
   - Represent 2-8% of epidermal cells.

4. **Merkel cells:**
   - Are found in the stratum basale.
   - Are most abundant in the fingertips.
   - Are closely associated with afferent (sensory) unmyelinated axons.
   - Function as light touch receptors (mechanoreceptors).