Unit 1 Basic structure of Skin & its function

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Structure of skin

- Surface area of skin in adults is approximately 1.5–2m²
- Skin is made up of dead cells, epithelium, connective tissue, muscles, nerves, blood vessels, as well as the so-called appendages (i.e., accessory structures), including the nails, hair, and glands, such as sebaceous glands, eccrine and apocrine sweat glands.



Skin Structure

Consists of three layers

- 1. **Epidermis superficial region**
 - Dermis middle region
- 3. Hypodermis deepest region
 - Subcutaneous layer deep to skin (not technically part of skin)
 - Mostly adipose tissue





- It is stratified squamous epithelium which is terminally differentiated.
- Thickness:0.05-0.1mm.
- Keratinocytes constitute more than 95% of epidermal cells.
- The "brick like " shape of keratinocyte is provided by cytoskeleton made of keratin intermediate filaments.
- As epidermis differentiates, cells gets flattened. This process involves the filament aggregating protein called filaggrin.
- Keratin and filaggrin comprises 90% of mass of epidermis.

Stratum corneum - is horny layer made up of **dead cells** that continuously shed and are replaced by cells in the adjacent layer. This layer is very thick compared to the others; it contains 15–30 layers of dead cells.

- Stratum lucidum, the translucent or clear layer, contains 3–5 rows of densely packed flat dead cells.
- Stratum granulosum, the granular layer, consists of 3–5 layers of flattened keratinocytes that begin to die. In this layer, granules can be observed in the cells, this is from where the name comes.
- Stratum spinosum, contains 8–10 rows of cells.
 This layer is responsible for lipid and protein synthesis.



- Melanocytes are found in the basal cell layer and are responsible for melanin production. Melanin is a pigment that gives the skin its color. Melanin also provides photo protection to the skin against ultraviolet (UV) light.
- Carotene is another pigment responsible for skin color. It is also found in the epidermis and has an orange-yellowish color. Carotene is also found in a variety of fruits(orange) & vegetables(carrot). One eating of a lot of vegetables containing carotene may actually get an orange skin tone.
 - Langerhans cells play an important role in the body's immune system.
 - Merkel cells tend to lie close to sensory nerve endings in the stratum basale. They function as **touch receptors**.

Stratum corneum

- It is made up of tightly packed, water-resistant dead cells called **corneocytes**, which are embedded in a complex lipid material(called **intercellular lamellar lipids**) made up of ceramides, cholesterol, and fatty acids
- Corneocytes contain hygroscopic compounds, that forms the natural moisturizing factor which plays a vital role in maintaining the hydration of the SC
- natural moisturizing factor components are water soluble, they are easily leached from the cells with excessive use of skin cleansing with soaps and cause dry, flaky, and uncomfortable skin

Sebum

factor

matrix

Corneocyte

Intercellular lipid

Cornified lipid

envelope

Corneodesmosome

Natural moisturizing



Keratinization

- also known as cornification,
- It is the dynamic process of epidermal renewal.
- It begins in the basal layer where new skin cells, known as keratinocytes, are formed and are continually pushed upward where their composition and shape change significantly
- cells reach the third layer, stratum granulosum, most have stopped dividing and have started producing keratin.
 - Cells migrate and eventually they fall off.
- The cells in the epidermis contain a lot of keratin which resists damage.
- Dead skin cells, shed from the surface of the skin. This process is referred to as **desquamation**





CELL LAYERS OF THE EPIDERMIS

- TIMING OF MOVEMENT BETWEEN LAYERS:
- Stratum Basal cells take to 15-30 days to reach Stratum Corneum.
- Cells remain in S. Corneum an additional 2 weeks before they are shed.
- Replace cells of the skin once every two months



Vitamin D production also occurs in the epidermis, which is known to be the main source of vitamin D in humans. UV light stimulates the conversion of the precursor7-dehydrocholesterol (also known as provitamin D3) to vitamin D3.



- Epidermis contains no blood vessels; it is entirely dependent on the underlying dermis for nutrient delivery.
- It is made up of a large quantity of keratin, which is responsible for the skin's strength.

Functions of the Epidermis

- Bacteria, viruses and other infectious agents are kept out, helping prevent infections on your skin.
- Water and nutrients are kept in for the body to use.
 - Body parts that are more susceptible to injury, like the soles of your feet and palms of your hands, have a thicker epidermis for even better protection.

Functions of the Epidermis



- Amount of melanin in each cell differs among people. The more melanin you have, the darker your skin tone.
- Sunlight can increase the amount of melanin produced in melanocytes to a degree. This is what causes a suntan.
 - The other important role of melanocytes is filtering out ultraviolet (UV) radiation from the sun. UV radiation is the leading cause of skin cancer. It also causes wrinkles. People with darker skin have more melanin, so they can filter out more UV radiation and are less likely to get skin cancer and wrinkles.

Dermis

The dermis is located under the epidermis that provide supporting frame to the epidermis, supplying it with nutrients and oxygen via the blood capillaries

- It is strong, flexible connective tissuefibroblasts (which produce the intercellular substance and collagen fibers), nerves and sensory organs, blood vessels, sebaceous glands, sweat glands, and hair follicles as well as connective tissue containing collagen and elastin fibers.
- Collagen fibers give the skin its strength, while elastin is responsible for the skin's elasticity, i.e., its ability to spring back after being stretched. If these fibers are damaged, for example, as a result of aging, the skin becomes loose and looks thin and wrinkled. In addition, collagen plays an important role in wound healing
 - Nerve endings are responsible in transmitting sensory signals, such as touch, pressure, pain, and temperature from the skin.
 - **Blood vessels** play an essential role in supplying the epidermis with oxygen and nutrients. In addition, they are particularly important in the regulation of body temperature, along with the sweat glands.

As water from sweat evaporates from the skin, it has a cooling effect, which subsequently decreases the body temperature.

Sebaceous glands

- Sebaceous (sĭ BAY shuss) glands are oil glands.
- They have tiny ducts that open into each hair follicle.
- Sebaceous glands are part of the pilosebaceous unit, which also includes hair follicles and a small muscle.



Sebaceous (Oil) Glands

- Widely distributed
- Most develop from hair follicles
- Become active at puberty
- Sebum
 - Oily holocrine secretion
 - Bactericidal
 - Softens hair and skin







- In normal skin, there is a **continuous movement of water** from the deeper layers toward the superficial layer where water eventually evaporates.
- skin hydration reflects the water content of the SC and represented as "transepidermal water loss" (TEWL).
 - TEWL is diffusion of water through the skin
- TEWL is not visible to the naked eye
- If the skin is damaged by either physical or chemical agents, the barrier function is somewhat compromised and an increase in TEWL can be observed.

Moisture Content of Normal Skin

- Water is necessary for the skin to maintain its flexibility. Otherwise skin is overly dry, it loses its ability to stretch, causing it to crack and peel more easily.
- Faster peeling means the skin cells are being shed more rapidly, which triggers an increase in the rate of cell production in the basal layer and the process of cell growth, migration, and shedding is accelerated
- the barrier is significantly weakened since cells providing the barrier do not have time to fully mature

Skin Flora

- Human skin is continuously inhabited by many different bacteria and fungi in a healthy individual are harmless and are even beneficial.
- Microbes on the skin are generally divided into two categories:
 - resident flora and
 - transient flora

Skin Flora : Resident flora

- The resident flora (resident microbiota) consists of microorganisms residing under the superficial cells of the stratum corneum and can also be found on the surface of the skin.
- The most common bacteria include Corynebacterium, Streptococcus, Staphylococcus, Neisseria, Peptococcus, Acinetobacter, and Proprionibacterium species, while the most common fungal genus is Malassezia.
- The resident flora protects the host from pathogenic bacteria

Skin Flora : Transient flora

- Transient or temporary skin flora refers to the microorganisms that transiently colonise the skin.
- This includes bacteria, fungi and viruses, which reach the hands, for example, by direct skin-to-skin contact or indirectly via objects
- The transient flora can be nonpathogenic or pathogenic microorganisms depending on what we touch
 - if the resident flora is disturbed, transient microorganisms can colonize, proliferate, and produce disease.



Skin Flora

Resident organisms

- In deeper layers of skin
- Permanent flora
- If disturbed reestablish themselves
- Not removed by routine hand wash
- Usually not associated with transmission of infection

Transient organisms

- In superficial layers of skin
- Temporary flora
- Usually do not reestablish themselves
- Easily removed by routine hand wash
- Usually associated with transmission of infection

Skin pH

- Maintenance of the resident flora and their barrier function requires the skin pH to be maintained
- Normally, the skin surface is slightly acidic and ranges between pH 4.5 and 5.5
- barrier homeostasis, SC integrity, and cohesion as well as the bacterial defense mechanisms



Appendages of the Skin

- Derivatives of the epidermis
 - Sweat glands
 - Oil glands
 - Hairs and hair follicles
 - Nails





Sweat Glands

Two main types of sweat glands

- 1. Eccrine sweat glands—abundant on palms, soles, and forehead
 - Sweat: 99% water, NaCl, vitamin C, antibodies, dermcidin, metabolic wastes
 - Sweat is acidic: pH of 4-6

Simple coiled tubular gland-secretory part lies coiled in the dermis and the duct extends to open in funnel shaped pore at the skin surface.

Function in thermoregulation-prevent overheating of the body.





Sweat Glands

2. Apocrine sweat glands —

- Approx. 2000
- Larger the eccrine glands, tend to lie deeper in the dermis, and ducts empty into hair follicles
 - Secrete sweat + fatty substances and proteins
 - Milky or yellowish color
 - Normally odorless until bacteria on the skin decompose organic molecule = source of body odor

Functional from puberty onward (as sexual scent glands?)



Hypodermis/ Subcutaneous

- It is a fat layer beneath the dermis, which is called the hypodermis (hypo means "below"), subcutaneous (sub means "under," cutaneous means "skin") layer, or subcutis.
- Hypodermis is a loose connective tissue that stores fat in the fat cells.
- It acts as a cushioning layer to protect the vital organs from trauma and provides protection against cold. In addition, the fat serves as an energy deposit for the body and defines the body's contours.



