

UNIT-II

INTEGUMENTARY SYSTEM:-

↳ (covering)

- The skin also known as cutaneous Membrane (or) Integument covers the External surface of the body.

- It is largest organ of the body in both S.A. & weight

↓
 2m^2 (or) 22ft^2

↓
4.5 to 5 kg
(10-11 lb)
16% of Total Body wt.

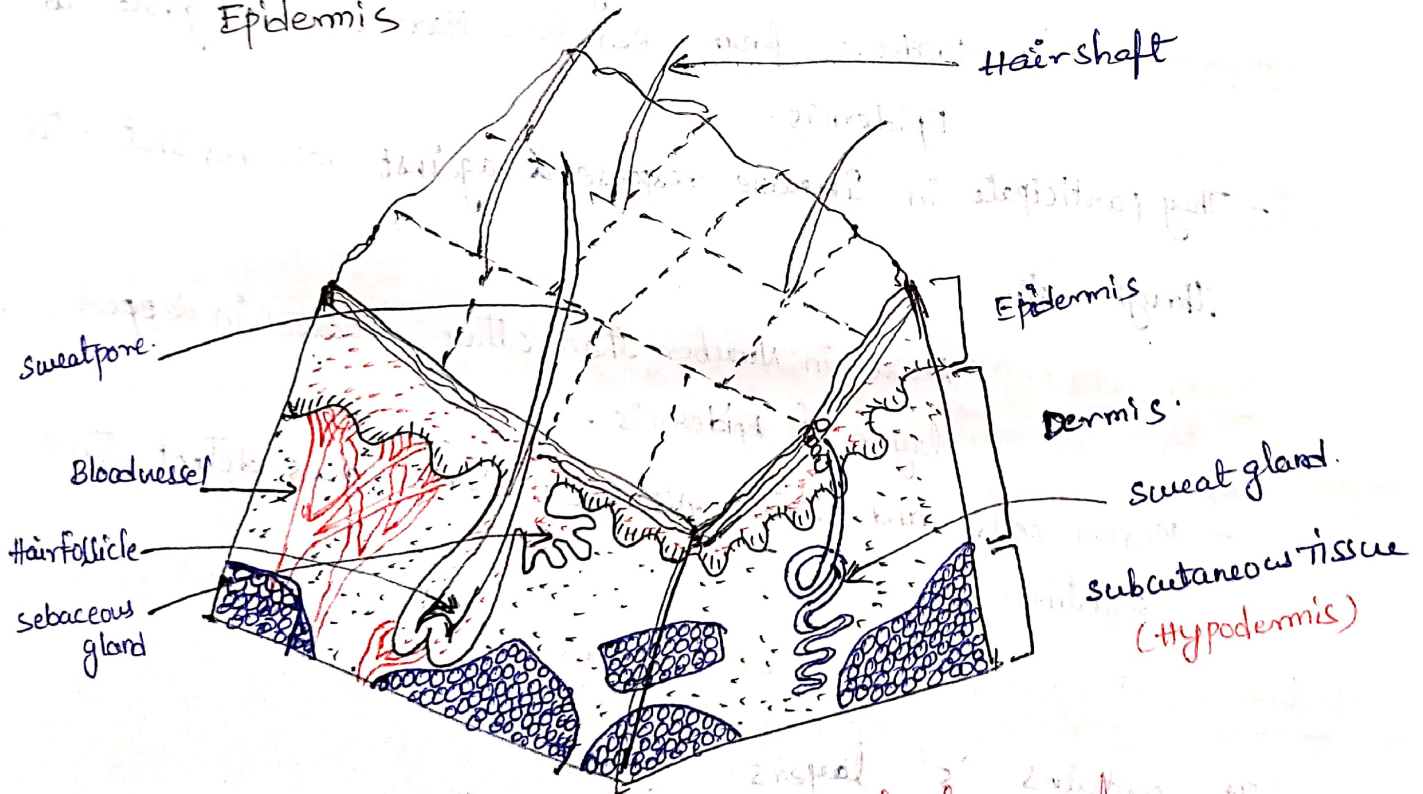
- Structurally the skin consists of two main parts

↳ Superficial, Thinner portion
composed of Epithelial tissue

↳ The deeper, thicker
connective tissue portion

Dermis

Epidermis



sectional view of skin and subcutaneous layer

(1) Epidermis:- It is composed of keratinized stratified squamous

epithelium

- It contains '4' principal types of cells

Keratinocytes

Melanocytes

Langerhans cell

Merkel cell

Keratinocytes :- It is about 90% of epidermal cells (4-5 layers)

↓

produce protein Keratin

→ Fibrous protein protect the skin & underlying tissues from heat, microbes and chemicals.

↓
tough layer

Melanocytes :- is about 8% of epidermal cells.

↓

produce pigment Melanin → It is yellow red (or) brown-black pigment that provide skin color & Absorbs damaging UV light.

Langerhans cells :- produce from Red bone Marrow and migrate to Epidermis.

- They participate in Immune response & against microbes that enter through skin.

Merkel cells :- least in number than other, located in deeper layer of Epidermis.

- Merkel cells and their associated Merkel discs detect touch sensations.

Layers of Epidermis :- (From superficial to deep)

- It contains '5' layers.

- In major body region it contains only '4' layers

(Doesn't contain stratum lucidum)

↓

Thin skin

- In body parts such as palms, soles, finger tips have greater friction

↓
Epidermis made of all '5' layers.

(a) Stratum Corneum :- It is the thickest outermost layer of Epidermis
(horn, cornified superficial layer)

- Made up of 20-30 layers of dead, flat keratinocytes that are continuous
- constantly removed & replaced by new cells from deeper layers.
- It provides
 - (i) strength & Elasticity to the skin.
 - (ii) Lipid impart water-repellant property.
 - (iii) Made up of dead cells so protects deeper layers from Microbes and Injury.

(b) Stratum Lucidum :- It is made up of 4-6 layers of flat, dead keratinocytes found in finger tips, palms & soles. [Thick skin]

- It protects skin from harmful effects of UV rays.
- It helps to reduce friction b/w stratum corneum.

(c) Stratum Granulosum :- It is made up of 3-5 layers of

- flat keratinocytes undergoing Apoptosis (programmed cell death)
- This layer contains dark-staining protein Granules called Kerato-hyalin that convert into keratin
- Keratin & water proofing lipids are synthesized in this layer.

(d) Stratum Spinosum :-

- It contains 8-10 layers of polygonal keratinocytes tightly linked by desmosomes.
- It also contains Melanocytes projections & Langerhans cells.
- This provides strength and support to the skin and helps it to resist Abrasion.

(c) Stratum Basale (or) germinative :-

- It is deepest layer of Epidermis containing one layer of columnar (or) cuboidal keratinocytes.
- In this layer, few stem cells are present which divide continuously to form new cells replace older ones.

(2) Dermis :-

It is deeper thicker layer of the skin containing.

- Collagen fibers (provide strength)
- Elastic " (provide flexibility)
- Reticular " (provide support)

Structurally it has two layers

- Upper papillary layer.
- Lower reticular layer

(a) Upper papillary layer :-

It is composed of loose Areolar CT with thin collagen and fine elastic fibers.

- These dermal papillae increases surface area of contact b/w Epidermis & dermis.

- The dermal papillae contain blood vessels that nourish

Epidermis.

- Few papillae contain sensory touch receptors & free nerve endings.

(b) Lower Reticular layer :-

It is composed of dense CT with fibroblasts, bundles of collagen fibers and Elastic fibers.

(parallel layers)

(Intertwined)

- This layer contains
 - Nerve endings
 - Blood vessels
 - Hair follicles
 - Glands (Sweat & oil glands).

(3) Hypodermis / Subcutaneous layer:-

- It is not actually part of the skin & present below the dermis layer.
- Attach the skin to underlying bones & muscles.
- It helps in the storage of fat.

Functions of the skin:-

There are number of functions of Integumentary system.

(1) Thermoregulation :-

- It is Homeostatic regulation of Body Temperature. (98.6°F)

- Skin contributes to thermoregulation in two ways.

(i) By liberating sweat at its surface in response to high

(ii) Environmental temperature (or) heat produced by Exercise, sweat production from sweat gland increases.

↓
Evaporation of sweat from skin surface, lower Body Temp.

(ii) Adjusting flow of blood in the dermis.

↓
More blood flow through dermis which increase the amount of heat loss from body.

- At low ~~low~~ environmental temperature → production of sweat reduce

↓
→ Blood-flow in dermis reduce.

→ Reduce heat loss from body.

(2) Blood Reservoir:- The dermis has more network of Blood vessels that carry 8 to 10% of total Blood flow in resting Adult.

(3) Protection :- The skin provide protection to the body.

- Keratin protects underlying tissues from microbes, Abrasion, heat and chemicals.

- Lipids released by lamellar granules
↓
Inhibit evaporation of water from skin so protect against dehydration.

- The oily sebum from sebaceous glands
↓

- protect skin & hair from drying out

- contain bactericidal chemicals that kill surface bacteria.

- Acidic pH of sweat retards growth of some bacteria.

- The pigment melanin protect us from damaging UV light.

- Langerhans cells in epidermis alert immune system to presence of harmful microbes.



Macrophages of dermis phagocytize bacterial & viruses.

(4) cutaneous sensations:-

cutaneous sensations arise in the skin including

↙
Tactile sensation



Touch, pressure, vibration and tickling

↘
Thermal sensation



Warmth and coolness

- Another cutaneous sensation is pain.

- There are various nerve endings & receptors distributed throughout skin.

} tactile discs of epidermis & corpuscles of touch in dermis.

(E) Excretion & Absorption

- Skin has a small role in Excretion & Absorption
- As stratum corneum is almost water proof in nature
↓
100 ml of H₂O evaporates daily, physically active person loses much more.

- Sweat is also acts as a vehicle for excretion of small amount of salts, CO₂, low organic molecules < Ammonia, urea.
- Lipid soluble materials like fat soluble vitamins (A, D, E & K), some drugs, O₂ & CO₂ do penetrate the skin.

(6) Synthesis of vitamin D:-

- Skin when exposed to UV rays (about 10-15 min at least twice a week)
↓
stimulate the production of calcitriol (Most active form of Vitamin D) from 7-dehydrocholesterol (lipid-based substance present in skin).
- Vitamin D (calcitriol) is essential for the absorption of calcium & phosphate from food.
↳ Also for the formation & maintenance of bones.

ASSOCIATED GLANDS

Integumentary system has '4' types of Exocrine glands, which secrete their product (or) substance outside the cells & body.

(i) Sudoriferous glands:-

Sweat glands excrete sweat via very small openings at the skin's surface.
- Function of sudoriferous glands is to emit perspiration

to help cool the body off when the

- (ii) Sebaceous glands:
- It is responsible for releasing oil into the hair follicle to help lubricate and protect the hair shaft, keeping it from becoming hard & brittle.

- (iii) Ceruminous glands:
- located in the ear canal. It produce Ear wax known as Cerumen.
 - cerumen prevent entry of dust, bacteria & harmful agent in the ear.

- (iv) Mammary glands:
- There are two Mammary glands located one at each side of the front of the chest wall.

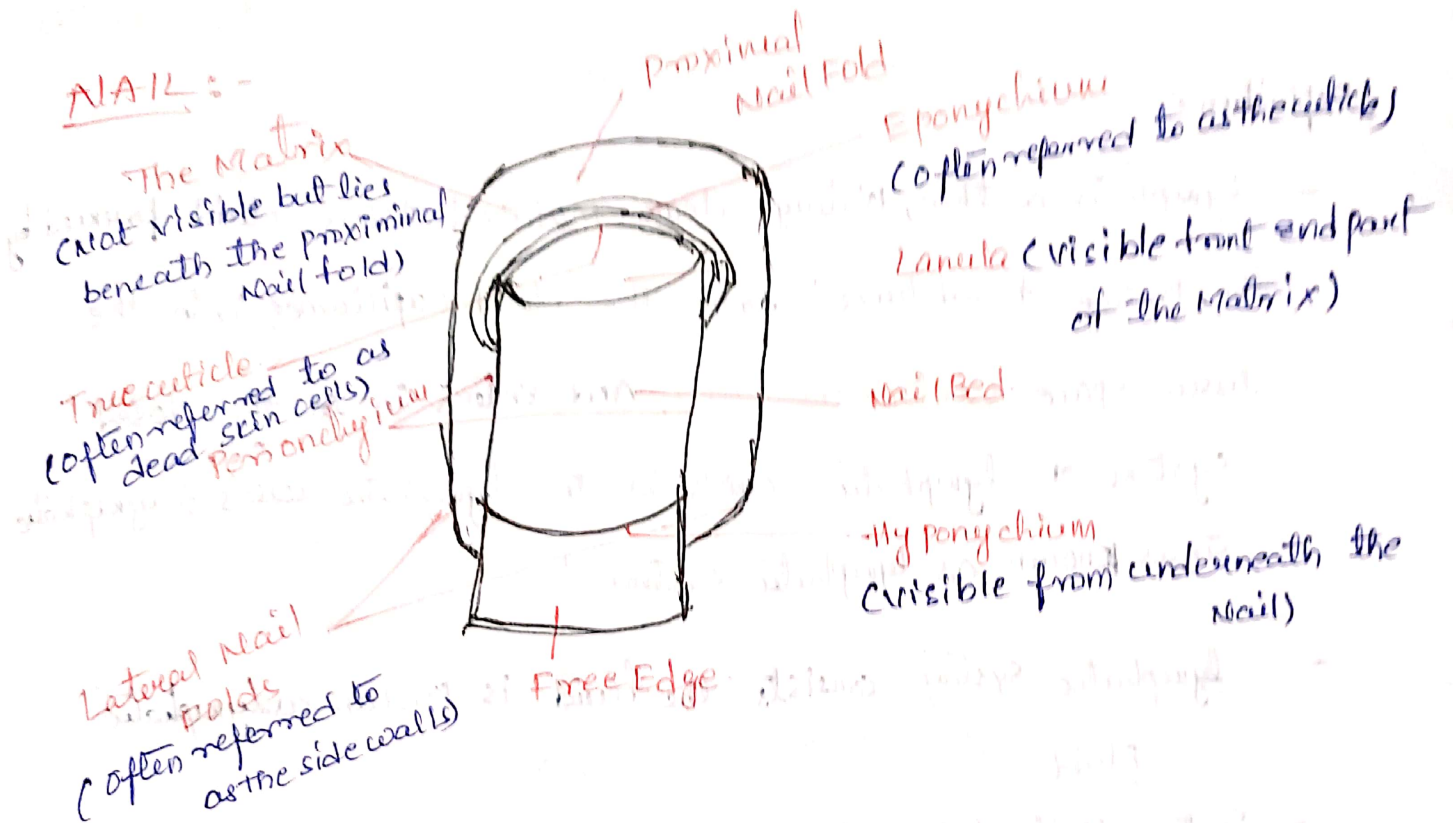
- Both men & women have mammary glands, but in men, these glands are underdeveloped. In females, the glands function to produce breast milk after giving Birth.

HAIR:

- Derived from the epidermis but grows its root deep into the dermis.
- Its structure divides into the externally visible hair shaft and the hair follicle within the skin.
- Hair is primarily composed of a fibrous protein and contains a very small amount of moisture.

- Hair comes from follicles, which are simple organs made up of cells called Epithelial cells.

NAIL :-



Nail consists of several segments, including:-

- (i) Nail plate: The part of the nail that is visible.
- (ii) Nail Bed: The skin that lies beneath the nail plate.
- (iii) Cuticle: The thin line of tissue that is located at the base of the nail and overlaps the nail plate.
- (iv) Nail Folds: The folds of the skin located on the sides of the nail plate.
- (v) Lanula: white-colored half-moon-shaped area located at the base of the nail plate.
- (vi) Matrix: part of the nail that is not visible, located underneath the cuticle, this is the area responsible for the growth of the finger nail.