Chapter - 21
Integumentary System of Human

Skin is present as an outermost covering of human body. Integumentary system is formed of skin and its derived structures. Mesodermal cell of human skin is with melanin pigment. It connects with underlying muscles by connective tissue. Muscular layer of skin combines with coelomic epithelium to form body wall.

Histology of skin

Human skin has two main layers –

I. Epidermis II. Dermis

I. Epidermis

It develops from embryonic ectoderm. Blood vessels are absent in it. Its thickness differs in different body parts. It is much thick in those parts where fraction is more i.e. sole and palm. It is thinnest in eye and cornea.

The epidermal cells are made up of several layers, so it is known as stratified epithelial tissue.

Five layers from inside to outside are found in epidermis

1. Stratum germinatium or stratum Malpighi– It is the inner most layer of epidermis which is situated just outside the dermis. The cells of this layer are living. These are attached by basement membrane derived from dermis. This layer is composed of columnar cells. This layer receives nutrition from blood cells of dermis. The cells of this layer always divide and move upward by producing new cells. At many places the cells of this layer exhibit invaginations on outside. These invaginations are known as **rete pegs.** Pigmented cells are present in between these cells and provide colour to skin. Melanin pigment is filled in them.

2. Statum spinosum- Many layers of polyhedral shaped cells are present at outside of stratum germinativum or stratum Malpighi and exhibits branching. The function of this layer is to provide rigidity to epidermis.

3. Stratum Granulosum– At outside of the stratum spinosum, the cells of 5-6 layers form stratum granulosum. Micro particles of Keratohyaline protein are filled into cytoplasm of the cells of this layer.

4. Stratum Lucidum- This layer is formed by 3-4 layered flat cells situated outside the stratum granulosum. **Eleidin** named substance is filled in their cytoplasm which is formed by decomposition of Keratohyaline. Their nucleus is destroyed. These cells become transparent. It is also known as barrier layer because skin becomes water proof by it.

5. Stratum corneum - It is the outermost layer of epidermis which is made up of flat and thin, scale like cells. These cells become dead because their cytoplasm with eleidin becomes dry and converted into a dead material horn or keratin. This layer is thickest because this layer has 8-10 layers of cells. Stratum corneum is much thicker in sole and palm.

The cells of stratum corneum are dead, flat and thin which move upward due to continuous growth of stratum germinativum and become separate from skin. By this skin remains clean and free from bacteria.

Keratinization – The process of formation of

nonliving keratin in the outer cells of epidermis is known as **keratinization.** In human, different exo skeletal organs such as hairs, nails are formed by this process for protection.

II Dermis–

It is the internal part of skin, developed from embryonic mesoderm. It is near about 2-3 times thicker than epidermis and located below the epidermis. It is flexible and strong part. The maximum, part of this layer is made up of fibrous connective tissue. White collagen fibres, yellow elastic fibres, blood vessels, nerves, unstraited muscle fibres, cutaneous receptors, cutaneous glands, hair follicle like organs are found in this layer.

Dermis is divided into two parts –

(a) Papillary layer- This layer is thin. It has thin collegen fibres, elastic fibres and blood vessels in more. It has villi like projections and epidermis stands on it.

(b) Reticular layer- Reticular layer is thick. Thick fibres are spread in it. This part has cutaneous glands, hair follicles, cutaneous receptors and adipose tissue layer.

A thick layer of adipose tissue is present in lower part of dermis which forms thermo insulating layer. It also helps to keep the skin well shaped.

Derivatives of skin –

Special structures are found in human skin which is known as skin derivatives i.e.

1. Hair and its structure-

Hair develops from living and active Stratum Malpighi layer of epidermis. It has following parts-

(a) Hair follicle- Basal part of hair sunken or embedded in dermis and forms sac like structure. This sac is known as **hair follicle.** The wall of follicle is made of two layers- (i) outer fibrous layer of dermis (ii) Inner cellular layer of epidermis.

(b) Hair root – The basal cells of hair follicle divides actively and root of hair is formed by them. Root is embedded in dermis.

© Hair papilla– A hollow pit is found at the base of hairfollicle in which blood capillaries of dermis form a dense bunch. This bunch is known as **hair papilla.** Supply of nutrients to root is carried by blood capillaries of this papilla. Inside the follicle the upper root part of papilla is swollen as tumor to form bulb.

(d) Hair shaft– The solid part of hair comes out from dermis is known as hair shaft. It is dead part of hair because reaching up to this part hair cells become keratinized. Hair shaft has three parts-

(i) Cuticle- It is the outermost layer of hair. It is much thin and unicellular thick layer. Its cells are scale shaped and stratified on each other.

(ii) Cortex - It is middle layer. It has several layers of cells. The cells of this layer have pigmented particles, by which hairs have colour. On account of deficiency of pigmented particles air is filled in cortical cells, due to this the hair looks white in colour.

(iii) Medulla- It is main and inner most part of the hair. Polyhedral cells are compactly arranged in it. These cells form axis of hair.

(e) Arrector pili muscles - These are special muscles, made of unstriped muscle fibres. These muscles are coming from hair follicle, attached with dermis and regulate movement of hairs. Hairs become erect when these muscles contract. Erection of hairs due to fear or cold is controlled by these muscles. Around these muscles nerve fibres are surrounded.

(2) Cutaneous glands–

Skin glands are exocrine because they have ducts which opens on the surface of epidermis. These glands are formed by invagination of Malpighi layer of epidermis into the dermis.

Cutaneous glands are as follow –

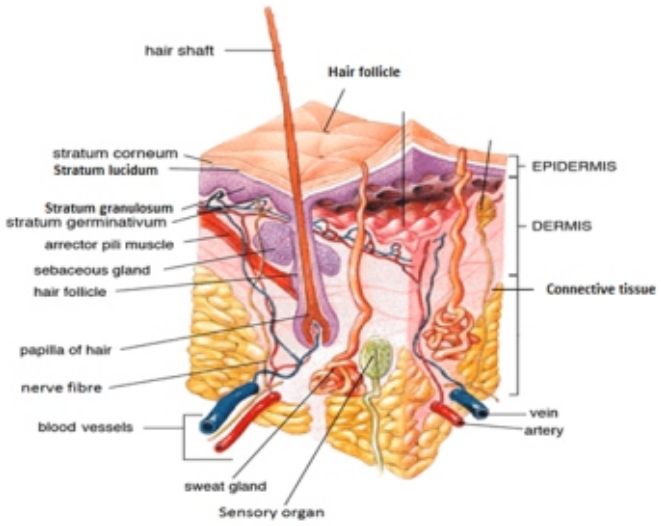

Fig. 21.1 : V.S. of skin of human

(a) Sweat glands - These glands are simple tubular glands. Its lower coiled part is deeply embedded in dermis. Its fine duct opens at outside on the epidermal surface. These glands secrete sweat. Sweat contains water, some salt, some quantity of urea and CO_2, due to these reasons sweat is salty. These are eccrine or merocrine type glands whose secretory material comes out through cell membrane. Approximately 25 lac sweat glands are found in human. Apocrine sweat glands are found near eye lids, genital organs, anus and nipples of mammary glands in human. Sweat glands are found in largest number in palms, soles and armpits of human.

The main function of sweat glands is thermo-regulation of body.

(b) Sebaceous glands– These glands are found near hair roots and follicles and formed from folding of epithelium of follicle. These glands open in follicle. Oil glands are holocrine. Gland cells are broken and move out with its secretion when filled with secretion. Oil glands are branched and alveolar in structure. These glands form thick milk like oily substance which is known as **Sebum.** Sebum makes hair shaft smooth and skin remains smooth and water resistant by it.

Oil glands are found in all over the body, but absent on palms and soles. Hairs are not found on lips, glans of penis, nipples of mammary gland but these glands are found. These glands may synthesize Vitamin-D in the presence of sun light.

(c) Mammary glands- These glands are present in thoracic part of human being. These glands are situated in deep of dermis. Their structure is compound tubular or compound alveolar type. These glands are apocrine type. Mammary glands are active in female and secrete milk for nourishment of child. The growth of mammary glands is controlled by progesterone and estrogen hormone and milk secretion is by oxytocin hormone. Generally mammary glands are formed by modified oil glands.

(d) Ceruminous glands- These are found in skin of external auditory meatus. These are coiled and tubular glands. These are modified sweat glands. These glands combine with sebaceous glands and secrete cerumin named ear wax. This cerumin protects ear tympanum.

(e) Perineal glands– These are modified sebaceous glands. These glands are found near anus and urinogenital aperture. These secrete odour substance so these are known as scent glands. These are apocrine type glands.

(f) Meibomian glands- These are formed by modification of sebaceous glands. These glands are found below eye lashes of eye lids. These secrete oily substance which lubricates cornea. It forms a thin film on cornea and protects it.

(g) Zeis glands– These are also modification of sebaceous glands. These glands are also found in follicles of eye lashes. These also secrete oily substance which helps to keep eye lashes smooth.

Functions of skin

1. Protection of body- It forms protective covering on the body which saves internal organs from external injury, attack, shocks etc. It controls entry of harmful bacteria, worms, fungus etc. and protects from them. It protects the soft organs of the body with the help of skin derived structures like hairs, nails etc. Skin acts as water proof. It protects from ultraviolet rays present in strong light.

2. Temperature regulation of body– Human is homothermal animal. Hence body temperature remains constant in cold and hot environment. Temperature of healthy person is 98.4^0 F. Presence

of fatty layer below the skin makes thermo insulator layer. Sweat glands provide cooling system. Sweat glands become more active by increasing body temperature and secrete sweat which evaporates in the form of vapour and keeps body cool. Temperature is regulated under instructions of thermostatic center situated in hypothalamus.

3. Shape of body– Skin helps to maintain body shape.

4. Storage of food material– Fat stored in adipose tissue of skin acts as food storage.

5. Secretion of useful substances – Various oily glands found in skin secrete useful substances i.e. ear wax, milk, vitamin D etc.

6. Excretion – Salt, urea and CO_2 are found in sweat secreted by skin. Thus it helps in excretion by removing them outside the body.

7. Locomotion- Skin is helpful in locomotion due to its flexibility.

8. Skeleton formation– Membranous bones are formed from connective tissues of dermis of skin.

9. Absorption – Skin is permeable for oil etc.So skin absorbs it by its massage and benefits the tissues.

10. Reception of stimuli– Various receptors present in dermis of skin receives sensation which makes it as sensory organ.

11. Formation of teeth– Some parts of teeth is formed from dermis of skin. Teeth are helpful in chewing food.

12. Sexual attraction– Colour of hair, configuration and scented material of Perineal glands are helpful for sexual attraction.

13. Regeneration– At the time of injury epidermis of skin has great capacity of healing wounds by regeneration.

Many important functions of the body are performed by the skin hence it is called as**"Jack of all trades"** of body.

Important points

1. Muscular layer of skin and coelomic epithelium jointly form body wall in human.
2. Human skin has two main layers (i) Epidermis (ii) Dermis.
3. Epidermis develops from embryonic ectoderm whereas dermis is developed from embryonic mesoderm.
4. Epidermis has five sub- layers – (i) Malpighi layer (ii) Spinosum layer (iii) Granulosum layer (iv) Lucidum layer (v) Corneum layer.
5. Malpighi layer of epidermis is the inner most layer which is located just outside the dermis. This layer is made up of columnar cells. Cells of this layer are living.
6. "Keratohyaline" granules of protein are found in cytoplasm of the cells of Granulosum layer.
7. The substance "Eleiden" is filled in the cells of Lucidum layer.
8. Corneum layer is the outermost layer of epidermis which is made up of flattened and thin scale cells. These cells are dead.
9. The colour of human skin is due to presence of granules of melanin pigment.
10. Dermis developed from embryonic mesoderm is the inner most part of skin. It is situated below the epidermis.
11. Most of the part of dermis made of fibrous connective tissue. It has white collagen fibers, yellow elastin fibers, blood vessels, nerves, unstrained muscle fibers, cutaneous glands, hair follicles etc.
12. Skin is helpful in important functions such as protection, temperature regulation, secretion, storage of nutritive substances, skeleton formation, stimulation receiving, excretion, development of teeth, body shape, sexual, attraction, locomotion and regeneration etc. Hence it is known as organ of "Jack of all trades"

Practice Questions

Multiple choice Questions –

1. Human skin develops from –
   a. Mesoderm b. Ectoderm
   c. Ectoderm and Mesoderm
   d. Ectoderm and Endoderm
2. Outermost layer of human skin is known as –
   a. Stratum corneum
   b. Stratum granulosum
   c. Stratum Spinosum
   d. stratum lucidum
3. The substance eleidin is found in –
   a. Stratum granulosum
   b. Stratum spinosum
   c. Stratum corneum
   d. Stratum lucidum
4. The substance Keratohyaline is found in –
   a. Stratum spinosum
   b. Stratum granulosum
   c. Stratum germinatum
   d. Stratum corneaum
5. Derevative structures of epidermis are –
   a. Nails b. Sweat glands.
   c. Sebaceous glands are d. All of above
6. Sebaceous glands are -
   a. Apocrine b. Merocrine
   c. Holocrine d. Eccrine
7. Barrier or Resistant layer of skin is known as –
   a. Stratum corneum b. Statum lucidum
   c. Stratum granulosum d. Stratum spinosum
8. Sweat glands are –
   a. Apocrine b. Merocrine
   c. Eccrine d. None of above
9. Pigmented granules in hair are found in –
   a. Cortical layer b. Cuticle
   c. Medulla d. All of above
10. Fatty layer found below the skin is helpful in –
    a. Making skin well shaped
    b. Making thermo resistant layer
    c. Food storage d. All of the above

Very short Answer Questions-

1. Which vitamin is synthesized from skin?
2. Where are meibomian glands found in human body
3. Milk glands of human are modification of which gland?
4. Which type of glands are mammary glands?
5. Why skin is known as "Jack of all trades"?
6. Colour of human skin is due to the presence of which pigment?
7. Dermis is originated from which layer?
8. Which protein is found in layer of dermis?
9. Write the name of oily substance found in sebaceous gland?
10. Write the name of muscles which controls movement of hairs?
11. What is 'Rate Pegs'?

Short Answer Questions-

1. Describe various layers of epidermis found in human.
2. Draw a labelled diagram of vertical section of human skin.
3. Write structure and function of hair found on skin.
4. Describe oily glands found in human skin.
5. Describe sweat glands.
6. Describe mammary glands.
7. Write five functions of skin.
8. What is keratinization? Which organs are formed from it, name them.
9. Write short notes on arrector pili muscles.
10. Describe cutaneous glands related with eye and ear.
11. Where are scent glands? What is their main function?

Essay type Questions

1. Describe with diagram, different parts of human skin.

2. Which are derivatives of human skin, Describe?
3. Describe in brief different glands found in human skin.
4. Why the skin is known as "Jack of all trades" organ? Write your views in detail.

Answer Key-

1. (c) 2. (a) 3. (d) 4. (b) 5. (d)
6. (c) 7. (b) 8. (c) 9. (a) 10. (d)