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HUMAN ANATOMY AND PHYSIOLOGY – I

UNIT 2

TOPIC :

- **Integumentary system**

  Structure and functions of skin

Integumetry System

- The Word Integumetry Means Covering
- The integumentary system is the organ system that includes the skin, hair, nails, and various exocrine glands (such as sweat and sebaceous glands).
- It forms the outermost covering of the body and plays a crucial role in protection, regulation, sensation, and homeostasis.

Skin

→ Skin is the largest organ of human body.

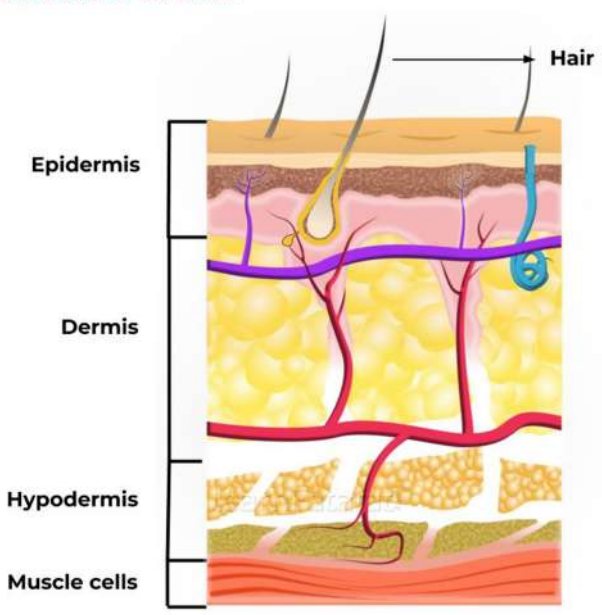
→ It is also known as the integument.

→ It has a surface area of 1.8m² and comprises of 16% of the total body weight.

→ Skin performs various functions out of which, the most important one is its action as a barrier to the external environment during selective inward and outward movement of water, electrolytes, etc.

→ It also provides protection by restricting the entry of microbes, UV rays, harmful chemicals, and mechanical wear and tear.

→ Skin is made up of three distinct structural layers, viz., epidermis, dermis, and hypodermis.



It is Composed of Three Layer

1. Epidermis
2. Dermis
3. Hypodermis

1. Epidermis

→ The epidermis is the outermost layer of the skin and acts as the body's first line of defense against the external environment.

→ It is composed mainly of stratified squamous epithelial cells and is avascular, meaning it lacks blood vessels.

→ Nutrients are supplied to the epidermis from the underlying dermis by diffusion.

→ The primary cell type found in the epidermis is the keratinocyte, which produces keratin, a tough, fibrous protein that helps waterproof and protect the skin.

→ Other important cells include melanocytes, which produce melanin (the pigment that gives skin its color and protects against UV radiation), Langerhans cells, which are involved in immune response, and Merkel cells, which are associated with the sense of touch.

→ The epidermis is arranged in five distinct layers (from innermost to outermost):

- **Stratum basale (germinativum)** – A single row of actively dividing cells attached to the basement membrane; contains melanocytes and Merkel cells.
- **Stratum spinosum** – Several layers of keratinocytes linked by desmosomes; provides strength and flexibility.
- **Stratum granulosum** – Cells begin to die and produce granules of keratohyalin and lamellar bodies, important for waterproofing.
- **Stratum lucidum** – A thin, clear layer of dead cells found only in thick skin (like palms and soles).

- **Stratum corneum** – The outermost layer composed of flattened, dead keratinized cells; this layer is continuously shed and replaced.

2. Dermis

→ The dermis is the middle and thickest layer of the skin, located beneath the epidermis.
→ It is composed mainly of dense connective tissue, which provides strength, elasticity, and flexibility to the skin.
→ Unlike the epidermis, the dermis is vascularized—it contains a rich supply of blood vessels, lymphatic vessels, nerve endings, and various skin appendages such as hair follicles and glands.
→ The dermis consists of two distinct layers:

- **Papillary layer**: This is the upper, thinner layer of the dermis. It is made of loose areolar connective tissue and forms projections called dermal papillae, which interlock with the epidermis to strengthen the connection between the two layers. This layer contains capillaries, pain receptors, and Meissner's corpuscles, which are responsible for the sensation of light touch.
- **Reticular layer**: This is the deeper and thicker part of the dermis. It is composed of dense irregular connective tissue, rich in collagen and elastin fibers, which give the skin strength and elasticity. It houses important structures such as sweat glands, sebaceous (oil) glands, hair follicles, blood vessels, deep pressure receptors (Pacinian corpuscles), and arrector pili muscles (small muscles attached to hair follicles that cause goosebumps).

3. Hypodermis (Subcutaneous Layer)

- The hypodermis, also known as the subcutaneous layer, is the deepest layer of the skin, lying beneath the dermis. It is primarily composed of loose connective tissue and adipose (fat) tissue. This layer functions as a protective cushion, insulator, and energy reservoir for the body.
- The adipose tissue in the hypodermis stores fat, which helps in temperature regulation by insulating the body and protecting internal organs from mechanical shocks. The loose connective tissue connects the skin to underlying structures such as muscles and bones, allowing the skin to move flexibly over them.
- The hypodermis also contains larger blood vessels and lymphatic vessels that branch into the dermis, as well as nerves and specialized sensory receptors like pressure sensors (Pacinian corpuscles).
- Overall, the hypodermis plays an essential role in shock absorption, energy storage, insulation, and anchoring the skin to deeper tissues. It also contributes to the overall contour and shape of the body.

Functions of Skin

The skin performs several vital functions essential for maintaining health and homeostasis. As the body's largest organ, it acts as a protective barrier while supporting various physiological roles. Below are the main functions of the skin:

- **Sensation:** For the detection of stimuli of temperature, touch, pressure, and pain there are numerous receptors and nerve endings present on the skin.
- **Protection:** The skin acts as a physical barrier which helps in protecting the deep-seated organs and tissues from microbial invasion; dehydration, UV radiation, and physical absorption.
- **Thermoregulation:** An increase in body temperature results in sweating and when this sweat gets evaporated from the skin surface, it cools the body (lowers the body temperature). On the other hand, in case of decreased body temperature, sweat production gets reduced which helps in the conservation of heat in the body.)
- **Immunity:** It provides immunologic information obtained during antigen processing to the appropriate effector cells in the lymphatic tissues.
- **Excretion:** The sweat released from skin excretes out the toxic substances, ions, and several other compounds.
- **Drug Delivery Route:** Skin acts as a route for delivery of drugs (transdermal patches). The transdermal drug delivery system involves the absorption of drug through systemic circulation by transdermal patches. The lipid soluble drugs and substances with low molecular weight, e.g., nitroglycerin, hormones, scopolamine, nicotine, etc., easily permeate through the skin.
- **Endocrine Function:** Skin helps in biosynthesis of Vitamin D. Ultraviolet light is essential for the first stage of Vitamin D formation.