

Skin

Structure and Function of Skin

Skin is the outermost covering of the body and covers the entire body.

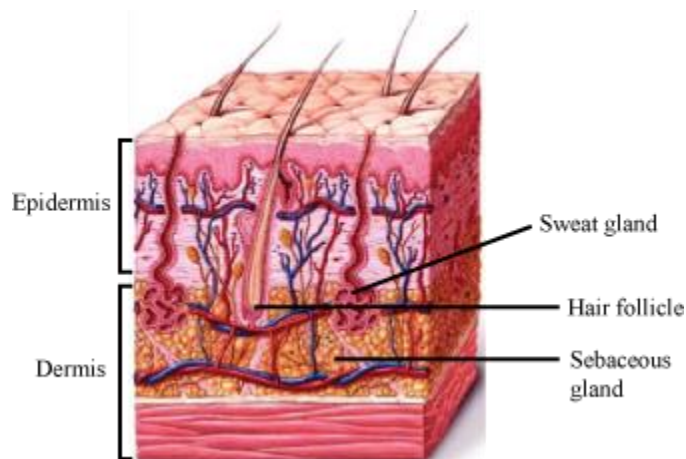
It has a surface area of 1.5-2 meters and accounts for 12-15% of the total body weight.

The skin along its derivatives constitutes the integumentary system.

Structure of the Skin

Skin is made up of two main components:

- Skin proper
- Skin derivatives



Skin Proper

The skin proper is composed of two layers:

- Epidermis
- Dermis

Epidermis

The epidermis is the outer layer of the skin, which is formed by stratified squamous epithelium layers, which are arranged in horizontal layers. It is considered to be a lifeless tissue as it lacks any blood vessels.

The epidermis contains keratin, which makes it tough. The epidermis is made up of three sub-layers, which are:

- **Outermost cornified layer (stratum corneum)** - This layer is made up of dead cells containing keratin. This layer forms a tough outer covering. The cells in these layers get worn out and are continuously replaced. This layer provides resistance against mechanical damage, bacterial infection and loss of water by evaporation.
- **Granular layer**- It consists of flattened living cells and replaces the cornified layer when its cells get worn out.
- **Malpighian layer** – It is the innermost layer of the epidermis. Cells in this layer are continuously dividing. This layer contains the pigment melanin, which determines the skin color.

Dermis

It lies below the epidermis and is thicker than the epidermis. The dermis has two main layers – the **papillary layer** consisting of **dermal papillae** and the **reticulate layer**. This layer consists of elastic connective tissue, blood vessels, sweat glands, oil glands, and hair follicles. The dermis also has specialized cells called **fibroblasts**, which help in the production of collagen and elastin fibres.

Functions of the Skin

The most important functions of the skin are:

- Protection – The skin provides protection to the body from mechanical injury, ultraviolet rays, from disease-causing microbes, and prevents desiccation.
- Temperature regulation – The skin helps in the maintenance of body temperature at a constant.
- The skin contains numerous sense receptors, which help in perceiving the surroundings.
- The skin is also involved in the synthesis of vitamins such as Vitamin D.
- The skin also helps in disposing of the excess water and salt by evaporation.

Can you tell the main determinant of the human skin colour?

Melanin is the pigment produced by certain glands in the skin. The amount of melanin present in the cells of the epidermis decides the skin colour. It is an effective absorbent

of light and protects the skin from the UV rays. The more the melanin present in the skin, the darker will be the colour of the skin.

There are some abnormalities related to skin pigmentation as well. These include:

- **Leucoderma (Vitiligo):** Melanin is lost at some regions of the body, resulting in appearance of white patches. Exact cause of this disease is yet unknown.
- **Albinism:** Melanin is completely absent all over the body, including hair, eyebrows, eyelashes, and sometimes even in the iris. It is a recessive trait caused due to inheritance.

Derivatives of the Skin

Derivatives are the structures, which are formed from the same precursors. Some of the derivatives of skin are:

- Hair
- Sebaceous glands
- Sweat glands
- Nails
- Mammary glands

Hair

Hair is formed in the hair follicles, which are the invaginations of the dermis. A hair consists of three parts:

- **Hair shaft**, the part that projects out from the skin and extends slightly below the surface of the epidermis
- **Hair root**, the part that is embedded within the dermis. It is enclosed by **hair follicle**.
- **Hair bulb**, which is the expansion of the lowest part of hair root. It contains a projection of the dermis, called **hair papilla**, with capillary blood supply.

The growth and elongation of the hair is ensured by the hair bulb and the hair follicle.

The hair colour depends on the quantity of melanin present. Hairs are supplied with nerves and hence, they are sensitive to touch. Hairs of the eyelashes, nose, and ears

help to prevent the entry of germs into the skin.

During winters, you must have experienced the raising of hairs at their ends. Do you know how this happens?

The raising of hairs at their ends, or goose-bumps, or **piloerection**, is caused by erector muscle of the hair. It runs obliquely between the hair follicle and the outer part of the dermis.

The contraction of this muscle at one end pulls the hair to a somewhat vertical position and depresses the epidermis, causing the wrinkled appearance of the skin.

Sebaceous Glands

The sebaceous glands produce oily secretion, called sebum and they open into the hair follicles. This oily secretion helps to prevent the dryness of the hair and skin. Some modified sebaceous glands are found at the margins of the eyelids as well. These are known as **meibomian glands**.

Their oily secretions lubricate margins of the eyelids and prevent the overflow of the tears. **Ceruminous glands** are the another modification of sebaceous glands which are found in the auditory canal. They secrete earwax or **cerumen**, which lubricates and protects the delicate parts of the ear.

Some common problems related to sebaceous glands are:

- **Pimples:** Caused by sebum accumulation, that results in bacterial growth as it is nutritive
- **Acne:** Caused by inflammation of sebaceous glands under hormonal influence
- **Black head:** Caused by oxidation of melanin and accumulated sebum

Sweat Glands

They are coiled, tubular structures connected to the skin by ducts. They produce sweat, which is a weak solution of sodium chloride with some urea and lactic acid.

The sweat produced is passed on to the epidermis, where it evaporates. This phenomenon cools the skin.

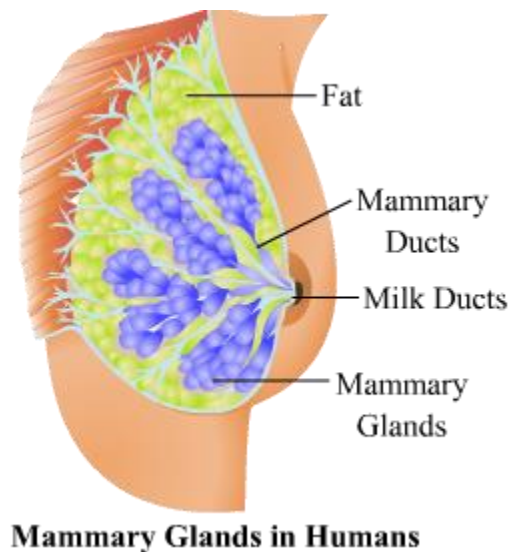
Nails

Nails are hard, keratinous structures, which arise from the nail root, which lies in the dermis. They consist of three parts:

- Plate: Hard, outer part of the nail made up of dead, keratinized cells
- Bed (root): Lies below the nail plate
- Matrix: Lies just below the skin surface at the base of the nail; produces new cells causing the growth of the nails

Mammary Glands

They are modified sweat glands, which produce milk. The presence of mammary glands is a unique feature of mammals. They are present both in males and females, but in males, they are present in the rudimentary state. In females, they enlarge at the time of puberty as breasts. The mammary glands become active after pregnancy.



Mammary Glands in Humans

Role of Skin in Heat Regulation

Within the body, heat is produced as a result of the various metabolic activities. Some of the major sources of heat production in our body are:

- Oxidation of glucose occurring specially in liver
- Vigorous activity of muscles
- Ingestion of hot food and beverages

This heat is transported to rest of the body through the blood. The extra heat is radiated from the skin's surface.

Heat is lost from body through the skin by following ways:

- Convection, radiation, and to a lesser extent by conduction
- By evaporation of sweat from the body surface

- Through expired air from the lungs
- Through urine and faeces

Poikilothermic Animals

Some animals such as amphibians, reptiles, and fishes are unable to balance the amount of heat produced with the amount of heat lost. They do not have a constant body temperature. These animals are called poikilothermic animals or ectotherms. They obtain heat from the surroundings.

Homeothermic Animals

Birds and mammals can maintain a constant body temperature irrespective of the outside temperature by generating body heat metabolically. These animals are called homeothermic animals or endotherms.

With their capability to maintain body temperature, they are capable of remaining active throughout the year.

How does our body regulate the body temperature?

The hypothalamus situated in the brain monitors the body temperature and also receives information about the temperature changes in the environment.

When the body temperature begins to rise, the body performs the following functions to balance it.

- The arterioles of the skin are dilated (**vasodilation**) to allow the flow of more blood so that more heat is lost by radiation.
- The activity of the sweat glands is increased.
- Breathing rate increases.
- The metabolic rate slows down so that less heat is generated.
- On a warm day, when the external temperature is high, nerve impulses are sent to the hypothalamus from the temperature receptors and the excess heat is lost by sweat.
- On a cold day, the arterioles of the skin are constricted (**vasoconstriction**), so that the body retains the heat produced within. The metabolic rate increases and sweat glands become less active.