The skin in man is the largest of all body organs. There are many structures and glands derived from the skin. Hence the skin along with its derivatives forms the **integumentary system** of the body.

**Functions of the skin**
- It is the outermost protective covering of the body.
- It perceives changes in the surroundings.
- It regulates body temperature.
- It plays an important role in regulating the water content in our body and excretion.
- It synthesizes Vitamin D.
- As it performs a variety of functions it is called “**Jack of all trades**”.

**STRUCTURE OF THE SKIN**

The skin can be studied under two heads:
- Skin proper
- Skin derivatives

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**EPIDERMIS** – is the outermost part of the skin without any blood capillaries.

**DERMIS** – is the inner thick, living layer which has blood capillaries, sensory corpuscles and is made of connective tissue.

Given below is a table with the different regions of the epidermis and dermis.
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CORNIFIED LAYER</th>
<th>GRANULAR LAYER</th>
<th>MALPIGHIAN LAYER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outermost layer</td>
<td>Middle layer of the epidermis, below cornified layer</td>
<td>Innermost, deepest layer</td>
<td></td>
</tr>
<tr>
<td>of the epidermis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STRUCTURE</td>
<td>1. Consists of several layers of dead squamous epithelial cells.</td>
<td>1. Consists of 3-5 rows of squamous epithelial cells, whose nucleus is</td>
<td>1. Consists of living cells, capable of cell division.</td>
</tr>
<tr>
<td></td>
<td>2. Contains a waterproof protein called keratin. This is also found in nails,</td>
<td>in a state of disintegration.</td>
<td>2. Cells produced by this layer move upwards and become a part of the granular</td>
</tr>
<tr>
<td></td>
<td>hair, horns and hoofs.</td>
<td>2. Contains granules called keratohyalin which is responsible for the</td>
<td>layer. Some cells of this layer migrate downwards to form sweat glands and</td>
</tr>
<tr>
<td></td>
<td>3. The upper layers of these cells are shed continuously and are replaced by</td>
<td>formation of keratin.</td>
<td>sebacious glands.</td>
</tr>
<tr>
<td></td>
<td>cells from the granular layer.</td>
<td>3. The upper layers of these cells are pushed upwards to replace the cells of</td>
<td>3. This layer contains a pigment called melanin which determines skin colour.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the cornified layer.</td>
<td></td>
</tr>
<tr>
<td>FUNCTION</td>
<td>Is tough and protects the underlying tissues from mechanical damage, bacteria</td>
<td>Cells of this layer are pushed upwards to replace the cells of the cornified</td>
<td>The pigment melanin gives colour to the skin and protects the body from the</td>
</tr>
<tr>
<td></td>
<td>invasion and dehydration.</td>
<td>layer.</td>
<td>harmful effects of the UV rays of the sun.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**DERMIS**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PAPILLARY REGION</th>
<th>RETICULAR REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper region of the dermis, below the malpighian layer.</td>
<td>Lower region of the dermis, below the papillary region</td>
</tr>
</tbody>
</table>

**STRUCTURE**
- Made of loose connective tissue and elastic fibres which make this part tough and flexible.
- Its surface is greatly increased by small finger like projections called **dermal papillae**.
- Contains blood capillaries and nerve endings.
- Blood capillaries provide nourishment.
- Made of dense connective tissue packed with interlacing bundles of fibres.
- Spaces between the fibres are occupied by adipose tissue, nerves, hair follicle, sebaceous and sweat glands.
- It is attached to the underlying organs such as bones and muscles by the subcutaneous layer.

**FUNCTION**
- Sensory nerve cells which are sensitive to touch called **Meissner's corpuscle** are present here.
- The dermal papillae, which project into the epidermis increases friction for grasping.
- Sensory cells which are sensitive to pressure called the **Paciniann corpuscle** is found here.
- The sweat gland regulates body temperature.
- The sebaceous gland produces sebum which keep the skin soft and supple. It also prevents the skin from drying up.
- The subcutaneous layer provides insulation and protects the body from mechanical injuries.

> **What is melanin? What is its importance?**
Melanin is a pigment produced by cells called melanocytes found in the malpighian layer of the epidermis.
Melanin gives the skin its color. Different quantities of this pigment lead to various skin colouration.
Melanin also protects the skin by absorbing the ultra violet rays of the sun.
When the skin is subjected to sunlight for a prolonged duration, it results in **tanning**. Amount of melanin produced is directly proportional to exposure to sunlight.

> **Name the two diseases associated with skin pigmentation.**
Two diseases associated with skin pigmentation are – **Albinism** and **Leucoderma**.

> **Differentiate between Albinism and Leucoderma.**
**Albinism** – is a hereditary disease in which there is a complete absence of melanin (pigmentation) in the body. The skin of an Albino looks pinkish and the hair, eyebrows and eyelashes look golden.
**Leucoderma** – it is a condition in which skin pigmentation is lost in patches of various sizes from different parts of the body. It is a harmless disorder and the cause is unknown.
SKIN DERIVATIVES

GLANDS
Two kinds of glands are associated with the skin they are 1. The sweat gland 2. The sebaceous gland

1. THE SWEAT GLANDS
Structure and location: They are highly coiled glands found in the deeper layers of the dermis. They are the derivatives of the malpighian layer.

The sweat glands open on the surface through a long duct as small openings called sweat pore.

Each sweat gland is surrounded by a network of capillaries

Function: Sweat glands secrete sweat under hot conditions. The gland cells extract water and excess salts from the blood which form sweat. The sweat comes up to the body surface, evaporates and causes a cooling effect. Hence, sweat glands play an important role in excretion as well as temperature regulation of the body.

Composition of sweat: It is made of water, mineral salts and urea.

2. THE SEBACEOUS GLANDS
Structure and location: They are lobulated glands consisting of many sacs that open into the hair follicle through a common duct.

Function: The glandular epithelium of these cells produce an oily substance called sebum. This lubricates the hair, makes it oily and waterproof.

The sebum keeps the skin soft and supple.

It prevents the skin from drying.
It kills bacteria present on the surface of the skin.

**Composition of sebum:** it is a mixture of fats, cholesterol, proteins and inorganic salts.

### 3. THE MAMMARY GLANDS

They are modified sweat glands. They are functional in females and nonfunctional in males. It produces milk after the birth of a child to nourish the new born. It remains active till the suckling continues.

Mammary glands consist of an elaborate system of alveoli that open at nipples as small pores. The glandular cells produce milk which is a complete food that nourishes the new born.

**HAIR**


1. **Shaft** – is a part of the hair that projects above the skin surface.

2. **Root** – is the part of the hair in the dermis. It is enclosed in a hair follicle. The wall of the hair follicle bulges out to form one or more sebaceous gland or oil gland. To each hair follicle is connected a smooth muscle called **erector pili**. This helps in squeezing out oil from the oil glands as well as in the movements of the hair.

3. **Bulb** - at the base of the hair follicle is present a swollen, inverted cup like structure called hair bulb. The cells here are constantly dividing as this is the only living part of the hair. This part of the hair is responsible for the growth of the hair.

4. **Papilla** - in the hair bulb is present a knot like structure made of blood vessels and is called **papilla**. The rapidly growing hair is nourished by this papilla.

Colour of the hair is due to the varying amounts of melanin pigment. The grey of the hair is caused due to minute spaces formed in the hair when the pigment is lost.

- **What is goose flesh?**
  - The erector muscle is a smooth muscle extending from the dermis of the skin to the side of the hair follicle. In its normal position, the hair is arranged at an angle to the surface of the skin. Under conditions of cold or stress (fear), these muscles contract and pull the hairs into a vertical position resulting in what is commonly called "goose flesh" or "goose bumps".

**NAILS**

Nails are formed by the epidermis present at the tips of all fingers and toes. These are very hard, slightly arched plates.

The nail is composed mainly of the plate, bed and matrix.

- **Plate** – is the hard outer part of the nail made up of dead, keratinized cells.

- **Bed** – lies below the plate. It appears pinkish in color due to the presence of blood vessels below.

- **Matrix** – is the base of the nail lying below the skin surface. It produces new cells which push out the older ones towards the tip of the nail.
SKIN AND TEMPERATURE CONTROL

Humans are warm blooded or endothermal. This means that their body maintains a constant body temperature which is usually about 37°C. This is achieved by a group of reflex responses that are controlled by a region in the brain called the hypothalamus.

a. **Vasodilation**
   1. When outside temperatures are high and the blood temperature increases, the hypothalamus stimulate nerves that cause the peripheral blood vessels of the skin to dilate.
   2. Thus, the blood flow to the skin is increased.
   3. As a result, the sweat glands extract more water and salts from the blood and sweat production is increased.
   4. Evaporation of the sweat causes cooling. This lowers and returns the body temperature to normal.

b. **Vasoconstriction**
   1. When outside temperatures are low and the blood temperature falls below normal, the hypothalamus stimulate nerves that cause the peripheral blood vessels of the skin to constrict.
   2. As a result, the flow of blood to the skin decreases.
   3. The sweat glands extract less water and salts from the blood. Thus, less or no sweat is produced.
   4. Heat loss is reduced and the internal body temperature is raised.

➢ What do the terms ectothermal and endothermal mean?
   **Ectothermal** animals are those whose body temperature changes with the temperature of their surroundings. They are also called cold blooded animals.
   Eg. Fish, amphibians and reptiles
   **Endothermal animals** are those whose body temperature remain constant and do not change with the temperature of their surroundings. They are also called warm blooded animals.
   Eg. Mammals and birds.

➢ What is a sunstroke?
   Heatstroke or sunstroke is a condition in which sweat production is unable to keep pace with its evaporation in very hot winds. This results in the rise in body temperature (fever) which may
sometimes be fatal. Drinking a lot of water and taking a little more salt in summer is a good precaution against heatstroke.

How is shivering caused?
Heat production is also increased by response of the skeletal muscles. Stimulation of the heat-promoting centre stimulates a part of the brain that send impulses to the skeletal muscles. Rapid contraction and relaxation of the muscles occurs. This repetition cycle called shivering increases the rate of heat production. During maximal shivering, body heat production can rise to about four times the normal rate in just a few minutes.