# SKIN

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# STRUCTURE OF SKIN

## INTRODUCTION

- Skin is the **largest organ** of the body.
- It is not uniformly thick. At some places it is thick and at some places it is thin.
- The average thickness of the skin is about 1 to 2 mm.
- In the sole of the foot and palm of the hand, it is considerably thick, measuring about 5 mm.
- In other areas of the body, the skin is thin.
- It is thinnest over eyelids and penis, measuring about 0.5 mm only.

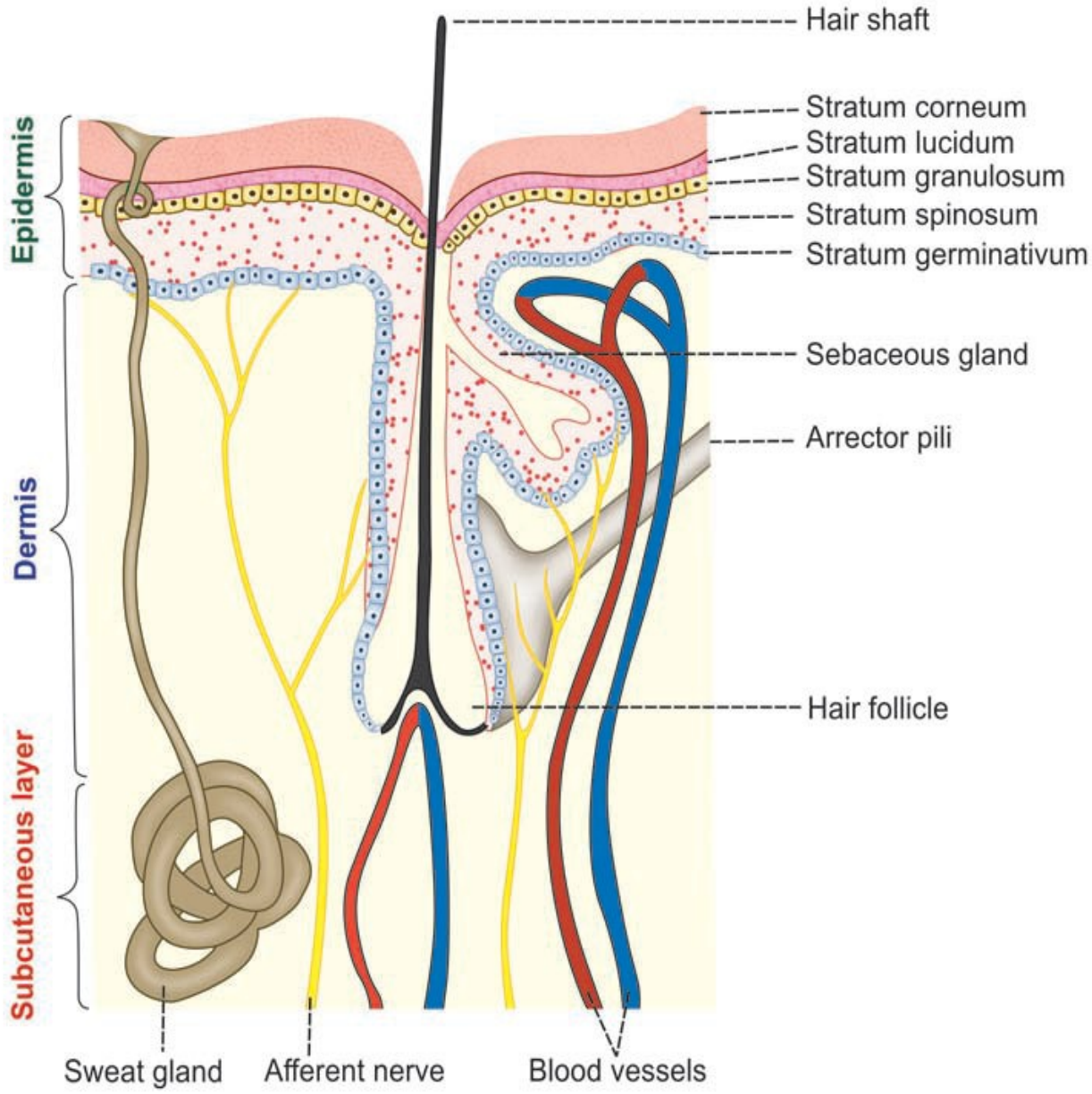



FIGURE : STRUCTURE OF SKIN

# LAYERS OF SKIN

- Skin is made up of two layers:

I. Outer epidermis
II. Inner dermis.

## 1. EPIDERMIS

- Epidermis is the **outer layer of skin**.
- It is formed by stratified epithelium.
- Important feature of epidermis is that, it does not have blood vessels.
- Nutrition is provided to the epidermis by the capillaries of dermis.

## LAYERS OF EPIDERMIS

- Epidermis is formed by five layers:

### i. STRATUM CORNEUM

- Stratum corneum is also known as **horny layer.**
- It is the outermost layer and consists of **dead cells,** which are called **corneocytes.**

## ii. STRATUM LUCIDUM

- Stratum lucidum is made up of **flattened epithelial cells**.
- Many cells have degenerated nucleus and in some cells, the nucleus is absent.

## iii. STRATUM GRANULOSUM

- Stratum granulosum is a thin layer with two to five rows of flattened **rhomboid cells.**

## iv. STRATUM SPINOSUM

- Stratum spinosum is also known as **prickle cell layer** because, the cells of this layer possess some spine like protoplasmic projections.

## v. STRATUM GERMINATIVUM

- Stratum germinativum is a thick layer made up of **polygonal cells**, superficially and **columnar** or **cuboidal epithelial cells** in the deeper parts.
- Here, new cells are constantly formed by mitotic division.

## 2. DERMIS

- Dermis is the **inner layer of the skin**.
- It is a connective tissue layer, made up of dense collagen fibers, fibroblasts.
- Collagen fibers exhibit elastic property and are capable of storing or holding water.
- Collagen fibers contain the enzyme collagenase, which is responsible for wound healing.

## LAYERS OF DERMIS

- Dermis is made up of two layers:

### i. SUPERFICIAL PAPILLARY LAYER

- Superficial papillary layer projects into the epidermis.
- It contains blood vessels, lymphatics and nerve fibers.
- This layer also has some pigment containing Cells known as **chromatophores.**

## ii. DEEPER RETICULAR LAYER

- Reticular layer is made up of **reticular and elastic fibers**.
- These fibers are found around the hair bulbs, sweat glands and sebaceous glands.
- The reticular layer also contains mast cells, nerve endings, lymphatics, epidermal appendages and fibroblasts.

# COLOR OF SKIN

- Color of skin depends upon two important factors:

## 1. PIGMENTATION OF SKIN

- Cells of the skin contain a brown pigment called **melanin,** which is responsible for the color of the skin.
- It is protein in nature and it is synthesized from the amino acid tyrosine by **melanocytes,** which are present mainly in the stratum germinativum and stratum spinosum of epidermis.
- Skin becomes dark when melanin content increases.

## 2. HEMOGLOBIN IN THE BLOOD

- Amount and nature of hemoglobin that circulates in the cutaneous blood vessels play an important role in the coloration of the skin.
- Skin becomes:

i. **Pale**, when hemoglobin content decreases.
ii. **Pink**, when blood rushes to skin due to cutaneous vasodilatation (blushing).
iii. **Bluish** during cyanosis, which is caused by excess amount of reduced hemoglobin.

# FUNCTIONS OF SKIN

- **Primary function** of skin is **protection of organs**.
- However, it has many other important functions also.

## 1. PROTECTIVE FUNCTION

- Skin forms the covering of all the organs of the body.
- Keratinized stratum corneum of epidermis is responsible for the protective function of skin.

- It protects organs of body from the following factors:

## i. BACTERIA AND TOXIC SUBSTANCES

- Skin covers the organs of the body and protects the organs from having direct contact with external environment.
- Thus, it prevents the bacterial infection. **Lysozyme** secreted in skin destroys the bacteria.

## ii. MECHANICAL BLOW

- Skin is not tightly placed over the underlying organs or tissues.
- It is somewhat loose and moves over the underlying subcutaneous tissues.
- So, the mechanical impact of any blow to the skin is not transmitted to the underlying tissues.

## iii. ULTRAVIOLET RAYS

- Skin protects the body from **ultraviolet rays** of sunlight.
- Exposure to sunlight or to any other source of ultraviolet rays increases the production of **melanin** pigment in skin.
- Melanin absorbs ultraviolet rays.

## 2. SENSORY FUNCTION

- Skin is considered as the **largest sense organ** in the body.
- It has many nerve endings, which form the specialized cutaneous receptors.
- These receptors are stimulated by sensations of touch, pain, pressure or temperature sensation and convey these sensations to the brain via afferent nerves.
- At the brain level, perception of different sensations occurs.

## 3. STORAGE FUNCTION

- Skin stores fat, water, chloride and sugar.
- It can also store blood by the dilatation of the cutaneous blood vessels.

## 4. SYNTHETIC FUNCTION

- Vitamin D3 is synthesized in skin by the action of ultraviolet rays from sunlight on cholesterol.

## 5. REGULATION OF BODY TEMPERATURE

- Skin plays an important role in the regulation of body temperature.
- Excess heat is lost from the body through skin by radiation, conduction, convection and evaporation.
- Sweat glands of the skin play an active part in heat loss, by secreting sweat.
- The lipid content of sebum prevents loss of heat from the body in cold environment.

## 6. REGULATION OF WATER AND ELECTROLYTE BALANCE

- Skin regulates water balance and electrolyte balance by excreting water and salts through sweat.

## 7. EXCRETORY FUNCTION

- Skin excretes small quantities of waste materials like urea, salts and fatty substance.

## 8. ABSORPTIVE FUNCTION

- Skin absorbs fat-soluble substances and some ointments.

## 9. SECRETORY FUNCTION

- Skin secretes **sweat** through **sweat glands** and **sebum** through **sebaceous glands.**
- By secreting sweat, skin regulates body temperature and water balance.
- Sebum keeps the skin smooth and moist.

## GLANDS OF SKIN

- Skin contains mainly two types of glands.

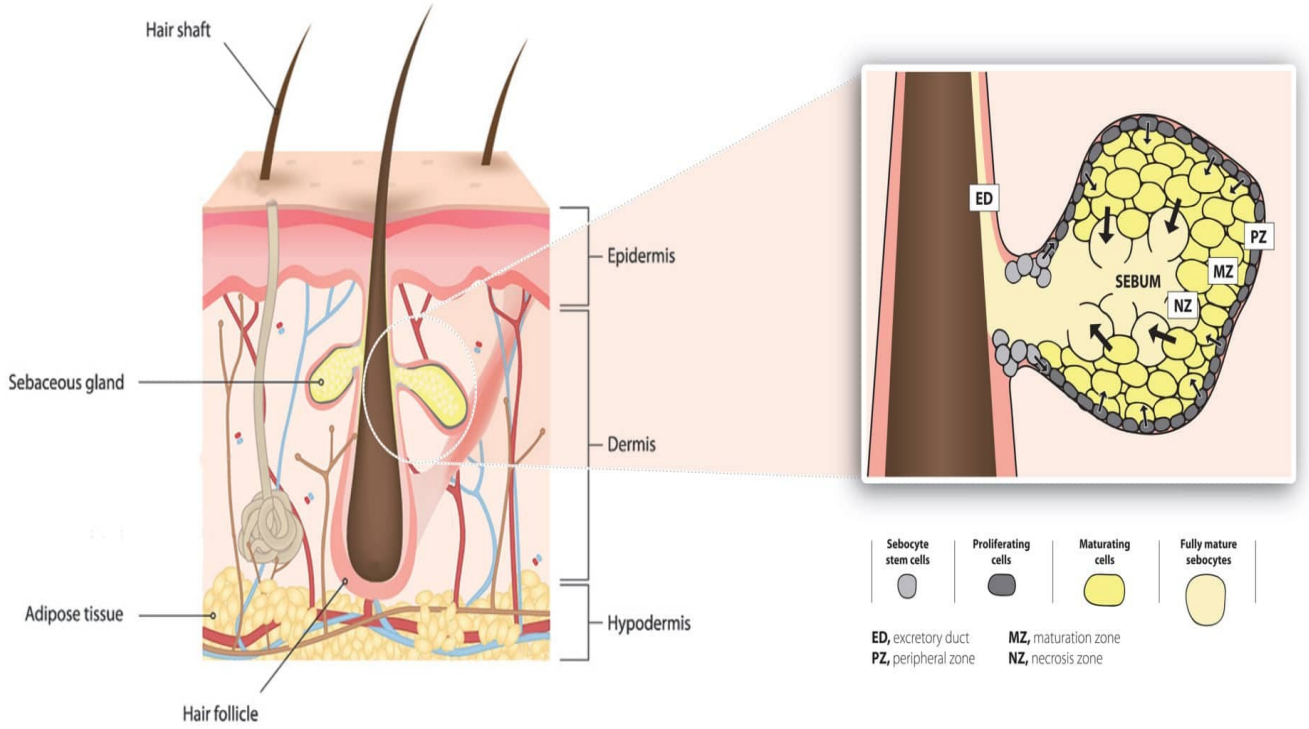
1. Sebaceous glands
2. Sweat glands.

# SEBACEOUS GLANDS

- Sebaceous glands are simple or branched alveolar glands, situated in the dermis of skin.

## STRUCTURE

- Sebaceous glands are ovoid or spherical in shape and are situated at the side of the **hair follicle.**




- These glands develop from hair follicles.
- So, the sebaceous glands are absent over the thick skin, which is devoid of hair follicles.
- Each gland is covered by a connective tissue capsule.
- The alveoli of the gland are lined by stratified epithelial cells.
- Sebaceous glands open into the neck of the hair follicle through a duct.
- In some areas like face, lips, nipple, glans penis and labia minora, the sebaceous glands open directly into the exterior.

## SECRETION OF SEBACEOUS GLAND – SEBUM

- Sebaceous glands secrete an oily substance called sebum.
- Sebum is formed by the liquefaction of the alveolar cells and poured out through the ducts either via the hair follicle or directly into the exterior.

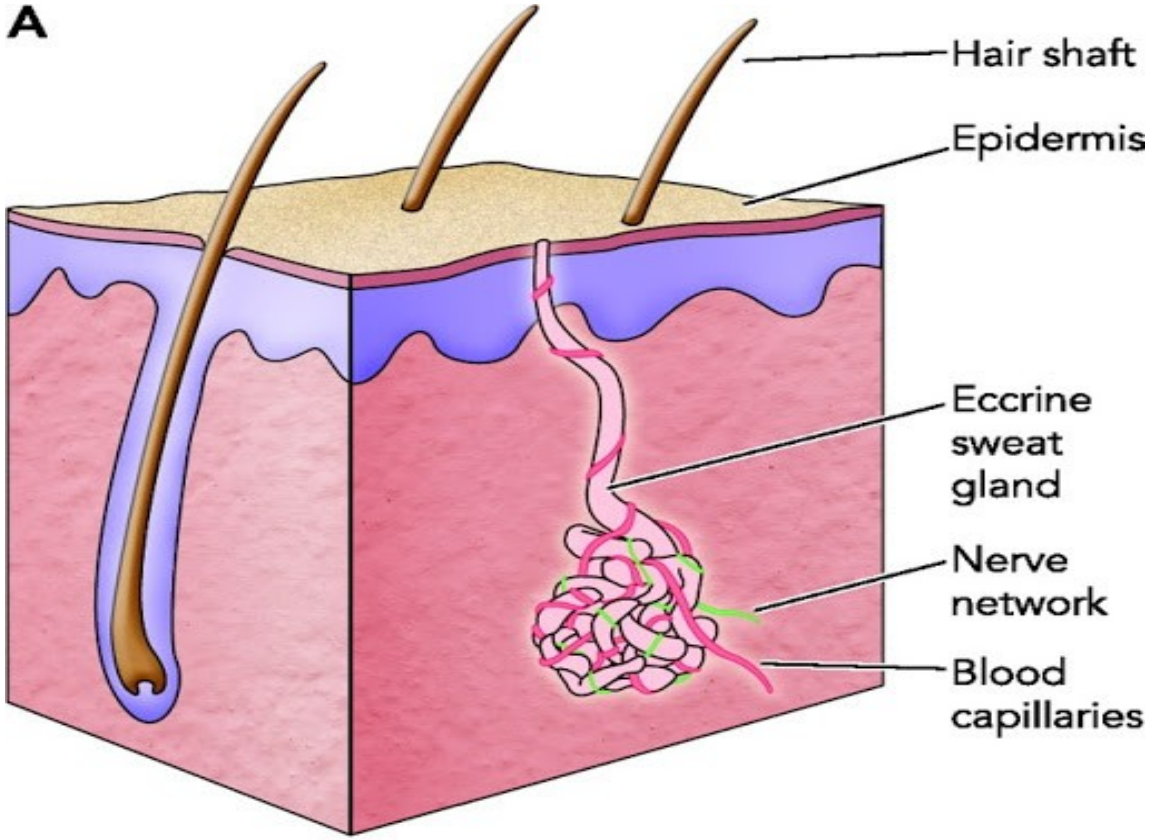
## FUNCTIONS OF SEBUM

1. Free fatty acid content of the sebum has antibacterial and antifungal actions. Thus, it prevents the infection of skin by bacteria or fungi.
2. Lipid nature of sebum keeps the skin smooth and oily. It protects the skin from unnecessary desquamation and injury caused by dryness.
3. Lipids of the sebum prevent heat loss from the body. It is particularly useful in cold climate.

# SWEAT GLANDS

- Sweat glands are of two types:

1. Eccrine glands
2. Apocrine glands.




## 1. ECCRINE GLANDS

- Eccrine sweat gland is a tubular coiled gland.
- It consists of two parts:

1. A coiled portion lying deeper in dermis, which secretes the sweat.
2. A duct portion, which passes through dermis and epidermis.

## DISTRIBUTION

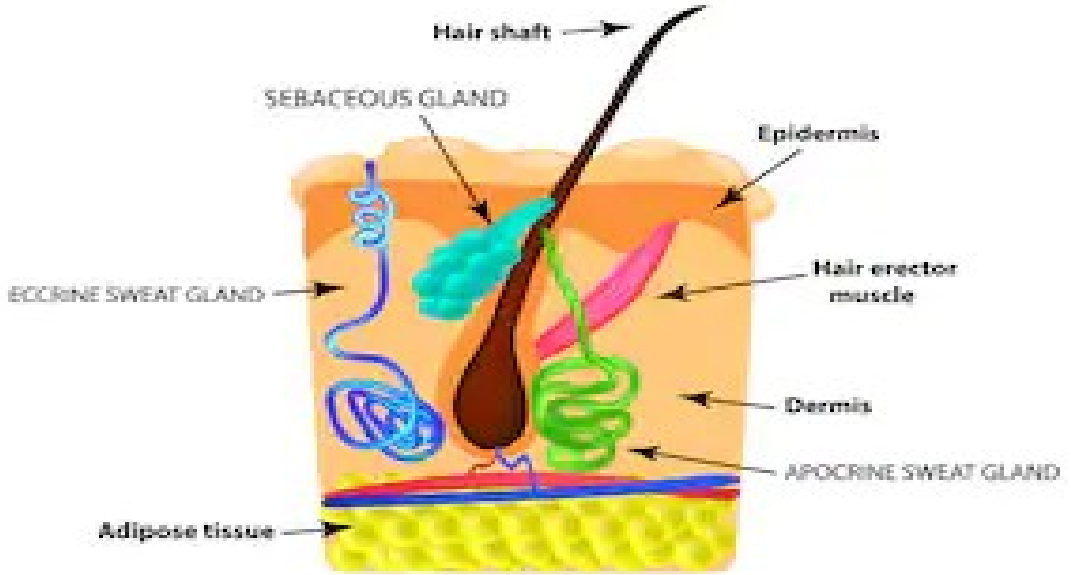
- Eccrine glands are distributed throughout the body.
- There are many eccrine glands over thick skin.

## SECRETORY ACTIVITY OF ECCRINE GLANDS

- Eccrine glands function throughout the life since birth.
- These glands secrete a clear **watery sweat.** The secretion increases during increase in temperature and emotional conditions.
- Eccrine glands play an important role in regulating the body temperature by secreting sweat.
- Sweat contains water, sodium chloride, urea and lactic acid.

## 2. APOCRINE GLANDS

- Apocrine glands are also tubular coiled glands.
- The coiled portion lies in deep dermis. But, the duct opens into the hair follicle above the opening of sebaceous gland.



## DISTRIBUTION

- Apocrine glands are situated only in certain areas of the body like axilla, pubis, areola and umbilicus.

## SECRETORY ACTIVITY OF APOCRINE GLANDS

- Apocrine sweat glands are nonfunctional till puberty and start functioning only at the time of puberty.
- In old age, the function of these glands gradually declines.
- The secretion of the apocrine glands is thick and milky.
- At the time of secretion, it is odorless. When microorganisms grow in this secretion, a characteristic odor develops in the regions where apocrine glands are present.
- Secretion increases only in emotional conditions.
- Apocrine glands do not play any role in temperature regulation like eccrine glands.

# LIPOPROTEINS

- Lipoproteins are the small particles in the blood which contain cholesterol, phospholipids, triglycerides and proteins.
- Proteins are betaglobulins called **apoproteins.**

## CLASSIFICATION OF LIPOPROTEINS

- Lipoproteins are classified into four types on the basis of their density:

### 1. VERY-LOW-DENSITY LIPOPROTEINS (VLDL)

- Contain high concentration of triglycerides (formed from FFA and glycerol) and moderate concentration of cholesterol and phospholipids

### 2. INTERMEDIATE-DENSITY LIPOPROTEINS (IDL)

- Formed by the removal of large portion of triglycerides from VLDL by lipoprotein lipase.
- Concentration of cholesterol and phospholipids increases because of removal of triglycerides

## 3. LOW-DENSITY LIPOPROTEINS (LDL)

- Formed from IDL by the complete removal of triglycerides. These lipoproteins contain only cholesterol and phospholipids

## 4. HIGH-DENSITY LIPOPROTEINS (HDL)

- Contain high concentrations of proteins with low concentration of cholesterol and phospholipids.
- All the lipoproteins are synthesized in liver. HDL is synthesized in intestine also.

## FUNCTIONS OF LIPOPROTEINS

- Primary function of lipoproteins is to transport the lipids via blood to and from the tissues.
- Functions of each type of lipoproteins are given in Table

| Lipoproteins | Functions |
|---|---|
| VLDL | Transports triglycerides from liver to adipose tissue |
| IDL | Transports triglycerides, cholesterol and phospholipids from liver to peripheral tissues |
| LDL | Transports cholesterol and phospholipids from liver to tissues and organs like heart |
| HDL | Transports cholesterol and phospholipids from tissues and organs like heart back to liver |

# IMPORTANCE OF LIPOPROTEINS

## HIGH-DENSITY LIPOPROTEIN

- Highdenisty lipoprotein (HDL) is referred as the **'good cholesterol'** because it carries cholesterol and phospholipids from tissues back to the liver for degradation and elimination.
- It prevents the deposition of cholesterol on the walls of arteries.
- High level of HDL is a good indicator of a healthy heart.

## LOW-DENSITY LIPOPROTEIN

- Lowdensity lipoprotein (LDL) is considered as the **'bad cholesterol'** because it carries cholesterol and phospholipids from the liver to different organs such as heart.
- It is responsible for deposition of cholesterol on walls of arteries causing blockage and hardening of the arteries.
- High level of LDL increases the **risk of heart disease.**

# ADIPOSE TISSUE

- Adipose tissue or fat is a loose connective tissue that forms the storage site of fat in the form of triglycerides.
- It is composed of **adipocytes,** which are also called **fat cells** or **lipocytes.**
- Obesity does not depend on the body weight, but on the amount of body fat, specifically adipose tissue.
- Adipose tissue is of two types, white adipose tissue and brown adipose tissue.

## 1. WHITE ADIPOSE TISSUE OR WHITE FAT

- White adipose tissue is distributed through the body beneath the skin, forming **subcutaneous fat.**
- This adipose tissue is formed by fat cells which are **unilocular,** i.e. these cells contain one large vacuole filled with fat.

# FUNCTIONS OF WHITE ADIPOSE TISSUE

- White adipose tissue has three functions:

## 1. STORAGE OF ENERGY

- Main function of white adipose tissue is the storage of lipids.
- Utilization for energy of fat is regulated by hormones, particularly insulin. depending upon the blood glucose level.

## 2. HEAT INSULATION

- **Insulation function** is due to the presence of adipose tissue beneath the skin.

## 3. PROTECTION OF INTERNAL ORGANS

- White adipose tissue protects the body and internal organs by surrounding them and by acting like a **mechanical cushion.**

## 2. BROWN ADIPOSE TISSUE OR BROWN FAT

- Brown adipose tissue is a specialized form of adipose tissue, having the function opposite to that of white adipose tissue.
- It is present only in certain areas of the body such as back of neck and intrascapular region.
- It is formed by fat cells which are **multilocular,** i.e. these cells contain many small vacuoles filled with fat.
- The coloration of this adipose tissue is due to high vascularization and large number of **iron-rich mitochondria.**

## FUNCTIONS OF BROWN ADIPOSE TISSUE

- Brown adipose tissue does not store lipids but generates heat by burning lipids.
- In infants brown adipose tissue plays an import ant role in regulating body temperature via **non-shivering thermogenesis.**

# TABLE : VALUES OF LIPID PROFILE

| Lipids | Desirable optimal level | Borderline range | High-risk level |
|---|---|---|---|
| Total cholesterol | < 200 mg/dL | 200 to 240 mg/dL | > 240 mg/dL |
| Triglycerides | < 150 mg/dL | 150 to 200 mg/dL | > 200 mg/dL |
| HDL | > 60 mg/dL | 40 to 60 mg/dL | < 40 mg/dL |
| LDL | < 60 mg/dL | 60 to 100 mg/dL | > 100 mg/dL |
| Total cholesterol – HDL ratio | < 2 | 2 to 6 | > 6 |

# THANK YOU