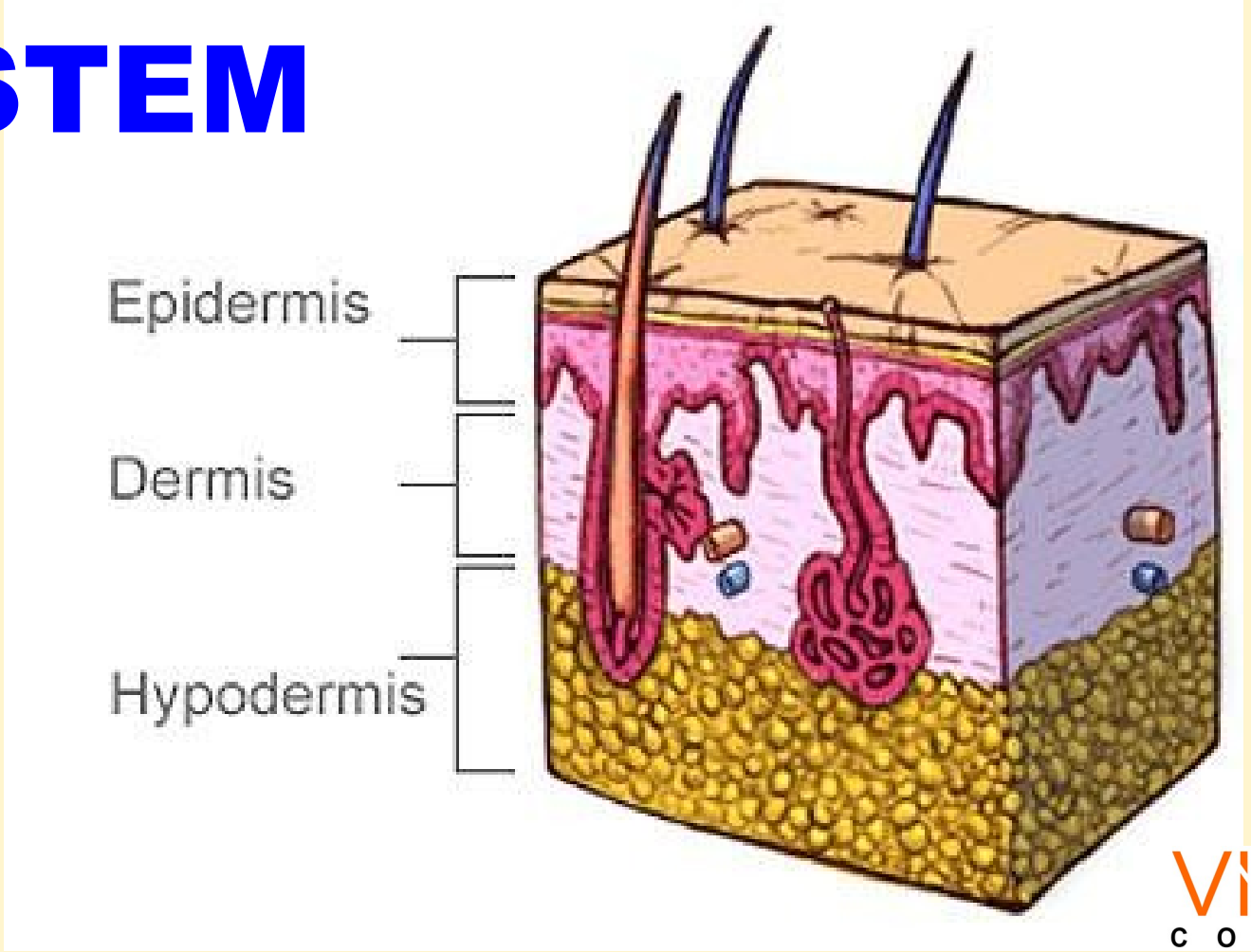
GHC 2013

INTEGUMENTARY SYSTEM



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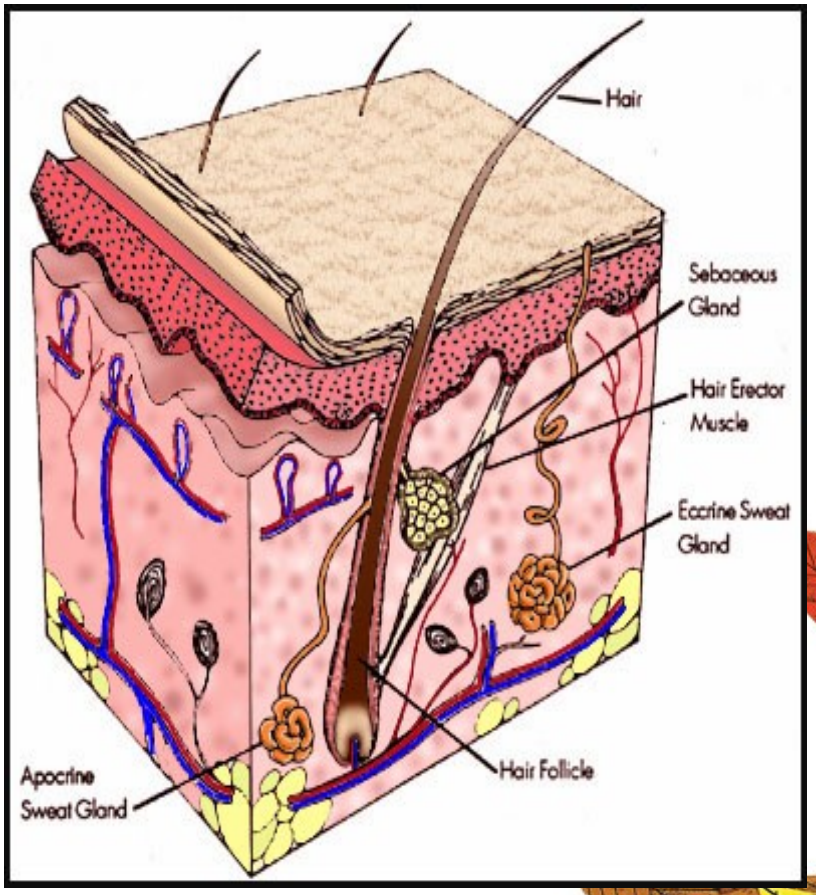
Learning Outcome

- **Upon completion of this lesson, you should be able to:**
  - Describe the **structure of the skin**.
  - Describe the **functions of the skin.**
  - Describe the functions of the **hair and nails.**
  - Describe the functions of the s**ecretions of sebaceous glands and exocrine sweat glands.**

Integumentary System

- Largest organ in the body.
- Has a surface area of about 1.5 to 2 meter sq. in adult.
- Is made up of the **skin** and its **accessory structures (appendages).**



- Hair
- Nails
- Sebaceous glands
- Sweat glands

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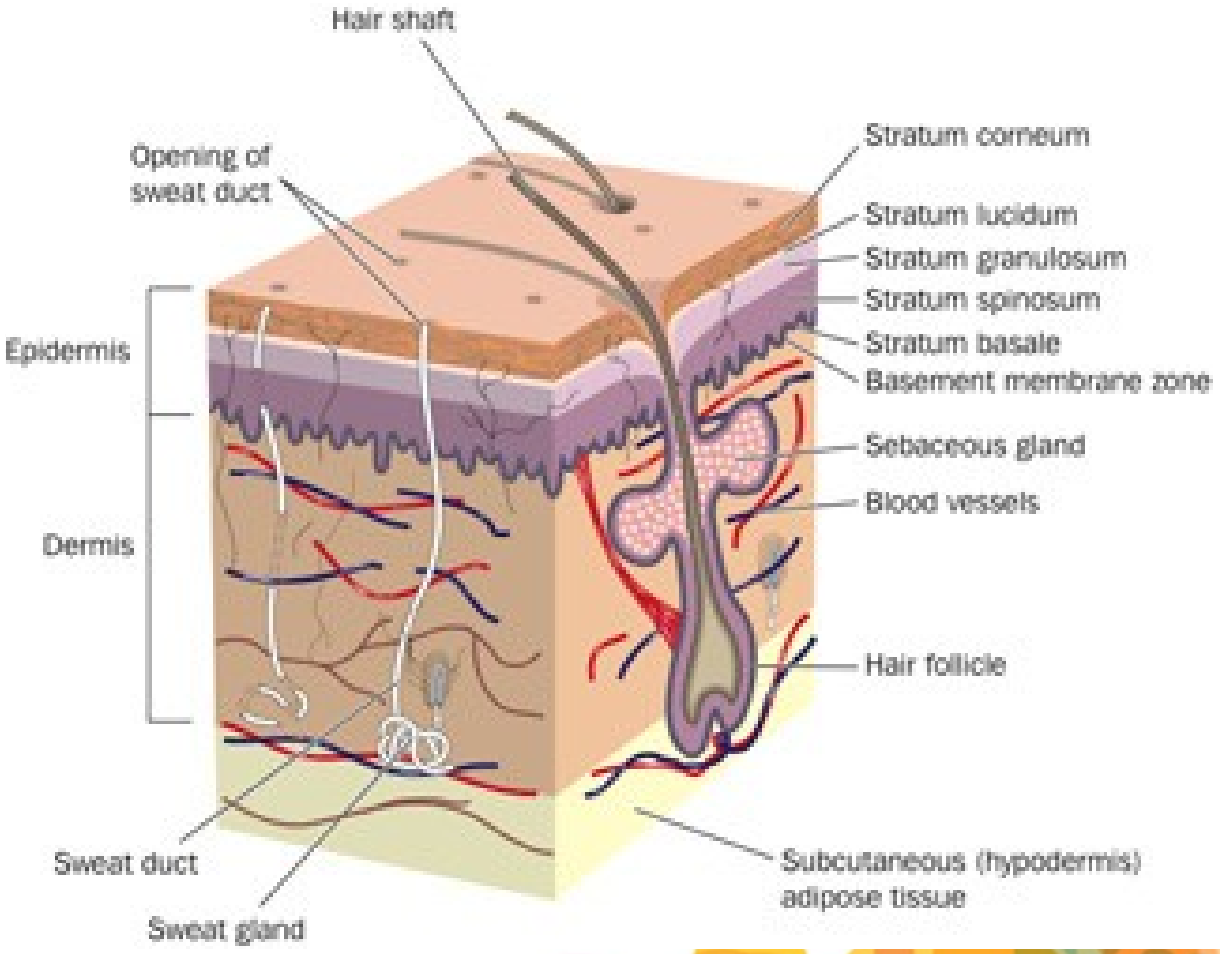
Structure of the Skin

- There are two main layers:

- Epidermis
- Dermis



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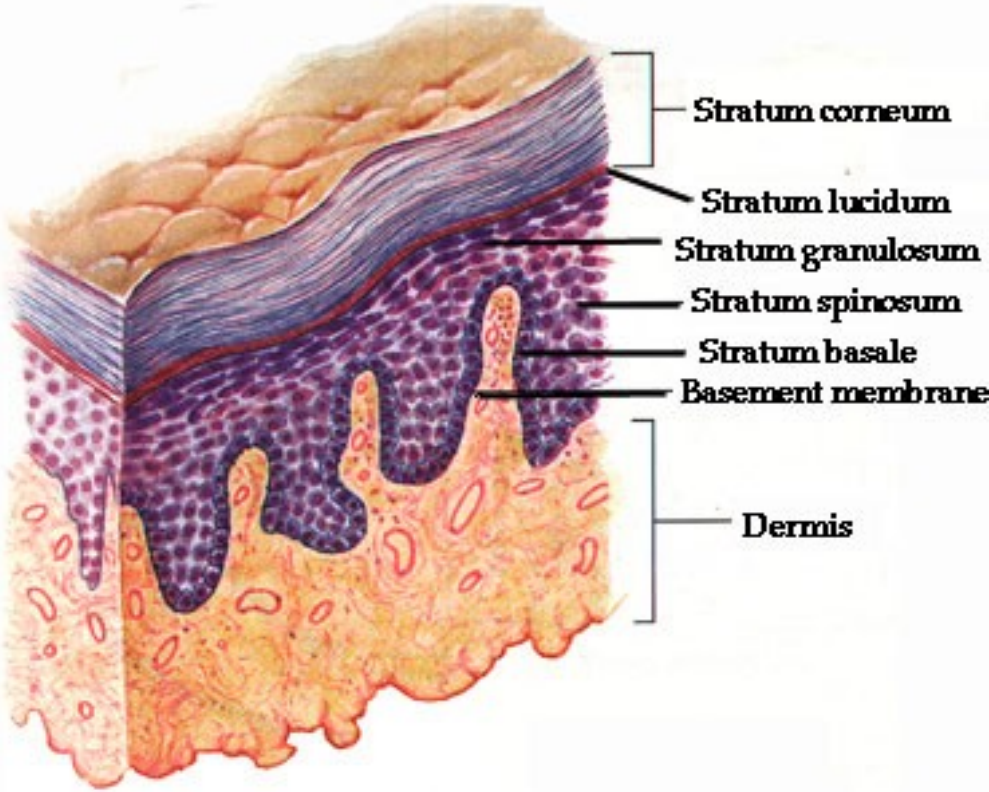
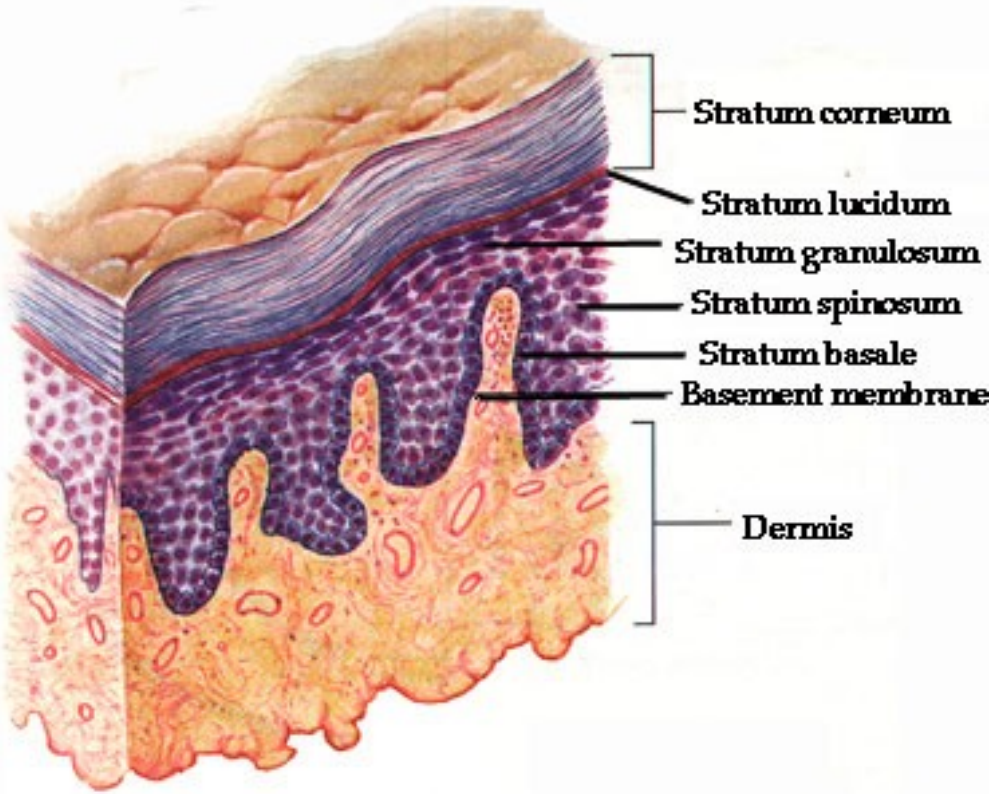
Epidermis

- The **most superficial layer** of the skin.
- Composed of stratified keratinised squamous epithelium.
- **No blood vessels** or **nerve endings** in the epidermis, but its deeper layers are bathed in **interstitial fluid** from the dermis, which <u>provides oxygen and nutrients</u>, and is drained away as lymph.



Epidermis

- The lowermost cells on epidermis divide by **mitosis,** so new cells push older cells up toward the surface.
- As they move up, they change shape and chemical composition because they **lost most of their water** and eventually **die**.
- This process is called **keratinization**.



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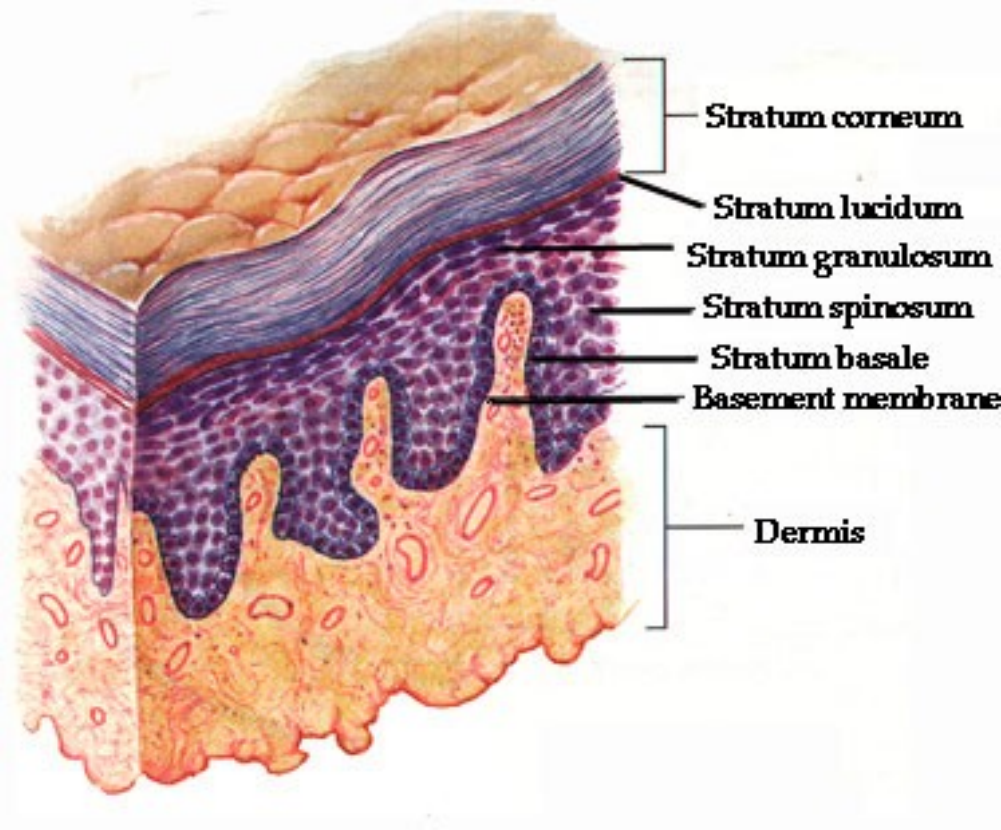
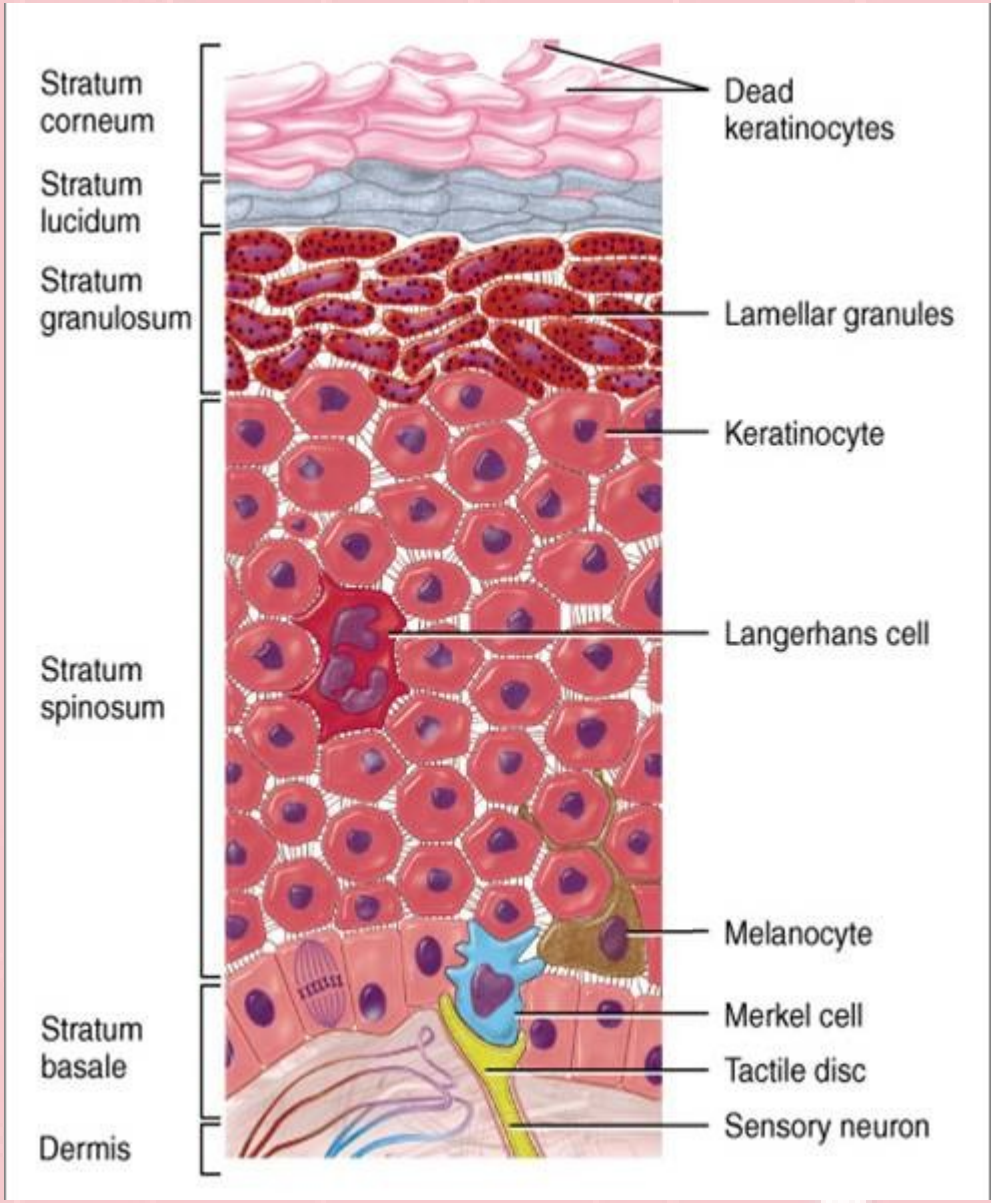
Epidermis

- Keratinization processes produces **5 layers (strata)**:
  - Stratum corneum
  - Stratum lucidum
  - Stratum granulosum
  - Stratum spinosum
  - Stratum basale (stratum germinativum)



Stratum Corneum

- The **outermost layer**.
- Consists of many layers of **dead cells/ dead keratinocytes**.
- <u>Functions</u>:
  - Physical barrier to pathogens and chemicals.



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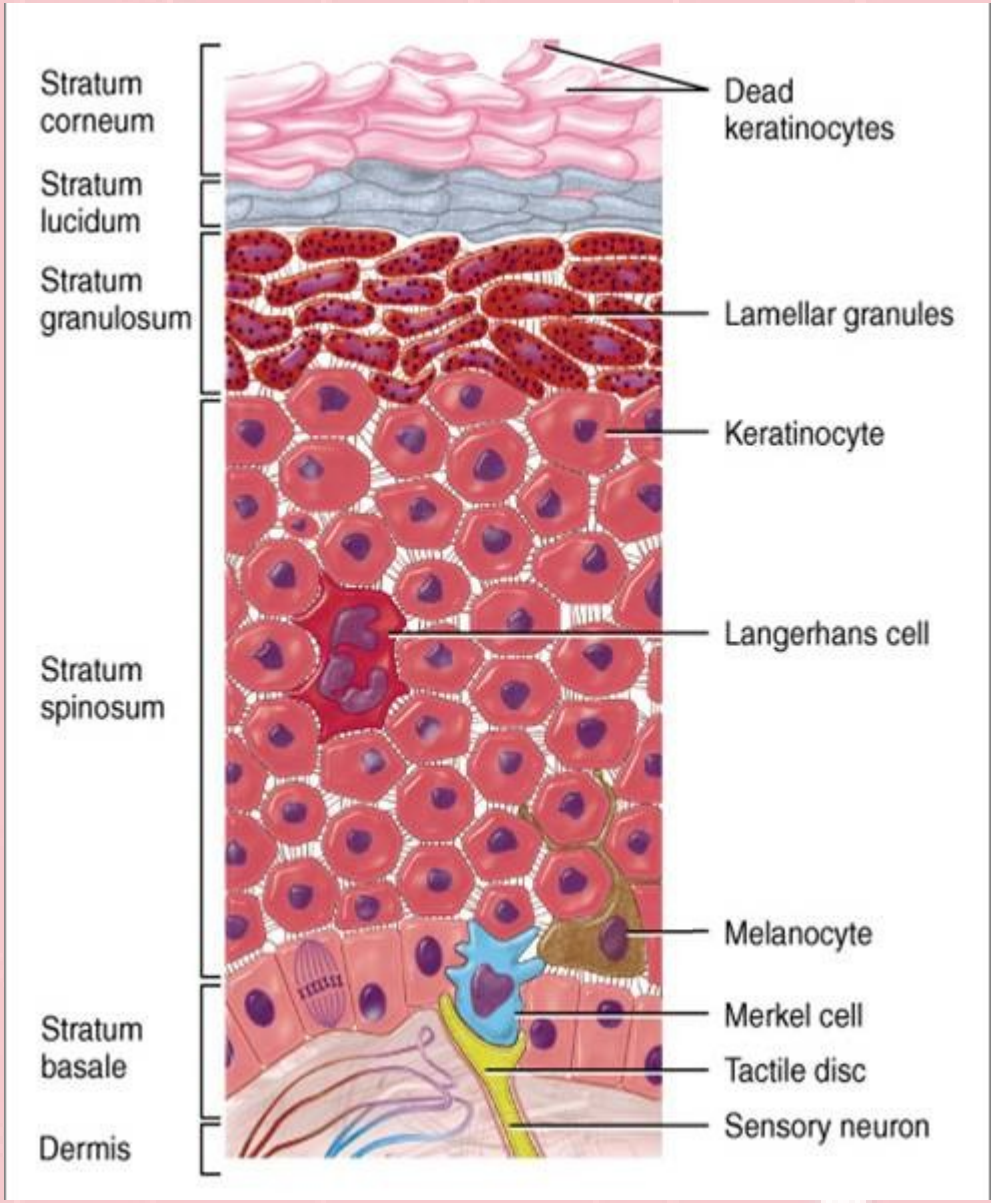
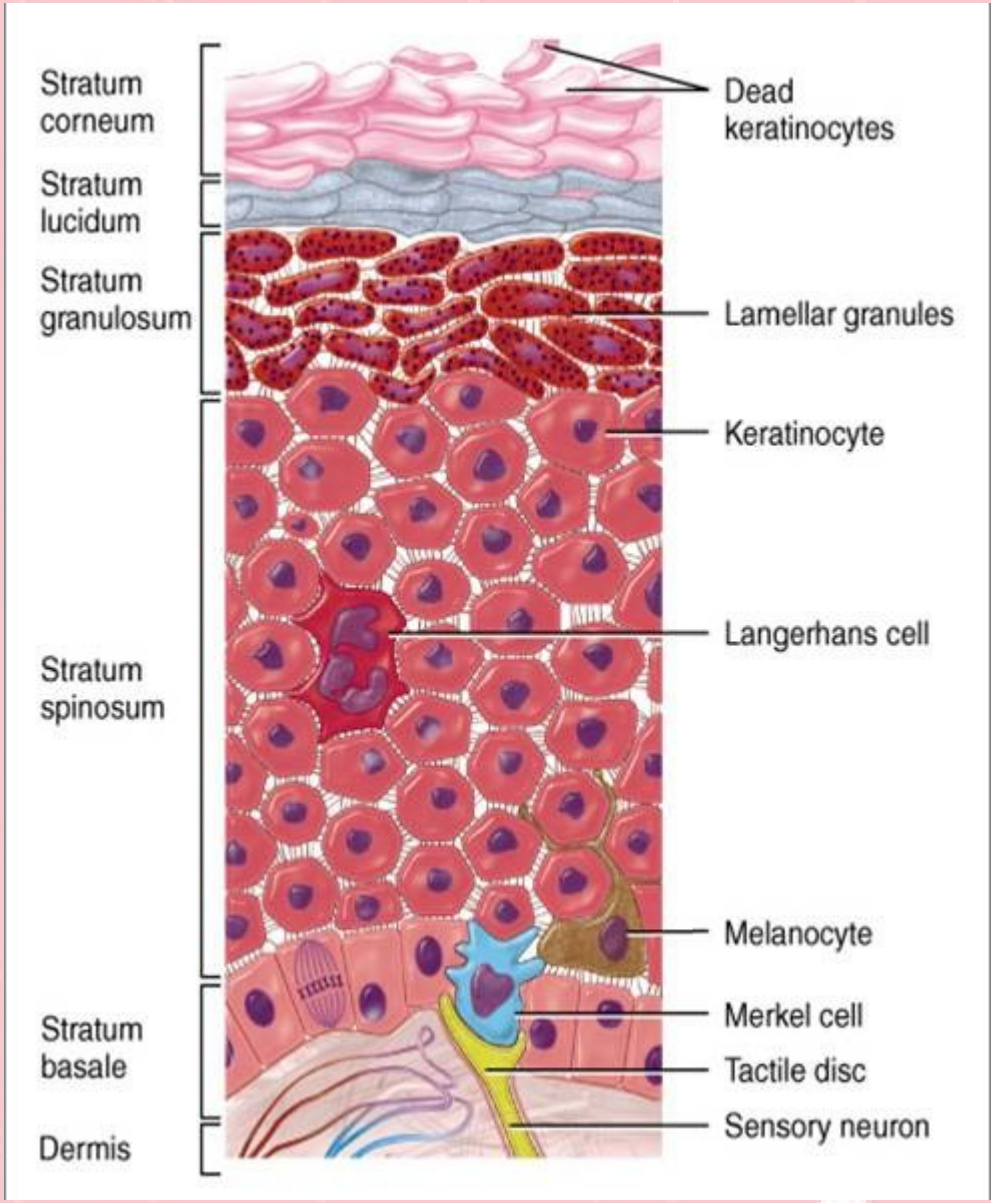
Stratum Lucidum

- Lies directly beneath the stratum corneum.
- Consists of only one or two cell layers thick (**very thin layer**).
- The cells are transparent and flat.



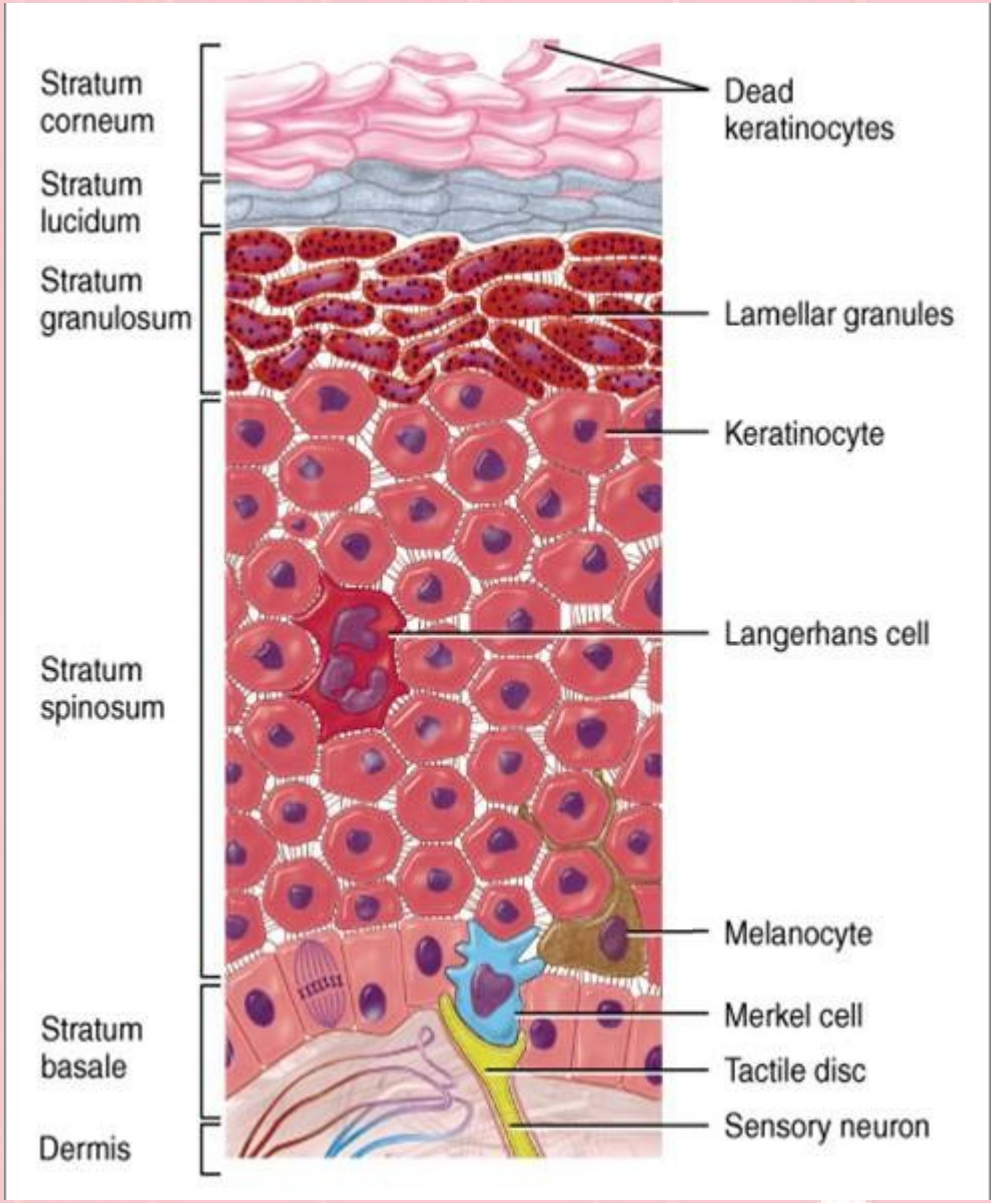
Stratum Granulosum

- Consists of two or three layers of flattened cells.
- **Granules** accumulate in these cells.
- Active in **keratinization**.
- The cells gradually lose their nuclei and become **compact and brittle**.



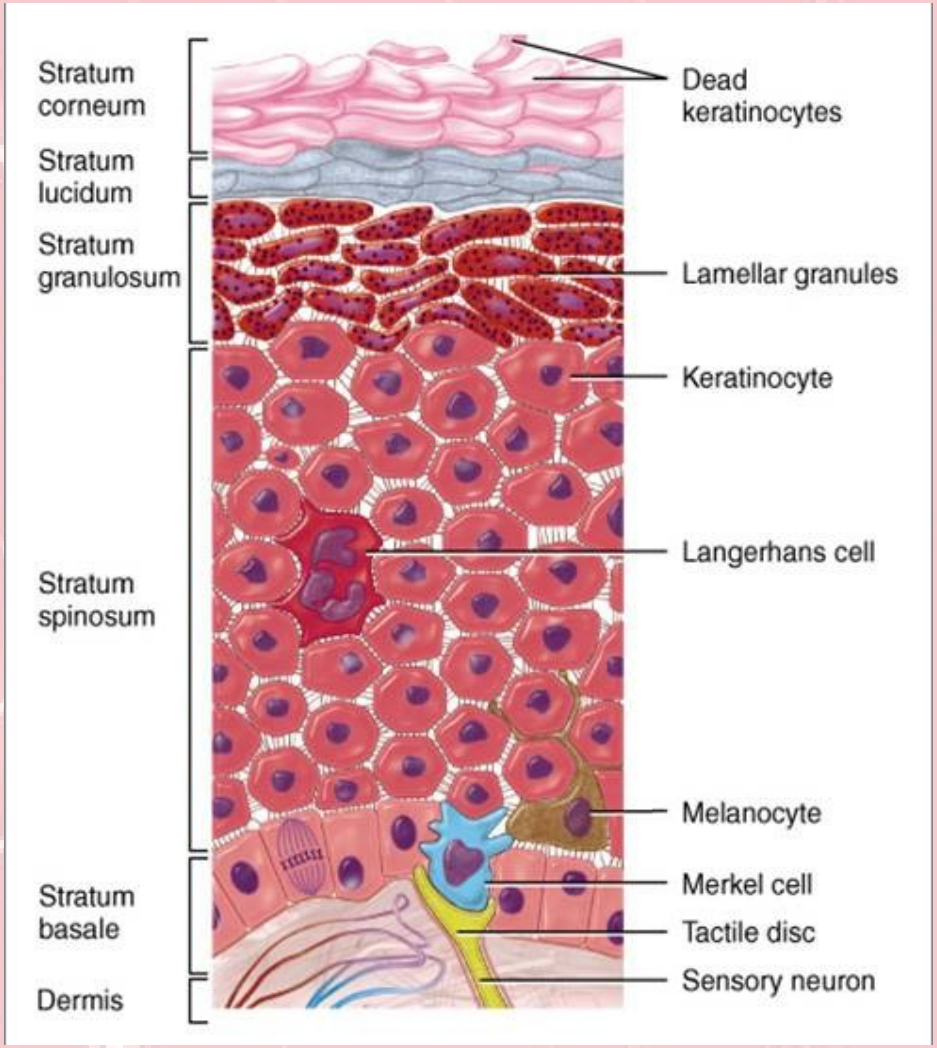
Stratum Spinosum

- Consists of several layers of prickly (pear shape) or spiny-shaped cells.
- **Langerhans cells** may found within this layer.
- Langerhans cell:
  - Also known as **dendritic (immune) cell**
  - Able to **phagocytize** (eating @ engulf) foreign materials.



Stratum Basale/Germinativum

- Is the **deepest** and **most important layer** of the skin.
- Contains only one cells of the epidermis that are capable of dividing by mitosis.
- **Merkel cell**: touch receptor associated with nerve fibres to form Merkel disc

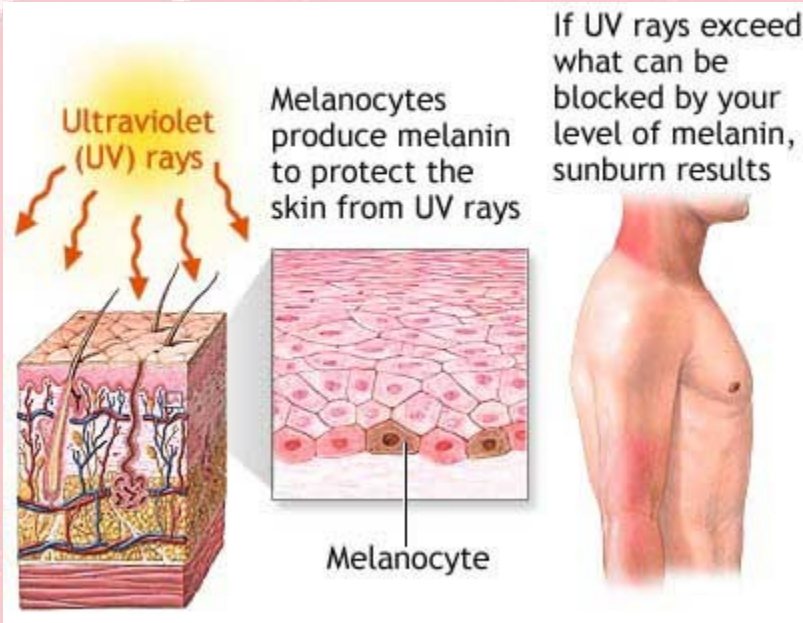


Stratum Basale/Germinativum

- Also contains **melanocytes**, which are responsible for **skin colour**.

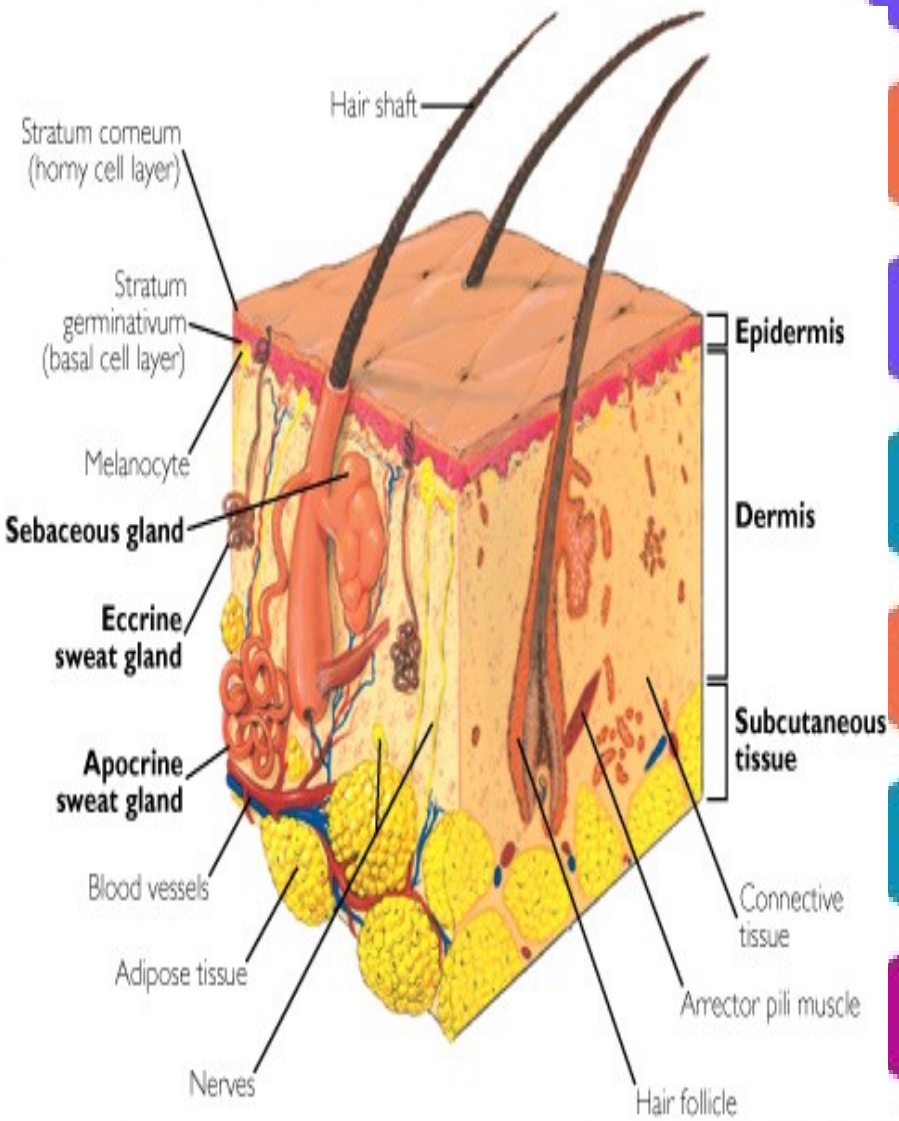
- Melanocytes:
  - Irregular shaped with long processes
  - Produce protein **melanin**

- Melanin: protects living skin layers from further exposure to UV rays



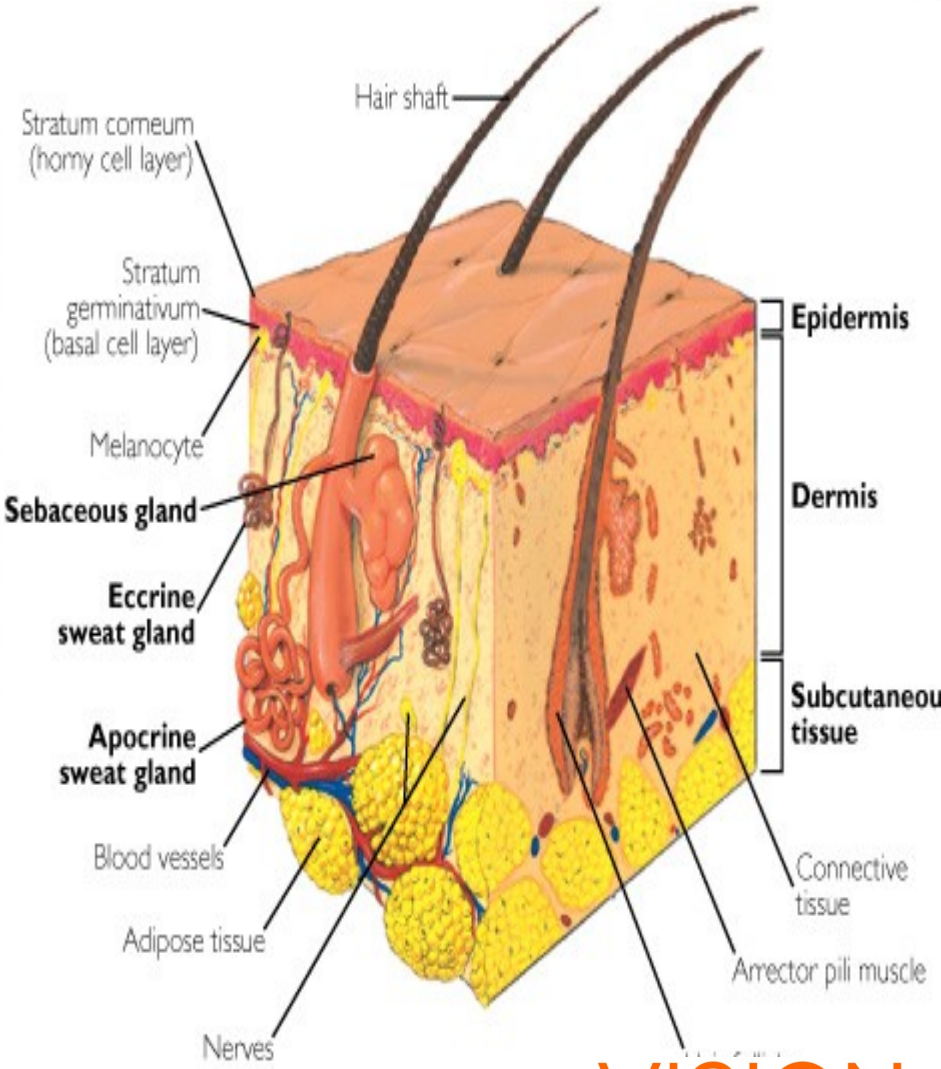
Dermis

- Is tough and elastic.
- Formed from connective tissue and the matrix contains collagen fibres interlaced with elastic fibres.
- **Fibroblasts, macrophages** and **mast cells** are the main cells.
- Underlying its deepest layer, there is areolar tissue and varying amounts of adipose tissue (fat).



Dermis

- Contains **blood vessels, lymph vessels, sensory (somatic) nerve endings, sweat glands and their ducts, hairs, arrector pili muscles and sebaceous glands**.



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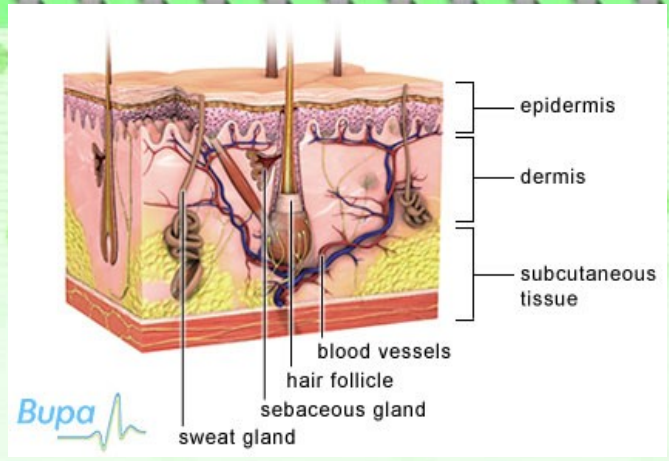
Subcutaneous Layer



- Refer to as the **hypodermis**.
- Connects the skin to the surface muscles.
- Loose connective tissues and large amount of **adipose tissue**.
- Fat serves as insulation and as reserve for energy.
- Blood vessels and nerves run through the subcutaneous layer.
- Thinnest on the eyelids and thickest on the abdomen.

Sweat Glands

- Composed of epithelial cells.
- Widely distributed, most numerous in the **palms of the hands, soles of the feet, axillae and groins.**
- Some open onto the surface as **pores**. Others open into **hair follicles**.
- Axilla- secrete an odourless milky fluid, which if decomposed by microbes, causes an unpleasant odour.

Sweat Glands

- Stimulated by sympathetic nerves in response to raised **body temperature** and **fear**.
- Sweat helps to regulate body temperature by **evaporation**.
- The amount of sweat produced is controlled by the temperature-regulating centre in the hypothalamus.

Sweat Glands

- There are 2 types:

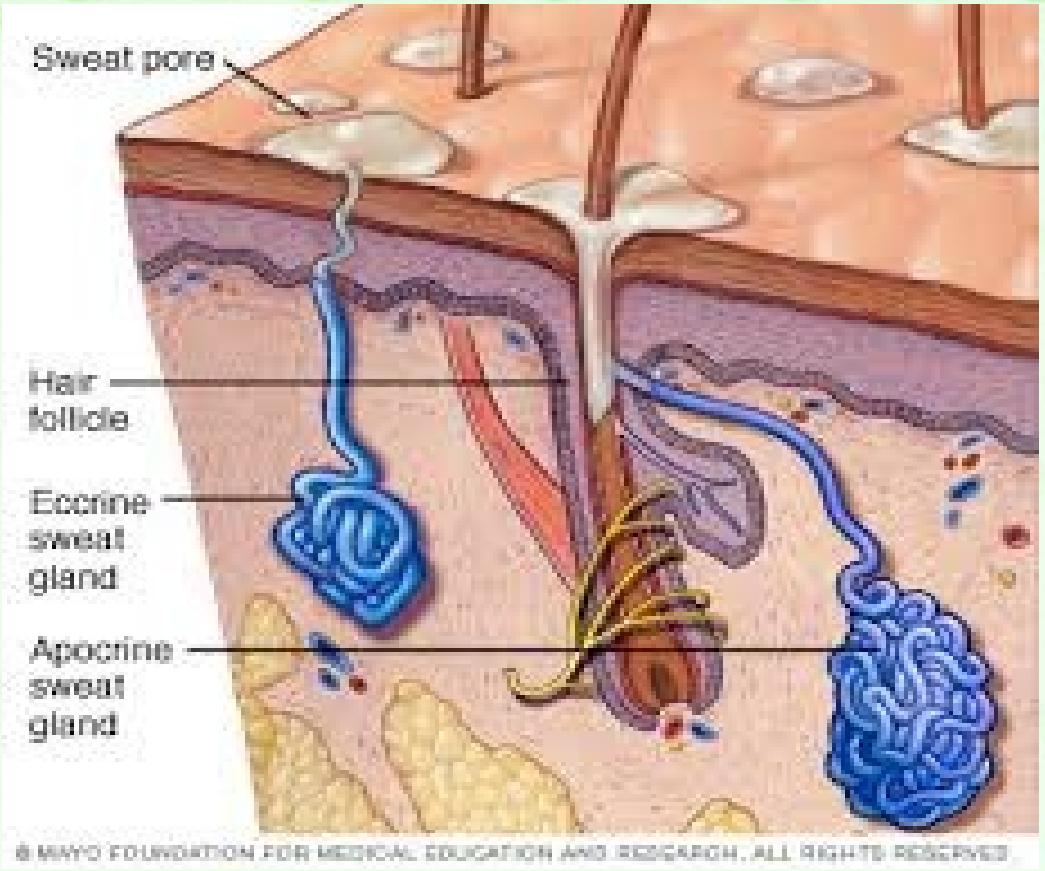
1) Apocrine glands

- Most numerous in axillae (underarm) and genital areas.
- Most active in stressful and emotional situations.
- Opens into hair follicles.

2) Eccrine glands

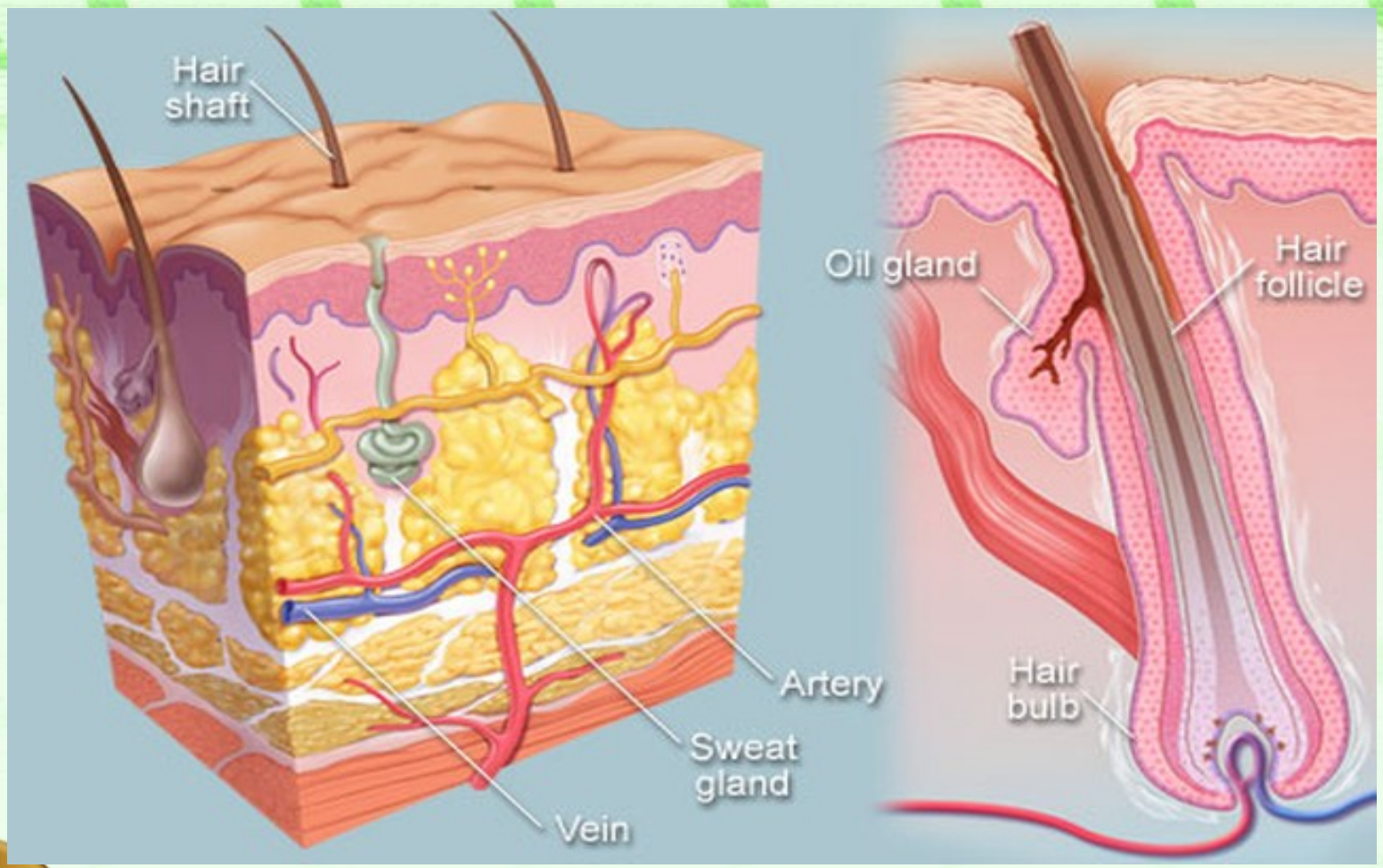
- Found over the body, but more prominent on the forehead, upper lip, palms, and soles (foot).
- Duct of its coiled tube extends to skin's surface and opens into a pore.

Sweat produced is important to maintain the normal body temperature.



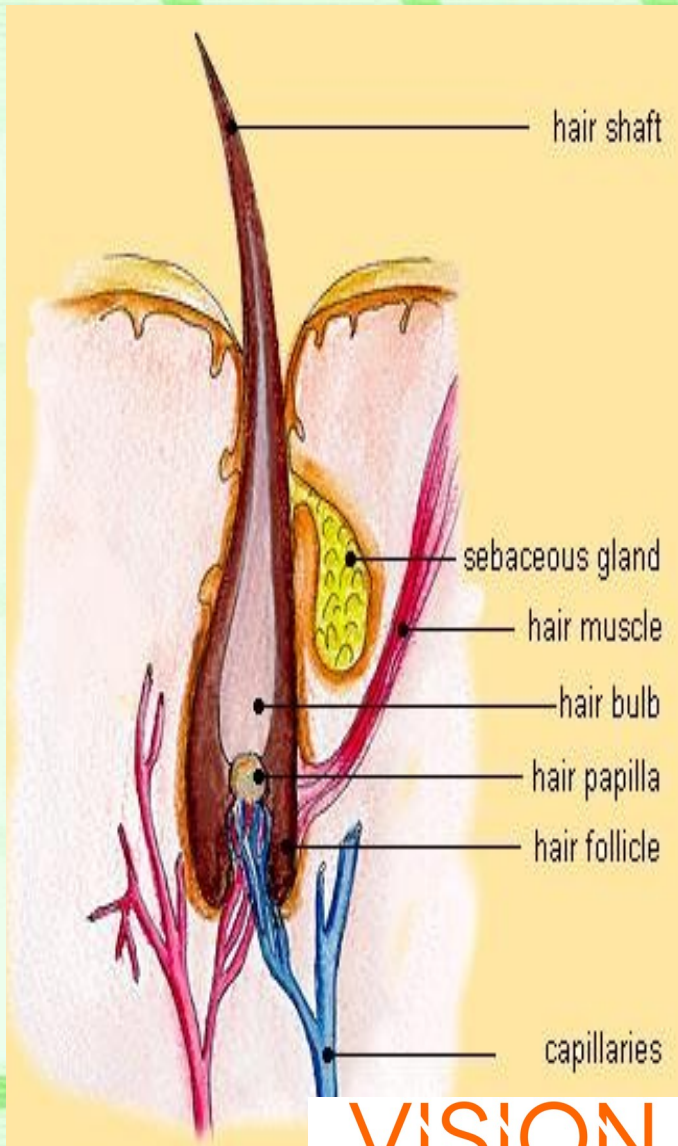
Hairs

- Composed mainly of keratin and is not living cells.
- Each hair is developed from living cells located in a bulb at the base of hair follicle.
- Different shades of melanin produce various hair colour.



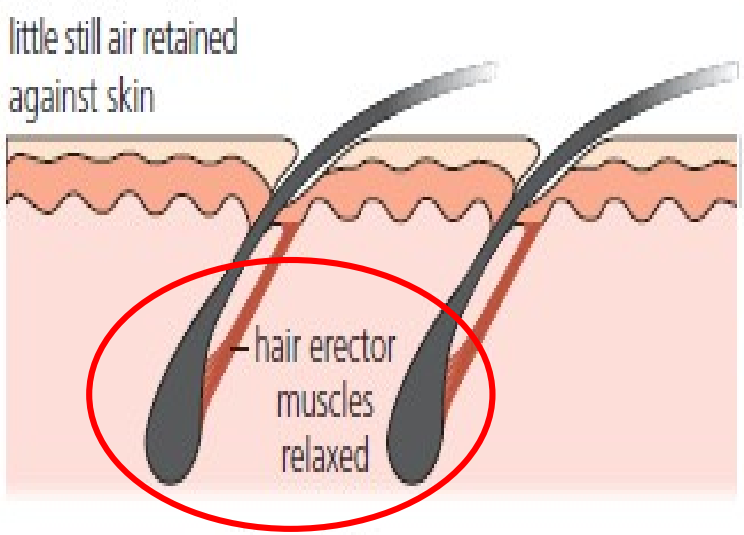
Hairs

- The part of the hair that projects above the skin is the shaft.
- Arrector muscle is attached to most hair follicles. When it contracts (in response to fear and cold), the hair is raised, forming “goose bumps”.



role of the hair in regulating heat loss through the skin

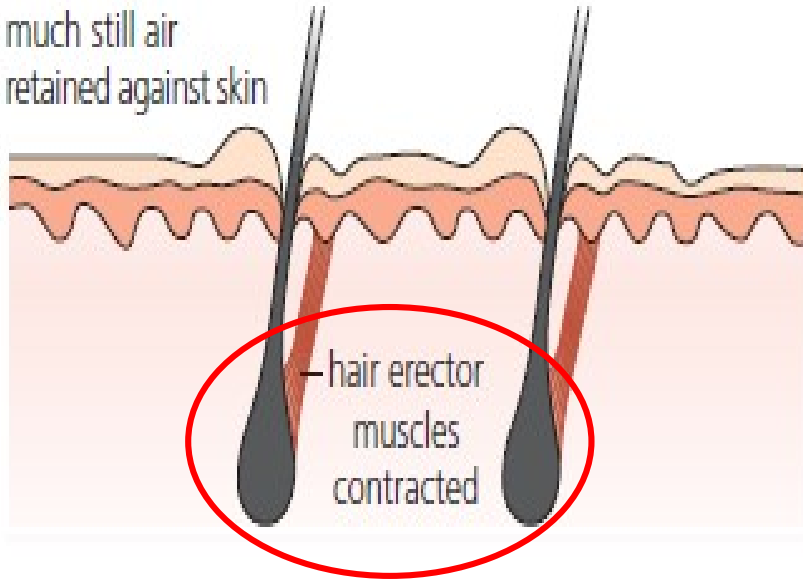
warm conditions



The hair erector muscles may be contracted or relaxed.

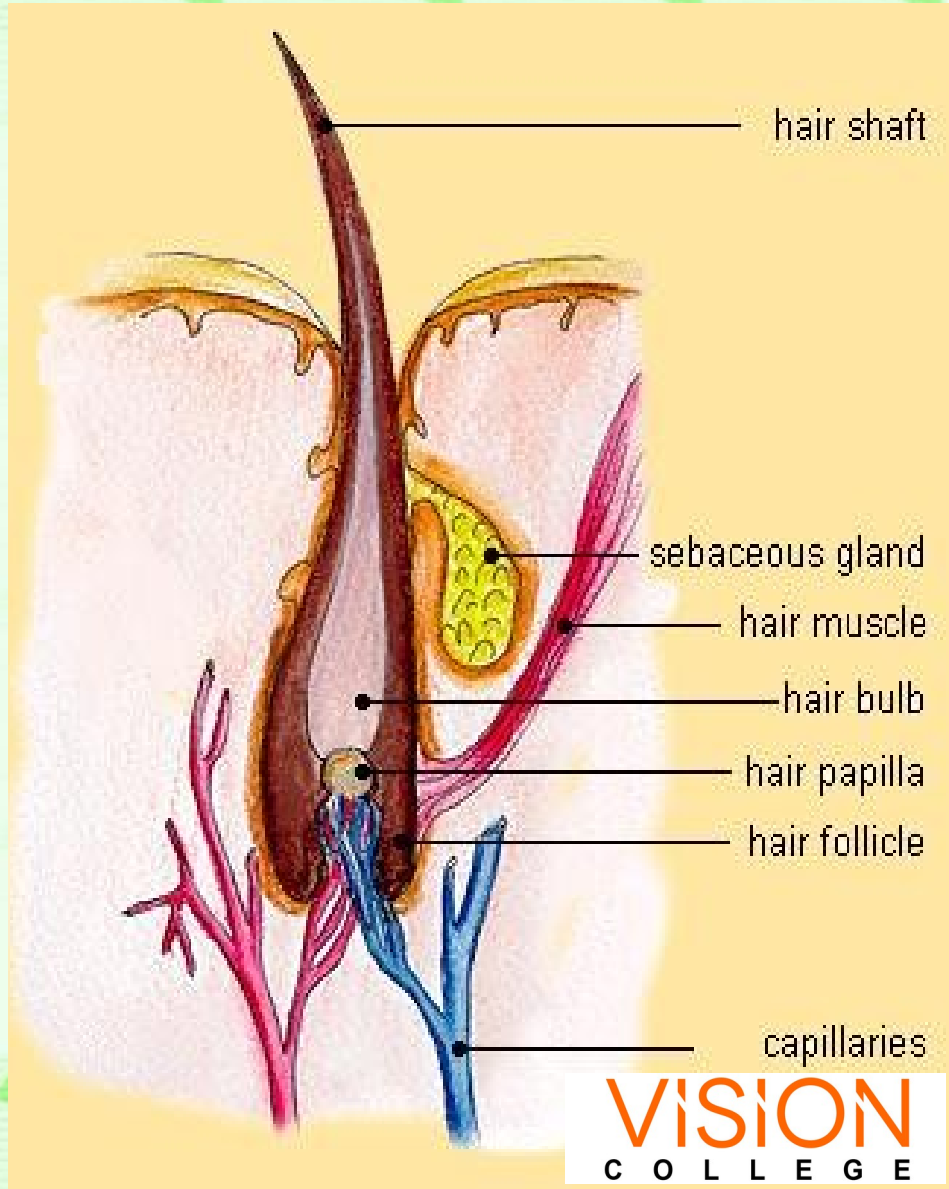
Still air is a poor conductor of heat.

cold conditions



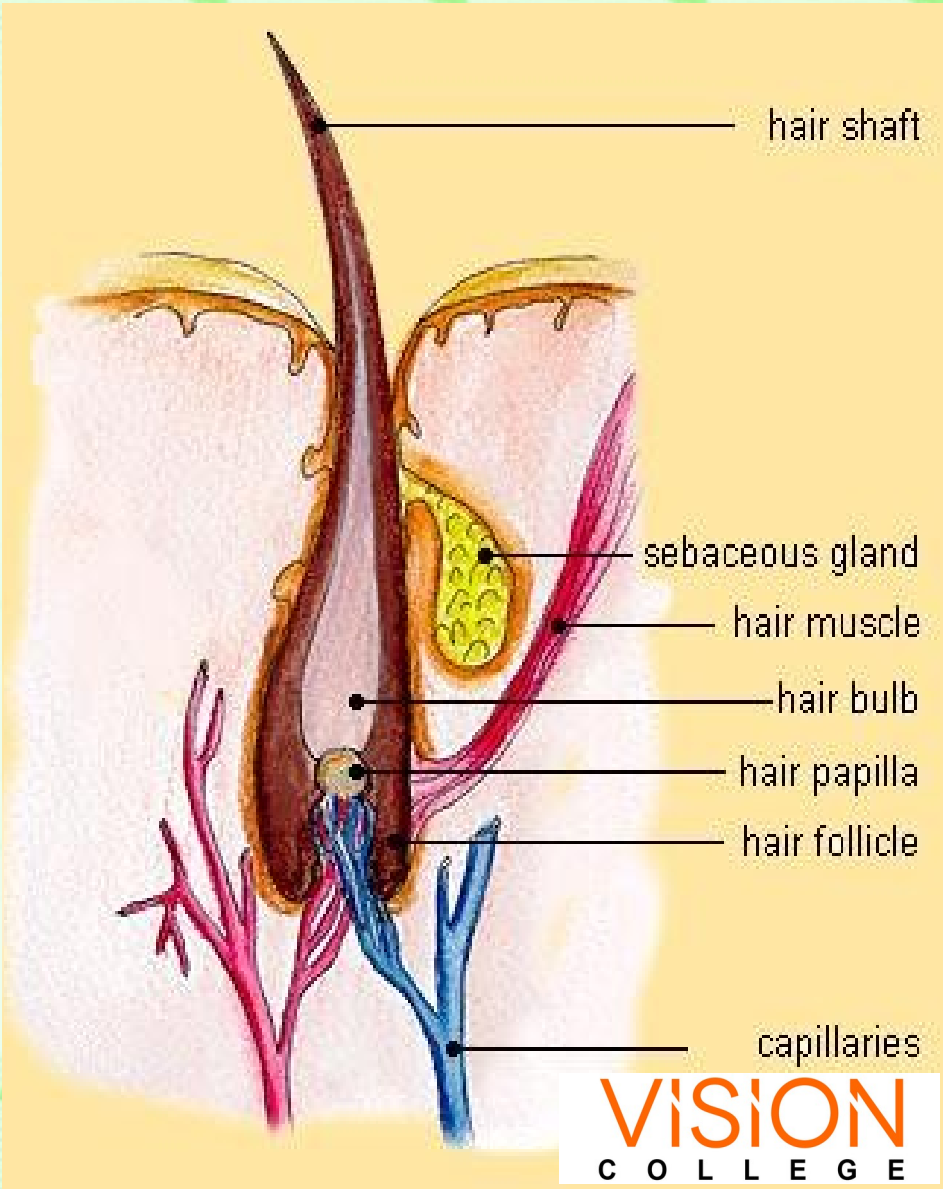
Sebaceous Glands

- Develop along the **walls of hair follicles** and **produce sebum**.
- This is an **oily substance** that is responsible for <u>lubricating the surface of skin.</u>



Sebaceous Glands

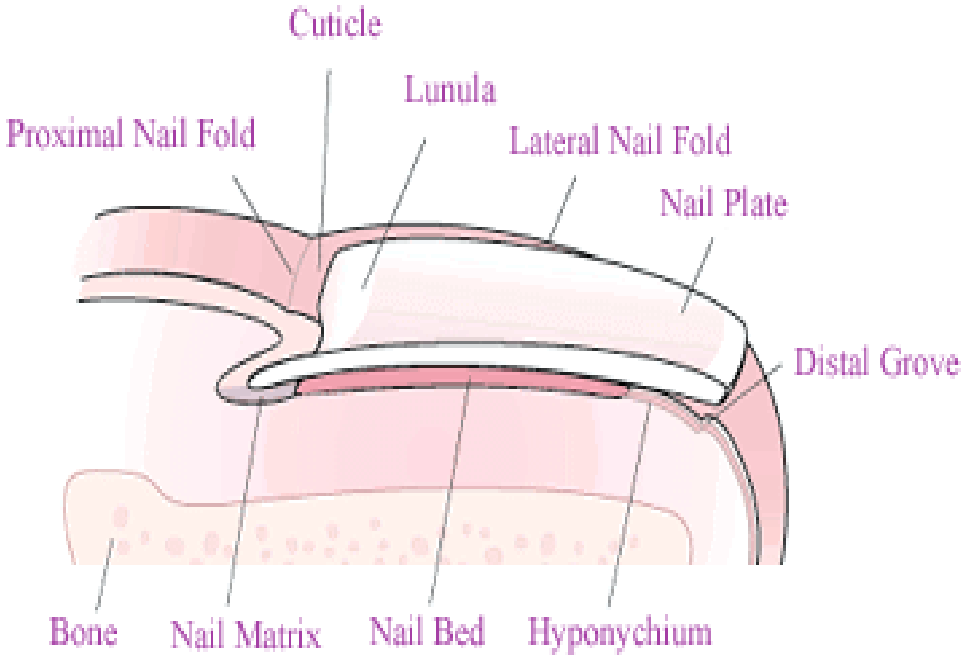
- Sebaceous secretion is under the control of the endocrine system.
- Secretion increases at puberty and late pregnancy.

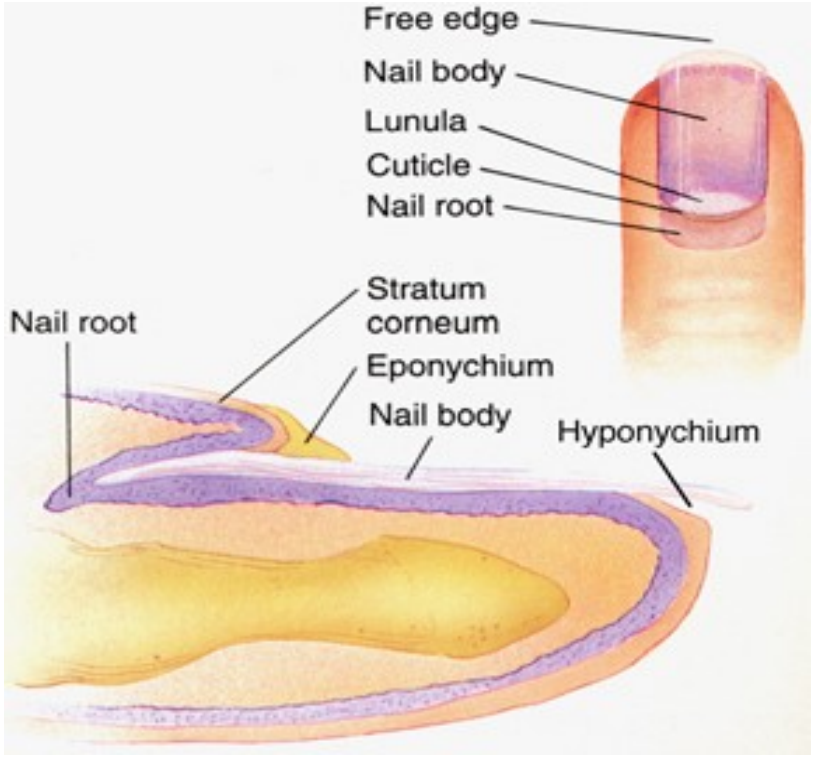


Nails

- Protect the tips of the fingers and toes.
- Made of hard keratin produced by cells that originate in the outer layer of the epidermis.
- The root of nail is embedded in the skin.
- Keratinocytes in the nail bed (matrix cells) proliferate, grow, synthesize hard keratin, dye, and form the matrix of the nail.

Cross Section of a Nail





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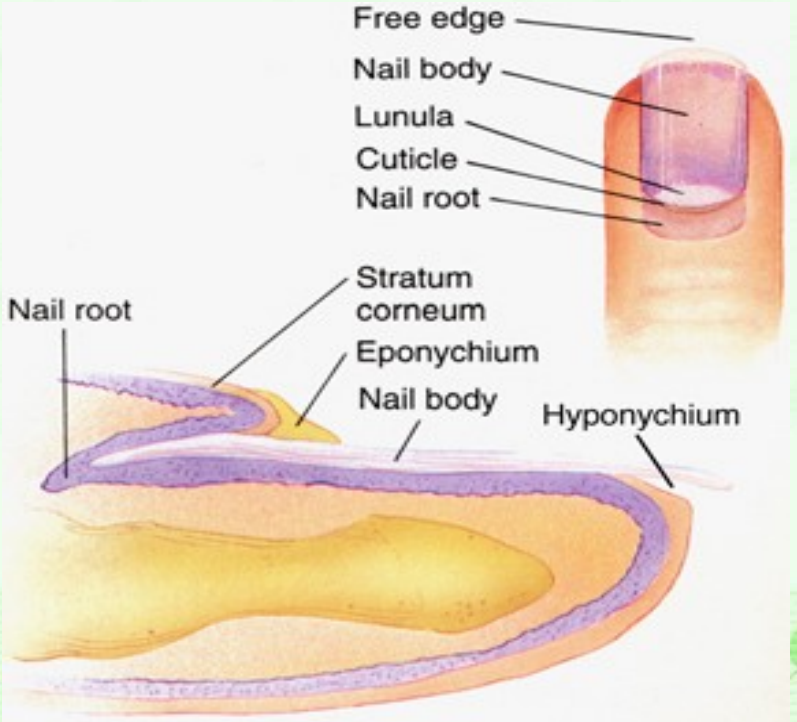
Nails

- **Lunula** represent **immature hard keratin** of the developing nail and is an <u>indicator of nail growth</u>.
- Growth is usually **fastest** in the **longest digit**.

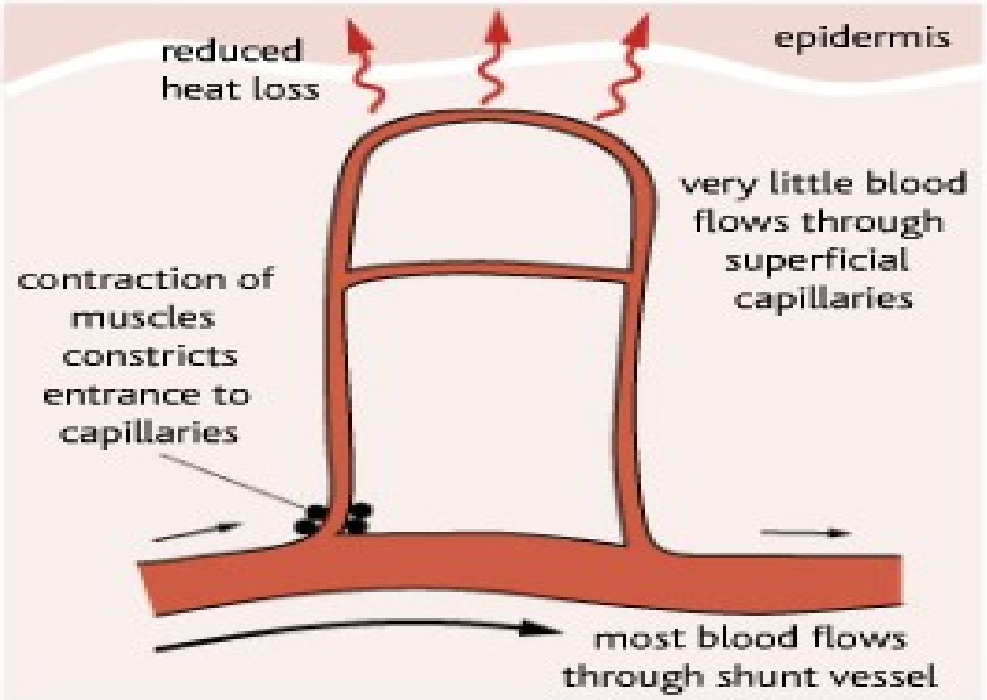


FUNCTIONS OF THE SKIN

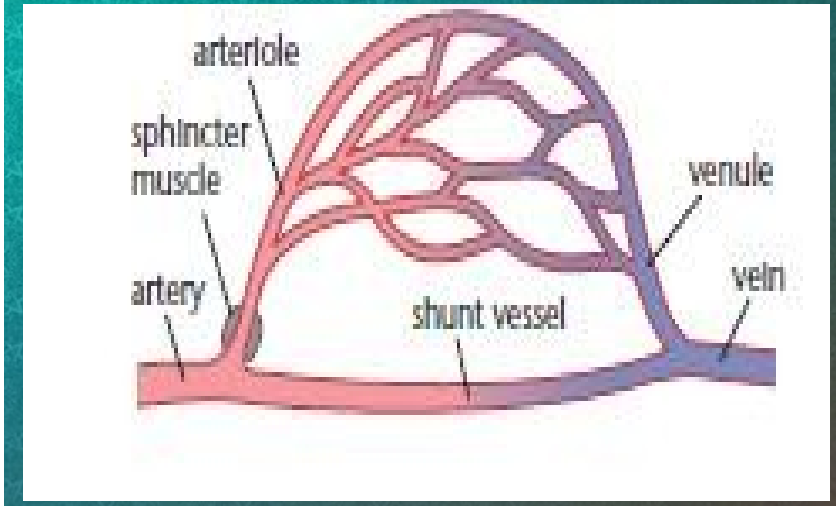
- **Protections** - against infection and dehydration (drying).
- **Regulation** - of body temperature.
- **Sensation** - collection of sensory information.
- **Absorption** – medications (patches).
- **Excretion** – water and electrolytes.
- **Manufacture of Vitamin D** with the help of ultraviolet light.

In a cold environment

- vasoconstriction occurs
- sphincter muscles around arterioles leading to superficial capillaries contract
- this constricts the passage into these capillaries and more blood flows through deeper shunt vessels
- less blood flows close to the body surface
- as most blood is diverted further from the body surface, the temperature gradient between the body surface and the environment is less steep, so heat loss by conduction and radiation is reduced.



Mechanism of temperature control



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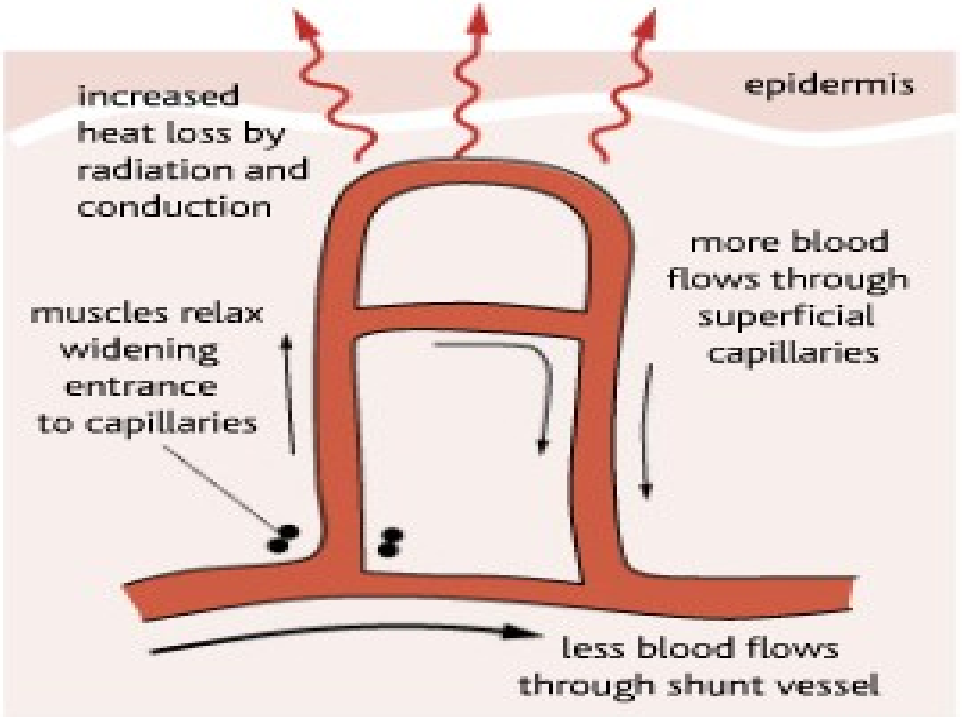
Mechanism of temperature control

In a warm environment

- vasodilation occurs
- sphincter muscles around arterioles leading to superficial capillaries are not stimulated to contract and therefore relax
- more blood can flow into these capillaries, dilating them with the pressure; less blood flows through deeper shunt vessels
- more blood flows close to the body surface
- as more blood flows close to the body surface, the temperature gradient between the body surface and the environment becomes steeper, so heat loss by conduction and radiation is increased.



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Any Questions??
Thank you
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