Physiology of Integumentary System
Part II: Hair, Nails and Skin Glands

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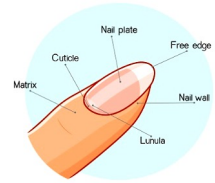

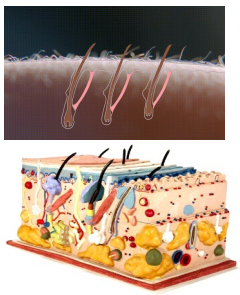

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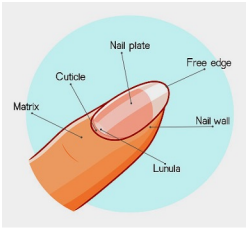
Contents:

- The accessory structures of the skin:
  - **Hair:**
    - Characteristics,
    - Hair Structure, Growth and Colours
    - Functions
  - **Skin glands:**
    - Sebaceous (oil) glands,
    - Sudoriferous (sweat) glands,
    - Ceruminous glands.
  - **Nails:**
    - Functions of Nails.



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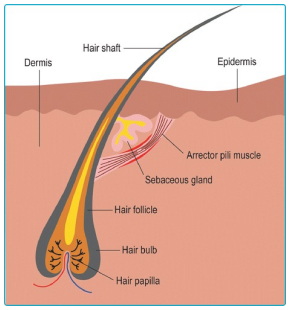
Objectives:

After studying this lecture, you will be able to:

1. Know the characteristics of hair.
2. Describe deferent types of skin glands.
3. List functions of deferent types of skin glands.
4. List functions of nails.



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Accessory structures of the skin:

The accessory structures of the skin:

- Are Hair, Nails, and Skin Glands
- Develop from the embryonic epidermis.
- Have a host of important functions. For example:
  - **Hair and Nails**: protect the body
  - **Sweat glands**: help regulate body temperature.

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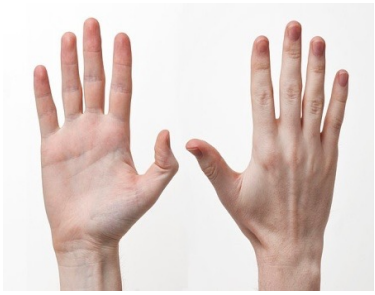
Skin Accessory Structures: ① Hair (or pili):

- It is a keratin structure growing out of the epidermis.
- It is found on all areas of the body except the palms of the hands, palmar surfaces of the fingers, the soles, and plantar surfaces of the feet and the lips.



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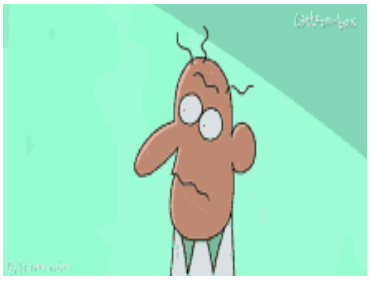
Skin Accessory Structures: ① Hair (or pili):

- In adults, it usually is most heavily distributed across the scalp, in the eyebrows, in the axillae (armpits), and around the external genitalia.
- Normal hair loss in the adult scalp is ~70–100 hairs/day



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Characteristics of the Hair:

- **Genetic** and **hormonal influences** largely determine the **thickness** and the **pattern** of hair distribution.



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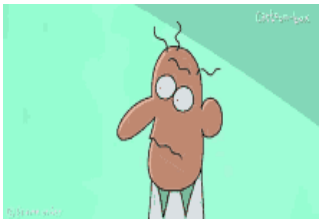
Characteristics of the Hair:

- Both the **rate of growth** and **the replacement cycle** may be altered by illness, radiation therapy, chemotherapy, age, genetics, gender, and severe emotional stress.
- Rapid weight-loss diets that severely restrict calories or protein increase hair loss.

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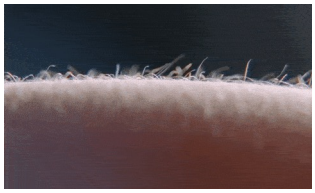
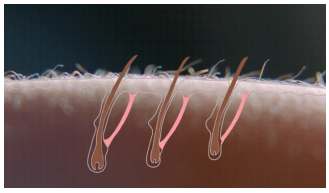
Characteristics of the Hair:

- Hair emerges at a less than 90-degree angle to the surface of the skin.
- Under physiological or emotional stress, such as cold or fright, autonomic nerve endings stimulate the **arrector pili muscles** to **contract**, which pulls the hair shafts perpendicular to the skin surface. This action causes "**goose bumps**" or "**gooseflesh**" because the skin around the shaft forms slight elevations.

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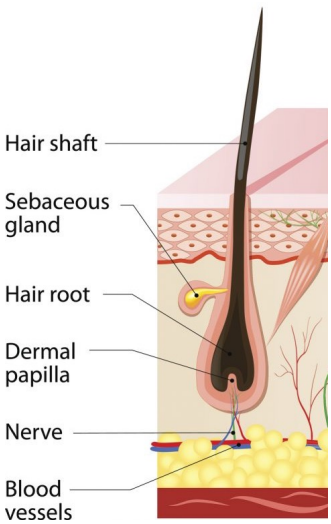
Structure of Hair:



Each hair is composed of columns of dead, keratinized epidermal cells bonded together by extracellular proteins.

- **Hair shaft**

It is the superficial portion of the hair, which projects above the surface of the skin.

- **Hair root**

It is the portion of the hair deep to the shaft that penetrates into the dermis, and sometimes into the subcutaneous layer.

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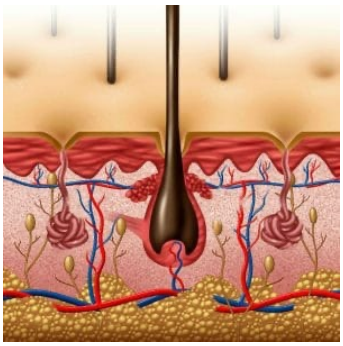
Structure of Hair:

- **Hair follicle** surrounding the root of the hair and is made up of an external root sheath and an internal root sheath.
- Together, the external and internal root sheath are referred to as the **epithelial root sheath**.
- The dense dermis surrounding the hair follicle is called the **dermal root sheath**.



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Structure of Hair:

- **Hair bulb** is an onion-shaped structure at the base of each hair follicle and its surrounding dermal root sheath. **The hair bulb houses:**
- the **hair papilla**:
  - a nipple-shaped indentation
  - contains areolar connective tissue and many blood vessels that nourish the growing hair follicle.
- the **hair matrix**,
  - a germinal layer of cells, its cells arise from the stratum basale.
  - its cells are responsible for the growth of existing hairs, and they produce new hairs when old hairs are shed.

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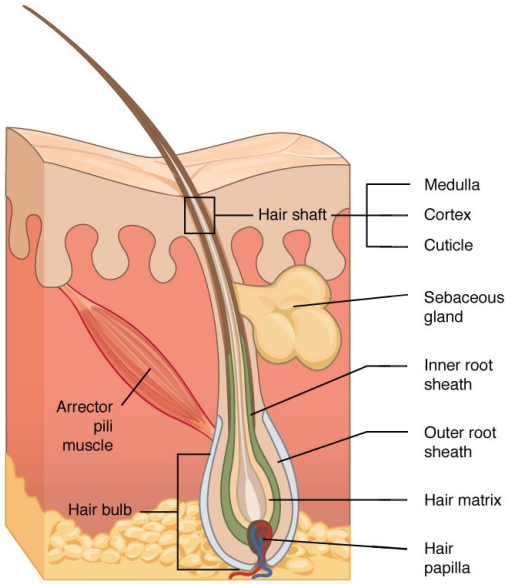
Structure of Hair:



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Hair Growth Stages:

- **The anagen phase:**
  - lasts ~3 or more years.
  - ~84% of hair remain in this phase.
- **The catagen (transition) phase:**
  - lasts ~3 weeks or less
  - ~1% of hair stay in this phase.
- **The telogen phase:**
  - followed by the anagen phase.
  - activated follicle stem cells produce a new hair shaft.

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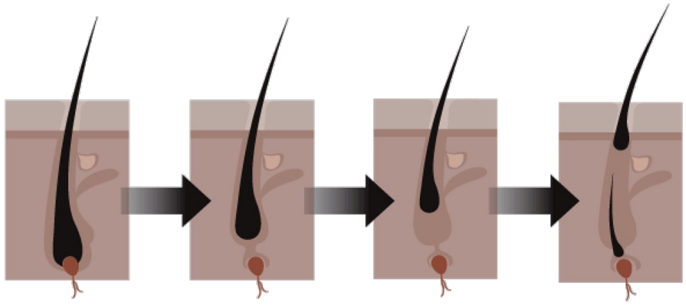
Hair Growth Stages:



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Hair Colour:

- Hair is similar to the skin in that it gets its colour from the pigment melanin, which is produced by melanocytes in the hair papilla.
- Hair colour is **genetically determined** but, as we age, melanin production decreases and the hair loses its colour, becoming grey and/or white.

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Hair Colour:

- The colour of hair is due primarily to the amount and type of melanin in its keratinized cells.
- **Dark-coloured hair:** mostly eumelanin (brown to black)
- **Blond and red hair:** variants of pheomelanin (yellow to red).
- **Gray hair:** few melanin granules cause progressive decline in melanin production.
- **White hair** lack of melanin and accumulation of air bubbles in the shaft.

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Functions of The Hair:

- **Protection:**
  - Hair on the head protects the skull from the sun,
  - Hair in the nose and ears and around the eyes (eyelashes) traps and excludes dust particles, which may contain allergens and microbes.
  - Eyebrows prevent sweat and other particles from dripping into the eyes
- **Sensory reception;**
- **Thermoregulation;**
- **Distribution of sweat-gland products;**
- **Psychosocial.**

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Skin Accessory Structures: ②Skin Glands:

- Glands are epithelial cells that secrete a substance.
- Several kinds of exocrine glands are associated with the skin:

➢ **Sebaceous (oil) glands,**

➢ **Sudoriferous (sweat) glands, and**

➢ **Ceruminous glands.**

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Skin Glands: Sebaceous (oil) glands:

- Sebaceous glands secrete an oily substance (**sebum**)

➢ **Sebum** is a mixture of triglycerides, cholesterol, proteins, and inorganic salts.

Functions of Sebum:

- It coats the surface of hairs and helps keep them from drying and becoming brittle.
- It prevents excessive evaporation of water from the skin, keeps the skin soft and pliable.
- It inhibits the growth of some (but not all) bacteria.

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Skin Glands: Sudoriferous glands:

- Their cells release **sweat**, or **perspiration**, into hair follicles or onto the skin surface through pores.
- Based on their **structure** and **type of secretion**, sweat glands are divided into two main types:

➢ **Eccrine sweat glands:**

➢ **Apocrine sweat glands:**

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Skin Glands: Ceruminous glands:

- Modified sweat glands in the external auditory canal.
- Produce a waxy lubricating secretion.

➢ **In combination with the sebaceous glands, ceruminous glands secrete a yellowish material called cerumen (or earwax).**

Functions of Cerumen:

- together with hairs in the external ear canal, provides a sticky barrier that impedes the entrance of foreign bodies and insects.
- It waterproofs the external auditory canal and prevents bacteria and fungi from entering cells.

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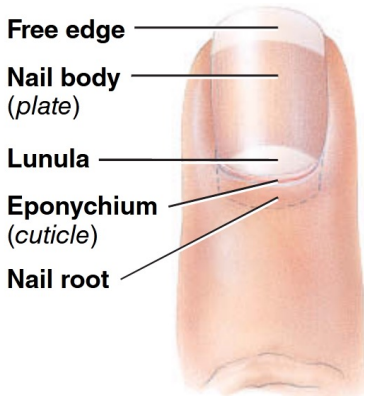
Skin Accessory Structures: ③Nails:

- Nails are hard, dead keratinized epidermal cells over the dorsal surfaces of the distal portions of the digits.
- Cell division of the nail matrix cells produces new nails.



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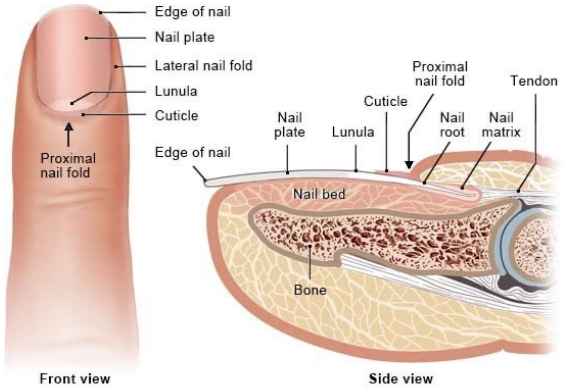
Skin Accessory Structures: ③Nails:

- **The principal parts of a nail are:**
  - Free edge,
  - Nail body,
  - Nail bed,
  - Hyponychium,
  - Lunula,
  - Nail root,
  - Eponychium,
  - Nail matrix.



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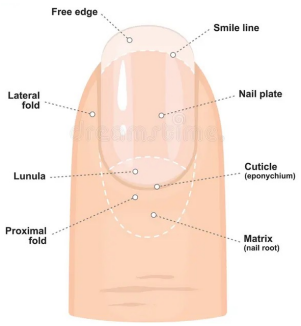
Skin Accessory Structures: ③Nails:

Functions of Nails:

- They protect the distal end of the digits.
- They provide support and counter pressure to the palmar surface of the fingers to enhance touch perception and manipulation.
- Nails allow us to grasp and manipulate small objects
- They can be used to scratch and groom the body in various ways.



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Questions and Comments:

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