

Integumentary System (Script)

Slide 1: Integumentary System

Slide 2: An overview of the integumentary system

Skin is the body's largest and heaviest organ making up 15% of body weight. Most skin is 1 to 2 mm thick

Skin, which is also referred to as the cutaneous membrane, consists of two main layers: epidermis and dermis. The epidermis is made up of stratified squamous epithelium. The dermis is found below the epidermis and is made up of connective tissue. Below the skin is the subcutaneous membrane, also referred to as the hypodermis, this layer consists of connective tissue.

These two membranes together make up the following layers from superficial to deep: epidermis, dermis, and hypodermis

Slide 3: Functions

Main functions of skin include: resistance to trauma and infection, other barrier functions, Vitamin D synthesis, sensation, thermoregulation, and nonverbal communication.

Skin is composed stratified squamous epithelium. The epithelium is thick and has densely packed cells called keratinocytes and protein called keratin, together making it an excellent physical barrier against trauma and infection. In addition, the environment of skin is acidic and dry; creating an acid mantle that prevents the growth of microbes. This is why skin provides both physical and chemical protection.

The physical protective nature of skin also creates a barrier that prevents water from entering or leaving the body. Skin is also a barrier against UV rays and many harmful chemicals.

A third function of skin is Vitamin D synthesis. This means that skin is able to make Vitamin D which is needed for bone development and maintenance. Skin initiates this process by absorbing the UV radiation and warmth from the sunlight to convert steroids into what will eventually become Vitamin D.

A fourth function of skin is sensation, this is due to the tactile cells in the epidermis and nerve endings in the dermis. This allows for various sensations such as heat, cold, touch, texture, pressure, vibration, and pain.

A fifth function of skin is thermoregulation. Skin contains mechanisms that allow for homeostasis of body temperature such as vasodilation and vasoconstriction. Vasodilation is the increase of blood vessel diameter, moving it closer to the surface of skin to allow heat to be released through sweating. Where vasoconstriction is the decrease of blood vessel diameter, moving it closer to the core of the body to conserve heat loss.

Skin also functions in nonverbal communication, this is where the condition of the skin, hair, and nails can communicate a person's age, race, and so on. This function also involves the skin and muscles to create facial expressions that allow for nonverbal communication.

Slide 4: Structure of Skin

Here is a diagram of our epidermis, its stratum and the various cells.

Epidermis is made up of keratinized stratified squamous epithelium. Some characteristics of the epidermis include:

- Contains dead cells at the surface packed with tough protein called keratin
- Is avascular, meaning it lacks blood vessels
- It depends on the diffusion of nutrients from underlying connective tissue
- Contains sparse nerve endings for touch and pain

Going from deep to superficial, the epidermis is composed of the following stratum:

Stratum Basale is the deepest and is made up of one layer of cells. This is the site for new skin cell production. The cells here appear cuboidal at first, but become stratified squamous as they move throughout the other stratum. This is why the epidermis is classified as stratified squamous epithelium. There are a number of cell types found in this stratum. There are mitotic **stem cells** that divide to become keratinocytes. The **keratinocytes** are the basic skin cells. They are layered throughout the stratum to form the protective thickness of skin. There are also melanocytes, these cells produce melanin (a pigment protein) which absorbs UV light and prevents it from going deeper. We all have the same number of **melanocytes**, what changes is the amount of melanin produced. Melanin is one of the pigments that give our skin color. Individuals with darker skin produce more melanin, this is due to the fact that their ancestors lived in climates with intense UV radiation. To protect and limit the amount of radiation, more melanin is produced. Individuals with fairer skin have ancestors who lived in climates with less intense radiation and did not need as much UV protection. These cells are only found in this layer. Then, there are **tactile cells**, which are attached to neurons in the underlying dermis and allow for sensation.

Moving up one stratum is the **Stratum Spinosum**: often times the thickest layer (except for in thick skin) consist of keratinocytes and dendritic cells. The keratinocytes are the same as in the previous layer, but they are starting to flatten out. The **dendritic cells** are a type of White Blood Cell (also called macrophages) that patrols the skin looking for invading organisms and material. Their role is more of a "scout" than "destroyer". They are not necessarily limited to this layer, but commonly found here.

The next stratum up is the **Stratum Granulosum**: This layer consists of 3-5 layers of keratinocytes that at this point produce a protein called keratin, which combines with lipids to create a water proof barrier for skin. The water proof barrier keeps water in and prevents dehydration through evaporation. The keratinocytes begin to die because they have moved away from the stratum basale and lack oxygen needed for metabolism.

The **Stratum Lucidum** is found only in thick skin, such as areas the soles of your feet and palms of your hands. This layer contains keratinocytes that are densely packed with eleidin (clear protein).

The **Stratum Corneum** is the most superficial layer. It is composed of many (approximately 30) layers of dead keratinocytes and keratin. Keratinized skin are especially resistant to abrasion, penetration, and water loss. This layer is shed as new keratinocytes are made and pushed up from the stratum basale.

Slide 5: Structure of Skin

To summarize, the epidermis layer consist of:

1. Stratum Basale: this layer is the deepest and has one layer of cells. Keratinocytes, melanocytes, and tactile cells can be found in this layer
2. Stratum Spinosum: thickest layer (except in thick skin) consists of flat keratinocytes with dendritic cells
3. Stratum Granulosum: layer consists of keratinocytes that contain granules
4. Stratum Lucidum: This layer is found only in thick skin.
5. Stratum Corneum: This is the most superficial layer. Contains dead keratinocytes and keratin

Slide 6: Skin

This is a diagram of all the layers.

A few key points to know about the epidermis. It takes 30-40 days for a keratinocyte to make its way to the surface and be sloughed off. The epidermis is avascular, does not blood vessels. It has a few nerve supply through the tactile cells. It is highly mitotic, the fastest reproducing cells in the body.

The next layer is the dermis. It provides support for the epidermis and is much thicker than the epidermis. There is a distinct line between the dermis and epidermis formed by the dermal papillae (of the dermis) and the epidermal ridges. These structures work like legos, with the finger like projections that lock together. They keep the epidermis in place and help it resist slipping and stress. The dermis is divided into a papillary layer and a reticular layer. The papillary layer is a thin layer near the dermal papillae and consists of areolar loose connective tissue and abundant blood vessels. The reticular layer is a thick layer below the papillary layer. The reticular layer consists of dense irregular connective tissue. The dermis also contains the associated structures such as glands, hair and follicles.

Under the dermis is the SUBCUTANEOUS MEMBRANE or HYPODERMIS. This layer is beneath the skin and binds skin to underlying tissue and structures. The boundary between the dermis and hypodermis is not as well defined as it is between the dermis and epidermis. Generally the hypodermis has more areolar and adipose tissue than the dermis. The hypodermis is highly vascular. It functions in padding the body to provide cushion and thermoregulation and binds skin to underlying tissue.

Slide 7: Accessory Organs

In addition to skin, the integumentary system includes hair and nail

Hair can be found almost everywhere on the body's surfaces except for palms, soles, certain areas of fingers and toes, nipples, and parts of the genitals. Hair consists of the following parts: the **follicle** which is a hollow tube in which hair grows, the **bulb** which is the base of hair – only portion that contains living hair cells, the **root** which is the remaining portion of the hair follicle, and the **shaft** which is the portion of hair that is exposed on the surface of skin.

Nail is an extension of the stratum corneum and consists of dead keratinocytes densely packed with parallel hard keratin fibers. Nail functions as a tool for picking and manipulating objects. It consists of the following parts: the **nail plate** which is the visible portion, the **nail root** which is embedded under the skin, and the **nail matrix** which consist of the stratum basale and is the site of nail growth.

Slide 8: Hair

Slide 9: Nail

Slide 10: Cutaneous Glands

There are two types of glands: Exocrine and Endocrine. Exocrine glands use ducts to transport their products and Endocrine uses the blood supply. We will be focusing on exocrine glands. There are a number of exocrine glands in the integumentary system.

Sweat Glands are found in the dermis and there are two types:

Merocrine sweat glands are the most numerous gland particularly in the palms and soles. They are located in the dermis all over the body. They produce watery perspiration for temperature regulation and waste removal. Perspiration, or sweat, is primarily composed of water, sodium chloride, potassium, lactic acid, and hydrogen ions (which contribute to the acid mantle environment of skin). **Aprocrine sweat glands** can be found in the groin, axilla, and areola regions of the body. They develop at puberty. The ducts lead to nearby hair follicles rather than an independent sweat pore. These sweat glands act as scent glands that release pheromones (scent) and are stimulated in response to stress and sexual stimulation.

Sebaceous Glands produce an oily substance called sebum. Sebum keeps skin from becoming dry and brittle and makes hair shiny. It is basically our natural lotion. Ducts usually open into a hair follicle, but some can open to the surface. Acne occurs when our glands produce a large amount of sebum that sticks to skin cells and plugs up the hair follicle. This situation causes bacteria that get trapped under the plug to thrive.

Ceruminous Glands are found only in the external ear canal. They produce secretions that combine with sebum to form ear wax (cerumen). Their ducts lead directly to surface skin. Cerumen waterproofs the ear canal, keeps the eardrum pliable, and kills bacteria.

| **Mammary Glands** are located in the breast and they produce milk.