

INTEGUMENTARY SYSTEM

Integument means "skin". It is also called the cutaneous membrane. Its functions include:

- **Protection:** the surface of the skin is impermeable to pathogens and water. Unbroken skin is our best defense against attack and dehydration.
- **Body Temperature Regulation:** blood vessels constrict when our core is too cool, and dilate if our core is overheating
- **Cutaneous Sensation:** sensory receptors fire action potentials when touch stimulated; axons project from the skin to the spinal cord
- **Vitamin D Synthesis:** cholesterol in the bloodstream moves into the dermis where enzymes can convert it into vitamin D. This can only happen in the presence of sunlight (or a tanning full-spectrum light). Vitamin D deficiency is particularly associated with development of autoimmune disorders such as type I diabetes and multiple sclerosis. Deficiencies in vitamin D during childhood may also set the stage for cancer or autoimmune diseases later in life.
- **Blood Reservoir:** During times of stress, blood can be moved rapidly out of the skin and toward the heart, blood vessels and skeletal muscles.
- **Excretion:** We can eliminate excess salt and stress hormones when we sweat.

The EPIDERMIS is composed of EPITHELIAL TISSUE

- Avascular: "no blood vessels"
- Keratinized stratified squamous epithelium. These cells are jam-packed with keratin, a fibrous protein that toughens skin and waterproofs it.
- Cells in the bottom of the epidermis undergo mitosis and are constantly pushed upward. They are gradually filled with keratin and, as they move farther from capillaries (blood supply), they eventually die. The different layers of the epidermis are named. Two of these layers are the:
 - Stratum Corneum: most superficial layer of epidermis, 20-30 cells thick—all dead! Constantly sloughed off
 - Stratum Basale: deepest layer of epidermis, where keratinocytes reproduce

Cell types found in the epidermis:

- **Keratinocytes:** Predominant cell type in the epidermis; produces keratin
- **Melanocytes:** produce melanin pigment that protects the nucleus of skin cells from UV radiation (a pituitary hormone known as melanocyte-stimulating hormone stimulates these cells).
 - Freckles/moles: accumulated melanin
 - Tanning: melanocytes are stimulated by sunlight
- **Merkel cells:** sensory cell receptors for touch—when stimulated, they send an electrical signal along a nerve to the brain

The DERMIS is composed of two different kinds of CONNECTIVE TISSUE

- The dermis is also called the "hide" or "leather" of an animal.
 - **Papillary layer:** composed of areolar connective tissue. This is a loose connective tissue that gives skin its ridges on hands and feet—good for gripping
 - sweat pores are found along the top border and their bumpy surfaces results in each individual's unique **fingerprint**
 - **Reticular layer:** dense irregular connective tissue houses the accessory structures:
 - blood vessels
 - fibers: collagen fibers prevent tearing and hold water; elastin fibers give flexibility
 - hair follicles, sweat (sudoriferous) glands, and oil (sebaceous) glands

HYPODERMIS (also known as the SUBCUTANEOUS LAYER): Contains subcutaneous adipose tissue

INTEGUMENTARY SYSTEM CONTINUED

A few homeostatic imbalances include:

- **stretch marks:** tears in dermal collagen
- **blisters:** fluid-filled separation of epidermis and dermis
- **cellulite:** if the collagen fibers aren't strong enough, the fat from hypodermis pushes outward and makes pooches and dimples in the skin surface.
- **Skin Cancer**
 - melanocytes = melanoma, very dangerous, metastatic;
 - basal cell carcinoma (from cells of stratum basale) much more common and less dangerous
- **Burns:** Acutely, dehydration is the greatest concern; the Rule of 9's helps health-care workers estimate need for IV fluid replacement. Chronically, infection is the greatest concern.
 - 1st degree—just epidermis, painful, red, heals quickly
 - 2nd degree—epidermis and part of dermis, painful, blisters form
 - 3rd degree—all of epidermis and dermis; no pain initially (nerves destroyed)—chance of infection VERY high
 - **Infections:** *Staphylococcus aureus*, and fungal infections are common and can infect the hair, skin (ringworm), nails, feet (athlete's foot), or groin (jock itch).

APPENDAGES OF THE SKIN

- **Sweat (Sudoriferous) Glands:** found on almost all skin surfaces
 - **eccrine sweat glands:** found all over body
 - acidic (pH between 4 and 6) secretion contains water, salt, antibodies
 - prevents overheating and reduces friction
 - stimulated by sympathetic nervous system
 - **apocrine sweat glands:** only found in armpit and the anogenital area
 - ducts empty into hair follicles, rather than onto skin surface
 - presence of some fats makes it more viscous, white or yellowish
 - "BO" is the smell as this compound is broken down
 - probably sexual "pheromones" for humans
 - **Ceruminous glands:** modified sweat glands that make ear wax
- **Oil (Sebaceous) Glands:** secrete oil (sebum).
 - Softens hair and skin, antibacterial properties
 - whitehead: blocked sebaceous gland; blackhead: oxidized oil; acne: inflammation of sebaceous glands, usually caused by bacteria
- **Hairs (pili) and Hair Follicles** – protects us from UV light, nose hairs trap particles, eyelashes protect eyes, etc.
 - *Hair*— the inner core is the **medulla**, the next portion the **cortex** and outermost part forms scale-like structures called the **cuticle**
 - Shaft—above skin; all dead keratinized cells
 - Root—below skin; some dead cells and some still living
 - Hair follicle – all living cells where mitosis occurs
 - Papilla—where blood supply of hair follicle is
 - Arrector pili muscle is smooth muscle that is attached to each hair follicle. It is stimulated by sympathetic motor nerves to make the hair stand "on end"
- **Nails**—very hard keratin