**EPITHELIAL membranes**

1. **Cutaneous membranes** (SKIN) – a dry membrane with a superficial epidermis composed of stratified squamous epithelium and underlying dermis is dense irregular connective tissue. The main function is protection.

2. **Mucous membranes** (mucosa) – composed of varies types of epithelium resting on areolar connective tissue called lamina propria.
   - Lines body cavities open to the exterior and organs of the respiratory, digestive, urinary and reproductive tracts. The mucosa is adapted for absorption or secretion of mucus.

3. **Serous Membranes** (serosa) – moist membrane found in ventral body cavities. The walls of ventral cavities and outer surface of visceral organs are covered by a thin, double-layered membrane. Serosa is composed of simple squamous epithelium with underlying areolar connective tissue. The main function is lubrication and cushioning.
   - Serous membranes occur in pairs. The parietal layer lines a specific portion of the wall of the ventral body cavity. The visceral layer covers the outside of the organs in the cavity.
   - The serous space between the layers is filled with lubricating fluid called serous fluid. The fluid is secreted by both layers and allows organs to slide without friction.
   - The membranes lining the abdominal cavity and organs are called peritoneum. The membranes lining the thoracic cavity and the lungs are called pleura. The membranes lining pericardial cavity and covers the heart is called pericardium.

**CONNECTIVE membranes**

1. **Synovial membranes** – only composed of aerolar tissue. These membranes line a fibrous capsule at joints, line brusae sacs and tendon sheaths. The membrane secretes synovial fluid to provide lubrication and cushioning for smooth movement.
**INTEGUMENTARY SYSTEM**

**Functions -**

1. Protection from .....  
   a. Mechanical damage – epidermis contains keratin which toughens cells  
   b. Infection by microbes – the low pH skin secretions (sweat & oil) creates an acid mantle which deters bacterial growth; sweat contains lysozymes (enzyme) and antibodies that destroy bacteria  
   c. Ultraviolet light – UV light stimulates cells to produce melanin which blocks much of the harmful UV light  
   d. Excessive water loss or dehydration – contains a waterproofing glycolipids and keratin to block diffusion of water  

2. Excretion – nitrogen containing waste are eliminated from body in sweat  

3. Cutaneous sensation – sensory receptors for heat, pain and pressure  

4. Body temperature regulation…..  
   a. Cold temperatures – blood vessels constrict to reduce blood flow to the skin and sweat production decreases to retain heat in the trunk of the body…shivering occurs to generate heat due to muscle activity  
   b. Hot temperatures – blood vessels dilate to increase blood flow to the skin to dissipate to the extremities and sweat production increases to cool body  

5. Blood reservoir – when other body organs need blood supply, the nervous system constricts dermal blood flow  

6. Production of Vitamin D – UV light converts circulating cholesterol into Vitamin D precursor which is needed for calcium metabolism

**Skin Layers -**

**EPIDERMIS** – keratinized stratified squamous epithelium  

1. Stratum Basale (stratum germinativum)  
   - deepest layer – lies above the basement membrane and dermis  
   - receives the most adequate nourishment via diffusion of nutrients from dermis  
   - Cells undergo rapid cell division; millions of cells are produced daily – daughter cells are pushed upward.  

2. Stratum Spinosum  
   - Several cell layers thick with tension resisting bundles of pre-keratin filaments giving it a spiny appearance.  

3. Stratum Granulosum  
   - Flattened layer full of active keratinocytes and the last layer to receive nourishment from underlying connective tissue.  

4. Stratum Lucidum  
   - Thin, translucent layer of dead keratinocytes and granules. Layer is only visible in thick skin of the palms, fingers, toes and soles. It increases friction and protection in these areas.  

5. Stratum Corneum  
   - Outermost layer of flattened, dead, keratin-filled cells that constantly flake off. Thickest layer providing an “overcoat” to protect underlying layers.
**Damage to the Skin:**
- Interruptions in blood flow to the skin can cause deterioration and necrosis resulting in decubitis ulcers (bedsores).
- Blisters occur when the epidermal and dermal layers are separated by fluid-filled pockets.
- Extreme stretching of the skin can tear the dermis resulting in stretchmarks.
- As a result of aging, elastic and collagen production decreases and subcutaneous fat decreases, resulting in saggy, wrinkled skin.

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**Cells of the epidermis –**
- Melanocytes – found under the basale cells and produce the brown pigment melanin. Vesicles of melanin are transferred into the overlying keratinocytes, darkening the skin and protecting the nucleus from the damaging effects of ultraviolet (UV) radiation in sunlight.
- Keratinocytes – produces a fibrous protein called keratin that gives the epidermis its protective properties. Mature keratinocytes produce keratin and a glycolipid granule that is tough, durable and water resistant.
- Merkel cells – found among the basale cells. Cells contain disc-like sensory nerve endings called Merkel disc which detect touch.
- Langerhans’ cells – arise from bone marrow and migrate to epidermis. Cells ingest foreign substances and help activate the immune system.

**DERMIS** – dense irregular connective tissue
- Contains nerve fibers, blood vessels, lymphatic vessels, hair follicle, oil glands, sweat glands, sensory receptors, white blood cells
  1. Papillary layer – thin, superficial layer containing areolar connective tissue filled with collagen and elastin fibers. Contains a rich supply of blood capillaries forming a papillary plexus and nerve endings for touch and pain.
    - Superior surface forms projections called dermal papillae that indent into the overlying epidermis. Dermal papillae are filled with capillary loops, free nerve endings to detect pain, and touch receptors called Meissner’s corpuscles.
    - On the palms of the hand and soles of the feet, these papillae form epidermal ridges that increase friction and enhance the gripping ability of the fingers and feet. These ridge patterns are genetically determined and sweat pores leave films of sweat in this pattern forming a fingerprint.
  2. Reticular layer – contains dense irregular connective tissue with bundles of collagen, elastic and reticular fibers. These fibrous bundles blend into the papillary layer and into the underlying subcutaneous layer.
    - Cutaneous plexus – network of blood vessels that lie between the reticular and subcutaneous layer that provide nourishment.
    - Layer contains collagen fibers that run varies ways, but mostly parallel to form tension lines. Surgeons cut parallel to tension lines to reduce scarring.
    - Pacinian corpuscles – sensory receptor that are sensitive to deep pressure

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**SUBCUTANEOUS LAYER (hypodermis)**
- Contains adipose and areolar connective tissue that anchor the skin to underlying organs. Serves as a shock absorber and insulates the deeper tissues.
Skin Pigments -

Melanin – ranges in color from yellow to reddish-brown to black. Its synthesis depends on the enzyme tyrosinase in melanocytes. All humans have same number of melanocytes, but production depends on genetics and sun exposure. Freckles and moles are local accumulations of melanin.

- Excessive sun exposure causes clumping of elastin fibers resulting in leathery skin, temporary depresses the immune system, and can alter the DNA of skin cells leading to skin cancer. UV radiation destroys body’s folate stores necessary for DNA synthesis.

Carotene – yellow to orange pigment that accumulates in the stratum corneum and the hypodermis.

Hemoglobin – pinkish hue is due to color of oxygenated hemoglobin in red blood cells circulating through dermal capillaries.

Skin Color Changes -----

- Erythema - reddening of skin due to embarrassment, hypertension, fever, inflammation or allergy.
- Pallor (blanching) - pale skin due to emotions, anemia or hypotension.
- Jaundice - yellow skin tone usually indicates liver disorder in which yellow bile pigments accumulates in the blood and is deposited in body tissues.
- Bruises – reveal where blood escaped from circulation and clotted beneath the skin. Clotted masses are called hematomas. An unusual tendency to bruise may be the result of Vitamin C deficiency or hemophilia
- Cyanosis – poorly oxygenated skin turns bluish during heart failure and severe respiratory disorders.
- Bronzing – bronze, metallic appearance is a sign of Addison’s disease, hypofunction of the adrenal cortex.
- Vitiligo – loss of melanocytes due to an autoimmune disease which the immune system mistakenly attacks and destroys the body’s melanocytes.
**APPENDAGES of the SKIN**

**Hair** – flexible strand of dead, keratinized cells produced by hair follicles.
- Hair follicles are composed of inner epidermal sheaths in the bulb that divide to form the hair. The outer dermal sheath (papilla) composed of connective tissue contains capillaries that supplies nutrients to the growing hair and signals it to grow. Melanocytes are found in the bulb within the follicle.
- Root plexus are knots of sensory nerve endings that wrap each hair bulb; bending hair stimulates these nerve endings.
- Hair shaft is the part projecting form the surface of the scalp or the skin.
- Arrector pili is smooth muscle attached to the hair follicle that contracts to make hair erect.
- Each hair consists of a central core called the medulla surrounded by a bulky cortex layer. The cortex is enclosed by an outermost cuticle. The cuticle provides strength and keeps hair layers tightly compacted. Split ends form when the cuticle wears away.

**Nails** – epidermal derivatives composed of dead, tightly compressed cells filled with keratin.

**Sebaceous (oil) Glands** – exocrine gland that release sebum (oil & fragmented cells) through a pore or on the hair follicle…..sebum lubricates skin and prevents bacterial growth

**Whitehead** – occurs when sebaceous ducts become blocked by sebum…when it dries, it forms a **blackhead**.

**Acne** – active infection of the sebaceous gland accompanied by pimples

**Seborrhea** – overactive sebaceous gland; “cradle-cap”

**Sudoriferous Glands** – exocrine gland that release sweat to the skin surface via ducts.
1. Eccrine (Merocrine) glands – excrete body waste, assist in temp regulation, deter bacterial growth
   a. located everywhere --- skin may contain 2-5 million per square inch
   b. sweat composition: 99% water, salt, metabolic waste (urea, uric acid & ammonia)
   c. pH of sweat 4-6….sweat is an acidic solution that deters bacterial growth
2. Apocrine glands – begin to function at puberty…their ducts empty secretions into hair follicles
   a. Located in axillary and genital region
   b. same secretions as eccrine, but contains fatty substances & proteins
   c. bacteria on skin decompose this sweat and release byproducts that form our body odor
3. Ceruminous glands – modified apocrine glands found in lining of external ear canal; secrete cerumen (earwax) that blocks entry of foreign material
4. Mammary glands – modified sweat gland that secretes milk

**Infections & Allergies**

**Athlete’s Foot** – fungal infection resulting in itchy, red, peeling condition of the skin

**Boils and Carbuncles** – inflammation of hair follicles and sebaceous glands caused by bacterial infection

**Cold Sores** – fluid-filled blisters caused by herpes simplex infection; virus stays dormant in a cutaneous nerve

**Contact dermatitis** – redness and swelling of skin, progressing to blister caused by exposure to chemicals

**Impetigo** – pink, water-filled, raised lesions that develop a yellow crust and rupture; caused by bacteria

**Psoriasis** – overproduction of skin cells that results in reddened epidermal lesions covered with dry scales
CANCER – abnormal growth of cells that form tumors...tumors may be benign or malignant (cancerous) and metastasize to invade other body areas. Use the ABCDE rule to examine skin for possible lesions.....Asymmetry, Border irregularity, Color, Diameter, Elevation.

Basal Cell Carcinoma – least malignant and most common with a 99% cure rate. Stratum basale cells proliferate and invade the dermis and hypodermis. This cancer is slow growing, does not metastasize, and often occurs on the face.

Squamous Cell Carcinoma – arises from keratinocytes of the stratum spinosum. Lesion appears as scaly, reddened papule and often arises on head or hands. This cancer tends to grow rapidly and metastasize. If caught early, change of complete cure is good after being surgically removed and radiation therapy.

Melanoma – cancer of melanocytes is the most dangerous because it is highly metastatic and resistant to chemotherapy. The chance of survival is poor if lesion is over 4 mm thick. Treatments include surgical excision accompanied by immunotherapy (immunizing the body against its cancer cells).

BURNS – tissue damage that denatures cell proteins and cause cell death in affected areas.

The immediate threat to life resulting from severe burns is a loss of body fluids containing proteins and electrolytes, resulting in dehydration and electrolyte imbalance. This leads to renal shutdown and circulatory shock. Lost fluids must be replaced immediately and replace supplementary nutrients.

After initial dehydration crisis, the leading cause of death is infection. Burned skin is sterile for about 24 hours, after this time pathogens are free to invade broken skin.

Rule of 9’s is used to estimate the extent and severity of burns.

Types of Burns
1. Partial Thickness burns
   o First-degree burns - only the epidermis is damaged; the area becomes red and swollen
   o Second-degree burns - injury to the epidermis, upper region of dermis resulting in a blister
2. Full Thickness burns
   o Third-degree burns – destroys entire thickness of skin and area becomes blackened, nerve endings are destroyed and burn area is not painful. Skin graft is necessary because regeneration isn't possible.

**CRITICAL** burns –
1. over 25% of body has 2nd degree burns
2. over 10% of body has 3rd degree burns
3. 3rd degree burns present on face, hands, feet