

HESI A2 Cheat Sheet

ANATOMY AND PHYSIOLOGY

Histology

Parenchyma: tissue that conducts the specific function of the organ; comprises the bulk of the organ.

Stroma: connective tissue, blood vessels, nerves, ducts.

Four Basic Tissue Types

- **Epithelial Tissue:** cells attached to one another to form an uninterrupted layer of cells that separates the underlying tissues from the outside world; provides the essential functions of protection, containment, absorption, and secretion.
- **Connective tissue:** several cell types and extracellular products which, together, provide essential functions of mechanical reinforcement, immune surveillance, transport/diffusion of nutrients and wastes, and energy storage.
- **Nervous Tissue:** highly specialized nerve cells and support cells; stimulates muscle contraction, creates an awareness of the environment, and plays a major role in emotions, memory, and reasoning.
- **Muscle tissue:** highly cellular and is well supplied with blood vessels; has the special ability to shorten or contract in order to produce movement of the body parts.

The epithelium is always supported by connective tissue. Peripheral nerves travel within connective tissue. Muscle tissue is enmeshed by connective tissue. Blood vessels travel within connective tissue.

Example: The *parenchyma* of the liver is epithelial tissue (hepatocytes). The blood vessels, nerves, and supporting connective tissue of the portal areas comprise the *stroma*.

Tissue architecture

- **Tubular organs** - three principal layers:

Mucosa: the epithelial lining of the organ, a layer of connective tissue immediately beneath that epithelial lining, called *lamina propria*.

Submucosa: loose ordinary connective tissue.

Muscularis: smooth muscle cells align with one another in bundles that share a common orientation, bundles typically orient with some fiber bundles encircling the tubular organ while others run approximately parallel to the axis of the tube.

- **Glandular organs**

At an orifice along an epithelial surface, the surface turns inward, forming a pore lined by duct epithelium. At its inner end, the duct is closed by a small ball of epithelial cells, called an *acinus*. The acinar cells are secretory, releasing their secretion into a lumen at the center of the acinus. The acinar lumen leads into the lumen of the duct. At the other end of the duct, at the pore, the duct lumen opens to the outside world.

Cell division

Mitosis - The process by which a cell replicates its chromosomes and then segregates them, producing two identical nuclei in preparation for cell division.

Meiosis - A type of cell division in sexually reproducing organisms that reduces the number of chromosomes in gametes (the sex cells, or egg and sperm). During meiosis, each diploid cell undergoes two rounds of division to yield four haploid daughter cells — the gametes.

Skin

Epidermis: the tough protective layer that contains the melanin-producing melanocytes.

Dermis: contains nerve endings, sweat glands, oil glands, and hair follicles.

Subcutis/hypodermis: fatty layer of subcutaneous tissue.

- **Basket Cells:** surround the base of hair follicles and can sense pressure.
- **Blood Vessels:** carry nutrients and oxygen-rich blood to the cells that make up the layers of skin and carry away waste products.
- **Hair Erector Muscle:** muscle connected to each hair follicle and the skin.
- **Hair Follicle:** tube-shaped sheath that surrounds the part of the hair that is under the skin and nourishes the hair.
- **Langerhans Cells:** attach themselves to antigens that invade damaged skin and alert the immune system to their presence.
- **Melanocyte:** a cell that produces melanin, and is located in the basal layer of the epidermis.
- **Merkel Cells:** tactile cells of neuroectodermal origin located in the basal layer of the epidermis.
- **Pacinian Corpuscle:** a nerve receptor located in the subcutaneous fatty tissue that responds to pressure and vibration.
- **Sebaceous Gland:** are small, sack-shaped glands that release an oily substance onto the hair follicle that coats and protects the hair shaft from becoming brittle. These glands are located in the dermis.
- **Sensory Nerves:** nerves that sense and transmit heat, pain, and other noxious sensations.
- **Stratum Corneum:** comprised of dead skin cells; protects the living cells beneath it by providing a tough barrier between the environment and the lower layers of the skin.
- **Sweat Gland:** located in the epidermis and produce moisture (sweat) that is secreted through tiny ducts onto the surface of the skin (stratum corneum).

Anatomical systems

Skeletal System

- There are two types of bone tissue: compact and spongy. Compact bone consists of closely packed osteons or haversian systems. Spongy bone consists of plates of bone, called trabeculae, around irregular spaces that contain red bone marrow.
- Osteogenesis is the process of bone formation. Three types of cells, osteoblasts, osteocytes, and osteoclasts, are involved in bone formation and remodeling.
- Bones grow in length at the epiphyseal plate between the diaphysis and the epiphysis. When the epiphyseal plate completely ossifies, bones no longer increase in length.

Muscular System

- Four major muscle groups of the body include: muscles of the head and neck, muscles of the trunk, muscles of the upper extremity, muscles of the lower extremity.

- Each muscle fiber is surrounded by endomysium. The fibers are collected into bundles covered by perimysium. Many bundles, or fasciculi, are wrapped together by the epimysium to form a whole muscle.

Nervous System

- Neurons are the nerve cells that transmit impulses. Supporting cells are neuroglia.
- The central nervous system consists of the brain and spinal cord. Cranial nerves, spinal nerves, and ganglia make up the peripheral nervous system.
- There are three layers of meninges around the brain and spinal cord. The outer layer is dura mater, the middle layer is arachnoid, and the innermost layer is pia mater.

Endocrine System

- Endocrine glands secrete hormones directly into the blood, which transports the hormones through the body.
- Many hormones are regulated by a negative feedback mechanism; some are controlled by other hormones, and others are affected by direct nerve stimulation.

Cardiovascular System

- Blood flows from the right atrium to the right ventricle and then is pumped to the lungs to receive oxygen. From the lungs, the blood flows to the left atrium, then to the left ventricle. From there it is pumped to the systemic circulation.
- Substances pass through the capillary wall by diffusion, filtration, and osmosis.

Lymphatic System

- The right lymphatic duct drains lymph from the upper right quadrant of the body and the thoracic duct drains all the rest.
- Pressure gradients that move fluid through the lymphatic vessels come from the skeletal muscle action, respiratory movements, and contraction of smooth muscle in vessel walls.
- Lymph enters a lymph node through afferent vessels, filters through the sinuses, and leaves through efferent vessels.

Respiratory System

- The frontal, maxillary, ethmoidal, and sphenoidal sinuses are air-filled cavities that open into the nasal cavity.
- The trachea divides into the right and left primary bronchi, which branch into smaller and smaller passageways until they terminate in tiny air sacs called alveoli.

Digestive System

- The digestive system prepares nutrients for utilization by body cells through six activities, or functions: ingestion, mechanical digestion, chemical digestion, movements, absorption, and elimination.
- Regions of the digestive system can be divided into two main parts: alimentary tract and accessory organs.

Urinary System

- The primary organs of the urinary system are the kidneys, which are located retroperitoneally between the levels of the twelfth thoracic and third lumbar vertebrae.
- The components of the urinary system are the kidneys, ureters, urinary bladder, and urethra.

Reproductive System

- The primary reproductive organs are the gonads, which produce the gametes and hormones. The secondary, or accessory, structures transport and sustain the gametes and nurture the developing offspring.