

Chapter 8

Body Structure and Function

Lesson 8.1

- Define the key terms and key abbreviations in this chapter.
- Identify the basic structures of the cell.
- Explain how cells divide.
- Describe 4 types of tissues.
- Identify the structures and functions of each body system.
- Explain how to promote PRIDE in the person, the family, and yourself.

Body Structure

- Knowing the body's normal structure and function will help you understand signs, symptoms, and the reasons for care and procedures.
- You will give safe and more efficient care.

Cells, Tissues, and Organs

- The basic unit of body structure is the cell.
- Cells have the same basic structure, but function, size, and shape may differ.
- You need a microscope to see cells.
- Cells need food, water, and oxygen to live and function.

Cell's Structure

- The cell's structures include:
 - The cell membrane is the outer covering.
 - The nucleus is the control center of the cell.
 - The cytoplasm surrounds the nucleus.
 - Protoplasm refers to all structures, substances, and water within the cell.
 - Chromosomes are thread-like structures in the nucleus.
 - Chromosomes contain genes.
 - Genes control the traits children inherit from their parents.

Tissues

- Groups of cells with similar functions combine to form tissues.
 - Epithelial tissue covers internal and external body surfaces.
 - Connective tissue anchors, connects, and supports other tissues.
 - Muscle tissue stretches and contracts to let the body move.
 - Nerve tissue receives and carries impulses to the brain and back to body parts.
- Groups of tissue with the same function form organs.
- Systems are formed by organs that work together to perform special functions.

The Integumentary System

- The integumentary system, or skin:
 - Is the largest system
 - Covers the body
 - Has epithelial, connective, and nerve tissue
 - Has oil glands and sweat glands
- There are two skin layers.
 - The epidermis is the outer layer.
 - The dermis is the inner layer.
 - The epidermis and dermis are supported by subcutaneous tissue.

The Integumentary System (Cont.)

- Skin appendages

- Hair covers the entire body, except the palms of the hands and the soles of the feet.
- Nails protect the tips of the fingers and toes.
 - Nails help fingers pick up and handle small objects.
- Sweat glands help the body regulate temperature.
- Oil glands lie near the hair shafts.
 - Oil helps keep the hair and skin soft and shiny.

The Integumentary System (Cont.)

- The skin has many functions:
 - It is the body's protective covering.
 - It prevents microorganisms and other substances from entering the body.
 - It prevents excess amounts of water from leaving the body.
 - It protects organs from injury.
 - Nerve endings in the skin sense both pleasant and unpleasant stimulation.
 - It helps regulate body temperature.

The Musculo-Skeletal System

- The musculo-skeletal system:
 - Provides the framework for the body.
 - Lets the body move.
 - Protects and gives the body shape.
- There are four types of bones:
 - Long bones bear the body's weight.
 - Short bones allow skill and ease in movement.
 - Flat bones protect the organs.
 - Irregular bones are the vertebrae in the spinal column.
 - Bones are covered by a membrane called the periosteum.
 - Bones contain bone marrow inside their hollow centers.
 - Blood cells are formed in the bone marrow.

The Musculo-skeletal System (Cont.)

- A joint is the point at which two or more bones meet.
 - Joints allow movement.
 - There are three major types of joints:
 - Ball-and-socket joints allows movement in all directions.
 - Hinge joints allows movement in one direction.
 - Pivot joints allows turning from side to side.

The Musculo-skeletal System (Cont.)

- Muscles

- The human body has more than 500 muscles.
- Voluntary muscles can be consciously controlled.
- Involuntary muscles work automatically.
- Cardiac muscle is in the heart.
 - It is an involuntary muscle.
- Muscles have three functions:
 - Movement of body parts
 - Maintenance of posture
 - Production of body heat

The Nervous System

- The nervous system controls, directs, and coordinates body functions.
 - It has two main divisions:
 - The central nervous system (CNS) consists of the brain and spinal cord.
 - The peripheral nervous system involves the nerves throughout the body.

The Nervous System (Cont.)

- The CNS (the brain and spinal cord)
 - The brain has three main parts:
 - The cerebrum is the center of thought and intelligence.
 - The cerebellum regulates and coordinates body movements.
 - The brainstem connects the cerebrum to the spinal cord.
 - The brainstem contains the midbrain, pons, and medulla.

The Nervous System (Cont.)

- The spinal cord lies within the spinal column.
 - It contains pathways that conduct messages to and from the brain.
- The brain and spinal cord are covered and protected by three layers of connective tissue called the meninges.
- Cerebrospinal fluid circulates around the brain and spinal cord.
 - The fluid cushions shocks that could injure brain and spinal cord structures.

The Peripheral Nervous System

- The peripheral nervous system
 - The peripheral nervous system has 12 pairs of cranial nerves and 31 pairs of spinal nerves.
 - Cranial nerves conduct impulses between the brain and the head, neck, chest, and abdomen.
 - Spinal nerves carry impulses from the skin, extremities, and the internal structures not supplied by cranial nerves.
 - Some peripheral nerves form the autonomic nervous system.
 - The autonomic nervous system is divided into the sympathetic nervous system and the parasympathetic nervous system.

The Sense Organs

- The sense organs

- The five senses are sight, hearing, taste, smell, and touch.
- Receptors for taste are in the tongue.
- Receptors for smell are in the nose.
- Touch receptors are in the dermis.

The Sense Organs (Cont.)

- The eye
 - Receptors for vision are in the eyes.
 - The eye has three layers:
 - The sclera is the outer layer.
 - The choroid is the second layer.
 - The retina is the inner layer.

The Sense Organs (Cont.)

- The ear
 - The ear functions in hearing and balance.
 - It has three parts:
 - The external ear
 - The middle ear
 - The inner ear

The Circulatory System

- The circulatory system is made up of the blood, heart, and blood vessels.
- The circulatory system has many functions:
 - Blood carries food, oxygen, and other substances to the cells.
 - Blood removes waste products from cells.
 - Blood and blood vessels help regulate body temperature.
 - The system produces and carries cells that defend the body from microbes that cause disease.

The Circulatory System (Cont.)

- The blood

- The blood consists of blood cells and plasma.
- Plasma is mostly water.
 - It carries blood cells to other body cells.
 - It carries substances that cells need to function.
- Red blood cells (RBCs) are called erythrocytes.
 - They give blood its red color because of a substance in the cell called hemoglobin.
- White blood cells (WBCs) are called leukocytes.
 - They protect the body against infection.
- Platelets (thrombocytes) are needed for blood clotting.

The Circulatory System (Cont.)

- The heart is a muscle.
 - It pumps blood through the blood vessels to the tissues and cells.
 - The heart is hollow and has three layers.
 - The pericardium is the outer layer.
 - The myocardium is the second layer.
 - The endocardium is the inner layer.
 - The two upper chambers (atria) receive blood.
 - The right atrium receives blood from body tissues.
 - The left atrium receives blood from the lungs.
 - The two lower chambers (ventricles) pump blood.
 - The right ventricle pumps blood to the lungs for oxygen.
 - The left ventricle pumps blood to all parts of the body.

The Circulatory System (Cont.)

- Valves between the atria and ventricles allow blood flow in one direction.
 - The tricuspid valve is between the right atrium and the right ventricle.
 - The mitral valve (bicuspid valve) is between the left atrium and left ventricle.
- Heart action has two phases:
 - Diastole is the resting phase.
 - Systole is the working phase.

The Circulatory System (Cont.)

- There are three groups of blood vessels:
 - Arteries, capillaries, and veins.
 - Arteries carry blood away from the heart.
 - The aorta is the largest artery.
 - The smallest branch of an artery is an arteriole.
 - Arterioles connect to capillaries.
 - Food, oxygen, and other substances pass from capillaries into the cells.

The Circulatory System (Cont.)

- Veins return blood to the heart.
 - They connect to the capillaries by venules (small veins).
 - The two main veins are the inferior vena cava and the superior vena cava.
 - The inferior vena cava carries blood from the legs and trunk.
 - The superior vena cava carries blood from the head and arms.

The Lymphatic System

- The lymphatic (lymph) system is a complex network that transports lymph throughout the body.
 - It collects extra lymph from the tissues and returns it to the blood. This helps maintain fluid balance. Water, proteins, and other substances normally leak out of the capillaries into surrounding tissues. The lymphatic system drains the extra fluid from the tissues. Otherwise, the tissues swell.
 - It defends the body against infection by producing lymphocytes. Lymphocytes are a type of white blood cell that defends the body against microorganisms that cause infection.
 - It absorbs fats from the intestines and transports them to the blood.

The Lymphatic System (Cont.)

- The right lymphatic duct collects lymph from the right arm and from the right side of the head, neck, and chest. It empties into a vein on the right side of the neck.
- The thoracic duct collects lymph from the pelvis, abdomen, lower chest, and rest of the body. It empties into a vein on the left side of the neck.
- Lymph nodes are shaped like beans. They range from the size of a pinhead to that of a lima bean. They are found in the neck, underarm, groin area, chest, abdomen, and pelvis.

The Lymphatic System (Cont.)

- Lymph enters lymph nodes through the lymphatic vessels.
- Certain lymphocytes—T lymphocytes (T cells) develop in the thymus.
- The spleen is the largest structure in the lymphatic system.
- The spleen:
 - Filters and removes bacteria and other substances.
 - Destroys old RBCs.
 - Saves the iron found in hemoglobin when RBCs are destroyed.
 - Stores blood; when needed, returns it to the circulatory system.

The Respiratory System

- The respiratory system brings oxygen into the lungs and removes carbon dioxide.
- Oxygen is needed to live.
- Air contains about 21% oxygen.

The Respiratory System (Cont.)

- Respiration is the process of supplying the cells with oxygen and removing carbon dioxide from them.
 - It involves inhalation (breathing in) and exhalation (breathing out).
- The lungs are spongy tissues filled with alveoli, blood vessels, and nerves.
 - Each lung is divided into lobes.
 - The right lung has three lobes.
 - The left lung has two lobes.

The Respiratory System (Cont.)

- The lungs are separated from the abdominal cavity by a muscle called the diaphragm.
- Each lung is covered by a two-layered sac called the pleura.
- A bony framework made up of the ribs, sternum, and vertebrae protects the lungs.

The Digestive System

- The GI system:
 - Breaks down food physically and chemically so it can be absorbed for use by the cells (digestion).
 - Removes solid wastes from the body.
- The digestive system involves the alimentary canal (GI tract) and the accessory organs of digestion.
- The alimentary canal extends from the mouth to the anus.

The Digestive System (Cont.)

- The process of digestion:
 - Digestion begins in the mouth (oral cavity).
 - During swallowing, the tongue pushes food into the pharynx.
 - Contraction of the pharynx pushes food into the esophagus.
 - Through peristalsis, food moves down the esophagus through the alimentary canal.
 - Strong stomach muscles stir and churn food to break it up into smaller particles.
 - Food is mixed and churned with the gastric juices to form a semi-liquid substance called chyme.

The Digestive System (Cont.)

- Through peristalsis, the chyme is pushed from the stomach into the small intestine.
- Undigested chyme passes from the small intestine into the large intestine (large bowel or colon).
- The colon absorbs most of the water from the chyme.
 - The remaining semi-solid material is called feces.
- Feces pass through the colon into the rectum by peristalsis.
- Feces pass out of the body through the anus.

The Urinary System

- The urinary system:
 - Removes waste products from the blood.
 - Maintains water balance within the body.

The Urinary System (Cont.)

- The process of urination:
 - The kidneys are two bean-shaped organs in the upper abdomen.
 - Each kidney has over a million tiny nephrons.
 - Each nephron is the basic working unit of the kidney.
 - The ureters carry urine from the kidneys to the bladder.
 - Urine is stored in the bladder until the need to urinate is felt.
 - Urine passes from the bladder through the urethra.
 - The opening at the end of the urethra is the meatus.
 - Urine passes from the body through the meatus.

The Reproductive System

- The male reproductive system.
- Human reproduction results from the union of a male sex cell and a female sex cell.
- The differences in the male and female reproductive systems allow for the process of reproduction.

The Reproductive System (Cont.)

- The testes (testicles) are the male sex glands (gonads).
- Male sex cells (sperm cells) are produced in the testes.
- Testosterone is produced in the testes.
- The testes are suspended between the thighs in the scrotum.
- Sperm travel from the testis to the epididymis.
- From the epididymis, sperm travel through the vas deferens.
- Each vas deferens joins a seminal vesicle.
- The two seminal vesicles store sperm and produce semen.
- The ducts of the seminal vesicles unite to form the ejaculatory duct, which passes through the prostate gland.

The Reproductive System (Cont.)

- The prostate gland secretes fluid into the semen.
- As the ejaculatory ducts leave the prostate, they join the urethra.
- The urethra is contained within the penis. It is the outlet for urine and semen.
- The penis is outside of the body and has erectile tissue.
- When a man is sexually excited:
 - The penis enlarges and becomes hard and erect.
 - The erect penis can enter a female's vagina.
 - The semen, which contains sperm, is released into the vagina.

The Reproductive System (Cont.)

- The female gonads are two almond-shaped glands called ovaries.
 - The ovaries contain the female sex cells (ova or eggs).
 - Ovulation occurs monthly during the woman's reproductive years.
- The ovaries secrete estrogen and progesterone.
- When an ovum is released from an ovary, it travels through a fallopian tube to the uterus.
- The cervix of the uterus projects into the vagina.
- The vagina opens to the outside of the body.
 - It receives the penis during intercourse.
 - It is part of the birth canal.

The Reproductive System (Cont.)

- The external female genitalia are called the vulva.
- The mammary glands (breasts) secrete milk after childbirth.
- Menstruation occurs about every 28 days.
 - The first day of the cycle begins with menstruation.
 - Ovulation occurs during the next phase.
 - Estrogen and progesterone are secreted by the ovaries, causing the endometrium to thicken for pregnancy.
 - If pregnancy does not occur, the hormones decrease in amount. This causes the endometrium to break up. It is discharged through the vagina. Another cycle begins.

The Reproductive System (Cont.)

- Fertilization is the uniting of the sperm and ovum into one cell.
 - To reproduce, a male sex cell (sperm) must unite with a female sex cell (ovum).
 - If a sperm and an ovum unite, fertilization results.
 - Pregnancy occurs.

The Endocrine System

- The endocrine system is made up of glands called the endocrine glands.
 - The endocrine glands secrete hormones into the bloodstream.
 - Hormones regulate the activities of other organs and glands in the body.

The Endocrine System (Cont.)

- The pituitary gland is called the master gland.
 - It is at the base of the brain behind the eyes.
 - The anterior pituitary lobe secretes:
 - Growth hormone (GH)
 - Thyroid-stimulating hormone (TSH)
 - Adrenocorticotrophic hormone (ACTH)
 - Hormones that regulate growth, development, and function of the male and female reproductive systems
 - The posterior pituitary lobe secretes:
 - Antidiuretic hormone (ADH)
 - Oxytocin

The Endocrine System (Cont.)

- The thyroid gland is shaped like a butterfly.
 - It is in the neck in front of the larynx.
 - It secretes thyroid hormone (TH, thyroxine).
- There are four parathyroid glands.
 - Two lie on each side of the thyroid gland.
 - The parathyroid glands secrete parathormone.

The Endocrine System (Cont.)

- There are two adrenal glands.
 - An adrenal gland is on the top of each kidney.
 - The adrenal medulla secretes epinephrine and norepinephrine.
 - The adrenal cortex secretes three groups of hormones needed for life:
 - Glucocorticoids
 - Mineralocorticoids
 - Small amounts of male and female sex hormones

The Endocrine System (Cont.)

- The pancreas secretes insulin.
- The gonads are the glands of human reproduction.
 - Male sex glands (testes) secrete testosterone.
 - Female sex glands (ovaries) secrete estrogen and progesterone.

The Immune System

- The immune system:
 - Protects the body from disease and infection.
 - Defends against threats inside and outside the body.
 - Gives the body immunity.
 - Immunity means that a person has protection against a disease or condition.

The Immune System (Cont.)

- Special cells and substances function to produce immunity:
 - Antibodies
 - Antigens
 - Phagocytes
 - Lymphocytes
 - B lymphocytes (B cells)
 - T lymphocytes (T cells)
- When the body senses an antigen from an unwanted substance, the immune system acts.