Chapter 6

BODY STRUCTURE AND FUNCTION
• 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.
• The basic unit of body structure is the cell.
– 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.
• 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.
• 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 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 musculoskeletal 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 periosteum.
  – Bones contain bone marrow inside their hollow centers.
    • Blood cells are formed in the bone marrow.
• 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 joint allows movement in all directions.
    • Hinge joint allows movement in one direction.
    • Pivot joint allows turning from side to side.
• 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.
  – Its two main divisions are:
    • The central nervous system (CNS) consists of the brain and spinal cord
    • The peripheral nervous system involves the nerves throughout the body
• The central nervous system (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 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 meninges.
– Cerebral spinal 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 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 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 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 ear
- The ear functions in hearing and balance.
- It has three parts:
  - The external ear
  - The middle ear
  - The inner ear
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 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 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.
• 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.
• 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.
• 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 RESPIRATORY SYSTEM

• The respiratory system brings oxygen into the lungs and removes carbon dioxide.
• 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 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
(GASTRO-INTESTINAL SYSTEM [GI 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 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.
– 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 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
- 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 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 female reproductive system
– 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 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 breakup. It is discharged through the vagina. Another cyclic begins.
• 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 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)
    • Adrenocorticotropic 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 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.
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 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.
• 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.