



Radnor High School Course Syllabus

Modified 9/1/11

Anatomy and Physiology 0352

Credits: 1.0
Weighted: Unweighted
Length: Year
Format: Meets Daily

Grades: 11th and 12th
Prerequisite: Advanced Biology or Higher
Physics or Higher

Overall Description of Course

Anatomy and Physiology is the study of the body's structures and respective functions at the molecular/biochemical, cellular, tissue, organ systemic and organism levels. Students explore the body through laboratory investigations, models, diagrams, and comparative studies of the anatomy of the cat. The study of anatomy and physiology prepares students for a variety of career endeavors such as health care, sports medicine and fitness careers, as well as for taking an active part in their own health and wellness.

Common Core Standards

Keystone Connections:

Not Applicable

Student Objectives:

Chapter 1-MAJOR THEMES OF ANATOMY AND PHYSIOLOGY

Section 1.1

- define *anatomy* and *physiology* and relate them to each other;
- describe several ways of studying human anatomy; and
- define a few subdisciplines of human physiology.

Section 1.5

- list the levels of human structure from the most complex to the simplest;
- discuss the value of both reductionistic and holistic viewpoints to understanding human form and function; and
- discuss the clinical significance of anatomical variation among humans.

Section 1.6

- state the characteristics that distinguish living organisms from nonliving objects;
- explain the importance of defining a reference man and woman;

- c. define *homeostasis* and explain why this concept is central to physiology;
- d. define *negative feedback*, give an example of it, and explain its importance to homeostasis; and
- e. define *positive feedback* and give examples of its beneficial and harmful effects.

Section 1.7

- a. explain why modern anatomical terminology is so heavily based on Greek and Latin;
- b. describe the efforts to achieve an internationally uniform anatomical terminology;
- c. break medical terms down into their basic word elements;
- d. state some reasons why the literal meaning of a word may not lend insight into its definition.

Chapter 2- THE CHEMISTRY OF LIFE

Section 2.1

- a. name the chemical elements of the body from their chemical symbols;
- b. state the functions of minerals in the body;
- c. explain the basis for radioactivity and the types and hazards of ionizing radiation;
- d. distinguish between ions, electrolytes, and free radicals; and

Section 2.2

- a. define *mixture* and distinguish between mixtures and compounds;
- b. describe the biologically important properties of water;
- c. show how three kinds of mixtures differ from each other;

Section 2.3

- a. define *metabolism* and its two subdivisions; and

Section 2.4

- a. explain why carbon is especially well suited to serve as the structural foundation of many biological molecules;
- b. explain how enzymes function;
- c. describe the structure, production, and function of ATP;

Chapter 3- CELLULAR FORM AND FUNCTION

Section 3.1

- a. describe cell shapes from their descriptive terms;
- b. state the size range of human cells and discuss factors that limit their size;

Chapter 4- GENETICS AND CELLULAR FUNCTION

Section 4.2

- a. give a working definition of the *gene* and explain why new discoveries in genetics have changed our concept of what a gene is;
- b. explain what the human genome is and what relationship it has to the health sciences;

Chapter 5- HISTOLOGY

Section 5.1

- a. name the four primary classes into which all adult tissues are classified;
- b. name the three embryonic germ layers and some adult tissues derived from each; and
- c. visualize the three-dimensional shape of a structure from a two-dimensional tissue section.

Section 5.2

- d. describe the properties that distinguish epithelium from other tissue classes;
- e. list and classify eight types of epithelium, distinguish them from each other, and state where each type can be found in the body;
- f. visually recognize each epithelial type from specimens or photographs.

Section 5.3

- g. describe the properties that most connective tissues have in common;
- h. discuss the types of cells found in connective tissue;
- i. name and classify 10 types of connective tissue, describe their components, and explain what distinguishes them from each other; and
- j. visually recognize each connective tissue type from specimens or photographs.

Section 5.4

- k. explain what distinguishes excitable tissues from other tissues;
- l. name the cell types that compose nervous tissue;
- m. identify the major parts of a nerve cell;
- n. visually recognize nervous tissue from specimens or photographs;
- o. name the three kinds of muscular tissue and describe the differences between them; and
- p. visually identify any type of muscular tissue from specimens or photographs.

Section 5.5

- q. describe the junctions that hold cells and tissues together;
- r. describe or define different types of glands;
- s. describe the typical anatomy of a gland;
- t. name and compare different modes of glandular secretion;
- u. describe the way tissues are organized to form the body's membranes; and
- v. name and describe the major types of membranes in the body.

Section 5.6

- w. name and describe the modes of tissue growth;
- x. define *adult* and *embryonic stem cells*

- y. name and describe the ways that a tissue can change from one type to another;
- z. name and describe the modes and causes of tissue shrinkage and death; and
- aa. name and describe the ways the body repairs damaged tissues.

Chapter 6- THE INTEGUMENTARY SYSTEM

Section 6.1

- a. list the functions of the skin and relate them to its structure;
- b. describe the histological structure of the epidermis, dermis, and subcutaneous tissue;
- c. describe the normal and pathological colors that the skin can have, and explain their causes; and
- d. describe the common markings of the skin.

Section 6.2

- a. distinguish between three types of hair;
- b. describe the histology of a hair and its follicle;
- c. discuss some theories of the purposes served by various kinds of hair; and
- d. describe the structure and function of nails.

Section 6.3

- a. name two types of sweat glands, and describe the structure and function of each;
- b. describe the location, structure, and function of sebaceous and ceruminous glands; and
- c. discuss the distinction between breasts and mammary glands, and explain their respective functions.

Section 6.4

- a. describe the three most common forms of skin cancer; and
- b. describe the three classes of burns and the priorities in burn treatment.

Chapter 7- BONE TISSUE

Section 7.1

- a. name the tissues and organs that compose the skeletal system;
- b. state several functions of the skeletal system;
- c. distinguish between bone as a tissue and as an organ;
- d. describe four types of bones classified by shape; and
- e. describe the general features of a long bone and a flat bone.

Section 7.2

- a. list and describe the cells, fibers, and ground substance of bone tissue;
- b. state the importance of each constituent of bone tissue;
- c. compare the histology of the two types of bone tissue; and
- d. distinguish between the two types of bone marrow.

Section 7.3

- a. describe two mechanisms of bone formation; and
- b. explain how mature bone continues to grow and remodel itself.

Section 7.4

- a. describe the processes by which minerals are added to and removed from bone tissue;
- b. discuss the role of the bones in regulating blood calcium and phosphate levels; and
- c. name several hormones that regulate bone physiology and describe their effects.

Section 7.5

- a. name and describe several bone diseases;
- b. name and describe the types of fractures;
- c. explain how a fracture is repaired; and
- d. discuss some clinical treatments for fractures and other skeletal disorders.

Chapter 8- THE SKELETAL SYSTEM

Section 8.1

- a. define the two subdivisions of the skeleton;
- b. state the approximate number of bones in the adult body;
- c. explain why this number varies with age and from one person to another; and
- d. define several terms that denote surface features of bones

Section 8.2

- a. distinguish between cranial and facial bones;
- b. name the bones of the skull and their anatomical features;
- c. identify the cavities in the skull and in some of its individual bones;
- d. name the principal sutures that join the bones of the skull;
- e. describe some bones that are closely associated with the skull;
- f. describe the development of the skull from infancy through childhood.

Section 8.3

- a. describe the general features of the vertebral column and those of a typical vertebra;
- b. describe the structure of the intervertebral discs and their relationship to the vertebrae;

- c. describe the special features of vertebrae in different regions of the vertebral column, and discuss the functional significance of the regional differences; and
- d. describe the anatomy of the sternum and ribs and how the ribs articulate with the thoracic vertebrae.

Section 8.4

- a. identify and describe the features of the clavicle, scapula, humerus, radius, ulna, and bones of the wrist and hand.

Section 8.5

- b. identify and describe the features of the pelvic girdle, femur, patella, tibia, fibula, and bones of the foot; and
- c. compare the anatomy of the male and female pelvic girdles and explain the functional significance of the differences.

Materials & Texts

MATERIALS Textbook, lab manual, Cat Specimen, dissecting tools (scissors, scalpel, forceps, bone cutter, teaser), Specimen Preservative, Lab coat (optional)

TEXTS Anatomy and Physiology: The Unity of Form and Function, Saladin
Lab Manual

Activities, Assignments, & Assessments

ACTIVITIES

Cat Dissection , Case Studies, Clinical Application

ASSIGNMENTS

Daily Readings

ASSESSMENTS

Midterm Exam, Final Exam, Practicum

Terminology

Chapter 1

- Anatomy
- Physiology
- Palpation

- Auscultation
- Percussion
- Dissection
- Cadaver

- Comparative anatomy
- Exploratory surgery

- Medical imaging
- Radiology
- Gross anatomy
- Histology
- Histopathology
- Cytology
- Comparative physiology
- Organism
- Organ system
- Tissue
- Cells
- Organelles
- Molecules
- Atoms
- Reductionism
- Holistic
- Organization
- Cellular composition
- Metabolism
- Responsiveness
- Homeostasis
- Development
- Reference man
- Reference woman
- Dynamic equilibrium
- Negative feedback
- Positive feedback

Chapter 2

- Trace elements
- Minerals
- Radioisotopes
- Radioactivity
- Ionizing radiation
- Biological half-life
- Electrolytes
- Free radicals
- Antioxidants
- Mixture
- Hydrophilic

- Hydrophobic
- Calorie
- Solution
- Solute
- Solvent
- Colloids
- Suspension
- Emulsion
- Temperature
- Catalysts
- Catabolism
- Anabolism
- Carbon backbone
- ATP
- DNA

Chapter 3

- Cytology
- Squamous
- Cuboidal
- Columnar
- Polygonal stellate
- Spheroidal
- Ovoid
- Discoid
- Fusiform
- Fibrous
- Micrometer
- Resolution
- Enzymes

Chapter 4

- DNA

Chapter 5

- Matrix
- Ground substance
- Tissue fluid
- Interstitial fluid
- Primary germ layers
- Ectoderm
- Endoderm

- Mesoderm
- Longitudinal section
- Cross section
- Transverse section
- Oblique section
- Smears
- Spreads
- Epithelial tissue
- Simple epithelium
- Simple squamous
- Simple cuboidal
- Simple columnar
- Pseudostratified columnar
- Goblet cells
- Stratified epithelia
- Stratified squamous
- Stratified cuboidal
- Stratified columnar
- Transitional epithelium
- Keratinized
- Nonkeratinized
- Connective tissue
- Fibrous connective tissue
- Loose connective tissue
- Dense connective tissue
- Areolar tissue
- Reticular tissue
- Dense regular connective tissue
- Elastic tissue
- Dense irregular connective tissue
- Adipose tissue
- Cartilage
- Chondrocytes
- Hyaline cartilage
- Elastic cartilage

- Fibrocartilage
- Bone
- Spongy bone
- Compact bone
- Central (Haversian) canals
- Osteocytes
- Blood
- Blood plasma
- Erythrocytes (RBC's)
- Leukocytes (WBC's)
- Platelets
- Nervous tissue
- Neurons
- Glial cells
- Dendrites
- Axon
- Muscular tissue
- Skeletal muscle
- Cardiac muscle
- Smooth muscle
- Myocytes
- Cell junctions
- Tight junction
- Desmosome
- Gap junction
- Gland
- Secretion
- Excretion
- Exocrine gland
- Endocrine gland
- Duct
- Serous gland
- Mucous gland
- Mixed glands
- Merocrine glands
- Holocrine glands
- Apocrine glands
- Cutaneous membrane
- Mucous

- membrane
- Serous membrane
- Hyperplasia
- Hypertrophy
- Neoplasia
- Differentiation
- Stem cells
- Necrosis
- Infarction
- Gangrene
- Decubitus ulcer
- Apoptosis

Chapter 6

- Integumentary system
- Keratinocytes
- Melanocytes
- Tactile (Merkel) Cells
- Dendritic (Langerhans) Cells
- Stratum basale
- Stratum spinosum
- Stratum granulosum
- Stratum lucidum
- Stratum corneum
- Dermis
- Papillary layer
- Reticular layer
- Melanin
- Erythema
- Pallor
- Albinism
- Jaundice
- Hematoma
- Accessory organ
- Hair follicle
- Bulb
- Root
- Shaft
- Dermal papillae

- Hair matrix
- Medulla
- Cortex
- Cuticle
- Piloerector muscle
- Sudoriferous (sweat) glands
- Apocrine sweat glands
- Merocrine sweat glands
- Myoepithelial cells
- Sebaceous glands
- Ceruminous glands
- Mammary glands
- Basal cell carcinoma
- Squamous cell carcinoma
- Melanoma
- Burns
- First-degree burns
- Second-degree burns
- Third-degree burns

Chapter 7

- Skeletal system
- Osseous tissue
- Calcification
- Flat bones
- Long bones
- Short bones
- Irregular bones
- Compact bone
- Medullary cavity
- Marrow cavity
- Spongy bone
- Diaphysis
- Epiphysis
- Articular cartilage
- Nutrient foramina
- Periosteum

- Endosteum
- Epiphyseal plate
- Osteogenic cells
- Osteoblasts
- Osteocytes
- Osteoclasts
- Hydroxyapatite
- Concentric lamellae
- Haversian canal
- Haversian system
- Spicules
- Trabeculae
- Bone marrow
- Red bone marrow
- Yellow bone marrow
- Ossification
- Intramembranous ossification
- Endochondral ossification
- Primary ossification center
- Secondary ossification center
- Metaphysis
- Zone of reverse cartilage
- Zone of cell proliferation
- Zone of cell hypertrophy
- Zone of calcification
- Zone of bone deposition
- Interstitial growth
- Epiphyseal line
- Appositional growth
- Mineralization
- Mineral resorption
- Calcitonin

- Parathyroid hormone (PTH)
- Hypocalcemia
- Hypercalcemia
- Calcitriol
- Orthopedics
- Stress fracture
- Pathological fracture

Chapter 8

- Axial skeleton
- Appendicular skeleton
- Sesamoid bone
- Sutures
- Cranial cavity
- Orbits
- Nasal cavity
- Oral cavity
- Inner ear cavity
- Middle ear cavity
- Frontal sinus
- Ethmoid sinus
- Maxillary sinus
- Foramina
- Cranium
- Posterior cranial fossa
- Middle cranial fossa
- Anterior cranial fossa
- Parietal bones
- Temporal bones
- Occipital bone
- Foramen magnum
- Sphenoid bone
- Ethmoid bone
- Facial bones
- Maxillae
- Palatine bones
- Zygomatic bones

- Lacrimal bones
- Nasal bones
- Inferior nasal conchae
- Vomer
- Mandible
- Vertebral column
- Vertebrae
- Cervical vertebrae
- Thoracic vertebrae
- Lumbar vertebrae
- Sacrum
- Coccyx
- Body
- Spinous process
- Transverse process
- Vertebral foramen
- Thoracic cage
- Sternum
- Ribs
- True ribs
- False ribs
- Floating ribs
- Pectoral girdle
- Clavicle
- Scapula
- Humerous
- Head
- Greater tubercles
- Lesser tubercles
- Lateral epicondyle
- Medial epicondyle
- Radius
- Head
- Neck
- Radial tuberosity
- Ulna
- Olecranon
- Ulnar tuberosity
- Carpals
- Metacarpals
- Phalanges
- Pelvic girdle

- ilium
- Iliac crest
- Iliac fossa
- Ischium
- Pubis
- Greater pelvis
- Lesser pelvis
- Acetabulum
- Femur
- Head
- Greater trochanter
- Lesser trochanter
- Lateral epicondyle
- Medial epicondyle
- Tibia
- Tibial tuberosity
- Medial condyle
- Lateral condyle
- Medial malleolus
- Fibula
- Head of fibula
- Lateral malleolus
- Tarsal bones
- Metatarsal bones
- Phalanges

Media, Technology, Web Resources

Common Core Standards

Keystone Connections:

Not Applicable

Student Objectives:

Chapter 9- JOINTS

Section 9.1

- a. explain what joints are, how they are named, and what functions they serve;
- b. name and describe the four major classes of joints;
- c. describe the three types of fibrous joints and give an example of each;
- d. distinguish between the three types of sutures;
- e. describe the two types of cartilaginous joints and give an example of each; and
- f. name some joints that become synostoses as they age.

Section 9.2

- a. identify the anatomical components of a typical synovial joint;
- b. classify any given joint action as a first-, second-, or third-class lever;
- c. explain how mechanical advantage relates to the power and speed of joint movement;
- d. discuss the factors that determine a joint's range of motion;
- e. describe the primary axes of rotation that a bone can have and relate this to a joint's degrees of freedom;
- f. name and describe six classes of synovial joints; and
- g. use the correct standard terminology for various joint movements.

Section 9.3

- a. identify the major anatomical features of the jaw, shoulder, elbow, hip, knee, and ankle joints; and
- b. explain how the anatomical differences between these joints are related to differences in function.

Chapter 10- THE MUSCULAR SYSTEM

Section 10.1

- a. describe the varied functions of muscles;
- b. describe the connective tissue components of a muscle and their relationship to the

- bundling of muscle fibers;
- c. describe the various shapes of skeletal muscles and relate this to their functions;
 - d. explain what is meant by the origin, insertion, belly, action, and innervation of a muscle;
 - e. describe the ways that muscles work in groups to aid, oppose, or moderate each other's actions;
 - f. distinguish between intrinsic and extrinsic muscles;
 - g. describe in general terms the nerve supply to the muscles and where these nerves originate; and
 - h. explain how the Latin names of muscles can aid in visualizing and remembering them.

Section 10.2

- a. name and locate the muscles that produce facial expressions;
- b. name and locate the muscles used for chewing and swallowing;
- c. name and locate the neck muscles that move the head; and
- d. identify the origin, insertion, action, and innervation of any of these muscles.

Section 10.3

- a. name and locate the muscles of respiration and explain how they affect airflow and abdominal pressure;
- b. name and locate the muscles of the abdominal wall, back, and pelvic floor; and
- c. identify the origin, insertion, action, and innervation of any of these muscles.

Section 10.4

- a. name and locate the muscles that act on the pectoral girdle, shoulder, elbow, wrist, and hand;
- b. relate the actions of these muscles to the joint movements described in chapter 9; and
- c. describe the origin, insertion, and innervation of each muscle.

Section 10.5

- a. name and locate the muscles that act on the hip, knee, ankle, and toe joints;
- b. relate the actions of these muscles to the joint movements described in chapter 9; and
- c. describe the origin, insertion, and innervation of each muscle.

Chapter 11- MUSCULAR TISSUE

Section 11.1

- a. describe the physiological properties that all muscle types have in common;
- b. list the defining characteristics of skeletal muscle; and
- c. discuss the possible elastic functions of the connective tissue components of a muscle.

Section 11.2

- a. describe the structural components of a muscle fiber;
- b. relate the striations of a muscle fiber to the overlapping arrangement of its protein filaments; and
- c. name the major proteins of a muscle fiber and state the function of each.

Section 11.3

- a. explain what a motor unit is and how it relates to muscle contraction;
- b. describe the structure of the junction where a nerve fiber meets a muscle fiber; and
- c. explain why a cell has an electrical charge difference across its plasma membrane and, in general terms, how this relates to muscle contraction.

Section 11.4

- a. explain how a nerve fiber stimulates a skeletal muscle fiber;
- b. explain how stimulation of a muscle fiber activates its contractile mechanism;
- c. explain the mechanism of muscle contraction;
- d. explain how a muscle fiber relaxes; and
- e. explain why the force of a muscle contraction depends on sarcomere length prior to stimulation.

Section 11.5

- a. describe the stages of a muscle twitch;
- b. explain why muscle does not contract in an all-or-none manner;
- c. explain how successive muscle twitches can add up to produce stronger muscle contractions;
- d. distinguish between isometric and isotonic contraction; and
- e. distinguish between concentric and eccentric contraction.

Section 11.6

- a. explain how skeletal muscle meets its energy demands during rest and exercise;
- b. explain the basis of muscle fatigue and soreness;
- c. define *oxygen debt* and explain why extra oxygen is needed even after an exercise has ended;
- d. distinguish between two physiological types of muscle fibers, and explain their functional roles;
- e. discuss the factors that affect muscular strength; and
- f. discuss the effects of resistance and endurance exercises on muscle.

Section 11.7

- a. describe the structural and physiological differences between cardiac muscle and skeletal muscle;

- b. explain why these differences are important to cardiac function;
- c. describe the structural and physiological differences between smooth muscle and skeletal muscle; and
- d. relate the unique properties of smooth muscle to its locations and functions.

Chapter 12- NERVOUS TISSUE

Section 12.1

- a. describe the overall function of the nervous system; and
- b. describe the major anatomical and functional subdivisions.

Section 12.2

- a. describe three functional properties found in all neurons;
- b. define the three most basic functional categories of neurons;
- c. identify the parts of a neuron; and
- d. explain how neurons transport materials between the cell body and tips of the axon.

Section 12.3

- a. name the six types of cells that aid neurons and state their respective functions;
- b. describe the myelin sheath that is found around certain nerve fibers and explain its importance;
- c. describe the relationship of unmyelinated nerve fibers to their supportive cells; and
- d. explain how damaged nerve fibers regenerate.

Section 12.4

- a. explain why a cell has an electrical charge difference (voltage) across its membrane;
- b. explain how stimulation of a neuron causes a local electrical response in its membrane;
- c. explain how local responses generate a nerve signal; and
- d. explain how the nerve signal is conducted down an axon.

Section 12.5

- a. explain how messages are transmitted from one neuron to another;
- b. give examples of neurotransmitters and describe their actions; and
- c. explain how stimulation of a postsynaptic cell is stopped.

Section 12.6

- a. explain how a neuron “decides” whether or not to generate action potentials;
- b. explain how the nervous system translates complex information into a simple code;
- c. explain how neurons work together in groups to process information and produce effective output; and

- d. describe how memory works at cellular and molecular levels.

Chapter 13- THE SPINAL CORD, SPINAL NERVES, AND SOMATIC REFLEXES

Section 13.1

- a. state the three principal functions of the spinal cord;
- b. describe its gross and microscopic structure; and
- c. trace the pathways followed by nerve signals traveling up and down the spinal cord.

Section 13.2

- a. describe the anatomy of nerves and ganglia in general;
- b. describe the attachments of a spinal nerve to the spinal cord
- c. trace the branches of a spinal nerve distal to its attachments;
- d. name the five plexuses of spinal nerves and describe their general anatomy;
- e. name some major nerves that arise from each plexus; and
- f. explain the relationship of dermatomes to the spinal nerves.

Section 13.3

- a. define *reflex* and explain how reflexes differ from other motor actions;
- b. describe the general components of a typical reflex arc; and
- c. explain how the basic types of somatic reflexes function.

Chapter 14- THE BRAIN AND CRANIAL NERVES

Section 14.1

- a. describe the major subdivisions and anatomical landmarks of the brain;
- b. describe the locations of the gray and white matter; and
- c. describe the embryonic development of the CNS and relate this to adult brain anatomy.

Section 14.2

- a. describe the meninges of the brain;
- b. describe the fluid-filled chambers within the brain;
- c. discuss the production, circulation, and function of the cerebrospinal fluid that fills these chambers; and
- d. explain the significance of the brain barrier system.

Section 14.3

- a. list the components of the hindbrain and midbrain and their functions; and
- b. describe the location and functions of the reticular formation.

Section 14.4

- a. name the three major components of the diencephalon and describe their locations and functions;
- b. identify the five lobes of the cerebrum and their functions;
- c. describe the three types of tracts in the cerebral white matter;
- d. describe the distinctive cell types and histological arrangement of the cerebral cortex; and
- e. describe the location and functions of the basal nuclei and limbic system.

Section 14.5

- a. list the types of brain waves and discuss their relationship to mental states;
- b. describe the stages of sleep, their relationship to the brain waves, and the neural mechanisms of sleep;
- c. identify the brain regions concerned with consciousness and thought, memory, emotion, sensation, motor control, and language; and
- d. discuss the functional differences between the right and left cerebral hemispheres.

Section 14.6

- a. list the 12 cranial nerves by name and number;
- b. identify where each cranial nerve originates and terminates; and
- c. state the functions of each cranial nerve.

Chapter 15- THE AUTONOMIC NERVOUS SYSTEM AND VISCERAL REFLEXES

Section 15.1

- a. explain how the autonomic and somatic nervous systems differ in form and function; and
- b. explain how the two divisions of the autonomic nervous system differ in general function.

Section 15.2

- a. identify the anatomical components and nerve pathways of the sympathetic and parasympathetic divisions;
- b. discuss the relationship of the adrenal glands to the sympathetic nervous system; and
- c. describe the enteric nervous system of the digestive tract and explain its significance.

Section 15.3

- a. name the neurotransmitters employed at different synapses of the ANS;
- b. name the receptors for these neurotransmitters and explain how they relate to autonomic effects;
- c. explain how the ANS controls many target organs through dual innervation; and
- d. explain how control is exerted in the absence of dual innervation.

Section 15.4

- a. describe how the autonomic nervous system is influenced by the central nervous system.

Chapter 16- SENSE ORGANS

Section 16.1

- b. define *receptor* and *sense organ*;
- c. list the four kinds of information obtained from sensory receptors, and describe how the nervous system encodes each type; and
- d. outline three ways of classifying receptors.

Section 16.2

- a. list several types of somatosensory receptors;
- b. describe the projection pathways for the general senses; and
- c. explain the mechanisms of pain and the spinal blocking of pain signals.

Section 16.3

- a. explain how taste and smell receptors are stimulated; and
- b. describe the receptors and projection pathways for these two senses.

Section 16.4

- a. identify the properties of sound waves that account for pitch and loudness;
- b. describe the gross and microscopic anatomy of the ear;
- c. explain how the ear converts vibrations to nerve signals and discriminates between sounds of different intensity and pitch;
- d. explain how the vestibular apparatus enables the brain to interpret the body's position and movements; and
- e. describe the pathways taken by auditory and vestibular signals to the brain.

Section 16.5

- a. describe the anatomy of the eye and its accessory structures;
- b. discuss the structure of the retina and its receptor cells;
- c. explain how the optical system of the eye creates an image on the retina;
- d. discuss how the retina converts this image to nerve signals;
- e. explain why different types of receptor cells and neural circuits are required for day and night vision;
- f. describe the mechanism of color vision; and
- g. trace the visual projection pathways in the brain.

Chapter 17- THE ENDOCRINE SYSTEM

Section 17.1

- a. define *hormone* and *endocrine system*;
- b. name several organs of the endocrine system;
- c. contrast endocrine with exocrine glands;
- d. recognize the standard abbreviations for many hormones; and
- e. compare and contrast the nervous and endocrine systems.

Section 17.2

- a. describe the anatomical relationships between the hypothalamus and pituitary gland;
- b. distinguish between the anterior and posterior lobes of the pituitary;
- c. list the hormones produced by the hypothalamus and each lobe of the pituitary, and identify the functions of each hormone;
- d. explain how the pituitary is controlled by the hypothalamus and its target organs; and
- e. describe the effects of growth hormone.

Section 17.3

- a. describe the structure and location of the remaining endocrine glands;
- b. name the hormones these endocrine glands produce and state their functions; and
- c. discuss the hormones produced by organs and tissues other than the classical endocrine glands.

Section 17.4

- a. identify the chemical classes to which various hormones belong;
- b. describe how hormones are synthesized and transported to their target organs;
- c. describe how hormones stimulate their target cells;
- d. explain how target cells regulate their sensitivity to circulating hormones;
- e. describe how hormones affect each other when two or more of them stimulate the same target cells; and
- f. discuss how hormones are removed from circulation after they have performed their roles.

Section 17.5

- a. give a physiological definition of stress; and
- b. discuss how the body adapts to stress through its endocrine and sympathetic nervous systems.

Section 17.6

- a. explain what eicosanoids are and how they are produced;
- b. identify some classes and functions of eicosanoids; and
- c. describe several physiological roles of prostaglandins.

Section 17.7

- a. explain some general causes and examples of hormone hyposecretion and hypersecretion;
- b. briefly describe some common disorders of pituitary, thyroid, parathyroid, and adrenal function; and in more detail, describe the causes and pathology of diabetes mellitus.

Materials & Texts

MATERIALS Textbook, lab manual, Cat Specimen, dissecting tools (scissors, scalpel, forceps, bone cutter, teaser), Specimen Preservative, Lab coat (optional)

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ACTIVITIES

Cat Dissection , Case Studies, Clinical Application

ASSIGNMENTS

Daily Readings

ASSESSMENTS

Terminology

Media, Technology, Web Resources

Enduring Understandings

Essential Questions

Common Core Standards

Keystone Connections:

Not Applicable

Student Objectives:

Chapter 18- THE CIRCULATORY SYSTEM: BLOOD

Section 18.1

- a. describe the functions and major components of the circulatory system;
- b. describe the components and physical properties of blood;
- c. describe the composition of blood plasma;
- d. explain the significance of blood viscosity and osmolarity; and
- e. describe in general terms how blood is produced.

Section 18.2

- a. discuss the structure and function of erythrocytes (RBCs);
- b. describe the structure and function of hemoglobin;
- c. state and define some clinical measurements of RBC and hemoglobin quantities;
- d. describe the life cycle of erythrocytes; and
- e. name and describe the types, causes, and effects of RBC excesses and deficiencies.

Section 18.3

- a. explain what determines a person's ABO and Rh blood types and how this relates to transfusion compatibility;
- b. describe the effect of an incompatibility between mother and fetus in Rh blood type; and
- c. list some blood groups other than ABO and Rh and explain how they may be useful.

Section 18.4

- a. explain the function of leukocytes in general and the individual role of each leukocyte type;
- b. describe the appearance and relative abundance of each type of leukocyte;
- c. describe the formation and life history of leukocytes; and
- d. discuss the types, causes, and effects of leukocyte excesses and deficiencies.

Section 18.5

- a. describe the body's mechanisms for controlling bleeding;
- b. list the functions of platelets;
- c. describe two reaction pathways that produce blood clots;
- d. explain what happens to blood clots when they are no longer needed;
- e. explain what keeps blood from clotting in the absence of injury; and
- f. describe some disorders of blood clotting.

Chapter 19- THE CIRCULATORY SYSTEM: THE HEART

Section 19.1

- a. define and distinguish between the pulmonary and systemic circuits;
- b. describe the general location, size, and shape of the heart; and
- c. describe the pericardial sac that encloses the heart.

Section 19.2

- a. describe the three layers of the heart wall;
- b. identify the four chambers of the heart;
- c. identify the surface features of the heart and correlate them with its internal four-chambered anatomy;
- d. identify the four valves of the heart;
- e. trace the flow of blood through the four chambers and valves of the heart and adjacent blood vessels; and
- f. describe the arteries that nourish the myocardium and the veins that drain it.

Section 19.3

- a. describe the unique structural and metabolic characteristics of cardiac muscle;
- b. explain the nature and functional significance of the intercellular junctions between cardiac muscle cells;
- c. describe the heart's pacemaker and internal electrical conduction system; and
- d. describe the nerve supply to the heart and explain its role.

Section 19.4

- a. explain why the SA node fires spontaneously and rhythmically;
- b. explain how the SA node excites the myocardium;
- c. describe the unusual action potentials of cardiac muscle and relate them to the contractile behavior of the heart; and
- d. interpret a normal electrocardiogram.

Section 19.5

- a. explain why blood pressure is expressed in millimeters of mercury;
- b. describe how changes in blood pressure operate the heart valves;
- c. explain what causes the sounds of the heartbeat;

- d. describe in detail one complete cycle of heart contraction and relaxation; and
- e. relate the events of the cardiac cycle to the volume of blood entering and leaving the heart.

Section 19.6

- a. define *cardiac output* and explain its importance;
- b. identify the factors that govern cardiac output;
- c. discuss some of the nervous and chemical factors that alter heart rate, stroke volume, and cardiac output;
- d. explain how the right and left ventricles achieve balanced output; and
- e. describe some effects of exercise on cardiac output.

Chapter 20- THE CIRCULATORY SYSTEM: BLOOD VESSELS AND CIRCULATION

Section 20.1

- a. describe the structure of a blood vessel;
- b. describe the different types of arteries, capillaries, and veins;
- c. trace the general route usually taken by the blood from the heart and back again; and
- d. describe some variations on this route.

Section 20.2

- a. explain the relationship between blood pressure, resistance, and flow;
- b. describe how blood pressure is expressed and how pulse pressure and mean arterial pressure are calculated;
- c. describe three factors that determine resistance to blood flow;
- d. explain how vasomotion influences blood pressure and flow; and
- e. describe some local, neural, and hormonal influences on vasomotion.

Section 20.3

- a. describe how materials get from the blood to the surrounding tissues;
- b. describe and calculate the forces that enable capillaries to give off and reabsorb fluid; and
- c. describe the causes and effects of edema.

Section 20.4

- a. explain how blood in the veins is returned to the heart;
- b. discuss the importance of physical activity in venous return;
- c. discuss several causes of circulatory shock; and
- d. name and describe the stages of shock.

Section 20.5

- a. explain how the brain maintains stable perfusion;
- b. discuss the causes and effects of strokes and transient ischemic attacks;
- c. explain the mechanisms that increase muscular perfusion during exercise; and
- d. contrast the blood pressure of the pulmonary circuit with that of the systemic circuit, and explain why the difference is important in pulmonary function.

Section 20.6

- a. trace the route of blood through the pulmonary circuit.

Section 20.7

- b. identify the principal systemic arteries and veins of the axial region; and
- c. trace the flow of blood from the heart to any major organ of the axial region and back to the heart.

Section 20.8

- a. identify the principal systemic arteries and veins of the limbs; and
- b. trace the flow of blood from the heart to any region of the upper or lower limb and back to the heart.

Chapter 21- THE LYMPHATIC AND IMMUNE SYSTEMS

Section 21.1

- a. list the functions of the lymphatic system;
- b. explain how lymph forms and returns to the bloodstream;
- c. name the major types of cells of the lymphatic system and state their functions;
- d. name and describe the types of lymphatic tissue; and
- e. describe the structure and function of the red bone marrow, thymus, lymph nodes, tonsils, and spleen.

Section 21.2

- a. identify the body's three lines of defense against pathogens;
- b. contrast nonspecific resistance with immunity;
- c. describe the defensive functions of each kind of leukocyte;
- d. describe the role of the complement system in resistance and immunity;
- e. describe the process of inflammation and explain what accounts for its cardinal signs; and
- f. describe the body's other nonspecific defenses.

Section 21.3

- a. define *specific immunity*;
- b. contrast cellular and humoral immunity, active and passive immunity, and natural and

- artificial immunity;
- c. describe the chemical properties of antigens;
- d. describe and contrast the development of T and B lymphocytes; and
- e. describe the general roles played by lymphocytes, antigen-presenting cells, and interleukins in the immune response.

Section 21.4

- a. list the types of lymphocytes involved in cellular immunity and describe the roles they play;
- b. describe the process of antigen presentation and T cell activation;
- c. describe how T cells destroy enemy cells; and
- d. explain the role of memory cells in cellular immunity.

Section 21.5

- a. explain how B cells recognize and respond to an antigen;
- b. describe the structure, types, and actions of antibodies;
- c. explain the mechanism of memory in humoral immunity; and
- d. compare and contrast cellular and humoral immunity.

Section 21.6

- a. distinguish between the four classes of immune hypersensitivity and give an example of each;
- b. explain the cause of anaphylaxis and distinguish local anaphylaxis from anaphylactic shock;
- c. state some reasons immune self-tolerance may fail, and give examples of the resulting diseases; and
- d. describe the pathology of immunodeficiency diseases, especially AIDS.

Chapter 22- THE RESPIRATORY SYSTEM

Section 22.1

- a. state the functions of the respiratory system;
- b. name and describe the organs of this system;
- c. trace the flow of air from the nose to the pulmonary alveoli; and
- d. relate the function of any portion of the respiratory tract to its gross and microscopic anatomy.

Section 22.2

- a. name the muscles of respiration and describe their roles in breathing;
- b. describe the brainstem centers that control breathing and the inputs they receive from other levels of the nervous system;
- c. explain how pressure gradients account for the flow of air in and out of the lungs, and how those gradients are produced;

- d. identify the sources of resistance to airflow and discuss their relevance to respiration;
- e. explain the significance of anatomical dead space to alveolar ventilation;
- f. define the clinical measurements of pulmonary volume and capacity; and
- g. define terms for various deviations from the normal pattern of breathing.

Section 22.3

- a. define *partial pressure* and discuss its relationship to a gas mixture such as air;
- b. contrast the composition of inspired and alveolar air;
- c. discuss how partial pressure affects gas transport by the blood;
- d. describe the mechanisms of transporting O₂ and CO₂;
- e. describe the factors that govern gas exchange in the lungs and systemic capillaries;
- f. explain how gas exchange is adjusted to the metabolic needs of different tissues; and
- g. discuss the effect of blood gases and pH on the respiratory rhythm.

Section 22.4

- a. describe the forms and effects of oxygen deficiency and oxygen excess;
- b. describe the chronic obstructive pulmonary diseases and their consequences; and
- c. explain how lung cancer begins, progresses, and exerts its lethal effects.

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Keystone Connections:

Student Objectives:

Chapter 23- THE URINARY SYSTEM

Section 23.1

- a. name and locate the organs of the urinary system;
- b. list several functions of the kidneys in addition to urine formation;
- c. name the major nitrogenous wastes and identify their sources; and
- d. define *excretion* and identify the systems that excrete wastes.

Section 23.2

- a. describe the location and general appearance of the kidney;
- b. identify the major external and internal features of the kidney;
- c. trace the flow of blood through the kidney;
- d. trace the flow of fluid through the renal tubules; and
- e. describe the nerve supply to the kidney.

Section 23.3

- a. describe the process by which the kidney filters the blood plasma, including the relevant cellular structure of the glomerulus;
- b. explain the forces that promote and oppose filtration, and calculate the filtration pressure if given the magnitude of these forces; and
- c. describe how the nervous system, hormones, and the nephron itself regulate filtration.

Section 23.4

- a. describe how the renal tubules reabsorb useful solutes from the glomerular filtrate and return them to the blood;
- b. describe how the tubules secrete solutes from the blood into the tubular fluid; and
- c. describe how the nephron regulates water excretion.

Section 23.5

- a. explain how the collecting duct and antidiuretic hormone regulate the volume and

- concentration of urine; and
- b. explain how the kidney maintains an osmotic gradient in the renal medulla that enables the collecting duct to function.

Section 23.6

- a. describe the composition and properties of urine; and
- b. carry out some calculations to evaluate renal function.

Section 23.7

- a. describe the functional anatomy of the ureters, urinary bladder, and male and female urethra; and
- b. explain how the nervous system and urethral sphincters control the voiding of urine.

Chapter 24- WATER, ELECTROLYTE, AND ACID–BASE BALANCE

Section 24.1

- a. name the major fluid compartments and explain how water moves from one to another;
- b. list the body's sources of water and routes of water loss;
- c. describe the mechanisms of regulating water intake and output; and
- d. describe some conditions in which the body has a deficiency or excess of water or an improper distribution of water among the fluid compartments.

Section 24.2

- a. describe the physiological roles of sodium, potassium, calcium, chloride, and phosphate;
- b. describe the hormonal and renal mechanisms that regulate the concentrations of these electrolytes; and
- c. state the term for an excess or deficiency of each electrolyte and describe the consequences of these imbalances.

Section 24.3

- a. define *buffer* and write chemical equations for the bicarbonate, phosphate, and protein buffer systems;
- b. discuss the relationship between pulmonary ventilation, pH of the extracellular fluids, and the bicarbonate buffer system;
- c. explain how the kidneys secrete hydrogen ions and how these ions are buffered in the tubular fluid;
- d. identify some types and causes of acidosis and alkalosis, and describe the effects of these pH imbalances; and
- e. explain how the respiratory and urinary systems correct acidosis and alkalosis, and compare their effectiveness and limitations.

Chapter 25- THE DIGESTIVE SYSTEM

Section 25.1

- a. list the functions and major physiological processes of the digestive system;
- b. distinguish between mechanical and chemical digestion;
- c. describe the basic chemical process underlying all chemical digestion, and name the major substrates and products of this process;
- d. list the regions of the digestive tract and the accessory organs of the digestive system;
- e. identify the layers of the digestive tract and describe its relationship to the peritoneum; and
- f. describe the general neural and chemical controls over digestive function.

Section 25.2

- a. describe the gross anatomy of the digestive tract from the mouth through the esophagus;
- b. describe the composition and functions of saliva; and
- c. describe the neural control of salivation and swallowing.

Section 25.3

- a. describe the gross and microscopic anatomy of the stomach;
- b. state the function of each type of epithelial cell in the gastric mucosa;
- c. identify the secretions of the stomach and state their functions;
- d. explain how the stomach produces hydrochloric acid and pepsin;
- e. describe the contractile responses of the stomach to food; and
- f. describe the three phases of gastric function and how gastric activity is activated and inhibited.

Section 25.4

- a. describe the gross and microscopic anatomy of the liver, gallbladder, bile duct system, and pancreas;
- b. describe the digestive secretions and functions of the liver, gallbladder, and pancreas; and
- c. explain how hormones regulate secretion by the liver and pancreas.

Section 25.5

- a. describe the gross and microscopic anatomy of the small intestine;
- b. state how the mucosa of the small intestine differs from that of the stomach, and explain the functional significance of the differences;
- c. define *contact digestion* and describe where it occurs; and
- d. describe the types of movement that occur in the small intestine.

Section 25.6

- a. describe how each major class of nutrients is chemically digested, name the enzymes involved, and discuss the functional differences among these enzymes; and
- b. describe how each type of nutrient is absorbed by the small intestine.

Section 25.7

- a. describe the gross anatomy of the large intestine;
- b. contrast the mucosa of the colon with that of the small intestine;
- c. state the physiological significance of intestinal bacteria;
- d. discuss the types of contractions that occur in the colon; and
- e. explain the neurological control of defecation.

Chapter 26- NUTRITION AND METABOLISM

Section 26.1

- a. describe some factors that regulate hunger and satiety;
- b. define *nutrient* and list the six major categories of nutrients;
- c. state the function of each class of macronutrients, the approximate amounts required in the diet, and some major dietary sources of each;
- d. name the blood lipoproteins, state their functions, and describe how they differ from each other; and
- e. name the major vitamins and minerals required by the body and the general functions they serve.

Section 26.2

- a. describe the principal reactants and products of each major step of glucose oxidation;
- b. contrast the functions and products of anaerobic fermentation and aerobic respiration;
- c. explain where and how cells produce ATP; and
- d. describe the production, function, and use of glycogen.

Section 26.3

- a. describe the processes of lipid catabolism and anabolism;
- b. describe the processes of protein catabolism and anabolism; and
- c. explain the metabolic source of ammonia and how the body disposes of it.

Section 26.4

- a. define the absorptive and postabsorptive states;
- b. explain what happens to carbohydrates, fats, and proteins in each of these states;
- c. describe the hormonal and nervous regulation of each state;
- d. define *metabolic rate* and *basal metabolic rate*; and
- e. describe some factors that alter the metabolic rate.

Section 26.5

- a. identify the principal sources of body heat;
- b. describe some factors that cause variations in body temperature;
- c. define and contrast the different forms of heat loss;
- d. describe how the hypothalamus monitors and controls body temperature; and
- e. describe conditions in which the body temperature is excessively high or low.

Chapter 27- THE MALE REPRODUCTIVE SYSTEM

Section 27.1

- a. identify the most fundamental biological distinction between male and female;
- b. define *primary sex organs*, *secondary sex organs*, and *secondary sex characteristics*;
- c. explain the role of the sex chromosomes in determining sex;
- d. explain how the Y chromosome determines the response of the fetal gonad to prenatal hormones;
- e. identify which of the male and female external genitalia are homologous to each other; and
- f. describe the descent of the gonads and explain why it is important.

Section 27.2

- a. describe the anatomy of the scrotum, testes, and penis;
- b. describe the pathway taken by a sperm cell from its formation to its ejaculation, naming all the passages it travels; and
- c. state the names, locations, and functions of the male accessory reproductive glands.

Section 27.3

- a. describe the hormonal control of puberty;
- b. describe the resulting changes in the male body; and
- c. define and describe male climacteric and the effect of aging on male reproductive function.

Section 27.4

- a. describe the stages of meiosis and contrast meiosis with mitosis;
- b. describe the sequence of cell types in spermatogenesis, and relate these to the stages of meiosis;
- c. describe the role of the sustentacular cell in spermatogenesis;
- d. describe or draw and label a sperm cell; and
- e. describe the composition of semen and functions of its components.

Section 27.5

- a. describe the blood and nerve supply to the penis; and

- b. explain how these govern erection and ejaculation.

Chapter 28- THE FEMALE REPRODUCTIVE SYSTEM

Section 28.1

- a. describe the structure of the ovary;
- b. trace the female reproductive tract and describe the gross anatomy and histology of each organ;
- c. identify the ligaments that support the female reproductive organs;
- d. describe the blood supply to the female reproductive tract;
- e. identify the external genitalia of the female; and
- f. describe the structure of the nonlactating breast.

Section 28.2

- a. name the hormones that regulate female reproductive function, and state their roles;
- b. describe the principal signs of puberty;
- c. describe the hormonal changes of female climacteric and their effects; and
- d. define and describe menopause, and distinguish menopause from climacteric.

Section 28.3

- a. describe the process of egg production (oogenesis);
- b. describe changes in the ovarian follicles (folliculogenesis) in relation to oogenesis;
- c. describe the hormonal events that regulate the ovarian cycle;
- d. describe how the uterus changes during the menstrual cycle; and
- e. construct a chart of the phases of the monthly sexual cycle showing the hormonal, ovarian, and uterine events of each phase.

Section 28.4

- a. describe the female sexual response at each phase of intercourse; and
- b. compare and contrast the female and male responses.

Section 28.5

- a. list the major hormones that regulate pregnancy and explain their roles;
- b. describe a woman's bodily adaptations to pregnancy;
- c. identify the physical and chemical stimuli that increase uterine contractility in late pregnancy;
- d. describe the mechanism of labor contractions;
- e. name and describe the three stages of labor; and
- f. describe the physiological changes that occur in a woman during the weeks following childbirth.

Section 28.6

- a. describe development of the breasts in pregnancy;
- b. describe the shifting hormonal balance that regulates the onset and continuation of lactation;
- c. describe the mechanism of milk ejection;
- d. contrast colostrum with breast milk; and
- e. discuss the benefits of breast-feeding.

Chapter 29- HUMAN DEVELOPMENT

Section 29.1

- a. describe the process of sperm migration and fertilization;
- b. explain how an egg prevents fertilization by more than one sperm;
- c. describe the major events that transform a fertilized egg into an embryo; and
- d. describe the implantation of the preembryo in the uterine wall.

Section 29.2

- a. describe the formation and functions of the placenta;
- b. explain how the conceptus is nourished before the placenta takes over this function;
- c. describe the embryonic membranes and their functions;
- d. identify the major tissues derived from the primary germ layers;
- e. describe the major events of fetal development; and
- f. describe the fetal circulatory system.

Section 29.3

- a. describe how and why the circulatory system changes at birth;
- b. explain why the first breaths of air are relatively difficult for a neonate;
- c. describe the major physiological problems of a premature infant; and
- d. discuss some common causes of birth defects.

Section 29.4

- a. define senescence and distinguish it from aging;
- b. describe some major changes that occur with aging in each organ system; summarize some current theories of senescence; and be able to explain how exercise and other factors can slow the rate of senescence.

Materials & Texts

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FROM CURRICULUM CONNECTOR

UNIT: Fill in unit name/month

Common Core Standards

Keystone Connections:

Student Objectives:

KNOWLEDGE

SKILLS

Materials & Texts

MATERIALS

TEXTS

Activities, Assignments, & Assessments

ACTIVITIES

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