HSP 2401 Human Anatomy and Physiology I

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Office Hours: Monday, Tuesday, Wednesday 2:00-3:00pm and by appointment

Course Description: This course, which provides a comprehensive study of the anatomy and physiology of the human body with an emphasis on health and medical issues, is designed for students preparing for careers in the health professions. It will include an overview of organ systems, basic chemical organization, cell structure and function, and tissues; followed by the study of the skeletal, muscular, and nervous systems.

Course Objectives: See end of the syllabus.


STUDENT RESPONSIBILITY AND ATTENDANCE
It is the student’s responsibility to be on time for class, participate in class discussions, and be actively engaged in the learning process. Instructions and assignments will often been given during class, therefore it is in your best interest to attend. If you have to miss class due to an unforeseen event/accident or illness, please contact the instructor prior to the start of class. Pending the reason for your absence, the instructor may inform you of any missed homework assigned during class. Not acceptable reasons for absences include but are not limited to: over sleeping, work, wanting to leave early or come back late from the weekend, and celebrating a friend, relative or pet’s birthday. If you are sick, let the instructor know and bring a physician’s note when you come back to class.

LATE WORK OR MISSED ASSIGNMENTS POLICY Late work will not be accepted unless you have received permission from the instructor prior to the due date. If you miss an assignment due to an unexcused absence, you are out of luck. Show up for class!

ACADEMIC HONESTY Academic honesty is expected on all work. Students are expected to maintain complete honesty and integrity in their online experiences. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU. The Department of Health Science Professions adheres to the academic honesty statement as set forth in the Angelo State University Student Handbook (2011-2012) http://www.angelo.edu/content/files/17358-university-honor-code. The University "faculty expects all students to engage in all academic pursuits in a manner that is above reproach and to maintain complete honesty and integrity in the academic experience both in and out of the classroom setting and may initiate disciplinary proceedings against a student accused of any form of academic dishonesty, including but not limited to, cheating on an examination or other academic work, plagiarism, collusion, and the abuse of resource materials."
PLAGIARISM
Plagiarism at ASU is a serious topic. The Angelo State University’s Honor Code gives specific details on plagiarism and what it encompasses. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it off as one's own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word for word without quotation marks and the source of the quotation. We use the APA Style Manual of the American Psychological Association as a guide for all writing assignments. Quotes should be used sparingly. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list. Papers are subject to be evaluated for originality via Bb Turnitin. Resources to help you understand this policy better are available at the ASU Writing Center http://www.angelo.edu/dept/writing_center/academic_honesty.php.

STUDENTS WITH DISABILITIES
1. “Angelo State University is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments Act of 2008 (ADAAA), and subsequent legislation.”

2. The Office of Student Affairs is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability, and it is the student’s responsibility to initiate such a request by contacting the Office of Student Affairs, University Center, Room 112 at (325) 942-2047 or (325) 942-2211 (TDD/FAX) or by e-mail at studentservices@angelo.edu to begin the process. The Office of Student Affairs will establish the particular documentation requirements necessary for the various types of disabilities. Reasonable accommodations will be made for students determined to be disabled or who have documented disabilities.

INCOMPLETE GRADE POLICY (OP 10.11 Grading Procedures)
It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required.

STUDENT ABSENCE FOR OBSERVANCE OF RELIGIOUS HOLY DAYS
“A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence.” Please see ASU Operating Policy 10.19.

COPYRIGHT POLICY
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SYLLABUS CHANGES
The faculty member reserves the option to make changes as necessary to this syllabus and the course content. If changes become necessary during this course, the faculty will notify students of such changes by email, course announcements and/or via a discussion board announcement. It is the student’s responsibility to look for such communications about the course on a daily basis.
This course is graded strictly on points NOT percentages. The amount of points you earn determines your grade in the course. I DO NOT ROUND UP GRADES at the end of the semester. It is your responsibility to keep track of the total course points you have accumulated and take advantage of the bonus points available in the course.

Course Evaluation and Grading Scale:

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<tr>
<th>Component</th>
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<td>6 Quizzes (100 points each)</td>
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Tentative Class Schedule

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<td><strong>Cumulative Final Exam -</strong></td>
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**Assignments**

**Ph.I.L.S. Labs: 18 labs worth 10 points each for a total of 180 points**

These physiology interactive lab simulations are designed to help you better understand different physiological concepts discussed this semester. There are 18 labs covered this semester. Each lab is worth 10 points for a total of 180 points. Each lab consists of an activity and then a post-lab quiz. To receive all 10 points, you must complete the activity completely and correctly. You must then save a copy of your lab results and email them to me by the indicated due date found in the course schedule. When you save your lab results you must use the following format: PhILS, the Lab Number, the Semester and Year, Your first initial and last name. So for example: PhILS1_F2018_KWhite.

**LearnSmart Assignments: 25 points each for a total of 400 points**

Each chapter covered this semester has a LearnSmart assignment associated with it. Each assignment is worth 25 points. These assignments should be done individually and will take on average 60-90 minutes to complete. These questions will test your knowledge on the topics discussed in class and will refer you to readings in the text that will help you better comprehend topics in class that are challenging for you. The LearnSmart assignments typically give you a
window of 3-4 days to complete. No late assignments will be accepted and each assignment closes at 11:59 of the assigned date.

Practice Questions – Chapters 1-16 – 160 Bonus Points Possible
These practice questions are optional to help you review and prepare for your quizzes. This is your chance to receive bonus points in the course for completion of the questions. Each chapter is worth up to 10 bonus points (160 total bonus points possible). The number of questions you correctly complete determines how many bonus points you receive. All practice questions are due by 8:00AM on the day of the corresponding quiz. For example, the practice questions for chapters 1, 2, and 3 are due on 2/1/19 at 8:00AM. There will be no exceptions and there will be no other bonus points awarded during the semester.
Chapter Objectives

• Chapter 1
  o Describe the science of anatomy.
  o List the subdivisions in both microscopic and gross anatomy.
  o Describe the science of physiology.
  o List the subdivisions in physiology.
  o Describe best practices for studying anatomy and physiology effectively.
  o List the characteristics common to all living things.
  o Describe the levels of organization in the human body.
  o Compare the organ systems of the human body.
  o Describe the anatomic position and its importance in the study of anatomy.
  o Describe the anatomic sections and planes through the body.
  o Define the different anatomic directional terms.
  o Identify the major regions of the body, using proper anatomic terminology.
  o Compare the terms used to subdivide the abdominopelvic region into 9 regions or 4 quadrants.
  o Define the components of a homeostatic system.
  o Be able to recognize each of the components in representative systems.
  o Define negative feedback.
  o Explain how homeostatic mechanisms regulated by negative feedback detect and respond to environmental changes.
  o Define positive feedback and describe the actions of a positive feedback loop.

• Chapter 2
  o Define matter, and list its three forms.
  o Describe and differentiate among the subatomic particles that compose atoms.
  o Explain the arrangement of elements in the periodic table based on atomic number.
  o Diagram the structure of an atom.
  o Describe an isotope.
  o Explain how radioisotopes differ from other types of isotopes.
  o Describe how elements are organized in the periodic table based on the valence electron number.
  o State the octet rule.
  o Define an ion and list some common ions in the body.
  o Differentiate between cations and anions.
  o Describe how charges are assigned or ions.
  o Define an ionic bond.
  o Describe an ionic compound of NaCl.
  o List other examples of ionic compounds.
  o Define a molecular formula.
  o Describe a structural formula, and explain its use in differentiating isomers.
  o Describe a covalent bond, and explain its formation based on the octet rule.
  o List the four most common elements in the human body.
  o Distinguish between single, double, and triple covalent bonds.
  o Explain polar and nonpolar covalent bonds.
  o Describe the difference between a nonpolar molecule and a polar molecule.
Define an amphipathic molecule.

Describe hydrogen bonding between polar molecules.

List and define the intermolecular attractions between nonpolar molecules.

Describe the molecular structure of water and how each water molecule can form four hydrogen bonds.

List the different properties of water, and provide an example of the importance of each property within the body.

Compare substances that dissolve in water with those that body dissolve and dissociate in water. Distinguish between electrolytes and nonelectrolytes.

Describe the chemical interactions of nonpolar substances and water.

Explain how amphipathic molecules interact in water to form chemical barriers.

Describe what is formed when water molecules dissociate.

Explain the difference between an acid and a base.

Define pH, and explain the relative pH values of both acids and bases.

Explain neutralization, and describe how the neutralization of both an acid and a base occurs.

Describe the action of a buffer.

Compare and contrast the three different types of water mixtures.

Explain how an emulsion differs from other types of mixtures.

Explain the different ways to express the concentration of solute in a solution.

Identify the six chemical elements that generally compose biological macromolecules.

Describe a hydrocarbon and its chemical properties, and explain and give examples of functional groups and their chemical properties.

Define the terms monomer, dimer, and polymer.

Describe the role of water in both dehydration and hydrolysis reactions in altering biological macromolecules.

Describe the general characteristics of a lipid.

Identify the four types of lipids and their physiologic roles.

Describe the distinguishing characteristics of carbohydrates.

Explain the relationship between glucose and glycogen.

Name some other carbohydrates found in living systems.

Describe the general structure of a nucleic acid.

Describe the structure of a nucleotide monomer.

Distinguish between DNA and RNA.

Name other important nucleotides.

List the general functions of proteins.

Describe the general structure of amino acids and proteins.

Name the categories of amino acids.

Distinguish between nonpolar, polar, and charged amino acids.

Give examples of amino acids with special characteristics.

Describe the different types of intramolecular attractions that participate in both folding a protein and maintaining its three-dimensional shape.

Distinguish between the four structural hierarchy levels of proteins.

Explain what is means by denaturation, and list factors that can cause it.
Chapter 3

- Describe the two classes of energy.
- Describe chemical energy and the various forms of kinetic energy.
- List the three important molecules within the body that function primarily in chemical energy.
- State the first law and second law of thermodynamics.
- Explain why energy conversion is always less than 100%.
- Explain what occurs in a chemical reaction.
- Distinguish between reactants and products.
- Describe the three classifications of chemical reactions.
- Distinguish between catabolism and anabolism.
- Discuss the exchange that takes place in an oxidation-reduction reaction.
- Explain ATP cycling.
- Define chemical reaction rate.
- Explain activation energy.
- Describe the general function of enzymes.
- Describe the key structural components of enzymes.
- Identify places in the body where enzymes may be found.
- Explain the steps by which an enzyme catalyzes a reaction.
- Describe cofactors and their role in reactions.
- Identify the six major classes of enzymes and the general functions of enzymes in each class.
- Describe the naming conventions for enzymes.
- Define how enzyme and substrate concentration affect reaction rates.
- Explain the effect of temperature on enzymes.
- Describe how pH changes affect enzymes.
- Describe how competitive and noncompetitive inhibitors control enzyme actions.
- Distinguish between a metabolic pathway and a multienzyme complex.
- Explain the role of negative feedback in enzyme regulation.
- Identify and explain the processes involving phosphate that commonly are used to regulate enzymes.
- Write the overall formula for glucose oxidation.
- Name the two pathways that generate ATP.
- List the four stages of glucose oxidation and where each stage occurs within a cell.
- Summarize the metabolic pathway of glycolysis, including where it occurs in a cell if it requires oxygen, the initial substrate and final product, and the molecules formed during energy transfer.
- Explain the enzymatic reaction of the intermediate stage, including a) where it occurs in a cell, b) if it requires oxygen, c) the initial substrate and final product, and d) the molecules formed during energy transfer.
- Describe the importance of NADH and FADH2 in energy transfer.
- Explain the actions that take place in the electron transport system.
- Calculate the number of ATP molecules produced in cellular respiration if oxygen is not available and if oxygen is available.
- Explain the fate of pyruvate when oxygen is in short supply.
- Describe the impact on ATP production if there is insufficient oxygen.
- Describe the entry point in the metabolic pathway of cellular respiration for both fatty acids and amino acids.
• Chapter 4
  o Distinguish among light microscopy, scanning electron microscopy, and transmission electron microscopy.
  o Describe the range in size of human cells.
  o Identify some of the shapes cells may exhibit.
  o Describe the three main structural features of a cell.
  o Identify the membrane-bound and non-membrane-bound organelles.
  o Distinguish between organelles and cell inclusions.
  o Explain the general functions that cells must perform.
  o List the lipid components of the plasma membrane, and explain the actions of each component.
  o Differentiate between the two types of membrane proteins based upon their relative position in the plasma membrane.
  o Name the six major roles played by membrane proteins.
  o Summarize the general concept of diffusion.
  o Distinguish between the cellular processes of simple diffusion and facilitated diffusion.
  o Define osmosis and osmotic pressure.
  o Describe the relationship of osmosis and tonicity.
  o Compare and contrast primary and secondary active transport.
  o Explain the difference between exocytosis and endocytosis.
  o Describe the endocytotic processes of phagocytosis, pinocytosis, and receptor-mediated endocytosis.
  o Define a resting membrane potential.
  o Describe the cellular conditions that are significant for establishing and maintaining a resting membrane potential.
  o Explain the role of both K+ and Na+ is establishing an RMP.
  o Discuss how NA+/K+ pumps are necessary in maintaining an RMP.
  o Explain how cells communicate through direct contact.
  o Describe the three general mechanisms of response to the binding of a ligand with a receptor.
  o List the membrane-bound organelles of a typical human cell.
  o Describe the structure and main function(s) of each.
  o List the non-membrane-bound organelles of a typical human cell.
  o Describe the structure and main function(s) of each.
  o Distinguish between cilia and flagella in terms of both structure and function.
  o Describe the structure and function of microvilli.
  o Compare and contrast the structure and function of the three major types of membrane junctions.
  o Describe the nuclear envelope.
  o Explain the structure and function of a nucleolus.
  o Describe the relationship of DNA, chromatin, and genes.
  o List the required structures for transcription.
  o Explain the three steps of transcription.
  o List the required structures for translation.
  o Name the three functional forms of RNA, explain what is meant by codon, and identify three types of codon sequences.
  o Describe the three steps of translation.
  o Explain why DNA is considered the cell's control center.
o Explain the structure and function of centrioles in cell division.
o Describe the structural difference between chromatin and chromosomes, and note when each is present in a cell.
o Summarize the phases of the cell cycle and the activities that occur in each phase.
o Name and explain the four main stages of mitosis.
o Explain the function of cytokinesis.
o Define apoptosis.
o List the actions that occur in a cell during apoptosis.

• Chapter 5
  o Describe the common features of epithelial tissue.
  o Explain the four functions of epithelial tissues.
  o Name the classes of epithelia based on cell layers and cell shapes.
  o Give examples of each type of epithelium.
  o Define glands.
  o Distinguish between endocrine and exocrine glands.
  o List exocrine gland types based on both anatomic form and physiologic method of secretion.
  o Describe the three components of connective tissue.
  o Give examples of resident cells and wandering cells in connective tissue proper.
  o Name three types of protein fibers found in connective tissue.
  o Identify three types of molecules that may be found in ground substance.
  o Describe the function of connective tissue.
  o Compare and contrast mesenchyme and mucous connective tissue.
  o Distinguish the types of connective tissue and the locations where each type is found.
  o Describe the structure of skeletal, cardiac, and smooth muscle.
  o Compare the functions of each type of muscle and where each type is found.
  o Describe the structure of nervous tissue.
  o List the functions of nervous tissue.
  o Define an organ.
  o Explain the roles of different tissues in an organ.
  o Explain the structure and functions of mucous, serous, cutaneous, and synovial membranes.
  o Identify the locations of these membranes.
  o Explain the stages of tissue development in the embryo.
  o Describe the three primary germ layers and the tissues to which they give rise.
  o Describe how tissues may change in form, size, or number of cells.
  o List some changes that occur in tissues with age.

• Chapter 6
  o Describe the five layers (strata) of the epidermis.
  o Differentiate between thick skin and thin skin.
  o Explain what causes differences in skin color.
  o Characterize the two layers of the dermis.
  o Explain the significance of cleavage lines.
  o Describe how dermal blood vessels function in temperature regulation.
  o List the functions of the subcutaneous layer.
  o Name ways in which the integument protects the body and prevents water loss.
Describe the integument’s involvement in calcium and phosphorus utilization.

Describe the integument’s role in secretion and absorption.

Identify the immune cells that reside in the integument, and describe their actions.

Explain how the skin helps cool the body or retain warmth.

List the sensations detected by the skin’s sensory receptors.

Describe the function of nails.

List the main components of the nail.

Describe the structure of a hair and a follicle.

List the functions of hair.

Differentiate between the two types of sweat glands.

Describe the function of sebaceous glands.

Name two other modified integumentary glands.

Distinguish between regeneration and fibrosis.

Describe the process of wound healing.

Describe how integument develops from two germ layers.

Explain the developmental origins of nails, hair, and glands.

Explain changes to the skin with age.

List factors that contribute to skin aging.

Chapter 7

List the structures of the skeletal system.

Compare and contrast compact and spongy bone.

Identify the types and location so cartilage within the skeletal system.

Describe the general functions of bone.

Describe the four major classes of bones as determined by shape.

Describe the structural components of a long bone.

Compare the gross anatomy of other bones to that of a long bone.

Explain the general function of blood vessels and nerves that serve a bone.

Compare and contrast the structure and location of the two types of bone marrow.

Name the four types of bone cells and their functions.

Describe the composition of bone’s matrix.

Explain bone matrix formation and resorption.

Compare the structure of compact bone and spongy bone.

Analyze the structure of hyaline cartilage and the cells in its matrix.

Identify bones that are produced by intramembranous ossification.

Explain the four main steps in intramembranous ossification.

Explain the steps in endochondral ossification of a long bone.

Differentiate between intramembranous ossification and endochondral ossification.

Compare and contrast the five zones of the epiphyseal plate, and describe how growth in length occurs there.

Describe the steps of appositional growth.

Define bone remodeling and give examples of how it varies in different bones and different portions of the same bone.

Explain the effect of mechanical stress on bone remodeling.

Identify the hormones that influence bone growth and bone remodeling and describe their effects.

Explain the activation of vitamin D to calcitriol.

Discuss the release of parathyroid hormone.
○ Explain how parathyroid hormone and calcitriol function together to regulate blood calcium levels.
○ Discuss the homeostatic system involving the hormone calcitonin and its effect on blood calcium levels.
○ Describe how age influences bone structure.
○ Explain the four steps by which fractures heal.

• Chapter 8
  ○ Compare and contrast the composition and functions of the axial and appendicular skeletons.
  ○ Become familiar with terminology for common bone markings.
  ○ Distinguish between the cranial and the facial bones.
  ○ Identify the locations of cranial and facial bones in various views of the skull.
  ○ Learn key bone markings and features of each of the bones in the cranium.
  ○ Compare and contrast the locations and contents of three cranial fossae.
  ○ Describe the locations of the sutures between the cranial bones.
  ○ List the bones that form the orbital and nasal complexes.
  ○ Describe the location and function of the paranasal sinuses.
  ○ Locate and identify the auditory ossicles.
  ○ Describe the structure and function of the hyoid bone.
  ○ Identify the similarities and differences between male and female skulls.
  ○ Compare the structure of fetal, child, and adult skulls.
  ○ List the fontanelles and the ages at which they close.
  ○ Describe the functions of the vertebral column.
  ○ List the five types of vertebrae.
  ○ Name the four spinal curvatures of an adult vertebral column.
  ○ Explain the sequence of curvature development.
  ○ Identify the parts of a typical vertebra.
  ○ Compare and contrast the different types of vertebrae.
  ○ Identify the three main components of the sternum and their features.
  ○ Describe the features found on all ribs.
  ○ Differentiate between true ribs and false ribs.
  ○ Identify skeletal features common to the upper and lower limbs.
  ○ Describe the functional reasons for differences between the upper and lower limb skeletons.
  ○ Identify and locate the clavicle and its landmarks.
  ○ Describe the landmarks and features of the scapula.
  ○ Describe the articulations of the humerus.
  ○ List landmarks and features of the humerus.
  ○ Compare and contrast the features of the radius and the ulna.
  ○ Explain how the radius, ulna, and humerus articulate.
  ○ Differentiate between supination and pronation of the forearm.
  ○ Locate and identify the carpals and metacarpals.
  ○ Describe the phalanges and their relative locations.
  ○ Name the three bones that make up each os coxae.
  ○ Describe how the ossa coxae articulate with each femur and sacrum.
  ○ Describe landmarks and features of an os coxae.
  ○ Differentiate between the true and false pelves.
- Compare and contrast the pelvic inlet and pelvic outlet.
- Compare and contrast the anatomy of male and female pelves.
- Describe the changes to the ossa coxae as a person ages.
- Describe the articulations of the femur.
- Identify key landmarks and features of the femur.
- Describe the location and function of the patella.
- Describe the features of the tibia and fibula.
- Explain how the function of the tibia differs from that of the fibula.
- Describe how the tibia and fibula articulate.
- Locate and identify the tarsals and metatarsals.
- Describe the phalanges and their relative locations.
- Describe the three arches of the foot and their functions.
- Describe how the limb buds form.
- Compare and contrast upper and lower limb bud development.

- **Chapter 9**
  - Define a joint.
  - Compare the structural and the functional classification of joints;
  - Explain the inverse relationship between mobility and stability within a joint.
  - Explain the location and characteristics of gomphoses.
  - Describe the location and functions of sutures.
  - List the locations of syndesmoses, and describe their function.
  - Describe the locations and functions of synchondroses.
  - Name the locations symphyses and their functions in these locations.
  - Identify the characteristics common to all synovial joints.
  - List the basic features of a synovial joint.
  - Describe the composition and function of synovial fluid in a typical synovial joint.
  - Explain the movement of a joint with respect to the three perpendicular axes of space.
  - Compare and contrast the six types of synovial joints.
  - Describe gliding motion, and name joints in which it occurs.
  - Describe angular motion.
  - Name the specific types of angular motion.
  - Give examples of joints that exhibit angular motion.
  - Explain rotational motion, and name joints in which it occurs.
  - Explain what is meant by special movements, and give examples of joints at which they occur.
  - Devine a lever.
  - Discriminate between the effort arm and the resistance arm in a lever.
  - Compare and contrast the three types of levers in the human body.
  - Describe the features of the temporomandibular joint.
  - List the movements of the TMJ.
  - Describe the three individual joints that make up the shoulder articulation.
  - Explain why the glenohumeral joint is relatively unstable.
  - Describe the elbow joint and its motion.
  - Explain why the elbow joint is relatively stable.
  - Describe the hip joint and its motions.
  - Explain why the hip joint is more stable than the glenohumeral joint.
  - Describe the knee joint and its motion.
Name the ligaments that support the knee joint.

Describe the talocrural joint and its motion

Explain how the three major types of joints form in the embryo and fetus.

Describe some of the common age-related changes in joints.

**Chapter 10**

- Explain the five general functions of skeletal muscle.
- Describe the five characteristics of skeletal muscle.
- Identify and describe the three connective tissue layers associated with a skeletal muscle.
- Describe the structure and function of a tendon and an aponeurosis.
- Explain the function of blood vessels and nerves serving a muscle.
- Explain how a skeletal muscle fiber becomes multinucleated.
- Describe the sarcolemma, T0tubules, sarcoplasmic reticulum, and triad of a skeletal muscle fiber.
- Distinguish between thick and thin filaments.
- Explain the organization of myofibrils, myofilaments, and sarcomeres.
- List and describe the structures associated with energy production within skeletal muscle fibers.
- Define a motor unit, and describe its distribution in a muscle and why it varies in size.
- Describe the three components of a neuromuscular junction.
- Describe a skeletal muscle fiber at rest.
- Explain the events that lead to release of the neurotransmitter Ach from a motor neuron.
- Describe the steps in excitation-contraction coupling.
- Summarize the changes that occur within a sarcomere during contraction.
- Discuss what happens to each of the following to allow for skeletal muscle relations: Ach, action potential, Ca2+ concentration in sarcoplasm, and troponin-tropomyosin complex.
- Explain the relationship of skeletal muscle elasticity and muscle relaxation.
- Describe how ATP is made available within skeletal muscle through myosin kinase, creatine kinase, glycolysis, and aerobic cellular respiration.
- Explain how the means of supplying ATP is related to intensity and duration of exercise.
- Define oxygen debt, and explain why it occurs.
- Explain the two primary criteria used to classify skeletal muscle fiber types.
- Compare and contrast the three skeletal muscle fiber types.
- Describe the distribution of skeletal muscle fiber types in a muscle and how this distribution relates to the muscle’s function.
- Describe what occurs in a skeletal muscle during a single twitch, and relate each event to a graph of a twitch.
- Explain the events that occur in motor unit recruitment as the intensity of stimulation is increased.
- Distinguish between wave summation, incomplete tetany, and tetany that occur with an increase in frequency of stimulation.
- Describe muscle tone, and explain its significance.
- Distinguish between isometric and isotonic contractions, and give examples of both.
- Explain the length-tension relationship in skeletal muscle contraction.
- Define muscle fatigue, and explain some of its causes.
Compare and contrast the changes in skeletal muscle that occur as a result of the two primary types of exercise programs or from the lack of exercise.

Summarize the effects of aging on skeletal muscle.

List and describe the similarities and differences between skeletal muscle and cardiac muscle.

Identify organs of various body systems where smooth muscle is located.

Compare the microscopic anatomy of smooth muscle to skeletal muscle.

Explain the sequence of steps in smooth muscle contraction.

Briefly explain the different means of controlling smooth muscles.

Explain the primary functional difference between multiunit and single-unit smooth muscle.

Compare the location and regulation of both multiunit and single-unit smooth muscle.

Chapter 11

Compare and contrast the superior (proximal) and inferior (distal) attachments of a skeletal muscle.

Describe and differentiate between the organizational patterns in muscle fascicles.

Differentiate between agonists, antagonists, and synergists.

List the seven characteristics of muscles that may contribute to their names.

Give examples of muscles whose names contain an indication of action, specific body region, attachments, orientation of muscle fibers, shape, size, and muscle heads.

Name the muscles that move the forehead, the skin around the eyes, and the nose, and describe their actions.

List the muscles that move the mouth and cheeks and their actions.

Become familiar with the six extrinsic muscles of the eye, and describe how each affects eye movement.

Name the three cranial nerves that innervate the extrinsic eye muscles, and identify which muscles they act upon.

Describe how each of the four muscles of mastication affects mandibular movement.

Describe the actions of the intrinsic muscles and the four paired extrinsic muscles of the tongue.

Explain what function the three primary muscles of the pharynx accomplish.

Contrast the actions of the four suprathyroid muscles and the four infrahyoid muscles.

Compare and contrast the actions of the anterolateral neck muscles and the posterior neck muscles.

Name and describe the three groups of erector spinae muscles.

Describe the actions of the transversospinalis and quadratus lumborum muscles.

List the posterior and anterior thoracic muscle groups involved in respiration, and describe their actions.

Describe the role of the diaphragm in breathing and in raising intraabdominal pressure.

List the four pairs of abdominal muscles.

Compare the actions of the rectus abdominis muscle with the oblique muscles and transversus abdominis.

Describe the functions of the pelvic floor muscles.

Identify the boundaries of the perineum.

Compare and contrast how the anterior and posterior thoracic muscles move the pectoral girdle.

List the muscles that extend, flex, adduct, and abduct the glenohumeral joint.
• Compare the actions of the four scapular muscles on the rotator cuff.
• Name the muscles in the arm’s anterior and posterior compartments, and contrast their common functions.
• Describe the muscles that pronate and supinate the forearm.
• Describe the muscles of the anterior compartment and their actions, and identify the layer in which each resides.
• Explain the actions of the muscles of the posterior compartment, and identify the layer in which each resides.
• Compare the actions of the three groups of intrinsic muscles of the hand.
• Compare and contrast the functions of the muscles in the anterior, medial, lateral, and posterior compartments of the thigh.
• Describe the actions of the three gluteal muscles.
• List the muscles of the thigh’s anterior compartment that move the knee joint.
• Describe the muscles of the thigh that flex the knee joint.
• Compare and contrast the muscles of the three compartments of the leg and their actions.
• Distinguish between the muscles of the superficial later and deep layer of the leg’s posterior compartment.
• Identify the muscles of each group and their actions.

• Chapter 12
  • Describe the three general functions of the nervous system.
  • Identify the structural components included in the CNS and those in the PNS.
  • Explain the functional organization of the nervous system.
  • Describe the structure of a nerve, including the three layers of connective tissue wrappings.
  • Explain how nerves are classified structurally and functionally.
  • Describe five distinguishing features common to all neurons.
  • Describe the three basic anatomic features common to most neurons.
  • Identify and describe the structures unique to neurons.
  • Name and describe the four structural categories of neurons.
  • Identify the three functional categories of neurons and where each is primarily located.
  • Define a synapse.
  • Describe the essential structural and functional differences between a chemical synapse and an electrical synapse.
  • List the distinguishing features of glial cells.
  • Describe the structure and function of the four types of glial cells within the CNS and the two types of glial cells within the PNS.
  • Define myelination, and describe the composition and function of a myelin sheath.
  • Distinguish between the myelination process carried out by neurolemmocytes in the PNS and by oligodendrocytes in the CNS.
  • Identify factors that influence regeneration of PNS, axons, and explain why axon regeneration in the CNS is limited.
  • Describe the events of Wallerian degeneration and axon regrowth.
  • Distinguish between a pump and a channel, and describe the three specific states of a voltage-gated NA+ channel.
  • List the channels and pumps that are located along the entire neuron, and identify the general function of each.
Identify and describe the four functional neuron segments, including the distribution of channels and pumps in each.

- Describe the conditions of a neuron at rest.
- Define resting membrane potential, and state its typical value for neurons.
- Explain how the resting membrane potential is established and maintained in neurons.
- Define summation, and describe the two types of summation that can occur in the initial segment.
- Describe and graph an action potential.
- Explain propagation of an action potential in both unmyelinated and myelinated axons.
- Define refractory period, and explain the difference between the absolute refractory period and relative refractory period associated with transmitting an action potential.
- Describe events that occur when the propagated action potential reaches the transmissive segment.
- Explain the general role of Ca2+ in neurotransmitter release.
- Compare graded potentials and action potentials.
- Describe the two primary factors that influence the velocity of action potential propagation.
- Identify the criteria used to distinguish the groups of nerve fibers.
- Describe how action potentials vary in frequency.
- Identify the four classes of neurotransmitters based upon chemic structure.
- Describe how neurotransmitters are classified based upon function.
- Describe how acetylcholine functions as a neurotransmitter.
- Discuss the different mechanisms for removing neurotransmitter from the synaptic cleft.
- Define neuromodulation, including its function in facilitation and inhibition.
- Describe how nitric oxide and endocannabinoids function as neuromodulators.
- Identify the four different types of neuronal pools, and explain how they function.

**Chapter 13**

- Describe the general regions of the brain.
- Describe the general process of nervous tissue development and neurulation.
- Provide the scientific names for the embryonic forebrain, midbrain, and hindbrain.
- Name the five secondary brain vesicles, describe their embryonic origins, and list the adult brain structures that are formed by each.
- Compare and contrast the general composition, function, and distribution of gray and white matter throughout the CNS.
- Compare and contrast the structure and locations of the three meninges, and identify the spaces between the meninges.
- Describe the four cranial dural septa, and give their locations.
- Describe the anatomy and location of the ventricles.
- Explain the three functions of cerebrospinal fluid.
- Trace the circulation of cerebrospinal fluid, beginning with its origin and ending with its removal.
- Describe the components that form the blood-brain barrier.
- Explain how the blood-brain barrier protects the brain.
- Describe the anatomic structure of the left and right cerebral hemispheres, and explain their general functions.
- Identify the role of the corpus callosum.
o Explain the physical boundaries, important features, and functions of each cerebral lobe.

o Locate and list the functions of the motor cortical regions and their associated areas.

o Differentiate among the sensory cortical regions and their association areas.

o Explain the functions of the prefrontal cortex, and hypothesize why this brain region may function differently in adults and teenagers.

o Describe the main actions of the Wernicke area.

o Identify the three main tracts of the central white matter.

o Explain the phenomenon of cerebral lateralization.

o Identify the functions of left and right hemispheres in most individuals.

o Describe the primary function of the cerebral nuclei; identify the four cerebral nuclei, and explain the specific function of each.

o List components located in the epithalamus, and describe their functions.

o Explain how circadian rhythm is regulated.

o Discuss the action of the thalamus on sensory information.

o Describe seven functions of the hypothalamus.

o List the major features of the midbrain.

o Identify the locations and functions of structures that are visible in a cross-sectional view of the midbrain.

o Explain the involuntary actions produced by the superior and inferior colliculi of the tectal plate.

o Identify the respiratory center located in the pons.

o Identify the actions of the superior olivary complex.

o Describe the main features of the medulla oblongata.

o List the autonomic centers of the medulla and the function of each.

o Name the parts and landmarks of the cerebellum.

o Identify the three tracts through which the brainstem is linked to the cerebellum.

o Explain the functions of the cerebellum.

o Describe the main functions of the limbic system.

o List the seven structures that compose the limbic system, and summarize their actions.

o Describe the components and function of the reticular formation.

o Explain the anatomy and function of the reticular activating system (RAS).

o Describe the relationship between age and higher-order brain functioning.

o Describe how an electroencephalogram examines brain activity.

o Describe the main characteristics of sleep.

o Compare and contrast non-REM and REM sleep.

o Identify the brain areas in which cognition occurs.

o Explain how lesions to different regions of the cortex affect cognition.

o Compare and contrast short-term and long-term memory, and describe the parts of the brain involved with each.

o Name the two regions of the limbic system involved in conversion of short-term memory to long-term memory.

o Explain the interactions of the prefrontal cortex and the limbic system in expression of emotions.

o List the cerebral centers involved in written spoken language, and describe how these centers work together.

o List the names and locations of the 12 pairs of cranial nerves.

o Compare the functions of each of the cranial nerves.
Chapter 14

- Describe the two primary functions of the spinal cord and spinal nerves.
- Describe the general structure of the spinal cord and its four anatomic subdivisions.
- Discuss the naming of the 31 pairs of spinal nerves, and provide a general description of a spinal nerve and its composition.
- Explain how the cauda equine arises during development.
- Discuss the relationship of the spinal cord and spinal nerves to the vertebral column.
- Describe the locations and functions of the spinal cord meninges, and compare and contrast the three spaces associated with the spinal cord meninges.
- Identify the four anatomic locations of gray matter on either side of the spinal cord.
- Describe the structures that form each gray matter region.
- Trace sensory input to the spinal cord and motor output from the spinal cord.
- Identify the locations of white matter within the spinal cord.
- List the three anatomic divisions of the white matter, and explain their general composition.
- Describe the general characteristics of the general sense receptors.
- List the neurons in the sensory pathway chain.
- Describe the three major somatosensory pathways.
- Define a motor pathway, and describe its actions.
- Distinguish between an upper motor neuron and a lower motor neuron, based upon function and cell body location.
- Compare and contrast the direct and indirect motor pathways.
- For each spinal nerve (except C1 and C01), identify the opening where that nerve exits from the vertebral column.
- Compare and contrast the anterior and posterior rami of a spinal nerve.
- Define a dermatome, and explain its clinical significance.
- Define a nerve plexus.
- Identify the distribution of the intercostal nerves.
- List the nerves of the cervical plexuses.
- Explain the action of the phrenic nerve.
- Explain the structure of the brachial plexus, including the three trunks, two divisions, and three cords.
- Describe the distribution of the five major nerve branches that arise from the three cords.
- Identify the spinal nerves that make up the lumbar plexus.
- Compare and contrast the femoral and obturator nerve composition and distribution.
- List the spinal nerves that form the sacral plexus.
- Describe the composition of the sciatic nerve, and compare its branches.
- Describe the properties of a reflex.
- Explain the general function of a reflex.
- List the structures involved in a reflex arc, and the steps in its action.
- Explain the five ways a reflex may be classified.
- Name and describe four common spinal reflexes.
- Explain the indications of a hypoactive reflex versus those of a hyperactive reflex.
- Describe how the neural tube forms the gray matter structures in the spinal cord.
**Chapter 15**

- List the similarities and differences between the SNS and the ANS.
- Compare and contrast lower motor neurons in the SNS and ANS.
- Describe how the two-neuron chain in the ANS facilitates communication and control.
- Describe the CNS hierarchy that controls the autonomic nervous system.
- Describe the general function of the parasympathetic and sympathetic divisions of the autonomic nervous system.
- Compare and contrast the anatomic differences in the lower motor neurons and associated ganglia of the parasympathetic and sympathetic divisions.
- Explain why parasympathetic activation is local discrete, and sympathetic activation can result in mass activation.
- Name the four cranial nerves associated with the parasympathetic division, and describe their actions.
- Explain the actions of the pelvic splanchnic nerves.
- Give the location of the sympathetic preganglionic neuron cell bodies.
- Describe the left and right sympathetic trunks and ganglia.
- Compare and contrast white and gray rami regarding their location and composition.
- Explain the differences between the sympathetic trunk ganglia and the prevertebral ganglia.
- Describe the four pathways of sympathetic neurons.
- Compare and contrast which general effector organs are innervated by each pathway.
- Describe the structure and location of the five autonomic plexuses.
- Explain the function and location of the enteric nervous system (ENS).
- Identify the targets of the cholinergic and adrenergic neurotransmitters of the ANS.
- Describe the two types of cholinergic receptors and the action of each when the neurotransmitter acetylcholine binds to them.
- List the neurotransmitters categorized as catecholamines.
- Name the four adrenergic receptors, and give the location of each.
- Discuss the nature of autonomic tone and its effects.
- Explain dual innervation.
- Describe the antagonistic and cooperative effects of dual innervation.
- Describe the systems innervated only by the sympathetic, division and how they function.
- Discuss how autonomic reflexes help maintain homeostasis.
- Describe some major examples of autonomic reflexes.

**Chapter 16**

- Describe the general function of sensory receptors as transducers.
- Describe the general structure of a sensory receptor, and explain the significance of a receptive field.
- Define a sensation.
- Explain the various characteristics of a stimulus that sensory receptors provide to the CNS.
- Identify and describe the three criteria used to classify receptors.
- Classify the various types of sensory receptors based upon each of the three criteria.
- Compare and contrast unencapsulated and encapsulated tactile receptors.
- Define referred pain, and explain its significance in diagnosis.
- Name the components of the olfactory receptors, and discuss their mode of action.
o Describe the olfactory pathways that relay sensory input to the brain.
o Describe the structure and function of papillae of the tongue.
o Discuss the structure and location of gustatory receptors, and describe the gustatory pathways that relay sensory input to the brain.
o Describe the five types of tastes, and explain the association of smell with taste.
o Describe the accessory structures of the eye, and list their functions.
o Describe the structures of the eye.
o Describe refraction of light.
o Discuss how light is focused on the retina.
o Define phototransduction.
o Compare and contrast the two general types of photoreceptors, including their photopigments.
o Explain the bleaching reaction and how it relates to dark adaptation and light adaptation.
o Describe the visual pathway from the photoreceptors to the brain.
o Explain how stereoscopic vision provides depth perception.
o Describe the structures of the outer, middle, and inner ear.
o Name the auditory ossicles, and explain how they function in hearing.
o Compare and contrast the bony labyrinth and the membranous labyrinth.
o Explain the components of the cochlea and how they function in the sense of hearing.
o Trace the path of a sound wave from outside the ear to stimulation of the vestibulocochlear nerve.
o Distinguish between frequency and intensity of sound.
o Describe the structures of the inner ear involved in equilibrium.
o Explain how the utricle and saccule detect static equilibrium and linear movements of the head, and explain how the semicircular ducts function to detect rotational movements of the head.
o Summarize the nerve pathways involved in equilibrium.