HSP 2402 Human Anatomy and Physiology II

Instructor: Chelsea Procter-Willman, MS, LAT, ATC
Office: Archer Building 222D
Phone: (325) 486-6423
E-Mail: cprocter@angelo.edu
Office Hours: Mon, Tues, & Thurs: 2pm-3pm and by appointment

Course Description: This course is a continuation of HSP 2401 and expands a comprehensive study of the anatomy and physiology of the human body with an emphasis on health and medical issues. Lecture topics include special senses, the endocrine system, cardiovascular and respiratory physiology, immunity, digestion, nutrition and metabolism, the urinary system, and the male and female reproductive 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 be 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 included 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](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 an form of academic dishonesty including but not limited to, cheating on an examination or other academic work, plagiarism, collusion, and the abuse of resource material.
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 literally 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 responsibly 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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<th>Assignments</th>
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**Tentative Class Schedule**
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Assignments

Ph.I.L.S. Labs: 16 labs worth 10 points each for a total of 160 points
These physiology interactive lab simulations are designed to help you better understand different physiological concepts discussed this semester. There are 16 labs covered this semester. Each lab is worth 10 points for a total of 160 points. Each lab consists of an activity and then a post-lab quiz. You must then save a copy of your lab results and email them to me by the indicated due date found in the course syllabus. 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. For example: PhILS1_SP2019_CProcter-Willman.

LearnSmart Assignments: 25 points each for a total of 325 points
Each chapter covered this semester has a LearnSmart assignment associated with it. Each assignment is worth 25 points. These assignments should be completed 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 17-29 – 130 Bonus Points Possible
These practice questions are optional to help you review and prepare for your exams. 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 (130 total bonus points possible). All practice questions are due by 8:00AM on the day of the corresponding quiz. For example, the practice questions for chapters 17, 18, and 19 are due on 2/8/19 at 8AM. There will be no exceptions and there will be no other bonus points awarded during the semester.
Chapter Objectives

- **Chapter 17**
  - Describe the general features of the endocrine system, including how hormones are transported between an endocrine gland and its target organs.
  - Compare and contrast the actions of the endocrine system and the nervous system to control body function.
  - Describe the general functions controlled by the endocrine system.
  - Identify the major endocrine glands and their location within the body.
  - Explain the three reflex mechanisms for regulating secretion of hormones.
  - Name the three structural categories of circulating hormones, and give examples within each category.
  - Distinguish the hormones that are lipid-soluble from those that are water-soluble.
  - Describe the general structure, formation, and function of local hormones.
  - Compare autocrine and paracrine signaling that occurs through local hormones.
  - Compare the transport of lipid-soluble hormones with that of water-soluble hormones.
  - Describe the two primary factors that affect the concentration level of a circulating hormone.
  - Explain what is meant by the half-life of a hormone.
  - Describe how lipid-soluble hormones reach their target cell receptors and the type of cellular change that initiates.
  - Describe how water-soluble hormones induce cellular change in their target cells.
  - Describe the conditions that influence the number of receptors available for a specific hormone.
  - Define up-regulation and down regulation.
  - Compare and contrast the three types of hormone interactions.
  - Describe the anatomic relationship between the hypothalamus and the pituitary gland.
  - Identify the specific structures associated with the posterior pituitary and the anterior pituitary.
  - Explain how the hypothalamus regulates the release of the two hormones from the posterior pituitary gland, and describe the general functions of each.
  - List the hormones released from the hypothalamus that control the anterior pituitary.
  - Explain how the hypothalamus controls the release of hormones from the anterior pituitary and the general functions of each.
  - Describe the release of growth hormone is regulated.
  - Describe the effects of growth hormone on its primary target organs.
  - Describe thyroid gland location and anatomy.
  - Identify the two specific types of endocrine cells within the thyroid and the specific hormone produced by each.
  - Explain the homeostatic system involving thyroid hormone.
  - Explain the role of calcitonin in regulating blood calcium.
  - Describe the structure and location of the adrenal glands.
  - Name the three zones of the adrenal cortex and the hormones produced in each zone.
  - Describe the homeostatic system involving cortisol.
  - Describe the gross anatomy and cellular structure of the pancreas.
  - Identify the primary types of pancreatic islet cells and the hormones they produce.
  - Describe the action of insulin in lowering blood glucose concentration.
  - Explain the action of glucagon in raising blood glucose concentration.
  - Describe the general structure, location, and function of the pineal gland.
  - Describe the general structure, location, and function of the parathyroid glands.
  - Identify and provide a description of the general function of the hormone(s) released from each of the organs discussed in this section. (Thymus, Heart, Kidneys, Liver, Stomach & Small Intestine, Skin, & Adipose Connective Tissue).
  - Describe how endocrine activity changes as people age.

- **Chapter 18**
  - Describe the general functions of blood.
  - Name six characteristics that describe blood, and explain the significance of each to health and homeostasis.
List the three components of a centrifuged blood sample.
Define hematocrit, and explain how the medical definition differs from the clinical usage.
Name the three formed elements of the blood, and compare their relative abundance.
Define colloid osmotic pressure
Identify the various types of plasma proteins, and explain the general function of each.
List dissolved substances in plasma by category.
Define hemopoiesis, and explain the role of colony-stimulating factors.
Describe the four cellular stages of erythropoiesis.
Compare the production of granulocytes, monocytes, and lymphocytes in leukopoiesis.
Summarize the process by which platelets are formed in thrombopoiesis.
Describe the structure of erythrocytes.
List the events by which erythrocyte production is stimulated.
Explain the process by which erythrocyte components are recycled.
Compare and contrast the different blood types and their importance when transfusing blood.
Explain the main function of leukocytes.
Distinguish between granulocytes and agranulocytes, and compare and contrast the various types.
Explain what is meant by a differential count and how it is clinically useful.
Explain the structure and function of platelets.
Describe vascular spasm, the first phase of hemostasis.
Name conditions that bring about vascular spasm.
Describe what happens when platelets encounter damage in a blood vessel.
Compare and contrast the intrinsic pathway and the extrinsic pathway for activating blood clotting.
Describe events in the common pathway.
Discuss the survival response that occurs when blood loss exceeds 10%.
Explain the processes of clot retraction and fibrinolysis.
Describe when and how blood is formed in the embryo, fetus, childhood, and adulthood.
List some conditions that occur with the bone marrow and blood in the elderly.

**Chapter 19**

Describe the general function of the cardiovascular system.
Differentiate among the three primary types of blood vessels.
Describe the general structure and function of the heart.
Compare and contrast pulmonary circulation and systemic circulation of the cardiovascular system. Trace blood flow through both circulations.
Describe the location and position of the heart in the thoracic cavity.
List the structural components of the pericardium.
Describe the function of the pericardium and the purpose of the serous fluid within the pericardial cavity.
Compare the superficial features of the anterior and posterior aspects of the heart.
Name the three layers of the heart wall and the tissue components of each.
Characterize the four chambers of the heart and their functions.
Compare and contrast the structure and function of the two types of heart valves.
Describe the location and function of the fibrous skeleton.
Describe the general structure of cardiac muscle.
Explain the intercellular structures of cardiac muscles.
Discuss how cardiac muscle meets its energy needs.
Identify the coronary arteries, and describe the specific areas of the heart supplied by their major branches.
Explain the significance of coronary arteries as functional end arteries.
Describe blood flow through the coronary arteries.
Identify the coronary veins, and describe the specific areas of the heart drained by their major branches.
Identify and locate the components of the heart’s conduction system.
Compare and contrast parasympathetic and sympathetic innervation of the heart.
Describe a nodal cell at rest.
Define autorhythmicity.

Describe the steps for SA nodal cells to spontaneously depolarize and serve as the pacemaker cells.

Describe the spread of the action potential through the heart’s conduction system.

Describe the conditions at the sarcolemma of cardiac muscle cells at rest.

List the electrical events of an action potential that occur at the sarcolemma.

Briefly summarize the mechanical events of muscle contraction.

Define refractory period.

Explain the significance of the plateau phase.

Identify the components of an ECG recording.

Identify the two processes within the heart that occur due to pressure changes associated with the cardiac cycle.

List the five phases of the cardiac cycle.

List and describe what occurs during the five phases of the cardiac cycle.

Explain the significance of ventricular balance.

Define cardiac output.

Explain what is meant by cardiac reserve.

Define chronotropic agents, and describe how they affect heart rate.

Discuss how autonomic reflexes alter heart rate.

List the three variables that may influence stroke volume.

Define each of the three variables, and describe the factors that influence each variable and how each variable affects stroke volume.

Summarize the variables that influence cardiac output.

Explain how postnatal heart structures develop from the primitive heart tube.

Describe septal defects that may occur during development.

- Chapter 20
  
  Describe the three tunics common to most vessels.
  
  Explain the distinguishing features of the tunics found in arteries, capillaries, and veins.
  
  Distinguish among elastic arteries, muscular arteries, and arterioles.
  
  Describe the general anatomic structure and function of capillaries.
  
  Compare the anatomic structure, function, and location of continuous capillaries, fenestrated capillaries, and sinusoids.
  
  Trace the movement of blood through a capillary bed.
  
  Describe the structure and general function of veins.
  
  Explain how veins serve as a blood reservoir for the cardiovascular system.
  
  Compare and contrast the simple and alternative pathways of blood vessels.
  
  Describe the relationship of the total cross-sectional area and velocity of blood flow.
  
  Predict the significance of slow blood flow in the capillaries.
  
  Explain the process of diffusion and vesicular transport between capillaries and tissues.
  
  Explain the processes of bulk flow, filtration, and reabsorption.
  
  Compare and contrast hydrostatic pressure and colloid osmotic pressure in the capillaries.
  
  Define net filtration pressure (NFP).
  
  Calculate net filtration pressure for both the arterial end and the venous end of a capillary.
  
  Explain the lymphatic system’s role at the capillary bed.
  
  Describe what is meant by degree of vascularization.
  
  Explain the process of angiogenesis and how it aids perfusion.
  
  Describe the myogenic response that maintains normal blood flow through a tissue.
  
  Compare and contrast a vasodilator and a vasoconstrictor.
  
  Explain how a tissue autoregulates local blood flow based on metabolic needs.
  
  Describe how local blood flow is altered by tissue damage and as part of the body’s defense.
  
  Explain the general relationship of total blood flow to local blood flow.
  
  Define blood pressure and blood pressure gradient.
  
  Compare and contrast blood pressure and blood pressure gradients in the arteries, capillaries, and veins.
  
  Calculate pulse pressure and mean arterial pressure (MAP) in the arteries.
Explain the mechanisms that help overcome the small pressure gradient in veins to return blood to the heart.

Define resistance, and explain how it is influenced by blood viscosity, vessel length, and vessel radius.

Explain the relationship of both the blood pressure gradient and resistance to total blood flow.

Discuss why blood pressure increases with increased resistance in the systemic circulation.

Describe the anatomic components associated with regulating blood pressure through short-term mechanisms.

Explain the autonomic reflexes that alter blood pressure.

Describe the hormones that regulate blood pressure.

Explain the renin-angiotensin system and its influence on blood pressure.

Contrast the effects of angiotensin II, aldosterone, and antidiuretic hormone on blood pressure with those of arterial natriuretic peptide.

Compare total blood flow and distribution at rest and during exercise.

Trace the pathway of vessels from the right ventricle to the lungs and back to the left atrium.

Identify features of the pulmonary circulation that distinguish it from systemic circulation.

List the arteries that transport blood away from the left ventricle of the heart to the major areas of the body.

Name the veins that return blood from the systemic circulation to the right atrium of the heart.

Name the arteries and veins associated with the head and neck structures.

Diagram and explain the cerebral arterial circle and its function.

Describe the general structure and function of dural venous sinuses.

Describe the pairs of arteries that supply the thoracic wall.

Discuss the arteries that supply the abdominal wall.

List veins that drain the thoracic and abdominal walls and delineate their pathways.

Describe the vessels that supply and drain the lungs, esophagus, and diaphragm.

Name the three major arteries that branch form the descending aorta to supply the gastrointestinal tract, and list their major branches.

Explain the function of the hepatic portal system.

Trace the route of blood from the gastrointestinal tract to the inferior vena cava.

Describe the arteries and veins that supply and drain the adrenal glands, kidneys, and gonads.

Name the main vessels associated with the pelvis and perineum.

Trace the arteries of the upper limb from the subclavian artery to the fingers.

Compare and contrast the superficial venous drainage and the deep venous drainage of the upper limb.

Trace the arteries of the lower limb from the external iliac artery to the toes.

Compare and contrast the superficial venous drainage and the deep venous drainage of the lower limb.

Trace the pathway of blood circulation in the fetus.

Describe the changes that occur after the baby is born and must utilize the pulmonary circulation.

Chapter 21

Describe lymph and its contents.

Discuss the location and anatomic structure of lymphatic capillaries.

Explain how fluid enters lymphatic capillaries.

Explain the mechanisms that move lymph through lymphatic vessels, trunks, and ducts.

Name the five types of lymphatic trunks and the regions of the body from which they drain lymph.

Describe the regions that are drained by the right lymphatic duct and by the thoracic duct.

Name the two categories of lymphatic tissue and organs, and identify components of the body that belong to each category.

Describe the location and general function of red bone marrow.

Identify the two major types of lymphocytes.

Describe the structure and general function of the thymus.

Describe the structure of lymph nodes.

Explain the function of lymph nodes.

Describe the spleen and its location.
Distinguish between white pulp and red pulp.
List the functions of the spleen.
Identify the main groups of tonsils and their location and function.
Describe the composition of individual lymphatic nodules.
Compare the locations of MALT and Peyer patches.

- **Chapter 22**
  - Compare and contrast the five major classes of infectious agents.
  - Describe prions, and name a disease they cause.
  - List the types of leukocytes of the immune system, and describe where they may be found.
  - Define cytokines, and describe their similarities to hormones.
  - List the general categories of cytokines.
  - Compare and contrast the primary features of innate and adaptive immunity.
  - Describe the physical, chemical, and biological barriers to entry of harmful agents into the body.
  - Describe the cells that function as part of the nonspecific internal defenses in providing innate immunity.
  - Explain the general function of interferons.
  - Define the complement system, and describe how it is activated.
  - Describe the four major means by which complement participates in providing innate immunity. Define inflammation, and discuss the basic steps involved, including the formation of exudate and its role in removing harmful substances.
  - Describe the benefits of inflammation.
  - List the cardinal signs of inflammation, and explain why each occurs.
  - Define a fever, and describe how it occurs.
  - List the benefits and risks of a fever.
  - Describe the features of an antigen, and explain what is meant by antigenic determinant.
  - Explain immunogenicity, and list attributes that affect it.
  - Discuss how haptens stimulate immune responses.
  - Describe receptors of both T-lymphocytes and B-lymphocytes.
  - Define antigen presentation.
  - Describe antigen-presenting cells, and list cells that sever this function.
  - Explain the process of formation of MHC class I molecules in nucleated cells and MHC class II molecules in professional antigen-presenting cells.
  - Diagram the interaction of TCR and CD receptors of a T-lymphocyte with antigen associated with the MHC molecules of other cells.
  - Identify the three significant events that occur in the lifetime of a lymphocyte.
  - Explain how T-lymphocytes mature.
  - Compare and contrast positive and negative selection of T-lymphocytes and what is meant by central tolerance.
  - Explain why T-lymphocytes leaving the thymus are called both immunocompetent and naïve.
  - Describe the formation and function of T-lymphocytes (Tregs) in peripheral tolerance.
  - Describe how both helper T-lymphocytes and cytotoxic T-lymphocytes are activated, including the specific role of IL-2 in both activations. Compare the activation of B-lymphocytes with that of T-lymphocytes.
  - Describe lymphocytes recirculation, and explain its general function.
  - Explain the effector response of helper T-lymphocytes.
  - Explain how an unhealthy cell is destroyed by cytotoxic T-lymphocytes.
  - Explain why the process of T-lymphocytes are collectively called the cell-mediated branch of adaptive immunity.
  - Describe the function of plasma cells in the effector response of B-lymphocytes.
  - Define antibody titer
  - Describe the general structure of an immunoglobulin molecule, including its two functional regions.
  - List the functions of the antigen-binding site and Fc region of antibodies, and briefly describe how each occurs.
Describe the structure, location, and specific function of the five major classes of immunoglobulins.
Define immunologic memory, and explain how it occurs.
Discuss the difference between the primary response and the secondary response to antigen exposure.
Define active immunity and passive immunity.
Describe how both active and passive immunity can be acquired naturally and artificially.

Chapter 23
State the function of the respiratory system.
Distinguish between the structural organization and the functional organization of the respiratory system.
Describe the structure of the mucosa that lines the respiratory tract and the structural changes observed along its length.
Explain the function of mucus produced by the mucosa.
Describe the structure and function of the nose.
Provide a general description of the structures and function of the nasal cavity.
Describe the structure and function of the four paired paranasal sinuses.
Compare the three regions of the pharynx, and describe their associated structures.
Describe the general functions and structure of the larynx.
Explain how the larynx functions in sound production.
Describe the structure of the trachea.
Explain the structure and function of the tracheal cartilages.
Describe the structural subdivisions of the bronchial tree.
Explain the processes of bronchoconstriction and bronchodilation.
Describe the structure and function of the components of the respiratory zone.
List three types of cells found in alveoli, and describe the function of each.
Explain the structure of the respiratory membrane.
Describe the location and general structure of the lungs.
Compare and contrast the right versus left lung.
Distinguish between the two types of blood circulation through the lungs.
Describe the innervation of lung structures by the autonomic nervous system.
Describe the pleural membranes and pleural cavity.
Explain the function of serous fluid in the pleural cavity.
Explain the anatomical properties that keep lungs inflated.
Give an overview of the process of pulmonary ventilation.
Explain how pressure gradients are established and result in pulmonary ventilation.
State the relationship between pressure and volume as described by Boyle’s law.
Distinguish between quit and forced breathing.
Describe the anatomic structures involved in regulating breathing.
Explain the physiologic events associated with controlling quite breathing.
Explain the different reflexes that alter breathing rate and depth.
Distinguish between nervous system control of structures of the respiratory system and nervous system control of structures involved in breathing.
Define airflow.
Explain how pressure gradients and resistance determine airflow.
Distinguish between pulmonary ventilation and alveolar ventilation, and discuss the significance of each.
Explain the relationship between anatomic dead space and physiologic dead space.
Define the four different respiratory volume measurements.
Explain the four respiratory capacities that are calculated from the volume measurements.
Give the meaning of forced expiratory volume (FEV) and maximum voluntary ventilation (MVV).
Define partial pressure and the movement of gases relative to a partial pressure gradient.
Describe the partial pressures that are relevant to gas exchange.
Explain the laws that govern gas solubility.
Describe alveolar gas exchange and the partial pressure gradients responsible.
- Name the two anatomic features of the respiratory membrane that contribute to efficient alveolar gas exchange.
- Explain ventilation-perfusion coupling and how it maximizes alveolar gas exchange.
- Explain the partial pressure gradients between systemic cells and the blood in capillaries.
- Differentiate between alveolar and systemic gas exchange.
- Explain why hemoglobin is essential to oxygen transport.
- Describe the three ways carbon dioxide is transported in the blood.
- Explain the conversion of CO$_2$ to and from HCO$_3^-$ within erythrocytes.
- Name the three substances carried by hemoglobin.
- Explain the significance of the oxygen-hemoglobin saturation curve for both alveolar and systemic gas exchange.
- Explain how hyperventilation and hypoventilation influence the chemical composition of blood.
- Describe how breathing rate and depth affect venous return of blood and lymph.
- Explain the changes in breathing that accompany exercise.

- **Chapter 24**
  - Identify the structures that compose the urinary system, and provide a description of the general function of each.
  - List the functions of the kidneys.
  - Describe the location of the kidneys in the body.
  - Name and describe the four tissue layers that surround and support the kidneys.
  - Identify the two distinct regions of the kidney and the components of each.
  - Explain the relationship among minor calyces, major calyces, and renal pelvis.
  - List the structures of the kidneys innervated by the sympathetic division.
  - Describe a renal corpuscle and its components.
  - Identify the location, and describe the structure, of the three components of a renal tubule.
  - Name and compare the two types of nephrons and the functional differences between them.
  - State the relationship between collecting tubules and collecting ducts.
  - Identify the two types of specialized epithelial cells found within distal convoluted tubules and collecting tubules and ducts.
  - Describe the location and structure of the juxtaglomerular apparatus.
  - Explain the two actions of granular cells.
  - Describe the function of the cells of the macula densa.
  - Name the arteries that supply the kidney, in sequence from largest to smallest.
  - Describe the two capillary beds through which blood must pass in the kidney.
  - List the veins through which blood leaves the kidney, in sequence form smallest to largest.
  - Distinguish among filtrate, tubular fluid, and urine.
  - Trace the fluid from its formation at the renal corpuscle until it exits the body through the urethra.
  - Compare and contrast the renal processes of filtration, reabsorption, and secretion.
  - Describe the three layers that make up the glomerular filtration membrane.
  - Give examples of substances that are freely filtered, that are not filtered, and that are filtered in a limited way.
  - Describe the phagocytic function of mesangial cells.
  - Define glomerular hydrostatic pressure (HP$_g$) and explain why it is higher than the pressure in other capillaries.
  - Name two pressures that oppose HP$_g$.
  - Explain how to calculate the net filtration pressure.
  - Define glomerular filtration rate and the factors that influence it.
  - Describe what is meant by intrinsic and extrinsic controls, and give examples of both.
  - Compare and contrast the myogenic response and the tubuloglomerular feedback mechanism, which are involved in renal autoregulation.
  - Explain the effects of sympathetic division stimulation on the glomerular filtration rate.
  - Describe the effects of atrial natriuretic peptide on the glomerular filtration rate.
  - Describe five characteristics and conditions that affect tubular reabsorption and secretion.
  - Define the transport maximum of a substance.
  - Explain what is meant by renal threshold.
o Explain the reabsorption of nutrients such as glucose.
o Describe the process by which protein is transported out of the filtrate and into the blood.
o List substances for which reabsorption is regulated.
o Describe how the reabsorption of sodium, potassium, calcium, and phosphate occurs.
o Describe the reabsorption of water, and compare how it is regulated by the actions of aldosterone and antidiuretic hormone.
o Describe how pH is regulated by intercalated cells.
o Identify the three nitrogenous waste products, and describe the fate of each.
o Give examples of other materials eliminated by kidneys.
o Explain what is meant by the countercurrent multiplier that occurs within the nephron loop.
o Describe the countercurrent exchange system that maintains the concentration gradient.
o Discuss the contribution of urea cycling to the concentration gradient.
o Describe the procedure for measuring the glomerular filtration rate.
o Explain the formula for calculating the glomerular filtration rate.

Chapter 25

o State the percentage of body fluid, and explain the significance of an individual’s percentage relative to fluid balance.
o List the factors that influence the percentage of body fluid.
o Describe the two major body fluid compartments, and compare their chemical compositions.
o Explain how fluid moves between the major body fluid compartments.
o Define fluid balance.
o List the sources of fluid intake.
o Distinguish between the categories of water loss.
o Name the different causes of fluid imbalance.
o Compare and contrast the different types of fluid imbalances.
o Explain what is meant by fluid sequestration.
o Describe the stimuli that increase fluid intake.
o Explain the conditions and stimuli that decrease fluid intake.
o Identify the four hormones that are involved in regulating fluid output.
o Describe the difference between a nonelectrolyte and an electrolyte.
o Explain the general role of electrolytes in fluid balance.
o List the six major electrolytes found in body fluids, other than H+ and HCO3-.
o Explain why Na+ is a critical electrolyte in the body.
o Describe the variables that influence K+ distribution.
o Identify the main locations, functions, and means of regulation for each of the common electrolytes.
o Explain he means by which angiotensin II formation can be triggered.
o List the four primary effects of angiotensin II.
o Explain how release of antidiuretic hormone (ADH) occurs from the posterior pituitary.
o Describe the three actions of antidiuretic hormone.
o List three conditions that lead to aldosterone release.
o Describe the changes that occur in response to binding of aldosterone by kidney cells.
o Describe the stimulus for the release of atrial natriuretic peptide (ANP) and its three actions.
o Explain the ways in which the effects of atrial natriuretic peptide differ from the effects of angiotensin II, ADH, and aldosterone.
Distinguish between the two categories of acids in the body.
Name the two buffering systems that regulate each category.
List the various sources of fixed acid.
Describe how the kidneys counteract increasing blood H^+.
Explain how the kidneys function in response to decreasing blood H^+.
Explain the normal relationship between breathing rate and acid-base balance.
Describe the components of the protein buffering system and where and how they help prevent pH changes.
Explain the reactions of the phosphate buffering system within the ICF.
Discuss how the bicarbonate buffering system maintains acid-base balance in the ECF.
Explain acid-base disturbance, compensation, and acid-base imbalance.
Define respiratory acidosis, identify some of the causes of this type of acid-base disturbance, and explain how it occurs.
Explain why infants are more susceptible to respiratory acidosis.
Define respiratory alkalosis, identify some of the causes of this type of acid-base disturbance, and explain how it occurs.
Explain how metabolic acid-base disturbances differ from respiratory acid-base disturbances.
Define both metabolic acidosis and metabolic alkalosis, identify some of the causes of each type of acid-base disturbance, and explain how each occurs.
Describe renal and respiratory compensation.

Chapter 26
Identify the six organs that make up the gastrointestinal (GI) tract.
List the accessory digestive organs and structures involved in the digestive process.
List and describe the six general functions of the digestive system.
List and describe the four tunics (layers) that make up the gastrointestinal wall.
Briefly describe the general process of abortion.
Distinguish the action of the muscularis mucosae from that of the muscularis tunic.
Describe the general function of the enteric nervous system and autonomic nervous system in the regulation of the digestive system.
Compare long reflexes and short reflexes that regulate the digestive system.
List the major hormones that regulate the processes of digestion.
Describe the structure of the serous membranes associated with the GI tract.
Distinguish between intraperitoneal and retroperitoneal organs.
Explain the function of the mesentery, and describe the five individual mesenteries of the abdominopelvic cavity.
Describe the components of the upper gastrointestinal tract.
Identify the anatomic structures of the oral cavity.
Describe the structure and function of salivary glands and how the release of saliva is regulated.
Explain the process of mastication.
Discuss the structure and development of the teeth.
Discuss the anatomy of the pharynx and esophagus and their complementary activities in the process of swallowing.
Describe the gross anatomy and histology of the stomach.
Explain the two general functional activities of the stomach.
Describe the phases that regulate motility and secretion in the stomach.
Describe the three components of the lower gastrointestinal tract.
Describe the anatomy of the small intestine.
List the glands found in the small intestine and their secretions.
Explain motility within the small intestine.
Describe the accessory digestive organs associated with the small intestine and the contributions of each to digestive processes.
Explain how both blood and bile flow through the liver.
Discuss the regulation of the accessory digestive glands associated with the small intestine.
Name the three major regions of the large intestine and four segments of the colon of the large intestine.
o Explain the distinguishing histologic features of the large intestine.
o Describe the bacterial action that takes place in the large intestine.
o Name the three classes of carbohydrates.
o Explain the processing in the oral cavity that initiates carbohydrate digestion.
o Describe the chemical digestion of carbohydrates that occurs in the small intestine.
o Identify the enzyme that initiates protein digestion in the stomach, and explain its activation and action.
o Explain why the proteolytic enzymes of the stomach and pancreas are synthesized in inactive forms.
o Describe the chemical digestion of proteins that occurs in the small intestine.
o Explain the role of bile salts in mechanical digestion of lipids and the role of pancreatic lipase in the chemical digestion of triglycerides.
o Discuss the process by which lipids are absorbed.
o Describe the digestion of nucleic acids.
o Describe the absorption of water, electrolytes, and vitamins.
o Explain the details of vitamin B₁₂ absorption.

- Chapter 27
  o Define both nutrition and nutrients.
o Distinguish macronutrients from micronutrients and essential from nonessential nutrients.
o Explain the meaning of recommended daily allowance (RDA).
o Identify the categories that are dietary sources of carbohydrates, and give examples of each category.
o Identify the types and dietary sources of triglycerides, and describe their functions.
o Describe the sources and functions of cholesterol.
o Explain why protein is required in our diet and the general amount that is needed.
o Explain the difference between a complete protein and an incomplete protein.
o Discuss nitrogen balance, and include the difference between a positive and negative nitrogen balance.
o Distinguish between water-soluble and fat-soluble vitamins.
o List examples of how both water-soluble vitamins and fat-soluble vitamins function in the body.
o Describe the difference between essential and non-essential vitamins.
o Define minerals, and list examples of how minerals absorbed in the small intestine function in the body.
o Distinguish between major minerals and trace minerals.
o Describe MyPlate, which was developed by the USDA to help people eat healthy.
o Identify the items that are included on a food label.
o Explain when the absorptive state occurs and how nutrient levels are regulated during this time.
o Explain when the postabsorptive state occurs and how nutrient levels are regulated during this time.
o Explain the relationship of dietary intake of cholesterol and level of cholesterol synthesis in the liver.
o Define lipoprotein, and provide a general overview of their function in the body.
o Describe the transport of lipids within the blood.
o Identify and briefly describe the numerous roles of the liver in metabolism.
o Describe where the following nutrient molecules enter the metabolic pathway of cellular respiration: glucose, the breakdown products of triglycerides, and amino acids.
o Explain deamination of proteins.
o Describe the physiological advantages of the ability to interconvert nutrient biomolecules.
o Define metabolic rate.
o Explain how both basal metabolic rate and total metabolic rate are measured and the variables that influence each.
o Define core body temperature, and explain why it must be maintained.
o Explain the neural and hormonal controls of temperature regulation.
• **Chapter 28**
  - List the similarities between the female and male reproductive systems.
  - Identify the hormones responsible for initiating puberty (sexual maturation) in females and males.
  - Compare the components of the perineum in females and males.
  - Distinguish between autosomes and sex chromosomes.
  - Explain why somatic cells contain 2n chromosomes but gametes must contain n chromosomes.
  - Compare and contrast meiosis and mitosis.
  - Describe events during interphase, before cell division begins, and the specific steps of meiosis.
  - Explain the difference between homologous chromosome pairs and sister chromatids.
  - Discuss why meiosis I is termed reduction division.
  - Describe the events of meiosis II and the final outcome of the two stages of meiosis.
  - Describe the gross and microscopic anatomy of the ovary.
  - Compare the different types of ovarian follicles that form in the ovary.
  - List the hormones responsible for oogenesis, and explain each hormone’s effect on oogenesis.
  - Identify the ovarian follicles that develop before birth and those that form after puberty.
  - Describe the three phases of the ovarian cycle.
  - Describe the anatomy and function of the uterine tubes.
  - List the functions of the uterus, and compare its three tunics.
  - Explain the gross anatomy of the vagina.
  - Compare the three phases of the uterine cycle.
  - List and explain what hormones influence the events in each part of the ovarian cycle.
  - Explain how the ovarian cycle and uterine cycle are interrelated.
  - Describe the components of the female external genitalia.
  - Explain the gross anatomy of the mammary glands.
  - Compare the hormones responsible for milk production and milk ejection.
  - Explain how the female sexual response and orgasm is elicited.
  - Describe the gross anatomy and function of the scrotum.
  - Describe the gross anatomy and microscopic anatomy of the testes.
  - Explain the process of spermatogenesis and spermiogenesis.
  - Compare and contrast spermatogenesis with oogenesis.
  - Explain the function of each component of the ducts associated with the male reproductive system.
  - Trace the pathway that sperm travel through the testes and duct system.
  - Describe the anatomy and function of the accessory glands.
  - Compare and contrast sperm, seminal fluid, and semen.
  - List the major components of semen and which accessory gland produces each component.
  - Describe the structure and functions of the penis.
  - Compare and contrast the processes of erection and ejaculation.
  - Explain how the male sexual response (and ejaculation) is elicited.
  - Compare and contrast genetic versus phenotypic sex.
  - List the gene(s) responsible for producing a phenotypic male.
  - Describe what anatomic structures are formed from the mesonephric and paramesonephric ducts.
  - Describe the events that cause the female internal reproductive organs to develop.
  - Identify the hormone responsible for inducing paramesonephric duct degeneration, and identify the cells responsible for secreting this hormone.
  - List the common primordial external genitalia structures, and compare their development in females and males.
  - Give the common definition for puberty, and list the age and range during which it commonly occurs.
  - List some of the common developmental events that occur during puberty.
  - Give the common definition and symptoms for menopause.
  - Describe events of the male climacteric.

• **Chapter 29**
  - Define the prenatal period, and identify the three shorter periods that occur during the prenatal period.
  - Describe the events of fertilization.
○ Explain capacitation of sperm and its relationship to fertilization.
○ Define cleavage, and explain when it occurs.
○ Compare and contrast the structures of the zygote, morula, and blastocyst.
○ Define implantation, and explain when it occurs.
○ Explain the physiologic significance of the syncytiotrophoblast’s production of hCG.
○ Describe the development of the bilaminar germinal disc.
○ Name the three extraembryonic membranes, and summarize their functions.
○ Compare the maternal and fetal portions of the placenta.
○ Describe the main functions of the placenta, and name the hormones that promote its development.
○ Describe the process of gastrulation.
○ List the three primary germ layers that compose the embryo.
○ Explain the process and the purpose of the folding of the embryonic disk.
○ Describe how the three primary germ layer differentiate.
○ Define organogenesis and explain the risk of teratogens during this period.
○ Describe the major events that occur during the fetal state of development.
○ Compare and contrast the first, second, and third trimesters of pregnancy.
○ Discuss the critical effects of estrogen and progesterone during pregnancy.
○ Identify other hormones whose levels are altered during pregnancy.
○ Explain the changes to the uterus in a pregnant woman.
○ Describe the hormones that affect mammary gland development during pregnancy.
○ Describe the effects of HPL and other hormones on the pregnant woman’s ability to utilize glucose.
○ List some common GI changes that occur during pregnancy and their causes.
○ List the cardiovascular changes a woman typically exhibits during pregnancy.
○ Explain the changes to the respiratory system during pregnancy.
○ Describe the effects of pregnancy on the mother’s urinary system.
○ Explain the physiologic processes that initiate labor.
○ List the signs and characteristics of false labor.
○ Explain the signs and characteristics of true labor.
○ Describe the positive feedback mechanism of true labor.
○ List the three stages of true labor and events of each stage.
○ Describe the respiratory events that occur as the newborn adjusts to life outside of the uterus.
○ Compare and contrast the fetal circulatory pattern with the newborn circulatory pattern.
○ Compare and contrast the hormonal levels of a woman prior to birth and after birth.
○ List the various ways that the mother loses the excess fluids gained during pregnancy.
○ Describe the process by which lactation occurs.
○ Explain the mechanisms by which the uterus returns close to its pre-pregnancy size.
○ Become familiar with common genetic terminology.
○ Compare and contrast the types of inheritance patterns.
○ Describe sex-linked inheritance, and give a clinical example of this type of inheritance.
○ Explain how the environment may influence genetic expression.