Anatomy and Physiology II

Course Text

VanPutte, Cinnamon, Jennifer Regan, and Andrew Russo. *Seeley's Anatomy & Physiology,* 13th edition, McGraw-Hill, 2022, ISBN: 9781264103881

The text is provided digitally as part of the course enrollment. Students may find used, new, or rental print copies by searching for the ISBN.

Course Description

Building on Anatomy and Physiology I, this course examines major parts of the body and how they work independently as well as together. The reproductive system is discussed as well as stages of human development. Students learn about the lymphatic system and the three lines of defense the body has against pathogens. Also explained are the cardiovascular, digestive, respiratory, and urinary systems as well as nutrition, metabolism, body fluid balances, and aging.

Course Objectives

After completing this course, you will be able to:

- Describe the functions of blood, composition of blood, blood coagulation, blood grouping, and diagnostic blood tests.
- Explain the structure and physiology of the heart.
- Describe the structures and functions of the circulatory system.
- Explain how various substances are transported and exchanged throughout the body.
- Explain the regulation of blood pressure.
- Describe the structures and functions of the lymphatic system.
- Explain how immunity is developed and maintained.
- Describe the structures and functions of the respiratory system.
- Describe the structures and physiology of the digestive system.
- Explain nutrition, metabolism, and temperature regulation.
- Describe the anatomy and physiology of the urinary system.
- Explain water, electrolyte, and acid-base balance in the body.
- Explain the structures and functions of the reproductive systems.
- Discuss human growth, development, and aging.

Course Prerequisites

It is suggested, though not required, that students take Anatomy & Physiology I or its equivalent before enrolling in Anatomy & Physiology II.

Important Terms

In this course, different terms are used to designate tasks:

- **Proctoring**: all final exams require proctoring which can be completed conveniently from your home. A webcam is required.
- **Tutoring**: memberships include online tutoring for students to access with any content/subject related questions in the place of faculty. If your tutor is not able to answer your questions please contact a student advisor.
- **Practice Quiz**: Non-graded quizzes that help highlight the content which will be assessed on graded exams.
- **Graded Exam**: A graded online assessment.

Academic Integrity Statement

Academic integrity is the pursuit of scholarly activity in an honest, truthful and responsible manner. Violations of academic integrity include, but are not limited to, plagiarism, cheating, fabrication and academic misconduct. Failure to comply with the Academic Integrity Policy can result in a failure and/or zero on the attempted assignment/examination, a removal from the course, disqualification to enroll in future courses, and/or revocation of an academic transcript.

Course Completion Policy

In order for a course to be considered complete, all required coursework must be attempted, submitted, and graded. Required coursework consists of graded assignments. Any Academic Integrity Policy violations may prevent a course from being considered complete.

Course Evaluation Criteria

Your score provides a percentage score and letter grade for each course. A passing percentage is **70%** or higher.

There are a total of 1000 points in the course:

Topic	Assessment	Points
3	Graded Exam 1	125
6	Graded Exam 2	125
6	Midterm Exam	200
9	Graded Exam 3	125
13	Graded Exam 4	125
14	Cumulative Final Exam	300

Course Topics and Objectives

Topics	Topic	Subtopics	Objectives
1	Cardiovascular System: Blood	• Functions of Blood • Composition of Blood • Plasma • Formed Elements • Hemostasis • Blood Grouping • Diagnostic Blood Tests	• Explain how blood helps to maintain homeostasis in the body. • List the components of blood. • Give the average blood volume for males and females. • Name the components of plasma. • Describe the functions of the major plasma proteins. • List the formed elements of blood. • Explain the origin of formed elements of blood. • Describe the structure and functions of hemoglobin. • Explain how fetal hemoglobin differs from adult hemoglobin. • Describe the life cycle of red blood cells. • Describe the different types of white blood cells. • Describe the structure and function of platelets. • Describe the three processes that lead to hemostasis. • Explain the regulation of clot formation and removal. • Explain the ABO blood group system. • Describe the Rh blood group system. • Describe diagnostic blood tests and their importance. • Describe the clinical importance of stem cells and taking aspirin. • Explain the dangers of blood clots. • Describe the following types of blood disorders: Sickle-Cell anemia, erythrocytosis, various types of anemia, leukemia, thrombocytopenia, clotting disorders, septicemia, malaria, infectious mononucleosis, and AIDS.
2	Cardiovascular System: The Heart	• Functions of the Heart • Size, Shape, and Location of the Heart • Anatomy of the Heart • Route of Blood Flow Through the	• Explain the major functions of the heart. • Give the size, shape, and location of the heart. • Describe the structure of the pericardium. • Describe the structure and function of each layer of the heart wall.

Topics	Topic	Subtopics	Objectives
		Heart • Histology • Electrical Properties • Cardiac Cycle • Mean Arterial Blood Pressure • Regulation of the Heart • The Heart and Homeostasis	• Describe the large vessels that are attached to the heart. • Describe the coronary circulation. • Explain the structures and functions of the chambers of the heart. • List the valves of the heart and give their locations, structures, and functions. • Describe the flow of blood through the heart. • Describe the heart skeleton. • Describe cardiac muscle cells. • Explain the conduction system of the heart. • Describe action potentials in cardiac muscle. • Explain autorhythmicity of heart muscle and pacemaker potential. • Explain the waves and intervals of an electrocardiogram. • Describe the cardiac cycle. • Explain how heart sounds are produced. • Define mean arterial pressure, cardiac output, and peripheral resistance. • Explain the role of MAP in causing blood flow. • Describe the intrinsic and extrinsic regulation of the heart. • Describe how the function of the heart is altered by changes in blood pressure, pH, carbon dioxide, oxygen, body temperature, and ion concentrations. • Discuss the following disorders affecting the heart: pericarditis, cardiac tamponade, angina, myocardial infarction, blocked coronary arteries, murmurs, incompetent valve, aortic valve stenosis, endocarditis, cardiomyopathy, rheumatic heart disease, coronary thrombosis, septal defect, patent ductus arteriosis, cyanosis, and heart failure.
3	Cardiovascular System: Blood Vessels and Circulation	• Functions of the Circulatory System	• Describe the difference between the pulmonary and systemic vessels. • Describe the functions of blood vessels.

Topics	Topic	Subtopics	Objectives
		• Structural Features of Blood Vessels • Pulmonary Circulation • Systemic Circulation: Arteries • Systemic Circulation: Veins • Dynamics of Blood Circulation • Physiology of the Systemic Circulation • Control of Blood Flow in Tissues • Regulation of Mean Arterial Pressure	• Describe the different types of capillaries, arteries, and veins. • Describe the innervations of blood vessels. • Describe the affect of aging on blood vessels. • Trace the flow of blood through the pulmonary circulation. • List the major arteries and describe the body areas they supply. • List the major veins and describe the body areas they drain. • Describe laminar and turbulent blood flow. • Explain how blood pressure is measured. • Explain Poiseuille's Law. • Describe how viscosity affects blood flow. • Explain Laplace's Law and critical closing point. • Describe the effects of vessel diameter and vascular compliance on blood pressure. • Describe the distribution of blood throughout the body. • Explain how blood vessel diameter affects blood flow. • Explain the effects of blood flow on blood pressure and resistance to flow. • Define pulse pressure and tell how it can be determined. • Describe the exchange of materials across the capillary wall. • Describe how preload, venous tone, and gravity affect cardiac output. • Explain the following controls of blood flow: local mechanisms, nervous stimulation, and hormonal mechanisms. • Define mean arterial pressure, cardiac output, and peripheral resistance. • Describe the factors that determine mean arterial pressure. • Explain the mechanisms that regulate arterial blood pressure. • Define circulatory shock and describe its causes.

Topics	Topic	Subtopics	Objectives
			• Describe the following disorders of blood vessels: varicose veins, phlebitis, gangrene, aneurysm, trauma to the aorta, stroke, edema, venous thrombosis, hypertension, occlusion of blood vessels, and carotid sinus syndrome.
4	Lymphatic System	• Functions of the Lymphatic System • Anatomy of the Lymphatic System	• Name the functions of the lymphatic system. • Describe the structures of the lymphatic system and their functions. • Describe the formation and flow of lymph. • Distinguish between lymphatic tissue and lymph organ. Give examples of each. • Describe the following disorders of the lymphatic system: lymphedema, elephantiasis, lymphangitis, lymphadenitis, bubonic plague, and lymphoma.
5	Immunity	• Immunity Overview • Innate Immunity • Adaptive Immunity • Acquired Immunity • Overview of Immune Interactions • Immunotherapy	• Explain specificity and memory in relationship to immunity. • Distinguish between innate immunity and adaptive immunity. • Explain the three components of innate immunity. • Describe the cells and chemicals involved in innate immunity. • Describe inflammation. • Describe antigens. • Describe haptens and explain their role in allergic reactions. • Explain the development, activation, proliferation, and inhibition of lymphocytes. • Explain the functions of MHC molecules. • Describe the differences between class 1 and class 2 MHC molecules. • Describe antibody-mediated immunity and the cells involved. • Describe cell-mediated immunity and the cells involved. • Describe the structure and functions of antibodies. • Explain primary and secondary immune responses.

Topics	Topic	Subtopics	Objectives
			• Describe the types and functions of T cells. • Explain the four ways adaptive immunity is acquired. • Explain how different types of immunity can interact to eliminate an antigen. • Describe different types of immunotherapy. • Discuss the following disorders of the immune system: allergic reactions, transplant rejection, gluten-sensitive enteropathy, AIDS, hay fever, asthma, immune complex disease, urtricaria, anaphylaxis, poison ivy or oak reactions, and SCID.
6	Respiratory System	• Functions of the Respiratory System • Anatomy and Histology of the Respiratory System • Ventilation • Measurement of Lung Function • Physical Properties of Gas Exchange • Oxygen and Carbon Dioxide Transport in the Blood • Regulation of Ventilation • Respiratory Adaptations to Exercise	• Describe the functions of the respiratory system • Describe the anatomy and functions of the parts of the respiratory system. • Describe the respiratory membrane. • Describe the blood and lymphatic supply to the lungs. • Describe the roles of the thoracic wall and pleural membranes in respiration. • Explain the events of inhalation and exhalation. • Describe how alveolar pressure changes affect breathing. • Explain the functions of surfactant. • Explain the factors that affect alveolar volumes. • Define compliance, minute ventilation, and alveolar ventilation. • Describe each pulmonary volume and capacity. • Define anatomical dead space and physiological dead space. • Define partial pressure and describe the partial pressure gradients for oxygen and carbon dioxide. • Describe the factors that affect gas movement across the respiratory membrane. • Explain the relationship between alveolar ventilation and pulmonary capillary perfusion. • Explain how oxygen and carbon dioxide are transported in the blood.

Topics	Topic	Subtopics	Objectives
			Describe the factors that affect their transport. • Explain how carbon dioxide is exchanged between the lungs and body tissues. • Compare fetal hemoglobin, adult hemoglobin, and maternal hemoglobin. • Describe how the brainstem, cerebral cortex, and limbic system affect breathing. • Describe how blood pH, carbon dioxide levels, and oxygen levels affect breathing. • Describe the Hering-Breuer reflex. • Describe how exercise affects breathing and the respiratory system.
7	Digestive System	• Anatomy of the Digestive System • Functions of the Digestive System • Histology of the Digestive Tract • Peritoneum • Oral Cavity • Swallowing • Stomach • Small Intestine • Liver • Gallbladder • Pancreas • Large Intestine • Digestion and Absorption	• Describe the regions of the digestive tract. • Explain the functions of the digestive system. • Discuss the histology of the digestive tract. • Describe the types of glands associated with the digestive tract. • Describe the peritoneum. • Define vestibule and oral cavity proper. • Describe the structures and functions of the lips, cheeks, palate, and tongue. • Describe the structure and function of teeth. • Explain the process of mastication. • Describe the major salivary glands. • Describe the composition of saliva. • Describe the structures and functions of the pharynx and esophagus. • Describe the process of swallowing. • Describe the gross anatomy and histology of the stomach. • Describe the secretions of the stomach, their functions, and how they are regulated. • Describe gastric movements. • Describe the structure and function of the small intestine. • Describe the cell types of the duodenal mucosa.

Topics	Topic	Subtopics	Objectives
			• Discuss the secretions and movements of the small intestine. • Describe the anatomy and histology of the liver. • Describe the digestive functions of the liver and how they are regulated. • Describe the structure, functions, and regulation of the gall bladder. • Explain the anatomy and histology of the pancreas. • Describe the secretions of the pancreas, their functions, and their regulations. • Describe the anatomy, histology, and functions of the large intestine. • Describe the chemical digestion and absorption of carbohydrates, lipids, and proteins. • Describe how water and ions are transported across the intestinal wall. • Discuss the following disorders of the digestive system: dental caries, peptic ulcer, gastroesophageal reflux, vomiting, hepatitis, chirrhosis, liver damage, appendicitis, lactose intolerance, cystic fibrosis, familial hypercholesterolemia, diarrhea, gall stones, IBD, IBS, constipation, typhoid fever, cholera, giardiasis, and dysentery.
8	Nutrition, Metabolism, and Temperature Regulation	• Nutrition • Metabolism • Carbohydrate Metabolism • Lipid Metabolism • Protein Metabolism • Interconversion of Nutrient Molecules • Metabolic States • Metabolic Rate • Body Temperature Regulation	• Define nutrition, nutrients, essential nutrients, and kilocalorie. • Explain the use of MyPyramid. • Describe the following for carbohydrates, lipids, and proteins: their dietary sources, uses in the body, and daily recommended amounts. • Describe the important vitamins and minerals for body health. • Define Reference Daily Intake and Daily Reference Value of food. • Explain metabolism, anabolism, and catabolism. • Describe the relationship between hydrogen atoms and energy. • Describe the process of glycolysis. • Explain the citric acid cycle.

Topics	Topic	Subtopics	Objectives
			• Describe the electron-transport chain and its production of ATP. • Discuss the differences between aerobic respiration and lactic acid fermentation. • Describe how lipids and proteins are used as energy sources in the body. • Define the following: glycogenesis, lipogenesis, glycogenolysis, and gluconeogenesis. • Describe absorptive and postabsorptive metabolic states. • Describe metabolic rate and name three major uses of metabolic energy in the body. • Describe how to maintain body weight. • Explain heat production and regulation in the body. • Describe the following disorders related to nutrition and metabolism: vitamin deficiencies, mineral definciencies, starvation, alcoholism, PKU, galactosemia, biotinidase deficiency, maple syrup urine disease, homocystinuria, tyrosinemia, obesity, hyperthermia, and hypothermia.
9	Urinary System	• Functions of the Urinary System • Kidney Anatomy and Histology • Urine Production • Regulation of Urine Concentration and Volume • Plasma Clearance and Tubular Maximum • Urine Movement	• Describe the locations of the organs of the urinary system. • Describe the functions of the kidneys. • Describe the anatomy of the kidneys. • Describe the structure and function of nephrons. • Explain the blood flow through the kidney. • Describe the process of urine formation. • Explain the factors that affect urine production. • Explain the roles of the following on urine volume and concentration: ADH, rennin-angiotensin-aldosterone hormone mechanism, and ANH. • Define plasma clearance. • Explain the use of inulin to estimate GFR. • Explain how renal plasma flow is determined.

Topics	Topic	Subtopics	Objectives
			• Define tubular load and tubular maximum. • Describe the anatomy and histology of the following: ureters, urinary bladder, and urethra. • Describe the flow of urine from the nephron to the urinary bladder. • Discuss micturition and how it is controlled. • Describe the following disorders of the urinary system: polycystic kidney disease, diabetic nephropathy, renal failure, diabetes insipidus, urinary bladder cancer, kidney stones, and automatic bladder.
10	Water, Electrolyte, and Acid-Base Balance	• Body Fluids • Regulation of Body Fluid Concentration and Volume • Regulation of Intracellular Fluid Composition • Regulation of Specific Electrolytes in the Extracellular Fluid • Regulation of Acid-Base Balance	• Describe the major fluid compartments of the body and their subdivisions. • List the major cations and anions in each fluid department of the body. • Explain the causes of edema. • Describe how fluid volumes are regulated in the body. • Discuss the regulation of the following ions in the body: sodium, chloride, potassium, calcium, magnesium, and phosphate. • Define acids, bases, and buffers. • Explain how buffer systems in the body work. • Describe the causes and effects of acid-base imbalances. • Describe the following disorders: hyponatremia, hypernatremia, hypokalemia, hyperkalemia, hypocalcemia, hypercalcemia, hypophosphatemia, hyperphosphatemia, acidosis, alkalosis, and gastroenteritis.
11	Male Reproductive System	• Functions of the Reproductive System • Anatomy of the Male Reproductive System • Physiology of Male	• Explain the functions of the male reproductive system. • Describe the structure and functions of the following: scrotum, testes, ducts of the male reproductive tract, penis, seminal vesicles, prostate gland, and bulbourethral glands. • Describe the specialized cells of the testes.

Topics	Topic	Subtopics	Objectives
		Reproduction	• Explain the process of spermatogenesis. • List the hormones that affect the male reproductive system and describe their effects. • Describe the changes that occur during puberty. • Describe the events that occur during the male sex act. • Discuss the following disorders: inguinal hernia, prostate cancer, male infertility, and erectile dysfunction.
12	Female Reproductive System	• Anatomy of the Female Reproductive System • Physiology of Female Reproduction	• List and describe the organs of the female reproductive system. • Describe the anatomy and histology of the ovaries. • Describe oogenesis, follicle development, ovulation, and fertilization. • Describe the changes that occur during puberty. • Describe the ovarian and menstrual cycles. • Describe the hormones that affect the female reproductive system and describe their effects. • Describe the events of the female sex act. • Describe embryo formation and implantation. • Explain menopause. • Discuss the following disorders: cervical cancer, breast cancer, menstrual cramps, amenorrhea, ectopic pregnancy, fibroid tumors, female infertility, PID, and sexually transmitted diseases.
13	Human Development, Growth, and Aging	• Prenatal Development • Parturition • The Newborn • Lactation • First Year After Birth • Aging and Death	• Describe the events of the prenatal period. • Describe the events of the postnatal periods. • Describe fertilization. • Describe implantation. • Explain the three germ layers and structures derived from each layer. • Describe the formation of the neural tube and neural crest.

Topics	Topic	Subtopics	Objectives
			• Describe the formation of the limbs, the face, and major organ systems. • Explain the events of parturition including hormonal changes. • Describe the changes that occur in the newborn right after birth. • Explain an Apgar score. • Explain the events of lactation including hormonal changes. • Describe the changes that occur during the first year of life after birth. • Describe the process of aging. • Describe the events that occur at the time of death. • Explain how twins are formed. • Discuss stem cell research, in vitro fertilization, and embryo transfer. • Discuss fetal alcohol syndrome, neural tube defects, heart defects, fetal monitoring, prematurity, and HIV in the newborn.
Review	Review	• Review	• Review

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