

Human Physiology
BIOL 201 – Spring 2017
Mon, Wed, Fri 2:00-2:50, SSMB Auditorium

Instructor: Dr. Jason Vance
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Office Hours: Mon, Wed, Fri 10am-11am, or by appointment
Lab Location: 145 SSMB
Lab Instructors: Dr. Farahdiba Jafri and Dr. Jeff Triplehorn

Required text: *Human Physiology: an Integrated Approach (Silverthorn)*
100 Case Studies in Pathophysiology (Bruyere)
Human Physiology Lab Manual (available via SAS-E Ink)

Course Description

BIOL 201, Human Physiology, explores the function of the human body at the cellular, tissue, organ, and organ-system levels. In addition, the lab provides hands-on experience for topics and principles of physiology presented in the lecture, and experience working together in small groups to achieve each lab's objectives. This course is intended for pre-allied health, pre-nursing, and health and human performance majors.

Learning Outcomes

1. Identify and use the basic vocabulary of physiology
2. Reiterate key physiological processes
3. Relate physiology to human health and disease
4. Demonstrate continued development of written, oral, and computational skill sets
5. Demonstrate the ability to work as part of team
6. Demonstrate an understanding of the scientific method and experimental design

Schedule

Week of:	Subject	Book Chapters	Exams, Case Studies, Notices
1/9	Intro to Physiology; Excitable Membranes	1,3,5	PreReq Exam due Sun Jan 15
1/16	Excitable Membranes and Neurons	5, 8	Research Assignment #1
1/23	Neurons and Sensory Physiology	8, 10	Case Study #44
1/30	Autonomic Nervous System	11	Exam 1: Friday, Feb. 3
2/6	Muscle Physiology	12	Research Assignment #2
2/13	Muscle Physiology	12	Research Assignment #3
2/20	Cardiovascular Physiology	14	Case Study #3
2/27	Cardiovascular Physiology	14, 15	Exam 2: Friday, Mar. 3
3/13	Respiratory Physiology	17, 18	Research Assignment #4
3/20	Renal Physiology	19, 20	Case Study #14
3/27	Renal Physiology	19, 20	Exam 3: Friday, Mar. 31
4/3	Digestion	21	Case Study #25
4/10	Endocrine System	7	Research Assignment #5
4/17	Endocrine and Immune System	7, 23, 24	Case Study #54
4/24	Immune System	24	Final Exam: Mon, May. 1 12:00 pm

Assessment

Assessment of the lecture will be in the form of exams, research assignments, case studies and weekly online quizzes. The Laboratory component will make up 25% of your overall BIOL 201 grade. The lecture and laboratory components both count towards the final grade, and are not assessed as separate units.

Prereq Exam	30 pts
Exam 1	100 pts
Exam 2	100 pts
Exam 3	100 pts
Final Exam	100 pts
Research Assignments	50 pts
Case Studies	50 pts
Online Quizzes	70 pts
<u>Lab</u>	<u>200 pts</u>
Total	800 pts

The PreReq Exam is an introductory exam to assess prerequisite knowledge, and your current understanding of basic anatomy and physiology. The points for the PreReq exam are awarded for participation; your score will not affect these points. This assessment serves to help the Dept. of Biology direct the development of the Human Anatomy and Physiology curriculum, and provides you feedback on your knowledge of the prerequisite material necessary for this course. This exam is to be completed online, through the course website on OAKS by Sunday, Jan. 15.

Exams will cover material presented in lecture, research assignments, case studies, and material presented in the lab. Exams are cumulative.

Research Assignments and Case Studies cover literature research skills, general information about disease, and specific information detailed within the Case Studies text. The requirements for these assignment will be posted on OAKS, and are to be printed on paper and due in class on the Friday of the week they are assigned.

Online quizzes are administered through OAKS. There are 14 online quizzes, which contain 5 multiple-choice questions and are worth 5 pts each. Ten minutes are allowed to complete each quiz.

Your grades are not curved! For students interested in health-related professions, please consider why this is important. However, extra credit is offered for completing additional work. 10 points may be earned by completing an additional case study. The requirements for this essay will be posted on OAKS. You may submit this extra credit at any time throughout the semester, up until the day of the final exam (May. 1).

Grade Policy

93-100% A; 90-92% A-; 87-89% B+; 83-86% B; 80-82% B-; 77-79% C+; 73-76% C; 70-72% C-; 67-69% D+; 63-66% D; 60-62% D-; 0-59% F

Lecture Attendance

Your success in this course will depend on your attendance and study habits. Lectures will not necessarily cover introductory material or general information. Therefore, it is expected that you have read the assigned book chapter prior to attending lecture. The assigned book chapters should serve as an introduction to the topics to be discussed in lecture, and as a reference when studying the physiological principles emphasized in lecture. Lecture PowerPoints will be posted to OAKS, but these do not contain notes, only figures used during lecture. You are encouraged to take advantage of every opportunity outside of the lecture to study the course material, whether that involves participating in study groups, attending SI study sessions, reviewing course material on Quizlet.com, or regularly attending office hours. Please consider these opportunities and incorporate them into your study habits!

Learning Objectives:

Excitable Membranes

1. Passive and active transport
2. Concentration gradients
 - a. Fick's Law of Diffusion
 - b. Nernst and GHK equations
3. Resting membrane potential
 - a. leak channels and permeability
4. Action potential
 - a. voltage-gated channels and permeability
 - b. refractory periods

Neurons

1. Cell body (site of nucleus and organelles)
2. Axon (structure, function)
3. Dendrites (structure, function)
4. Myelin sheath, Schwann cells, oligodendrocytes, insulation of axon, nodes of Ranvier (role in propagation of nerve impulse along axon)
5. Synapse (site of impulse propagation between cells)
6. Synaptic activity
 - a. transmitter molecules
 - b. synaptic knobs
 - c. fatigue
 - d. propagation between cells without resistance loss
7. Resting potential (electrochemical gradient)
8. Action potential
 - a. threshold, all-or-none
 - b. sodium-potassium pump
9. Excitatory and inhibitory nerve fibers (summation, frequency of firing)

Sensory Physiology

1. Major functions
 - a. high-level control and integration of body systems
 - b. response to external influences
 - c. sensory input
 - d. integrative and cognitive abilities
2. Organization of vertebrate nervous system
3. Sensor and effector neurons
4. Sympathetic and parasympathetic nervous systems (functions, antagonistic control)
5. Reflexes
 - a. feedback loop, reflex arc, effects on flexor and extensor muscles
 - b. roles of spinal cord, brain
 - c. efferent control
6. Nervous System: Sensory Reception and Processing
 - a. Skin, proprioceptive and somatic sensors
 - b. Olfaction, taste
 - c. Hearing
 - i. ear structure
 - ii. mechanism of hearing
 - d. Vision
 - i. light receptors
 - ii. eye structure
 - iii. visual image processing

Muscle Physiology

1. Muscle Cell/Contractile
 - a. Energy sources for muscle contraction (ATP sources)
 - b. Organization of contractile elements (actin and myosin filaments, cross bridges, sliding filament model)
 - c. Calcium regulation of contraction, sarcoplasmic reticulum
 - d. Sarcomere – Band, Lines, Zones
 - e. Presence and function of troponin and tropomyosin

- f. Mechanisms of muscular fatigue
- 2. Muscle System
 - a. Functions
 - b. support, mobility
 - c. peripheral circulatory assistance
 - d. thermoregulation (shivering reflex)
 - e. Structural characteristics of skeletal, smooth, and cardiac muscle; striated versus non-striated
 - f. Nervous control
 - i. motor neurons
 - ii. neuromuscular junctions, motor end plates
 - iii. voluntary and involuntary muscles
 - g. sympathetic and parasympathetic innervation
 - h. Muscle fiber types

Cardiovascular Physiology

1. Functions (circulation of oxygen, nutrients, hormones, ions, and fluids; removal of metabolic waste)
2. Role in thermoregulation
3. Four-chambered heart (structure, function), Cardiac Cycle, Pressure-Volume diagrams
4. Systolic and diastolic pressure
5. Pulmonary and systemic circulation
6. Arterial and venous systems (arteries, arterioles, venules, veins)
 - a. structural and functional differences
 - b. pressure and flow characteristics
7. Capillary beds
 - a. mechanisms of gas and solute exchange
 - b. mechanism of heat exchange
8. Composition of blood
 - a. plasma, chemicals, blood cells
 - b. erythrocyte production and destruction (spleen, bone marrow)
 - c. regulation of plasma volume
 - d. coagulation, clotting mechanisms, role of liver in production of clotting factors
9. Oxygen and carbon dioxide transport by blood
 - a. hemoglobin, hematocrit
 - b. oxygen content
 - c. oxygen affinity
10. Details of oxygen transport: biochemical characteristics of hemoglobin
 - a. modification of oxygen binding affinity

Respiratory Physiology

1. General structure and function
 - a. gas exchange, thermoregulation
 - b. protection against disease, particulate matter
2. Breathing mechanisms
 - a. diaphragm, rib cage, differential pressure
 - b. resiliency and surface tension effects
3. Regulation

Renal Physiology

1. Roles in homeostasis
 - a. blood pressure
 - b. osmoregulation
 - c. acid-base balance
 - d. removal of soluble nitrogenous waste
2. Kidney structure
 - a. cortex
 - b. medulla
3. Nephron structure
 - a. glomerulus
 - b. Bowman's capsule
 - c. proximal tubule
 - d. loop of Henle
 - e. distal tubule

- f. collecting duct
- 4. Formation of urine
 - a. glomerular filtration
 - b. secretion and reabsorption of solutes
 - c. concentration of urine
 - d. countercurrent multiplier mechanism (basic function)
- 5. Storage and elimination (ureter, bladder, urethra)

Digestion

- 1. Ingestion
 - a. saliva as lubrication and source of enzymes
 - b. epiglottal action
 - c. pharynx (function in swallowing)
 - d. esophagus (transport function)
- 2. Stomach
 - a. storage and churning of food
 - b. low pH, gastric juice, protection by mucus against self-destruction
 - c. production of digestive enzymes, site of digestion
 - d. structure (gross)
- 3. Liver
 - a. production of bile
 - b. roles in nutrient metabolism, vitamin storage
 - c. roles in blood glucose regulation, detoxification
 - d. structure (gross)
- 4. Bile
 - a. storage in gallbladder
 - b. function
- 5. Pancreas
 - a. production of enzymes, bicarbonate
 - b. transport of enzymes to small intestine
 - c. structure (gross)
- 6. Small intestine
 - a. absorption of food molecules and water
 - b. function and structure of villi
 - c. production of enzymes, site of digestion
 - d. neutralization of stomach acid
 - e. structure (anatomic subdivisions)
- 7. Large intestine
 - a. absorption of water
 - b. bacterial flora
 - c. structure (gross)
- 8. Rectum (storage and elimination of waste, feces)
- 9. Muscular control
 - a. sphincter muscle
 - b. peristalsis
- 10. Regulation

Endocrine System

- 1. Hormones
 - a. Function of endocrine system (specific chemical control at cell, tissue, and organ levels)
 - b. Definitions of endocrine gland, hormone
 - c. Major endocrine glands (names, locations, products)
 - d. Major types of hormones (groupings and examples)
 - e. Comprehensive list of hormones and functions
- 2. Endocrine System: Mechanisms of Hormone Action
 - a. Cellular mechanisms of hormone action
 - b. Transport of hormones (bloodstream)
 - c. Specificity of hormones (target tissue)
 - d. Integration with nervous system (feedback control)

Immune System

- 1. Cells and their basic functions

- a. macrophages, neutrophils, mast cells, natural killer cells, dendritic cells
 - b. T lymphocytes
 - c. B lymphocytes, plasma cells
2. Tissues
- a. bone marrow
 - b. spleen
 - c. thymus
 - d. lymph nodes
3. Innate immune function
- a. phagocytes
 - b. natural killer cells
 - c. interferons
 - d. complement proteins
 - e. inflammation
 - f. fever
4. Concepts of antigen and antibody
- a. immunoglobulin classes
 - b. class 1 and 2 MHCs
 - c. primary and secondary immune response

Student Conduct

1. There is to be no talking during the lecture. If you have a question, please raise your hand prior to asking the question. While answering a student's question, please remain quiet so that the student and other class members can hear the reply.
2. Remember, you are attending the lecture to learn, not to text-message, surf the internet, sleep, or distract the instructor or the other students.
3. Please turn off all cellular phones, tablets/laptops before entering the lecture. Bring a pen/pencil and paper; take notes, draw diagrams and become proficient illustrating the anatomy that underlies the physiological concepts!
4. Be prepared! Read the relevant sections in the assigned book chapters before coming to class and lab.
5. No form of academic dishonesty is acceptable. Dishonesty includes, but is not limited to: cheating on an exam; stealing exam questions; substituting one person for another at an exam; falsifying data; destroying, tampering with, or stealing a computer program or file; and plagiarizing (using as one's own the ideas and writings of another). If you are caught cheating you will be reported to the Chair of the Biology Department and you will receive a grade of 0 points for the paper, project, or exam in which the dishonesty was observed. Additionally, you may also receive an F for the course and may receive additional disciplinary action through the Dean of Students and Honor Board.
6. If you have a documented disability than may require assistance, you will need to contact the Center for Disability Services for coordination of your academic accommodations. If the CDS will be involved in administering an exam, we request that you inform us in advance (e.g. the day before the exam is not acceptable). The CDS is located in the Lightsey Center in Suite 104. The CDS phone number is (843) 953-1431. For more information about disabilities, see <http://disabilityservices.cofc.edu>.
7. No College of Charleston employee or student should be subject to unwelcome verbal or physical conduct. It is expected that students, faculty and staff will treat one another with respect. Individuals who violate this policy are subject to discipline up to and including termination and/or expulsion from the College and the possibility of civil and criminal prosecution.