

Syllabus Section - 01

Biology 201: Human Physiology 4 Credit Hours

Fall 2016

Lecture MWF 11-11:50 am SSMB 129

Lecture Instructor Dr. Eric McElroy

Office Hours By appointment; email: mcelroye@cofc.edu

Required Texts:

1. Human Physiology by Dee Silverthorn (4th or 5th or 6th edition)
2. 100 Case Studies in Pathophysiology by Harold Bruyere

Course Description: An introduction to the structure and function of the major organ systems of the human body. This course is specifically intended for pre-allied health, physical education, and pre-nursing majors. Lectures three hours per week; laboratory three hours per week. Prerequisite(s): BIOL 111/BIOL 111L, BIOL 112/BIOL 112L.

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

Assessment:

1. **Examinations:** There will be 3 regular exams and 1 final exam.
 - a. Regular exams will cover the lecture and laboratory material PRIOR to the exam.
 - b. Final exam is comprehensive. It will include any/all material covered in the course.
 - c. They will be given on the dates in the schedule below and last EXACTLY 50 minutes, 11-1150 am).
 - d. Format: Multiple choice and short answer.
 - e. Purpose is to test of your knowledge and ability regarding the material covered in lecture & laboratory.
 - f. There will be practice questions in OAKS and a study guide distributed prior to each exam.
2. **Case Study Assignments:** There will be 4 case studies
 - a. The case studies are listed in the schedule below. You need to complete each on by the due date.
 - b. You turn in a one-page report (guidelines provided in OAKS) printed on paper by the due date (i.e. in lecture). I will not accept electronic submission.
3. **Research Skills:** There will be 5 assignments, posted within OAKS. You need to work alone to complete each assignment and hand them in (printed on paper!) on the due date. I will not accept electronic submission.

Points Distribution for Lecture:

Exam 1	100 pts
Exam 2	120 pts
Exam 3	140 pts
Case Studies (15 points each)	60 pts
Research Skills (4 points each)	20 pts
Final Exam	160 pts

NOTE: Be prepared for each exam. Be sure to come see me if your exam performance is below your expectation.

Lecture is worth 75% of final grade (600 pts), Laboratory is worth 25% (200 pts). Your lab instructor will outline lab assignments.

Grading Scale (%):

≥ 93 A, 92-90 A-, 89-87 B+, 86 - 83 B, 82-80 B-, 79- 77 C+, 76 - 73 C, 72-70 C-, 69 - 67 D+, 66 - 63 D, 62-60 D-, < 60 F

No curving, no extra credit.

Attendance Policy: I do not take attendance during lectures, but you need to attend lecture to do well in the course. You are required to be present for exams on the dates listed in the schedule below. You are required to attend all laboratory sessions. I will verify your enrollment in the course during the first 2 weeks via an ungraded quiz within OAKS. Failure to complete this quiz may result in you being dropped from the course role...the College is legally required to verify that enrolled students are attending courses!

Disabilities: The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying me as soon as possible and for contacting me one week before accommodation is needed.

Academic Dishonesty: Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved. Incidents where the instructor determines the student's actions are related more to a misunderstanding will be handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed both by the instructor and the student, will be forwarded to the Dean of Students and placed in the student's file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student's transcript for two years after which the student may petition for the X to be expunged. The F is permanent. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration--working together without permission-- is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone or computer), copying from others' exams, fabricating data, and giving unauthorized assistance. Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor.

Students can find the complete Honor Code and all related processes in the *Student Handbook* at <http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>

COURSE SCHEDULE:

Week	Topic*	Module in Oaks[#]	Exams and Case Studies
1, Aug 22	Nervous System	0, 1	
2, Aug 29	Sensory Systems	1	Research Assignment 1 (due Aug 31)
3, Sept 5	Muscles	2	Research Assignment 2 (due Sept 7)
4, Sept 12	Muscles	2	Case Study 1 (due Sept 14)
5, Sept 19	Cardiovascular Physiology	3	Exam 1 (Nervous and Muscle), Wednesday Sept 21
6, Sept 26	Cardiovascular Physiology	3	Research Assignment 3 (due Sept 28)
7, Oct 3	Cardiovascular Physiology	3	Research Assignment 4 (due Oct 5)
8, Oct 10	Respiration & Gas Transport	4	Research Assignment 5 (due Oct 12)
9, Oct 17	Respiration & Gas Transport	4	Case Study 2 (due Oct 17)
10, Oct 24	Renal	5	Exam 2 (Cardiac and Respiratory), Wednesday October 26
11, Oct 31	Renal	6	
12, Nov 7	Renal	6	Fall Break (Nov 7, 8)
13, Nov 14	Digestion and Metabolism	7, 8	Case Study 3 (due Nov 14)
14, Nov 21	Endocrine	9	
15, Nov 28	Immune	10	Exam 3 (Renal, Digest, Endocrine, Immune), Wednesday November 30
16, Dec 5	Reproduction	11	Case Study 4 (due Dec 5)
Dec 12			Final Exam, 12 – 3 pm

*Use table of contents in SILVERTHORN and the topic list to identify chapters that are relevant to specified topics. Your best strategy is to use the topic list and the book's index to find relevant material.

#Versions of my lectures are posted as 'voicethreads' within OAKS. I will occasionally assign portions of lectures for you to view outside of class time. NOTE: my in class delivery will differ from the voicethread delivery (for example, I often draw on the board in lecture); you are responsible for what I talk about in lecture and what is on the topic list. Also, all powerpoint slides are posted within OAKS so that you can take notes on them, the powerpoint slides and voice threads are identical

Case Study Matrix:

In lab you should choose a 'letter' (A-D) within your lab group. So a group of 4 people would have: A, B, C, D. Group of 3: A, B, C. Case studies are not group assignments!

Then use the matrix below to figure out which case study to complete for each of the 4 due dates.

	A	B	C	D
Case Study 1	91	93	94	95
Case Study 2	3	4	13	15
Case Study 3	31	32	34	35
Case Study 4	63	72	65	68

Matrix of questions to answer with each case study:

Case Study Number	List of Questions
91	5, 7, 9, 11, 13
93	4, 5, 6, 7, 8
94	1, 2, 8, 10, 11, 12
95	1, 2, 3, 6, 7
3	13, 14, 15, 16, 17
4	3, 5, 6, 7, 8
13	6, 8, 9, 10, 15
15	1, 6, 7, 8, 10
31	5, 6, 7, 8, 10
32	2, 5, 6, 7, 8
34	1, 3, 5, 8, 9
35	2, 5, 6, 7, 11
63	1, 2, 3, 5, 11 (note you might find it useful review questions 4-11, but you only need to answer those listed)
72	1, 5, 6, 7, 9
65	3, 4, 6, 9, 11
68	4, 5, 6, 10, 14

TOPIC LIST FOR BIOL201: Use this list, coupled with lecture material, to identify important material for exams. If we do not cover it is STILL fair game for exams, so you should look up the material in your book.

NERVOUS AND SENSORY SYSTEMS

A. Nerve Cell/Tissue

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
5. Nodes of Ranvier (role in propagation of nerve impulse along axon)
6. Synapse (site of impulse propagation between cells)
7. Synaptic activity
 - a. transmitter molecules
 - b. synaptic knobs
 - c. fatigue
 - d. propagation between cells without resistance loss
8. Resting potential (electrochemical gradient)
9. Action potential
 - a. threshold, all-or-none
 - b. sodium–potassium pump
10. Excitatory and inhibitory nerve fibers (summation, frequency of firing)

B. Structure and Function

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

C. Sensory Reception and Processing

1. Skin, proprioceptive and somatic sensors
2. Olfaction, taste
3. Hearing
 - a. ear structure
 - b. mechanism of hearing
4. Vision
 - a. light receptors
 - b. eye structure
 - c. visual image processing

MUSCLE SYSTEM

A. Muscle Tissue/Cells

1. Energy sources for muscle contraction (ATP sources)
2. Organization of contractile elements (actin and myosin filaments, cross bridges, sliding filament model)
3. Calcium regulation of contraction, sarcoplasmic reticulum
4. Sarcomere – Band, Lines, Zones
5. Presence and function of troponin and tropomyosin
6. Mechanisms of muscular fatigue

B. Muscle System

1. Functions

- a. support, mobility
- b. peripheral circulatory assistance
- c. thermoregulation (shivering reflex)
- 2. Structural characteristics of skeletal, smooth, and cardiac muscle; striated versus nonstriated
- 3. Nervous control
 - a. motor neurons
 - b. neuromuscular junctions, motor end plates
 - c. voluntary and involuntary muscles
 - d. sympathetic and parasympathetic innervation
- 4. Muscle fiber types
- 5. Lever systems, biomechanics of muscle-skeleton integration

CIRCULATORY and LYMPHATIC SYSTEMS

A. Circulatory System

- 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. regulation of plasma volume
 - c. coagulation, clotting mechanisms, role of liver in production of clotting factors

B. Lymphatic System

- 1. Major functions
 - a. equalization of fluid distribution
 - b. transport of proteins and large glycerides
 - c. return of materials to the blood
- 2. Composition of lymph (similarity to blood plasma; substances transported)
- 3. Source of lymph (diffusion from capillaries by differential pressure)
- 4. Lymph nodes (activation of lymphocytes)

RESPIRATORY SYSTEM

- 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. Oxygen and carbon dioxide transport by blood
 - a. hemoglobin, hematocrit
 - b. oxygen content
 - c. oxygen affinity
 - d. hormonal regulation of hemoglobin levels
- 10. Details of oxygen transport: biochemical characteristics of hemoglobin
 - a. modification of oxygen binding affinity

RENAL SYSTEM

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)

DIGESTIVE SYSTEM

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. Control of blood glucose levels (Glycogen, Insulin)

IMMUNE SYSTEM (INNATE AND ADAPTIVE)

- 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. Basic aspects of innate immunity and inflammatory response
- 4. Concepts of antigen and antibody
- 5. Structure of antibody molecule
- 6. Mechanism of stimulation by antigen; antigen presentation

ENDOCRINE SYSTEM

A. Hormones

- 1. Function of endocrine system (specific chemical control at cell, tissue, and organ levels)
- 2. Definitions of endocrine gland, hormone
- 3. Major endocrine glands (names, locations, products)
- 4. Major types of hormones (groupings and examples)
- 5. Comprehensive list of hormones and functions

B. Mechanism of Hormone Action

- 1. Cellular mechanisms of hormone action
- 2. Transport of hormones (bloodstream)
- 3. Specificity of hormones (target tissue)
- 4. Integration with nervous system (feedback control)

REPRODUCTIVE SYSTEM AND DEVELOPMENT

- 1. Male and female reproductive structures and their functions
 - a. gonads
 - b. genitalia
 - c. differences between male and female structures
- 2. Gametogenesis by meiosis
- 3. Ovum and sperm
 - a. differences in formation
 - b. differences in morphology
 - c. relative contribution to next generation
- 4. Reproductive sequence (fertilization, implantation, development, birth)
- 5. Menstrual cycle
 - a. Hormonal control and cellular/tissue changes
 - b. Pregnancy & Birth

OTHER SYSTEMS (we will barely discuss these in lecture)

A. Skin System

- 1. Functions in homeostasis and osmoregulation
- 2. Functions in thermoregulation

- a. hair, erectile musculature
- b. fat layer for insulation
- c. sweat glands, location in dermis
- d. vasoconstriction and vasodilation in surface capillaries
- 3. Physical protection
 - a. nails, calluses, hair
 - b. protection against abrasion, disease organisms
- 4. Structure
 - a. layer differentiation, cell types, tissue types (epithelial, connective)
 - b. relative impermeability to water

B. Skeletal System

- 1. Functions
 - a. structural rigidity and support
 - b. calcium storage
 - c. physical protection
- 2. Skeletal structure
 - a. specialization of bone types; structures
 - b. joint structures
 - c. endoskeleton versus exoskeleton
- 3. Cartilage (structure, function)
- 4. Ligaments, tendons
- 5. Bone structure
 - a. calcium–protein matrix
 - b. bone growth (osteoblasts, osteoclasts)

BACKGROUND INFO YOU NEED BEFORE YOU START BIOL201!

ENZYMES AND METABOLISM

A. Enzyme Structure and Function (BACKGROUND...FROM INTRO BIOL)

- 1. Function of enzymes in catalyzing biological reactions
- 2. Reduction of activation energy
- 3. Substrates and enzyme specificity

B. Basic Metabolism

- 1. Glycolysis (anaerobic and aerobic, substrates and products)
- 2. Krebs cycle (substrates and products, general features of the pathway)
- 3. Electron transport chain and oxidative phosphorylation (substrates and products, general features of the pathway)
- 4. Metabolism of fats and proteins

GENERALIZED EUKARYOTIC CELL

A. Membrane-bound Organelles (BACKGROUND...FROM INTRO BIOL)

- 1. Mitochondria
 - a. site of ATP production
 - b. self-replication; have own DNA and ribosomes
 - c. inner and outer membrane
- 2. Lysosomes (vesicles containing hydrolytic enzymes)
- 3. Endoplasmic reticulum
 - a. rough (RER) and smooth (SER)
 - b. RER (site of ribosomes)
 - c. role in membrane biosynthesis: SER (lipids), RER (transmembrane proteins)
 - d. RER (role in biosynthesis of transmembrane and secreted proteins that cotranslationally targeted to RER by signal sequence)
- 4. Golgi apparatus (general structure; role in packaging, secretion, and modification of glycoprotein carbohydrates)

B. Plasma Membrane

1. General function in cell containment
2. Protein and lipid components, fluid mosaic model
3. Osmosis
4. Passive and active transport
5. Membrane channels
6. Sodium–potassium pump
7. Membrane receptors, cell signaling pathways, second messengers
8. Membrane potential
9. Exocytosis and endocytosis
10. Cell–cell communication (general concepts of cellular adhesion)
 - a. gap junctions
 - b. tight junctions
 - c. desmosomes

SPECIALIZED EUKARYOTIC CELLS AND TISSUES

1. Epithelial cells (cell types, simple epithelium, stratified epithelium)
2. Endothelial cells
3. Connective tissue cells (major tissues and cell types, fiber types, loose versus dense, extracellular matrix)
4. Muscle/Neural Tissue (covered above)