

# Syllabus

# Biology 201: Human Physiology

Fall 2015

**Lecture** MWF 11-11:50 am SSMB 129

**Instructor** Dr. Eric McElroy

**Office Hours** By appointment; email: [mcelroye@cofc.edu](mailto:mcelroye@cofc.edu)

## Required Texts:

1. Human Physiology by Dee Silverthorn (4<sup>th</sup> or 5<sup>th</sup> or 6<sup>th</sup> edition)

## 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 from the topic list.
  - c. They will be given on the dates in the schedule below and last EXACTLY 50 minutes, 11-1150 am).
  - d. Format: MAINLY Multiple Choice, possible matching or 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 (called DIY quizzes)
2. **Case Study Assignments:** There will be 4 case studies
  - a. The case study will be posted within OAKS, your lab group should access and complete it by the due date.
  - b. Your group turns in a one page report via DROPBOX within OAKS by the due date.
  - c. A portion (3-5 questions) of each exam will involve questions stemming from the case study.
3. **IBIOSKETCH:** You will be required to build a CV / Resume as part of this course. Use the websites below to do so. While there are not points for doing the assignment, there are PENALTIES for not doing the assignment. I will deduct 10% from your first exam grade and then 10% from each exam thereafter until you complete the assignment.
  - a. <http://ibiosketch.com/register/CollegeofCharleston> Use this website for registration
  - b. <http://www.ibiosketch.com> Use this website to build your CV/Resume, ENTER AS MUCH INFORMATION AS POSSIBLE!
  - c. You are required to show me proof of your complete CV/resume in IBIOSKETCH. To do this, go to the ACCOUNT TOOLS tab, then SELF-DESIGNED BIOSKETCH, CV, RESUME, Click CONTINUE, FINISH, go the the URL displayed and save as a .pdf. Upload the .pdf to the dropbox for the assignment within OAKS.
  - d. Due by September 14.

## Points Distribution for Lecture:

Exam 1	120 pts
Exam 2	120 pts
Exam 3	120 pts
Case Studies (20 each)	80 pts
Final Exam	160 pts

NOTE: Poor performance on the first exam can really hurt your final grade. 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 assignments for lab.

**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.**

**SNAP students:** Please notify me ASAP. Providing extra testing time will require planning, due the condensed schedule in MAYMESTER. We need to plan for this early in the semester. The SNAP office will provide a testing space and oversee your examination.

**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:**

<b>Week</b>	<b>Topic*</b>	<b>Module in Oaks<sup>#</sup></b>	<b>Exams and Case Studies</b>
1, Aug 24	Nervous System	0, 1	<b>CS1 (Nervous System)</b>
2, Aug 31	Sensory Systems	1	
3, Sept 7	Muscles	2	
4, Sept 14	Muscles	2	<b>IBIOSKETCH COMPLETED</b>
5, Sept 21	Cardiovascular Physiology	3	<b>Exam 1, Wed Sept 23</b>
6, Sept 28	Cardiovascular Physiology	3	
7, Sept 20	Cardiovascular Physiology	3	
8, Oct 5	Respiration & Gas Transport	4	<b>CS2 (Respiratory)</b>
9, Oct 12	Respiration & Gas Transport	4	
10, Oct 19	Renal	5	<b>Exam 2, Wed Oct 21</b>
11, Oct 26	Renal	6	<b>Last Day for W, Oct 29</b>
12, Nov 2	Renal	6	
13, Nov 9	Digestion and Metabolism	7, 8	<b>CS3 &amp; CS4 (Digestion/Metabolism)</b>
14, Nov 16	Endocrine	9	
15, Nov 23	Immune	10	
16, Nov 30	Reproduction	11	<b>Exam 3, Wed Dec 2</b>
Dec 11			<b>Final Exam, 12 – 3 pm</b>

\*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.

<sup>#</sup>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.

**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)