PCB 3713C – Cellular and Systems Physiology

Syllabus Policy

You are solely responsible for reading and following the instructions, guidelines and schedules in this syllabus, and for checking the e-Learning announcements at least weekly for announcements regarding any changes. Not having read the information in this syllabus or the announcements will not constitute an excuse for missing an assignment or deadline.

Course Description

How cells, organs, and higher level systems are integrated and coordinated in the functions of humans and other animals. Emphasis will be placed on the use of model organisms, mathematical models and the physical sciences to understand the mechanistic basis of normal physiology and dysfunction. 4 credits.

Prerequisites

One semester of general biology (BSC 2010), two semesters of general chemistry (CHM 2045 and CHM 2046, or CHM 2047, CHM 2051 or CHM 2096), and two semesters of general physics (PHY 2048 and PHY 2049, or PHY 2053 and PHY 2054, or PHY 2061), all with a minimum grade of C.

Corequisite

None

Instructors

COURSE INSTRUCTOR

David Julian, Ph.D. (Physiology)
Associate Professor, Department of Biology
Office hour: TBD in BAR 123

COURSE GRADUATE TAS

Mehmet Celepkolu, M.S. (Computer Engineering)
Ph.D. student, Educational Technology
Office hour: TBA in BAR 123

Course Schedule

Section 004D, Tuesdays and Thursdays, periods 2-3 (8:30 p.m. - 10:25 a.m.) in TUR L005

Course Fee

None. (You will need to purchase a Peerceptive license for $6.95, see below.)

Course Objectives

At the end of the course, students should be able to:

- Explain physiological mechanisms of humans and representative model organisms by applying basic principles of physics, chemistry and engineering.
- Describe the fundamental mechanisms underlying normal function of cells, tissues, organs, and organ systems in humans and other animals.
- Explain the basic mechanisms of homeostasis by integrating the functions of cells, tissues, organs, and organ systems.
- Effectively solve basic problems in physiology, working independently and in groups.
- Apply knowledge of functional mechanisms and their regulation to explain the pathophysiology underlying common diseases.
- Generate hypotheses about physiological processes, design experiments to test these hypotheses using mathematical models of complex physiological systems, and then analyze, interpret and report experimental results.
- Use primary literature readings to understand basic physiological principles and mechanisms.
- Read and critically evaluate the design, results and conclusions of experiments published in primary physiology literature
- Interpret and knowledgeably discuss primary literature among peers

Required Course Materials, Software and Hardware

Primary Course Textbook

Medical Physiology, 2e Updated Edition: with STUDENT CONSULT Online Access. W.F. Boron and E.L. Boulpaep. Elsevier Publishers, 2012.

You may use the electronic or hardcover textbook, but be sure it is the ***updated*** second edition (i.e., the edition with a blue cover from 2012, not the second edition with the green cover from 2008), and that you have online access.

Other Free, optional Textbook Resources

Ganong's Review of Medical Physiology, 25th edition, by Barrett, Boitano, Barman and Brooks (McGraw-Hill Companies, Inc.) 2016.

This textbook is available free to UF students online via AccessMedicine. You must be on a campus computer, using VPN, or using off-campus library access procedures *while* reading the book online.

Color Atlas of Physiology, 7th edition, by Despopoulos and Silbernagel (Thieme, NY), 2015.

This textbook is available free to UF students for reading on your own computer using the iOffline viewer or online at the UF Health Science Center Library via the Thieme Electronic Book Library. You must be on a campus computer, using VPN, or using off-campus library access procedures *while* reading the book online. The online option is less convenient than reading it with the Offline viewer, but the images look better.

Classroom Response System

We will use the Learning Catalytics classroom response system to both aid and assess your understanding of the course material. You will be able to participate using a laptop, iPad or other tablet. During the first week of classes you will receive information on registering for this service.

DIGITAL LESSONS

All non-textbook course readings and lessons will be accessible from the Canvas website (https://elearning.ufl.edu).

COMPUTER REQUIREMENT

To participate in the problem-based learning activities you must bring a computing device that can access the internet wirelessly. This device may be a laptop or tablet.

To complete the tutorials outside of class, you must have a computer that runs the Windows operating system. As of December 2015, all of the simulations also run on Intel-based Macs running Boot Camp or VMware.

The course instructor will not provide any computer support. You may be able to get assistance from the UF Computing Help Desk, but in the past, most students have gotten the best support from other students in the course via discussion posts.

SIMULATION SOFTWARE

All of the simulation software packages used in the course are publicly available for your use. You must download and install each package in order to participate in the course activities outside of class.

- Nernst-Goldman Simulator
  A simple simulation of resting membrane potential and action potentials in neurons using the Hodgkin-Huxley model: http://www.nernstgoldman.physiology.arizona.edu/.
- Nerve
  A web-based simulation of nerve action potentials and action potential propagation (with a squid model): http://nerve.bsd.uchicago.edu/nervejs/MAP.html.
- SWIMMY
  A simulation of a complex neural network in a fish. The software was developed at UCLA, based on NEURON software developed primarily at Duke University. The software can be downloaded from http://mdcune.psych.ucla.edu/modules/swimmy.
- HumMod
  HumMod Modeler is a detailed, customizable simulation of human physiology that utilizes over 5,000 physiological variables. The software was initially developed at the University of Mississippi Medical Center. The project is http://hummod.org/. Note that this course uses a custom version of the simulation that will be available from a link on the course home page. **Do not** use the version of the simulation that is available from the HumMod site. This version of HumMod may also be available for this course on UF Apps.
- JustPhysiology
  JustPhysiology (www.justphysiology.com) is a web application based on the HumMod simulation engine. You will be provided an access code.

Activities and Assessments

The class content will include textbook reading, in-class lessons, in-class problem-based learning ("active learning" questions), experiments using physiological simulations, and writing and peer-review of research reports.

PROBLEM-BASED LEARNING

During most "lecture" sessions you will be asked to work with your classmates to answer questions and solve problems. You will use a classroom response system to provide your answers.

SIMULATIONS

You will complete 10 tutorials that use computerized mathematical simulations to explore systems physiology. These tutorials have embedded questions that gauge and reinforce your comprehension of key physiology concepts. Each tutorial will typically require 2-4 hours to complete.

RESEARCH REPORTS AND PEER REVIEW

You will individually complete two research reports during the term. For each report, you will be provided with a research problem about a physiological phenomenon. You will typically do the following:

1. Develop a hypothesis for the assigned problem.
2. Design and conduct an experiment to test your hypothesis using the physiology simulation software.
3. Collect and analyze the data.
4. Craft a clear, well-supported draft report explaining the answer to the question.
5. Submit your draft report for peer review.
6. Participate in peer reviews of other student draft reports.
7. Revise your draft report based on reviewer feedback.
8. Back-evaluate your reviewer feedback.
9. Submit your report.
10. Participate in peer reviews of other student reports.
11. Back-evaluate the reviewer feedback you received on your report.

Your report must be formatted according to the detailed instructions provided for each report, which will be posted on the course home page. Reports that are not formatted correctly will receive a score of zero. You are welcome to work on your report with other students in the course, but the final product must represent your own work. Completion of each research report, including the peer review process, will typically require 12 hours. The total grade will be determined from the following criteria:

- **Review Grade** - a combination of the Accuracy and Helpfulness grades, which are then curved, after which any Reviewing Late Penalties are subtracted.
- **Accuracy -** correlation of your own ratings to mean ratings by others on same documents.
- **Helpfulness** - how helpful the author thought your comments were via back evaluation.
- **Reviewing Late Penalty** - penalty for submitting reviews during the grace period (based on how the instructor created the course).
- **Writing Grade -** average score given by reviewers which is then curved, and then any Writing Late Penalties are subtracted.
- **Writing Late Penalty** - penalty for submitting document during the grace period.
- **Task Grade** - accounts for the percentage of assigned reviews and back-evaluations that were done. It represents only your reviewing activities, which is then curved.
- **Weighting** – How each category is weighted. The breakdown is 40% reviewing, 40% writing, and 20% task.
- **Overall** - The sum of all of the weighted grades

EXAMS

There will be a midterm exam and a final exam. These will consist mostly of problem-based, multiple choice, fill-in-the-blank, ordering and numeric (calculation) questions. The midterm will cover all course material

through week 8, will consist of approximately 50 questions, will be administered during a normal lecture session (115 minutes in duration), and will be worth 250 points. The final exam will cover all course material from the entire term but will focus primarily on the last half of the course. It will also consist of approximately 50 questions and will be worth 250 points, but it will be administered during the final exam period (2 hours duration). Both exams will be closed-book and you will not be allowed to use notes, but you will be expected to utilize the physiology simulation software to answer some of the questions. The exams will be administered in a computer lab, so you will use a university computer.

Grading

ASSESSMENTS

Assessment Type	Quantity	Points	Subtotal	Pct of Total
Problem-based Learning	150	2	**300**	30%
Simulation Tutorials	10	10	**100**	10%
Simulation Research Reports	2	50	**100**	10%
Midterm Exam	1	250	**250**	25%
Final Exam	1	250	**250**	25%
Total			**1000**	100%

GRADE DISTRIBUTION

Point Range (%)	Letter Grade
93.33 or higher	A
90-93.32	A-
86.66-89.99	B+
83.33-86.65	B
80-83.32	B-
76.66-79.99	C+

Point Range (%)	Letter Grade
73.33-76.65	C
70-73.32	C-
66.66-69.99	D+
63.33-66.65	D
60-63.32	D-
< 60	E

Grades will not be assigned by a curve, but the grade cutoffs may be adjusted downward. In other words, if your final point accumulation is 93.33%, then you are guaranteed to receive an A. This means there is no upper limit to the number of "A" grades that can be given out.

Note that a "C-" will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. More information on grades and grading policies is here:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

EXTRA CREDIT

There will be no opportunities for extra credit.

Time Commitment

The UF College of Liberal Arts and Sciences assumes that you will devote 3-4 hours per week per credit-hour to each course during the regular fall and spring semesters. Because this course is 4 credits (including the Discussion session), you should therefore expect to devote 12-16 hours per week to this course, of which only four hours per week will be spent in class (including the Discussion sessions). Therefore, you are responsible for budgeting about 2/3 of the time you will spend on this course. If you find yourself spending

more than 16 hours per week on average, discuss this with your course instructor to see if you can refine your work and study habits. If you find yourself spending less than 12 hours per week on average, you should recognize that you may have difficulty fully learning and comprehending the material in this time, which will probably be reflected in poor performance on the various assessments, causing you to receive a lower overall course grade.

Activity	Time (hours)
Lectures/Problem-based Learning	60
Textbook Readings and Reviewing Notes	90
Simulation Tutorials	20
Simulation Research Reports	20
Midterm Exam	2
Final Exam	2
Total	*194*

Communication

Updates and changes to the course schedule, this syllabus, and any other aspects of the class content and structure will be communicated to you via announcements on the course e-Learning site. You are responsible for checking this site regularly for announcements.

COMMUNICATING ELECTRONICALLY WITH THE INSTRUCTOR AND GRADUATE TEACHING ASSISTANT

There are two primary modes of electronic communication for this class -- the discussion forum and Canvas mail. To ensure that your questions are answered as promptly as possible, please follow the communications guidelines below:

Discussion Forum: This course is participatory. Use the discussion forum on the course website for questions/answers about the course content, structure, assignments and activities. You are strongly encouraged to respond to your peers if you know the answer or can provide guidance. The course Graduate TA will monitor this area, but the TA may not be able to read every posting and therefore this should **not** be used to communicate with the instructors.

Direct Canvas Mail to the Instructors: Direct email to Dr. Julian or to your TA should be used only for messages that are **private** in nature or that have been posted to the Discussion Forum but were not solved. Use the Mail tool in Canvas for all such direct email. If you use any other email tool, it may be filtered as spam or otherwise not be seen by your instructors.

Course Policies

ACADEMIC HONESTY

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code http://www.dso.ufl.edu/sccr/process/student-conduct-honorcode/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

POLICY RELATED TO ABSENCES AND MAKE-UP WORK

Requirements for class attendance and make-up exams, assignments, and other work are consistent with university attendance policies: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

If you must miss an assignment or exam due to an allowable scheduled absence (for example, to participate in a sanctioned university function), you must notify the instructor as soon as the event is scheduled or during the first week of classes. If you miss an assignment or exam due to an allowable but unscheduled absence (e.g., illness), you must contact the instructor as soon as possible. In the case of illness, you must provide a signed note from your primary care provider indicating that you were unable to complete the assignment or take the exam on the day(s) in question.

USING ELECTRONIC DEVICES IN CLASS

You are welcome to make audio recordings of the lectures for your personal use, but you may not make video recordings. You may not distribute or upload any recorded material from this class to sites other than the course Canvas site (much of the course material is copyrighted).

As noted above, you are required to bring a laptop or tablet computer with wireless Internet access to the lectures to utilize the classroom response system. Note that there is no course policy against using these electronic devices in class for other purposes. However, if the instructor perceives your activities to be a distraction to any other members of the class, you will be warned that you are being disruptive. Multiple disruptions will be considered grounds for the assignment of a failing grade.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

COURSE EVALUATION PROCESS

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

Course Schedule (subject to change)

Assignments are due at 11:59 p.m. on the date indicated on the course e-Learning site schedule

Wk #	Week of	Lecture Topic (Chapter)	Simulation Tutorial	Research Report
1	Jan 04	Introduction, Homeostasis (1); Cell Structure (2); Signal Transduction (3)		
2	Jan 11	Regulation of Gene Expression (4); Cellular Transport (5); Electrophysiology of Cell Membrane (6); Electrical Excitability and Action Potentials (7)	T1 Membrane Potential	
3	Jan 18[1]	Synaptic Transmission and the Neuromuscular Junction (8); Cellular Physiology of Muscle (9); Exercise Physiology and Sports Science (60, *Muscle*)	T2 Synapses	
4	Jan 25	Organization of the Nervous System (10); Neuronal Microenvironment (11); Physiology of Neurons (12)		
5	Feb 01	Synaptic Transmission in the Nervous System (13); Autonomic Nervous System (14); Sensory Transduction (15)	T3 Fight or Flight	
6	Feb 08	Circuits of the CNS (16); Organization of Endocrine Control (47); Endocrine Regulation of Growth and Body Mass (48)	T4 Internal Receptors	
7	Feb 15	Thyroid Gland (49); Adrenal Gland (50); Endocrine Pancreas (51); Parathyroid Gland and Vitamin D (52)	T5 Endocrine Ctrl of Glucose	R1 Draft
8	Feb 22	Sexual Differentiation (53); Fertilization, Pregnancy and Lactation (56); **Midterm** (Thursday Feb 25 during normal class time, Weil Hall 408)		R1 Draft Reviews
Spring Break February 27 – March 5				
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1. January 18 is a holiday (Martin Luther King Jr. Day).

Wk #	Week of	Lecture Topic (Chapter)	Simulation Tutorial	Research Report
9	Mar 07	Organization of the Cardiovascular System (17); Blood (18); Arteries and Veins (19); Microcirculation (20); Cardiac Electrophysiology (21)		R1 Final
10	Mar 14	Heart as a Pump (22); Regulation of Arterial Pressure and Cardiac Output (23); Special Circulations (24); Integrated Control of the Cardiovascular System (25)	T6 Cardiac Output	R1 Final Reviews
11	Mar 21	Organization of the Respiratory System (26); Mechanics of Ventilation (27); Acid-Base Physiology (28)	T8 Ventilation	
12	Mar 28	Transport of O_2 and CO_2 in the Blood (29); Gas Exchange in the Lungs (30), Ventilation and Perfusion of the Lungs (31); Control of Ventilation (32)	T7 Gas Exchange	R2 Draft
13	Apr 04	Organization of the Urinary System (33); Glomerular Filtration and Renal Blood Flow (34);Transport of Sodium and Chloride (35); Transport of Urea, Glucose, Phosphate, Calcium, Magnesium, and Organic Solutes (36); Transport of Potassium (37); Urine Concentration and Dilution (38); Transport of Acids and Bases (39); Integration of Salt and Water Balance (40)	T9 Renal Function	R2 Draft Reviews
14	Apr 11	Organization of the GI System (41); Gastric Function (42); Pancreatic and Salivary Glands (43); Intestinal Fluid and Electrolyte Movement (44); Nutrient Digestion and Absorption (45); Hepatobiliary Function (46)		R2 Final
15	Apr 18[1]	Metabolism (58); Regulation of Body Temperature (59); Exercise Physiology and Sports Science (60, *Metabolism*); Environmental Physiology (61)	T10 Homeostasis	R2 Final Reviews
Final exam[2]: Monday, April 25, 8:30-10:25 a.m., Weil Hall 408				

1. Last class meeting is April 19, Reading Days are April 21-22.
2. Final exam schedule code 25A.