PCB 3713C – Cellular and Systems Physiology

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.
Associate Professor, Department of Biology
http://biology.ufl.edu/People/faculty/djulian.aspx
Office hour: TBA

COURSE GRADUATE TAS

Joni Wright, M.S.
Ph.D. candidate in Zoology, Department of Biology
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Biswadeep Dhar
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Course Schedule

Lecture/Active-Learning Sessions: MWF, period 6 (12:50 p.m. - 1:40 p.m.) in RNK 0110
Discussions:

Day	Period	Room
M	7	BLK 0315
T	6	BLK 0315
T	7	NPB 1220
T	8	NPB 1216
W	7	ROG 0106
R	6	TUR 2303
R	7	ROG 0106
R	8	TUR 2303

Course Fee

None

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.
- Successfully acquire primary literature articles through database searches.
- 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

Color Atlas of Physiology, 6th edition, by Despopoulos and Silbernagel (Thieme, NY), 2009.

This textbook is available free to UF students for reading on your own computer using iOffline. Instructions are available online. Note that you must be connected to the UF network directly or via campus VPN. This application allows you to make electronic notes on the textbook pages. Note that this is the fastest and easiest way to read the electronic version of the book, but the trade-off is that most of the images look pretty poor (but you have good-quality versions of most images in the lesson slides).

The textbook is also available 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. This is less convenient than reading it with the Offline viewer, but the images look better.

Finally, you can purchase a paper copy of the book for as little as $31 (including tax and shipping) through online vendors. This is an attractive, small book that is great for taking with you everywhere, even if you also have it on your computer.

SECONDARY COURSE TEXTBOOK

Ganong's Review of Medical Physiology, 24th edition, by Barrett, Boitano, Barman and Brooks (McGraw-Hill Companies, Inc.) 2012.

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

Paper copies of the book are available for purchase (about $56), but we won't use the book enough this semester to justify purchasing it.

CLASSROOM RESPONSE SYSTEM

We will use a 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, or smartphone. During the first week of classes you will receive information on registering for this service. The fee is $15 for a one-semester subscription, which you must purchase on your own through a third-party website.

COMPUTER REQUIREMENTS

You must have a computer that runs the Windows operating system to complete the Simulations outside of class. As of December 2013, 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 the Q&A Forum.

DIGITAL LESSONS

All of your course lessons will be accessible from the Sakai website (https://elearning2.courses.ufl.edu).

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
  This is a simple simulation of resting membrane potential and action potentials in neurons using the Hodgkin-Huxley model. The software can be run online as a java applet from http://www.nernstgoldman.physiology.arizona.edu/.
- Nerve
  This is a web-based simulation of nerve action potentials and action potential propagation (http://nerve.bsd.uchicago.edu/nerve1.html).
- SWIMMY
  This is 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 Sakai home page. **Do not** use the version of the simulation that is available from the HumMod site.

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 ASSISTANTS

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

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

Sakai Mail to the Instructors: Direct email to Dr. Julian or to your TA should be used only for messages that are **private** in nature. Use the Mail tool in Sakai 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. If your message or question is not private in nature, you should instead use the discussion forum.

Activities and Assessments

The class sessions will include in-class lessons, active learning questions, physiological simulation, in-class presentations, and discussions of classic primary literature.

LESSONS:

Most course "lecture" material will be posted online as pre-recorded, narrated lessons. You are responsible for reviewing these lessons.

ACTIVE LEARNING QUESTIONS:

On most class sessions you will be asked to work with your classmates to answer questions, which may include solving 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.

SIMULATION RESEARCH REPORTS AND PEER REVIEW

You will submit five simulation research reports. These will be based on the material and concepts in the simulation tutorials and will require you to investigate a physiological problem or phenomenon by designing and conducting an experiment using the simulation software.

Brainstorming Sessions. During five of the discussion meetings, you will have the opportunity to brainstorm with your classmates on how to design and conduct the simulation experiment, and how to collect and analyze the data. Your Graduate TA will be available during these brainstorming sessions to provide guidance and feedback. Participation in these sessions is optional, but regardless of whether you participate in the brainstorming sessions, you must write your own reports.

Report Formatting. Your report must adhere to the style and formatting guidelines contained in the detailed "Simulation Research Report Instructions" document, which you can access from the course Home Page. Reports that are not formatted correctly will receive a score of zero.

Report Peer Review. Each report will be evaluate using a peer review process. Upon submitting your report, you will complete a calibration assignment designed to train you to evaluate reports. Following successful completion of this training, you will review three of your peers' reports and assign scores based on an established rubric. Next, you will complete a self-assessment of the report you submitted. These steps will be completed sequentially.

Once all the reviews are done, you will receive your report score and you will be able to see the reviews submitted by the two other reviews of the submissions you reviewed, giving you a better sense of how good your evaluations were. Your score will be based on the points you earn in four categories:

1) **Peer Review Training** - the score you earned during your training in conducting reviews.
2) **Report Rating** - the score your peers assigned to the research report you submitted. Note that the scores are weighted and averaged according to the accuracy of training calibration for each peer reviewer.
3) **Peer Review Accuracy** – a score based on a comparison of the scores you assigned to the reports you reviewed with the scores assigned by the other reviewers who evaluated the same reports.
4) **Peer Review Self-Assessment** – a self-assessment score of your own report and comparison of the score you gave your own report with those given by the reviewers who evaluated your report.

A strict timeline will be adhered to for simulation report assignments and calibrated peer review processes. Late reports will not be accepted and failure to submit a report will disqualify you from participating in the subsequent calibration training, peer review, and self-assessment assignments, resulting in an overall score of zero for all categories associated with that report assignment.

RESEARCH PAPER DISCUSSIONS:

Throughout the semester the Discussion Groups will read and discuss classic physiology research papers. In each session you will either be a discussion leader or a discussion participant. The research papers will be released two weeks prior to the date the paper will be presented and discussed in class, in order to allow all students equal preparation time.

Discussion Participant Role. You are expected to read and analyze the assigned research papers before attending the associated discussion meetings. You will receive participation points reflecting the quality and extent of your participation in the discussion.

Pre-discussion Homework. You must complete the pre-discussion homework in order to attend the associated discussion session. Failure to complete the pre-discussion homework will result in the loss of all points associated with the discussion for that week.

Discussion Leader Role. Twice during the semester, you will be part of a group that will lead the research paper discussion. You will use the paper to teach related physiological principles to your peers and lead a discussion of the methods, results and conclusions of the paper. A rubric for the assignment will be provided on the course Sakai site. Students will work in groups of four or five to understand the paper and prepare for the presentation. Every student in the group is expected to understand and be able to explain, teach, and discuss all parts of the paper (i.e. students will not distribute parts of the paper and concepts among the group members.) At the beginning of the class period for each presentation day, a lottery will be used to assign each group member one figure from the paper and/or one physiological concept associated with the paper. Each group member will be given 8 minutes to explain the figure and concept. The group will then lead a discussion related to the paper in the remaining time. Presenting twice during the semester will provide you with an opportunity to gain feedback aimed at enhancing your second performance. Because of this, presentations will be weighted such that the second presentation is worth more (i.e. Presentation 2 will be worth 50% more points than Presentation 1).

Discussion Leader Deadlines. You must sign up for your two presentation dates and topics during the first class meeting. When you are a discussion leader, your group must meet with the Graduate TA no less than one week prior to your presentation date to discuss the assigned paper and presentation plan. You are responsible for contacting the TA to set up this required meeting. Each discussion leader must contact the TA no less than 10 days prior to the scheduled discussion in order to schedule this meeting. Failure to

arrange this meeting on time and to meet with the Graduate TA on time may cause you to forfeit your discussion opportunity (and the points associated with it).

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 30 questions, will be administered during a normal lecture session (50 minutes in duration), and will be worth 200 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 consist of approximately 50 questions, will be administered during the final exam period (2 hours duration), and will be worth 300 points. Both exams are closed-book and you may not use notes, but you will be expected to utilize the physiology simulation software to answer some of the questions.

Grading

ASSESSMENTS

Assessment Type	Quantity	Point Value	Subtotal
Active Learning Questions	100	1	100
Simulation Tutorials	10	10	100
Simulation Research Reports	5	30	150
Pre-Discussion Homework	5	5	25
Discussion Participation	5	10	50
Discussion Leader Presentation 1	1	30	30
Discussion Leader Presentation 2	1	45	45
Midterm Exam	1	200	200
Final Exam	1	300	300
Total			1000

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 to 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.

Your Responsibilities

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.

SCHEDULE AND SYLLABUS CHANGES

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 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 Sakai site (much of the course material is copyrighted).

You are required to bring a laptop, tablet computer or smartphone 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 may be considered 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)

Week #	Week of	Lecture Topic	Simulation Tutorial[1]	Discussion Activity	Textbook Pages
1	Jan 06[2]	Life and Cells		No Discussion Meeting	2-15
2	Jan 13	Transport and Energetics	Sim 1. Membrane Potential (Fri 1/24)	Intro to Research Papers; Exper Design and Stats	16-41
3	Jan 20[3]	Nerves, Muscles and Work	Sim 2. Synapses (Fri 1/31)	No Discussion Meeting	42-77
4	Jan 27	ANS and CNS	Sim 3. Homeostasis 1 (Fri 2/7)	Brainstorming 1: Membrane Potential	78-87, 312-313, 326-333
5	Feb 03	Senses	Sim 4. Internal Receptors (Fri 2/14)	Group Presentation 1: Membrane Potential	314-325, 344-377
6	Feb 10	Hormone Signaling	Sim 5. Endocrine Control of Glucose (Fri 2/21)	Brainstorming 2: Fight or Flight	268-281
7	Feb 17	The Endocrine System		Group Presentation 2: Synapses	282-311
8	Feb 24	The Immune System		No Discussion Meeting	94-101
Midterm, **Friday** Feb 28 (normal lecture time and location)					
Spring Break Mar 01-08 March					
9	Mar 10	Blood, Gas Exchange	Sim 6. Gas Exchange (Fri 3/21)	Brainstorming 3: Gas Exchange	88-93, 102-131
10	Mar 17	Respiratory Control and Acid-Base	Sim 7. Ventilation (Fri 3/28)	Group Presentation 3: Endocrine Control	132-147
11	Mar 24	Kidneys, Salt and Water Balance	Sim 8. Renal Function (Fri 4/4)	Brainstorming 4: Renal Function	148-187
12	Mar 31	Cardiovascular Function	Sim 9. Cardiac Output (Fri 4/11)	Group Presentation 4: Renal Function	188-201, 204-209
13	Apr 07	Cardiovascular Regulation	Sim 10. Homeostasis 2 (Fri 4/18)	Brainstorming 5: Hemorrhage	210-223
14	Apr 14	Nutrition and Digestion		Group Presentation 5: Cardiovascular Regulation	228-267
15	Apr 21[4]	Thermoregulation		No Discussion Meeting	224-227
Final exam, **Thursday** May 01, 3:00-5:00 p.m. in the **CSE Testing Area**[5]					

1. Simulation tutorials are due at 6 p.m. on the date indicated in parentheses.
2. No class meeting on January 6, and no discussion meetings first week
3. January 20 is a holiday (Martin Luther King Jr. Day).
4. Last day of classes is April 23, Reading Days are April 24-25.
5. Final exam schedule code 1D.