USC School of Pharmacy

Pharmacy Undergraduate Programs

Fall 2022: BPSI 405: Organ Systems Physiology, Drug Delivery, and Drug Action

Instructor

Curtis T. Okamoto, Ph.D.

Course Weight:
4 Units: 2 x 1 hr. 20 min. sessions per week

Day/Time/Location:
Tuesday/Thursday, 3:30 PM to 4:50 PM in LVL13 (Leavey Library)

Introduction: An understanding of the physiology of organ systems underlies the understanding of drug action and drug delivery routes and is a cornerstone of the field of biopharmaceutics. This course will integrate the basics of anatomy, cell and organ physiology, the mechanism of action of a number of widely prescribed drug, all discussed in the context of these organ systems. These principles and concepts will be reinforced through the discussion of 4 major organ systems: cardiovascular, gastrointestinal, renal, and respiratory (neurophysiology, other than cellular, endocrine, and reproductive physiology, covered in the context of these major organ systems will otherwise not be covered). The course will, throughout, attempt to integrate fundamental cellular physiology and anatomical principles with organ system function, as well as considering how the activities of these multi-organ functions are integrated.

Student Learning Outcomes: This course is designed for upper-level undergraduate and early graduate students who are interested in organ physiology, therapeutics, and drug delivery. USC students who are pursuing a career in health or whi are biological science majors, such as pharmacy or medical professions, would be the most appropriate target audience. In addition, this course would be of interest for early-stage Master students in health/biological sciences.

Upon successful completion of this course, the student should be able to demonstrate a working knowledge of:
1. Basic principles in cell physiology: ion and water transport, muscle contraction, hormone action (mainly short-term activities of signal transductions pathways).
2. Basic physiology of the following organ systems: cardiovascular, gastrointestinal, renal, and respiratory, and how these organ systems may integrate their activities/
3. The mechanism of action of the most popular, therapeutically relevant drugs acting on these organ systems

Grading and Evaluation
V. Grading

Each quiz will be designed to last 10 min. Each midterm, 60 min.; final exam, 120 min. (explained below).

a. Breakdown of Grade

Assignment	% of Grade	Points each
Midterm exam	25%	50
Midterm exam	25%	50
Quizzes	20%	10 each/40 total
Final exam	30%	60
Extra credit essay		5
TOTAL	**100%**	

b. Grading Scale (approximate)

93% to 100%: A	79% to 81%: B-	65% to 67%: D+
90% to 92%: A-	76% to 78%: C+	62% to 64%: D
87% to 89%: B+	71% to 75%: C	55% to 61%: D-
82% to 86%: B	68% to 70%: C-	0% to 54%: F

Course Readings

Required Readings
Course Readings
• Cellular Physiology and Neurophysiology, 2nd ed. 2019. Mordecai P. Blaustein, Joseph P. Y. Kao, and Donald Matteson. ISBN: 9780323057097 (available online, Norris Medical Library, and
• Physiology, 6th ed. Linda S. Costanzo. 2018. ISBN: 978-0-323-47881-6 (available online, Norris Medical Library, and Elsevier ClinicalKey)

Supplemental Readings:

• Goodman & Gilman's: The Pharmacological Basis of Therapeutics, 13e. 2018. Laurence L. Brunton, Randa Hilal-Dandan, and Björn C. Knollmann. ISBN 978-1-25-958473-2 (available online, Norris Medical Library, and Access Medicine)

• Applied Biopharmaceutics & Pharmacokinetics. 2016. Leon Shargel, and Andrew B.C. Yu. ISBN 0-07-182964-4 (available online, Norris Medical Library, and Access Pharmacy)

Content Warning

Our course readings and classroom discussions may focus on mature, difficult, and potentially challenging topics. As with any course dealing with pharmacology and physiology, course topics can at times be political and personal. Readings and discussions might trigger strong feelings—anger, discomfort, anxiety, confusion, excitement, humor, and even boredom.

Some of us will have emotional responses to the readings; some of us will have emotional responses to our peers' understanding of the readings; all of us should feel responsible for creating a space that is both intellectually rigorous and respectful. Above all, please be respectful (even when you strongly disagree) and be mindful of the ways that our identities position us in the classroom.

Course Outline and Schedule

This course will be in the format of a directed lecture under the guidance of the instructor for the specific session. During each weekly session the instructor will engage the students with questions and draw comments or interpretations primarily based on the coverage of the slide sets. Students are expected to ask questions and participate in an interactive fashion.

There are **no plans for make-up exams or quizzes**. If exceptional circumstances prevent you from attending an exam, your reason for missing it must be accompanied by a written statement from a third party (e.g., a note from a medical doctor), as per USC policy.

Notes, books, calculators, electronic dictionaries, regular dictionaries, cell phones, or any other aids are not allowed during exams. There will be more explicit instructions regarding the administration of online quizzes and exams forthcoming.

There will be 5 quizzes, 2 mid-term examinations and 1 final examination for this course. A score of one of the quizzes with the lowest outcome will be automatically dropped and not be included in the calculations of the final grade. The questions for quizzes and exams will primarily be based on the lecture content and readings from textbooks. The quizzes (10 points each), midterms (50 points each), and the final exam (60 points) will include multiple-choice questions (1-2 points each), fill-in-the-blank questions (1-2 points each), and short essay questions (1-2 points to 5-10 points each).

Attendance at all classes is expected, and may also be considered when assigning final grades. Participation will include asking and answering questions and being actively involved in the discussion of topics that are presented. It is expected that the students read the assigned papers and book chapters prior to the lecture and be prepared to discuss background, current understanding, treatments, and gaps in knowledge for the topic in each lecture.

Week & Date	Topic	Subtopics to be Included	Assigned and Supplemental Reading
Week 1 Aug. 23, Aug. 25	Introduction Cell physiology—solute and water transport	Introduction to the principles of membrane transport and electrophysiology. Introduction to the principles of intracellular signaling pathways	Mordecai, Ch. 1-13 Costanzo, Ch. 1-3 G&G, Ch. 3, 5
Week 2 Aug. 30, Sept. 1	Cell physiology—solute and water transport Electrophysiology	Introduction to the principles of membrane transport and electrophysiology. Introduction to the principles of intracellular signaling pathways	Mordecai, Ch. 1-13 Costanzo, Ch. 1-3 G&G, Ch. 3, 5
Week 3 Sept. 6, Sept. 8	Muscle cell physiology	Introduction to the principles of muscle contraction: skeletal, cardiac, and smooth muscles	Mordecai, Ch.14-16 Costanzo, Ch. 1-4
Week 4 Sept. 13, Sept. 15	Quiz 1 Autonomic nervous system	Introduction to the principles of hormone-receptor signaling and of drug action Overview of the autonomic nervous system	Costanzo, Ch. 1-3 G&G, Ch. 3 Costanzo, Ch. 2
Week 5 Sept. 20, Sept. 22	Quiz 2 Cardiovascular physiology	Overview of circulation and cardiac function; Overview of the regulation of the heart action and vasculature	Costanzo, Ch. 4
Week 6 Sept. 27, Sept. 29	Quiz 3 Cardiovascular physiology	Overview of circulation and cardiac function; Overview of the regulation of the heart action and vasculature	Costanzo, Ch. 4
Week 7 Oct. 4, Oct. 6	Midterm 1; Gastrointestinal physiology	Functional anatomy and general principles of regulation in the gastrointestinal tract; integrated response to a meal	Costanzo, Ch. 8
Week 8 Oct. 11	Quiz 4 Gastrointestinal physiology	Functional anatomy and general principles of regulation in the gastrointestinal tract; integrated response to a meal	Costanzo, Ch. 8
Fall Recess – October 13th & 14th. No class on Thursday, October 13, 2022			
Week 9 Oct. 20	Renal physiology	Elements of renal function, solute and water	Costanzo, Ch. 6, 7

		transport along the nephron: tubular function	
Week 10 Oct. 25, Oct. 27	Renal physiology	Control of body fluid osmolality and volume; diuretics, antihypertensives	Costanzo, Ch. 6, 7
Week 11 Nov. 1, Nov. 3	Quiz 5 Renal physiology	Control of electrolyte & pH balance	Costanzo, Ch. 6, 7
Week 12 Nov. 8, Nov. 10	Midterm 2; Respiratory physiology	Structure and function of the respiratory system, mechanical properties of the lung and chest wall	Costanzo, Ch. 5
Week 13 Nov. 15, Nov. 17	Respiratory physiology	Structure and function of the respiratory system, mechanical properties of the lung and chest wall	Costanzo, Ch. 5
Week 14 Nov. 22	Thanksgiving Holiday—No class		
	November 24, 2022	Thanksgiving Recess November 23 through November 26. **No class on Wednesday, November 24, 2022**	
Week 15 Nov. 29, Dec. 1	No class, or, maybe, as needed?		
Final Exam, Tuesday, December 13, 2022 from 2 to 4 PM in LVL13			

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on Research and Scholarship Misconduct.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted

documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
osas.usc.edu
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
ombuds.usc.edu
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

*Occupational Therapy Faculty Practice - (323) 442-33*40 or otfp@med.usc.edu
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Supplement: Zoom and Blackboard

Zoom

Zoom is a videoconferencing application that enables audio and video conferencing between multiple users on both desktop computers and mobile devices. It can allow faculty to host class lectures, discussions, share screens andfiles, and chat with students using a PC, tablet, or even a cell phone equipped witha camera. Zoom is available to all faculty and students at no cost.

- Instructors may host live class sessions on Zoom at the same day and timeas their regular class.
- Instructors are required to record all Zoom lectures and discussions for ADA (Americans with Disabilities Act) compliance, but also to accommodate students who may not be able to keep to the original classschedule.

Links to the recordings of lectures will be posted and organized in Blackboard assoon as they are available.

1. Getting Started with Zoom:
    - You might be required to use Zoom in this course, please familiarize yourself with it by thoroughly reading all of the materials and the step-by-step instructions.
    - You will access the Zoom meeting space in one of two ways:
        1. Log in via blackboard after you have followed the instructions to initially download, install, and login. Then enter the meeting by going to the link ***USC Zoom Meetings*** in the left-hand navigation pane. You will need to click the "Join" button next to the classroomfor the time set for the meeting.
        2. Copy and paste the URL (or click on the web link) provided by yourinstructor at the time specified for the meeting. Launch the app (after initially downloading, installing, and logging in), and you will enter the meeting immediately.
    - You may choose to use Zoom on your mobile device (phone or tablet).
2. Things to Know About Zoom:
    - Because you sign in using your USC information, you have your ownprofile in Zoom.
    - Attendance and participation can be tracked using your USC profile.
    - You can find the privacy and accessibility policies for Zoom by clicking onthe Learner Support tab in the left-hand navigation pane of your Blackboard course.

Blackboard

Blackboard is the University's Learning Management System (LMS) used by instructors across campus to distribute course materials, communicate with students in discussion boards, and to collect and assess student work through assignments, quizzes, and tests. A Blackboard course is created for every course at USC and should be the primary tool used for classroom management and communication.

Visit https://blackboardhelp.usc.edu to learn more about the various functions of Blackboard.