

MCB 401: Cell and Membrane Physiology
Fall 2019

Course Moodle page: <https://learn.illinois.edu/course/view.php?id=37857>

Course Outline and Objectives: The main objective of this course is to provide you with a substantial introduction to the basic principles of cellular physiology. The content will focus on the cellular and molecular bases of physiological processes including cellular homeostasis, signal transduction, water transport, membrane potentials, cellular excitability, synaptic transmission and plasticity, and neuromuscular function. After you complete this course, you will be more knowledgeable about the underlying mechanisms of fundamental physiological processes, and will have learned how to read and assess works in the scientific research literature. This course is appropriate for senior undergraduate and graduate students.

Class hours: Monday, Wednesday, Friday 1:00-1:50 PM

Classroom: Engineering Hall 106B8

Instructor:

Dr. Catherine Christian

cathchri@illinois.edu

Office: 523 Medical Sciences Building

Office hours: Friday 10:30 – 11:30 AM

TA: Daphne Eagleman, daphnee2@illinois.edu

Office hours by appointment

Please come and speak with us during office hours if you have a question or concern about the class. If the designated office hour times do not work in your schedule, please email to schedule an alternative appointment time.

Prerequisite: MCB 252 (Cells Tissues & Development) or permission of instructor

Main Textbook:

Medical Physiology, 3rd ed., Boron and Boulpaep, Elsevier ISBN 9781455743773

Note: An online version of this book is freely available through the UIUC library.

Supplemental reading materials will be provided on the lab Moodle site as needed.

Powerpoint slides will be available on the Moodle site before each class.

Journal Club:

Selected papers from the literature will form the basis for our Journal Club. These papers and associated questionnaires will be provided on the course Moodle site at least 2 weeks before the designated class. For each session, you are expected to come to class having read the assigned paper and completed the written questionnaire.

You are encouraged to consult with each other to discuss the papers as part of your preparation of the assignment. However, **you must compose your answers to the questionnaire independently**; any written work that indicates copying or plagiarism will be treated as an academic violation. All written assignments must be uploaded to Moodle prior to the beginning of class on the day of discussion. Each questionnaire will be worth 10 points. No credit will be given for questionnaires that are not submitted by the start of the designated class.

On the days in the schedule designated for Journal Club, we will have a general class discussion of the papers. As part of the discussion, we will incorporate group activities and iClicker questions. Participation will be worth 5 points for each Journal Club.

Policies:

Academic Integrity: All students are expected to adhere to the Student Code guidelines on Academic Integrity, found at http://studentcode.illinois.edu/article1_part4_1-401.html. Cheating and plagiarism of any form will not be tolerated. Examples of infractions, and the procedures for addressing suspected violations, may be found at <http://www.las.illinois.edu/students/integrity/>.

Phones and Laptops/Tablets: Turn off all cell phones before class begins. If your phone rings, you must silence it immediately without answering. If this happens more than once, you may be asked to leave class for the day.

You may use a laptop or tablet for taking notes with all sounds muted. Any use of computers or devices that is disruptive to the learning of your fellow students will not be tolerated and may be grounds for removal from the class. Use of laptops, tablets, calculators, or other electronic devices during quizzes or exams is strictly prohibited.

Any behaviors disruptive to the class that are not addressed upon request from the instructors will not be tolerated, and you may be asked to leave class for the day.

Class cancellation: If a class time is cancelled due to an unforeseen circumstance (e.g., campus closure, severe illness of instructor), we will make up that time by replacement of the exam review sessions. If this occurs, an updated schedule will be posted to the course website.

Exams and Grading:

There will be 4 exams, 4 quizzes, and 4 Journal Clubs. All exams and quizzes will be taken during regular class hours (except for Exam 4, which will be taken during the Final Exam period). Each exam will have 25 questions. Quizzes will each consist of 10 multiple choice or fill-in-the-blank questions, and will be taken in the first 15 min of the designated class session. Your scores will be available for review on the MCB 401 Gradebook within the course Moodle website.

Exams 1-4	100 points (25 points each)
Quizzes 1-4	40 points (10 points each)
Journal Clubs 1-4 written	40 points (10 points each)
Journal Clubs 1-4 discussion	20 points (5 points each)

Total **200 points**

Minimum points for each letter grade:

A+ = 196; A = 184; A- = 180; B+ = 176; B = 164; B- = 160; C+ = 156; C = 144; C- = 140; D+ = 136; D = 124; D- = 120; F < 120

Depending on overall class performance, the minimum values required for each final grade may be lowered across the scale at the sole discretion of the instructors. No requests for changes to final grades will be granted, and extraneous requests for extra credit opportunities will not be entertained.

iClicker questions will be used during lectures to assess how well you are learning and integrating key concepts as the course progresses. Up to 10 points in extra credit will be awarded. Half of this credit will be awarded based on the percentage of questions that are answered (whether or not the answer is correct), and the remaining half will be awarded proportional to the percentage of questions answered correctly. iClicker

questions may refer to material covered in recent lectures; therefore, you should try to stay as up to date with the material as possible. Participation in-class **group activities** will be incorporated into this credit calculation as the equivalent of a certain number of correct iClicker questions (exact values will be given for each activity). **You must register your iClicker in Moodle by the end of the first week of class.**

Attendance Policy:

Credit is not given in this class for attendance only. However, by attending you can participate in the iClicker questions as well as the discussions for the Journal Clubs, both of which earn credit.

Missed Exams/Quizzes and Scheduling Conflicts:

Make-up exams or quizzes will be scheduled only for students who have a documented excuse or written evidence of the conflict. Note that a scheduling conflict consists of an expected inability to be present in class at the scheduled exam/quiz time due to justified travel and/or a required academic activity that is scheduled at the same time. Alternative times will **not** be arranged just because you have exams in other classes on the same day. Conflict exams/quizzes can only be taken before the regularly scheduled date.

As soon as you are aware of an unavoidable scheduling conflict with an exam or quiz time, you must fill out an **online MCB 401 exam conflict request form** (available on the course Moodle website) and email Prof. Christian. Note that as time gets closer to the exam/quiz day, it may become impossible to arrange for an alternative exam/quiz time. If an alternative time cannot be arranged, you must submit an MCB 401 absence report form (see below) which may or may not be accepted as a justified excuse.

In the case of extreme illness or other severe unforeseen circumstance on an exam or quiz day, proof of the illness (i.e., a doctor's note) and/or written evidence of a documented excuse must be provided, and you must complete an **online MCB 401 absence report form** (available on Moodle). If you have a concern about confidentiality, you may provide the written documentation to the Dean of Students rather than to Prof. Christian. However, please note that in our experience, the Dean of Students typically refers these decisions to the course professor, who will need at least some form of documentation to make an informed decision.

There will not be make-up assignments available for missed Journal Club discussions. If you are unable to attend class on a Journal Club day, and would like your final grade to be pro-rated to include only 3 Journal Club discussions, you must submit the MCB 401 conflict or absence report form and provide Prof. Christian with evidence of the scheduling conflict or documented illness or excuse as described above. Note that a pro-rated recalculation will only be performed for **one** Journal Club discussion. If you miss more than one discussion day, you will receive 0 points for missed discussions.

Disability Access Statement:

We are committed to providing a learning environment where all students can succeed. If you require special accommodations, please contact Prof. Christian and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-4603, or email disability@illinois.edu. We will try to meet all accommodations once the process has started. Please note accommodations begin the day you contact Prof. Christian with a current letter of accommodation from DRES and are not retroactive to the beginning of the semester.

Schedule – MCB 401 Cell and Membrane Physiology, Fall 2019
(designated pages from Boron and Boulpaep, “Medical Physiology” 3rd ed.)

M Aug 26 Course/Syllabus Overview

Membrane Structure, Signal Transduction, and Solute/Water Transport

W Aug 28 Structure of Biological Membranes, Function of Membrane Proteins (Ch 2, pg. 8-19)

F Aug 30 Cellular Communication & Signal Transduction: Part 1 (Ch 3, pg. 47-56)

M Sep 3 NO CLASS (Labor Day)

W Sep 4 Cellular Communication & Signal Transduction: Part 2 (Ch 3, pg. 56-62, 66-68, 70-72)

F Sep 6 Solute Transport Across Cell Membranes: Part 1 (Ch 5, pg. 105-108)

M Sep 9 Solute Transport Across Cell Membranes: Part 2 (Ch 5, pg. 108-117, 120-125)

W Sep 11 **Quiz 1** Regulation of Intracellular Ion Concentrations (Ch 5, pg. 125-127)

Quiz 1 covers Aug 30-Sep 9

F Sep 13 Water Transport and Regulation of Cell Volume (Ch 5, pg. 127-132)

M Sep 16 Transport of Solutes and Water Across Epithelia (Ch 2, pg. 43-46; Ch 5, pg. 136-140)

W Sep 18 **Journal Club 1**

F Sep 20 review

M Sep 23 **Exam 1**

Membrane Bioelectricity, Action Potentials, and Ion Channel Physiology

W Sep 25 Ionic Basis of Membrane Potentials: Part 1 (Ch 6, pg. 141-146)

F Sep 27 Ionic Basis of Membrane Potentials: Part 2 (Ch 6, pg. 146-149)

M Sep 30 Electrical Properties of Cell Membranes (Ch 6, pg. 149-152)

W Oct 2 Patch Clamp Electrophysiology and Single Channel Recordings (Ch 6, pg. 152-157)

F Oct 4 **Quiz 2** Action Potentials: Part 1 (Ch 7, pg. 173-177)

Quiz 2 covers Sep 25-Oct 2

M Oct 7 Action Potentials: Part 2 (Ch 7, pg. 177-182, 199-203)

W Oct 9 Classification of Voltage-Gated Ion Channels (Ch 6, pg. 157-165; Ch 7, pg. 182-186)

F Oct 11 Voltage-Gated Ion Channel Physiology and Pharmacology (Ch 7, pg. 186-199)

M Oct 14 **Journal Club 2**

W Oct 16 review

F Oct 18 **Exam 2**

Neuromuscular Transmission and Muscle Physiology

M Oct 21 Synaptic Transmission; Neuromuscular Junction: Part 1 (Ch 8, pg. 204-212)

W Oct 23 Neuromuscular Junction: Part 2 (Ch 8, pg. 212-217)

F Oct 25 Synaptic Vesicle Release and NMJ Pharmacology (Ch 8, pg. 217-227)

M Oct 28 **Quiz 3** Cellular Physiology of Muscle: Skeletal (Ch 9, pg. 228-234)

Quiz 3 covers Oct 21-25

W Oct 30 Cellular Physiology of Muscle: Skeletal + Cardiac (Ch 9, pg. 234-238, 241-242)

F Nov 1 Cellular Physiology of Muscle: Smooth (Ch 9, pg. 242-249)

M Nov 4 **Journal Club 3**

W Nov 6 review

F Nov 8 **Exam 3**

Central Neurophysiology and Plasticity

M Nov 11 Neuronal Physiology: Part 1 (Ch 10, pg. 254-256, 258-260; Ch 12, pg. 295-300) (*online lecture*)

W Nov 13 Neuronal Physiology: Part 2 (Ch 12, pg. 300-306)

F Nov 15 Mechanisms of Bursting and Tonic Firing in Thalamocortical Neurons (readings on Moodle)

M Nov 18 **Quiz 4** Glial Cells (Ch 11, pg. 287-294)

Quiz 4 covers Nov 11-15

W Nov 20 Central Synaptic Transmission: Part 1 (Ch 13, pg. 307-311, 314, 318-320)

F Nov 22 Central Synaptic Transmission: Part 2 (Ch 13, pg. 323-328)

-----*Thanksgiving Break*-----

M Dec 2 Plasticity of Central Synapses (Ch 13, pg. 328-333)

W Dec 4 **Journal Club 4**

F Dec 6 Emerging Techniques for Manipulating Neuronal Physiology (readings on Moodle) (*online lecture*)

M Dec 9 NO CLASS

W Dec 11 review

Exam 4 – given during Final Exams: 8-8:50 AM, Thursday Dec 19