

Chemistry 655 / Biology 668
METABOLIC BIOCHEMISTRY OF HUMAN DISEASE
Course Syllabus – Fall 2024

Instructor: Dr. Caryn E. Outten
Dept: Chemistry & Biochemistry
Office: Palms Center for Grad. Sci. Res. 308
Office Hrs: T/Th 10-10:50 AM or by
appointment (best option)

Class Time: T/Th 8:30-9:45 AM
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Prerequisite: Grade of C or higher in CHEM 555/BIOL 545 or CHEM 550/BIOL 541

Undergraduate and Graduate Bulletin Description:

CHEM 655 / BIOL 668 (3). Core concepts of biochemistry as applied to human health and disease.

Instructional Delivery: This course will use an active learning or “flipped classroom” approach, which means that recorded lectures and other course materials providing fundamental background information on metabolic pathways will be posted on Blackboard (Bb) (25%), while the class period will be used for exploring real-world medical problems and cases related to the lecture material (75%). Recorded lectures and/or readings will be posted on Bb for students to view and digest before class. After viewing and/or reading these materials, students are required to perform an activity specified on Bb, such as taking a short quiz or completing a homework assignment. These activities must be completed BEFORE the accompanying lesson and will be graded for participation and accuracy. During class meetings, students will work through medical biochemistry case studies and solve problems together using iClickers and group discussion to understand the real-world applications of the lecture material. All powerpoint slides and other instructional materials used for in-class lessons will also be posted on Bb after the lesson begins.

Blackboard Site: This course is cross-listed as Chem 655 and Biol 668. To simplify distributing course materials, both courses are merged under the **CHEM655** Blackboard site. The **CHEM655** site will be used exclusively for posting lecture videos, online quizzes, class assignments, and other course materials. ALL students should be able to access this site to view and download course materials. These recordings as well as all other instructional materials (pre-recorded videos, PowerPoint presentations, case study handouts, study guides, exams, etc.) are the intellectual property of the faculty and they may not be shared or reproduced without the explicit written consent of the faculty member. Further, students may not share these materials with those not in the class or upload them to any other online environment. Doing so would be a breach of the UofSC Honor Code.

List of Course Materials posted on Blackboard:

- Recorded lectures (accessed on Vimeo via the link provided on Bb) and accompanying PowerPoint slides. The Notes section in these slides includes the script of the recording.
- Bb quizzes and pre-class assignments – these are posted in each lesson with an assigned due date & time.
- PowerPoint slides and handouts used for In-Class Case Studies – these will be posted on Bb at the start of the corresponding lesson.

- Study guides for Exams 1, 2, and 3. These study guides outline the important information covered in each lesson. Take note: I will often use some of these same questions for the short answer portion of the exams, so make sure you can answer them all.
- Additional readings/interesting articles related to a particular lesson. You will not be tested on the info provided in these materials – it is just for your own interest, if so desired.

REQUIRED Course Materials: iClicker+, iClicker 2, or iClicker Student App.

iClicker is a response system that allows students to respond to questions in class. Students are graded on in-class participation, so they need to bring iClicker remotes or iClicker-enabled mobile devices to every class period. Every student is required to have his/her own clicker or iClicker account. An iClicker remote and the iClicker app will not record your participation if you are not physically in class. Students must answer at least **75%** of the clicker questions in each class period to receive in-class participation credit



(regardless of whether or not the answers are correct). iClicker in-class activities will be used for credit starting on **Thursday, August 22, 2024**. Students must add this course to their iClicker student account or register their iClicker remote before that date.

iClicker Registration: To enroll in this class using the iClicker Student Mobile App, please use this **join link**: <https://join.iclicker.com/KOHG>. If you are using an iClicker remote, please check out this link for instructions to register your iClicker for this course: <https://mhe.my.site.com/iclicker/s/article/How-to-Register-a-Remote-in-the-iClicker-Student-App>. Once your iClicker remote is registered, you can enroll in this class with the **join link** listed above. iClicker Student account info: <https://www.iclicker.com/students/>.

Recommended (not Required) Textbook: *Marks' Basic Medical Biochemistry: A Clinical Approach*, Lieberman and Peet, 6th Edition (2022) Wolters Kluwer, Philadelphia, PA. This textbook is a useful resource but is not required for this course.

Excused Absences: Students must attend scheduled classes in person, unless otherwise specified. Students who miss classes due to COVID-19 quarantine, a diagnosed health condition, or registered disability should contact the [Office of Student Advocacy](#) or [Student Disability Resource Center](#) to document the reason for their absence. **ALL excused absences and accommodations for disabilities MUST have proper official documentation.** All absences due to documented illness/disability will be excused, and no grade penalty will be assessed for missing classes for this reason. Students with documented absences may be offered previously recorded classes and have the opportunity to reschedule exams at the instructor's discretion.

Exam Make-Up Policy: Students are required to notify the instructor by e-mail and/or phone prior to an exam if circumstances will prevent them from attending. In the case of accidents or illness, **a valid excuse is required** before you can take a makeup exam. In the event classes are officially cancelled on the day of an exam, the exam will be administered during the next regularly scheduled class period.

Disability Statement: Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class,

contact the [Student Disability Resource Center](#): 803-777-6142, email sadrc@mailbox.sc.edu, or stop by Close-Hipp, Suite 102. All accommodations must be approved through the Student Disability Resource Center.

Diversity and Inclusion: The university is committed to a campus environment that is inclusive, safe, and respectful for all persons, and one that fully embraces the Carolinian Creed. To that end, all course activities will be conducted in an atmosphere of friendly participation and interaction among colleagues, recognizing and appreciating the unique experiences, background, and point of view each student brings. You are expected at all times to treat others with dignity and respect.

Academic Integrity: You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and may result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation. Please be aware that it is a violation of the UofSC Honor Code to enter responses on any iClickers/Reef account other than your own (for example to give another student participation credit when they are absent).

Student Well-Being: Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the [Division of Student Affairs and Academic Support](#). If you are comfortable doing so, please notify me as the professor so that we can find resources that may be helpful. Students do not learn when they do not feel safe. If you feel unsafe on campus at any time in any place, please contact Police Dispatch at 803-777-4215 (in an emergency, please call 911) and reach out to the Division of Student Affairs and Academic Support. Again, if you are comfortable doing so, please notify me as the professor, and I will do my best to make appropriate accommodations. Students may experience situations or challenges that can interfere with learning and interpersonal functioning including stress, anxiety, depression, substance use, concern for a family/friend, or feelings of hopelessness. There are numerous campus resources available to students including [University Counseling & Psychiatry Service](#) and [University Student Health Services](#). Help is available 24/7. Students who need immediate help should call 803-777-5223. An outside resource is the National Suicide Prevention Lifeline (800-273-8255).

Hazardous Weather: In case of emergency class cancellations and/or closure of the university, any syllabus changes will be posted on Blackboard. Emergency closures are announced on the university's Carolina alert website: <http://carolinaalert.sc.edu/>

Chem 655/Biol 668 LESSON & EXAM SCHEDULE

Day	Date	Topic	Textbook
1	T, 8/20	Lesson 1: Course Overview & Medical Terminology	
2	TH, 8/22	Lesson 2: Fuel Metabolism	Chapters 1-3
	M, 8/26	Last day to drop/add without grade of "W"	
3	T, 8/27	Lesson 3: Daily Energy Expenditure & Caloric Balance	Chapter 1-3
4	TH, 8/29	Lesson 4: Carbohydrate Digestion and Absorption	Chapter 21
5	T, 9/3	Lesson 5: Glycolysis	Chapter 22
6	TH, 9/5	Lesson 6: Fructose/Galactose Metabolism	Chapter 22
7	T, 9/10	Lesson 7: Glycogen Metabolism	Chapter 26
8	TH, 9/12	Exam 1 (Lessons 1-7)	
9	T, 9/17	Lesson 8: Citric Acid Cycle	Chapter 23
10	TH, 9/19	Lesson 9: Oxidative Phosphorylation (ETC)	Chapter 24
11	T, 9/24	Lesson 10: Oxidative Phosphorylation (ATPase)	Chapter 24
12	TH, 9/26	Lesson 11: Oxygen Toxicity and Free Radical Injury	Chapter 25
13	T, 10/1	No class meeting: Review Lessons 8-11	
14	Th, 10/3	No class meeting: Group Project Preparation	
15	T, 10/8	Lesson 12: Pentose Phosphate Pathway	Chapter 27
16	TH, 10/10	Lesson 13: Gluconeogenesis	Chapter 28
17	T, 10/15	Lesson 14: Maintenance of Blood Glucose Levels	Chapter 19, 28
	TH, 10/17	Fall Break – no classes	
18	T, 10/22	Exam 2 (Lessons 8-14)	
19	TH, 10/24	Lesson 15: Glycoconjugates (via Zoom)	Chapter 27
20	T, 10/29	Lesson 16: Lipid Digestion and Absorption	Chapter 29
21	TH, 10/31	Lesson 17: Fatty Acid & Ketone Oxidation	Chapter 30
	T, 11/5	General Election Day – no classes	
	W, 11/6	Last day to drop without "WF" grade	
22	TH, 11/7	Lesson 18: Fatty Acid & Triglyceride Synthesis	Chapter 31
23	T, 11/12	Lesson 19: Hormone Regulation of Metabolism	Chapter 34
24	TH, 11/14	Lesson 20: Ethanol Metabolism	Chapter 33
25	T, 11/19	Lesson 21: Iron/Heme Metabolism	Chapter 42
26	TH, 11/21	Exam 3 (Lessons 15-21)	
	11/26-28	Thanksgiving Break – no classes	
27	T, 12/3	Group Presentations	
28	TH, 12/5	Group Presentations	
	S, 12/7	Reading Day	
	TH, 12/12	No final exam	

Learning Outcomes:

Upon successful completion of this course, **undergraduate students** will be able to:

- Describe human metabolic biochemistry at the molecular, cellular, organ, and whole body level.
- Identify the relevance and utility of biochemistry in the diagnosis and management of disease.
- Evaluate clinical symptoms and test results to construct a diagnosis and treatment for metabolic diseases or disorders.
- Develop and present a group project that describes a clinical case study on a specific metabolic disease/condition chosen by the group.

Upon successful completion of this course, **graduate students** will do all of the above and:

- Create a written report outlining the clinical symptoms, biochemical basis, prognosis, available cures/treatments, and prevalence of a specific metabolic disease/condition assigned by the instructor.

Course Points (all students):

Exam 1 (9/12):	100 pts
Exam 2 (10/22):	100 pts
Exam 3 (11/21):	100 pts
Bb quizzes/activities:	100 pts
iClicker participation:	100 pts
<u>Group Presentation:</u>	<u>100 pts</u>
Undergrad Total:	600 pts

Grading Scale

A	=	90–100%
B+	=	85–89.9%
B	=	80–84.9%
C+	=	75–79.9%
C	=	70–74.9%
D+	=	65–69.9%
D	=	60–64.9%
F	=	< 60%

Graduate Additional Points:

<u>Written Report</u>	<u>100 pts</u>
Grad total:	700 pts

The instructor may choose to lower the final grade cutoffs systematically at her discretion if the class average at the end of the semester is below 82.5%.

Exams: 3 exams @ 100 pts each. There will be 3 exams given in class on the dates specified in the syllabus. The format will include approximately 66 pts (2/3) of multiple choice, true-false, or matching questions, and approximately 33 pts (1/3) of short answer and essay questions.

Bb quizzes/activities: 23 quizzes/activities @ 5 pts each – drop three lowest grades = 100 pts. There will be 23 quizzes, surveys, or other homework activities assigned on Bb that are each worth 5 pts. The quizzes (8-10 questions each) each have a 20-min time limit and must be taken on-line by the specified due date & time. No credit will be given for quizzes/assignments submitted after the due date/time. The three lowest grades for these Bb quizzes/activities will be dropped to add up to 100 possible points. A quiz/assignment missed due to a documented illness will be counted towards the three dropped quiz grades.

iClicker participation/attendance: 22 lessons/class meetings @ 5 pts each – drop two lowest grades = 100 pts. Attendance will be taken for lessons 2-21 via iClicker and for the two presentation days. There are 22 total class meetings worth 5 pts each. The lowest grade will be dropped to add up to 100 possible points. Please note that all of the iClicker participation points can be obtained by simply participating in the in-class lessons. Students must answer at least 75% of the iClicker questions to receive full participation points for each lesson.

Detailed Course Lesson/Assignment Schedule (with Due Dates)

Lessons	Topic	Assignment/Activity (Online)	Assignment/Activity (Face-to-Face[F2F])	Due Date
Lesson 1: F2F Meeting on Tues 8/20	Course Overview & Medical Terminology	<ul style="list-style-type: none"> • Complete syllabus and medical terminology quiz on Bb 	<ul style="list-style-type: none"> • Review course format/expectations • Complete medical terminology worksheet • Answer clicker questions 	Tues 8/20
Lesson 2: F2F Meeting on Thurs 8/22	Fuel Metabolism	<ul style="list-style-type: none"> • Watch the Lesson 2 lecture video • Complete the Lesson 2 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 8/22
Lesson 3: F2F Meeting on Tues 8/27	Daily Energy Expenditure & Caloric Balance	<ul style="list-style-type: none"> • Watch the Lesson 3 lecture video • Track calories for at least 1 day using calorie counting app • Complete calorie counting survey on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tue 8/27
Lesson 4: F2F Meeting on Thurs 8/29	Carbohydrate Digestion and Absorption	<ul style="list-style-type: none"> • Watch the Lesson 4 lecture video • Complete the Lesson 4 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 8/29
Lesson 5: F2F Meeting on Tues 9/3	Glycolysis	<ul style="list-style-type: none"> • Watch the Lesson 5 lecture video • Complete the Lesson 5 lecture quiz 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 9/3
Lesson 6: F2F Meeting on Thurs 9/5	Fructose/ Galactose Metabolism	<ul style="list-style-type: none"> • Watch the Lesson 6 lecture video • Complete the Lesson 6 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 9/5
Lesson 7: F2F Meeting on Tues 9/10	Glycogen Metabolism	<ul style="list-style-type: none"> • Watch the Lesson 7 lecture video • Complete the course survey on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 9/10
Exam 1: F2F Meeting on Thurs 9/12	Lessons 1-7	<ul style="list-style-type: none"> • Study for Exam 1 	<ul style="list-style-type: none"> • Take Exam 1 	Thurs 9/12
Lesson 8: F2F Meeting on Tues 9/17	Pyruvate Dehydrogenase & TCA Cycle	<ul style="list-style-type: none"> • Watch the Lesson 8 lecture video • Complete the Lesson 8 pre-class assignment on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 9/17
Lesson 9: F2F Meeting on Thurs 9/19	Oxidative Phosphorylation (ETC)	<ul style="list-style-type: none"> • Watch the Lesson 9 lecture video • Complete the Lesson 9 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 9/19
Lesson 10: F2F Meeting on Tues 9/24	Oxidative Phosphorylation (ATPase)	<ul style="list-style-type: none"> • Watch the Lesson 10 lecture video • Complete the Lesson 10 pre-class assignment on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 9/24
Lesson 11: F2F Meeting on Thurs 9/26	Oxygen Toxicity and Free Radical Injury	<ul style="list-style-type: none"> • Watch the Lesson 11 lecture video • Complete the Lesson 11 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 9/26
Group Project: Topic & Work Plan No F2F Meeting	Group Project	<ul style="list-style-type: none"> • Submit topic and group work plan on Bb for approval 	<ul style="list-style-type: none"> • Meet with your assigned group members • Choose a presentation topic • Develop group work plan 	Thurs 10/3

Lesson 12: F2F Meeting on Tues 10/8	Pentose Phosphate Pathway	<ul style="list-style-type: none"> • Watch the Lesson 12 lecture video • Complete the Lesson 12 pre-class assignment on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 10/8
Lesson 13: F2F Meeting on Thurs 10/10	Gluconeogenesis	<ul style="list-style-type: none"> • Watch the Lesson 13 lecture video • Complete the Lesson 13 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 10/10
Lesson 14: F2F Meeting on Tues 10/15	Maintenance of Blood Glucose Levels	<ul style="list-style-type: none"> • Watch the Lesson 14 lecture video • Complete the Lesson 14 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 10/15
Exam 2: F2F Meeting on Tues 10/22	Lessons 8-14	<ul style="list-style-type: none"> • Study for Exam 2 	<ul style="list-style-type: none"> • Take Exam 2 	Tues 10/22
Lesson 15: F2F Meeting on Thurs 10/24	Glycoconjugates	<ul style="list-style-type: none"> • Watch the Lesson 15 lecture video • Complete the Lesson 15 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 10/24
Lesson 16: F2F Meeting on Tues 10/29	Lipid Digestion and Absorption	<ul style="list-style-type: none"> • Watch the Lesson 16 lecture video • Complete the Lesson 16 pre-class assignment on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 10/29
Lesson 17: F2F Meeting on Thurs 10/31	Fatty Acid & Ketone Oxidation	<ul style="list-style-type: none"> • Watch the Lesson 17 lecture video • Complete the Lesson 17 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 10/31
Lesson 18: F2F Meeting on Thurs 11/7	Fatty Acid & Triglyceride Synthesis	<ul style="list-style-type: none"> • Watch the Lesson 18 lecture video • Complete the Lesson 18 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 11/7
Lesson 19: F2F Meeting on Tues 11/12	Hormone Regulation of Metabolism	<ul style="list-style-type: none"> • Watch the Lesson 19 lecture video • Complete the Lesson 19 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 11/12
Lesson 20: F2F Meeting on Thurs 11/14	Ethanol Metabolism	<ul style="list-style-type: none"> • Watch the Lesson 20 lecture video • Complete the Lesson 20 pre-class assignment on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Thurs 11/14
Lesson 21: F2F Meeting on Tues 11/19	Iron/Heme Metabolism	<ul style="list-style-type: none"> • Watch the Lesson 21 lecture video • Complete the Lesson 21 lecture quiz on Bb 	<ul style="list-style-type: none"> • Participate in clicker case studies 	Tues 11/19
Exam 3: F2F Meeting on Thurs 11/21	Lessons 15-21	<ul style="list-style-type: none"> • Study for Exam 3 	<ul style="list-style-type: none"> • Take Exam 3 	Thurs 11/21
Group Presentations F2F Meetings 12/3 and 12/5	Group Projects		<ul style="list-style-type: none"> • Groups 1&2 present Tues 12/3 • Groups 3&4 present Thurs 12/5 • Peer review assigned group presentations on presentation day 	Tues 12/3- Thurs 12/5
Group Presentations Review Sun 12/8	Group Projects	<ul style="list-style-type: none"> • Fill out group presentation questionnaire on Bb 		Sun 12/8