

CHEM 3521 / CHEM 6501 - Biochemistry I
Fall 2023
Course Syllabus

COURSE MEETING TIME/PLACE

Time: Tuesdays/Thursdays (TR) 9:30 am - 10:45 am

Place: Gilbert Hillhouse Boggs Building B5

770 State St NW, Atlanta, GA 30313

Dates: Aug 21, 2023 - Dec 14, 2023

COURSE DESCRIPTION

This is a one-semester course in biochemistry where you will develop mastery in the nomenclature, structure, and function of the major classes of biomolecules (proteins, carbohydrates, lipids, and nucleic acids) associated with living organisms. You will also learn state-of-the-art practical techniques used in modern biochemistry research. The subject matter is intended to provide you with a foundational understanding of biochemistry concepts and practical experience with application of biochemistry in research and medicine. The course is also designed to prepare you for medical school, pharmacy school, dentistry school, and master/doctoral programs in biology, chemistry, bioengineering, biochemistry, and molecular biology. You will earn 3.0 credits from successful completion of this course. Learning objectives will be outlined at the start of each lecture. Lecture slides will be provided for each class (ideally before the lecture so you can take notes as needed).

Biochemistry can be overwhelming since it applies fundamental concepts from several disciplines (chemistry, biology, physics, genetics). In addition, the material contains a *lot* of nomenclature / memorization. Don't panic! Come to lectures (it is not required but is recommended for you to attend each lecture unless there is a compelling reason to miss), take notes, study often (not just before quizzes or exams), complete homework assignments, use the provided study guides, and use supplemental learning sources (i.e., the textbook). You might need to investigate different ways of studying (i.e., flash cards). We are always available to help you and we will provide resources to help you succeed. Make friends and study in groups when possible. We aim to make learning biochemistry interesting, practical, and fun to help hold your attention in the material.

PREREQUISITES

It is recommended that you have taken college-level Chemistry, Biology, and Organic Chemistry I courses previously. We will do our best to provide refreshers and summary material related to these subjects, such that everyone is on the same page for learning biochemistry. If you have concerns about your past experiences or past courses taken in relation to Biochemistry I, please talk to us.

INSTRUCTOR

Andrew McShan, Ph.D.

Pronouns: They/them

Assistant Professor

School of Chemistry and Biochemistry

E-mail: andrew.mcshan@chemistry.gatech.edu

Website: <http://mcshanlab.com/>

Office Location: Molecular Sciences and Engineering Building (MoSE) G022

901 Atlantic Dr NW, Atlanta, GA 30318

My office is located on the *ground floor* of MoSE

Office Hours: Thursday 11 am – 12 pm in MoSE G022

Meetings can be scheduled at different times upon e-mail request.

Virtual meetings may also be scheduled through Zoom upon e-mail request.

How to contact Dr. McShan:

Recommended contact via e-mail. I try to respond to e-mails within 24 hours of receipt but please be patient with me.

When sending an e-mail message, please use the following format in the subject line:

CHEM 3521 / CHEM 6501 – Your Name – Subject

Non-conforming e-mails are likely to be lost in my mailbox and may not receive a reply.

Teaching Assistants (TAs)

Uche Arunsi (he/him)

uarunsi3@gatech.edu

Office Hours: MoSE 2100F Wednesday 3 PM - 4 PM

Vahab Rajaei (he/him)

vrajaei3@gatech.edu

Office Hours: MoSE 1222 Tuesday 11 AM - 12 PM

Brie Lindgren (they/them)

blindgren6@gatech.edu

Office Hours: IBB 2316 Monday 12 PM - 1 PM

COURSE MATERIALS

We will use a digital textbook (freely available!) which is meant to guide and supplement the lectures.

The suggested textbook is:

Lehninger: Principles of Biochemistry, 7th Edition

By Nelson, Cox. ISBN:9781319230906

Free link to textbook:

https://mcshan.chemistry.gatech.edu/static/course_materials/Lehninger%20Principles%20of%20Biochemistry%2C%207th%20Edition.pdf

Required Software:

PyMOL (free educational version)

<https://pymol.org/2/>

Georgia Tech also offers PyMOL licenses through an OIT request here:

<https://software.oit.gatech.edu/request.php>

Note: if you have trouble getting a PyMOL license...no worries! You can use it without the license. Just click "skip activation" when PyMOL opens.

+ other webservers mentioned in the homework assignments.

CANVAS PAGE (COURSE WEBSITE)

Canvas will include lecture slides, homework assignments, quizzes, exams, study guides, and relevant course updates. Check often!

FINAL GRADES

A = 100 - 90%

B = 89.9 - 80%

C = 79.9 - 70%

D = 69.9 - 50%

F = < 50%

Assignments, quizzes, exams, and final grades *will not* be curved. Quizzes and exams will contain opportunities for extra credit.

Item	Total Number of Points	Percent of Final Grade (100%)
Final Exam	100	5%
Scheduled Exams	300	35%
Quizzes	600	30%
Homework	1500	30%

I. Homework – 1500 points, 30% of final grade

There will be fifteen (15) homework assignments given throughout the semester. Homework assignments will include a mix of “problem sets”, activities using freely available software (with detailed instructions for use!), and worksheet-like activities. Homework assignments will be uploaded to Canvas. You will also submit the homework assignment via Canvas. Please note that homework assignments are meant to serve as “participation points” rather than fully graded assignments. This means you could get an answer wrong and still get full points. That said, you still need to answer all questions with meaningful answers (not blank, not gibberish) and submit your answers for full points. Each homework assignment is worth 100 points each for a total of 1500 throughout the semester. Due dates for the homework will be noted on Canvas. Homework answer keys will be provided after the due date for the assignment. Please feel free to work in groups for homework assignments (just don't copy each other's answers). Homework assignments are not “busy work” but are part of your studying routine.

Please note: do not worry about doing problem sets from the *Lehninger* textbook. The questions you will see on exams come from those related to examples seen in study guides, lectures, homework assignments, or quizzes.

II. Scheduled Exams – 300 points, 35% of final grade

There will be a total of four (4) scheduled exams. Exams will be *in class* on specific days (see schedule). The exams are closed book and closed note. Exams will include a wide variety of question types: crossword puzzles, true/false, multiple choice, fill in the blank, and short answers. Each scheduled exam will be worth 100 points. The lowest scored exam grade of the four exams will be dropped. That means if you miss an exam for any reason, it will automatically become your drop grade. The total sum of the three remaining scores will comprise 35% of your course grade. I will distribute detailed *Study Guides*. The purpose of the study guide is to focus your studying for the exam. I will also prepare practice exam questions, which will be available for you to become familiar with the types of questions that will appear in the exams. The exams will only cover material if we discussed it in class or homework. Each exam will contain an opportunity for extra credit. Answer keys will be provided after the exam due date.

III. Quizzes – 600 points, 30% of final grade

There will be six (6) quizzes held during the semester to test your knowledge prior to exams. Each quiz will be given on Canvas (not in class; you can take it whenever on the day it opens) and will consist of ten (10) multiple-choice questions. Quizzes are open note and open book. However, the quizzes are closed to any internet help. You must take quizzes independently; you cannot share answers with anyone. Use of internet or sharing answers is a breach of academic integrity. Each Quiz is worth 100 points each for a total of 600 throughout the semester. Each quiz will contain an opportunity for extra credit. Answer keys will be provided after the quiz due date.

Practice Quiz and Practice Exams will be provided on Canvas; not for points. These are for you to practice your knowledge.

V. Final Exam – 5% of final grade

We will have a non-cumulative final exam for this course. The final exam *in class* on the final exam day (see schedule). The final exam will follow the format mentioned above for regular semester exams.

COURSE OUTLINE

Lecture	Date(s)	Topic(s)	Book Chapter (Lehninger)	Thing(s) to do* *Due dates on Canvas
1	Aug 22	Introduction / Foundations of Biochemistry	Chapter 1	Goal Setting and Reflection Survey (Canvas)
2	Aug 24	Foundations of Biochemistry	Chapter 1	HW 1 (Canvas) – Lecture 1-2
3	Aug 29	Water	Chapter 2	HW 2 (Canvas) – Lecture 3
4	Aug 31	Nucleotides & Nucleic Acids	Chapter 8	Quiz 1

				Covers Lecture 1 – 3 (Canvas)
5	Sept 5	Nucleotides & Nucleic Acids	Chapter 8	HW 3 (Canvas) – Lecture 4-5
6	Sept 7	Nucleic Acid Metabolism: DNA replication and DNA transcription	Chapter 25- 26	HW 4 (Canvas) – Lecture 6-7
7	Sept 12	Nucleic Acid Metabolism: mRNA translation	Chapter 27	Quiz 2 Covers Lecture 4 – 6 (Canvas)
-	Sept 14	Exam 1 Covers Lectures 1 – 7 (in class)	-	-
8	Sept 19	Nucleic Acid Based Technologies	Chapter 8	HW 5 (Canvas) – Lecture 8
9	Sept 21	Nucleic Acid Based Technologies	Chapter 9	HW 6 (Canvas) – Lecture 9
10	Sept 26	Carbohydrates and Glycobiology	Chapter 7	HW 7 (Canvas) – Lecture 10-11
11	Sept 28	Advanced Topics: Carbohydrate and Glycan Based Technologies	-	Quiz 3 (Canvas) Covers Lectures 7 - 10
-	Oct 3	Exam 2 Covers Lectures 8 - 11 (in class)	-	-
12	Oct 5	Amino Acids, Peptides, Proteins	Chapter 3	-
-	Oct 10	Fall Break – No Class		-
13	Oct 12	The Three-Dimensional Structure of Proteins	Chapter 4	HW 8 (Canvas) – Lecture 12-13
14	Oct 17	Working with proteins	Chapter 3	HW 9 (Canvas) – Lecture 14
15	Oct 19	Protein Folding	Chapter 4	Quiz 4 (Canvas) Covers Lectures 11 - 14
-	Oct 24	Exam 3 Covers Lectures 12 - 15 (Canvas)	-	-
16	Oct 26	Protein Function	Chapter 16	HW 10 (Canvas) – Lecture 15- 16
17	Oct 31	Advanced Topics: Protein Based Technologies	-	-
18	Nov 2	Enzymes	Chapter 6	HW 11 (Canvas) – Lecture 18
19	Nov 7	Enzymes	Chapter 6	HW 12 (Canvas) – Lecture 19
20	Nov 9	Lipids	Chapter 10	Quiz 5 (Canvas) Covers Lectures 16 - 19
-	Nov 14	Exam 4 Covers Lectures 16 - 19 (in class)	-	-
21	Nov 16	Advanced Topics: Lipid Based Technologies	-	HW 13 (Canvas) – Lecture 20- 21
22	Nov 21	Biological Membranes and Transport	Chapter 11	HW 14 (Canvas) – Lecture 22
-	Nov 23	Thanksgiving Break – No Class	-	-
23	Nov 28	Biochemical Signaling	Chapter 12	HW 15 (Canvas) – Lectures 23
24	Nov 30	Advanced Topics: Biochemistry in Modern Medicine	-	Quiz 6 (Canvas) Covers Lectures 20 - 23
25	Dec 5	Advanced Topics: Chemical Evolution and Origins of Life	-	-
-	Dec 11	Final Exam Covers Lectures 20 - 25 8 AM – 10:50 AM (In class)	-	-

STATEMENT OF INTENT FOR DIVERSITY, EQUITY, AND INCLUSIVITY

I am committed to creating a learning environment for students that supports a diversity of thoughts, perspectives and experiences that honors your cultural and social identities (including race, gender, class, sexuality, religion, or ability).

To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official Georgia Tech records, please let me know. If I pronounce your name wrong, please correct me (I want to do better).
- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to talk to me (if you feel comfortable doing so). I will do my best to point you in the direction to get help.
- If something was said by anyone in class (including me) that made you feel uncomfortable, please feel free to bring it up. Anonymous feedback is always an option (see: <https://www.gatech.edu/accountability>).

Finally, in an ideal world, science would be objective and inclusive. However, much of science is subjective and is historically built on a small subset of privileged voices. I acknowledge that the readings and content for this course were primarily authored in the main by cisgendered white men.

ACADEMIC INTEGRITY

All course content is subject to the Georgia Institute of Technology's academic honor code: <https://policylibrary.gatech.edu/student-affairs/academic-honor-code>. Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Any student suspected of cheating or plagiarizing an assignment or exam will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

The use of AI-powered language models (i.e., ChatGPT or related) is strictly prohibited in this course.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

If you are a student with disabilities that needs that require special accommodation, please contact me to discuss your needs. Also, contact the Office of Disability Services at (404) 894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your needs and to obtain an accommodation letter.

CAMPUS RESOURCES FOR LEARNING

In your time at Georgia Tech, you may find yourself in need of support academic or emotional support. I am always available to you. However, a summary of additional resources for Georgia Tech students is available at <https://catalog.gatech.edu/academics/academic-resources/> and <https://grad.gatech.edu/resources>.

CAMPUS RESOURCES FOR MENTAL HEALTH

The Center for Mental Health Care & Resources (<https://mentalhealth.gatech.edu/>) is here to offer confidential support and services to students in need of mental health care. During regular business hours, students who are not actively in counseling may **call 404-894-2575** or **walk-in to the office** located on the first floor, Suite 102B Smithgall Student Services Building, 353 Ferst DR NW Atlanta GA 30313 (Flag building next to the Student Center). Any time outside of business hours, students may **call 404-894-2575** and select the option to speak to the after-hours counselor.