CHEM 6501 - Biochemistry I
Spring 2024
Course Syllabus

COURSE MEETING TIME/PLACE
Time: Tuesdays/Thursdays (TR) 9:30 am - 10:45 am
Place: Molecular Science & Engineering Building 3201A
901 Atlantic Dr NW, Atlanta, GA 30332
Dates: Jan 8, 2024 – May 02, 2024

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, nucleic acids, carbohydrates, lipids) associated with living organisms. You will also learn state-of-the-art experimental techniques used in modern biochemistry research. The subject matter is intended to provide you with a foundational understanding of biochemistry core concepts as well as practical experience with application of biochemistry in research and medicine. The course is designed to prepare you for medical school, pharmacy school, dentistry school, and masters/doctoral programs in biology, chemistry, mechanical engineering, chemical engineering, 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 lecture (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 in addition to practical problem solving. Don't panic! Come to lectures, take notes, review material often, complete homework assignments, use the provided study guides, and use supplemental learning sources (i.e., the textbook, YouTube videos). You might need to investigate different ways of studying (*i.e.,* flash cards). I am always available to help you and we will provide resources to help you succeed. Make friends and study in groups when possible. I 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 courses previously. Note that these classes are not a strict prerequisite for CHEM 6501, but you may find yourself lost during some sections if you haven't taken them. I will do my 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 me. Most likely you will be fine.

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 near the G021 lecture hall*
Office Hours: Friday 10 – 11 am 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 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)

None for CHEM 6501

COURSE MATERIALS
We will use a digital textbook (freely available!) which is meant to guide and supplement the lectures. You don't actually need to use the textbook during the course, but it might be a helpful supplement for you.

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 – license file will be provided by Dr. McShan)
https://pymol.org/2/

Georgia Tech also offers PyMOL licenses through an OIT request here:
https://software.oit.gatech.edu/request.php

+ other webservers mentioned in the homework assignments.

CANVAS PAGE (COURSE WEBSITE)
Canvas will include lecture slides, homework assignments, take home 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 and grades *will not* be curved.

EVALUATION CRITERIA

Item	Total Number of Points * 100	Percent of Final Grade (100%)
Research Paper	100/100	25%
Take Home Exams	Average of 5 exams out of 100 each	30%
Attendance	28/28	15%
Homework	1500/1500	30%

Example final course grade assignment:

C	D	E	F	G
Assignment	**Grade**			**Final %**
Research Paper	92	25%	Research Paper	23.0
Exam 1	74	30%	Exam Average	26.8
Exam 2	99	15%	Attendance	13.9
Exam 3	82	30%	HW average	28.5
Exam 4	100			
Exam 5	92		Total Grade	92.2
Attendance	92.8571429			
HW average	95			

I. Homework – 1500/1500 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, and worksheet-like activities. Homework assignments will be uploaded to Canvas. You will also submit the homework assignment via Canvas. Homework assignments will be graded for accuracy and completeness. Each homework assignment is worth 100 points each for a total of 1500 throughout the semester. Homework will contribute to the final grade with the formula: 1500/1500 * 100 * 0.3. 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. On average, homework assignments should take no more than 1 hour to complete.

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, and homework assignments.

II. Take-Home Exams – Average of 100 points each, 30% of final grade

There will be a total off five (5) take-home exams. The exams are open book, open note, and open to internet help. You must work independently on the exam (*i.e.,* you cannot work with friends or classmates), and while the exams are open you cannot just copy answers from the textbook or internet. Exams will include a wide variety of question types: crossword puzzles, true/false, multiple choice, fill in the blank, and short answers. Each exam will be worth 100 points. All exams will comprise 30% of your course grade. Exams will contribute to the final grade with the formula: Exam Average * 100 * 0.3. I will distribute detailed *Study Guides*. The purpose of the study guide is to focus your studying for the exam. The exams will only cover material if we discussed it in class or the homework. Exams are due the next class after the lecture the exams are assigned. Answer keys will be provided after the exam due date. No exams will be dropped.

III. Attendance – 28/28 points, 15% of final grade

Lecture attendance is required for this course and will count towards your final grade. Each attended lecture is worth 1 point for a total of 28 points throughout the semester. Attendance will contribute to the final grade with the formula: 28/28 * 100 * 0.15. If you cannot attend class for any reason (for example, illness, conference, research related meeting, etc.), please e-mail me for an excused absence *before* that class. Each student is allowed two excused absences without effecting their attendance grade.

V. Research Paper – 100/100 points, 25% of final grade

A major daily task for biochemistry researchers is to understand how to understand a research paper. To gain experience with this, each student will be assigned a modern peer-reviewed Biochemistry paper from the literature focused on the study of a class of biomolecule (*i.e.,* nucleic acid, protein, lipid, carbohydrate). Your task will be to write a summary and analysis of the paper, including its research aims, methods, results, and major conclusions. You must work on the research paper individually (*i.e.,* not in groups). Detail instructions (word count, contents, format, citation style, etc) and a grading rubric will be provided for the Research Paper closer to the due date. The Research Paper will contribute to the final grade with the formula: 100/100 * 100 * 0.25. A few lectures at the end of semester will provide the opportunity to work on the paper in class with my help.

COURSE OUTLINE

Lecture	Date(s)	Topic(s)	Book Chapter (Lehninger)	Thing(s) to do* *Due dates on Canvas
	Jan 9	No class	No class	No Class
1	Jan 11	Introduction / Foundations of Biochemistry	Chapter 1	Goal Setting and Reflection Survey (Canvas)
2	Jan 16	Foundations of Biochemistry	Chapter 1	HW 1 (Canvas) – Lecture 1-2
3	Jan 18	Water	Chapter 2	HW 2 (Canvas) – Lecture 3
4	Jan 23	Amino Acids, Peptides, Proteins	Chapter 3	-
5	Jan 25	The Three-Dimensional Structure of Proteins	Chapter 4	HW 3 (Canvas) – Lecture 4-5
6	Jan 30	Working with proteins	Chapter 3	HW 4 (Canvas) – Lecture 6
7	Feb 1	Protein Folding	Chapter 4	Take Home Exam 1 Covers Lectures 1-6
8	Feb 6	Protein Function	Chapter 16	Post Exam-1 Survey (Canvas)
9	Feb 8	Protein Function	Chapter 16	HW 5 (Canvas) – Lectures 8-9
10	Feb 13	Advanced Topics: Protein Based Technologies (Protein Design)	-	HW 6 (Canvas) – Lecture 10
11	Feb 15	Enzymes	Chapter 6	-
12	Feb 20	Enzymes	Chapter 6	HW 7 (Canvas) – Lecture 11-12
13	Feb 22	Nucleotides & Nucleic Acids	Chapter 8	Take Home Exam 2 Covers Lectures 7-12
14	Feb 27	Nucleotides & Nucleic Acids	Chapter 8	HW 8 (Canvas) – Lecture 13-14
15	Feb 29	Nucleic Acid Metabolism: DNA replication and DNA transcription	Chapter 25-26	-
16	March 5	Nucleic Acid Metabolism: mRNA translation	Chapter 27	HW 9 (Canvas) – Lecture 15-16
17	March 7	Nucleic Acid Based Technologies	Chapter 8	Take Home Exam 3 Covers Lectures 13-16
18	March 12	Nucleic Acid Based Technologies	Chapter 9	HW 10 (Canvas) – Lecture 17
19	March 14	Carbohydrates and Glycobiology	Chapter 7	HW 11 (Canvas) – Lecture 18
-	March 19	Spring Break	-	-
-	March 21	Spring Break	-	-
20	March 26	Advanced Topics: Carbohydrate and Glycan Based Technologies	-	HW 12 (Canvas) – Lecture 19-20
21	March 28	Lipids	Chapter 10	Take Home Exam 4 Covers Lectures 17-20
22	April 2	Advanced Topics: Lipid Based Technologies	-	HW 13 (Canvas) – Lectures 21-22
23	April 4	Biological Membranes and Transport	Chapter 11	HW 14 (Canvas) – Lecture 23
24	April 9	Biochemical Signaling	Chapter 12	HW 15 (Canvas) – Lecture 24
25	April 11	Advanced Topics: Biochemistry in Modern Medicine	-	-
26	April 16	Advanced Topics: Chemical Evolution and Origins of Life	-	Take Home Exam 5 Covers Lectures 21-26
27	April 18	Work on Research Paper in class	-	-
28	April 23	Work on Research Paper in class	-	-
-	-	No final exam	-	-

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. I will attempt to highlight the critical contributions and voices in science beyond this.

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.

SPECIFIC RESOURCES

- Center for Academic Success http://success.gatech.edu
    - 1-to-1 tutoring https://tutoring.gatech.edu/tutoring/
    - Peer-Led Undergraduate Study (PLUS) https://tutoring.gatech.edu/plus-sessions/
    - Academic coaching https://advising.gatech.edu/academic-coaching
- OMED: Educational Services (http://omed.gatech.edu/programs/academic-support)
    - Group study sessions and tutoring programs
- Individualized help with writing and multimedia projects: Communication Center (http://www.communicationcenter.gatech.edu)

- Academic advisors for your major http://advising.gatech.edu/

- The Office of the Dean of Students: https://studentlife.gatech.edu/content/get-help-now; **404-894-6367**; Smithgall Student Services Building 2nd floor
    - You also may request assistance at https://gatech-advocate.symplicity.com/care_report/index.php/pid383662?
- Center for Assessment, Referral and Education (CARE) **404-894-3498**; https://care.gatech.edu/
    - Smithgall Student Services Building 1st floor
    - A single point of entry through which students can access mental health resources and services on campus and in the community. Students seeking assistance from the Counseling Center or Stamps Psychiatry need to visit CARE first for a primary assessment and referral to on and off campus mental health and well-being resources.
    - *Students in crisis may walk in during business hours (8am-4pm, Monday through Friday) or contact the counselor on call after hours at **404-894-2575 or 404-894-3498**. Other crisis resources:* https://counseling.gatech.edu/content/students-crisis
- Students' Temporary Assistance and Resources (STAR): https://studentlife.gatech.edu/content/star-services
    - Can assist with interview clothing, food, and housing needs.
- Stamps Health Services: https://health.gatech.edu; **404-894-1420**
    - Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition
- OMED: Educational Services: http://www.omed.gatech.edu
- Women's Resource Center: http://www.womenscenter.gatech.edu**; 404-385-0230**
- LGBTQIA Resource Center: http://lgbtqia.gatech.edu/**; 404-385-2679**
- Veteran's Resource Center: http://veterans.gatech.edu/**; 404-385-2067**

Georgia Tech Police: 404-894-2500; http://www.police.gatech.edu