CHEM 6501 - Biochemistry I
Fall 2026
Course Syllabus

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 associated with life. These include small molecules, proteins, nucleic acids, carbohydrates, and lipids.

COURSE OBJECTIVES
You will develop mastery in the nomenclature, structure, and function of the major classes of biomolecules associated with life. These include small molecules, proteins, nucleic acids, carbohydrates, and lipids. You will learn state-of-the-art computational and 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 the application of biochemistry to research, industry, and medicine. The course is designed to prepare you for medical school, pharmacy school, dental school, and masters/doctoral programs in biology, chemistry, chemical engineering, bioengineering, biochemistry, and molecular biology. You will earn 3.0 credits from completion of the 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). The material contains a lot of nomenclature in addition to practical problem solving. You will learn to "speak the language of biochemistry". Don't panic! Come to lectures, take notes, review material throughout the course (not just before exams), complete homework assignments, use the study guides, and use supplemental learning sources as necessary (i.e., YouTube videos). You might need to investigate different ways of studying (i.e., flash cards, studying in groups). We are always available to help you and will do our best to provide you with resources to succeed. We aim to make learning biochemistry interesting, practical, and fun to hold your attention in the material.

PREREQUISITES
It is recommended that you have taken college-level physics, chemistry, biology, and organic chemistry (CHEM 2311 organic chemistry I or related course) courses. I will do my best to provide refreshers and summary material related to these subjects when relevant, such that everyone is on the same page for learning biochemistry. If you have concerns about your past courses taken as prerequisites to Biochemistry I please talk to Prof. McShan.

INSTRUCTOR
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My office is located on the ground floor of MoSE near the G021 lecture hall

How to contact Dr. McShan:
Please contact me via e-mail rather than Canvas. I try to respond to e-mails within 24 hours of receipt but please be patient.

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

CHEM 3521/CHEM 6501 - Subject title

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

COURSE MATERIALS
This course is not taught using a textbook so there's no need to purchase one. However, you will still have access to a digital textbook (freely available!) to guide and supplement the lectures as needed. You don't actually need to read the textbook or do any problem sets from the textbook during the course. It is being provided solely as a potentially helpful supplement to your learning.

The digital 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)
You also do not need a license; you can run the free, non-activated version if desired.
https://pymol.org/

+ other free webservers mentioned in the homework assignments.

Calculator:
You will need a scientific calculator for in class exams. I recommend the Texas Instruments TI-30X IIS 2-Line Scientific Calculator.

CANVAS PAGE (COURSE WEBSITE)
Canvas will include lecture slides, homework assignments, quizzes, exams, study guides, and relevant course updates. Check often!

ATTENDANCE POLICY
Lecture attendance is required for this course and will count towards your final grade.

FINAL GRADES
A = 100 - 90%
B = 89.9 - 80%
C = 79.9 - 70%
D = 69.9 - 50%
F = < 50%

Assignments, exams, and final grades *will not* be curved.

Opportunities for extra credit will be provided.

COURSE OUTLINE

Topic(s)
Introduction / Foundations of Biochemistry Part 1
Foundations of Biochemistry Part 2
Molecular Interactions and Water
Amino Acids, Peptides, Proteins
The Three-Dimensional Structure of Proteins
Working with proteins
Protein Folding
Protein Function
Advanced Topics: Protein Design
Enzymes 101
Enzyme Kinetics
Nucleotides & Nucleic Acids part 1
Nucleotides & Nucleic Acids part 2
Nucleic Acid Metabolism: DNA replication and DNA transcription
Nucleic Acid Metabolism: mRNA translation
Nucleic Acid Based Technologies part 1
Nucleic Acid Based Technologies part 2

Carbohydrates and Glycobiology
Advanced Topics: Carbohydrate and Glycan Based Technologies
Lipids
Advanced Topics: Lipid Based Technologies
Biological Membranes and Transport
Biochemical Signaling
Advanced Topics: Biochemistry in Modern Medicine
Advanced Topics: Chemical Evolution and Origins of Life

STATEMENT OF LEARNING SUPPORT

I am committed to creating a learning environment for students that supports a mixture 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 support.
- If something was said by anyone in class 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 will attempt to highlight the critical contributions and voices for all types of individuals in STEM.

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 when completing assignments, such as quizzes, homework, and exams.

Plagiarism: Using the work of another (including AI) as one's own is known as plagiarism. Plagiarism is inappropriate in this course and in all other situations, and constitutes a violation of the Georgia Tech Honor Code. Students are strongly encouraged to study in groups, but assignments should be performed independently. Responses on homework, quizzes, and exams should be unique. Any incidents of cheating will be reported to the Office of Student Integrity. In addition to the penalty recommended by OSI, the opportunity to "drop" an exam will be forfeited by any student found to be in violation of the honor code.

Honor code: Each student must abide by the Georgia Institute of Technology Student Code of Conduct, see: https://osi.gatech.edu/students/honor-code.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

If you are a student with disabilities that requires special accommodation, please contact Prof. McShan to discuss your needs. You should also contact the Office of Disability Services at http://disabilityservices.gatech.edu/ as soon as possible to make an appointment to discuss your needs and to obtain an accommodation letter. For example, if you wish to arrange taking an exam outside of class in the testing center.

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. If you're experiencing significant mental health difficulties and need immediate support, staff is available during business hours (8 a.m.-5 p.m.). Call 404.894.2575 or visit us in Suite 238, Smithgall Student Services Building, 353 Ferst Dr NW, Atlanta, GA 30313. After hours, call 404.894.2575 and select the option for the after-hours counselor. In an emergency, call Georgia Tech Campus Police at 404.894.2500 on campus or 911 off campus.

OTHER USEFUL RESOURCES

- Center for Academic Success http://success.gatech.edu
    - 1-to-1 tutoring https://tutoring.gatech.edu/tutoring/
    - Academic coaching https://www.success.gatech.edu/retention/academic-coaching/
- 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/our-staff
- Center for Assessment, Referral and Education (CARE) https://care.gatech.edu/
- Students' Temporary Assistance and Resources (STAR): https://studentlife.gatech.edu/content/star-services
- Stamps Health Services: https://health.gatech.edu
- Belonging Resource Center: https://belonging.gatech.edu/studentsupport
- Veteran's Resource Center: http://veterans.gatech.edu/
- Georgia Tech Police: 404-894-2500; http://www.police.gatech.edu