Grove City College
Spring Semester 2025
CHEM 352: Biochemistry II

Instructor

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Office Hours	M, 10:00-10:50, 12:00-12:50; W, 10:00-10:50, 13:00-13:50; R, 10:00-11:00, 12:00-13:50; F, 10:00-10:50, 12:00-12:50	

Meeting Hours

Lecture Section A	MWF 9:00–9:50, STEM 155
Laboratory Section L	M 13:00–16:59, STEM 155

Course Objectives(•), Assessments(◦) and (Biochemistry Program Outcomes)

Upon completion of this course, the student will be able to:

- Write metabolic pathways for the synthesis and degradation of lipids and nucleic acids.
  ◦ Unit examinations and final examination (1 and 2)
- Identify and explain the components and functions of a biological membrane.
  ◦ Unit examinations and final examination (1 and 2)
- Describe and predict the structures of nucleic acids under a variety of solution conditions.
  ◦ Unit examinations, final examination and laboratory reports (1, 2, 3 and 4)
- Identify and describe the structures and activities of DNA replication, maintenance, RNA processing and protein synthesis and degradation.
  ◦ Unit examinations and final examination (1, 2, 3 and 4)
- Describe the experiments of DNA technology and apply those fundamentals to novel problems.
  ◦ Unit examinations, final examination and laboratory reports (1, 2, 3 and 4)
- Describe the techniques of protein and nucleic acid structure determination at both high and low resolution.
  ◦ Unit examinations and final examination (1, 2, 3 and 4)
- Describe the protein folding problem and analyze experimental evidence for theories.
  ◦ Unit examinations and final examination (1, 2 and 3)
- Perform basic experimental protocols such as micropipette measurements, solution preparation, titrations and the handling of small quantities of biochemical reagents.
  ◦ Laboratory reports (1, 2, 3, 4, 5 and 6)

Required Materials

Nelson, D. L. and Cox, M. M., **Lehninger Principles of Biochemistry, 7th Edition**, W. H. Freeman and Company, New York, NY, 2017. ISBN 1-4641-2611-9

https://biochemistry.prof/352/

Grading

Course Grade

Exam I	18%
Exam II	18%
Exam III	18%
Final Exam	21%
Laboratory	25%

Grading Scale

The grading scale is ten percent to the letter grade with appropriate ± distinctions. Thus, the lowest "A−" is ninety percent, the lowest "B−" is eighty percent, the lowest "C−" is seventy percent, and the lowest passing grade for the course is sixty percent.

Laboratory

Laboratory Theme

The goal of the laboratory component of this course is to provide an experience as close to authentic laboratory work as possible. To this end, the only thing prepared for laboratory is a set of protocols for the experiments. You will be responsible for all solution preparation in addition to completing the experimental protocol. Your laboratory instructor and assistant(s) will serve primarily as a reference for you during the laboratory sessions. In preparation for laboratory, your laboratory group should meet and prepare a detailed flow chart for your activities, to make sure you complete everything and do so in a timely manner.

In the lab, all experiments will be run each week, see the course website for your particular sequence through the following experiments.

GOT Protein? Purification of Glutamate Oxaloacetate Transaminase

DNA: Isolation, Quantitation and Physical Characterization

PCR: The Polymerase Chain Reaction

Proteins and Nucleic Acids: Restriction Endonucleases

Laboratory Grading

Laboratory reports are graded on a satisfactory (100%)/unsatisfactory (60%) grade basis. Laboratory reports which receive an unsatisfactory grade may be corrected by submitting a revision (correct page(s) with error(s) and attach to the end of the original report) by the next time you are in laboratory (study day for the final lab rotation). Laboratories for which no laboratory report is submitted will receive no credit.

Laboratory reports compose eighty percent of your laboratory grade. The other twenty percent is based on your laboratory notebook and electronic data (if applicable).

Laboratory Citizenship

In any laboratory, many people will be competing for scarce resources. It is in your best interest to be a good laboratory citizen. In our environment, there are a few particular resources that we need to be careful with while using them. Many dry chemicals are used in multiple experiments, please return dry chemicals to their proper storage locations as soon as you are finished using them. With multiple week experiments, samples will need to be saved in refrigerators or freezers; our cold storage space is at a premium. Store what you need in your designated area, but please clean out reagents at the end of each experiment and/or at the end of the semester. There should be no reagents or samples left in lab storage when you have finished your experimental course. Glassware should be washed when you are finished with it; glassware can safely be left to dry around the sinks in STEM 155.

Laboratory Safety

While working in the laboratory (either STEM 155 or STEM 176), all students must be properly attired (long pants and closed-toe shoes) and wearing appropriate personal protective equipment (safety goggles). Students failing to meet these requirements will be asked to leave the laboratory until they are able to conform to these requirements. If you are planning experiments, analyzing data or completing computational portions of the laboratory, feel free to step out to the atrium at any time as that work will be easier without personal protective equipment.

Laboratory Reports

A laboratory report is required from each *group* for each laboratory activity. The laboratory report should be a complete paper (you may drop the methods section unless you deviate significantly from the written protocols). Laboratory reports are due two weeks following the completion of experimentation, see course website for schedule details.

Laboratory Notebook

Each student is required to keep a laboratory notebook that details their work in the laboratory portion of this course. The laboratory notebook is the sole written record of your work in the laboratory and should be used for *all* record keeping related to laboratory work. While there is some freedom in notebook choice and record keeping style, each laboratory notebook must conform to the following:

- The laboratory notebook must be kept in a bound notebook. Either a glued or stitched binding is acceptable; a three ring or spiral binding is not acceptable. The purpose of a permanent binding is to prevent the removal of pages and show evidence when that has happened.
- The pages of the notebook must be numbered, and the first several pages should be reserved for a table of contents created at the end of the semester. Either printed or hand written pages numbers are acceptable.
- All writing in the notebook must be in ink.
- Each entry must be dated.

- Each new laboratory topic must be introduced with a very brief statement of the purpose of the experiments.
- All notes, calculations and data should be entered into the notebook as they are made. If some element is incorrect, strike it and correct it below.
- Analysis of data, even if completed outside of the scheduled laboratory time, should be done in the laboratory notebook.
- Calculations and plots prepared electronically may be printed and included in the lab notebook by staple, tape or glue.

In laboratory, students will work in small groups. Individual tasks for an experiment may be completed by a subset of students. As a result, an individual notebook will not be a complete record of the work done. This is alright. Your notebook only needs to be a record of the work you completed; you do not need to copy information from others to "complete" your notebook.

Your laboratory notebook is due on or before study day, 1 May, 2025.

Laboratory Schedule[†]

Date	Topic
13 January	*No Laboratories*
20 January	Laboratory Introductions
27 January	Rotation 1, Week 1
3 February	Rotation 1, Week 2
10 February	Exam I
17 February	Rotation 2, Week 1
24 February	Rotation 2, Week 2
3 March	*No Laboratories–Spring Recess*
10 March	Rotation 3, Week 1
17 March	Exam II
24 March	Rotation 3, Week 2
31 March	Rotation 4, Week 1
7 April	Rotation 4, Week 2
14 April	Exam III
21 April	*No Laboratories–Easter Recess*
28 April	*No Laboratories*

[†] *The laboratory schedule may be changed at anytime to better meet the needs of the course.*

Course Policies

Readings

Readings from the text are listed on the lecture schedule which follows. The reading listed for a day is the background for the lecture content of that day. In addition to readings listed in the lecture schedule, some examples of the primary literature will be provided on the course website. These articles will typically highlight the theory or practice of an idea discussed in a lecture. These readings are supplements to connect discussion to the literature—they do not need to be memorized in detail.

Suggested Problems

Biochemistry is a problem-solving discipline; in order to fully learn biochemistry, you must solve problems. For many lecture topics, there will be a document of "suggested problems" on the course website. This document will contain a few problems or references to problems in the text related to that discussion. This document will also contain answers to problems not found in the text and, when necessary, more complete solutions for problems from the text. These problems will emphasize and extend lecture content; similar problems will be included on examinations.

Examinations

Examinations in this course will be given during the laboratory sessions. The primary reason for this is to eliminate the time constraint of a fifty minute period for examination.

The final examination for this course is a comprehensive final examination. It will cover all topics discussed during the semester.

Unit examinations are not permanently returned to students. You may review unit exams at any time during normal office hours.

Final Examination

Grove City College requires each faculty member to give a rigorous, comprehensive, faculty-proctored final examination in each course. It is the student's responsibility to review the final exam schedule (*https://www.gcc.edu/Info/Events-News/Academic-Calendar*) at the beginning of the semester and make work and travel plans accordingly. See page 47 of the *2024-2025 Grove City College Bulletin* for the Grove City College final examination policy.

Attendance

As adopted by the Grove City College faculty, three (3) unexcused lecture absences are permitted without grade penalty. Unexcused absences are not permitted for laboratories or examinations. If you must miss your scheduled laboratory section, you may attend another laboratory section during the same week. Make-up laboratories and examinations will be given for excused absences; formats and requirements may be different for make-up work. See pages 45–47 of the *2024-2025 Grove City College Bulletin* for Grove City College attendance expectations.

Accessibility and Accommodation

Any required learning accommodations will be provided in this course. See pages 31–32 of the *2024-2025 Grove City College Bulletin* for information on requesting services from the Disability Services Coordinator.

Academic Integrity

All work submitted in this course must be the student's own scholarly work prepared originally for this course. See pages 50–53 of the *2024-2025 Grove City College Bulletin* for Grove City College policies and procedures related to academic integrity.

Lecture Schedule[†]

Lecture	Date	Topic	Reading
1	13 January	Lipids	Chp. 10
2	15 January	Fatty Acid Oxidation	Chp. 17
3	17 January	Fatty Acid Oxidation *(continued)*	Chp. 17
4	20 January	Diseases of Fatty Acid Metabolism	Chp. 17
5	22 January	Lipid Biosynthesis	Chp. 21
6	24 January	Lipid Biosynthesis *(continued)*	Chp. 21
7	27 January	Biological Membranes	Chp. 11 p. 385–395
8	29 January	Membrane Dynamics	Chp. 11 p. 395–402
9	31 January	Membrane Transport	Chp. 11 p. 402–427
10	3 February	The Nucleotides	Chp. 8 p. 281–287
11	5 February	Nucleotide Biosynthesis	Chp. 22 p. 910–920
12	7 February	Nucleotide Degredation ***final lecture in Unit I*	Chp. 22 p. 920–925
13	10 February	DNA Structure	Chp. 8 p. 287–293
14	12 February	DNA Structure *(continued)*	Chp. 8 p. 287–293
15	14 February	RNA Structure	Chp. 8 p. 293-297
16	17 February	Nucleic Acid Chemistry	Chp. 8 p. 297–308
17	19 February	Genomes	Chp. 24 p. 979–985
18	21 February	*(m)* Aligning Sequences	–
19	24 February	DNA Packing	Chp. 24 p. 985–1003
20	26 February	*(m)* We Be GELlin'	Chp. 3 p. 92–96
21	28 February	DNA Replication	Chp. 25 p. 1011–1027
–	3 March	*No Class–Spring Recess*	–
–	5 March	*No Class–Spring Recess*	–
–	7 March	*No Class–Spring Recess*	–
22	10 March	*(m)* DNA Sequencing	Chp. 8 p. 302-306
23	12 March	*(m)* Polymerase Chain Reaction	Chp. 9 p. 327–331
24	14 March	*(m)* Polymerase Chain Reaction ***final lecture in Unit II*	Chp. 9 p. 327–331
25	17 March	DNA Repair	Chp. 25 p. 1027–1038
26	19 March	DNA Recombination	Chp. 25 p. 1038–1052
27	21 March	DNA-Dependent RNA Synthesis	Chp. 26 p. 1057–1069
28	24 March	RNA Processing	Chp. 26 p. 1069–1085
29	26 March	Protein Synthesis	Chp. 27 p. 1103–1139
30	28 March	Protein Synthesis *(continued)*	Chp. 27 p. 1103–1139
31	31 March	Protein Targeting and Degredation	Chp. 27 p. 1139–1149
32	2 April	*(m)* Recombinant Protein Expression	–
33	4 April	*(m)* Absorbance Spectroscopy	Box 3–1 p. 80
34	7 April	*(m)* Emission Spectroscopy	Box 12–3 p. 448–449
35	9 April	*(m)* Nuclear Magnetic Resonance of Proteins	Box 4–5 p. 134–136 Chp. 19 p. 771–776
36	11 April	*(m)* Nuclear Magnetic Resonance of Proteins *(continued)* ***final lecture in Unit III*	Box 4–5 p. 134–136
37	14 April	*(m)* X-Ray Crystallography of Proteins	Box 4–5 p. 134–136
38	16 April	*(m)* X-Ray Crystallography of Proteins *(continued)*	Box 4–5 p. 134–136
–	18 April	*No Class–Easter Recess*	–
–	21 April	*No Class–Easter Recess*	–
39	23 April	Protein Folding	Chp. 4 p. 143–151
40	25 April	*(m)* Equilibrium Studies of Protein Folding	Chp. 4 p. 143–151
41	28 April	*(m)* Equilibrium Studies of Protein Folding *(continued)*	Chp. 4 p. 143–151
42	30 April	Diseases of Protein Folding	Chp. 4 p. 143–151
–	2 May	Final Exam, Section A, 8:00	–

[†] *The lecture schedule may be changed at anytime to better meet the needs of the course.*