



Biochemistry 501
Introduction to Biochemistry
Fall 2023

Course Credits: 3

Course Designation and Attributes:

Breadth - Physical Sci. Counts toward the Natural Sci. req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Course Description:

The chemical, physical, and biological processes occurring within living organisms.

Course Requisites:

Chem 341 or 343 or concurrent enrollment or graduate student.

Meeting Time and Location:

September 6 – December 13

Section 001: MWF, 12:05-12:55 PM

Room 1220, Microbial Sciences

1500 Linden Dr., Madison, WI 53706

Section 002: online, Canvas course site

Instructional Modality:

Section 001: in-person

Section 002: online

Credit hour designation:

This class meets for three, 50-minute class periods each week over the semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc.) for about 2 hours out of the classroom for every class period. The syllabus includes additional information about meeting times and expectations for student work.

Teaching Team (Instructors)

Office hours: Instructors are available for you to ask questions. Please attend. We enjoy talking to students. Each Unit module on Canvas will provide a page with a Zoom link to join office hours online.

Times may vary between units – check unit module for specific days/times

Professors:

Dr. Samuel Butcher (**office hours:** during Unit 1 – TBA)
141E DeLuca Biochemistry Laboratories, 433 Babcock Dr.,
sebutcher@wisc.edu

Dr. Scott Coyle (**office hours:** during Unit 2 - TBA)
6426A DeLuca Biochemistry Sciences Building, 440 Henry Mall.,
smcoyle@wisc.edu

Dr. Richard Amasino (**office hours:** during Unit 3 - TBA)
215B DeLuca Biochemistry Laboratories, 433 Babcock Dr.,
amasino@biochem.wisc.edu

Course Coordinator and Instructor:

Dr. Mario Pennella (**office hours:** during Unit 4 - TBA)
1142E DeLuca Biochemistry Building, 420 Henry Mall,
mpennella@wisc.edu

Course Learning Outcomes

1. Describe how biomolecules store, transmit, and receive information to carry out cellular functions, such as catalysis, information transfer, energy production, and biosynthesis.
2. Explain how molecular interactions drive the formation of macromolecular structure, including protein, lipid, nucleic acid, and carbohydrate structure.
3. Recognize and identify the molecular structure of the building blocks for proteins, lipids, nucleic acids, and carbohydrates and describe how their structure relates to their biological function.
4. Describe the process of DNA replication, DNA repair, RNA transcription, and protein synthesis and recognize how these biochemical processes can be used to develop biotechnological applications in medicine and agriculture.

5. Relate the chemical structure of metabolites and the pathways through which they flow to how cells use those pathways for both biosynthesis (anabolism) and energy production (catabolism).

6. Analyze the major anabolic and catabolic pathways of central metabolism in terms of energetics, molecular structure, hormonal control, and regulation.

7. Recognize that all life on earth shares a common ancestor as illustrated by the use of the same genetic code and the existence of common biochemical pathways between all organisms.

Regular and Substantive Student-Instructor Interaction

Each unit instructor will be available for direct interaction during their unit, 5-6 hours each week. This includes during scheduled class times and office hours.

Grading

40 Quizzes (each worth 0.375%)	15%
4 Unit Exams (each worth 21.25%)	85%
Total	100%

A = 90 – 100%

AB = 86 – 89.9%

B = 80 – 85.9%

BC = 76 – 79.9%

C = 65% – 75.9%

D = 55% – 64.9%

F = 0% – 54.9%

Course Website, Learning Management System & Digital Instructional Tools:

This course will utilize Canvas. Students are encouraged to become familiar with these tools prior to the start of the semester. Support can be found here:

<https://it.wisc.edu/services/canvas/>

Course website: <https://canvas.wisc.edu/courses/358408>

Canvas Support:

The [DoIT Help Desk](#) provides instructors, staff and students with free tech support and troubleshooting help by phone at 608.264.4357, email at help@doit.wisc.edu and chat at helpdesk.wisc.edu. In-person support is also available at the service desk in the Computer Sciences building. Visit helpdesk.wisc.edu for hours and more information.

Piazza – Discussion board:

We encourage students to post questions and collaborate on responses to these questions on Piazza instead of emailing instructors. Students can post anonymously to other students but student names will be visible to instructors. Instructors will monitor students answers/questions, endorse student answers, and edit/delete any inappropriate posted content. The purpose of Piazza is to provide relatively rapid feedback to student questions by other students with additional input by instructors. You can access Piazza directly in the Canvas course site.

Discussion Sessions

A team of graduate students and former 501 undergraduates will lead **optional discussion sections meeting at times specified on Canvas**. Although attendance is optional, we strongly encourage you to attend one or more sections each week. The Teaching Assistants will go over problems from worksheets and answer questions from students. Copies of these worksheets are posted within the Module entitled, “Discussion Material” on Canvas. These additional problems are designed to reinforce the important points from the lectures. In addition, we encourage you to bring questions. **You do NOT need to sign up for discussion sections**, just show up at the time that works for you. Access to the discussion schedule, which includes a brief description of how the discussions work, can be found within the ‘Discussion material’ module on Canvas. The first discussion session will start at 1:20 PM on Wednesday, January 25 with all others following.

Textbook - Recommended (Not Required)

Lehninger Principles of Biochemistry, by Nelson and Cox, 8th edition (earlier editions suitable as well). We will not assign readings or homework directly from the textbook. However, many of you may find the book to be a useful study guide and reference. To facilitate use of the book as a study guide and reference, the lectures will closely follow this textbook and the parts of the book relevant to lecture will be referenced by providing page numbers or by providing the number of the figures in the book that correspond to the images used in lecture. (The figures are labeled sequentially in each chapter; thus, Figure 22-5 is the 5th figure in Chapter 22.) Here are your options for textbook access.

1. Use reserve copies. We keep a few copies of the textbook on reserve at Steenbock and Helen C White libraries.
2. Buy a used book. There should be some 7th edition used books available. Furthermore, an old copy of the 5th or 6th edition will be suitable for almost all of the material we cover in the course.
3. The publisher offers several different types of versions of the textbook (e-book, loose-leaf, or paperback copy of the book) at a range of prices depending on the type and if you want to rent or own. These options can be found here:

<https://store.macmillanlearning.com/us/product/Lehninger-Principles-of-Biochemistry/p/1464126119?searchText=lehninger>

Quizzes and Exams

Quizzes

You will be assigned one, 4-question quiz for each lecture, excluding class 1 of Unit 1 (40 quizzes total). The links to quizzes can be found within each Class page within each unit module on the Canvas course site. There are 10 quizzes per unit. Quizzes for the corresponding Unit will open at the beginning of the Unit and close at the end of the Unit. **Please look carefully at the due dates for quizzes.** A quiz will tentatively be due every 48 hours after a class date, starting after class 2. You have two attempts for each quiz. **If you submit the quiz after the due date, you will only receive 50% credit for completing the quiz based on questions answered correctly.** Once a Unit is finished, quizzes will be closed and makeups will only be allowed under special circumstances.

NOTE 1: Students are responsible for material on class slides covered by quiz questions for that class even if the instructor was not able to finish that day. Remember quizzes are open resource (notes, textbook, websites, and etc. are allowed).

NOTE 2: Taking a graded quiz after the submission due date will result in a re-grade by Canvas, which will then deduct points as it counts the quiz as late. Please do not re-take quizzes to study for exams as this will deduct points if taken after the due date.

Exams

The course is divided into 4 parts. There will be an exam given after the completion of each unit. Each of these exams will have 33 questions. You will have **60 minutes** to complete each Unit Exam. ***There is NO cumulative exam and all 4 exam scores are included in calculation of final grade.*** Exams include multiple choice and true/false questions. Practice exams for each Unit are provided on the Canvas course site within each Unit module. We strongly recommend reading through the practice exam questions at the beginning of each Unit and taking the practice exams multiple times throughout each Unit. **It is possible some exam questions will come directly from practice exams.**

An alternate version of your lowest scoring exam can be taken again during the scheduled final exam time. You have the option to take an alternate version of the exam with the lowest score during the final exam time scheduled by the University. For example, if Exam 2 was your lowest exam score, you can take another version of Exam 2 at the end of the semester during the scheduled final exam time. The alternate exam will have different questions over the same concepts. The higher score will be included in the calculation of your final grade. The lower score (original versus alternate) will be dropped.

Exams will be taken online through Honorlock.

The dates/times to take exams can be found in the schedule below and on Canvas.

Exam	Date and Times available	Time for exam
Unit 1	October 3, 8:00 PM (CDT), Tuesday	60 minutes
Unit 2	October 24, 8:00 PM (CDT), Tuesday	60 minutes
Unit 3	November 16, 8:00 PM (CST), Thursday	60 minutes
Unit 4	December 13, 8:00 PM (CST), Wednesday	60 minutes
Lowest Exam score 're-take'	December 21, 10:05 AM (CST), Thursday	60 minutes

Alternate exam time

If you are not able to take an exam at the designated time, then you can take the exam earlier in the day, **only in-person with a paper exam.** Please find the link ('Sign-up for Alternate Exam Times') within the 'Exams' module on the **Canvas course site for times and locations of the alternate exams.** You must indicate why you cannot take the exam at the scheduled time.

Exam accommodations. If you have accommodations through the McBurney Center that allow for extra time on exams or other accommodations, they will be provided. Contact the course coordinator (mpennella@wisc.edu) with questions.

Exam proctoring: ONLINE EXAMS using Honorlock

Honorlock will proctor your exams this semester. Honorlock is an online proctoring service. You **DO NOT** need to create an account, download software or schedule an appointment in advance. All that is needed is a computer, a working webcam/microphone, your ID, and a stable internet connection.

The use of the Honorlock is a condition of enrollment in the class and is required while taking exams for this course (unless students have accommodations through the McBurney Center which describe alternatives). Failure to use Honorlock will result in a zero on exams.

To get started, you will need Google Chrome and download the [Honorlock Chrome Extension](#). You can do this right before you take the practice exam. To check if your device meets minimum system requirements, please visit <https://honorlock.com/support/> and scroll to the 'Run System Check'.

When you are ready to take the exam, log into Canvas, go to the 501 course, and click on the appropriate exam link within the 'Exams' module. Clicking "Launch Proctoring" will begin the Honorlock authentication process, where you will take a picture of yourself, and show your ID. Honorlock will be recording your exam session through your webcam, microphone, and recording your screen. Please do not attempt to search for answers, even on a secondary device.

PLEASE NOTE: After you complete the Honorlock authentication process, you will begin the exam. Before you answer any questions, please scan your desk area and show that your scratch paper is blank. When you start answering questions (taking the exam) be sure that your face and hands are always on the screen. A video tutorial will be provided before the first exam showing how to scan your desk and surrounding area and how you should have both your eyes, hands, and desk surface within the camera at all times during your exam.

Honorlock support is available 24/7/365. If you encounter any issues, you may contact them through live chat on the [support page](#) or within the exam itself. Some guides you should review are found within the 'Online Exam proctoring – Honorlock' page within the Course information module.

How to succeed in this class

To succeed it is important to study consistently and effectively. Here are some suggestions for effective studying. Also see information within Course information module for additional suggestions.

- ▶ **Read** the lecture slides and/or suggested chapters (textbook optional). Focus on general concepts rather than getting lost in the details. This “priming” exercise will make lecture easier to follow.
- ▶ **Watch class videos** faithfully. Each day, go over your notes and fill in parts that you do not fully understand using material from the course. If you did not understand something, also review the lecture video and study the practice questions that are designed to help you learn important concepts.
- ▶ **Attend Discussion Sessions and/or Office hours.**
 - Discussion** – See days and times on Canvas Course site
 - Office hours** – See days and times on Canvas Course site
- ▶ **Writing is important to learning.** Highlighting sentences with marker pen is not an effective way to transfer knowledge to the brain. Rather, putting concepts into your own words and writing them down results in your assimilating the concepts and recognizing relationships among concepts.
- ▶ **Complete the problem sets** provided in each Unit module. Research has shown that working through problems is one of the best ways to prepare for a multiple choice exam.
- ▶ Taking accurate and complete **notes** and **asking questions** are part of the learning process. If you do not understand a topic that was presented, **ask questions**. Even if you don’t ask questions, please **read Piazza daily** to see if questions your classmates ask are ones that you can answer or determine if you are understanding topics/concepts as well.

Lecture Schedule

Part 1: Structural and Catalytic Components of Cells – Prof. Butcher				
Class	Topic	Day of the Week	Date	Assignment Due
1	Overview of the Course, Chemical Principles, and Cellular Basics	Wednesday	September 6	
2	Structure and Properties of Water, pH, Buffers	Friday	September 8	
3	Amino Acids and Protein Primary Structure	Monday	September 11	Quiz – Class 2
4	Protein Purification and Analysis	Wednesday	September 13	Quiz – Class 3
5	Three Dimensional Structure of Proteins	Friday	September 15	Quiz – Class 4
6	Protein Function	Monday	September 18	Quiz – Class 5
7	Enzyme Properties, Mechanisms, and Kinetics	Wednesday	September 20	Quiz – Class 6
8	Enzyme Structure, Function, and Regulation	Friday	September 22	Quiz – Class 7
9	Enzyme Inhibition & Structure and Properties of Lipids	Monday	September 25	Quiz – Class 8
10	Lipids as Signaling Molecules & Membrane Structure	Wednesday	September 27	Quiz – Class 9
11	Membrane transport	Friday	September 29	Quiz – Class 10
<i>Q & A Session</i>	<i>Online via Zoom *OPTIONAL* Will be recorded</i>	<i>TBA</i>	<i>TBA</i>	
Exam 1	8:00 PM, online Canvas with Honorlock	Tuesday	October 3	Exam 1

Part 2: Genetic Information Transfer – Prof. Coyle				
Class	Topic	Day of the Week	Date	Assignment Due
12	Introduction to Information Transfer	Monday	October 2	Quiz – Class 11
13	DNA and Chromosome Structure	Wednesday	October 4	Quiz – Class 12
14	DNA Replication	Friday	October 6	Quiz – Class 13
15	Mutagenesis and Repair	Monday	October 9	Quiz – Class 14
16	DNA Recombination	Wednesday	October 11	Quiz – Class 15
17	Transcription	Friday	October 13	Quiz – Class 16
18	Gene Regulation & Epigenetics	Monday	October 16	Quiz – Class 17
19	RNA Processing	Wednesday	October 18	Quiz – Class 18
20	Translation	Friday	October 20	Quiz – Class 19
21	Molecular Techniques and Synthetic Biology	Monday	October 23	Quiz – Class 20
<i>Q & A session</i>	<i>Online via Zoom *OPTIONAL* Will be recorded</i>	TBA	TBA	
		Wednesday	October 25	Quiz – Class 21
Exam 2	8:00 pm, online Canvas with Honorlock	Tuesday	October 24	Exam 2

Part 3: Energy Production: Catabolism and Bioenergetics – Prof. Amasino				
Class	Topic	Day of the Week	Date	Assignment Due
22	Thermodynamics and Bioenergetics	Wednesday	October 25	Quiz – Class 21
23	Glycolysis	Friday	October 27	Quiz – Class 22
24	After Glycolysis: Fermentation or Citric Acid Cycle	Monday	October 30	Quiz – Class 23
25	Citric Acid Cycle	Wednesday	November 1	Quiz – Class 24
26	Catabolism of Lipids	Friday	November 3	Quiz – Class 25
27	Nitrogen Utilization	Monday	November 6	Quiz – Class 26
28	Mitochondrial Electron Transport	Wednesday	November 8	Quiz – Class 27
29	ATP Synthesis	Friday	November 10	Quiz – Class 28
30	Photosynthesis	Monday	November 13	Quiz – Class 29
31	Metabolism and Evolution	Wednesday	November 15	Quiz – Class 30
		Thursday	November 16	Quiz – Class 31
<i>Review Session</i>	<i>Online via Zoom *OPTIONAL* Will be recorded</i>	<i>TBA</i>	<i>TBA</i>	
Exam 3	8:00 pm, online Canvas with Honorlock	Thursday	November 16	Exam 3

Part 4: Energy Storage: Anabolism and Bio-signaling – Dr. Pennella				
Class	Topic	Day of the Week	Date	Assignment Due
32	Overview of metabolism; Carbohydrates	Friday	November 17	Quiz – Class 31
33	<u>Fasting state:</u> Glucagon signaling Glycogenolysis; Lipolysis	Monday	November 20	Quiz – Class 32
No Class	<u>Thanksgiving break</u>	Wednesday	November 22	
34	Gluconeogenesis and Ketogenesis	Monday	November 27	Quiz – Class 33
35	<u>Fed state:</u> Insulin signaling Glycogen synthesis	Wednesday	November 29	Quiz – Class 34
36	Pentose Phosphate Pathway (PPP)	Friday	December 1	Quiz – Class 35
37	Lipid metabolism: Fatty Acid (FA) synthesis	Monday	December 4	Quiz – Class 36
38	Triacylglycerol synthesis Phospholipid synthesis	Wednesday	December 6	Quiz – Class 37
39	Cholesterol synthesis Lipid transport	Friday	December 8	Quiz – Class 38
40	Nitrogen Metabolism: Amino acid synthesis Nucleotide synthesis	Monday	December 11	Quiz – Class 39
41 (Review)	Unit 4 Q & A session	Wednesday	December 13	Quiz – Class 40 Quiz – Class 41
Exam 4	8:00 pm, online Canvas with Honorlock	Wednesday	December 13	Exam 4
Lowest Exam score re-take	10:05 am, online Canvas with Honorlock	Thursday	December 21	<u>Take another version of exam w/ lowest score</u>

Academic Policies and Statements

Teaching & Learning Data Transparency Statement

The privacy and security of faculty, staff and students' personal information is a top priority for UW-Madison. The university carefully evaluates and vets all campus-supported digital tools used to support teaching and learning, to help support success through [learning analytics](#), and to enable proctoring capabilities. View the university's full [teaching and learning data transparency statement](#).

Privacy of Student Records & the Use of Audio Recorded Lectures Statement

View [more information about FERPA](#).

Lecture materials and recordings for this course are protected intellectual property at UW-Madison. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record lectures without permission unless you are considered by the university to be a qualified student with a disability who has an approved accommodation that includes recording. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities, with the exception of sharing copies of your personal notes as a notetaker through the McBurney Disability Resource Center. Students are otherwise prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

Resource links to other campus services such as

- [*University Health Services*](#)
- [*Undergraduate Academic Advising and Career Services*](#)
- [*Office of the Registrar*](#)
- [*Office of Student Financial Aid*](#)
- [*Dean of Students Office*](#)
- [*Graduate Student Services*](#)

Course Evaluations

Students will be provided with an opportunity to evaluate this course and your learning experience. Student participation is an integral component of this course, and your confidential feedback is important.

Digital Course Evaluation (AEFIS)

UW-Madison uses a digital course evaluation survey tool called [AEFIS](#). For this course, you will receive an official email two weeks prior to the end of the semester, notifying you that your course evaluation is available. In the email you will receive a link to log into the course evaluation with your NetID. Evaluations are anonymous. Your participation is an integral component of this course, and your feedback is important. We strongly encourage you to participate in the course evaluation.

Students' Rules

[Rights & Responsibilities](#)

Diversity & Inclusion Statement

[Diversity](#) is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

Academic Integrity Statement.

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion. For more information, refer to <https://conduct.students.wisc.edu/academic-misconduct/student-resources/>

Accommodations for Students with Disabilities Statement

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy ([UW-855](#)) require the university to provide reasonable accommodations to students with disabilities to access and participate in its academic programs and educational services. Faculty and students share responsibility in the accommodation process. **Students are expected to inform the course coordinator (Mario Pennella, at mpennella@wisc.edu) of their need for instructional accommodations during the beginning of the semester, or as soon as possible after being approved for accommodations.** The course coordinator will work either directly with the student or in coordination with the McBurney Center to provide reasonable instructional and course-related accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: [McBurney Disability Resource Center](#))

More information on the McBurney Center can be found here:

Web: [How to Become a McBurney Client](#)

Phone: (608) 263-2741

Email: mcburney@studentlife.wisc.edu

Text: (608) 225-7956

Fax: (608) 265-2998

[Academic Calendar & Religious Observances](#)