



The mission of the University of Mount Union is to prepare students for fulfilling lives, meaningful work, and responsible citizenship.

Department of Chemistry and Biochemistry College of Natural and Health Sciences

CHE 370: Introduction to Biochemistry 4 Credit Hours

INSTRUCTOR INFORMATION:

- Keith R. Miller, Ph.D.
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- millerkr@mountunion.edu
- TR 9:00 – 10:00 am

COURSE DESCRIPTION:

This course is an introductory course into the basic building principles of biochemistry including protein, carbohydrate, lipid and polynucleotide chemistry, enzyme kinetics and inhibition, mechanisms of enzyme action, and regulation of enzymes.

COURSE PURPOSE:

The field of biochemistry is an area of science that seeks to understand the chemical processes within living organisms. It bridges and combines biology and chemistry principles to identify and solve biological problems at a molecular level. By studying cellular components including proteins, nucleic acids, carbohydrates, and lipids, insight how the structure of a molecular relates to its overall function is determined. Fields ranging from medicine, agriculture, cosmetics, forensic crime research, and drug discovery and development all rely on biochemistry and the advances in this field.

REQUIRED COURSE MATERIALS:

Voet, D.; Voet, J.G.; and Pratt, C. (2016) *Fundamentals of Biochemistry* (5th Edition or latest). John Wiley and Sons Inc. ISBN: 978-1-118-91840-1

All course materials comply with copyright/fair use policies

COURSE DELIVERY:

This course is delivered Online Asynchronously. Your instructor will provide materials for you in our learning management system (D2L). Some of the materials will be readings, lectures for viewing, assignments for completing, and exams for evaluation. You can access and satisfy these requirements on your own schedule, so long as you meet the expected deadlines. Some of the methods we employ for asynchronous online learning include self-guided lesson modules, pre-recorded video content, virtual libraries, lecture notes, and online discussion boards or other media platforms.

This course is organized in alignment with Mount Union University's online course template. Each weekly lesson contains an overview and objectives, readings, and related materials, learning activities and assessments, as well as supplemental resources.

COURSE LEARNING OBJECTIVES:

The Department of Chemistry and Biochemistry at the University of Mount Union has set the following goals for each student in CHE 370 in accordance with the American Society for Biochemistry and Molecular Biology:

1. Become well-grounded in the fundamentals of chemistry and biology and the key principles of biochemistry and molecular biology a. This includes the following: nucleotides and nucleic acids, amino acids, proteins primary structure, protein function, carbohydrates, lipids, biological membranes (introduced), and enzyme catalysis (introduced);
2. Understand structure/function relationship in a biological system;
3. Dissect a problem into its key features;
4. Design experiments and understand the limitations of the experimental approach;
5. Interpret experimental data and identify consistent and inconsistent components;
6. Use computers as information and research tools.

MEASUREMENT OF LEARNING OBJECTIVES:

Each of the course learning objectives are aligned with weekly learning objectives. Each week students will be given resources, lectures, and activities to complete that align with the weekly learning objectives. After reviewing the resources and participating in the weekly activities, the student will be assessed to see if they have achieved the knowledge or skills described in the learning objectives.

TECHNOLOGY REQUIREMENTS FOR ONLINE COURSES:

College coursework during these times requires students to be more responsible than ever in keeping up with reading and assignments, checking email and D2L frequently, and staying in regular communication with instructors. Technology access will therefore be critically important to your success in this course. The lecture presentations, links to articles, assignments, quizzes, and rubrics are located on the D2L site for the course. To participate in learning activities and complete assignments, you will need:

- Access to a working computer that has a current operating system with updates installed, plus speakers or headphones to hear lecture presentations.
- Access to a video/web camera.
- Reliable Internet access and a Mount Union email account.
- A current Internet browser that is compatible with D2L.
- Microsoft Word as your word processing program.
- Reliable data storage for your work, such as a USB drive or Office365 OneDrive cloud storage.

Please contact the IT Help Desk at (330) 829-8726 or Helpdesk@mountunion.edu if you need assistance with obtaining or using a device, any necessary software, or internet access at any time during this semester.

ASSIGNMENTS:

All course written requirements should be submitted via the Assignments tool in D2L. Lessons will run Monday-Sunday of each course week. Lessons will open on the Friday prior to the start of a lesson. All assignments should be completed and submitted by the time posted on D2L. Because of the way the course is structured, students must stay on track with assignment dates and cannot complete assignments from previous weeks once the due date is passed.

DISCUSSION FORUM PARTICIPATION:

Participation in discussion forums is critical for maximizing students' learning experiences and is required for the online delivery of this course. Each student is required to be part of an online community who interact, through discussion, to enhance and support the professional development of the group.

Active participation in discussion topics is defined as making at least one (1) original posting for each discussion topic and at least two (2) responses to colleagues' postings. This will result in a minimum total of three (3) postings per topic.

NOTE: Your original post will be due by Wednesday for each discussion topic at 11:00 p.m. and all subsequent posts will be due by Sunday at 11:00 p.m.

The course discussion rubric provides specific guidelines on how discussion contributions will be graded and what is considered a substantive response. Some characteristics that are part of excellent discussion contributions are outlined below. The instructor will consider these characteristics when assessing students' quality and level of participation.

- Each student should submit his/her initial post(s) early in the session and your subsequent responses to the posts of other learners at timely intervals within the duration of the session. Keep in mind the goal is to have a dynamic discussion that lasts throughout the entire session.
- Discussions occur when there is dialogue. Build upon the posts and responses of other learners to create discussion threads. Revisit the discussion forum and respond (if necessary) to what other learners have posted to initial responses.
- Postings should be substantive and will be evaluated on their quality and the degree to which they promote discussion among classmates.
- For a posting to be considered substantive, it should meet the following criteria:
 - It avoids repeating or rehashing points made by others.
 - It demonstrates understanding and integration of course readings and provides relevant citations.
 - It incorporates ideas shared by others and the instructor to create a clearer and more comprehensive presentation of the concept under review.
 - It poses real-life questions or challenges that spring from the discussion material and attempts to shape informed conclusions.

COURSE GRADING:

Grades will be based on depth of personal insight, critical thinking, and application of theoretical concepts to scenarios being analyzed. Specific guidelines and grading criteria will be provided with each assignment. The following activities will be evaluated, and the relative weight of that evaluation is noted:

<u>Assignments/Assessments</u>	<u>% of Final Grade</u>
Exams	45
Quizzes	15
Case Studies	15
Figure Summaries	15
Discussion Forum Participation	10
Total	100%

Grading Scale

94-100%	A	77-79%	C+
90-93%	A-	74-76%	C
87-89%	B+	70-73%	C-
84-86%	B	67-69%	D+
80-83%	B-	64-66%	D
		60-63%	D-
		59% or less	F or fails

CASE STUDIES:

Over the course of the semester case studies will be assigned. Although some case studies may be used to introduce new material, in general, case studies are designed to help you learn, review and reinforce concepts we will be covering. Typed case studies are not to exceed two pages of text when submitted. **Don't forget to include references!!**

RESEARCH ARTICLE FIGURE SUMMARY:

Part of research involves knowing and appreciating the academic literature. For selected topics, as noted in this syllabus, students will be expected to locate a primary peer-reviewed research article that uses that week's laboratory test/technique/concept and write a two-page double-spaced 12 pt font summary of **ONE** of the Figures (not Tables) related to the topic. This summary should provide enough information for a science major to understand the reason for the figure, the question the figure was attempting to answer, the results the figure presented, and the figure's conclusions. In addition, extra points can be gained by providing your own thorough evaluation whether the figure achieved its goals and related the right information for its conclusions i.e. did the figure use the right controls? Is data presented clearly? The found primary

research article and the two-page double-spaced summary will be required to be turned in by the end of the assigned class session; if not turned in by this time, no points will be given for late work.

Research Article Figure Summary Evaluation Criteria:

Criteria	Points
Necessary background is provided in a concise fashion to understand the reasoning for the figure	/10
The objective of the figure is clearly presented	/5
Explanation of reasoning for use of technique	/10
The results are appropriately discussed	/10
Discussion of the conclusions drawn from the figure are presented	/10
The entire research article figure summary is easy to read and communicates ideas with a logical flow	/5
BONUS Critique of figure	
Total	/50

EXAMS:

Exams will be a combination of multiple-choice, fill-in, true and false, and short answer. Exams will be written so that a well-prepared student can finish in one hour, but up to two hours will be allowed for completion of each exam. Due to the nature of the material, all exams will be cumulative, but will focus on the most recently covered concepts.

Help session run by the professor will be held via virtual classroom at 7:00-9:00 pm the day before each exam.

COURSE FLEXIBILITY:

Every course syllabus is subject to change at the discretion of the instructor, and in these unpredictable times students and faculty should expect, anticipate, and plan for change as a likely part of the semester. Flexibility will be more important than ever on the part of instructors and students to adapt to changes that may have to occur to course instruction. Changes may come with little advanced notice, could impact the way in which the class meets and conducts coursework, and may be temporary or last the semester long. It is important to remember that your Mount Union email account is the official method of communication and will be used by University faculty and officials to communicate any notices, updates, or changes regarding your courses and all other aspects of your University life.

COURSE POLICIES/PROCEDURES/EXPECTATIONS

COURSE COMMUNICATION:

Students are expected to check their Mount Union email account frequently for important course information. If you are having trouble understanding any aspect of the course, please let me know. I will be communicating with you regarding grades and assignments. If you need to get in touch with me, the best method is via email. I am here to help and will do my best to respond to inquiries in a timely manner. Generally, I will reply to emails within one business day. Feedback on assignments will be posted within one week after the due date, unless otherwise noted.

LATE WORK POLICY:

Assignments which are submitted late will receive a 0 for the grade.

ACADEMIC INTEGRITY:

Academic Integrity is at the heart of the mission and values of the University and is an expectation of all students. Maintaining academic integrity is a reflection of your character and a means to ensuring that you are achieving the outcomes of this course and that your grades accurately reflect your learning and understanding of the course material. Cutting corners or cheating in this class will result in cheating yourself out of learning.

Academic integrity is a partnership between me, as the instructor, and you, as the student. My role, as instructor of this course, is to facilitate learning and to provide you with clear guidelines and feedback to help you maintain your academic integrity. Your role in this course is to take responsibility for your learning and to complete all assignments in an honest manner and to ask for clarification from me if you are unsure of how to do so.

Students who are found responsible for committing academic dishonesty will receive a zero for the assignment. The academic dishonesty issue will also be brought to the Department Chair and the Office of Academic Affairs who may impose additional sanctions as provided in the University policy regarding Academic Honesty.

ONLINE LEARNING:

Attendance for an online or hybrid course is defined as an online presence demonstrated by active participation and engagement in all learning activities as required by the instructor. Failure to fulfill requirements within the parameters of each session will be construed as absence.

Example of online expectations:

- If you violate one of the standards in the University Academic Honesty statement, it will result in a zero for that assignment, and I am required to report it to the Office of Academic Affairs.
- While group studying and sharing of ideas is encouraged, you may not consult with other students about papers or other assignments in this course.

ONLINE CONDUCT:

Professionalism is always expected. Because the virtual classroom is a place designed for the free exchange of ideas, we must show respect for one another in all circumstances. We will show respect for one another by exhibiting patience and courtesy in our exchanges. Appropriate language and restraint from attacking those whose perspectives differ from your own is a minimum requirement. Bullying will not be tolerated. Courtesy and kindness are the norm for those who participate in my class. Think before you type or communicate. Remember, typing in all CAPS is the same as yelling, and sarcasm comes across differently when written.

HELP WITH WRITING:

The absolute worst practice a student can have when it comes to written and oral communication is to wait to the last minute to prepare. Get your ideas down early and think about them. Bounce these ideas off your classmates. Your instructor is an excellent source for help for the written assignments.

INTELLECTUAL PROPERTY:

As a learning community, the University of Mount Union embraces the entrepreneurial mindset, creativity, and innovation. To support innovation, the University has an Intellectual Property Policy to help identify, protect, communicate, and commercialize innovation resulting in possible monetary rewards for the innovator at UMU. The University strongly encourages innovators to have an open discussion with the Office of Academic Affairs to discuss any innovations. The complete UMU Intellectual Property Policy is available on iRaider under “Policies -> Institutional Policies”.

STUDENT RIGHTS AND GRIEVANCES:

Students have a right to equitable access for their course instruction, materials, and facility. Students also have a right to respectfully express their views and opinions in class discussion boards as well as in their writing and speaking assignments, without fear of ridicule or retribution. In addition, students have a right to safety and privacy during their course instruction that prohibits discrimination and harassment of any type by any person. Students also have a right to fairness in grading and learning objective assessment, as well as timely communication from the instructor. Any student who may feel that their rights have been violated may file a grievance regarding Title IX, civil rights, conduct, discrimination or harassment using the appropriate grievance procedure in the University’s student handbook available on the Mount Union website. Academic complaints, such as disputes over a grade, should be filed in accordance with the procedures laid out in the University Catalogue available on the Mount Union website.

UMU DIVERSITY AND INCLUSION STATEMENT:

At the University of Mount Union, we continuously strive to welcome, accept, and respect all people. We believe that through the union of disparate perspectives, we strengthen our community, facilitate global enlightenment, and enable collective self-discovery. As such, we embrace diversity and inclusiveness to facilitate the development of ideas, the

advancement of global perspectives, and to create a greater understanding and acceptance of all people. We actively promote a diverse and inclusive environment that obliges mutual respect and positive engagement to effectively enrich learning and living for our students, faculty, staff, administration, and community.

As members of the University of Mount Union community, we pledge to:

- Acknowledge, respect, honor, and celebrate diversity.
- Work together to create an environment that is both diverse and inclusive.
- Take these inclusive attitudes with us as we continue our life journeys.

OTHER RESOURCES AND POLICIES

Other UMU resources and Policies can be found on the [UMU Common Syllabus Elements](#) page. Elements found on this page are:

- Academic Integrity
- Accessibility
- Resources for Student Success
- Student Rights and Grievances
- Technology Support

ASSIGNMENTS AND COURSE SCHEDULE

COURSE SCHEDULE SUBJECT TO CHANGE BY THE INSTRUCTOR BASED UPON STUDENT NEEDS

Week	Topics	Activity	Due Date/Time
Week 1	Syllabus and Introduction Chapter 1: Cell Structure Review Chapter 1: Thermodynamics Chapter 2: Water Physical and Chemical Properties Chapter 3: Nucleotides and Nucleic Acid Structure Chapter 3: Nucleic Acid Function and Sequencing Special Topic: Biotechnology and CRISPR	Discussion Board #1	Initial Posting May 19, 11:00 pm Final Posting May 23, 11:00 pm
		Quiz #1	May 20, 11:00 pm
		Case Study #1	May 21, 11:00 pm
		Exam #1	May 23, 11:00 pm
Week 2	Chapter 4: Amino Acid Structure and Ionization Chapter 5: Protein Primary Structure and Protein Production/Purification Chapter 5: Protein Analysis Chapter 6: Protein Structure Chapter 6: Protein Stability and Folding	Discussion Board #2	Initial Posting May 26, 11:00 pm Final Posting May 30, 11:00 pm
		Quiz #2	May 27, 11:00 pm
		Figure Summary #1	May 28, 11:00 pm
		Exam #2	May 30, 11:00 pm
Week 3	Chapter 7: Binding Kinetics Chapter 7: Myoglobin and Hemoglobin Structure/Function Chapter 7: Myoglobin and Hemoglobin Regulation Chapter 7: Molecular Motors and Muscle Contraction Chapter 7: Antibodies Chapter 8: Carbohydrates Structure and Function	Discussion Board #3	Initial Posting June 2, 11:00 pm Final Posting June 6, 11:00 pm
		Quiz #3	June 3, 11:00 pm
		Case Study #2	June 4, 11:00 pm
		Exam #3	June 6, 11:00 pm
Week 4	Chapter 9: Lipid Structure and Function Chapter 9: Cell Membrane and Membrane Proteins Chapter 10: Transport Thermodynamics Chapter 10: Passive and Active Transport	Discussion Board #4	Initial Posting June 9, 11:00 pm Final Posting June 13, 11:00 pm
		Quiz #4	June 10, 11:00 pm
		Figure Summary #2	June 11, 11:00 pm
		Exam #4	June 13, 11:00 pm
Week 5	Chapter 11: Enzymes and Catalytic Mechanisms Chapter 11: Serine Proteases Chapter 12: Michalis Menten Kinetics Chapter 12: Enzyme Inhibition Chapter 12: Enzyme Regulation Special Topic: Drug Design	Discussion Board #5	Initial Posting June 16, 11:00 pm Final Posting June 20, 11:00 pm
		Quiz #5	June 17, 11:00 pm
		Case Study #3	June 18, 11:00 pm
		Exam #5	June 20, 11:00 pm
Week 6	Chapter 13: Hormones Chapter 13: Tyrosine Kinases Chapter 13: GCPR Special Topic: Vaccines Special Topics: Selected by Students	Discussion Board #6	Initial Posting June 23, 11:00 pm Final Posting June 27, 11:00 pm
		Quiz #6	June 24, 11:00 pm
		Figure Summary #3	June 25, 11:00 pm
		Exam #6	June 27, 11:00 pm

APPENDICES**Discussion Rubric**

Criterion	Below Average	Average	Very Good	Excellent	Score
Quality of Information in Posting	Posting simply restates the main concept. Does not demonstrate an understanding of materials and concepts Introduces little or no substantive contribution to discussion	Demonstrates a moderate understanding of materials and concepts No details and/or examples are given.	Postings consistently focus on the week's topic and relate the underlying concepts in the readings to the discussion. Provides at least 1 supporting detail or example. Demonstrates strong understanding of materials and concepts	Postings consistently focus on the week's topic and relate the underlying concepts in the readings to the discussion. Comments including several supporting and details and/or examples. Demonstrates a superior understanding of materials and concepts	
Citations and Resource Development	Never cites sources and/or does not provide information regarding outside resources related to the topic.	Rarely cites sources or provides information regarding outside resources related to the topic.	Occasionally cites sources or provides information regarding outside resources related to the topic.	Consistently cites relevant and reliable sources used to develop posting and provides information regarding outside resources related to the topic.	
Critical Thinking	Does not identify and summarize the problem, is confused or identifies a different or inappropriate problem	Identifies the main problem and subsidiary, embedded, or implicit aspects of the problem	Identifies not only the basics of the issue, but recognizes nuances of the issue	Provides exemplary insights, engages other opposing postings, and draws support from experience and information not available from assigned sources	
Word Choice, Voice, and Grammar	The writer struggles with a limited vocabulary and is unable to convey meaning. Grammar, spelling, and basic punctuation are often incorrect.	Though understandable, writing lacks detail and precision. Some problems exist with word usage, syntax and grammar are present.	The writer demonstrates a strong grasp of standard writing conventions. A few problems with word usage and grammar are present	The writer demonstrates a strong grasp of standard writing conventions, including spelling, punctuation, word usage appropriate for graduate level work. Very few grammatical and/or typographical errors were present, if any.	
Participation	A post own comments but does not interact with others in the online community.	Rarely interacts or responds to other members of the online community other than required responses.	Occasionally responds to other members of the online community over the required minimum number of postings.	Consistently encourages and facilitates interaction among members of the online community on an ongoing basis over the required minimum number of postings. Provides very timely responses to postings	
Total Score:					

Detailed Grading Rubric Article Figure Summary

Necessary Background	10 9 8 pts	7 6 5 pts	4 3 pts	2 1 pts	0 pts
	Background clearly and concisely answers the reason/need for this research to be completed and why. Provides necessary and thorough information on the reasoning for the figure.	Background concisely answers the reason/need for this research to be completed and why. Provides necessary information on the reasoning for the figure.	Background answers the reason/need for this research to be completed and why. Provides information on the reasoning for the figure.	Background barely answers the reason/need for this research to be completed. Information on the reasoning for the figure is vague	Background is not relevant to the research. Information on the reasoning for the figure is missing
Objective	5 pts	4 pts	3 pts	2 1 pts	0 pt
	Clear and thorough objective of the figure is presented in one or two sentences	Clear objective of the figure is presented in one or two sentences	Objective of the figure is presented in one or two sentences	Objective of the figure is vague	Objective of the figure is missing
Explanation of reasoning for use of technique	10 9 8 pts	7 6 5 pts	4 3 pts	2 1 pts	0 pts
	Thoroughly explains why the technique was selected and the information the data derived from the technique gives	Explains why the technique was selected and the information the data derived from the technique gives	Vaguely explains why the technique was selected and the information the data derived from the technique gives	Vaguely explains why the technique was selected only.	Explanation is missing
Discussion of Results	10 9 8 pts	7 6 5 pts	4 3 pts	2 1 pts	0 pts
	Completely discusses the figure and all necessary components of the figure (axes/data points) and addresses the controls if present	Discusses the figure and all necessary components of the figure (axes/data points) and addresses the controls if present	Discussion of the figure is vague and is missing essential details of the results in addition to discussion of controls	Results are inadequately discussed and major results/control are missing	Is not present
Conclusions	10 9 8 pts	7 6 5 pts	4 3 pts	2 1 pts	0 pts
	Clear and thorough analysis of the conclusions drawn in the paper from the figure. Leads the reader to understand the logic behind the conclusions drawn from the figure's results	Analysis of the conclusions drawn in the paper from the figure. Leads the reader to understand the logic behind the conclusions drawn from the figure's results	Vague analysis of the conclusions drawn in the paper from the figure. Briefly leads the reader to understand the logic behind the conclusions drawn from the figure's results	Unclear and/or missing analysis of the conclusions drawn in the paper from the figure. Unclear logic presented to understand conclusions drawn from figure's results	Conclusions are missing
Readability and logic of prelab article	5 pts	4 pts	3 pts	2 pts	1-0 pt
	Reader is guided smoothly through the logically arranged prelab article summary. There is evidence of sufficient proof-reading for grammar, no first person, and proper sentence structure	Reader is guided through the logically arranged prelab article summary. There are errors in grammar, first person used, spelling, and proper sentence structure	Reader is guided through the prelab article summary. Numerous errors in grammar, first person used, spelling, and proper sentence structure	Reader is often lost and is unable to make connections to the content discussed. Quite obvious no proof-reading for grammar, first person used, spelling, and proper sentence structure	Reader cannot interpret the logic or organization of the prelab article summary. Writing is unreadable with errors in grammar, first person used, spelling, and proper sentence structure