

West Virginia University
Department of Biochemistry and Molecular Medicine

Biochemistry-339 (BIOC-339)

Introduction to Human Biochemistry

Fall 2023

BIOC-339 Course Description: *Prerequisite:* Students must have taken Organic Chemistry (CHEM231 or CHEM 233) to enroll for this course. BIOC-339 is a 4 credit, introductory course suitable for undergraduates and graduate students. It is strongly biased towards the study of the biochemistry of higher animals and is especially suited to students intending to progress further in the Health Sciences. Material covered in this course includes structures, properties and functions of biomolecules, including sugars, fats, amino acids, nucleotides, proteins, and nucleic acids. Topics also include enzyme kinetics and mechanisms, structure and functions of bio-membranes, metabolic pathways, and mechanisms regulating metabolism and gene expression. It consists of four 50 min lectures per week, with 4 exams, a comprehensive makeup exam and a comprehensive final exam.

FACULTY:

Dr. Steven Frisch, Professor
Room: 116 BMRC (Erma Byrd building)
Phone: 293-2980
Email: sfrisch@hsc.wvu.edu

Dr. Vazhaikurichi Rajendran, Professor, co-coordinator
Room: 3146 HSC-N
Phone: 293-0510
Email: vazhaikurichi.rajendran@hsc.wvu.edu

Dr. Mike Schaller, Professor, co-coordinator
Room: 4008A HSC-N
Phone: 293-9514
Email: mschaller@hsc.wvu.edu

Dr. Max Sokolov, Professor
Room: 224 BMRC (Erma Byrd building)
Phone: 293-1123
Email: msokolov@hsc.wvu.edu

COURSE OBJECTIVES

This is an introductory course in biochemistry. The objectives for the course are for the student to develop an understanding of the structure and function of the molecules making up living organisms, the mechanisms of the biosynthesis of these molecules, metabolism and inheritance of genetic information.

After completion of the course, the student should be able to do the following:

- Describe the structures and functions of enzymes and other proteins found in human cells
- Discuss general mechanisms of energy generation and storage in cells
- Compare the mechanisms of synthesis and degradation between different common classes of molecules found in cells including sugars, lipids, proteins and nucleic acids
- Describe how cells store, access, and process information that is necessary for the generation of all cellular components

Each individual lecture has a list of more focused objectives which will, in summation, lead the student to be able to complete the comprehensive course objectives listed above.

RULES AND REGULATIONS

1. Lectures. Four 50 min lectures per week on Mondays and Wednesdays from 9:00 to 10:50 AM in the Health Sciences Addition G17 (Hostler Auditorium). Students are expected to attend all the lectures. Quarterly exams and the makeup exam will be given at 9 AM in Hostler Auditorium (in class time).

2. Course Materials.*

1. *Textbook.* 1) Biochemistry: The Molecular Basis of Life, 7th edition, by McKee & McKee. 2) Molecular Biology of the Cell, 7th edition by Alberts. Biochemistry lectures are based on first text and molecular biology lectures are based on the second text. Students will benefit from having the texts to follow or supplement lectures.
2. *PowerPoint Files.* Lectures will be presented as PowerPoint slide shows. The PowerPoint files will be available on the Health Science Center educational website (SOLE) for viewing and downloading before the lectures are given.
3. *Additional material.* Faculty may provide additional material to assist student preparation for lecture or review following lecture. This material will be posted on the SOLE site.
4. *iClicker polling.* We will be using iclicker polling for quizzes and engagement in active learning activities. You will need your smart phone to participate.

* All course materials, including lectures, class notes, quizzes, exams, handouts, presentations, and other materials provided to students for this course are protected intellectual property.

3. Quizzes and Class Participation. Participation will be an important component of class. There will be class quizzes to test comprehension of material that students are asked to master before a class or review after a class. Quizzes will be taken using iClicker polling. Bring your Smart Phone to class (and make sure it is charged!). Students may also be asked to participate during class to reinforce concepts and review facts as part of active learning activities. Quizzes/class participation will be graded. Attendance, participation in class quizzes and in active learning activities will all be assessed for class participation. Every lecture will have a quiz and a participation component (48 quizzes/participation scores) and there will be NO opportunity to make up a missed quiz. Students with an excused absence (arranged in advance) will be given credit for a missed quiz/participation. To accommodate unforeseen circumstances resulting in an unexcused absence and a missed quiz, the final cumulative quiz/participation score will count only the quiz/participation score from 44 lectures. The quiz/participation score for each class will be a maximum of 5 points, with half the points coming from the quiz and half from participation. 5 points X 44 lectures = 220 points. Quiz/participation will be weighted to account for 15% of the final grade.

4. Exams. During the semester, there will be 4 quarterly exams, a makeup exam and a final exam. Students with an excused absence on an exam day should consult the course coordinators *in advance of the exam*.

1. Quarterly Exams. 4 exams of 50 questions (10-12 lectures/exam; 60 min/exam) scheduled in class time (9:00 – 10:00) on Mondays in Hostler Auditorium (except the Nov 15 exam – Exam 4, which is scheduled on a Wednesday). Questions will mostly be of multiple-choice with a few True/False types. Exams will be graded out of 50 points. Exams will be weighted so that each exam accounts for 15% of the final grade.

2. Makeup Exam. There will be a single, comprehensive makeup exam on Monday, December 4, 2023, at 9 AM in Hostler Auditorium. No other makeup exams for unexcused absences will be provided. The makeup exam will cover material from each lecture and will consist of 100 questions, mostly of multiple-choice with a few True/False types. The makeup exam will be 110 minutes long. If a student takes all four quarterly exams and the makeup exam, the score on the makeup exam could be used to replace a grade of any of the 4 quarterly exams. The makeup exam will be graded out of 100 points. If the makeup exam is used in calculating the final grade, it will be weighted to account for 15% of the final grade.

3. Final Exam. At the end of the semester, there will be a final exam (100 questions; 110 minute exam), which will be a comprehensive exam covering material from each lecture and will mostly be of multiple-choice with a few True/False types. Date, time and location to be determined. The final exam will be graded out of 100 points. The final exam will be weighted to account for 25% of the final grade.

5. Midterm Grades. Midterm grades will be posted, approximately halfway through the semester. The grade will be based upon the scores from the first two exams and 24 quizzes.

6. Grading. Each of the quarterly exams will count for 15% of the final grade. The Final Exam will count for 25% of the final grade. After an exam, students will have one week to bring any questions regarding that exam's grade to the faculty member involved. No grade changes will be made after this deadline. Quizzes/class participation will count for 15% of the final grade (7.5% for quizzes and 7.5% for participation).

7. Grades. The following scale is a guide for how grades are usually assigned; however, final grades may deviate slightly from the scale below:

A = 90 – 100%

B = 80 – 89%

C = 70 – 79%

D = 60 – 69%

8. Attendance. Students will need to attend the lectures to successfully complete this course. Attendance is required for class participation. Quizzes will occur during class time.

9. Faculty Consultation. Students are encouraged to consult Drs. Schaller or Rajendran, course co-coordinators, concerning any aspect or problem related to the course. Concerns relating to lecture material should be addressed to the individual instructor, preferably at the end of lectures, although Drs. Rajendran, Schaller, Sokolov and Frisch are available for consultation at any time. **Students should contact instructors by email to schedule a meeting outside of lecture hours.** Faculty often contact students via email regarding information related to this course – students should check their email accounts daily.

10. Academic Integrity/Dishonesty. Students enrolled in BIOC-339 should be aware that the Department of Biochemistry and Molecular Medicine will enforce the approved regulations on Academic Integrity/Dishonesty as laid out in the WVU catalog and the WVU Student Code of Conduct.

11. Summary.

Lectures: Monday and Wednesday 9:00-10:50 AM (Health Sciences Addition G17 (Hostler Auditorium))

Exam Schedule:

Exam 1 (Lectures 1-12): Monday, 9/11/23, 9:00-10:00 AM; Hostler Auditorium

Exam 2 (Lectures 13-22): Monday, 10/02/23, 9:00-10:00 AM; Hostler Auditorium

Exam 3 (Lectures 23-35): Monday, 10/30/23, 9:00-10:00 AM; Hostler Auditorium

Exam 4 (Lectures 36-48): ***Wednesday***, 11/15/23, 9:00-10:00 AM; Hostler Auditorium

Makeup Exam (Comprehensive): Monday, 12/04/23, 9:00-10:50 AM; Hostler Auditorium

Final Exam (Comprehensive): Date, time and location to be determined

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise Dr. Rajendran or Schaller and make appropriate arrangements with the [Office of Accessibility Services](http://diversity.sandbox.wvu.edu) (304-293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see <http://diversity.sandbox.wvu.edu>

The list of topics covered in the course in Fall 2023 is listed in the lecture schedule below:

Introduction to Human Biochemistry			
BIOC339 FALL 2023 Schedule			
	Wed Aug 16	First Day of Classes	
1	Wed Aug 16	Biomolecules	Schaller
2		Water - Structure and Properties	Schaller
3	Mon Aug 21	Water ionization, pH, Buffers	Schaller
4		Biochemical Reactions	Schaller
5	Wed Aug 23	Energy, Reactions, ATP	Schaller
6		Prokaryotes, Eukaryotes and Biological Membranes	Schaller
7	Mon Aug 28	Amino Acids	Sokolov
8		Proteins and Peptides	Sokolov
9	Wed Aug 30	Protein Structure	Sokolov
10		Properties of Enzymes	Sokolov
	Mon Sept 4	Labor Day	
		No class	
11	Wed Sept 6	Enzyme Kinetics	Sokolov
12		Enzyme Inhibition	Sokolov
	Mon Sept 11	EXAM 1 (LECTURES 1 - 12)	
		Exam 1 Review	Schaller/Sokolov
13	Wed Sept 13	Catalytic Mechanisms, Enzyme Regulation	Sokolov
14		Monosaccharides	Sokolov
	Sept 15 to 17	Rosh Hashanah	
15	Mon Sept 18	Dissaccharides, Homoglycans	Sokolov
16		Heteroglycans, Glycoconjugates	Sokolov
17	Wed Sept 20	Cell Surface and Nuclear Receptors	Sokolov
18		Glycolysis and Regulation	Rajendran
	Sept 24-25	Yom Kippur	
19	Mon Sept 25	Gluconeogenesis and Regulation	Rajendran
20		Pentose Phosphate Pathway & Glycogen Metabolism	Rajendran
	Sept 26 to 27	Prophet's birthday	
21	Wed Sept 27	Oxidation/Reduction Reactions	Rajendran

22		Citric Acid Cycle	Rajendran
	Mon Oct 2	EXAM 2 (LECTURES 13 -22)	
		Exam 2 Review	Sokolov/Rajendran
23	Wed Oct 4	Electron Transport & Oxidative Phosphorylation	Rajendran
24		Reactive Oxygen Species & Anti-oxidants	Rajendran
		Mid-Check Grades are due	
	October 5&6	Fall Break	
		No Classes	
25	Mon Oct 9	Lipid Structure & Classification I	Rajendran
26		Lipid Structure & Classification II	Rajendran
27	Wed Oct 11	Lipid Digestion, Absorption & Biotransformation	Rajendran
28		Fatty Acid Oxidation and Regulation	Rajendran
	Oct 15-24	Navratri	
29	Mon Oct 16	Fatty Acid Synthesis and Regulation	Rajendran
30		Phospholipid & Cholesterol Metabolism	Rajendran
31	Wed Oct 18	Integration of Metabolism: Feeding-Fasting Cycle	Rajendran
32		Nitrogen Fixation, Assimilation & Transamination	Schaller
33	Mon Oct 23	Amino Acid Synthesis	Schaller
34		Protein Turnover and Amino Acid Catabolism	Schaller
35	Wed Oct 25	Nucleotide Structure and Synthesis	Schaller
36		Deoxynucleotide Synthesis/Nucleotide Catabolism	Schaller
	Mon Oct 30	EXAM 3 (LECTURES 23-34)	
		Exam 3 Review	Rajendran/Schaller
37	Wed Nov 1	DNA, RNA and Chromatin Structure and Function	Frisch
38		DNA Replication and Repair	Frisch
39	Mon Nov 6	Transcription & RNA Processing	Frisch
40		Regulation of Gene Expression and Epigenetics	Frisch
41	Wed Nov 8	Protein Translation	Frisch
42		Protein Modification and Sorting	Frisch
	Sun Nov 12	Diwali	
43	Mon Nov 13	Regulation of the Cell Cycle	Frisch
44		Recombinant DNA	Frisch
	Wed Nov 15	EXAM 4 (LECTURES 35-44)	
		Exam 4 Review	Frisch/Schaller
	Nov 18-26	Fall Recess	
		No Classes	
45	Mon Nov 27	Clinical Correlation: Sickle Cell Anemia	Sokolov
46		Clinical Correlation: Coagulation	Schaller
47	Wed Nov 29	Clinical Correlation: Diabetes	Rajendran
48		Clinical Correlation: Carcinogenesis	Frisch
	Mon Dec 4	Makeup EXAM (Comprehensive - Lectures 1 to 48)	
	Wed Dec 6	MAKEUP EXAM REVIEW	All

Thurs Dec 7	Last day of classes
Dec 7 to 15	Hanukkah
Dec 11 to 15	Final Exams
TBA	FINAL EXAM (Comprehensive - Lectures 1 to 48)