

# BIOCHEMISTRY I

Chem 4600 (CRN 83855) / HON Chem 4600 (CRN 84758)

Fall 2019

Prerequisites:	<i>Required: Chem 1212K, 2400 and 2410 (grade of C or higher in Organic II )</i> <i>Recommended: Biol 3800 (Molecular Cell Biology), Chem 3400 (Biomolecules)</i>
Instructor:	<b>Dr. Gigi B. Ray, 212 Courtland North, Tel. (404) 413-5540, <a href="mailto:gbray@gsu.edu">gbray@gsu.edu</a></b>
Lecture:	<b>MWF 12:30 pm – 2:00 pm Classroom South 150 (5-credit hour course)</b> <b><i>Students are expected to come to class having PREVIEWED topics for that day</i></b>
iCollege:	PowerPoint notes posted on iCollege as Cross Listed Section (print and bring to class): <b>BIOCHEMISTRY I XLS GROUP VW FALL SEMESTER 2019</b>
Optional Weekly Review Sessions ( <i>Biochemistry Office Hours</i> )  Strongly Recommended	<b><u>Reviews: Mondays 2:15 – 3:00pm &amp; Wednesdays 2:15 –3:00pm, Location TBA</u></b> The <b>instructor</b> will be available every week all semester for review sessions (biochemistry office hours) to answer questions on current material. <b><i>This is the best time to ask questions on specific homework problems and lecture topics.</i></b> Regularly work problems at home, come frequently with questions, and improve your understanding and skills in solving biochemistry problems. <b><u>Tutoring Center</u></b> in Sports Arena 110 (STEM Center) – student tutor available specifically for Biochemistry courses in Chemistry Tutoring Center. Time TBA.
General Office Hours:	<b>Mondays 3:30 – 5:00 pm &amp; Fridays 9:30 – 10:30 am in 212 Courtland North</b> Instructor will be available to meet with students individually during office hours. <i>Students must bring their textbook, lecture notes, and attempted homework.</i> Office Hours are suspended on exam days. No questions will be answered on exam days. <b><i>Students who wish to discuss exam absences or other individual concerns need to schedule an appointment outside of class time, during office hours.</i></b> Students desiring to discuss course advising or career plans, can request to schedule an appointment outside of office hours.
Text (Required): <b>Use 8<sup>th</sup> Edition*</b> <b>7<sup>th</sup> Edition can be used, homework question numbers vary</b> <b>*Not using new 9<sup>th</sup> Edition</b>	<b><u>Textbook (required):</u></b> <b><i>Biochemistry, 8th Ed.,</i></b> Berg,J.M.; Tymoczko,J.L.; Gatto,G.J.; Stryer,L., (2015), W.H. Freeman: New York, NY. [ISBN 1-4641-2610-0 <i>Hardcover</i> or ISBN 1-4641-8801-7 <i>Looseleaf</i> ] <b><u>Workbook (strongly recommended):</u></b> Includes learning objectives, self-assessment problems with solutions, and expanded solutions to end-of-chapter textbook problems. <b><i>Biochemistry Student Companion, 8th Ed.,</i></b> Fertuck, K.; Rhodes, C.; Josephy, D.; Koeppe, R.E., (2015), W.H. Freeman: New York, NY. [ISBN 1-4641-8803-3 <i>Paperback</i> ]
Learning Outcomes:	The course will focus on <b><i>developing an understanding of the biochemical principles and processes that govern structure, interactions, functions &amp; transformations of biomolecules</i></b> ; this will help students rationalize biochemical facts and solve problems.  Upon successful completion of the course students will have the tools to be able to apply their knowledge of biochemistry to understand the causes of human diseases, as well as applications of biochemistry in medicine, agriculture and the environment.

Course Objectives:	<p>A comprehensive and integrated review of modern biochemistry with emphasis on proteins, enzymes, nucleic acids, lipids, carbohydrates and metabolism.</p> <p>Will examine <b>biomolecular structure-function relationships</b>, concepts of enzyme function, regulation, bioenergetics, metabolism, gene expression, and characterization of biomolecules. Organization, transport and signaling in cells will also be examined.</p> <p><b><u>Principles of ORGANIC MECHANISMS, KINETICS and THERMODYNAMICS will be applied throughout (working knowledge is expected PRIOR to taking biochemistry).</u></b></p>
Grading for Undergraduate Students:	<ul style="list-style-type: none"> <li>• <b>There will be four class exams worth 100 points each.</b> The lowest grade among class exams 1,2 &amp; 3 will be dropped. Note: exam 4 will not be dropped.</li> <li>• <b>There will be a comprehensive final exam worth 150 points</b> (Dec 16<sup>th</sup> at 10:45 am). <b>The final exam is mandatory</b> and it will not be dropped under any circumstance.</li> <li>• <b>Quizzes will collectively be worth 50 points.</b> (1) Ten question online quizzes (in iCollege) will start Fri at 5pm &amp; end Mon at 11am. Lowest score of the 10 online quizzes will be dropped. (2) Five 2pt in-class quizzes. <b>[ Quiz Points = sum of quiz scores / 2 ]</b></li> </ul> <p><b>Semester Grade = [(sum 3 best class exams + quiz points + final exam) / 500] * 100</b></p> <ul style="list-style-type: none"> <li>• <b>Total possible points is 500.</b> No makeup exams or quizzes will be allowed.</li> </ul>
Grading Scale:	<p><b>A+ 97% A 90% A- 87% B+ 84% B 80% B- 76% C+ 71% C 65%</b></p> <p><b>C- 59% D 50% F &lt;50%</b></p>
Exams:	<p style="text-align: center;"><b><u>COURSE POLICIES</u></b></p> <p><b><u>1) NO MAKE-UP or RESCHEDULING OF EXAMS (before or after exam date and time) will be carried out under ANY CIRCUMSTANCE.</u></b></p> <p><b><u>If you miss a class exam for ANY reason, that is your dropped grade.</u></b></p> <p><b><u>The Final Exam must be taken Monday Dec 16<sup>th</sup> at 10:45 am – 1:15 pm.</u></b></p> <p><b>2) <u>On exams and quizzes students are responsible for knowing all assigned reading material in the textbook, PowerPoint notes, and assigned homework problems</u></b> (even if not covered in class). Homework problems may appear as exam questions.</p> <p><b>3) The Instructor reserves the right to seat or move students during exams for any reason.</b></p> <p><b>4) Students are required to show (and leave) their student identification out on the desk in order to take and submit an exam. Exams will be collected and <u>graded ONLY if a student picture I.D. is shown (GSU ID card or driver's license).</u></b></p> <p><b>5) <u>Cell phones, calculators, ipods, iphones, tablets, laptops and all other electronic devices are NOT allowed out on classroom tables during exams.</u></b> Cell phones and anything with an on/off switch must be <u>OFF</u> during all exams, and silent during class. If a phone rings during an exam, the instructor may answer it and deduct points.</p> <p><b>6) Students are responsible for checking their exam scores posted in iCollege. <u>Scantrons &amp; Exams can be viewed during scheduled times in instructor's office.</u></b> Any discrepancies need to be addressed within 1 week after grades have been posted in iCollege. Changes will not be made at the end of the semester.</p> <p><b>7) <u>Tuesday Oct 15<sup>th</sup> is the last day to withdraw from the class and receive a "W".</u></b> You are responsible for withdrawing before the deadline if you need to do so. <u>If more than one exam is missed for legitimate reasons</u>, you should seek a hardship withdrawal from the Dean of Students. If you do not withdraw and miss the final exam, or miss more than one class exam, then zeros will be assigned for these grades. Poor performance will not be rewarded with incompletes. The University requires that faculty members must, on a date after the mid-point of the course to be set by the Provost (or his designee):</p> <ol style="list-style-type: none"> <li>1. Give a WF to all those students who are on their rolls but no longer taking the class</li> <li>2. Report the last day the student attended or turned in an assignment.</li> </ol>

<p>Suggestions for how to do well in Biochemistry:</p>	<p><b><u>Biochemistry cannot be learned overnight, do NOT wait till the end to study.</u></b></p> <p><b><i>To succeed in biochemistry one must learn to speak the language of biochemistry:</i></b></p> <p><b>PREVIEW</b> the day's topic before class so you are prepared for class. <b>PARTICIPATE</b> in class by asking questions. After class, <b>REINFORCE</b> by READING the textbook carefully. <b>REVIEW</b> and write your own notes, make summaries, draw diagrams. <b>PRACTICE</b> and <b>APPLY</b> concepts by regularly doing assigned <b>HOMEWORK PROBLEMS</b> from textbook and workbook. It is difficult to answer questions on exams if problems have not been practiced at home. <i>Passing the course requires more than short term memorization; you need to learn and understand the material well, so that you can apply concepts to new questions and teach them to a classmate.</i> <b>ASK</b> questions during weekly <b>REVIEWS</b>.</p> <p><b><u>Material from each class is often used in next class, so STUDY biochemistry DAILY!</u></b></p> <ul style="list-style-type: none"> <li>- Download &amp; preview lecture notes from the iCollege website before coming to class.</li> <li>- <b><u>Attendance at all classes is crucial to the student's success in this course.</u></b></li> <li>- Board notes &amp; answers to blanks in PowerPoint notes will ONLY be available during class.</li> </ul> <p><b><u>The exam is not a good place to do problems for the first time!</u></b></p> <p><b>Chapter outlines</b> will be posted listing specific problems for each chapter from the <b>workbook self-test questions &amp; problems</b>, and the <b>textbook end-of-chapter problems</b>. Attempt problems on topics covered each day, rather than waiting to finish the chapter before starting any problems. <b><i>Solutions to all problems (including those in textbook) are available in the workbook. Practice exams</i></b> will be posted before each class exam.</p> <p><b>Weekly quizzes</b> will be assigned <b>online in iCollege</b> – 10 questions quizzes will open at <b>5pm on Fridays</b> and close at <b>11am the following Monday</b>, before the start of the next class.</p> <p><b>Announcements</b> will be posted on iCollege, so please check on a daily basis.</p>
<p>Cheating:</p>	<p>All tests and quizzes taken must represent your individual, unaided effort. <b>To receive or offer information during an examination is cheating.</b> The use of unauthorized supplementary materials or any electronic or photographic device during tests is also cheating.</p> <p><b><u>A student who cheats on an exam will receive a zero for that exam, which cannot be dropped as the lowest grade.</u></b> Any suspected offenses may also be referred to the Department Chair for appropriate action.</p> <p>The Department of Chemistry follows the university policy on academic honesty published in the "Faculty Affairs Handbook" and the "On Campus: The Undergraduate Co-Curricular Affairs Handbook."</p>

**TENTATIVE CLASS SCHEDULE (Subject to change) Q=Quiz starts at 5pm. Due by 11am the following Monday**

Date	Day	Chapter	<i>Amino Acids, Proteins and Hemoglobin Function</i>	Lecture No.
Aug 26	M	1	Introduction to Course	1
Aug 28	W	1	Review: Intermolecular Interactions and Acid-Base Chemistry (pK <sub>a</sub> )	2
Aug 30 <b>Q1</b>	F	2	Aqueous Biochemistry (Buffers) and Amino Acids	3
<b>Sept 2</b>	<b>M</b>		Amino Acid Structures, Properties (pI, net charge) and Reactivity	
			<b>Labor Day Holiday, no class</b>	
Sept 4	W	2	Peptide Bonds and Secondary Structure	4
Sept 6 <b>Q2</b>	F	2	3D Protein Structure (3° & 4°) & Protein Folding	5
Sept 9	M	7	Hemoglobin Structure & Oxygen Transport	6
Sept 11	W	7	Hemoglobin Cooperativity	7
Sept 13 <b>Q3</b>	F	7	Hemoglobin Allostery: Fine Tuning O <sub>2</sub> Binding Affinity	8
Sept 16	M	3	Protein Purification Techniques	9
Sept 18	W	3	Protein Sequencing and Structure Analysis	10
<b>Sept 20</b>	<b>Fri</b>		<b>Exam 1 (Material from Chapters 1, 2, 3, 7)</b>	<b>11</b>

**TENTATIVE CLASS SCHEDULE (Subject to change) Q=Quiz starts at 5pm. Due by 11am the following Monday**

Date	Day	Chapter	<i>Enzymes: Kinetics, Catalytic Mechanisms and Regulation</i>	Lecture
Sept 23	M	8, 3	Introduction to Enzymes	12
Sept 25	W	8	Enzymes: Michaelis-Menten Kinetics	13
Sept 27 <b>Q4</b>	F	8	Enzymes: Inhibition	14
Sept 30	M	9	Catalytic Strategies and Serine Proteases	15
Oct 2	W	9	Chymotrypsin Mechanism and Specificity	16
Oct 4 <b>Q5</b>	F	10	Enzymes: Regulation	17
Oct 7	M	10	Chymotrypsin Regulation: Zymogens	18
Oct 9	W	11	Carbohydrates: Structure and Reactivity	19
<b>Oct 11</b>	<b>Fri</b>		<b>Exam 2 (Material from Chapters 8, 9, 10, 3)</b>	<b>20</b>
			<i>Carbohydrate Metabolism: Glycolysis and Glycogen</i>	
Oct 14	M	11	Disaccharides and Polysaccharides: Glycosidic Bonds	21
<b>Oct 15</b>	<b>T</b>		<b>Last day to Withdraw and possibly receive a W</b>	
Oct 16	W	15	Bioenergetics: Energy & Phosphoryl Transfer Potential	22
Oct 18 <b>Q6</b>	F	15	Bioenergetics in Cellular Conditions & Reactions of Metabolism	23
Oct 21	M	16	Glycolysis Reactions I, and Enzyme Mechanisms	24
Oct 23	W	16	Glycolysis Reactions II, and Enzyme Mechanisms	25
Oct 25 <b>Q7</b>	F	21	Introduction to Glycogen Metabolism	26
Oct 28	M	21, 16	Glycogen, Glycolysis Regulation & Gluconeogenesis	27
Oct 30	W	12	Lipids and Membrane Structure	28
<b>Nov 1</b>	<b>Fri</b>		<b>Exam 3 (Material from Chapters 11, 15, 16, 21)</b>	<b>29</b>
			<i>Energy Metabolism: Citric Acid Cycle, ATP and Fatty Acids</i>	
Nov 4	M	17	Citric Acid Cycle (TCA) Reactions I, and Enzyme Mechanisms	30
Nov 6	W	17	Citric Acid Cycle (TCA) Reactions II, and Enzyme Mechanisms	31
Nov 8 <b>Q8</b>	F	17, 13	Fates of Pyruvate (PDHC) & Membrane Transport	32
Nov 11	M	18	Electron Transport Chain & Biochemical Oxidation-Reduction	33
Nov 13	W	18	Mitochondrial ETC: Q-cycle, O <sub>2</sub> Reduction, and Proton Pumping	34
Nov 15 <b>Q9</b>	F	18	Oxidative Phosphorylation (ATP Synthase) & Respiratory Control	35
Nov 18	M	22, 18	Introduction to Fatty Acid Catabolism & Energy Output	36
Nov 20	W	4	DNA Structure and Function	37
<b>Nov 22</b>	<b>Fri</b>		<b>Exam 4 (Material from Chapters 12, 13, 17, 18, 22)</b>	<b>38</b>
<b>Nov 25 - 29</b>	<b>M - F</b>		<b>Thanksgiving Break, no class</b>	
			<i>DNA Replication and Gene Expression</i>	
Dec 2	M	4, 28	DNA Replication Mechanisms	39
Dec 4	W	30	Gene Expression in Prokaryotes: Protein Synthesis	40
Dec 6 <b>Q10</b>	F	14	Diabetes and Hormonal Regulation by Insulin and Glucagon	41
Dec 9	M		Final Exam Review	42
Dec 11	**W		Optional Final Exam Review (time & location TBA)	**optional
Dec 13	**F		Optional Final Exam Review (time & location TBA)	**optional
<b>Dec 16</b>	<b>Mon</b>		<b>Cumulative Final Exam – All Chapters Covered Time: 10:45 am – 1:15 pm (includes Chapters 4, 28, 30, 14 )</b>	