

# **BIOCHEMISTRY I**

**Chem 4600 (CRN 84947) / HON Chem 4600 (CRN 86944)**

**Fall 2016**

Prerequisites:	<i>Required: Chem 1212K, 2400 and 2410 (grade of C or higher in Organic II )</i> <i>Recommended: Biol 3800 (Molecular Cell Biology)</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 8:30 am – 10:00 am, Library South 102 (5-credit hour course)</b> <b><i>Students are expected to come to class having PREVIEWED topics for that day.</i></b>
iCollege:	Class notes posted on iCollege as Cross Listed Section (print and bring to class): <b>BIOCHEMISTRY I XLS GROUP VW FALL SEMESTER 2016</b>
Optional Weekly Tutorial Sessions Strongly Recommended	<b><u>Reviews on Wednesdays 10 - 11am &amp; Fridays 2:30 - 3:30pm, in PSC 362 (tentative)</u></b> The instructor will be available once a week all semester for review sessions 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.
Office Hours:	<b>Mondays 12:00 – 3:00 pm and Wednesdays 1:00 – 4:00 pm in 212 Courtland North</b> Instructor will be available to meet with students individually during office hours. Students must bring their textbook, lecture notes, and homework. <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> <b>Office Hours are suspended the day of the Exam.</b> No questions will be answered on the day of exams. Students desiring to discuss course advising, career plans, etc., can request to schedule an appointment outside of office hours.
Text (Required): <i>You can use either the 7<sup>th</sup> or 8<sup>th</sup> Edition</i>	<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>or</b> <b><i>Biochemistry, 7th Ed.,</i></b> Berg, J.M.; Tymoczko, J.L.; Stryer, L., (2012), W.H. Freeman: New York, NY. [ISBN 1-4292-2936-5 <i>Hardcover</i> or ISBN 1-4292-7396-8 <i>Looseleaf</i> ] <b><u>Workbook (strongly recommended): Biochemistry Student Companion, 7th Ed.,</u></b> Deis, F.H.; Gerber, N.C.; Gumpport, R.I.; Koeppe, R.E., (2012), W.H. Freeman: New York, NY. [ISBN 1-4292-3115-7 <i>Paperback</i> ]. <i>Includes learning objectives, self-assessment problems with solutions, and expanded solutions to end-of-chapter textbook problems.</i> <b>7<sup>th</sup> or 8<sup>th</sup> Edition of Textbook and Workbook can be used, but assigned homework question numbers may be different.</b>
Learning Outcomes:	The course will focus on <b><i>developing an understanding of the biochemical principles and processes that govern the 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 characterizing 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:	<p><b>There will be four class exams worth 40 points each.</b> The class exam with the lowest grade will be dropped before totaling the remaining <b>possible points out of 200.</b></p> <p><b>There will be a comprehensive final exam worth 60 points</b> (on Dec 7<sup>th</sup> at 8:00am). <b>The final exam is mandatory</b> and it will not be dropped under any circumstance.</p> <p><b>Quizzes will collectively be worth 20 points.</b> There will be 10 quizzes and the lowest two quiz grades will be dropped. Each quiz has 10 questions. [Quiz Points = divide sum of best 8 quiz scores by 4]</p> <p><b>Semester Grade = [(sum 3 best class exams + quiz points + final exam) / 200] * 100</b></p>
Grading Scale:	<p><b>A+ 97% A 90% A- 87% B+ 84% B 80% B- 76% C+ 71% C 65%</b>  <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 Wed Dec 7<sup>th</sup> at 8:00 – 10:30 am.</u></b></p> <p><b>2) <u>Exams and quizzes may cover material assigned in textbook or in PowerPoint notes, but not necessarily covered in class.</u></b> Students are responsible for knowing all assigned reading material and homework problems. Class notes posted on iCollege.</p> <p><b>3) The Instructor reserves the right to seat or move students during exams.</b></p> <p><b>4) Students are required to show (and leave) their student identification 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 <b>OFF</b> during all exams and silent during class. If a phone rings during an exam, points may be deducted.</p> <p><b>6) Students are responsible for checking their exam scores posted on iCollege. Scantrons can be viewed during scheduled times in instructor's office. Any discrepancies need to be addressed within 1 week after grades have been posted.</b> Changes will not be made at the end of the semester.</p> <p><b>7) Tuesday Oct 11<sup>th</sup> is the last day to withdraw from the class and receive a "W".</b> You are responsible for withdrawing before the deadline if you need to do so. If <b><u>more than one exam is missed for legitimate reasons</u></b>, you should seek a hardship withdrawal or an incomplete. 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.</p> <p>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>1) Students are strongly encouraged to <b>download the lecture notes from the iCollege website before coming to class.</b> <u>Attendance at all classes is crucial to the student's success in this course.</u> Answers to blanks in notes will ONLY be available during class.</p> <p>2) <b>PREVIEW before coming to class: students are strongly encouraged to carefully READ and STUDY the day's topic in the lecture notes and textbook prior to class.</b></p> <p>3) <b>Chapter outlines</b> will be posted listing text topics and reading. <b>Specific problems will be assigned for each chapter from the workbook self-test questions &amp; problems, and the text end-of-chapter problems.</b> It is recommended that problems be tried in this sequence for each chapter. Solutions to all problems (including those in textbook) are available in the workbook. <b>Practice exams</b> will also be posted for each class exam.</p> <p><b><u>The exam is not a good place to do problems for the first time!</u></b></p> <p>4) <b>Keep up with the material, by READING the text, REVIEWING the notes, and DOING HOMEWORK PROBLEMS REGULARLY prior to the next class meeting. Also attend REVIEW SESSIONS often and ask QUESTIONS.</b></p> <p><b><u>Material from each class is often used in next class, so STUDY biochemistry DAILY!</u></b></p> <p>5) <b>Weekly quizzes</b> will be assigned <b>online using iCollege:</b> quizzes will open on <b>Fridays at 5:00pm</b> and be <b>due before the start of the next class meeting</b> on Mondays <b>before 8:00am.</b></p> <p>6) <b>Announcements</b> will be posted on iCollege, so please check on a daily basis, and between class meetings.</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 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)** \* indicates after class REVIEW    **Q** = start of quiz

Date	Day	Chapter	<i>Amino Acids, Proteins and Hemoglobin Function</i>	Lecture No.
Aug 22	M	1	Introduction to Course Review: Intermolecular Interactions and Acid-Base Chemistry (pK <sub>a</sub> )	1
Aug 24	W*	1	Aqueous Biochemistry (Buffers) and Amino Acids	2
Aug 26 <b>Q1</b>	F*	2	Amino Acid Structures, Properties (pI and net charge), Reactivity	3
Aug 29	M	2	Peptide Bonds and Secondary Structure	4
Aug 31	W*	2	3D Protein Structure (3° & 4°) & Protein Folding	5
Sept 2 <b>Q2</b>	F*	7	Hemoglobin Structure & Oxygen Transport	6
<b>Sept 5</b>	<b>M</b>		<b>Labor Day Holiday, no class</b>	
Sept 7	W*	7	Hemoglobin Cooperativity	7
Sept 9	F*	7	Hemoglobin Allostery: Fine Tuning O <sub>2</sub> Binding Affinity	8
<b>Sept 12</b>	<b>Mon</b>		<b>Exam 1 (Material from Chapters 1, 2, 7)</b>	<b>9</b>

**TENTATIVE CLASS SCHEDULE (Subject to change)** \* indicates after class REVIEW Q = start of quiz

Date	Day	Chapter	<i>Enzymes: Kinetics, Catalytic Mechanisms and Regulation</i>	Lecture
Sept 14	W*	8	Introduction to Enzymes	10
Sept 16 <b>Q3</b>	F*	8	Enzymes: Michaelis-Menten Kinetics	11
Sept 19	M	8	Enzymes: Inhibition	12
Sept 21	W*	9	Catalytic Strategies and Serine Proteases	13
Sept 23 <b>Q4</b>	F*	9	Chymotrypsin Mechanism and Specificity,	14
Sept 26	M	10	Enzymes: Regulation	15
Sept 28	W*	10, 3	Chymotrypsin Regulation & Protein Sequencing	16
Sept 30	F*	9, 3	Carbonic Anhydrase Mechanism & Protein Purification	17
<b>Oct 3</b>	<b>Mon</b>		<b>Exam 2 (Material from Chapters 8, 9, 10, 3)</b>	<b>18</b>
			<i>Carbohydrate Metabolism: Glycolysis and Glycogen</i>	
Oct 5	W*	11	Carbohydrates: Structure and Reactivity	19
Oct 7 <b>Q5</b>	F*	11, 15	Complex Carbohydrates, Energy and Metabolism	20
Oct 10	M	15	Bioenergetics	21
<b>Oct 11</b>	<b>T</b>		<b>Last day to Withdraw and possibly receive a W</b>	
Oct 12	W*	15, 16	Reactions of Metabolism and Glycolysis	22
Oct 14 <b>Q6</b>	F*	16	Glycolysis Reactions and Enzyme Mechanisms	23
Oct 17	M	16	Glycolysis Reactions and Regulation	24
Oct 19	W*	16, 11	Gluconeogenesis and Polysaccharides	25
Oct 21	F*	21	Introduction to Glycogen Metabolism	26
<b>Oct 24</b>	<b>Mon</b>		<b>Exam 3 (Material from Chapters 11, 15, 16, 21)</b>	<b>27</b>
			<i>Energy Metabolism: Citric Acid Cycle, ATP &amp; Fatty Acids</i>	
Oct 26	W*	17	Pyruvate Dehydrogenase Complex and Citric Acid Cycle	28
Oct 28 <b>Q7</b>	F*	17	Citric Acid Cycle (TCA) Reactions and Enzyme Mechanisms	29
Oct 31	M	12, 13	Membrane Structure and Transport Across Membranes	30
Nov 2	W*	18, 13	Biochemical Oxidation-Reduction Reactions	31
Nov 4 <b>Q8</b>	F*	18	Electron Transport Chain: Q-cycle & Proton Pumping	32
Nov 7	M	18	Oxygen Reduction Coupled to ATP Synthesis	33
Nov 9	W*	22	Introduction to Fatty Acid Catabolism: Beta Oxidation	34
Nov 11 <b>Q9</b>	F*	17, 16	Energy Output and GLUT Transporters	35
Nov 14	M	14	Signal Transduction: Hormonal Regulation of Metabolism (GPCR)	36
Nov 16	W*	4	DNA Structure and Function	37
<b>Nov 18</b>	<b>Fri</b>		<b>Exam 4 (Material from Chapters 17, 18, 22, 12, 13)</b>	<b>38</b>
<b>Nov 21-25</b>	<b>M – F</b>		<b>Thanksgiving Break, no class</b>	
			<i>DNA Replication, Gene Expression, Integration of Metabolism</i>	
Nov 28	M	28	DNA Replication	39
Nov 30	W*	29	Gene Expression: Transcription in Prokaryotes	40
Dec 2 <b>Q10</b>	F*	30	Protein Synthesis: Translation in Prokaryotes	41
Dec 5	M*	27	Integration of Carbohydrate Metabolism & Final Exam Review	42
Dec 6	**T		<i>Optional Final Exam Review (time &amp; location TBA)</i>	<i>**optional</i>
<b>Dec 7</b>	<b>Wed</b>		<b>Cumulative Final Exam – All Chapters Covered Time: 8:00 am - 10:30 am (includes Chapters 4, 28, 29, 30, 14)</b>	