

Course Description
Fundamentals of Biochemistry
Biochemistry 401G
Summer 2015

Last revised March 1, 2015

Course description: This course introduces students to the general families of biomolecules that comprise the science of biochemistry and to the principles that integrate biochemistry with other chemical and biological disciplines. This course is excellent preparation for students headed into professional programs in medicine, dentistry, pharmacy, and other health professions. Students are well advised to have completed courses in general chemistry, organic chemistry, and introductory biology before undertaking this course.

This four-week course is intellectually rigorous and will proceed at a pace twice that seen in the course offered during the fall or spring semesters. It will require students to attend classes and study on a daily basis. Students are not encouraged to take this course if they are taking other courses, working a significant amount of time during the summer session, or planning to travel over weekends. The following is an abbreviated summary of the course meeting times, problem-solving sessions and examinations. A more detailed summary of this information is found later in this course description and in the syllabus.

	M	T	W	Th	F	
week of May 11	{	1	4	7	10	
		2	5	8	11	
		3	6	9	12	

	M	T	W	Th	F	
week of May 18	{	E	13	16	19	22
			14	17	20	23
			15	18	21	24

	M	T	W	Th	F	
week of May 25	{	E	25	28	31	
			26	29	32	
			27	30	33	

	M	T	W	Th	F	
week of June 1	{	E	34	37	40	43
			35	38	41	44
			36	39	42	45

	M	T	W	Th	F	
week of June 8	{					
			E			

Instructors: All instructors are faculty members in the Department of Molecular and Cellular Biochemistry, and we are located in either the BBSRB building or in the BioPharm Building.

Instructor	Office	Email	Telephone	Office Hours
David Watt (Course Director)	BioPharm Complex, BPC421	dwatt@uky.edu	576-7373	TBA
	BBSRB Bldg,			TBA
	BBSRB Bldg,			TBA

Teaching Assistant: _____ is a Teaching Assistant this semester and can be reached at _____.

Office Hours: Instructors will hold office hours by appointment only. Because the buildings in which we have offices are under controlled access, we will meet with students on an individually scheduled basis. Students should feel free to contact instructors by email as a means of resolving questions and if this is not satisfactory, arrange a time to meet.

Class meeting time and place: The course will meet at _____ in BioPharm Complex Building BPC124.

Attendance policy: Students are encouraged to attend class. The lectures will highlight important concepts covered in the textbook and will emphasize the material that will be covered on the examinations. A weekly problem-solving session on Fridays will assist students in preparing for the examinations scheduled early in the following week.

Starting with lecture seven, there will be several classroom quiz questions during each class period for which students will need Turning Point ResponseCards, otherwise known as a “clickers”. The classroom quizzes count toward a student’s final grade as discussed in the section below labeled Classroom Quizzes.

Audience for which this course is designed: This course is designed for undergraduates seeking to prepare for pre-professional examinations, undergraduates seeking to expand their understanding of natural science and undergraduates who will enter professional programs in medicine, veterinary medicine, dentistry and pharmacy. This course is also designed for graduate students in PhD programs where a background in biochemistry would be helpful.

Auditors: Students who wish to audit this course should see the Course Director for permission. Permission will be granted on a space-available basis.

Student learning outcomes and course goals: This course will introduce students to the basic, molecular principles that comprise the study of biochemistry. Students will understand the features of protein structure; basic concepts and kinetics of enzymes; the roles of carbohydrates and lipids; the nature of cell membranes, channels, pumps and receptors; the basic concepts of metabolism including the role of glycolysis and gluconeogenesis; the citric acid cycle and oxidative phosphorylation; the metabolism of glycogen, fatty acids and lipids; the metabolism of nitrogen-containing compounds; and a molecular view of the Central Dogma of molecular biology.

Required materials: The textbook for this course is: *Biochemistry: A Short Course* (Second Edition) by J.L Tymoczko, J. M. Berg and L. Stryer/Freeman Publisher. Students will also need to purchase, register (on Blackboard) and bring to class a Turning Point ResponseCard (“clicker”). Students will *not* need a calculator in this course, and indeed, we prohibit the use of calculators and any communication devices during the examinations. Students cannot share “clickers”.

Description of course activities and assignments: Students should attend lectures, download copies of lecture notes, and read the appropriate sections of the textbook. Students will be expected to participate in classroom quizzes using their clickers and complete three, 50-minute, “hour” examinations and a comprehensive two-hour, examination. The examinations will be exclusively multiple-choice questions. The dates of the examinations are listed below; the final examination is administered at the time dictated by the Registrar’s Office.

First Hour Examination	Monday, May 18, _____
Second Hour Examination	Tuesday, May 26, _____
Third Hour Examination	Monday, June 1, _____
Final Examination	Tuesday, June 9, _____

Blackboard:

We will make extensive use of Blackboard. This site will be used to the purposes described below. For problems with Blackboard or to obtain a user account, please contact: <http://wiki.uky.edu/Blackboard>

Lecture Notes: Copies of lecture notes (Powerpoint slides) will be posted on the course’s Blackboard site. Students will need to get an account in order to gain access to this site. Students will be expected to print and bring copies of the lecture notes to class.

Echo recordings: Lectures will be recorded and posted on BB.

Syllabus and Course Description: Copies of these documents will be posted on the Blackboard site.

Practice examinations: Past hour and final examinations will be posted on the Blackboard site

My Grades: We will post student grades in the “My Grades” site within Blackboard. Students who do not see their grades on this Blackboard site should first check with the Registrar to confirm their registration for the course and should then contact the Course Director by e-mail. Students should also contact the Course Director if there is a mistake in any of the posted grades.

Helpful summaries: The instructors will post useful summaries, such as “Mathematics for Students in the Biological Sciences”, which contains useful information about algebra and geometry that will be used during the semester.

Tools: Students must use this site to register the identification code on their “clickers” using the “Turning Point Registration Tool.” Students must register their clickers in order to receive a grade for the classroom quizzes.

Examinations: Three 50-minute “hour” examinations (100 points each) and a mandatory, two-hour, comprehensive final examination (200 points) will be administered at the times listed above. The examinations will be exclusively multiple-choice questions.

Re-grading of examinations: Examinations will be machine-graded. The Course Director has not seen a single instance in over twenty years of teaching in which the scoring machine has made an error in scoring a “bubble sheet”, but students who believe that a mistake was made in the grading of an hour examination should see the Course Director. Questions about the grading of a particular examination must be made before the next examination.

Classroom Quizzes: Starting with the third evening class period, we will give classroom quiz questions that will count toward the final grade. Students will use their clickers to answer these questions. We will use the quizzes during the first and second evening class periods to verify that the clickers are working properly and grades are recorded correctly. **It will be each student’s responsibility to check that scores during these first two class periods were captured and posted on BlackBoard.**

Students must use this site to register the identification code on their “clickers” using the “Turning Point Registration Tool” on Blackboard. Students must register their clickers in order to receive a grade for the classroom quizzes. If a student loses or changes clickers during the semester for any reason, the student not only must register their new clicker on Blackboard but also must notify the Course Director who will update the participant list of students matched against their identification code.

Assuming the electronic grade capture system works properly throughout the semester, we anticipate giving between 50 and 75 questions over the course of the summer semester. At the end of the semester, we will use quiz scores to award a maximum of 50 points toward the final grade. For example, if we gave 64 questions and if a student correctly answered 48 or 75% of the questions, then the student would receive 75% of 50 possible points or 37.5 points toward their final grade.

We will not give “makeup” classroom quizzes for students who miss lectures.

A student’s use of another person’s registered clicker constitutes academic dishonesty.

Short Papers (Graduate Students and Post-baccalaureate Students Only): Graduate and post-baccalaureate students enrolled for credit in BCH401G must complete a paper on an assigned topic in addition to taking the hour and final examinations. Post-baccalaureate students are defined (for the purposes of this course) as any student registered for this course who already has a bachelor's degree or better in any discipline from any accredited university. The University Registrar will determine who is a post-baccalaureate student.

The topic for the paper for this semester’s evening section of BCH401G is Gout. The paper should discuss in detail the biochemical/molecular mechanisms leading to this disease, a brief discussion of its major symptoms and affected cell types/tissues, a brief discussion of any genetic mutations involved, and a thoughtful evaluation of possible therapies for treating individuals afflicted with this disease. Suggested resources include the OMIM (On-line Mendelian Inheritance in Man) database and Malacards, a human disease database (<http://www.malacards.org/>). The paper should emphasize biochemistry while touching lightly on phenomenology and subject areas distantly related to biochemistry chemistry. For example, if the topic were “the causes of phenylketonuria”, students would be expected to discuss the biochemical basis of this disease but not an elaborate discussion of the symptoms of patients with the disease or the history of the disease. The papers that are most likely to receive a “high pass” grade are those that display critical thinking, particularly with respect to possible therapies. Critical thinking does not mean that a student has included ten obscure references or cited an expert in the field. For example, students discussing the “causes of phenylketonuria” might discuss related disorders that also involve a defect in an oxidation process.

Students should be careful to avoid plagiarism. Short papers will be evaluated using an electronic plagiarism detection program.

An electronic copy of the paper must be submitted to the Course Director by 9 PM on the date specified in the syllabus. Graduate students and post-baccalaureate students who fail to complete the paper will automatically fail the course. The papers must be at least three, but no more than four pages in length including text, figures, and tables. The list of references does not count as part of the four-page limit. The paper must be single-spaced, use Arial 11 for font type and size, and have 1" margins all around.

Papers will be graded as “high pass”, “pass” and “low pass”. Papers that are not submitted by the due date; paper that plagiarize information/text from published articles without correct documentation; and/or papers are not compliant with the typing requirements will be given a “low pass”.

Literature references must be books or articles in scientific journals. References to web sites are not acceptable. Student should use acceptable reference styles such as those used in journals published by Cell Press (<http://www.cell.com>).

"Make up" Examinations: Students are expected to take every examination. Students who miss an hour examination *for any reason* will not be given a “make-up” examination. Instead, the mandatory, comprehensive, final examination will serve as the "make up" examination. Please see the section below on Grading for Undergraduate Students or the section below on Grading for Post-baccalaureate Students and Graduate Students for a discussion of how missing an hour examination affects the calculation of the final grade. An alternative final exam will be given for students who have an excused absence.

Grading for Undergraduate Students: For undergraduate students, grades will be determined on the basis of three 50-minute “hour” examinations that are worth 100 points each, a comprehensive, two-hour final examination that is worth 200 points, and class quizzes that are worth 50 points. The examinations will count about 90% and the quizzes about 10% of the final grade.

The hour examinations, final examination and quizzes will be worth a total of 550 points and will determine the final grade for undergraduate students.

	If you miss no examinations	If you miss one hour examination (excused absence only!)	If you miss two hour examinations (excused absence only!)	If you miss three hour examinations (excused absence only!)
Maximum Points for three hour exams, each worth 100 points	300	200	100	0
Maximum Points for Final examination	200	300	400	500
Maximum Points for Turning Point quizzes	50	50	50	50
Total points	550	550	550	550

At the end of the course, the numerical scores (total points) will be compiled and rank ordered from highest to lowest, and the instructors will determine the final cutoffs for all letter grades assigned in the course. The following grading scale may be modified downward, but will not be modified upward. That is, if a student gets a 90, the student

will certainly get an A in the course. It is possible that students with lower percentages may also earn grades of A, depending on the overall performance of the class.

90-100%	A
80-89%	B
70-79%	C
60-69%	D
<60%	E

Grading for Graduate and Post-baccalaureate Students: Grades for graduate and post-baccalaureate students will be determined on the basis of three hour examinations worth 100 points each, a comprehensive, two-hour final examination worth 200 points, class quizzes worth 50 points, and a short paper. The examinations will count about 90% and the quizzes about 10% of the final grade. The short paper will influence the grade as described below.

The hour examinations, final examination and quizzes will be worth a total of 550 points and will determine the *preliminary* grade for graduate and post-baccalaureate students.

	If you miss no examinations	If you miss one hour examination (excused absence only!)	If you miss two hour examinations (excused absence only!)	If you miss three hour examinations (excused absence only!)
Maximum Points for three hour exams, each worth 100 points	300	200	100	0
Maximum Points for Final examination	200	300	400	500
Maximum Points for Turning Point quizzes	50	50	50	50
Total points	550	550	550	550

At the end of the course, the numerical scores (total points) will be compiled and rank ordered from highest to lowest, and the instructors will determine the final cutoffs for all *preliminary* letter grades assigned in the course. The following grading scale may be modified downward, but will not be modified upward. That is, if a student gets a grade of 90, the student will certainly get a *preliminary* grade of A in the course. It is possible that students with lower percentages may also earn *preliminary* A grades, depending on the overall performance of the class. It should be emphasized that these are the *preliminary* grades based only on written examinations. It should also be noted that The Graduate School only accepts grades of A, B, C and E.

90-100%	A
80-89%	B

70-79%	C
60-69%	D
<60%	E

The short paper will influence the final course grades as shown in the following table. For example, a graduate or post-baccalaureate student with a numerical score on the examinations equivalent to a *preliminary* B grade and a "high pass" on the short paper will receive a final A grade in the course. Similarly, a graduate or post-baccalaureate student with a numerical score on the examinations equivalent to a *preliminary* D grade and a "high pass" on the short paper will receive a final C grade in the course. A graduate student with a *preliminary* E grade and a "high pass" on the paper will receive an E in the course. That is, a "high pass" on the paper will not rescue a failing performance on the written examinations.

Final Course Grades for Graduate Students and Post-baccalaureate Students

Preliminary Grade based on examinations	Grade on Short Paper		
	high pass	pass	low pass
A	A	A	B
B	A	B	C
C	B	C	E
D	C	E	E
E	E	E	E

Academic integrity: Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero or E on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the University, may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website and links available at that website: "http://www.uky.edu/Ombud/ForStudents_AcademicIntegrity.php". A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that all students review this information as ideas borrowed from others must be properly credited. Academic work, written or otherwise, submitted by students to their instructors, must be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission. When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or

anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism.

Students may discuss assignments among themselves, with one of their instructors, or with a tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes, while leaving the organization, content and phraseology intact, constitutes plagiarism.

Short papers will be evaluated using an electronic, plagiarism-detection program.

Policy on Incomplete Grades:

Incomplete grades will be giving only when an absence that meets the criteria for a University excuse prevents completion of the course. University Senate Rule S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

An "I" will be given only when a reasonable possibility exists the student can complete the work within the allowed period of time and that a passing grade will result from completion of the work (SR 5.1.3.2). The "I" must be replaced by a regular letter grade no later than 12 months from the end of the academic term in which the grade was awarded OR prior to the student's graduation, whichever occurs first.

For any student receiving an I grade, the Course Director will create a statement that includes the following, and forward the statement to the Chair and other 401G course directors:

- the name of the student;
- semester and year of enrollment;
- signature of the Course Director;
- a brief statement of the reason(s) for recording the incomplete; and
- specific instructions on how alternate grades on the work to be completed will affect the final grade;
- the specific time requirement (not to exceed 12 months) set by the Course Director for removal of the I grade and consequences of not removing the I grade; and
- signature of the student, if feasible.

Accommodations due to disability: If a student has a documented disability that requires academic accommodations, please contact the Course Director as soon as

possible. In order to receive accommodations in this course, a student must provide the Course Director with a Letter of Accommodation from the Disability Resource Center located in Alumni Gym, Room 2, at the corner of Avenue of Champions and South Limestone Street (next to the Student Center and across South Limestone Street from Kennedy Bookstore).

Class Periods	Day	Date	Readings	Lecturer	Topic
1	Tue	12-May	Ch 1	Watt	Introduction
2	Tue	12-May	Ch 2	Watt	Properties of Water and Non-covalent Interactions
3	Tue	12-May	Ch 3	Watt	Amino Acids
4	Wed	13-May	Ch 4	Watt	Protein Three-dimensional Structure
5	Wed	13-May	Ch 9	Watt	Quaternary Structure: Hemoglobin
6	Wed	13-May	Ch 5	Watt	Techniques in Protein Biochemistry
7	Thur	14-May	Ch 5	Watt	Techniques in Protein Biochemistry
8	Thur	14-May	Ch 6	Watt	Basic Concepts of Enzyme Action
9	Thur	14-May	Ch 7	Watt	Enzyme Kinetics and Regulation
10	Fri	15-May	Ch 8	Watt	Enzyme Mechanisms
11	Fri	15-May	Ch 8	Watt	Enzyme Inhibitors
12	Fri	15-May		Watt	Problem-solving Session 1
	Mon	18-May		Watt	First Hour Examination
13	Tue	19-May	Ch 10	Watt	Carbohydrates
14	Tue	19-May	Ch 11	Watt	Lipids
15	Tue	19-May	Ch 12	Watt	Membrane Structure and Function
16	Wed	20-May	Ch 13	Watt	Signal Transduction Pathways
17	Wed	20-May	Ch 14	Watt	Catabolism of Biopolymers: Digestion
18	Wed	20-May	Ch 15	Watt	Metabolism: Basic Concepts
19	Thur	21-May	Ch 16	Watt	Glycolysis
20	Thur	21-May	Ch 17	Watt	Gluconeogenesis
21	Thur	21-May	Ch 18	Watt	Citric Acid Cycle
22	Fri	22-May	Ch 19	Watt	Harvesting Electrons from the Cycle
23	Fri	22-May	Ch 20	Watt	Electron Transport
24	Fri	22-May		Watt	Problem-solving Session 2
	Mon	25-May			MEMORIAL DAY HOLIDAY
	Tue	26-May		TBA	Second Hour Examination
25	Wed	27-May	Ch 21	TBA	Proton-motive Force
26	Wed	27-May	Ch 24	TBA	Glycogen Degradation
27	Wed	27-May	Ch 25	TBA	Glycogen Synthesis
28	Thur	28-May	Ch 26	TBA	Pentose Phosphate Pathway
29	Thur	28-May	Ch 27	TBA	Fatty Acid Catabolism
30	Thur	28-May	Ch 28	TBA	Fatty Acid Anabolism
31	Fri	29-May	Ch 29	TBA	Storage Lipids, Phospholipids and Cholesterol
32	Fri	29-May	Ch 30	TBA	Amino Acid Catabolism and the Urea Cycle
33	Fri	29-May		TBA	Problem-solving Session 3
	Mon	1-Jun		TBA	Third Hour Examination
34	Tue	2-Jun	Ch 31	TBA	Amino Acid Anabolism
35	Tue	2-Jun	Ch 32	TBA	Nucleotide Metabolism
36	Tue	2-Jun	Ch 33	TBA	Structure of Nucleic Acids and their Polymers
37	Wed	3-Jun	Ch 34	TBA	DNA replication
38	Wed	3-Jun	Ch 41	TBA	Recombinant DNA Techniques
39	Wed	3-Jun	Ch 35	TBA	DNA Repair and Recombination
40	Thur	4-Jun	Ch 36	TBA	RNA Synthesis and Regulation
41	Thur	4-Jun	Ch 37	TBA	Eukaryotic Gene Expression
42	Thur	4-Jun	Ch 38	TBA	RNA Processing
	Thur	4-Jun			Graduate Student Paper Due by 5PM
43	Fri	5-Jun	Ch 39	TBA	Genetic Code
44	Fri	5-Jun	Ch 40	TBA	Protein Synthesis
45	Fri	5-Jun		TBA	Problem-solving Session 4
	Mon	8-Jun		TBA	Help session or make-up class if needed
	Tue	9-Jun		TBA	Comprehensive Final Examination