

BIO 205 SYLLABUS - SPRING 2018

COURSE DESCRIPTION

This course provides an introduction to Biological Chemistry. Part I is a review of some portions of general chemistry and organic chemistry, making a connection to their applications in biological systems. Parts II and III cover the structure and function of the four major classes of biological molecules. Part II focuses on proteins, the major appliances in our cells, including details for hemoglobin and the enzyme chymotrypsin. Part III examines carbohydrates, nucleic acids, and lipids. Then the last two portions of BIO 205 switch to metabolism. Part IV focuses on metabolism in depth, looking at a portion of the carbohydrate pathways : reaction steps, enzyme types, differences between catabolism and anabolism, regulation by hormones, and variations in different tissues. Part V is metabolism in breadth, finishing up carbohydrate processing by adding in the Krebs cycle and electron transport, and examining lipid breakdown and synthesis. Practice questions provide students with multiple choice and short answer examples from previous exams. Multiple choice is completed on-line and allows two tries for each answer, thereby enabling students to learn from feedback for wrong answers and improve their grades. Additional homework includes computer-graded organic-structure-drawing questions.

3 cr , lecture course

Prerequisite : one semester of organic chemistry

Detailed list of lecture topics : See Appendix I

Calendar : See Appendix II

EXAM SCHEDULE :

EXAM I	Lectures 1-7	Chemical foundations	Mon	Feb 19
EXAM II	Lectures 8-15	Protein structure	Mon	Mar 12
EXAM III	Lectures 16-22	Other structures	Wed	Apr 4
EXAM IV	Lectures 23-29	Glycogen -> pyruvate	Wed	Apr 25
EXAM V	Lectures 31-36	Other metabolism	Wed	May 9
Final exam	Lectures 1-36	Selected items	Mon	May 14

Exams will cover the classnotes, homework, and any additional material covered in class.

STUDENT LEARNING OUTCOMES

Course objectives :

- A. Review principles of organic and general chemistry
- B. Learn hierarchy of protein structure (amino acids, sequences, folding, assembly)
- C. Understand how molecular chemical structure leads to biological function
- D. Consider evolution at the level of DNA/protein sequences
- E. Understand metabolism in depth (sugars) and breadth (integrating sugars and lipids)
- F. Integrate physiology with biochemistry
- G. Develop critical thinking skills for interpreting rotatable computer-modeled structures
- H. Develop quantitative reasoning skills with oxygen binding curves
- I. Learn about current applications of biochemistry in the field of medicine
- J. Develop an appreciation of the biochemical basis of good nutrition

For details regarding course objectives, assessment instruments, and links to departmental program objectives, see Appendix III (Excel spreadsheet).

COURSE REQUIREMENTS

Summary of points :

Exams :	600 pts
Homework :	138 pts
Multiple choice (72 pts = best 12 @ 6 pts)	
Structure drawing (66 pts = best 11 @ 6 pts)	

Total possible : 738 pts

Details are provided in Appendix IV.

ACADEMIC CONTENT

Students are required to read and understand the classnotes.

Students must complete the homework exercises on time.

Attendance in class is expected, but absences from lectures will not be recorded.

GRADING POLICY : Make-up exams and regrading

Make-up exams will be provided when the student has a valid medical excuse or family emergency, or makes arrangements with Dr. Snyder ahead of time (such as for varsity athletic events, medical school interviews, religious obligations). Unexcused absences will result in a grade of 0 (F).

Students who miss an exam must phone Dr. Snyder (645-4939) and talk with him personally before noon on the day of the exam. E-mails are NOT acceptable substitutes for talking to Dr. S, nor are written notes, nor is a phone voice mail message, nor are messages left with any other person.

Religious excuses : letter 1 week in advance from rabbi/priest/pastor/other with need and dates

Medical excuses : letter from a doctor telling what dates the student should be excused.

UB health clinic : Doctor must be willing to state in a phone call that he/she is certain that you were too sick to take the exam. In many cases, complaints of stomach aches or headaches do not generate such a statement, because there are no physical data (such as elevated temperature, signs of infection) to indicate disease.

Mental health : letter from a licensed M.D. psychiatrist indicating what dates you should be excused. Without this, a student's personal claim of "exam stress" will not be honored.

Family emergency : letter from parent, with documentation of funeral/wedding/location/dates

Excused absences : student may make up the exam as soon as the medical/family emergency is over, provided that the student spoke with Dr. S on the morning of the original exam.

Unexcused absences OR undocumented excuses (faulty alarm clocks, faulty cars) OR failure to speak with Dr. S on the morning of the exam : no make-up will be permitted. The grade will be an F (0 %).

Three exams on the same day : see Dr. S before that date to request a make-up date for the Bio 205 exam if you want that option. Two exams on the same day: must take Bio 205 exam as scheduled.

Requests for regrading of exams must be made no later than 1 week after grades are posted at UBLearn in your personal gradebook. Exams are photo-copied before being returned to students, to discourage their being altered before any regrading.

REQUIRED ITEMS for each new student

Available at : Follett's bookstore on North Campus

Wiley Custom Publishing bundle : about \$102

- A. Bio 205 Classnotes - revised 2016 edition
Also includes short answer homework
- B. WebAssign passcard is automatically included as part of this bundle

If you purchase used notes from a former BIO 205 student, then you will need to purchase WebAssign online. This online site costs about \$45 when purchased separately instead of as part of the BIO 205 course pack. Do not buy WebAssign online if you are purchasing new classnotes at Follett's.

It is recommended that you purchase new classnotes so you can take notes by writing on unmarked large figures (2 per page).

If you are repeating the course, you will be able to reuse your classnotes. However, you will need to purchase a WebAssign passcard for Spring 2018 online for about \$45. Do not buy WebAssign online if you are purchasing new classnotes at Follett's.

INSTRUCTOR :

Dr. Snyder : Cooke 373A : 645-4939 : gsnyder@buffalo.edu : Cooke 109 mailbox

EMAILS : Dr. Snyder uses UBLearns to send emails to your buffalo.edu email account, usually after each class period. You are required to use this account or forward mail from it to your preferred account. You are required to check for an email after each class period. Please put "Bio 205" in the title of your emails to Dr. Snyder.

OFFICE HOURS : Time and place to be announced

PREREQUISITES :

2nd semester of general chem (kinetics, equilibria, thermodynamics, redox, acid/base)
1st semester of organic chem (functional groups, stereochemistry, resonance, nucleophiles)

COMPUTERS : Students must be able to use :

1. Microsoft Office suite : Word, Excel, Powerpoint
2. Adobe Reader : reading .pdf files
3. Internet access to sites such as UBLearns and the WebAssign course homework site

LAB COURSE : BIO 215 Biochem Lab : not needed for BIO 205 : these are separate courses

Some Bio majors take Bio 215 their sophomore year, some take it later, some never take it. The "lecture" in BIO 215 covers lab methods and data analysis, and therefore is different from the lectures in BIO 205.

INCOMPLETE ("I") GRADES : may NOT be used to avoid a failing grade

A student who is physically unable to take one of the exams in the course (for example because of an extended illness documented by a doctor's letter) may request to complete that work at a later date, receiving an "I" in the course. That student may not restart the whole course all over in a later semester. The completed exams have been completed, and those grades will be saved and used to calculate the final average when the missed exams have been finished. "A grade of incomplete (I) may be given to students who have not completed all of the assigned work in a course if they have a passing average." This quoted rule is the official university policy. If you have an F average, you do not have a passing average and may not receive an "I". If you are failing the first half of the course, you should resign with an R grade before the deadline for that option.

Reference to UB Incomplete Policy :

<http://undergrad-catalog.buffalo.edu/policies/grading/explanation.shtml>

PROFICIENCY LEVELS IN BIO 205 (%'s of 738 pts)

Range	Grade	Range	Grade
100.00-92.00	A	75.99-72.00	C+
91.99-88.00	A-	71.99-68.00	C
87.99-84.00	B+	67.99-64.00	C-
83.99-80.00	B	63.99-60.00	D+
79.99-76.00	B-	59.99-52.00	D

REPORTING ERRORS IN POSTED GRADES : 1 week deadline

Grades will be posted at the end of each of the five parts of the course. You must report any suspected errors in grading within 1 week of that posting. After that deadline, the grades will be considered unchangeable, even if there is an error.

ASSIGNED SEATING

You will be given assigned seats for the exams. Students with special exam needs should provide a letter from the Office of Accessibility Resources by the end of the 1st week of class.

STARTING THE COURSE LATE

Although students may formally register for a course after the beginning of the semester, university policy permits courses to require students to attend class and participate in graded exercises from the very first day of the semester, regardless of when they formally commit to a course by registration. This is how Bio 205 is constructed. Students who register after Jan 28 and miss graded exercises conducted at the beginning of the course will receive grades of 0 for those exercises. The ability to drop the lowest grades in homework will accommodate this, but this is a poor way to spend those allowed "drops".

ACADEMIC INTEGRITY

Reference to the UB Academic Integrity Policy

<http://undergrad-catalog.buffalo.edu/policies/course/integrity.html>

Use of cell phones during exams is strictly forbidden : use will be penalized

Exams must be turned in on time : continued writing after 8:50 AM will be penalized

OFFICE OF ACCESSIBILITY RESOURCES

UB's Accessibility Resources Office : for students needing special accommodations on exams

60 Capen Hall ; 645-2608

<http://www.buffalo.edu/studentlife/accessibility>

COURSE WEBPAGE : <https://ublearns.buffalo.edu>

BIO 205 : SPRING 2018 : Appendix I

	<u>Topic #</u>	<u>Date</u>
I. CHEMISTRY FOUNDATIONS		
Introduction : four classes of biomolecules	1	1/29 & 1/31
Stereochemistry : D/L , enzyme/substrate recognition	2	2/2
Acids and bases	3	2/5
Thermodynamics	4	2/7
Polar and nonpolar molecules	5	2/9
Kinetics and equilibrium	6	2/12
Oxidation / reduction	7	2/14
	Exam 1-7	2/19
II. STRUCTURE / FUNCTION : PROTEINS		
Amino acids : stereochem, acid/base, polar/nonpolar	8	2/16
Protein sequences	9	2/21
Protein folding : "smart" polymers, alpha helices	10	2/23
Protein folding : beta sheets, SS bonds, oligomers	11	2/26
Hemoglobin : positive cooperativity	12	2/28
Hemoglobin : effects of pH, DPG, and mutations	13	3/2
Enzyme mechanisms and regulation : qualitative aspects	14	3/5
Enzyme kinetics	15	3/7
	Exam 8-15	3/12
III. SUGARS, NUCLEIC ACIDS, LIPIDS		
Sugars : monosaccharides	16	3/9
Sugars : disaccharides and polysaccharides	17	3/14
Nucleic acids : monomers and chains	18	3/16
Nucleic acids : folding	19	3/26
Nucleic acids : colinear with proteins, binding proteins	20	3/28
Lipids : fatty acids	21	3/30
Lipids : isoprene derivatives; interactions with proteins	22	4/2
	Exam 16-22	4/4
IV. METABOLISM : GLYCOGEN -> GLUCOSE -> PYRUVATE		
Introduction : roadmaps, energy releasing reactions	23	4/6
Glycolysis : 10 steps	24	4/9
Glycolysis : energetics	25	4/11
Gluconeogenesis	26	4/13
G6P fates : F6P, ribose (for nucleotides), glycogen	27	4/16
Hormone regulation (phosphorylation vs. dephos)	28	4/18
Tissue differences : muscle vs. liver	29	4/20
	Exam 23-29	4/25
V. METABOLISM : PYRUVATE -> ATP ; LIPIDS		
Diabetes : poor regulation of blood glucose levels	30	5/11 (last class)
Fates of pyruvate : fermentation vs. PDH	31	4/23
TCA (Krebs) cycle	32	4/27
Electron transport chain, H ⁺ gradient, ATP synthesis	33	4/30
Fatty acid metabolism : breakdown and synthesis	34	5/2
Metabolism of cholesterol, lipoproteins, prostaglandins	35	5/4
Sugars --> lipids, but not lipids --> sugars (in animals)	36	5/7
	Exam 31-36	5/9

Accumulative final exam : from list of 3-4 items per lecture

Final exam 5/14

BIO 205 : SPRING 2018 : Appendix II

SUN	MON	TUES	WED	THURS	FRI	SAT
28	Topic #1 biomol	30	Topic #1 (continued)	1	Topic #2 stereochem	FEBRUARY 3
4	Topic #3 acids/bases	Mult #1-2	Topic #4 thermodyn	Draw #1	Topic #5 polar/nonpol	10
Mult #3-5	Topic #6 kinetics/equi	13	Topic #7 oxid/reduct	Draw #2	Topic #8 amino acids	17
Mult #6-7	EXAM I Topics 1-7	20	Topic #9 sequences	Draw #3	Topic #10 helices	24
Mult #8-10	Topic #11 sheets	27	Topic #12 Hb + coop	Draw #4	Topic #13 Bohr, DPG	3
Mult #11-13	Topic #14 enzym mech	6	Topic #15 enzym kinet	Draw #5	Topic #16 monosacch	MARCH 10
Mult #14-15	EXAM II Topics 8-15	13	Topic #17 polysacch	Draw #6	Topic #18 mononucl	17
18	Spring Recess 19	20	21	22	23	24
25	Topic #19 polynucl	Mult #16-18	Topic #20 DNAprotein	29	Topic #21 fatty acids	31
Mult #19-21 APRIL	Topic #22 isoprene	3	EXAM III Topics 16-22	Draw #7	Topic #23 fav paths	7
Mult #22-23	Topic #24 glycol steps	10	Topic #25 glycol energ	Draw #8	Topic #26 gluconeogen	14
Mult #24-26	Topic #27 G6P fates	17	Topic #28 hormone reg	Draw #9	Topic #29 tissue differ	21
Mult #27-29	Topic #31 pyruv fates	24	EXAM IV Topics 23-29	Draw #10	Topic #32 Krebs cycle	28
Mult #31-32 (not #30)	Topic #33 e- transport	1	Topic #34 FA metab	Draw #11 Draw #12	Topic #35 cholesterol	MAY 5
Mult #33-35	Topic #36 Atkins diet	8	EXAM V Topics 31-36	Draw #13	Topic #30 diabetes	Reading day 12
Mult #30,36	FINAL EXAM	15	16	17	18	Final exams end 19
Graduation						

Multiple choice homework : due at WebAssign site on the "Mult" dates listed above by 11 PM
 Short answer homework : you should keep up to date with this : it makes up 30% of each exam
 Structure drawing (Marvin JS) : due at WebAssign site on the "Draw" dates listed above by 11 PM

ACCUMULATIVE FINAL (from published list of most important parts from each lecture) :

May 14, 2018 : Knox 20 : 8:00-10:00 AM

Exams I-II in Bio 215 (Fridays Mar 9, Apr 6) do not conflict with Bio 205 exams.

APPENDIX III

Number	Program Learning Outcome	Depth	Specific outcome objectives for Bio 205	Assessment instrument
1	Provide breadth of knowledge of basic principles and concepts	2	Review principles of organic and general chemistry (stereochemistry, resonance, acids/bases, kinetics/equilibrium, oxidation/reduction) and link them to biological examples Learn heirarchy of protein structure (amino acids -> linear sequences -> folded monomers -> large oligomeric assemblies Understand how protein structure leads to function (examples : oxygen carriers and enzyme catalysts) Consider evolution at the level of DNA/protein sequences (families : cytochrome c, hemoglobin, trypsin) Biochemistry principles : how structure leads to function for carbohydrates, nucleic acids and lipids Biochemistry principles : understanding metabolism in depth for one small pathway (glycogen -> pyruvate) : (1) enzymes, (2) energetics, (3) regulation, (4) tissue differences, (5) structure progressions	Exam 1, Homework 1-7 1st half of Exam 2; Homework 8,10,&11; Quiz 1 : Foldit exercises 2nd half of Exam 2 ; Homework 13-14 Homework 9
2	Provide depth within specialized areas	2	Biochemistry principles : understanding metabolism in breadth : integrating sugar and lipid breakdown and synthesis pathways	Exam 3, Homework 16-22 Exam 4, Homework 23-28, Quiz 2 (arranging glycolysis flashcards)
3	Provide an understanding of experimental design and methodology	0	N/A	Exam 5, Homework 31-35, Quiz 3 (arranging Krebs cycle flashcards) N/A
4	Develop approaches for integration of information	1	Integrate physiology with biochemistry : (A) muscles vs. liver receptors, expressed genes, isozymes, and transporters ; (B) pancreatic hormones regulating liver enzymes (phosphorylation/dephosphorylation)	Homework 29
5	Encourage critical thinking and hypothesis building	1	Develop enhanced critical thinking skills by rendering and viewing rotatable computer-modeled structures to "discover" features not apparent in 2d textbook pictures Develop effective quantitative reasoning skills : interpret oxygen binding curves (hyperbolic vs sigmoidal) and enzyme kinetics data	Interactive Rastop modeling exercises 1-9 Homework 12 and 15
6	Provide skills in scientific communication	0	N/A	N/A
7	Provide contemporary information	1	Learn about current applications of biochemistry regarding the molecular mechanisms and treatment of human diseases	Medical bonus point sets 1-5
8	Encourage appreciation of scientific values	1	Develop an appreciation of the biochemical basis of good nutrition to encourage students to make healthy decisions affecting their personal lives (diabetes, Atkin's diet, cholesterol)	Homework 30 and 36
9	Provide opportunity for BS	0	N/A	N/A

In all of the measurements (exams, quizzes, home- work) 70% mastery = outcome achieved

APPENDIX IV : DETAILS REGARDING EXAMS AND HOMEWORK

EXAMS (600 pts)

5 hourly exams @ 100 pts = 5 grades

1 partially accumulative final exam :

counts double, so if you receive 85% on the final = you get 2 grades of 85%

Drop the lowest grade from the 7 grades above.

The accumulative final exam will be taken from a list of 3-4 items per lecture which are especially important. This list of "most important" items will be given out near the end of the semester. It represents about 1/3 of the material in the course.

Format :

Exams I-IV : 28 multiple choice @ 2.5 = 70 pts , short answer = 30 pts

Exam V : 40 multiple choice @ 2.5 = 100 pts

Accumulative final : same as exams I-IV but twice as long (2x questions, 2x time) = 2 x 100 pts

MULTIPLE CHOICE HOMEWORK (14 weekly sets at @ 6 pts, drop 2 lowest = 12 x 6) : 72 pts

Answers are submitted online at the WebAssign site.

You will have two chances to pick the right choice for each question.

After your 1st try, each "wrong" answer will give you a hint or explain why it is wrong.

No make-up opportunities, except during an extended illness documented by a physician.

SHORT ANSWER HOMEWORK : ungraded

Short answer questions : should be completed and corrected after each topic is considered in class, using answers posted at UBLearns.

Partial answers will be posted on the UBLearns course webpage. For questions which can be answered by referring to a single classnotes figure, the figure reference will be given. For other questions, complete answers will be given to you.

STRUCTURE DRAWING HOMEWORK (13 @ 6 pts each, drop two lowest = 11 x 6) : 66 pts

Students will use MarvinJS software posted at WebAssign to draw the organic chemistry structures of biological molecules. Questions will be of three types :

1. Starting with a blank page and drawing a complete structure
2. Starting with a given structure and modifying it slightly to generate a different molecule
3. Marking specific atoms in a structure, such as all the chiral carbons

Students will have three attempts to complete each drawing, with a hint provided after the 1st try. The correct structure will be given after 3 attempts. MarvinJS is capable of grading structures drawn in different orientations by different students. For browsers please use Chrome on a PC and use Safari on a Mac. Do not use Firefox. With these recommended browsers, most operating systems will run the software without generating error messages or security permission concerns.