

BISC 312: Molecular Biochemistry



4 units

Spring 2020

Monday, Wednesday and Friday—

9-9:50 a.m. or 10-10:50 a.m.

Room: ZHS 159

Instructor: Christa Bancroft, Ph.D.

Office: ZHS470

Office Hours:

Monday and Friday 11-12 p.m. 1/13 - 3/6 (while lecturing)

Contact Info:

Email: cbancrof@usc.edu (best choice) Subject line should state: "BISC 312".

Phone number: 213-740-5553

I will typically reply to emails within 24 hours during the workweek and 48 hours over the weekend.

Instructor: Nancy Castro, Ph.D.

Office: ZHS256

Office Hours:

Tuesday and Thursday 8:30-9:30 a.m. (after 3/6)

Contact Info:

Email: ncastro@usc.edu

Teaching Assistant: TBD

Office:

Office Hours:

Contact Info:

Course Topic Description

The student will learn the structure and function of biological macromolecules: DNA, RNA, proteins, lipids and carbohydrates. We will study cellular metabolism and energy production pathways, including glycolysis, the Citric Acid cycle, oxidative phosphorylation, gluconeogenesis, and the pentose phosphate pathway. Students will gain an understanding of how these systems are all controlled via hormone regulation. We will also learn how DNA, RNA and proteins act to copy, express and accurately transmit genetic information, specifically the mechanisms of: DNA replication, transcription, translation, DNA repair, recombination and gene regulation. Techniques used to study molecular biology and biochemistry will be presented in the context of these major biological mechanisms.

Learning Objectives

1. Relate covalent and non-covalent interactions to their importance in biological interactions and structures.
2. Identify the amino acids and their chemical properties. Analyze how their presence in a protein

- changes its overall characteristics.
3. Identify the levels of structure in proteins and describe the stabilization of these structures.
 4. Describe the structure and mechanism of representative enzymes in biochemical pathways.
 5. Interpret plots of enzyme kinetic data both with and without inhibitors.
 6. Describe the primary catabolic and anabolic pathways pertaining to the following molecular classes (Glycolysis, Citric Acid Cycle, Electron Transport, Oxidative Phosphorylation, Pentose Phosphate Pathway, Gluconeogenesis, Glycogenesis, Glycogenolysis and Beta-Oxidation):
 - a. Carbohydrates
 - b. Lipids
 7. For each pathway in 6, identify the key regulatory points, the energetics of the reactions, the enzymes and the chemical transformations involved. Analyze how energetic changes and hormonal signals modify the reactions and change the active pathways.
 8. Identify important characteristics of lipid membrane structure and compare mechanisms of molecular transport across membranes.
 9. Evaluate how organismal energy state and hormonal signals modify activation and inhibition of different biochemical pathways.
 10. Compare major cellular signaling pathways (Tyrosine kinase receptors, G-protein coupled receptors and steroid receptors).
 11. Interpret biochemical data tables.
 12. Describe the important enzymatic steps involved in DNA synthesis, RNA transcription, and Protein synthesis in both prokaryotes and eukaryotes.
 13. Compare how gene regulation systems in prokaryotic and eukaryotic organisms control protein concentration in a cell.

Recommended Preparation: BISC 220/221

Course Notes

Lectures:

The lecture slides posted on the course Blackboard internet site (<https://blackboard.usc.edu>). All lectures will have an audio and written transcript section that should be read or listened to at home before coming to lecture that day. It is also recommended to read the corresponding section of the textbook in preparation for in-class problem sets. There will be quiz questions associated with the at-home portion of the lecture on Blackboard prior to coming to lecture. The remainder of the lecture slides will be presented in class.

It is important to attend all of the lectures during the course and to take good notes for study. Prior to attending each lecture, it is also recommended to read the appropriate portions of the textbook. Examinations will be based on application of material from lecture slides, verbal information conveyed during lecture, quiz material, and in-class problem sets. Material from the textbook that is not presented in lecture slides or in the lecture presentation will not be included in examination material. All course lecture material, information, announcements and grades will be posted on Blackboard until the end of the semester.

Email Communication:

To ensure privacy, only student's USC email accounts may be used for email communications. Students are responsible for understanding the content of email messages that the instructor sends to their USC accounts. Therefore, each student must check their USC email regularly and make sure their account is not over quota, so that new messages can be received.

Recommended Readings and Supplementary Materials

Appling, Anthony-Cahill, Mathews, Biochemistry: Concepts and Connections (2015, 1st edition) or (2018, 2nd edition). Can be purchased as a package in the bookstore in hardback or loose-leaf. Alternatively, you may buy e-text access online.

MCAT Practice Materials (in-class problem sets):

7 Full-Length Practice Tests for the MCAT: 5 in the Book and 2 Online. RuvencO Publishing, 2019.

“AAMC MCAT Official Prep Sample Test.” Official MCAT Sample Test (Online), <https://store.aamc.org/official-mcat-sample-test-online.html>.

AAMC MCAT Section Bank (Online). <https://store.aamc.org/aamc-mcat-section-bank-online.html>.
 “Biological and Biochemical Foundations of Living Systems Passages.” Khan Academy, Khan Academy, <https://www.khanacademy.org/test-prep/mcat/biological-sciences-practice#biological-sciences-practice-tut>.

“Biological and Biochemical Foundations of Living Systems Passages.” Khan Academy, Khan Academy, <https://www.khanacademy.org/test-prep/mcat/biological-sciences-practice#biological-sciences-practice-tut>.

MCAT Practice Tests: Biological & Biochemical Foundations of Living Systems. Sterling Test Prep, 2020.

MCAT: Organic Chemistry & Biochemistry Practice Questions with Detailed Explanations. Sterling Test Prep, 2020.

MCAT® Biology & Biochemistry: Practice Questions. Sterling Test Prep, 2020.

Schnecker, Bryan, and Anthony Lafond. “MCAT Biology and Biochemistry: Strategy and Practice.” Amazon, Next Step Pre-Med, LLC, 2016, <https://www.amazon.com/MCAT-Biology-Biochemistry-Strategy-Practice/dp/1944935029>.

Description and Assessment of Assignments

Midterms will include multiple choice problems that can be done without a calculator. Quizzes will be on material from the at-home portion of flipped lecture material and should be answered individually prior to coming to class. Points will be given both for participation and correctness. In-class problem sets from flipped lectures will be on material from the entirety of the lecture. Problems will be completed in pairs or small groups on the class Blackboard website.

Grading Breakdown

The course grade will be based upon **702 possible points**:

Assignment	Points	% of Grade
Midterm 1	110	15.67
Midterm 2	110	15.67
Midterm 3	110	15.67
Final Exam	110	15.67
At-home Quizzes	72	10.26
In-class problem sets	190	27.07
Total	702	100

Course letter grades:

Course final grades will be determined using the following scale:

A 90-100
 A- 87-89.9
 B+ 82-86.9
 B 77-81.9
 B- 72-76.9
 C+ 67-71.9
 C 62-66.9
 C- 57-61.9

D+ 52-56.9
 D 49-51.9
 D- 46-48.9
 F 45 and below

Assignment Submission Policy

Answers to quiz questions for flipped lectures should be submitted prior to the start of class at 9:00 a.m. or 10 a.m., depending on your enrolled lecture section. Quizzes for a subsequent flipped lecture are typically open 48 hours in advance of the next flipped lecture.

Answers to group work assignments should be submitted **before lecture section ends** at 9:50 a.m. or 10:50 a.m., respectively. Any technical difficulties or other issues that result in your not being able to submit on time should be brought up to the professor in class.

If you do not have access to a smart phone, tablet or laptop computer, please see Dr. Bancroft to make accommodations to submit your assignments.

Lecture Absences and Missed in-class work:

Attendance at all lecture sections is expected. If you must miss class due to illness or valid USC travel, please present Dr. Bancroft with evidence of the reason for absence and you will be allowed to make-up in-class work assignments within **1 week** of the missed lecture period. **No makeups will be allowed after one week post due date of the assignment.**

Grading Timeline

Grades for Midterm Exams will be posted within one calendar week following the exam date.

Additional Policies

Missing Midterm Exam:

In case a midterm exam must be missed for legitimate reasons, discuss the situation with the course instructor prior to the exam, if possible. If an exam is missed for an emergency or for a valid health reason (with written documentation), the scores of the other three exams will be prorated to comprise your total point score. Rules governing exams are given in more detail in your Student Contract, which is also posted on the class website: <https://blackboard.usc.edu>.

Regrades:

In the event an error is made in the grading of your exam, written submittal of a description of the error with the exam should be returned to Dr. Bancroft **within 1 week** after receiving your graded exam. After this time period, exams will not be regraded.

Course Schedule:

Wk.	Date	Lecture Topic	Reading	Assignment
1	Jan. 13 (CB)	Intro to Biochemistry and the Language of Chemistry	Ch. 1	
	Jan. 15	Chemical Foundations of Life	Ch. 2	Lec. 2 quiz & prob. set
	Jan. 17	Energy in Biochemistry	Ch. 3	Lec. 3 quiz & prob. set
2	Jan. 20	No lecture, MLK Day		
	Jan. 22	Energy in Biochemistry	Ch. 3	Lec. 4 quiz & prob. set
	Jan. 24	Nucleic Acids	Ch. 4	Lec. 5 quiz & prob. set
3	Jan. 27	Amino Acids and Analysis	Ch. 5	Lec. 6 quiz & prob. set
	Jan. 29	Protein Structure	Ch. 6	Lec. 7 quiz & prob. set
	Jan. 31	Protein Structure and Biochemical Methods	Ch. 6	Lec. 8 quiz & prob. set

4	Feb. 3	Biochemical Methods and Enzymes	Ch. 8	Lec. 9 quiz & prob. set
	Feb. 5	Enzymes	Ch. 8	Lec. 10 quiz & prob. set
	Feb. 7	Enzymes	Ch. 8	Lec. 11 quiz & prob. set
5	Feb. 10	Midterm 1		
	Feb. 12	Enzymes	Ch. 8	Lec. 12 quiz & prob. set
	Feb. 14	Carbohydrates (on-line class, not in classroom)	Ch. 9	Lec. 13 quiz & prob. set
6	Feb. 17	No lecture, President's Day		
	Feb. 19	Lipids, Membranes and Cellular Transport	Ch. 10	Lec. 14 quiz & prob. set
	Feb. 21	Lipids, Membranes and Cellular Transport	Ch. 10	Lec. 15 quiz & prob. set
7	Feb. 24	Principles of Metabolism	Ch. 11	Lec. 16 quiz & prob. set
	Feb. 26	Carbohydrate Metabolism	Ch. 12	Lec. 17 quiz & prob. set
	Feb. 28	Carbohydrate Metabolism	Ch. 12	Lec. 18 quiz & prob. set
8	Mar. 2	Carbohydrate Metabolism	Ch. 12	Lec. 19 quiz & prob. set
	Mar. 4	Carbohydrate Metabolism	Ch. 12	Lec. 20 quiz & prob. set
	Mar. 6	Midterm 2		
9	Mar. 9 (NC)	Citric Acid Cycle	Ch. 13	Lec. 21 quiz & prob. set
	Mar. 11	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 22 quiz & prob. set
	Mar. 13	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 23 quiz & prob. set
10	Mar. 16	No lecture, Spring Break		
	Mar. 18	No lecture, Spring Break		
	Mar. 20	No lecture, Spring Break		
11	Mar. 23	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 24 quiz & prob. set
	Mar. 25	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 25 quiz & prob. set
	Mar. 27	Lipid Metabolism	Ch. 16	Lec. 26 quiz & prob. set
12	Mar. 30	Metabolic Control and Hormone Regulation	Ch. 17	Lec. 27 quiz & prob. set
	Apr. 1	Metabolic Control and Hormone Regulation	Ch. 17	Lec. 28 quiz & prob. set
	Apr. 3	Metabolic Control and Hormone Regulation	Ch. 17	Lec. 29 quiz & prob. set
13	Apr. 6	Signal Transduction	Ch. 20	Lec. 30 quiz & prob. set
	Apr. 8	The Genome	Ch. 21	Lec. 31 quiz & prob. set
	Apr. 10	Midterm 3		
14	Apr. 13	DNA Synthesis	Ch. 22	Lec. 32 quiz & prob. set
	Apr. 15	DNA Synthesis	Ch. 22	Lec. 33 quiz & prob. set
	Apr. 17	DNA: Repair and Recombination	Ch. 23	Lec. 34 quiz & prob. set
15	Apr. 20	Gene transcription	Ch. 24	Lec. 35 quiz & prob. set
	Apr. 22	Gene transcription	Ch. 24	Lec. 36 quiz & prob. set
	Apr. 24	Translation: Protein Synthesis	Ch. 25	Lec. 37 quiz & prob. set
16	Apr. 27	Translation: Protein Synthesis	Ch. 25	Lec. 38 quiz & prob. set
	Apr. 29	Gene Regulation	Ch. 26	Lec. 39 quiz & prob. set
	May. 1	Gene Regulation	Ch. 26	Lec. 40 quiz & prob. set
		Final Exam (tentative): 9 a.m. section: Friday, May 8th, 9-10 a.m. 10 a.m. section: Monday, May 11th, 9-10 a.m.		

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

USC Support and Advocacy - (213) 821-4710

uscса.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

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