USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

BISC 312: Molecular Biochemistry

4 units
Spring 2024
Monday, Wednesday and Friday:
9-9:50 a.m., 10-10:50 a.m., or 11-11:50 a.m.
Room: THH 301

Instructor: Christa Bancroft, Ph.D.
Office: ZHS 470
Office Hours: Monday 1-2 p.m. and Wednesday 1-2 p.m. via Zoom (1/8 – 3/1)
Contact Info:
Email: cbancrof@usc.edu
Subject line should state: "BISC 312".
I will typically reply to emails within 24 hours during the workweek and 48 hours over the weekend.

Instructor: Nancy Castro, Ph.D.
Office: ZHS 256
Office Hours: Monday 4-5pm and Wednesday 12:30-1:30pm via zoom. Links are posted on Blackboard (after 3/4)
Contact Info:
Email: ncastro@usc.edu
Subject line should state: "BISC 312".

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 attending lecture that day. It is also recommended to read the corresponding section of the textbook in preparation for 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 or watch video recordings of 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.

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 and submitted on the class Blackboard website.

Grading Breakdown

The course grade will be based upon **739 possible points**:

Assignment	**Points**	**% of Grade**
Midterm 1	120	16.24
Midterm 2	120	16.24
Midterm 3	120	16.24
Final Exam	120	16.24
At-home Quizzes (37)	74	10.01
In-class problem sets (37)	185	25.01
Total	739	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., 10 a.m., or 11 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 11:59 p.m. PDT on the day of the lecture**. Any technical difficulties or other issues that result in your not being able to submit on time should be brought up to the professor as soon as possible and within one week at the latest, see below for missed classwork protocols.
If you do not have access to a smart phone, tablet or laptop computer, please contact Dr. Bancroft to make accommodations to submit your assignments.

Lecture Absences and Missed classwork:
Attendance at all lecture sections is encouraged. If you must miss class due to illness or valid USC travel, please present the current instructor with evidence of the reason for missing the assignment and you will be allowed to make-up classwork 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, 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. 8 (CB)	Intro to Biochemistry and the Language of Chemistry	Ch. 1	
	Jan. 10	Chemical Foundations of Life	Ch. 2	Lec. 2 quiz & prob. set
	Jan. 12	Energy in Biochemistry	Ch. 3	Lec. 3 quiz & prob. set
2	Jan. 15	No lecture, MLK Day		
	Jan. 17	Energy in Biochemistry	Ch. 3	Lec. 4 quiz & prob. set
	Jan. 19	Nucleic Acids	Ch. 4	Lec. 5 quiz & prob. set
3	Jan. 22	Amino Acids and Analysis	Ch. 5	Lec. 6 quiz & prob. set
	Jan. 24	Protein Structure	Ch. 6	Lec. 7 quiz & prob. set
	Jan. 26	Protein Structure and Biochemical Methods	Ch. 6	Lec. 8 quiz & prob. set
4	Jan. 29	Biochemical Methods and Enzymes	Ch. 8	Lec. 9 quiz & prob. set
	Jan. 31	Enzymes	Ch. 8	Lec. 10 quiz & prob. set
	Feb. 2	Enzymes	Ch. 8	Lec. 11 quiz & prob. set
5	Feb. 5	Carbohydrates	Ch. 9	Lec. 12 quiz & prob. set
	Feb. 7	Midterm 1 (lectures 1-11)		
	Feb. 9	Lipids, Membranes and Cellular Transport	Ch. 10	Lec. 13 quiz & prob. set
6	Feb. 12	Lipids, Membranes and Cellular Transport	Ch. 10	Lec. 14 quiz & prob. set
	Feb. 14	Principles of Metabolism	Ch. 11	Lec. 15 quiz & prob. set
	Feb. 16	Carbohydrate Metabolism	Ch. 12	Lec. 16 quiz & prob. set
7	Feb. 19	No lecture, President's Day		
	Feb. 21	Carbohydrate Metabolism	Ch. 12	Lec. 17 quiz & prob. set
	Feb. 23	Carbohydrate Metabolism	Ch. 12	Lec. 18 quiz & prob. set

8	Feb. 26	Carbohydrate Metabolism	Ch. 12	Lec. 19 quiz & prob. set
	Feb. 28	Midterm Review		
	Mar. 1	Midterm 2 (lectures 12-19)		
9	Mar. 4 (NC)	Citric Acid Cycle	Ch. 13	Lec. 20 quiz & prob. set
	Mar. 6	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 21 quiz & prob. set
	Mar. 8	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 22 quiz & prob. set
10		SPRING RECESS (March 11-15)		
11	Mar. 18	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 23 quiz & prob. set
	Mar. 20	Electron Transport and Oxidative Phosphorylation	Ch. 14	Lec. 24 quiz & prob. set
	Mar. 22	Lipid Metabolism	Ch. 16	Lec. 25 quiz & prob. set
12	Mar. 25	Metabolic Control and Hormone Regulation	Ch. 17	Lec. 26 quiz & prob. set
	Mar. 27	Metabolic Control and Hormone Regulation	Ch. 17	Lec. 27 quiz & prob. set
	Mar. 29	Signal Transduction	Ch. 20	Lec. 28 quiz & prob. set
13	Apr. 1	The Genome	Ch. 21	Lec. 29 quiz & prob. set
	Apr. 3	Midterm 3 (Lectures 20 - 29)		
	Apr. 5	DNA Synthesis	Ch. 22	Lec. 30 quiz & prob. set
14	Apr. 8	DNA Synthesis	Ch. 22	Lec. 31 quiz & prob. set
	Apr. 10	DNA Repair	Ch. 23	Lec. 32 quiz & prob. set
	Apr. 12	Homologous Recombination/Gene Transcription	Ch. 23	Lec. 33 quiz & prob. set
15	Apr. 15	Gene transcription	Ch. 24	Lec. 34 quiz & prob. set
	Apr. 17	Translation: Protein Synthesis	Ch. 25	Lec. 35 quiz & prob. set
	Apr. 19	Translation: Protein Synthesis	Ch. 25	Lec. 36 quiz & prob. set
16	Apr. 22	Regulation of Prokaryotic Gene Expression	Ch. 26	Lec. 37 quiz & prob. set
	Apr. 24	Regulation of Eukaryotic Gene Expression	Ch. 26	Lec. 38 quiz & prob. set
	Apr. 26	Gene Expression by RNAi	Ch. 26	Lec. 39
	Tues May 9	**Tuesday, May 7th from 4:30 -5:30pm Final Exam (Lectures 30-39): 9 a.m., 10 a.m. & 11 a.m. sections**		

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 Research and Scholarship Misconduct.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

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 for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.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 for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
osas.usc.edu
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.
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, Equity and Inclusion - (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.

***Occupational Therapy Faculty Practice - (323) 442-33*40 or otfp@med.usc.edu**
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.