

BISC 330L Biochemistry

4 Units

Spring Semester—MWF—Time: 11:00-11:50 a.m.
(Section 13023), 12:00-12:50 p.m. (Section 13024)

Location: THH 101

Instructor: Dr. Grayson Jagers

Office: ZHS 256

Office Hours: Tuesday 1-2:30pm

Contact Info: Email: jagers@usc.edu (Generally replies within 24 hours)

Instructor: Dr. Lin Chen

Office: RRI 204C

Office Hours: Tuesday 1-2pm

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Instructor: Dr. Fabien Pinaud

Office: RRI 204A

Office Hours: Tuesday 1-2pm

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Course Description

Biochemical bonds and reactions. Interactions with water molecules. Structure/function of DNA, RNA, proteins, lipids and carbohydrates. Enzyme kinetics and mechanisms. Enzyme cofactors and vitamins. Enzyme regulatory strategies. Glucose oxidation and ATP production: glycolysis, citric acid cycle & oxidative phosphorylation. Glucose and O₂ production by photosynthesis in plant chloroplasts. Ribose biosynthesis from glucose by pentose phosphate pathway. Lipid catabolism by beta-oxidation.

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, Light and Dark Photosynthetic Reactions, Calvin Cycle, 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.

Prerequisite(s): CHEM 322A (Organic Chemistry)

Course Notes

The course is composed of a lecture and laboratory component. Students must also enroll in a quiz section in order to take midterm exams. All lecture slides will be posted on Blackboard throughout the semester. Lab manual will be provided on Blackboard.

Required Readings and Supplementary Materials

Berg, Tymoczko & Stryer, *BIOCHEMISTRY* (8th, 2015)
BISC 330L Lab Manual (Provided for you online)

Description and Assessment of Assignments

Midterms will include a mixture of short-answer, multiple-choice, and mathematical questions. Laboratory assignments are described in the laboratory syllabus and lab manual.

Grading Breakdown

The course grade will be based upon **1000** possible points:

- 250 pts. Midterm 1
- 250 pts. Midterm 2
- 250 pts. Final Exam
- 250 pts. Laboratory (see lab syllabus for specific assignments)

Exam Dates:

Midterm 1: Tuesday February 13, 4:00-4:50pm (Lectures 1 – 12)
Midterm 2: Tuesday March 27, 4:00-4:50pm (Lectures 13 – 28)
Final Exam: May 8, 4:30-6:30am (Lectures 29 – 43)

Grading Scale

Course final grades cutoffs are set at the end of the term. However, in order to receive a grade of C- or better, students are expected to earn a minimum of 500 points, out of a total of 1000 possible.

Grading Timeline

Midterm scores are typically posted one week after 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 two 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>.

Midterm Exam Regrade: 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. Mathews or your lab TA within a week after receiving your graded exam. After this time period, exams will not be regraded.

Lectures: 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 important to have read the appropriate portions of the textbook. However, many of the lectures will contain new and additional information that is not in the textbook. Examinations will be based mainly on information given in the lectures. In studying for examinations, complete and accurate lecture notes are of prime importance.

The lecture slides posted on the course Blackboard internet site (<https://blackboard.usc.edu>), may contain material that is not in the lectures—and the lectures may contain information that is not conveyed in the Blackboard lecture summaries. The lecture slides, as posted on Blackboard, and the textbook are intended to be helpful, but auxiliary to the lectures. All course 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 new messages can be received

Lecture Schedule:

Wk.	Date	Lecture Topic	Reading
1	Jan. 8 (LC)	Introduction: chemistry of life process	1.1-1.2
	Jan. 10	Water, pH and acid/base equilibria	1.3
	Jan. 12	DNA discovery & genomic revolution	1.4
2	Jan. 15	No Lecture – Martin Luther King's Birthday	
	Jan. 17	Amino acid structures & properties	2.1
	Jan. 19	Primary structure of proteins	2.2
3	Jan. 22	Primary structure of proteins	2.3
	Jan. 24	Tertiary & quaternary structures	2.4 - 2.6
	Jan. 26	Protein purification methods	3.1
4	Jan. 29	Amino acid analysis & sequencing	3.2
	Jan. 31	Protein structure determination	3.6
	Feb. 2	Protein structure determination	4.1 - 4.2
5	Feb. 5	DNA replication & gene expression	4.3 - 4.4
	Feb. 7 (FP)	Enzymes: Basics	8.1 - 8.2
	Feb. 9	Enzymes: Transition State	8.3
6	Feb. 12	Enzymes: Michaelis-Menten; Inhibition	8.4 – 8.5
	Feb. 14	Enzymes: Catalytic Strategies	9
	Feb. 16	Enzymes: Regulatory Strategies	10
7	Feb. 19	No Lecture – President's Day	
	Feb. 21	Carbohydrates	11
	Feb. 23	Lipids and Cell Membranes	12.1 – 12.3
8	Feb. 26	Lipids and Cell Membranes	12.4 – 12.6
	Feb. 28	Membrane Channels & Pumps	13
	Mar. 2	Signal Transduction Pathways	14

9	Mar. 5 (GJ)	Introduction to Metabolism	15
	Mar. 7	Introduction to Metabolism	15
	Mar. 9	Glycolysis	16
		Spring Recess	
10	Mar. 19	Regulation of Glycolysis	16
	Mar. 21	Gluconeogenesis	16
	Mar. 23	Glycolysis and Review	16
11	Mar. 26	The Citric Acid Cycle	17
	Mar. 28	The Citric Acid Cycle	17
	Mar. 30	Oxidative Phosphorylation	18
12	Apr. 2	Oxidative Phosphorylation	18
	Apr. 4	Oxidative Phosphorylation	18
	Apr. 6	Oxidative Phosphorylation	18
13	Apr. 9	Photosynthesis	19
	Apr. 11	Photosynthesis	19
	Apr. 13	Photosynthesis	19
14	Apr. 16	The Calvin Cycle	20
	Apr. 18	The Calvin Cycle	20
	Apr. 20	The Pentose Phosphate Pathway	20
15	Apr. 23	Glycogen	21
	Apr. 25	Fatty Acid Metabolism	22
	Apr. 27	Review for Final Exam	
	May 8	Final Exam: 4:30-6:30 p.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, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

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

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu