

THE UNIVERSITY OF BRITISH COLUMBIA



UBC's Point Grey Campus is located on the unceded, traditional and ancestral territory of the x^wməðk^wəỷəm (Musqueam).

This syllabus is a general representation of the course as previously offered and is subject to change.

Biology 201 – Introduction to Biochemistry

General Course Syllabus (as of November 2023)

Course Description: Biological molecules, protein structure and enzyme action, energy transfer, central metabolic pathways and their regulation. Examples drawn from plants, animals and microorganisms. (Consult the Credit Exclusion list within the Faculty of Science section of the Calendar.) Credit will be granted for only one of BIOL 201, BIOC 202, or BIOC 203.

Course Format: Lecture and Tutorial

Credits: 3 credits

Prerequisites: BIOL 200 and one of CHEM 233, CHEM 260. (; or BIOL 200 and a corequisite of CHEM 213; or a corequisite of either CHEM 313 or CHEM 330.)

Course Learning Goals:

- Demonstrate understanding of the chemistry underlying the following biological processes:
 - pH-dependent behavior of biomolecules and their functional relevance under biological conditions
 - Protein folding, function and kinetics
 - Energy Transformation
 - Metabolism
- Demonstrate understanding of protein structure and its importance in protein function.
- Describe and interpret experimental data based on conceptual knowledge of chemistry and biology.
- Solve problems related to biochemistry by Integrating and applying knowledge of Chemistry and Biology.
- Articulate the interdisciplinary nature of biochemistry within the context of the 'bigger picture' of everyday life.

Course Materials:

Course Website: BIOL201 will be administered through Canvas - access to the website (see: <u>https://lthub.ubc.ca/guides/canvas-student-guide/</u>) requires UBC CWL and password.

Textbook: An access code to the digital platform (**"Achieve" website**) is EXPECTED for this course – it provides e-textbook access to Nelson DL & Cox. *Lehninger, Principles of Biochemistry*, 8th Edition. WH Freeman & Company, New York.

"Achieve" is the online companion to the textbook, where the weekly **pre-reading quizzes** will be administered. In addition to the e-text, "Achieve" houses the weekly targeted reading guides, videos and other supplemental materials, which will be assigned periodically.

Problem Sets: for topics associated with each unit of the course will be posted on Canvas at the start of each Unit.

- The Problem Sets have been explicitly designed to expose students to various types of problem-solving, and similar to those on the exams. Exams-I and Exam-II will each contain a combination of questions, including short answers, problem solving with calculations, data analysis, T/F, fill-in the blanks, and the occasional multiple-choice question.
 - Use of the Learning Objectives provided for each topic is <u>highly</u> recommended to guide and help focus your studying.
 - Working through the Problem Sets is the **BEST** way to learn application of concepts and prepare for the exams.

Week	Unit	Problem Set
1-2	Unit 1: Aqueous Ionization Tendencies	PS#1
2-4	Unit 2: Proteins	
	2A: Aspects of globular protein structure	PS#2
	2B: Protein Folding & Common Experimental Tools	PS#3
5-6	Unit 3: Enzymes	
	3A: Mechanism of Enzyme Catalysis	PS#4
	Exam I	
7	3B: Enzyme Kinetics & Inhibition	PS#5
8	Unit 4: Energy Transfer	
	4A: The basics + ATP usage in biosynthesis	PS#6
9	4B: Mechanisms of ATP synthesis	PS#7
10-12	Unit 5: Metabolism	
	5A: Universal Catabolic Pathways	PS#8
	5B: Plant-Specific (Anabolic) Pathways	PS#9
	Exam II	

BREAKDOWN OF COURSE UNITS AND PROBLEM S	ETS
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Course Evaluation:

Assessment breakdown (students must achieve 50% = 42 /84 on EXAM-I AND EXAM-II to pass the course):				
Exam-I*	34%	(2 h)		
Exam-II (Final)*	50%	(2.5 h)		
*Both Exam I and Exam-II must be completed to complete the course.				
Pre-Reading Quizzes	5%	Weekly quizzes on Achieve, based on Targeted Reading		
(10 x 0.5%)		Guides; best 10 of 11 (or 12) quizzes will be counted		
Scheduled Tutorials	4%	Four Scheduled Tutorials during the term – two before Exam-I		
(4 x 1%)		and two after Exam-I. See Tutorial Schedule for details.		
Homework on Canvas	7%	 Similar to PS questions (Best 7 counted) 		
		 Other activities & homework assigned from class 		

INFORMATION REGARDING EXAM-I AND EXAM-II

- In order to pass the course, a passing grade on the aggregate scores of Exam-I and Exam-II is required. The exams (I and II) are worth 84 marks collectively, so a score of 42/84 (50%) or higher is required. For aggregate scores less than 50% on the Exams, scores from the remaining 16% (from Pre-Reading Quizzes, Scheduled Tutorials and Canvas Homework completion) will be added to the final grade up to a maximum of 45%.
- **Exam-I**: held on the Thursday before the start of the Reading Week Break in February.
 - If you have course conflicts at the time of Exam-I, please let us know as soon as possible.
 - If your absence was unanticipated (e.g. unexpected illness), you must notify your instructor with a completed self-declaration form for academic concession within 24 hours of the exam (the form can be found at: https://biologyprogram.sites.olt.ubc.ca/files/2022/09/Academic-Concession-Form-2022W.pdf)
- **Exam-II**: held during the final exam period in April. If you miss exam-II, you must apply for deferred status through the Dean's Office of your Faculty. Deferred BIOL 201 exams are scheduled by enrollment services in late July/early August.
- Exams-I and Exam-II test different content.
 - Exam-I will cover materials from Units 1, 2 and 3A (i.e. Problem sets 1 4)
 - \circ Exam-II will cover materials from Units 3B, 4 and 5 (i.e. Problem sets 5 9).
 - This means: Exam-I and Exam-II are both treated as final exams for the covered topics.
- Exam-II is NOT cumulative, and it will be designed to test course units past exam-I. However, in the case where a student is unable to write Exam-I for a valid reason, they will write a Cumulative Exam during the Final Exam period, covering all course unit topics.
- Since both exams are treated as final exams, they will **NOT** be returned to students.

Course Format & Learning Activities:

- This course consists of five units, each covering a broad topic area of biochemistry.
- Each week, students are expected to complete a **pre-reading quiz** (on Achieve), attend and participate in class, work on problem sets, and complete homework problems assigned.
- The tutorials and weekly office hours (offered by Instructors and Peer Tutors), and Piazza discussion board in BIOL 201 are designed to support learning in the course.
- Weekly tutorials there are two different types of the weekly tutorials:
 - 1. SCHEDULED TUTORIALS: FOUR scheduled tutorials offered during different weeks of the term. For these scheduled tutorials, students are expected to attend the tutorial section that they are registered in.

2. **DROP-IN TUTORIALS:** During the rest of the term (when no Scheduled Tutorials are in session), students may drop-in to get help from TAs within the drop-in times. TA assignments to specific drop-in Tutorial sections will be posted on Canvas.

- **Piazza**, the online discussion board: In this course, we strongly encourage student engagement on Piazza this is the platform to collaborate, discuss, etc. as you work through problems in the problem sets. Your peers are your most valuable resource for learning, and teaching each other is the best way to learn.
- ICLICKER CLOUD the classroom response system: This will be used in almost every lecture, as an interactive tool, to guage your level of knowledge based on prior learning, comprehension of reading assignments, and to gauge conceptual understanding after most in-class activities.

Academic Integrity Policies:

Academic Integrity: Academic integrity is important to us, and we know it is to most students. Academic integrity means being an honest, diligent, and responsible scholar – yes, as a student you are a member of this university's scholarly community. Being a scholar in this course, among other things includes, completing assignments independently or acknowledging collaboration when appropriate, and taking exams without cheating. Collaboration through group work is an effective way to learn. We will clearly indicate when you should collaborate, for example during in-class group work and on some online homework assignments.

Any instance of cheating or taking credit for someone else's work, whether intentionally or unintentionally, can and often will result in a grade of zero for the assignment, and these cases will be reported to the Head of the Department and Associate Dean Academic of the Faculty of Science.

Course Schedule:

1 Unit 1 - Aqueous Ionization Phenomena L1: Intro. 16 BIOL202; (PS), and Average Molecules (AM) Drop-in Tutorials: work on PS1 PSE1 released 2 Unit 2A - Globular Protein Structure L2: Aqueous Ionization - Part 1: Predominant Species (PS), and Average Molecules (AM) Drop-in Tutorials: work on PS1 PSE1 released 3 Unit 2A - Globular Protein Structure L4: 2A Globular Proteins - part 1 Sched. Tutorial 1 (an. 16 to 19) Column Chromatography PSE2 released - Unit 2A 4 Unit 2B - Protein Folding L6: 2B Protein Folding - Part 2 PSE3 released - Unit 2A 5 Unit 3A - Enzyme Catalysis L6: 2B Protein Folding - Part 2 PSE3 released - Unit 2B 6 L7: 2B Protein Folding - Part 1 Drop-in Tutorials: work on PS4 Drop-in Tutorials: work on PS4 7 Unit 3A - Enzyme Catalysis - Part 1 Drop-in Tutorials - PS1, PS2, PS3, PS4 Drop-in Tutorials - PS1, PS2, PS3, PS4 7 Unit 3B - Enzyme Kinetics L1: 3B Enzyme Kinetics Drop-in Tutorials - PS1, PS2, PS3, PS4 8 Unit 4A - Energy Transfer I: RM2 L1: 4A Energy Transfer - Part 1 (Equilibria and Steed, Ystee) PS45 released - Unit 3B Sched. Tutorial 3 (Feb 27 to March 2) Enzyme Kinetics - I 9 Unit 4A - Energy Transfer I: RM2 L4: 4A Energy Intermediates Cd, + 4B Metabolism - Photosyn	Week	Topics	Lecture Topics	Tutorial Week	
Solectric Point (p) Sched. Tutorial 1 (Jan. 16 to 19) 13: Aqueous Ionization – Part 3: PS, AM, pl Sched. Tutorial 1 (Jan. 16 to 19) 38 Unit 2A – Globular Protein Sched. Tutorial 2 (Jan. 16 to 19) 39 Structure L5: 2A Globular Proteins - part1 Sched. Tutorial 2 (Jan. 23 to 26) 40 L6: 2B Protein Folding - Part2 Sched. Tutorial 2 (Jan. 23 to 26) 51 Unit 2B – Protein Folding L6: 2B Protein Folding - Part2 PSM released - Unit 2A 56 Unit 3A – Enzyme Catalysis L1: 3B Enzyme Catalysis - part3 Drop-in Tutorials - PS1, PS2, PS3, PS4 66 Exam -1 Covers materials in Units 1-3A, PS 1-4 Drop-in Tutorials - PS1, PS2, PS3, PS4 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition PSM5 released - Unit 28 7 Unit 4A – Energy Transfer I: Role L12: 3B Enzyme Inhibition PSM5 released - Unit 4A 8 Unit 4B – Energy Transfer I: Role L12: AA Energy Transfer - Part2 (Coupled Reactors); High Energy Intermediates Cd. + 4B Kinetics - I 9 Unit 4B – Energy Transfer I: Role L12: AA Energy Transfer - Part2 (Coupled Reactors); High Energy Intermediates Cd. + 4B Kinetics - I 10 Unit 4B	1		Aqueous Ionization – Part 1: Predominant Species		
2 L4: 2A Globular Proteins - part1 Column Chromatography PSE released - Unit 2A 3 Structure L3: 2A Globular Proteins - Part2 Sched. Tutorial 2 (Jan. 23 to 26) Get Hectrophoresis PSE released - Unit 2B 4 Unit 2B – Protein Folding L6: 2B Protein Folding - Part1 PSE released - Unit 2B 5 Unit 3A – Enzyme Catalysis L9: 3A Enzyme Catalysis - part2 Drop-in Tutorials: work on P54 6 Exam – I Covers materials in Units 1:3A, P5 1.4 Drop-in Tutorials – PS1, PS2, PS3, PS4 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition PSES released - Unit 3B 7 Unit 4B – Energy Transfer I: Bole of ATP in biosynthesis L13: 4A Energy Transfer - Part2 (Equilibria and Steady State) PSES released - Unit 4A 9 Unit 4B – Energy Transfer I: Bole of ATP in biosynthesis L14: 4A Energy Transfer - Part2 (Coupled Reactions); High Energy Intermediates PSES released - Unit 4A 9 Unit 4B – Energy Transfer I: Bole of ATP in biosynthesis L14: 4A Energy Transfer - Part2 (Equilibria and Steady State) PSES released - Unit 4A 10 Unit 5A – Metabolism: Universal Pathways L16: 4B Oxidative phosphorylation (Oxphos) + Tools to study Oxphos PSES released - Unit 4A 112: 5A Metabolism I – part1 – Central Pa			Isoelectric Point (pl)		
3 Structure L5: 2A Globular Proteins - Part2 Sched. Tutorial 2 (Jan. 23 to 26) Gel Electrophoresis PSW3 released - Unit 28 4 Unit 2B – Protein Folding L5: 2A Globular Proteins - Part1 PSW3 released - Unit 28 5 Unit 3A – Enzyme Catalysis L9: 3A Enzyme Catalysis - part2 PSW4 released - Unit 3A 6 L1: 3B Enzyme Catalysis - part3 Drop-in Tutorials - PS1, PS2, PS3, PS4 11: 3B Enzyme Kinetics Drop-in Tutorials - PS1, PS2, PS3, PS4 7 Midterm Break – No classes Drop-in Tutorials - PS1, PS2, PS3, PS4 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition 8 Unit 4A – Energy Transfer I: Role of ATP in biosynthesis L13: 4A Energy Transfer - Part1 (Equilibria and Steady State) 9 Unit 4B – Energy Transfer I: Mechanisms of ATP Synthesis L15: 4A High Energy Intermediates cd. +48 Mechanisms of ATP Synthesis PSW6 released - Unit 4A Sched. Tutorial 3 (March 6 to 9) Enzym Kinetics – I 10 Unit 5A – Metabolism: Universal Pathways L13: Si Avelabolism - Diroco-50 Giycol Vol 200005 + Tools to study Oxphos ctd. +5A Metabolism I - part2 - Central Pathways Intro. PSW7 released - Unit 4B Drop-in Tutorials: work on PS7 10 Unit 5B - Plant-spec. Metabolism: Photosynthesis L13: 5A Metabolism I - CA- part 1 PSW7 released - Unit 5A Drop-in Tutorials: work on PS7, PS8 112 Unit 5B - Plant-spec. Metabolism: Photosynthesis L23: 5A Metabolism I - CA- part 1	2			Column Chromatography	
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Unit 3A – Enzyme Catalysis Drop-in Tutorials – P51, P52, P53, P54 6 Exam – I Covers materials in Units 1-3A, P5 1-4 Drop-in Tutorials – P51, P52, P53, P54 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition P5#5 released - Unit 3B 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition P5#5 released - Unit 3B 8 Unit 4A – Energy Transfer I: Role L14: 4A Energy Transfer - Part2 (Coupled Reactions); High Energy Intermediates P5#6 released - Unit 4A 9 Unit 4B – Energy Transfer I: Role L14: 4A Energy Intermediates ctd. + 4B Mechanisms of ATP Synthesis P5#7 released - Unit 4A 9 Unit 4B – Energy Transfer I: Role L17: 4B Tools to study Oxphos ctd. + 5A Metabolism I - part1 – Central Pathways Intro. P5#7 released - Unit 4B 10 Unit 5A – Metabolism: Universal Pathways L18: 5A Metabolism I – Introduction Glyco-5 D P5#8 released - Unit 5A 11 Unit 5B – Plant-spec. L20: 5A Metabolism I – Oxopi to Copy-1 o Copy-1 n Tutorials: work on P57, P58 Drop-in Tutorials: work on P57, P58 12 Unit 5B – Plant-spec. L23: 5B Metabolism II Plant-specific – part 1 Drop-in Tutorials: work on P57, P58 12 Unit 5B – Plant-spec. L23: 5B Metabolism II Plant-specific – part			L8: 3A Enzyme Catalysis - Part 1		
6 L10: 3A Enzyme Catalysis – part3 Drop-in Tutorials – PS1, PS2, PS3, PS4 6 L11: 3B Enzyme kinetics Drop-in Tutorials – PS1, PS2, PS3, PS4 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition PS#5 released - Unit 3B 8 Unit 4A – Energy Transfer I: Role of ATP in biosynthesis L12: 4A Energy Transfer – Part2 (Coupled Reactions); High Energy Intermediates PS#6 released - Unit 4A 9 Unit 4B – Energy Transfer I: Role of ATP in biosynthesis L14: 4A Energy Transfer – Part2 (Coupled Reactions); High Energy Intermediates PS#6 released - Unit 4A 9 Unit 4B – Energy Transfer I: Mechanisms of ATP Synthesis L16: 4B Oxidative phosphorylation (Oxphos) + Tools to study Oxphos PS#7 released - Unit 4B 10 Unit 5A – Metabolism: Universal Pathways L18: 5A Metabolism I – Introduction Glycolysis – Glyco-1 to Glyco-5 PS#8 released - Unit 5A 11 Unit 5B - Plant-spec. Metabolism: Photosynthesis L12: TCA – part 2 and wrap up Drop-in Tutorials: work on PS7, PS8 12 Unit 5B - Plant-spec. Metabolism: Secondary metabolites L23: 5B Metabolism II Plant-specific – part 1 Drop-in Tutorials: work on PS7, PS8 13 L24: 5B Metabolism II Plant-specific – part 2 Drop-in Tutorials: work on PS7, PS8, PS#9 released - Unit 5B	5		L9: 3A Enzyme Catalysis - part2	Drop in Tutoricle DS1 DC2 DS2 DS4	
6 Exam - I Covers materials in Units 1-3A, P5 1-4 Drop-in Tutorials – P51, P52, P53, P54 7 Unit 3B – Enzyme Kinetics L12: 3B Enzyme Inhibition P5#5 released - Unit 3B Sched. Tutorial 3 (Feb 27 to March 2) Enzyme Kinetics – I 8 Unit 4A – Energy Transfer I: Role of ATP in biosynthesis L14: 4A Energy Transfer – Part2 (Coupled Reactions); High Energy Intermediates L15: 4A High Energy Intermediates std. + 4B Mechanisms of ATP Synthesis Intro P5#6 released - Unit 4A Sched. Tutorial 4 (March 6 to 9) Enzym Kinetics – II 9 Unit 4B – Energy Transfer II: Mechanism of ATP Synthesis Intro L16: 4B Oxidative phosphorylation (Oxphos) + Tools to study Oxphos L17: 4B Tools to study Oxphos ctd. + 5A Metabolism I – part1 – Central Pathways Intro. P5#7 released - Unit 4B Drop-in Tutorials: work on P57 10 Unit 5A – Metabolism: Universal Pathways L18: 5A Metabolism I – Introduction Giycolysis – Giyco-1 to Giyco-5 L19: 5A Metabolism I – Complete Anaerobic catabolism PDH Reaction. L21: 5A Metabolism I – TCA – part 1 L22: TCA – part 2 and wrap up P5#8 released - Unit 5A Drop-in Tutorials: work on P57, P58 P5#9 released - Unit 5B 12 Unit 5B – Plant-spec. Metabolism: Secondary metabolites L23: SB Metabolism II Plant-specific –part 1 Photophosphorylation and Calvin Cycle Prop-in Tutorials: work on P57, P58 P5#9 released - Unit 5B 13 L24: SB Metabolism II Plant-specific –part 2 Plant secondary metabolites Drop-in Tutorials: work on P57, P58, P5#9		Unit 3A – Enzyme Catalysis	L10: 3A Enzyme Catalysis – part3	Drop-In Lutoriais – PS1, PS2, PS3, PS4	
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