BIOCHEMISTRY 3300 SYLLABUS

PLEASE NOTE THAT WITH THE CURRENT ENVIRONMENT, IT IS IMPORTANT THAT YOU CHECK BACK TO THIS PAGE OFTEN FOR CHANGES IN SCHEDULING, ASSIGNMENTS, MAJOR ANNOUNCEMENTS BY THE PROFESSOR ETC.

Lecture Time/Location: Tuesdays 7:00-9:30PM | Location 263 Macy Hall (in Teacher's College)

The location is in Teacher's College. The easiest way to get there is to enter through the 120th St Entrance by Zankel Building.

Professor: Nam Ho: dnh2109@columbia.edu

Office Hours: 9AM Sundays on Zoom. Please check Zoom Class Sessions.

Please note that the Zoom OH timing may be changed so please check often.

FINAL EXAM REVIEW SESSION: FRIDAY, DECEMBER 15TH, 1:00-2:30 PM IN FAIRCHILD 800

Teaching Assistants:

James Lao: jyl2188@columbia.edu

Eric Mao: em3570@columbia.edu

Kaira Oraedu: kao2153@columbia.edu

Office Hours:

James: 11:00 AM - 12:00 PM on Fridays (in Fairchild 601C)

Eric: 7:00 - 8:00 PM on Fridays (in Fairchild 900)

Kaira: 7:00 - 8:00 PM on Mondays (in Fairchild 900)

COURSE DESCRIPTION

Biochemistry is the study of the chemical processes within organisms that give rise to the immense complexity of life. This complexity emerges from a highly regulated and coordinated flow of chemical energy from one biomolecule to another. This course serves to familiarize students with the spectrum of biomolecules (carbohydrates, lipids, amino acids, nucleic acids, etc.) as well as the fundamental chemical processes (glycolysis, citric acid cycle, fatty acid metabolism, etc.) that allow life to happen. In particular, this course will employ active learning

techniques and critical thinking problem-solving to engage students in answering the question: how is the complexity of life possible?

Pre-requisites: one year of introductory biology and one year of general chemistry. At least 1 semester of organic chemistry.

It is HIGHLY recommended that you complete the full course of organic chemistry before taking this class as much of the chemistry covered here is covered in OChem 2nd semester.

READING MATERIAL

The assigned textbook for the course is: David Nelson and Michael Cox. Lehninger Principles of Biochemistry, 8th Edition. W.H. Freeman and Company, New York, 2021.

The 7th edition of the book is the only other edition of the textbook that is appropriate for this class. All readings and additional questions are from the 8th edition. It is up to the responsibility of the student to reconcile the differences between the two editions if the 7th edition is being used.

POLL EVERYWHERE

Poll Everywhere is an Audience Response System (ARS) that will be used to engage students and track understanding of the material throughout a semester. This will be an important tool for the professor to gauge comprehension. Poll Everywhere requires no external app to be downloaded and is easy to use with a smartphone, laptop, or iPad.

For now, Poll Everywhere is not used as a quizzing tool.

You will get 1 pt a class lecture for participation. If you miss a class, you can still get full free participation credit, up to 2 times.

UCSF CHIMERA

UCSF Chimera is a program for the interactive visualization and analysis of molecular structures and related data, including density maps, trajectories, and sequence alignments.

- In this class, the program is used to show the 3-D structures of sugars, proteins, and other molecules. It is also used to generate images for quizzes, problem sets, and exams. Thus, it is very important that students get familiar with the different kinds of visualizations, colors used by default, etc.

To download Chimera, go here: https://www.cgl.ucsf.edu/chimera/download.htmlLinks to an external site.

To do a short tutorial on Chimera, go to "Files > Supplemental" and use the "UCSF_Chimera_tutorial_small.pdf"

Please note: ChimeraX will note used for demonstrations, but there's no reason to think that it won't have the same visualization style and functions so feel free to use that if it is better for your operating system.

SCHEDULE OF LECTURES (SCHEDULES CAN CHANGE SO CHECK BACK OFTEN!)

Please note these readings for from the 7th Edition of the book so the section numbers might be slightly off.

Date	Topic	Recommended Reading	Assignments Due and Quiz/Exam During Lecture	TA Grading Responsibilities
Sept 5	Lecture 1: Intro to Biochemistry & Core Concepts	Chp 1.1 – 1.5	None	
Sept 12	Lecture 2: Carbohydrates & Lipids	Chp 2.1 - 2.3, Chp 7.1 – 7.2, Chp 10.1 – 10.2	Quiz 1 Problem Set 1 Due	Eric
Sept 19	Lecture 3: Amino Acids	Chp. 3.1 - 3.3, Chp 4.1-4.3, Chp. 8.1-8.2	Quiz 2 Problem Set 2 Due	James
Sept 26	Lecture 4: Part 1 Proteins	Chp 4.1-4.3, Chp. 8.1-8.2, Chp. 5.1 Chp. 6.1 - 6.3 (This is required reading) Chp. 13.1 - 13.2	Quiz 3 Problem Set 3 Due	Kaira
Oct 3	Exam 1		No Quiz Problem Set 4 Due	Eric

Oct 10	Lecture 4: Part 2 Kinetics Lecture 5: Glycolysis & Gluconeogenesis	Chp 14.1 - 14.3 Chp 15.1-15.2	No Quiz No problem set due	
Oct 17	Lecture 6: The Citric Acid Cycle	Chp 16.1 - 16.3	Quiz 4 Problem Set 5 Due	Kaira
Oct 24	Lecture 7: Electron Transport Chain	Chp. 19.1 - 19.3	Quiz 5 Problem Set 6 Due	James
Oct 31	Lecture 8: Fatty Acid Anabolism & Catabolism	Chp. 17.1-17.3 Chp. 21.1	Quiz 6 Problem Set 7 Due	Eric
Nov 7	No Class - Academic Holiday			
Nov 14	EXAM 02		No Quiz Problem Set 8 Due	James
Nov 21	Lecture 9: Nitrogen Fixation & Amino Acid Metabolism	Chp. 18.1-18.2 18.3 is good but there's a lot of unnecessary info so read judiciously	No Quiz No Problem Set Due	
Nov 28	Special Clinical Lecture	No reading	Quiz 7 Problem Set 9 Due	Kaira
Dec 5	Clinical Series Lecture Research Project Presentations	No reading	Quiz 8 No Problem Set Due	Eric

			Research Presentations Due Dec 3 5:00PM Research Posters Due Dec 5 7:10PM	
Dec 19	FINAL EXAM (EXAM 3) 7:00 – 10:00PM			

GROUP RESEARCH PROJECT TOPICS:

Group 1: MCAD Deficiency

Group 2: Batten Disease

Group 3: MELAS Syndrome

Group 4: Tuberculosis

Group 5: Rabies

Group 6: Leigh Syndrome

Group 7: Alkaptonuria

Group 8: Adrenoleukodystrophy

Additional End-of-Chapter Problems That Might be Helpful to Practice:
(please note these are all from the 7th Ed of Lehninger and I very quickly scanned the topic of these questions so not everything may be applicable. Because I read these briefly, I don't have answers to them but the book provides abbreviated answers in the back of the book)

Chp. 01: 6, 7, 8, 9, 11

Chp. 02: 3, 10, 11, 13, 15, 17, 22, 34

Chp. 03: 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 19, 21, 22

Chp. 04: 1, 4, 5, 6, 7, 9, 19, 11

Chp. 05: 1, 12

Chp. 06: 1, 6, 7, 8, 9, 10, 11, 12, 13, 16, 18, 19, 23

Chp. 07: 2, 4, 6, 8, 13, 14, 21

Chp. 08: not applicable (but I just saw that Fig 8-41 is a good reference image for NAD+ and FAD)

Chp. 09: not applicable

Chp. 10: 1, 3, 15, 16, 17

Chp. 11: not applicable

Chp. 12: not applicable

Chp. 13: 2 to 9, 11, 12, 15 to 20, 30

Chp. 14: 1, 2, 3, 4, 6, 10, 18, 19, 21, 25, 26

Chp. 15: 1, 2, 3, 4, 5, 12

Chp. 16: 2, 3, 5, 6, 7, 8, 11, 17, 18, 21, 26, 31

Chp. 17: 1, 3, 4, 7, 9, 10, 20, 23, 26

Chp. 18: 1, 2, 3, 5, 7, 8, 10, 19, 21

Chp. 19: 2, 3, 4, 9, 11, 13

Chp. 20: not applicable

Chp. 21: 2, 3, 6, 10, 15

Chp. 22: 2, 3, 4, 5, 8

List of Acceptable Abbreviations You Can Use on Exams (this list is always growing so check before each exam):

α-KG = α-ketoglutarate

ACC - acetyl-CoA carboxylase

ADP/AMP/ATP - adenosine di/mono/triphosphate

CAT1/2 - carnitine acyltransferase I/II

CoA - coenzyme A

DTT - dithiothreitol

ETC - electron transport chain

ETF - electron transfer flavoprotein

ETF:QO - electron transfer flavoprotein oxidoreductase

$FAD/FADH_2$ - flavin adenine dinucleotide (oxidized and reduced form, respectively)

FAS - fatty acid synthase

FMN - flavin mononucleotide

GDP/GMP/GTP - guanosine di/mono/triphosphate

HMG-CoA - β-Hydroxy β-methylglutaryl-CoA

KDH - alpha-ketoglutarate dehydrogenase complex

NAD+/NADH - nicotinamide adenine dinucleotide (oxidized and reduced form, respectively)

OAA - oxaloacetate

PEP - phosphoenolpyruvate

Pi - inorganic phosphate

PDH - pyruvate dehydrogenase complex

PFK-1 - phosphofructokinase-1 (can also use PFK-2 for the other enzyme)

PLP - pyridoxal phosphate

Q - ubiquinone

QH - semiquinone

QH_2 - ubiquinol

SDS - sodium dodecyl sulfate

TCA - Tricarboxylic Acid Cycle (aka The Krebs Cycle; aka The Citric Acid Cycle)

TPP - thiamine pyrophosphate

The following are acceptable abbreviations only when referring to domains of fatty acid synthase:

ACP - acyl carrier protein

DH - dehydratase

ER - enoyl reductase

KR - ketoreductase

KS - ketoacyl synthase

MAT - malonyl-CoA-/acetyl-CoA-ACP transacylase

COURSE GRADE EVALUATION

Grades for the course are dependent on: research project, quizzes, problem sets, and exams.

There is no weight to the different types of assignments, so all points are worth exactly the same regardless of whether they are from quizzes, problem sets, exams, etc.

There's a specific section below for online testing and make-up exams/quizzes policy.

Description and Breakdown of Grades:

PollEverywhere - 9 pts for the entire semester

PollEverywhere participation is only counted once per lecture (there are 9 lectures), so in total it will be approximately 1.5% of the final grade.

You are allowed 1 free PollEverywhere make-up point (for 1 absence).

Quizzes – 10 pts each

Oftentimes, the materials and concepts introduced in Biochemistry can snowball. Quizzes are designed to keep the students up-to-date and present in the course. Quizzes are given at the first break during the lecture (see designated schedule above). The number of quizzes per semester changes depending on the schedule of lectures.

Each quiz will only test on the previous week's lecture only. No notes or calculators allowed.

The single lowest quiz score is dropped.

You are ALSO allowed 1 make-up quiz during the semester if you are unable to take on respective lecture day. Please see full make-up policy below for details and when to notify the professor/TAs.

Problem Sets – (Values typically range from 10-20 pts)

Homework assignments allow students to evaluate themselves and practice solving biochemical problems outside the classroom. Students are encouraged to form small study groups in tackling these problem sets. Answers must be fully elucidated to show the complete thinking process in reaching the solution.

Problem Sets are ONLY accepted digitally via coursework submission at 7:10PM on the designated date (see schedule above). **Accepted formats include PDF ONLY. It is the responsibility of the student to turn in assignments in the acceptable format.**

DOUBLE-CHECK YOUR SUBMISSIONS --> unfortunately sometimes your iPad won't upload it correctly the first time so ALWAYS DOUBLE-CHECK your submissions

Late assignments will be accepted up to one week later, albeit with a 20% automatic score deduction from the total points possible, rounded to the nearest 0.5 (i.e. If an assignment is worth 16 pts and it is late, the max you can get is 13).

No problem sets are dropped.

You are allowed 1 problem set deferral during the semester (allowed to turn them in up to 1 week later than original due date). Please see full make-up policy below for details and when to notify the professor/TAs.

Exams – Exam 1, Exam 2 , & Exam 3 (Final) (Values typically range from 100-200 pts)

Exams serve to incorporate all the concepts introduced and critical thinking skills that have been developed. Questions will draw from materials introduced in class lectures, homework assignments, quizzes, textbook, and original research articles. **Exam topics are accumulative** due to the nature of the biochemistry material. That is, the material naturally builds throughout the semester so one cannot forget what was learned in the beginning of the class to understand the later parts of the class. Exams are the only assignments in the class that is curved and thus, point values denoted here are only estimate ranges.

No exams are dropped.

The final exam cannot be regraded nor will the exam be handled back.

Notes that can be used for the exam:

- Exam 1: no notes are allowed
- Exam 2: 1 double-sided, handwritten, 3"x5" (3 inch x 5 inch) notecard/index card is allowed
- Exam 3: 1 double-sided, handwritten, 4"x6" (4 inch x 6 inch) notecard/index card is allowed
- Note cards cannot be typed and will be checked before a student enters the classroom for an exam.
- There are no restrictions to what can be written on the index cards, color-coding, or type of writing instrument (pen or pencil). It's all up to you.

Research Project - 40 pts (this point value might change)

A group research assignment, worth 40 points, will be due near the end of the semester. It consists of a poster and a presentation. An entire project-specific syllabus will be given near Exam 02.

Distribution of Grades:

Grades are divided as follows:

Grade	Percentage Range
A	93 - 100
A-	90 - <93

B+	87 - <90
B	81 - <87
B-	78 - <81
C+	75 - <78
C	68 - <75
C-	65 - <68
D+	62 - <65
D	54 - <62
D-	51 - <54
F	1 - <51

The class itself is not curved, but the exams may be curved.

Regrades Policy:

All work in the class (quizzes, problem sets, tests) must be written in pen to qualify for a regrade. Pencil can often be light, even when scanned in/photo taken so a pen is required. Write in black or blue pen ONLY.

The following can be regraded:

- Problem Sets + Quizzes --> submit request via email to specific TA, CCing the professor, and outlining the reasons for a regrade. If possible, have a conversation with the specific TA after the class instead as this is often more productive and easy.

- Requests for problem set or exam (except for final exam) regrades can be submitted to the appropriate TA or professor up to 1 week AFTER it is graded.

  Problem sets will be regraded by the respective TA designated in the schedule table above (or the main TA if no one is designated).

- Exam 1 and Exam 2
  - Exams (except for final exam) will be optionally regraded by the professor.
  - There is a special digital template word document that must be submitted along with the request.
  - All requests must be submitted live. Print the completed template and staple it to the top of the exam and hand in the packet to the professor up to 1 week after you have been given back the test.

FINAL EXAM: There are no regrades for the final exam nor will it be handled back.

MAKE-UP POLICY

Quizzes and Problem Sets

Students are allowed 1 make-up quiz and 1 problem set deferrals, no questions asked but notification VIA EMAIL (written trail is needed) and approval is still needed (perfect for traveling home early [ie Thanksgiving week], med school interviews, sick days, etc.).

Make-ups can also be used for religious holidays, but if the need for this specific purpose is expected to be beyond the number allotted above, please communicate and discuss with the professor.

All requests for make-ups and deferrals should come in advance of the need (before missing the original quiz/problem set due date) unless there are extenuating circumstances (hospitalization, or other occurrences where you're unable to provide advance notification). In these extenuating circumstances, you are expected to provide notice as soon as you are able.

ONLY THE PROFESSOR CAN APPROVE THESE REQUESTS

If there is proper notification and the request is approved:

- Quiz: You can make up a quiz anytime before the following week's lecture date. (i.e. If you can't take a quiz on Oct 11, you can take a make-up up to Oct 18 7:10PM.) TAs will administer the make-up quizzes so coordination between them and the student are necessary. **ALWAYS CC the Professor for final approval.**
- Problem Set: You can turn in a problem set digitally to Courseworks before the following week's lecture date and time. (i.e. If you can't turn in a problem set on Oct 11, you can turn in a problem set up to Oct 18 7:10PM.) **ALWAYS CC the Professor for final approval.**

- If you are taking the quiz with ODS, then absolutely reach out to the professor first, get the approval, and then forward email to ODS to show them.
- Additional extenuating circumstances (extended absences for medical reasons, etc.) will be considered on a case-by-case basis
- **If you scheduled a make-up exam/quiz and then miss the appointment, this is still counted as one of your make-ups.**

Exams

Generally, exams cannot be made up except for special circumstances (COVID-19, death of a family member, hospitalization, religious holiday). A written approval/confirmation by the dean/advisor *may* be requested by the professor to confirm such accommodations. The procedure is expedited if the request should come from the dean directly (preferred) but this is recognized as unlikely. When a special circumstance is known ahead of time (i.e. a religious holiday), the request must come at least a week in advance.

Medical school interviews and traveling home early for holidays are not considered special circumstances.

If there are extenuating circumstances and prior notice cannot be given, please notify as soon as you can.

COVID-19 POLICIES

In order to maintain the health and safety of students, staff and faculty during this academic year, students who are adhering to University-required isolation or quarantine must not attend class. Student absences relating to COVID-19 will be recognized as circumstances for which absences are excused and students will not be penalized.

- Students must contact their instructor to inform them that they will be unable to attend in-person classes for medical reasons. The student may decide to share the reason for the absence, but is not required to do so. Students must include the required dates of their absence and communicate regularly with the instructor about their ability to participate during that time.
- Students should then work with their instructors to develop a plan to receive instruction and complete course related work. Instructors are expected to make reasonable accommodations for students who miss classes, assignments or exams due to necessary quarantine or isolation related to COVID-19 exposure or illness.
- If the instructor is recording their course lecture, the student may request to view the lecture. Students should note that not all courses are being recorded and they should be in touch with their instructor as to the best way to make up missed class and assignments.

If students are attending a class in which a COVID-19 diagnosis or exposure has occurred they should continue to attend class if they are not experiencing symptoms. Vaccinated students who have been in close contact with an individual who tests positive do NOT need to quarantine after

the exposure, and should continue to attend class. If asked, professors should reinforce the University guidance with regards to isolation, quarantine, and class attendance and refer the students to the information on the Columbia COVID-19 Resource website.

Additional University policies concerning a return to in-class instruction can be found here:

- https://covid19.columbia.edu/content/return-person-instruction
- https://covid19.columbia.edu/
- https://covid19.columbia.edu/news/three-updates-booster-shots-gateway-testing-and-masking
- **You are responsible for understanding these policies.**

STATEMENT OF ACADEMIC INTEGRITY

The intellectual venture in which we are all engaged requires faculty and students alike the highest level of personal and academic integrity. As members of an academic community, each one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity.

Scholarship, by its very nature, is an iterative process, with ideas and insights building one upon the other. Collaborative scholarship requires the study of other scholars' work, the free discussion of such work, and the explicit acknowledgement of those ideas in any work that inform our own. This exchange of ideas relies upon a mutual trust that sources, opinions, facts, and insights will be properly noted and carefully credited.

In practical terms, this means that, as students, you must be responsible for the full citations of others' ideas in all of your research papers and projects; you must be scrupulously honest when taking your examinations; you must always submit your own work and not that of another student, scholar, or internet agent.

Any breach of this intellectual responsibility is a breach of faith with the rest of our academic community. It undermines our shared intellectual culture, and it cannot be tolerated. Students failing to meet these responsibilities should anticipate being asked to leave Columbia.

FOR STUDENTS WITH DISABILITIES

Student Rights and Responsibilities

In order to ensure their rights to reasonable accommodations, it is the responsibility of students to report any learning-related disabilities, to do so in a timely fashion, and to do so through the Office of Disability Services. Students who have documented conditions and are determined by

DS to need individualized services will be provided an DS-certified 'Accommodation Letter'. It is students' responsibility to provide this letter to all their instructors and in so doing request the stated accommodations.

Disability Services Rights and Responsibilities

To receive disability-related academic accommodations for this course, students must first be registered with their school Disability Services (DS) office. Detailed information is available online for both the Columbia and Barnard**Links to an external site. **registration processes. Refer to the appropriate website for information regarding deadlines, disability documentation requirements, and drop-in hours (Columbia)/intake session**Links to an external site. **(Barnard).

For this course, students registered with the Columbia DS office can refer to the "Courses that do not require professor signature" section of the DS Testing Accommodations page for more information about accessing their accommodations.

FAQs

Do I have to read the book?

The reading is recommended, but not required. The book acts as a great backgrounder that gives greater context to the topics covered in the lectures. I do not consult the book in making my exams. The one exception is Chapter 6, which IS REQUIRED. Students have noted that the textbook can really help them understand the material deeper.

How many students a semester get As?

It's hard to say because each semester fluctuates. There's not a percentage of students that I am aiming for.

Do you round up at the end?

That depends, on both your level of participation during lecture, attendance at office hours, and other things that show me that you tried and put a lot of effort. A 92.89% in the course does not mean I automatically round up to 93%. In general, if you are 92.89% and have shown diligence and participation to the course, I am likely to round you up to 93% and give you an A. If you are 92.1%, then I generally can't round up, even with participation. If you consider that the class likely has about 600-700pts total a semester, 0.9% is ~6-7 pts and that is fairly far away, whereas .11% is only 1 pt away.

Is there extra credit?

There are some instances of extra credit a semester (not that many though, so don't count on it to substantially shift your grade). More details are given at those specific times.

When does the research project start?

Around Exam 2 time, group assignments are given out. The groups are random.

Are the "Additional Problem Set" keys released?

Yes, approximately 1-2 weeks before an exam, an abbreviated answer key will be released. If you're having trouble figuring out an answer, be sure to leverage the office hours and review sessions!

Is the course recorded?

Yes, we are trying to record the course lectures over zoom. They will be available through the Zoom Class Sessions feature on the navigation bar. Zoom class sessions ARE NOT substitutes for attending the class live. They are only used for people to re-watch lectures or for those who had to miss a class. Remember that Poll Everywhere and quizzes are live in-class!

Date	Details	Due
Tue Sep 12, 2023	Assignment Problem Set 1	due by 7pm
Tue Sep 19, 2023	Assignment Problem Set 2	due by 7pm
Tue Sep 26, 2023	Assignment Problem Set 3	due by 7:10pm
Tue Oct 3, 2023	Assignment Problem Set 4	due by 7:10pm
Tue Oct 17, 2023	Assignment Problem Set 5	due by 7:10pm
Tue Oct 24, 2023	Assignment Problem Set 6	due by 7:10pm
Tue Nov 14, 2023	Assignment Problem Set 8	due by 11:59pm
	Assignment Ad Hoc EC	
	Assignment Exam 1	
	Assignment Exam 2	
	Assignment Exam 3	
	Assignment PollEverywhere	
	Assignment Problem Set 7	
	Assignment Problem Set 9	
	Assignment Quiz 01	
	Assignment Quiz 02	
	Assignment Quiz 03	
	Assignment Quiz 04	
	Assignment Quiz 05	

Date	Details	Due
	Assignment Quiz 06	
	Assignment Quiz 07	
	Assignment Research Project Poster	
	Assignment Research Project Presentation	