

MEDS4027 – Syllabus, Fall 2020

MEDS4027, given in the fall semester, will introduce to the class the structure and function of proteins and nucleic acids. In addition, the biosynthesis of DNA, RNA and proteins will also be discussed. The objective is to understand how these large molecules are regulated and used physiologically. The class begins with a discussion of protein structure and protein folding. Proteins perform the majority of functions within a cell. Mutations in proteins frequently lead to disease. In order to understand these diseases, it is important that the function of the protein is understood, at a molecular level. The environment plays a critical role in how a protein folds and behaves, thus considerable time will be spent discussing the properties of water, and how water's properties help to drive the folding of proteins into their final structure. After understanding protein structure and folding we will discuss how proteins are purified for further study. After protein purification, we will move to the topic of enzyme kinetics, enzyme mechanisms, and modes of regulation of enzyme activity. Enzymes catalyze all of the reactions which occur in cells, and over 99% of the enzymatic activity in cells is due to proteins. Thus, to understand the biochemical reactions which occur within cells, it is important to understand how the enzymes work, at a molecular level. Of particular importance in this section is how enzyme activity is regulated. Frequently different enzymes will catalyze reactions which go in opposite directions. If both enzymes were active at the same time a futile cycle would be developed, and a reaction pathway would not be able to go in the direction intended. The regulation of enzyme activity will prevent this from occurring. Once protein folding and enzyme regulation is understood the class will examine the hemoglobin molecule in detail, to understand how different protein subunits can communicate with each other and aid in a physiological function, the transport of oxygen from the lungs to the tissues. Once proteins and their functions are understood we will end the quarter discussing the function of DNA and RNA, and the biosynthesis of these large polymers. Enzymes are important in the synthesis of these information containing molecules, and having the background in enzymes will enable our discussion of nucleic acids to go at a rapid pace. Protein synthesis (translation) will also be discussed, as will molecular techniques aimed at understanding the structure and expression of the nucleic acids.

When does the class meet?

The class will meet most like meet virtually this upcoming semester. Classes will be synchronous, starting at 4:30 pm on Tuesdays and Thursdays (first day is August 25, 2020), and ending by 6 pm. A link will be published to attend each class (most likely WebEx). My style of teaching for this class is to write on the board, and have students take notes. I will be doing the same virtually. The only recording will be my voice, not what I write on the virtual board. I also like to interact with the class, so I'll be asking questions as we go through a class, and students can answer via voice or the chat. It may be possible to meet in person if the class splits in half, and half attend in person and half attend virtually, and the groups will change every week. If you have any thoughts about this please let me know.

For this semester office hours are from 3-4 pm on Tuesday and Thursday in my virtual room. Extra office hour sessions will be held before exams. If you would like a meeting outside of those times send me an email and we will identify a time to meet to answer questions. A link to

the virtual room is on the menu to the left in Canvas. I am also open to one on one in-person meetings that allow for appropriate social distancing.

Exams are likely to be in-person in the medical sciences building in room 5051 - more information concerning that as the time nears. Exams usually consist of 10-15 short answer problems, and the class is given two hours to complete them.

Schedule

The schedule is appended at the end of this document.

Problem Sets

There are 8 problem sets which be discussed during the course. The schedule indicates on which date these problem sets will be discussed in class. The problem sets are designed to help the student learn how to solve problems in biochemistry, and resemble questions that will appear on examinations. The answers to the problem sets are not collected from students, nor are they posted.

Practice multiple-choice questions

Within each module of Canvas there are "exams" to test your knowledge on practice questions. After you do the test (or part of the test) you can see if you answered correctly or not, and see an explanation of the correct answer. These quizzes can be taken multiple times, and they do not count for your grade, nor will they appear in the gradebook - they are here for you to practice on. These questions are good for testing your overall knowledge, but are probably a little easier than the questions you will see on exams (there is little medical relevance to these practice questions, but they do test biochemistry). Recall, the "real" exams will not be multiple choice questions.

Grading policies and test information

There will be four exams during the quarter, the first worth 100 points (September 22, 2020), the second 100 points (October 20, 2020), the third exam, also worth 100 points (November 17, 2020) and the fourth exam, which will be a cumulative exam over the entire quarter (150 points, given sometime during exam week). Students are expected to take the exams when scheduled. Any unexcused absence will result in a grade of zero for that exam, and absences must be approved in advance. If ill, a doctor's note will be required to have a valid absence from an exam, and the doctor must have been seen on the day of the exam. Anyone caught cheating on an exam will receive a zero for the exam and will be reported to the Provost's office for unprofessional behavior.

It is anticipated that the course will be graded on a curve, but there are certain targets which will guarantee a passing grade. A final score of 405 points or more will guarantee an A; a final score of 360 points or more will guarantee a B; a final score of 315 points or more will guarantee a C; and a final score of 270 points or more will guarantee at least a D. Thus, even if all students score above 405 points for the year, all students will receive an A. If the exams are more difficult

than anticipated, then these numbers may drop, but there is no guarantee that such an adjustment will occur.

Supplemental Instructor

We are fortunate to have a Supplemental Instructor this year, Mr. Brendan Ho, a student who took this class last year and did extremely well. Mr. Ho will address the class at its first session to discuss his office hours and when he will hold biweekly review sessions for the students. **The SI worksheets can be found in the SI module.**

Schedule

2020 FALL SEMESTER SCHEDULE - MEDS4027

Date	Class Number	Topic	Reading	Problem Set
8/25/20	1	Introduction to Proteins/Water	Chapters 1-2	Problem Set #1
8/27/20	2	Acid-Base/pK/Secondary Structure	“	
9/1/20	3	Tertiary Structure/Review Structure	“	
9/3/20	4	Discussion of Problem Set #1		
9/8/20	5	Finish Problem Set #1/Protein Purification	Chapter 3	Problem Set #2
9/10/20	6	Protein Purification	“	
9/15/20	7	Discuss Problem Set #2/Review		
9/17/20	8	Enzymes: Concepts and Kinetics	Chapter 8	Problem Set #3
9/22/20 (until 6:30 pm)		Exam I (100 points) (covers classes 1-7)		
9/24/20	9	Enzymes: Concepts and Kinetics, begin catalytic strategies		
9/29/20	10	Enzymes: Catalytic Strategies	Chapter 9	Problem Set #4
10/1/20	11	Discuss Problem Set #3; continue catalytic strategies		
10/6/20	12	Enzymes: Catalytic Strategies and Discuss Problem Set #4; Begin Regulatory strategies		
10/8/20	13	Enzymes: Regulatory Strategies	Chapter 10	
10/13/20	14	Enzymes: Hemoglobin	Chapter 7	Problem Set #5
10/15/20	15	Discuss Problem Set #5/Begin Nucleic acids	Chapter 4	
10/20/20 (until 6:30 pm)		Exam II (100 points), covers classes 8 through 15 (but not nucleic acids)		
10/22/20	16	Continue nucleic acids/DNA Synthesis in detail	Chapter 28	Problem Set #6
10/27/20	17	Discuss Problem Set #6		

10/29/20	18	RNA synthesis in detail	Chapter 29	Problem Set #7
11/3/20	19	Protein synthesis	Chapter 30	
11/5/20	20	Protein synthesis/targeting		
11/10/20	21	Discuss Problem Set #7		
11/12/20	22	Review Molecular Biology/Start Molecular Techniques	Chapters 4 and 5	Problem Set #8
11/17/20 (until 6:30 pm)		Exam III (100 points: covers classes 15-21, nucleic acids, protein synthesis - not molecular techniques)		
11/19/20	23	Molecular Techniques		
11/24/20	24	Molecular Techniques		
11/26/20		NO CLASS - THANKSGIVING		
12/1/20	25	Discuss Problem set #8 and extra problems - ONLINE		
Finals week, 12/3 through 12/8, to be determined (until 6:30 pm) (depends on finals schedule)		Comprehensive final exam, 150 points, covers classes 22-25 (40 points) and everything else in course (110 points)		