MLS410 Protein Metabolism

The Molecules of Life

Course Description and Objectives

In this course, we will explore the structure and function of selected proteins in health and disease.

Description. The eukaryotic cell will serve us as a roadmap for this course. We will discuss four selected organelles/locations in the cell and explore the structure and function of crucial proteins that are responsible for the fundamental physiological processes at those cellular locations. The last section of this course will address protein function in health and disease. All together we will discuss five - major topic sections - that will be based on text book or review articles, followed by selected primary research literature, highlighting the structure and function of one or more proteins.

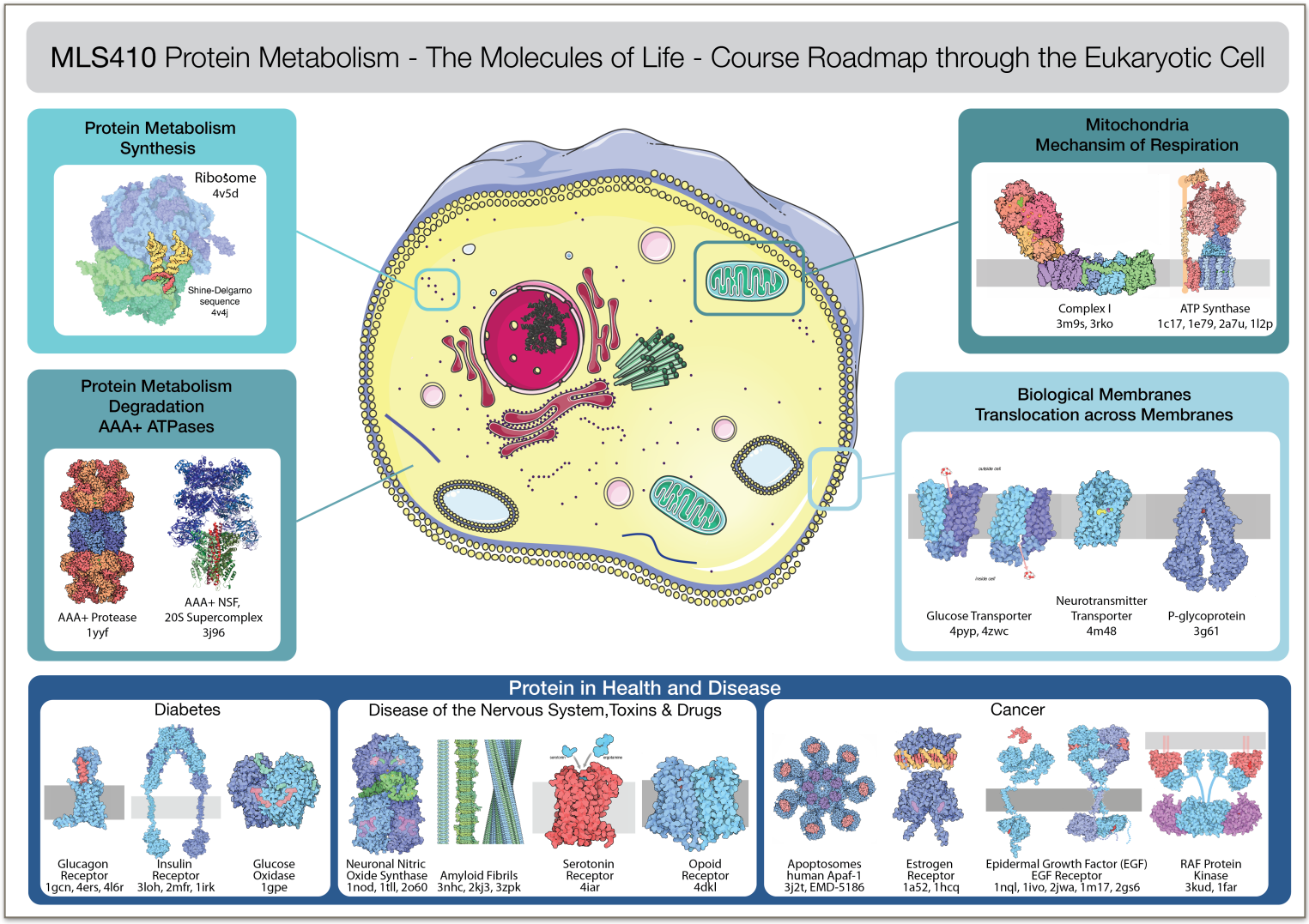
This course will combine lectures with reading, presenting and discussing primary literature in addition to analyzing and understanding protein structures. By the end of this course you will be able to read primary research literature critically, understand and know how to analyze protein structures in their context of function, and answer questions such as:"Where and how does antibiotics inhibit ribosome function?" on a molecular level.

COURSE DETAILS

Canvas	TBD
Location	Simon Hall S001
Days and Time	Tuesdays and Thursday 2:30-3:45pm
Class Notes	Will become available the day before class on Canvas

Required texts: Voet &Voet, Biochemistry, (5th Edition), 2016, (available as eText at the library), primary literature will be provided on Canvas by the instructor

Other useful books: **a) Carl Branden & John Tooze, Introduction to Protein Structure 2nd edition, Garland publishing Inc.** (a "Classic" for a passionate structure biologist!)
b) John Kuriyan, The Molecules of Life (a fantastic book highlighting the chemical and physical principles that doesn't break the bank)



"Education is not the learning of facts but the training of the mind to think" - Albert Einstein

Learning Objectives

What will you have learned by the end of this class? You will be able to critically read various forms of primary research literature, ask question that will encourage discussions and present the research. You will become proficient in analysis and understanding of protein structures, which will allow you to transfer knowledge across cellular locations and functions in health and disease. Most importantly you will become truly excited about the field of protein structure biology.

Course Requirements

Attendance **You** are absolutely essential for this class. This course lives through your **active** attendance. It is important to attend classes. You will be asked to put your initials and sign your name each class. Signing for someone else will be considered dishonest and will have consequences. If you provide a medical excuse, or miss class due to a University sanctioned event, those absences will be considered as attending the class.

Reading Textbook Chapters It will be absolutely essential for you to read assigned chapters that will accompany each major topic section in this course. Most lecture classes will start with a 10 min "In Class Quiz (ICQ)" to review the textbook chapters and/or other reading material. At each end of a major section there will be Block Quiz (BQ) that will reflect questions from these chapters and reading materials discussed from about 4 week.

Reading Review Articles Review articles will sometimes replace textbook chapters, as these summarize the latest primary research literature in a particular field. It will be essential for you to read these review articles to understand each section. Your final exam can be a short review article about a section of your choice, so you should get really familiar with the style of review writing. This would be a good form of a final exam if you choose to work alone on your final project.

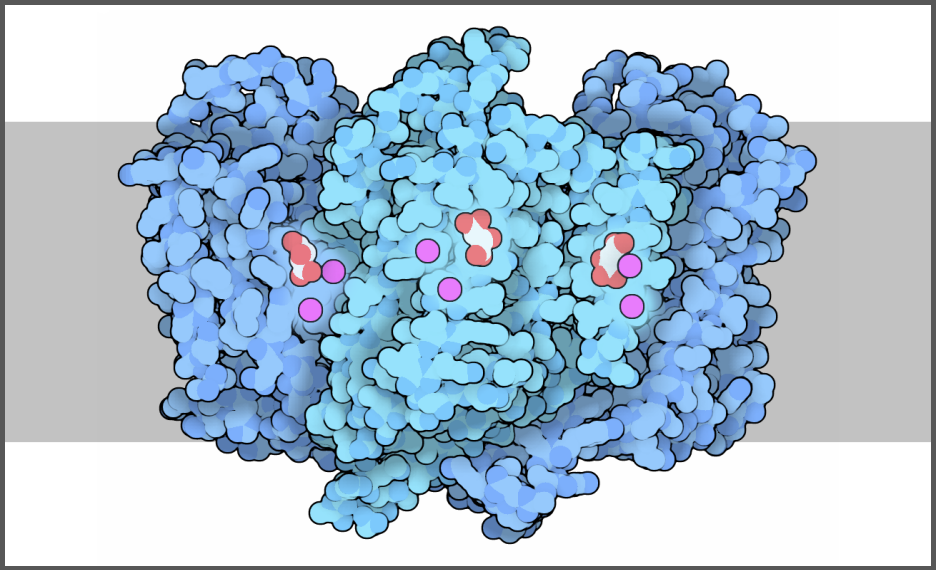
Reading Primary Research Literature You will have to read each primary research literature that we will discuss in class. For each paper, you will have to submit 3 questions about the paper on canvas prior to the day of class. Alternatively, it is encouraged you to

GRADING SCALE

Attendance	**112**	Silent attendance will not earn full credit. Sleeping or texting in class lowers your grade. Daily work cannot be made up, it depends on being in class. You are allowed one "no show" with no questions asked that will count just 1pt. 4 x 28 pts = 112
Canvas Quizzes	**188**	This includes ICQ and BQ. There will be a total of 13 ICQ (5pts each = 65pts) and 6 BQ (20.5 pts each = 123) Quizzes. Total points 188.
Take Home Projects	**300**	There will be three Take Home projects of 100 pts each.
Final Project	**400**	You choose the style of science communication/presentation and the section topic for your Final Project.

Grading Scale:

A+: 1000 pts - 966pts
A: 965 pts - 933 pts
A-: 932pts - 900 pts
B+:899 pts - 866 pts
B: 865 pts - 833 pts
B-: 832 pts - 800 pts
C+: 799 pts - 766 pts
C: 765 pts - 733 pts
C-: 732 pts - 700 pts
D+: 699 pts - 666 pts
D: 665 pts - 633 pts
D-: 632 pts - 600 pts
F: 599 pts and below



How to take this course

It's not what you "get" in this course, it's how high you want to climb. Think about why someone has decided that learning this material might be essential to your college experience, and what that means for you personally. It is entirely possible to do well in the class without being transformed by your new-found structure biology knowledge, but it would be a darn shame. I like to think that this (and indeed, any) course operates on three levels. Imagine you are standing in the Valley pictured below and the course are the Alps. Decide how high you want to climb...it is your choice...

The Mountaineer
as a Mountaineer you want to go higher and see the next mountain tops, as a focused critical thinker you are able to transfer knowledge readily to other areas.

You are experienced, a "Mountaineer" doesn't take any of the course's structure or content as natural or inevitable. They see (and then fill) the course's gaps. They are curious, passionate, and concerned with WHY The Molecules of Life matter.

The Alpinist
as the Alpinist you have a grasp of protein biochemistry and are ready to think scientifically and explore what's above the Valley grounds. You want to see the neighboring Valley and maybe even see the next mountain tops.

"Alpinists" identify new questions and notice scientific inconsistencies and with that they start scientific discussions. Alpinists are interested in HOW & WHY proteins work the way they work and what it means in the broader perspective of the cell.

The Hiker
as a Hiker you need the basic understanding of protein biochemistry, the cell, the main compartments & proteins, the surface-level knowledge.

"Hikers" will tend to assume that textbook, documents, and professor are mutually reinforcing, telling basically the same story.
Nothing wrong with being a happy Hiker in the Valley, but with a little more energy you invest to get to higher ground, you will be able to see into the next Valley.

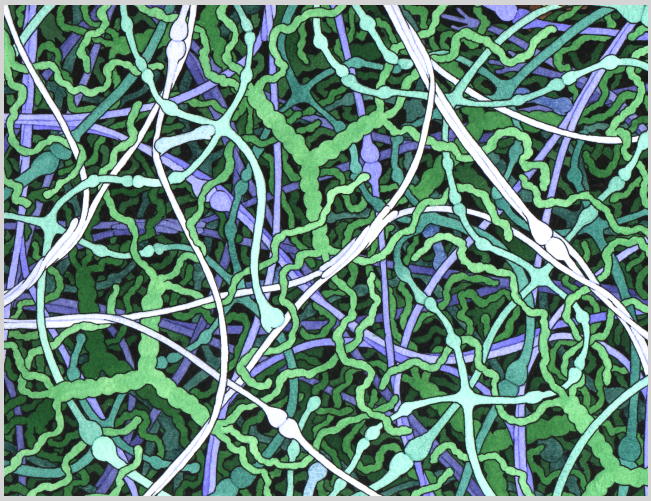
work through the papers in teams. Those teams can be up to 4 individuals. You have to submit minimum 3 and maximum 8 questions per team. It is highly encouraged to read and discuss each paper in small study groups/ teams. Your active participation is expected and will count towards your final grade. We will address your questions in class. (ICQ and BQ will have content from these materials.)

Take Home Projects There will be three Take Home Projects (THoP) throughout the course. Each project is worth 100 points. You will have four to six weeks to complete the Project. You are allowed to choose what project will count double towards your final grade. The purpose is to compensate for the difficulty of some of the material, amount of it, or other issues that may have contributed to a poor project performance either of a personal, health or academic nature. There will be three main science communication styles you can choose for your projects:

1) Creation of a video (5min)
2) Creation of a podcast (5min)
3) In-class powerpoint presentation (15 min)

CLASS PHILOSOPHY

This class is a community. We all have the same objective to learn. I need each of you to approach this course with a great attitude and a willingness to help each other. Many problems and questions can be resolved by asking a fellow student. I am always here to help you but I truly believe your experience will be better if you communicate with your fellow students through the semester. Let's work together to make this semester great for everyone!



No matter the style of science communication you choose, each have to show the following elements:

- Introduction of the scientific background
- Expression of scientific questions
- Definition of keywords
- Presentation of results
- Conclusion of results in context of scientific background and questions
- Discussion of results in larger context of the scientific field
- Identification and definition of outstanding knowledge

More detailed assignment information will be provided to you on the course Canvas page.

Each project is timed in such a way that you will have at least one review session with the instructor before your upload your final product. For review sessions please make an appointment with the instructor as soon as possible. Don't wait until the last minute to discuss the progress of your project. It is highly encouraged you to do at least two reviews before turning it in.

You can choose to work alone or in a team of two. If you decide to work in a team, you have to identify very clearly each members' contribution to the project. Each team member then has to upload the whole project. The projects need to be uploaded latest at noon the Sunday before the Tuesday class so that selected projects can be reviewed for discussion in class. There will be a 20 point penalty for late project upload. Late projects will only be accepted with a medical excuse. If you cannot turn in a project at the appointed time/date (religious observance, IU athletics etc.), let me know immediately, as early in the semester as possible. Total points 300

Final Project

The Final Project is a more detailed version of the THoPs. You can start working on your Final Project as soon as you want, which in theory would give you ~15 weeks to finish it. You can choose to work on this Final Project alone or in a team of two. If it makes sense for your project to work in a larger team(4 max), then you have to deliver a pitch of your project concept to the instructor. If you decide to work in a team, you have to identify very clearly each members' contribution to each section of the project. Each team member then has to upload the whole project. Total points 400

Tips for maximum success

Attend all classes and discussions.

Practice, practice, practice. Solve all projects

and find even aspects beyond the assigned project to work on. Learn how to visualize proteins in PyMol or Chimera, write scripts and create images, movies and sessions. Develop and use your own study aids. Be persistent in asking questions. Take advantage of discussion sections and engage in discussions. Come to office hours as soon as you are having problems you cannot solve by yourself or in a team with your classmates. Form study groups and teams. Don't fall behind, as it will be hard to catch up.

The Fine Print

Turning in Projects: This class is tree/eco-friendly and it is encouraged to use electronic files only, and upload them on Canvas.
Plagiarism: On Quizzes and Projects, doing your own work is absolutely essential, even if you work in a team. In ALL papers, you must cite the sources of any information, quotations or ideas, which are not your own, using standard citation methods. Let me be very clear; you cannot copy and paste text from the internet into your papers and pass it off as your own writing. You cannot turn in a project that someone else has written or that you have bought or downloaded from online. The integrity of the course is taken very seriously, and any acts of misconduct will be reported to the College. This to protects the students who take the learning objectives of the course seriously. Assignment with plagiarism will receive a zero, and further punitive action may be taken based on the severity of the student's action. All IU University policies will be respected and followed. Any student that violates the code of student conduct by "any activity that tends to undermine the academic integrity of the institution." will be subjected to the procedures established by IUB. The actions that are considered as violations include, but are not limited to cheating in any form, including fabrication, plagiarism from any source (copying), or from another student.

The web site at which you can find the information regarding IUB procedures related to misconduct can be found at: https://studentaffairs.indiana.edu/office-student-ethics/misconduct-charges/academic-misconduct.shtml

Any dishonest practice regarding exams (plagiarism, copying some else's exam, etc) will be considered serious and will be reported to the instructor's discretion.

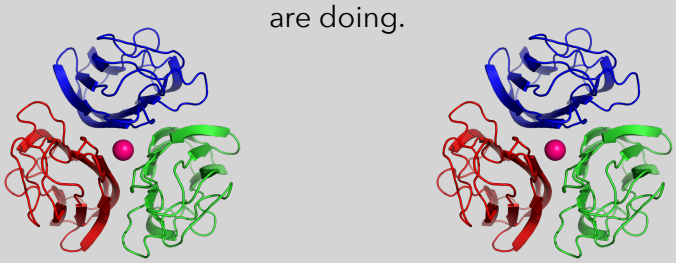
All materials provided in this course are subject to copyright and cannot be

ACCOMMODATIONS

If you have a documented disability (learning or otherwise), and you need a reasonable accommodation made for you in this course, please consult with me immediately at the outset of the course so we can design a solution that will help you be successful in the class.

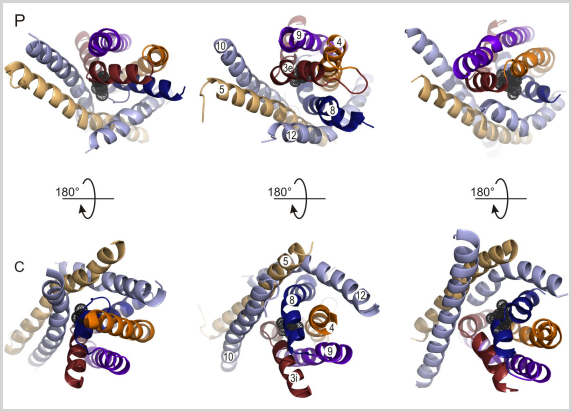
Please inform me if you are red/green blind or have reduced color vision. I can then take it into account for figures and videography that will be used during this course.

I want to see you succeed! My personal goal is to see every individual student succeed to the level he or she is willing to work - as a Hiker, Alpinist or Mountaineer. Please feel free to talk with me and keep me up to date with how you are doing.



Your Instructor: Dr. Susanne Ressl
Office: Simon Hall 305A
Phone: 812-856-5801
email: suressl@indiana.edu
!!! Emails have to start with [MLS410 student] in the subject line, otherwise will not be read!

Office Hours: Thursday: 4-5pm, you must schedule an appointment. This will allow me to



distributed, posted on a web site or sold. The copyrighted material includes the syllabus, lectures, study guides, projects, quizzes and all other resources provided to enrolled students. Do not redistribute these materials. As it currently stands, an instructor, having observed a student redistributing course materials, could file a "Personal Misconduct" report to the Dean of Students (violating Part II, Section H, #25).

Technology Use in Class: We will be busy in every class session and we don't need any electronic distractions. Silence your cell phones before you enter the classroom. Filming, voice recording or taking pictures with your cell phone or any other device is strictly forbidden as it would violate copyrights of the material. You may bring a laptop, but only for taking notes or accessing relevant course material during discussion or you want to use a protein visualization tool while we discuss a protein structure. **Do not use your laptop in class to surf the internet, check your email, update your Facebook status** this will result in deductions towards your attendance grade.

First day of class will start with a quiz about this Syllabus!

Note: This syllabus may be subject to change, including assignment due dates. Any changes will be announced in class and posted on the web site.

MLS410 - Fall 2018 Schedule Overview

BQ= Block quiz, ICQ = in class quiz, THoP = Take Home Project, PL=Primary Literature

WEEK section	#	Date	TOPIC	Required Reading	Protein Structure	What is due?	Quiz/ Exam
	1	Tue 08/21	Introduction, Syllabus Q&A	Syllabus	various		Syllabus Quiz
	1	Thr 08/23	How we understand Life. What is Life on a Molecular Level?	posted on Canvas	various		
	2	Tue 08/28	Protein Structures, how do we determine and analyze them?	posted on Canvas	various		ICQ
	2	Thr 08/30	Critically read a scientific paper & ask good questions. Forms of science communication.	posted on Canvas	various		BQ
	3	Tue 09/04	Protein Metabolism - Synthesis How is a protein synthesized?	Voet 27.1-2	Ribosome		ICQ
no class	3	Thr 09/06	Ribosome - What does the structure of the Ribosome consist of?	Voet 27.1-3A&B	Ribosome		
	4	Tue 09/11	Ribosome - how does it function?	Voet 27.4-5 & PL	Ribosome		ICQ
	4	Thr 09/13	How do Antibiotics affect Protein Synthesis?	posted on Canvas	Ribosome, NDM-1		BQ/ THoP1
	5	Tue 09/18	Protein Metabolism - Degradation - What if a protein doesn't fold correctly?	Voet 21.1	Proteasome		ICQ
	5	Thr 09/20	AAA+ ATPase - Structure & Function of the Proteaseom	posted on Canvas	Proteasome		
	6	Tue 09/25	AAA+ ATPase - Fusion - How is fusion of membranes facilitated and regulated?	posted on Canvas	NSF		ICQ
	6	Thr 09/27	AAA+ ATPase in Health and Disease	posted on Canvas	various		BQ
	7	Tue 10/02	**THoP1 Project Presentations**			**upload THoP1 12pm 9/30**	THoP 2
Fall break	7	Thr 10/04					
	8	Tue 10/09	Mitochondrium - Mechanism of Respiration	Voet 18.1-2	various		ICQ

WEEK section	#	Date	TOPIC	Required Reading	Protein Structure	What is due?	Quiz/ Exam
	8	Thr 10/11	The electron-transport chain - How do Mitochondria supply us with energy?	posted on Canvas	Complex-I, II & III		
	9	Tue 10/16	Oxidative Phosphorylations - how Life depends on it.	Voet 18.3-4	ATP-Synthase		ICQ
	9	Thr 10/18	Mitochondrial Disease -	posted on Canvas	various		BQ
	10	Tue 10/23	**THoP2 Project Presentations**			**upload THoP2 12pm 10/21**	
	10	Thr 10/25	Biological Membranes - What do membranes consist of?	Voet 9.1-2	various		ICQ
	11	Tue 10/30	Biological Membranes - How are membranes organized?	Voet 9.3-4	various		ICQ
	11	Thr 11/01	The Secretory Pathway - How are proteins translocated across a membrane?	posted on Canvas	SecY complex		BQ
	12	Tue 11/06	Active Transport -How are molecules translocated across a membrane?	Voet 1.1,3	various		THoP 3
	12	Thr 11/08	Proteins in Health and Disease - Diabetes	posted on Canvas	Glucagon GPCR		ICQ
	13	Tue 11/13	Proteins in Health and Disease - Cancer I	posted on Canvas	Apoptosome Estrogen Receptor		ICQ
	13	Thr 11/15	Proteins in Health and Disease - Cancer II	posted on Canvas	RAS, RAF kinase		ICQ
Thanks	14	Tue 11/20					
giving	14	Thr 11/22					
	15	Tue 11/27	**THoP3 Project Presentations**			**upload THoP3 12pm 11/25**	
	15	Thr 11/29	Proteins in Health and Disease - Disease of the Nervous System	posted on Canvas	various		ICQ
	16	Tue 12/04	Proteins in Health and Disease - Toxins & Poisons & Drugs	posted on Canvas	ALAD, G-proteins Acetylcholine Receptor		BQ

WEEK section	#	Date	TOPIC	Required Reading	Protein Structure	What is due?	Quiz/ Exam
	16	Thr 12/06	Course review, Q&A				
EXAM	17	Tue 12/11					
EXAM	17	Thr 12/13				Final Project 12am 12/14	