

BIOL 6366/8366

Advanced Protein Biotechnology

Fall 2020

Instructor Contact Information:

Dr. Andy Truman

Office: Woodward Hall 486C

Tel: 704-687-5228

Email: atruman1@uncc.edu

Course Meeting Time:

4pm-5-15pm, Monday and Wednesday

Virtual via Zoom

Office Hours:

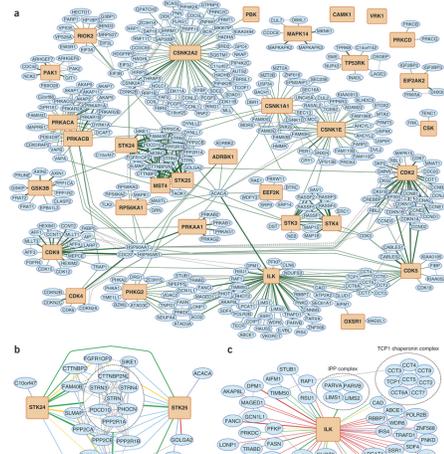
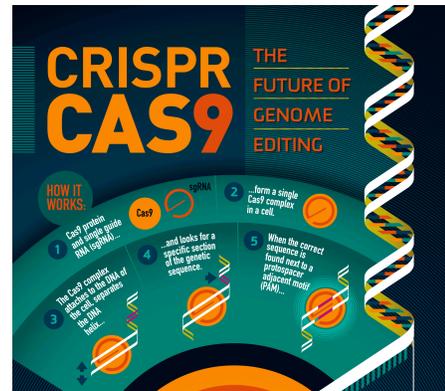
9:00am -10:00am, Friday

[Additional meetings set up by appointment]

Course Description:

The study of proteins is important in most modern molecular biology laboratories. In Advanced Protein Biotechnology, students will learn the principles behind a range of commonly used molecular biology techniques and how to optimize them. This will also include state of the art methodologies such as CRISPR-CAS9 and mass spectrometry. By the end of the course students will be able to design and optimize complex protein-based experiments. All students interested in cell/molecular biology, biotechnology and cancer biology are encouraged to participate. Students will learn:

1. General DNA cloning methodologies
2. Expressing and purifying proteins from bacterial, yeast and human cells
3. Mutagenesis of proteins and its use in studying protein function
4. Useful software for molecular biology studies, including a detailed overview of SnapGene
5. Methods for measuring protein abundance
6. Post-translational modifications on proteins and how to detect them
7. Protein interaction technologies
8. Uses of mass spectrometry in protein biology



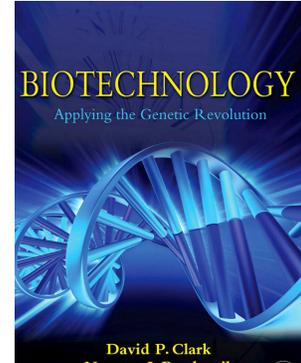
9. CRISPR-CAS9 genome engineering and its use in protein biology

Course Prerequisite:

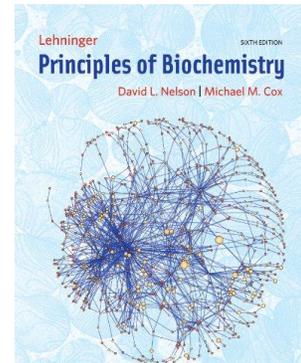
To be eligible to take this course, students must have completed 6270/8270-Cell Pathways and Metabolism or permission of Instructor.

Textbook (recommended):

Biotechnology-Appling the Genetic Revolution David P. Clark, Nanette J. Pazdernik (Free and uploaded in Canvas)



Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). *Lehninger principles of biochemistry*. New York: Worth Publishers.



Grading

Final grades in APB will be based on:

- 3 Exams, 15% each=**45%** total final grade
- Oral presentation=**15%** final grade
- Mock NIH proposal=**25%** final grade
- Presentation of Specific Aims=**10%** final grade
- Class participation=**5%** final grade

Grading Scheme: A = 100-90, B = 89-80, C = 79-70, U < 60

Exams (45%)

There will be 3 take-home exams with one week provided for completion. As such, they will not rely on regurgitation of memorized material, but rather on problem solving. You may use whatever resources you choose in answering the questions with the exception of living organisms. In other words, by submitting your exam you verify that all of the work is your own and that you have not discussed the questions or answers with anyone else. If you use publicly available resources (website, book, journal articles, etc) you should provide references. Using these as resources is allowed, but copying material without clear citation is a violation of academic integrity. All exams must be submitted to me by email or hard copy by the due date and time.

Oral Presentation Guidelines (15%)

Students will give oral presentations on primary research papers related to class topics (see below schedule). Papers can be substituted with ones of your choice, but these substitutions must be submitted to Dr. Truman at least one week before the presentation date. Presentations should be timed to last 30 minutes followed by 5 minutes discussion. All presentations should be given using MS PowerPoint with **approximately 30-40 slides** for each presentation. Please email me your pptx file at least one day prior to the presentation for loading on Canvas giving access to all.

In these presentations, you will be to outline the metabolic pathways/regulatory mechanisms involved and the experimental approaches used to elucidate the pathway or mechanism.

All presentations will be graded on the following sections:

- Background (what were the authors trying to investigate)
- Explanation of the technologies used (at a level the class can understand!)
- Explanation of what the authors discovered (their results)
- Overall Conclusions of the paper
- Discussion of any flaws in the paper/future directions of the paper
- Quality of powerpoint slides (font, layout, figure resolution etc)
- Timing (keep to 30 mins)
- Answering of student/teacher questions

Final 10% of grade for this assignment:

You will need to contact an author on the paper by email/zoom and ask the following questions:

- What was the most exciting discovery during this project?
- What was the most unexpected result?
- What was the hardest experiment to get to work?
- What was the review process like?

The papers presented should be involve at least one of the following technologies:

- Protein mutagenesis
- Protein abundance technologies
- Protein interaction technologies
- Post-translational modifications of proteins/mass spectrometry
- Genome Engineering
- Large-scale screens

Mock NIH proposal (25%)

Each student will write a mock NIH R01 proposal (just the Research Summary/Plan part). Although not required, it is advisable for the grant to relate to research you are currently doing/will do in your lab, however it **must** contain one example of each of the following 4 kinds of technologies mentioned above.

The proposal should be a maximum of 12 pages (without references) and contain the following- Significance, Innovation, and Approach. For an application with multiple Specific Aims, the applicant may address Significance, Innovation and Approach for each Specific Aim individually, or address Significance, Innovation and Approach for all of the Specific Aims collectively. Please see pages 3-8 of:

<https://deainfo.nci.nih.gov/extra/extdocs/gntapp.pdf>

For writing preliminary results, feel free to use unpublished or published data from your/PIs current studies. Alternatively, you may use published data from other labs as preliminary data.

Presentation of Specific Aims (10%)

Students will write a one-page summary of their proposal in NIH Specific Aims format. In addition, they will present this in a 10-minute powerpoint presentation to the class. The presentation should briefly describe the background of the project, 3 Aims and roughly what will be investigated in each Aim. The Specific Aims of each student will be discussed by the class for feasibility.

Class participation (5%)

Each student is expected to come to class on time and get involved in discussions of papers/presentations etc.

Course Policies:

This syllabus contains the policies and expectations we have established for BIOL 6270/8270. Please read the entire syllabus carefully before continuing in this course. These policies and expectations are intended to create a productive learning atmosphere for all students. Unless you are prepared to abide by these policies and expectations, you risk losing the opportunity to participate further in the course.

- (1) Dr. Truman will conduct this class in an atmosphere of mutual respect. Dr. Truman encourages active participation by students in class discussions. Each of us may have strongly differing opinions on the various topics of class discussions. The conflict of ideas is encouraged and welcome. The orderly questioning of the ideas of others, including mine, is similarly welcome. However, Dr. Truman will exercise his responsibility to monitor the discussions so that ideas and argument can proceed in an orderly fashion. You should expect that you will **NOT** be permitted to participate further if your conduct during class discussions seriously disrupts the atmosphere of mutual respect we expect in this class.
- (2) **Tardiness, cancellation, and rescheduling:** If Dr. Truman is late in arriving to class, students must wait a full 15 minutes after the start of class before you may leave without being counted absent, or you must follow any written instructions given by Dr. Truman about the possible anticipated tardiness. If a class meeting is going to be cancelled or rescheduled, Dr. Truman

will coordinate these events and students will be notified in class or via email or Canvas course website.

- (3) **Disability:** It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact their instructors early in the semester to discuss their individual needs for accommodations. If you have a disability that qualifies you for academic accommodations, please provide a letter of accommodation from the Office of Disability Services in the beginning of the semester. For more information regarding accommodations, please contact the Office of Disability Services at 704-687-4355 or stop by their office in Fretwell 230. <http://ds.uncc.edu/sitemap>
- (4) **Integrity:** *Students have the responsibility to know and observe the requirements of the UNC Charlotte Code of Student Academic Integrity. This code forbids cheating, fabrication or falsification of information, multiple submissions of work, plagiarism, abuse of academic materials, and complicity in academic dishonesty.* <http://legal.uncc.edu/policies/up-407>
- (5) **Religious accommodations:** Students will be provided reasonable accommodations for religious obligations in accordance with University Policy #409: Religious Accommodation for Students (<http://legal.uncc.edu/policies/up-409>). This policy (1) authorizes a minimum of two excused absences each academic year for religious observances as required by the faith of a student; and (2) provides students the opportunity to make up any missed work. Students are asked to submit their request for religious accommodation to faculty member prior to the census date of each semester.
- (6) **Electronic devices:** The use of cell phones, beepers, or other communication devices is disruptive, and is therefore **prohibited** during class. Once such disruptive behavior is found in the classroom, Dr. Truman has the right to ask this student leave the classroom. Students are permitted to use computers in class for note-taking and other class-related work only. Those using computers in class for work not related to that class must leave the classroom.
- (7) All students are required to abide by the UNC Charlotte Sexual Harassment Policy and Grievance Procedures (<http://legal.uncc.edu/policies/up-502>) and the policy on Responsible Use of University Computing and Electronic Communication Resources (<http://legal.uncc.edu/policies/up-304>). Sexual harassment, as defined in the UNC Charlotte Sexual Harassment Policy, is prohibited, even when carried out through computers or other electronic communications systems, including course-based chat rooms or message boards.
- (8) **Copyright statement for the course materials:** The images, artwork, videos, and text presented in class and contained within the Powerpoint Presentations on the BIOL 6000/8000 course website will be used for teaching purpose in the context of this course. Students can only use this material for learning, and cannot disseminate these images, artwork, videos, or text in the Powerpoint Presentations for any other purpose. This is in keeping with the policy on responsible use of University computing and electronic communication resources found at <http://legal.uncc.edu/policies/up-307>

Important note: The standards and requirements set forth in this syllabus may be modified at any time by the course instructor Dr. Truman. Notice of such changes will be by announcement in class or by written or email notice or by changes to this syllabus posted on the course Canvas website.

Tentative Schedule for BIOL 6000/8000 Fall 2020

Meeting	Date	Topics
1	Sep 7th	Introduction of the course
2	Sep 9th	Introduction to amino acids and proteins
3	Sep 14th	Introduction to nucleotides
4	Sep 16th	Cloning 1
5	Sep 21st	Cloning 2
6	Sep 23rd	SNAPGENE
7	Sep 28th	Mutagenesis
8	Sep 30th	Student presentation 1
9	Oct 5th	Gene Art from Thermo
10	Oct 7th	Midterm Exam 1
11	Oct 12th	Protein abundance technologies
12	Oct 14th	Student presentation 2
13	Oct 19th	Protein expression and purification
14	Oct 21st	Protein interaction technologies
15	Oct 26th	Student presentation 3
16	Oct 28th	PTMs of proteins
17	Nov 2nd	Mass Spectrometry
18	Nov 4th	Specific Aims presentations-1
19	Nov 9th	Specific Aims presentations -2
20	Nov 11th	Midterm Exam 2
21	Nov 16th	Genome engineering-1
22	Nov 18th	Genome engineering-2
23	Nov 23rd	Protein expression in Plants 1
24	Nov 25th	Protein expression in Plants 2 (Also, give draft NIH proposal in end of day)
25	Nov 30th	Proposal workshop 1 (Dr. Truman will provide 1 on 1 feedback on proposal)
26	Dec 2nd	Proposal workshop 2 (Dr. Truman will provide 1 on 1 feedback on proposal)
27	Dec 7th	Tour of the David H. Murdock Research Institute (DHMRI)
28	Dec 9th	Student presentation 4 (final proposals due)
29	Dec 14th	Final exam (Due on 21 st)

Dr. Truman reserves the right to modify the policies, procedures, and expectations identified in this syllabus. Any such changes will be announced in class or the Canvas website for this course.