BCHM 198: Molecular Biology and Human Disease

Instructors
Prof. Stephen Dunaway (HS-109)
Prof. Jane M. Liu (HS-212)

Class
Tu, Th 11:50-1:05 (HS-112)
Tu 1:15-4:15 (HS-112)

Office Hours
Dunaway: Tu, Th 9:30-10:25 am; W 1:30-2:30 pm
Liu: Tu,F 9:15-10:15 am; and Th 2-3 pm

PRE-REQUISITES: BIOL 22

COURSE OBJECTIVES

This research course will focus on addressing questions at the frontiers of science with the potential to combat infectious diseases and genomic instability disorders. Although several different questions will be tackled, all the research done in this course will stem from the use of fundamental and powerful techniques that underlie all of molecular biology. With an emphasis on experimental approaches that are cross-disciplinary, students will learn to develop testable hypotheses, design and execute experiments, and work collaboratively to solve problems involving on-going research projects. In particular, an objective of this course is for students to be able to ask and answer the following questions:

- **What is the "molecular biology toolkit"?**
- **How can this toolkit be used to address questions in science?**

Students will present their findings through oral presentations throughout the semester.

Learning outcomes: The successful completion of this course will contribute to your

- Ability to use the tools of molecular biology to tackle questions in science
- Ability to process information and interpret data
- Ability to present data and results to both a general and an expert audience
- Ability to find and read primary literature
- Ability to design experiments
- Ability to problem solve and think critically
- Ability to work with others
- Ability to learn independently

GRADES

Laboratory Performance	
Notebook	6
Slide Deck	8
In class efforts	26
Presentations	
Introduction	6
Summary	18
Discussion and Participation	
In class	12
Colloquia	4
Primary Literature Assignment	20
Total	**100**

Laboratory Performance:

Students are expected to participate fully in lab and to be responsible for conducting research throughout the semester. Research rarely fits into a defined time, so the expectation is that students will be meeting throughout the week to do their research. During the 11:50-1:05 meeting times, there will be a chance for each of the research teams to talk about what they accomplished, to troubleshoot and to plan for the upcoming week. **The expectation is that students will spend 6 hours per week doing research (including class time).** If a student misses a Tuesday lab, the student is still expected to spend 6 hours that week doing research.

Each student is expected to keep a lab notebook and to bring it to every class and whenever the student is doing research. Keep a log of the dates and times that you are working on your project. Throughout the semester, **your notebook will be graded** for organization, readability and completeness.

Presentations:

Each team will give two oral presentations during the course of the semester:

1. Introduction (~10-15 minutes; ~6-7 slides). This presentation should answer the following questions:
   - What question/hypothesis are you trying to address?
   - Why is this research question important?
   - What experiments are you planning to address this question?
2. Summary Presentation (~30 minutes; ~15-18 slides). This presentation should provide relevant background (from the primary literature) and context for the questions you are posing, as well as addressing results, interpretation of data, and future directions.

Discussion and Participation:

Students who are not presenting are expected to ask questions and discuss the material being presented. A record will be kept of who asks questions or participates in discussion. Grades for participation in this part of the class will be given as follows:

Class Participation	**Excellent (3 points)**	**Good (2 points)**	**Acceptable (1 point)**	**Unacceptable (0 points)**
Answering questions (From Professors **and** Peers)	Answers directly refer to topics under consideration & reflect both careful and critical thinking and original thought.	Answers directly refer to topics. Answers reflect careful but not necessarily critical thinking of topics, and do not incorporate much original thought.	Answers connected to general discussion if not to specific topics. Answers may show some original thought, but because it is not connected to the topics, do not suggest careful and critical thinking.	Never answers questions.
Posing questions	Poses questions that are connected to the topics. Questions reveal critical thinking about the topics and add significantly to class discussion (i.e. spark new discussions)	Poses questions specifically connected to class topics. Questions may be more factually based rather than demonstrating critical thinking.	Poses questions generally related to the materials and the class. Poses factually based questions with simple (meaning: not complex) answers.	Never poses questions.
Responding to peer (or professor) observations and arguments	Engages comments of peers with questions or responses addressed to peer. Comments are respectful whether agreeing or disagreeing. Comments often refer to reading and/or personal experiences.	Responds to peer comments respectfully. Responses generally focus on personal experiences, but sometimes reference the presentations or readings.	Responds to peer comments respectfully, but only speaks generally to the class or speaks only about personal experiences.	Disrespectful responses or failure to respond to peer comments

You will also be asked to attend a minimum of 3 seminars/colloquia throughout the semester. These can be any scientific field. Please **type up no more than 1 page of summary** of the talk you attended and your impressions of how effective the speaker was in conveying scientific information.

Primary Literature Assignment:

A critical component of science research is finding, reading and interpreting scientific literature that is relevant to your own projects. Engaging scientific literature allows researchers to get new ideas, validate ideas they already have, learn new techniques, or even to find out who their competitors are. This semester, you will be expected to read at least 6 primary science articles related to your chosen project. Your instructor will provide two of these articles for you; you will need to find the remaining four on your own. After reading each paper (several times!), you should write a 1-2 page summary, in your own words, addressing the following questions:

- Who did the research and where did they do it?
- What was already known prior to this paper's publication?
- What new question was asked in this paper?
- What did the researchers do?
- What were the major results?
- What is the take home point? (Why should we care?)

POTENTIAL PROJECTS

- **Engineer biosensors to monitor pathogenesis regulation in *Vibrio cholerae*** (molecular biology, chemical biology, microbiology)
- **Investigate the regulation of mannitol metabolism in *Vibrio cholerae* with a *lacZ* reporter** (molecular biology, microbiology, biochemistry)
- **Develop a riboswitch-based biosensor for the class of organic pollutants: polychlorinated biphenyls (PCBs)** (molecular biology, chemical biology, chemistry)
- **Identify genes that collaborate with Pfh1 in DNA repair** (molecular biology, genetics)
- **Determine the involvement of the DNA damage checkpoint response in the modification of Pfh1 in response to DNA damage** (molecular biology, biochemistry)

SCHEDULE (subject to Change)

Lab	Date	Topic	Assignment Due (at 1:15 pm)
1	1/25 1/27	Pick a Research Topic How to Read a Primary Paper	**Read over Primary Paper**
2	2/1 2/3	Define hypothesis and experimental design Experimental Design	
3	2/8 2/10	Experimental Work	**Primary Paper Summary 1**
4	2/15 2/17	Experimental Work	**Slide Deck Check 1**
5	2/22 2/24	Experimental Work and **Presentations 1-2**	**Primary Paper Summary 2**
6	3/1 3/3	Experimental Work and **Presentations 3-4**	**Notebook Check 1**
7	3/15 3/17	Experimental Work and **Presentations 5-6**	**Primary Paper Summary 3**
8	3/22 3/24	Experimental Work	
9	3/29 3/31	Experimental Work	**Primary Paper Summary 4** **Notebook Check 2**
10	4/5 4/7	Data Analysis	**Slide Deck Check 2**
11	4/12 4/14	Data Analysis	**Primary Paper Summary 5** **Slides for Final Presentation**
12	4/19 4/21	**Final Presentations**	
13	4/26 4/28	**Final Presentations**	**Primary Paper Summary 6**

How to keep an "A" notebook

Every time you step into the lab, you should have a record of it in your notebook. Your notebook should include a Table of Contents and should be organized and readable. For each experiment you do, the following should be written down in your notebook:

- Date(s) and time(s)
- Purpose – what is the question you are asking and how are you tackling that question? Do you have any expectations or hypotheses?
- What is the protocol that you are using? If you are using a published protocol, make sure to reference it and note any changes you make.
- Observations – what did you observe?
- Data and results – Raw data should be recorded and data analysis can be included as well
- Interpretations – what do you take away from your experiment? What were the main outcomes? Did they meet your expectations? Support your hypothesis? Where do you want to go from here?

How to keep an "A" slide deck

For every experiment that you do, you should create slides in a PowerPoint file to address the following questions. You should have one file that you keep adding slides to throughout the semester. Remember to backup your file often!!

1. What question did you ask?
2. What did you do?
3. What were the major results? (Graphs and/or Tables could go here)
4. What is the take home point?

Answering these questions should take 1-2 slides, depending on the experiment.

Every slide should include the date of the experiment and reference the pages in your notebook that are relevant.

Additional information you may include might be the actual raw data (copied/pasted from an Excel worksheet), experimental notes (which can be typed into the "notes" section), and/or names of related files (images, spreadsheets, etc.)

Examples will be provided in class.

Attendance and Late Policy: Attendance for this course is MANDATORY. Late assignments will be accepted at a 10% penalty for each 24 hour period past the due date for that assignment.

Honor Code: I fully expect that all students in this class will abide by the honor code and Standards of Academic Integrity set forth by Drew University's College of Liberal Arts!!! Any violations of these standards will be handled by the Dean.

Behavior Code: Students will conduct themselves respectfully during discussions. Failure to do so will result in a reduction of your discussion grade for that class. Students will also not be permitted to use cell phones during class and computers will only be used for course related activities. Violations of this policy could result in being asked to leave the class for that day.

Academic Accommodations: Should you require academic accommodations, you must file a request with the Office of Educational Affairs (BC 114, extension 3327). It is your responsibility to self-identify with the Office of Educational Affairs and to provide me with the appropriate documentation from that office at least one week prior to any request for specific course accommodations. There are no retroactive accommodations."