

## BME 7130: Core Concepts in Disease

### Instructor:

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### Course description:

Most diseases emerge due to a relative small number of biological processes, including infection, inflammation, neoplasia, genetic mutation, protein misfolding, and metabolic dysregulation. In Core Concepts in Disease, students will learn about disease-state biology by focusing on these broad disease pathways. The didactic component of the course will consist of several modules, each focused on one broad class of disease mechanism, and will include both a discussion of the underlying biology of the disease pathway as well as examples of specific diseases that involve those mechanisms and existing or potential treatment strategies. This course will complement the training in fundamental normal-state biology students are already receiving by providing a mechanism-centered view of disease development.

### Lecture Format:

For each disease mechanism module, there will be one or two didactic lectures given by the course instructor or TA followed by two to three days of journal club style critical readings of key review papers and original articles. Students will present the journal club papers in teams of two. Additional lectures will be spent on student presentations of their projects for the course.

### Course website:

**Please check the BME 7130 website on Blackboard frequently.** Office hour schedules, course announcements, reading assignments, critical reading questions, information about the term projects, and extra materials will all be distributed via the website. Please enroll in the BME 7130 site at <http://blackboard.cornell.edu/> as soon as possible. **The access code to enroll is: 987654.** Detailed instructions for enrolling are given below.

### Reading materials:

The reading materials for the course, including journal club papers, will be posted on the course website.

### Schedule:

Lecture: Tuesday and Thursday, 10:10 – 11:25 am, in 368 Hollister Hall.

### Course assignments:

1. Complete web-based critical reading questions, once or twice per module (on your own)
2. Present journal club papers, once or twice during the term (with a partner)
3. Write a “mini-review” format paper on an emerging disease mechanism (with a partner)
  - i. Abstract, outline, list of relevant papers due in mid February
  - ii. Final five page paper due in late March
  - iii. Revised five page paper due in late April
  - iv. Five minute presentation on review topic in early May
4. Write a short, NIH-format proposal for original biomedical research (with a partner)
  - i. Specific Aims page due in late February
  - ii. Five minute presentation on proposal in mid March
  - iii. Final five page proposal due in mid April
  - iv. Revised five page proposal due in early May
5. Participate in anonymous peer-review of mini-review papers and proposals (on your own)
  - i. Submit one page written reviews of two mini-reviews in early April
  - ii. Submit one page written reviews of two proposals in late April

### Critical reading questions:

Online questions about the assigned reading and recent lectures/journal clubs will be due periodically throughout the term, about once or twice per module. As new reading is assigned, online questions will be posted, with about a week of time before the assignment is due. The quiz will focus on the reading for upcoming journal clubs and on issues dis-

cussed in the previous two or three lectures or journal clubs. There will be two short essay questions that ask you to describe concepts in the reading material and lectures, respectively, that you found confusing (or interesting, if nothing was confusing). In these two essay questions it must be clear from your response that you have read the assigned reading, attended the lectures, and have thought carefully about the material covered in the reading and lectures. In most cases, three to four, well-crafted sentences should be adequate for answering these questions. The goal of these questions is to encourage you to be active about what and how you are learning. You most effectively learn and integrate new concepts when you actively challenge your own understanding. The long-term goal should be for this active questioning to become second nature to you. In this course, you are asked to write down your critical evaluations of your understanding as a means of becoming better at doing it.

### **Journal club presentations:**

You should identify a partner for your journal club presentations. Once or twice during the term, you and your partner will be responsible for discussing the findings, approach, implications, etc. of a review paper or original article in class. You will be expected to lead an approximately 30 minute discussion of deep scientific issues about the paper. A presentation that flatly presents the results or shallowly criticizes technical issues in the paper is not acceptable. Everyone in the course is expected to read all the journal club papers and participate in the discussions. The presenters of a paper are, in addition, expected to garner a deeper understanding of the topic through additional reading and thinking so they are prepared to productively guide the discussion, address difficult questions, identify connections to other research topics, and suggest implications of the work. The goal of giving these presentations is to both help educate your peers as well as to help you learn how to rapidly assimilate new ideas and to learn how to judge when your understanding is sufficient to answer other people's questions or to pose original questions that lead to new research ideas.

### **Mini-review:**

You should identify a partner (different from your journal club partner) for your mini-review paper. With your partner, identify an emerging topic in disease biology. An aspect of a field that has more than a few but less than 20 original published papers (of respectable quality, ignoring junk) is probably appropriate. Your goal for the term is to prepare an exceptional quality, short review paper on your topic. This project will have four stages. First, you will submit and receive comments on an abstract, outline, and list of relevant papers. Second, you will submit a high-quality review paper. You will receive two reviews from your classmates (and you will review your peer's papers). Based on these reviews, you submit a final version of your review. Finally, you share your insights with your peers in a five minute, formal presentation in class. Your review paper should be five pages or less, single-spaced, 0.5 inch margins, 11 pt. Arial font, including all figures, tables, captions, etc. A descriptive title and summarizing abstract should be included. You can section the body of the review in whatever way seems appropriate. References can be included on an additional page. Example reviews are posted on the course website. Note that some of these are longer than what you will produce. The goal of this assignment is to help you learn how to assemble a coherent picture of a scientific field from a collection of original articles (some of which may be incoherent and/or wrong). This is an absolutely critical skill as a scientist or engineer. Note that the goal is not to propose new work or to suggest ideas that cannot be tested against existing data. Rather, the goal is to use published data to develop a consensus picture of what is and is not understood both at a broad and detail-oriented level and to clearly and coherently describe that consensus understanding.

### **Proposal:**

You should identify another partner (different from both your journal club and mini-review partners) for your proposal. With your partner, develop a proposal for original research on a basic or applied topic that is relevant to human health (either directly or through advances in biomedical research). The work should be sufficiently focused that you can develop a convincing justification for doing the proposed work and a credible research plan for collecting and analyzing the data in a short proposal. There will again be four stages to this assignment. First, a "Specific Aims" page will be submitted and you will receive comments. Second, your team will present a five-minute proposal pitch to the class and answer questions. Third, you will submit a five-page proposal (same length, font, etc. restrictions as the mini-review). You will receive reviews of your proposal from your peers (and be responsible for reviewing other's proposals). Finally, you will submit a revised version of the proposal based on the comments you received. The proposal should follow the new NIH format: one page "Specific Aims," then a four page "Research Strategy" that includes sections on "Significance," "Innovation," and "Approach." The relevant sections from the new NIH guide to proposals about the focus of each of these sections is posted on the course website. You may use properly-referenced published data from the literature as preliminary data to support the feasibility of your proposal. One of the main goals of this course is to help you gain some of the knowledge and concepts necessary to begin to develop original research ideas of your own. Our standard for this project is very high – we hope you will develop and convincingly describe novel research.

### Mini-review and proposal reviewing

You will be asked to provide a one-page review of two of the mini-reviews and two of the proposals produced by your peers. This reviewing process will be completely anonymous and you should not make any efforts to discover who is reviewing your work nor whose work you are reviewing. Your reviews should include a short paragraph summarizing the mini-review or proposal (to show you understood it), followed by constructive comments and criticism. Each point you raise should include a statement of what needs to be done so the work meets your standard. When you revise your mini-review or proposal, all reviewer comments that you receive should be taken into account.

### Overlap with thesis research topics:

It is acceptable if your mini-review and/or proposal overlap with topics that you are working on in the lab you have joined. However, the work you turn in for this course **MUST** represent **YOUR** synthesis of existing literature or **YOUR** ideas for new research. Starting from a draft proposal or review paper/book chapter from your advisor (or any other source) is not acceptable. I hope that some of these documents go the other way, and become drafts of reviews or proposals that do get submitted by you and your research advisor.

### Grading:

Critical reading questions: 10%

Journal club presentations and in-class discussion participation: 20%

Mini-review

Abstract and Outline: 5%

First submission: 7%

Resubmission: 10%

Presentation: 8%

Proposal

Specific Aims page: 5%

Presentation: 7%

First submission: 8%

Resubmission: 10%

Reviewing

Mini-reviews: 5%

Proposals: 5%

### Academic integrity:

Academic integrity is expected of all students of Cornell University at all times, whether in the presence or absence of members of the faculty. Violations of the code of academic integrity will be prosecuted through the Academic Integrity Hearing Board. For more information, see the following page on academic integrity: <http://cuinfo.cornell.edu/Academic/AIC.html>.

### Blackboard Basics:

To Enroll in a Blackboard Site:

1. In a web browser, go to <http://blackboard.cornell.edu>.
2. Click the Login button.
3. Enter your Blackboard user name and password and click the Login button.
  - If you don't have a Blackboard account, you will need to get one before you can enroll. Click the "Create Blackboard Account" link near the top of the page and follow the instructions.
4. Click on the "All Blackboard Sites" tab along the top of the page.
5. Click on the "Browse Course Catalog" link on the right. Courses are listed by school and department.
6. Locate "Core Concepts in Disease (BME 7130)" by navigating first to "Engineering" then to "Biomedical Engineering."
7. Click the Enroll button to the right of the course listing. A confirmation screen will appear.
8. **When asked for an Access Code, enter "987654".**
9. Click the Submit button to enroll in the site.
10. Click the OK button on the next screen to go straight to the site. From now on, a link to the site will appear in the course list on your My Blackboard page when you log in.