Cell Biology Syllabus

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Class Meeting Time and Place
MWF 11:15-1:10 PM, 312 Bruininks Hall

Course Prerequisites
This course assumes that you have taken an upper level genetics course similar to Biol 4003 or Bioc 4332 and an upper level biochemistry course similar to Bioc 3021 or Bioc 4331. Though exceptions are occasionally made and the course is designed such that the emphasis is not on the subject of these other course, the aim of having these prerequisites is to protect you from getting yourself into a course before you are ready. You will need to be the judge of your readiness.

Description, Scope and Format of Course
This 3-unit course focuses on structures and processes fundamental to cells, with a particular emphasis on animal cells. Topics include molecular and cellular laboratory methods, membrane composition, structure and function, intracellular transport of molecules and vesicles, inter- and intra-cellular communication, programmed cell death, the cell cycle, cytoskeleton and molecular motors, cell contacts and extracellular matrix, cancer cell physiology and stem cell technology. Cell biological topics that are the focus of genetics and biochemistry courses, the prerequisites to this course, are generally de-emphasized.

The course follows a Team-Based Learning (TBL) format developed by Larry Michaelsen that has been shown to increase long-term retention of course concepts, shift the emphasis from basic remembering of central concepts to using them to carry out more complex cognitive tasks, and give students the experience of working as part of a high-performance team. The course takes place in one of the cutting-edge SCALE-UP-style classrooms at the U of M, inspired by the pioneering work of Robert Beichner. [SCALE-UP stands for...
“Student Centered Activities for Large Enrollment University Programs”]. As with Team-Based Learning, students have class time to work through team challenges – the kinds of questions that are central to cell biology – to use and even discover for themselves the principles that there might be no time for in a traditional lecture. Collaborative student work on these activities is facilitated by the availability of team-dedicated circular tables, materials, microphones, whiteboards and wall displays in our classroom.

The amount of reading assigned will be very similar to that of a traditional lecture-based course but the conceptual mastery expected on exams differs from some other cell biology courses that focus more on recall of molecular facts.

**Course Objectives and Expectations**

The three main learning goals that I have students in this course are for you to

1. Master the concepts and cell biology as described in (and at the level of) the assigned reading MBC 6th edition by Alberts et al., chapters 8-13, 15-20 & 22.

2. Be able to identify, define, and solve problems in cell biology individually and collaboratively using the textbook, relevant primary literature, and your own creativity.

3. Communicate clearly and effectively your understanding of cell biology in writing and images – in solutions to problem sets, reflections on what you’ve learned in the previous week, in answers to open-ended quiz and exam questions and in a written design proposal describing novel cell-based therapies that could solve current health challenges.

4. Enjoy cell biology more than you did before taking this course, and want to continue learning about cell biology in the years ahead.

I know you will make as great an effort as these goals require.

To help you, work through the reading study guides for each chapter are posted at the course website. The study guides summarize briefly the main idea of many sections of chapter and indicates which sections of the chapter you can safely skim or skip. Note, however, that the definitive description of required reading is not in the study guides’ description of sections of the chapter. Rather the identification of the pages I’d like you to read are given in the reading grid.

I expect that you will read the assigned chapters in the text prior to class, attempt to solve all assigned problems, and attend class regularly. Each of these activities will reinforce the other; neglect of any of the three will compromise your ability to achieve the course goals. Your success in this course depends heavily on your commitment to it. I will do my best to help you by being prepared for
class, presenting course material clearly, making sure you get ample feedback and treating you with the deepest respect. By the end of this course, I want you to understand cell biology far better than you do now and want you to be so inspired by the questions that cell biologists try to answer that you have a life-long interest in how cells work.

Required Text
The required book for this course is Molecular Biology of the Cell, 6th edition (MBC6) by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter (ISBN: 9780815344322). This book is very well written and provides an excellent senior-level discussion of cell biology. In this class you will need to read prior to the discussion and use of the material in class. As a summer class compressing 14 weeks of material into seven weeks, this course will demand time, focus, and dedication from you.

You should schedule time to read 7-14 pages a day, six days/week rather than trying to do it all in the day or two before it is due to be completed. This last sentence is underlined because so many students have said at the end of the course that they realized that this habit was the key to them doing well in the class – or that failing to do it was the main reason for them doing badly. Do it now: block out some reading time each day on your calendar and show yourself that you can be as disciplined is sticking to that plan requires you to be 😊.

Timing how long it takes you to read that many pages with good comprehension would be a good second step in determining how much time you should set aside. If you know it takes an hour to read 10 pages well, block out two hours. Needless to say you should do your reading at a time of day when your mind is working at its best not turning the wee hours of the night when you will nod off because of the difficulty of the material.

You can always look up topics in the 4th edition of this book online at NCBI Books (http://www.ncbi.nlm.nih.gov/books/). This isn’t a full text version but rather a fully searchable text database where you can see sections of the text containing terms you use as your search query. If you are away from your textbook but able to get online, this is an important resource to know about.

The Modular Structure of the Course
The course is divided into six topical units, each combining two areas of cell biology represented in different chapters of MBoC. Each unit has the common format shown below, where Day 1 is Monday, Day 2 is Wednesday and Day 3 is Friday. The week of July 4 has Day 1 on Wednesday and Day 2 on Friday.
**Classroom Atmosphere**

While I appreciate the learning that can happen in an intense and all-business classroom, I think as much learning can happen in a more relaxed and easy-going environment. Though our goal may be to learn an extraordinary amount of cell biology, we ought to be able to have some fun along the way. I’ll do my part and am counting on you to do yours.

It is also important to me that the class not be a one-way information delivery experience, where I lecture and you quietly sit and listen. I recognize that not everyone in this class may be as relaxed as I am about piping up, particularly since there will also be about 20 classmates listening. Most of you, in fact, may
find speaking in front of so many people somewhat intimidating. Still, I believe we learn as much from trying to express what we understand and hearing incorrect or imprecise ideas as from hearing the correct answer delivered parsimoniously and precisely. I ask questions in class so I can hear your thoughts, not so I can get the correct answer. I want to hear what you have to say and know I can count on you to listen respectfully when your classmates are trying to find the words they are looking for. I hope by the end of the course you have become comfortable asking questions and trying to answer them.

Optional Discussion Sections
We are lucky to have Keehun Kim working with us as the course TA. Keehun will offer an optional weekly discussion section to provide additional help with course material, and with the problem sets in particular. Location, dates, and times to be announced by the end of the first week of the course.

Learning Readiness Quizzes (LRQs)
Learning readiness quizzes at the start of class on the first day of each unit provide further incentive to do the reading before the week that the material is taken up and, and this is important, provide a powerful learning opportunity and team-building opportunity as well. The quizzes typically have 16 questions that are more difficult than the self-test questions and focus on what I consider some of the central concepts of the assigned reading. Immediately after taking the quiz individually, you will take the same quiz as a team, where you have the chance to discuss questions amongst yourself. For the team component of the LRQ, everyone on the team receives the same score.

Problem Sets
The five weekly problem sets pose more challenging problems for you to solve and present experimental data for you to interpret. Your solutions are always due at the course website by 7 pm precisely the night before the unit quiz. The one exception is PS3 which is due Saturday, July 8th at 7 pm. Other weeks the problem sets are due on Thursday evenings. The key to the problem set will be posted at 7:05 pm that same evening, which is why the due date/time is precise. Email Keehun or me if you don’t see them by then.

Your solutions will be checked for completeness and for originality (i.e. not copied from another student in the class or from answers provided). While it might be tempting to look at the answers before trying to solve the problems as a way to save time, if you do this you will lose the valuable mental training that problem solving provides you. In particular, you will not have faced the problem with the need to answer it on your own, with the knowledge you have. There will be many times in your life, and on the course exams in particular, where being able to think through a problem quickly will be a skill that sets you apart from others who may first turn to Google or PubMed in an effort to find a hint or the answer itself. While I’d be the first to argue for the power of such searches a good amount of the problem solving process should be able to happen in your
head, with the information and principles you’ve taken in. So, give the problems your best effort before looking for help with the answers. When you read the answers, pay attention not just to the “final answer”, but also to the method used and explanation.

In my experience, such active engagement with the material is a more effective and less stressful way of mastering course material than simply that “read, review, regurgitate” method, a common alternative. Problem solving takes some time but gives you the vital, early feedback on whether you understand the material or not, while there is still time to go back and review what is unclear. Finally, since quiz and exam questions will often be modified from those in the problem sets – and in some cases lifted directly – solving these problems will be an effective way of preparing for the weekly quizzes and the final exam.

**Quizzes and Final Examination**

There are five unit quizzes (UQs; 1, 2, 3&4, 5, 6) and one cumulative final examination in this course (100 pts). They will each consist of a variety of question types, from multiple-choice and fill in the blank to short answer and essay. A large fraction of the quizzes and exam will be problems, often drawn from the problem sets and in-class team challenge problems and always at least one question from the reading that was assigned but not elaborated on in class. Of the 37-point quiz, 31 pts will be for questions answered individually and 6 pts will be for a problem solved together as a team. Unit quiz 3&4 is a double quiz worth twice the points (74 pts).

Post-unit quiz analysis can be completed for any unit quiz. This will allow you to earn back ¼ pt per point missed on the individual unit quiz. It’s due, stapled on top of the quiz, the next class meeting after you receive your graded unit quiz.

**Project Updates**

Each week I will ask for an update on your progress on the nanoparticle design project. This is a team assignment where the product is expected to be professional in its argument, organization, writing style and presentation. Typically each update will be two pages of text (double-spaced) plus at least one figure, and three sources that you cite and include full bibliographic information for in a sources cited section. I will generally meet with members of your team (a sub-group or the entire team) on the Friday the week that the update is due to answer questions, give you feedback on your thinking and discuss additional ideas. You should think of these updates as steps toward your final project proposal and poster.

**Inter-team and Intra-team Evaluations**

As peer review is central to the work of a biologist and additionally a great way to get insight into a task at hand or your own performance, there are several opportunities for you to give feedback to your peers over the course of the semester. You are evaluated on the quality of the feedback you give, and these
peer review opportunities are typically worth quite a few points. Be as constructively critical and professional as you can be.

**Reflections**
Write a short reflection (about 200 words – 150 minimum) after the end of each three-day unit about what you have learned the previous week and how it relates to your current interests, future goals, articles you’ve read, and/or questions you’ve had but not known the answer to until now. This activity is included in the course because so many studies have shown reflections to improve student learning. Post these reflections to the course Moodle site by 11:55 pm on the date on the assignment schedule; no late submissions will be accepted, as the point of the assignment is to reflect on the learning of the previous week while it is still fresh. There are no particular right answers. Overly brief reflections or *recitations of the facts learned* in class, however, will receive only partial credit the first time and no credit after that. I read all of these and look forward to hearing your thoughts. There are eight opportunities to write reflections: grade is based on best seven scores, so you can forget one and lose no points.

**Extra Credit**
There are three forms of extra credit possible in this course.
(1) Completing two Biol 4004-related surveys – *About You* (2 points) and *Course Eval* (4 points). Your thoughts on this class and how it can be made even more effective are very important to the long-term success of the class. Here’s the link to the About You survey: https://www.surveymonkey.com/r/BRRXPBN.

(2) Completing two online cell biology concept inventories – *another 4 points if both completed within the specified time window and with genuine effort.*

(3) Completing a survey for college students – the *CalNew Survey* (6 pts) – on behaviors and habits of mind possibly related to success in college. While this survey is not related to cell biology directly, the topic of each questions might well be relevant to you as you consider how you approach college and will, soon, approach graduate school, professional school, or your regular job or career. Some of the questions will seem a bit personal. I promise that my interest is not in your particular answers – I won’t go back and check what you chose for question #35, for example, or read through student answers one by one. It would take too long and I respect your privacy. However, I *am* interested in aggregate trends and so will look for patterns that arise from hundreds of students’ responses. Bottom line: it’s worth 6 points of extra credit and would help me tremendously as I investigate the correlations between beliefs/values and behaviors/habits of mind and some different measures of college success. Please take the survey and answer each question honestly. Thank you!
Point Allocation

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Total pts</th>
<th>Type</th>
<th>%</th>
<th>Total %</th>
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</thead>
<tbody>
<tr>
<td>Unit Quizzes (6 x 31 pts each)</td>
<td>186</td>
<td>I</td>
<td>23.3%</td>
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</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
<td>I</td>
<td>12.5%</td>
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<tr>
<td>iLRQs (6 x 16 pts each)</td>
<td>96</td>
<td>I</td>
<td>12.0%</td>
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<tr>
<td>Problem sets (5 x 6 pts each)</td>
<td>30</td>
<td>I</td>
<td>3.8%</td>
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<tr>
<td>Reflections (7 x 3 pts each)</td>
<td>21</td>
<td>I</td>
<td>2.6%</td>
<td>54.1%</td>
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<tr>
<td>Project (5 x 15; 30+30)</td>
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<td>T</td>
<td>16.9%</td>
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<tr>
<td>Team challenges (6 x 6 pts)</td>
<td>36</td>
<td>T</td>
<td>4.5%</td>
<td></td>
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<tr>
<td>Team unit quiz (6 x 6 pts)</td>
<td>36</td>
<td>T</td>
<td>4.5%</td>
<td></td>
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<tr>
<td>Inter-team evaluations given</td>
<td>36</td>
<td>T</td>
<td>4.5%</td>
<td></td>
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<tr>
<td>tLRQ (6 x 4 pts each)</td>
<td>24</td>
<td>T</td>
<td>3.0%</td>
<td>33.4%</td>
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<tr>
<td>Intra-team performance eval</td>
<td>100</td>
<td>TM</td>
<td>12.5%</td>
<td>12.5%</td>
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<tr>
<td><strong>Extra credit (2 + 4 + 4 + 6 pts)</strong></td>
<td><strong>[16]</strong></td>
<td>EC</td>
<td><strong>[2.0%]</strong></td>
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<td><strong>800</strong></td>
<td><strong>100%</strong></td>
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Note that unit quizzes are worth 37 points (31 individual + 6 team) and that the final project has six weekly updates worth 15 points each and a poster (30 pts) and written design proposal (30 pts). Intra-team performance evaluation reflects your own teammate’s appraisal of your contributions to the team efforts (80 pts) and your giving thoughtful critiques of your peers (2 x 10 pts each).

Criteria for Grading and Grading Standards
How course grades will be assigned based on points earned:

- 736-800  92%-100%  A
- 720-735  90%-91.9%  A-
- 704-719  88%-89.9%  B+
- 656-703  82%-87.9%  B
- 640-655  80%-81.9%  B-
- 624-639  78%-79.9%  C+
- 496-623  62%-77.9%  C
- 480-495  60%-61.9%  C-
- 400-479  50%-59.9%  D
- <400 <50% F

This constitutes my agreement with you: if you achieve the minimum number of points for each grade shown above, you will earn at least that grade. It is possible for everyone in the course to get an A if each person earned 92% of course points. This hasn’t happened yet, but I would love to see the day when it...
does. More often many students just can’t give the course the time required to master all the material. I encourage you to give this course your best.

Class Policies

No Electronic Devices Permitted Except Tape Recorders
Out of respect for all of you I will often ask that each of you turn off, put away, and not use your laptop computer, cell phone or other electronic devices in class. It is very important that you and others in the class are able to focus on the discussion at hand rather than giving it your partial, divided attention. Thank you for your consideration of this request. If you have a special need that requires the use of a particular device, please let me know. Laptops are welcome when the class is working on the class project. Tape recorders may be used to record the class if that would help you.

Student Information and Privacy
In this class, our use of technology will sometimes make students' names and UMN Internet IDs visible within the course website, but only to other students in the same class. Since we are using a secure, password-protected course website, this will not increase the risk of identity theft or spamming for anyone in the class. If you have concerns about the visibility of your Internet ID, please contact me for further information.

Academic Integrity
Collaboration with other students in the course is highly encouraged for all assignments (not, obviously, during quizzes and examinations). Note: permitted collaboration in this course excludes the use of another student’s written (digital or printed) solutions to any problem. Discovery of such answer sharing will result in a zero score on the assignment for both donor and recipient! Use of other published or unpublished solutions written by others is also not permitted.

See the campus Academic Integrity Policy and Board of Regents Student Conduct Code for definitions of academic dishonesty, reporting process, sanctions against violators, and student rights in such circumstances (http://www1.umn.edu/oscai/conduct/regentspolicy.html).

Accommodation for Students with a Disability
It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have documented disability conditions (e.g., physical, learning, psychiatric, vision, hearing, or systemic) that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact Disability Services and their instructors for a confidential discussion of their individual need for academic accommodations. Disability Services is located in Suite 180 McNamara Alumni Center, 200 Oak Street. Staff can be reached by calling 612-626-1333 voice or TTY.
Make-up Quizzes
Students who foresee the need to reschedule a unit quiz, or who have a doctor's note indicating they are too sick to attend class are expected to make the appropriate rescheduling arrangements with the instructor. I will consider giving an alternative quiz or examination date to students with a clear and compelling need for one. As so much will be happening during class meetings in this course, it will be difficult to make-up other aspects of the class (e.g. LRQs, team challenge questions, in-class peer reviews). These components will generally not have an option for make-up.

Incompletes
If you have completed a substantial amount of the course work (the first two thirds of the class, for instance) but are unable to complete this course for an acceptable reason, please let me know as soon as possible, definitely before the final exam. A strategy for completing the course will be made according to the needs of each individual situation.