MCB 471 Cell Structure and Dynamics.

William M. Brieher
Fall, 2019. Dr. William M. Brieher, Instructor
Tuesday and Thursday, 11:00 am – 12:20 pm.
161 Noyes Laboratory
John Li, Teaching Assistant, Ph.D. Candidate in Cell and Developmental Biology

Contact Information and Office Hours.

wbrieher@illinois.edu Write "MCB471" in the subject line to prevent me from deleting your email. **Office Hours** are Monday and Tuesday, 4:00 – 5:00 pm in the MCB Learning Center in Burrill Hall. I recommend coming to office hours. It's your chance to have an Oxford style education here at UIUC.

Intended audience.

This class assumes you understand eukaryotic cell biology at the level of an introductory course taught at the college level, like MCB 252. If you have never had a cell biology class, then you might want to consider buying a good textbook in order to learn the basics as we go along. Recommended textbooks are listed below.

Statement on academic honesty.

I encourage you to discuss the material with your friends and colleagues as work through the material. *However!* You need to work on the exams by yourself. All your answers to quizzes and exams are to be your own. My quizzes and exams are all open book, open notes, and open internet. However, plagiarism will not be tolerated. One way to avoid plagiarism is the following: once you use a resource, like a textbook, to help you answer a question, then close book. Walk away and then write your answer half an hour later.

I follow university and MCB policies on academic honesty and plagiarism. A full statement on academic honesty can be found at the end of the syllabus.

Copyrights.

Lecture slides, my voice in lecture, my quizzes, my study guides, my exams, and all written material prepared by me for this course is my intellectual property.

Therefore, for example, you **cannot** post my class material to a commercial website like Course Hero. Use of any social or electronic media to share course information, request course information or make confidential course information public is prohibited. Any use of this type may earn you a zero or a more extreme penalty at the discretion of the instructor on an assignment or exam.

Course summary.

This class is meant to be radically different from any other MCB course that you have ever taken. This is not a survey course. There is no required textbook. The point is not to memorize a bunch of facts. Rather, the primary goals are to teach inquiry and proper application of the scientific method to the subject of cell biology. If we work together, I think you will get a small but useful taste of what it is like to be an expert scientist devoting an entire career towards understanding cell function. Who knows? Maybe, you will catch the excitement that surrounds the intellectual challenge of coming up with a new question in cell biology and discovering how cells work.

Topics.

The course is basically divided into two segments. In the first segment, we will look at a few, different examples of *how* researchers identified new problems in cell biology and performed experiments to understand the underlying mechanisms. This section will teach you the various methods used to study cells, show you how scientists developed hypotheses, designed experiments, used controls, analyzed data, and drew conclusions. Examples will include the problem of:
Protein targeting to membranous organelles
Maintaining organelle identify
Cholesterol regulation
How cells generate force
The discovery of liquid-liquid phase separations in cells

In the second segment, you will try doing cell biology yourself by tracking the development of our modern understanding of tissue organization. Serious discussion of the molecular basis of tissue organization started in the 1950s when Townes and Holtfreter observed selective cell affinities in early embryos. This will be the point of departure. From there, we will work together to come up with our own questions as to how cells interact. We will try to convert those questions into testable hypotheses. Then, we will design experiments to test the hypotheses, analyze the data, and interpret the results. We will think about the significance of the results in the broader context cell biology, evolution, and human health. Importantly, we are always thinking ahead to the next question, the next hypothesis, the next experiment. This process will take us from 1955 to the present.

Our investigation into tissue organization will lead us in unexpected directions to cover the following topics (among others): monoclonal antibody technology, expression cloning, mutagenesis, basic biochemical methods, structural biology, imaging, mass spectrometry, using data bases for discovery, membrane organization, cell adhesion, cell motility, cell fate decisions, axis specification and induction, nuclear import, transcription, signal transduction via kinases and protein degradation, cell cycle control, cancer, metastasis, epithelial to mesenchymal transitions, cytoskeletal dynamics and function, mechanobiology, and the evolutionary origins of multicellularity. Along the way, we will see scientific inquiry in action and learn how to do science, not just memorize it.

Evaluation.

500 points total for the class.

100 points for quizzes. There will be a quiz due at 10:00 am every Tuesday and Thursday. Quizzes correspond to the reading assignments. Each quiz is worth four points. 28 quizzes total. You can drop three of them = 100 points.

400 points for exams. There will be four exams. Each is worth 100 points.

All exams and quizzes are open note, open book, open internet. However, all of your answers need to be your own. No working in groups, no plagiarism.

Exam Schedule:

To be determined, soon.

Classroom discussion.

1. Class involves lots of discussion. The classroom is going to be a safe place to test out our ideas and understanding of the material. Remember, we are not born with this information. We learn it! Find a way to contribute to the conversation. Everybody's contribution is to be treated with respect. Don't worry about being "wrong" in class. Professional scientists spend a lot of time being wrong. Advancing our understanding of cell biology involves thinking about the problem, coming up with a reasonable hypothesis, and testing it. We often find out that our hypothesis was wrong or that the experiment wasn't the best one. Many times, we don't even realize our ideas were wrong unless somebody else points out the flaws in our thinking. The very existence of peer review in science, where all grant proposals and scientific publications are subject to intense scrutiny by anonymous colleagues, proves that the scientific method is difficult, not innate, and requires constant reinforcement throughout life.

2. You need to come class. I don't take attendance, but you need to be in class. Class time is meant for discussion. The best way to understand this material is to talk about it. Every year, a couple of students who do poorly on the exams, and every year it's those students who didn't come to class.

3. You need to read the reading assignments before coming to class.

Textbooks.

There is no required textbook. If you need to review a subject, then I recommend the following:
Molecular Biology of the Cell by Alberts, et al., 6th edition.
Molecular Cell Biology by Lodish, et al., 7th or 8th edition.
Essential Cell Biology by Alberts, et al., 4th edition.

Reading assignments, study guides, quizzes.

Reading assignments, study guides, and discussion questions are posted on the course website
https://learn.illinois.edu/course/view.php?id=40032

MCB Policies on academic honesty, absences, etc.

I follow the official MCB policies. The policies are posted on the course website in session 1.