

UC-Berkeley, College of Letters and Sciences
MCELLBI 230 Advanced Cell and Developmental Biology
Spring Semester, 4 units

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Lectures: Tuesday/Thursday 2-3:30 PM Room XXX

Discussion sections: Friday 2-3 PM Room XXX

Office hours: TBD

Description: This course will discuss modern concepts of cell and developmental biology, with a strong emphasis on regulatory mechanisms at different length-scales (intermolecular, intracellular and intercellular). It will cover methods of quantitative, single-cell, and organismal biology in cell lines, stem cells, and model organisms. A solid foundation of core cell biology concepts, such as the cell cycle, cytoskeleton, or vesicle transport, is helpful, but not essential.

Lectures: will be recorded to allow students to review the material after class and in rare cases where a student cannot participate in real-time. MCB230 is not an asynchronous class; attendance and participation in both lectures and sections are required. We encourage students to plan lab work and other activities around the scheduled hours.

Grading: Students will complete two assignments during each third of the class. First, each student will work (often with a group) to give an oral presentation about an important paper related to the lecture material, picked in consultation with the instructor. Presentations will be mostly given during the discussion session, but may also be given following lectures. Second, each student will write a 'News and Views'-style critical summary of a paper of their choice. Grades will be determined 40% by the presentations, 40% by the written assignments, and 20% by class participation.

COURSE POLICIES

Course evaluations will be provided during the last week of each section.

Disabilities: If you need disability-related accommodations in this class, if you have emergency medical information you wish to share with us, or if you need special arrangements in case the building must be evacuated, please inform the instructor immediately. Students who need academic accommodations (for example, a notetaker), should request them from the [Disabled Students' Program](#). 260 César Chávez Center, 642-0518 (voice or TTY). DSP is the campus office responsible for verifying disability-related need for academic accommodations, assessing that need, and for planning accommodations in cooperation with students and instructors as needed and consistent with course requirements.

Code of Conduct: All students are expected to do their own work and to uphold the standards of intellectual integrity. We assume that you have read, and will abide by the student code of conduct and academic integrity: <https://sa.berkeley.edu/conduct/integrity>.

Academic Honesty: All students are expected to do their own work and to uphold the standards of intellectual integrity. It is your responsibility to familiarize yourself with the University's policies governing plagiarism. You may find [this website](#) helpful in defining and avoiding plagiarism.

Safe, Supportive, and Inclusive Environment: Whenever a faculty member, staff member, post-doc, or GSI is responsible for the supervision of a student, a personal relationship between them of a romantic or sexual nature, even if consensual, is against university policy. Any such relationship jeopardizes the integrity of the educational process. Although faculty and staff can act as excellent resources for students, you should be aware that they are required to report any violations of this campus policy. If you wish to have a confidential discussion on matters related to this policy, you may contact the Confidential Care Advocates on campus for support related to counseling or sensitive issues. Appointments can be made by calling (510) 642-1988. The classroom, lab, and work place should be safe and inclusive environments for everyone. The Office for the Prevention of Harassment and Discrimination (OPHD) is responsible for ensuring the University provides an environment for faculty, staff and students that is free from discrimination and harassment on the basis of categories including race, color, national origin, age, sex, gender, gender identity, and sexual orientation. Questions or concerns? Call (510) 643-7985, email ask_ophd@berkeley.edu, or go to [this site](#).

Mental Health & Wellness: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, depression, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. UC offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, consider utilizing the confidential mental health services available on campus. We encourage you to reach out to the [Counseling Center](#) for support (510) 642-2000). An on campus counselor or after-hours clinician is available 24/7.

Lecture topics (subject to change)

<i>Date</i>	<i>Topic</i>
1/19	MR-1: Introduction into signaling and network analyses
1/21	MR-2: Synthetic biology approaches to signaling
1/26	MR-3: Analog versus digital: switch-like transitions in cellular state
1/28	MR-4: Feedback motifs in signaling
2/2	MR-5: Pulsatile and frequency-based signaling
2/4	MR-6: Crosstalk between dynamic signaling systems
2/9	MR-7: Signaling in noisy environments: fold-change detection
2/11	MR-8: Signal compartmentalization by phase separation
2/16	MR-9: Stable signaling: the good among prions
2/18	DB-1 Intro to Developmental Biology (signaling to specify animal axes)
2/23	DB-2 Differentiation I (intrinsic signaling)
2/25	DB-3 Differentiation II (inductive signaling)
3/2	DB-4 Patterning I (morphogens)
3/4	DB-5 Patterning II (establishing boundaries and periodic patterns)
3/9	DB-6 Cell and Tissue polarity
3/11	DB-7 Morphogenesis
3/16	DB-8 Growth
3/18	DB-9 Evolution and Development
3/22	Spring break
3/24	Spring break
3/30	JH-1 Lipids and membranes: biology in two dimensions
4/1	JH-2 Compartmentalization of the eukaryotic cell and the personalities of organelles
4/6	JH-3 Structure and dynamics of the actin and microtubule cytoskeletons
4/8	JH-4 Transport into and out of organelles
4/13	JH-5 Organellar contact sites
4/15	JH-6 Secretion, fast and slow

4/20	JH-7 Cell eating: endosomes, autophagy, and lysosomes
4/22	JH-8 Signal compartmentalization by membranes
4/27	JH-9 How intracellular pathogens hijack cell compartments

Reading: No textbook is required; lectures will be based on primary literature, and there will be assigned reading posted on bCourses each week.

Examples of primary papers include:

- Bassik MC, Kampmann M, Lebbink RJ, Wang S, Hein MY, Poser I, Weibezahn J, Horlbeck MA, Chen S, Mann M, Hyman AA, Leproust EM, McManus MT, Weissman JS. A systematic mammalian genetic interaction map reveals pathways underlying ricin susceptibility. *Cell*. 2013 Feb 14;152(4):909-22. doi: 10.1016/j.cell.2013.01.030. Epub 2013 Feb 8. PMID: 23394947; PMCID: PMC3652613.
- Toettcher JE, Weiner OD, Lim WA. Using optogenetics to interrogate the dynamic control of signal transmission by the Ras/Erk module. *Cell*. 2013 Dec 5;155(6):1422-34. doi: 10.1016/j.cell.2013.11.004. PMID: 24315106; PMCID: PMC3925772.
- McKinley KL, Sekulic N, Guo LY, Tsinman T, Black BE, Cheeseman IM. The CENP-L-N Complex Forms a Critical Node in an Integrated Meshwork of Interactions at the Centromere-Kinetochore Interface. *Mol Cell*. 2015 Dec 17;60(6):886-98. doi: 10.1016/j.molcel.2015.10.027. Epub 2015 Nov 19. PMID: 26698661; PMCID: PMC4690846.
- McKenna A, Findlay GM, Gagnon JA, Horwitz MS, Schier AF, Shendure J. Whole-organism lineage tracing by combinatorial and cumulative genome editing. *Science*. 2016 Jul 29;353(6298):aaf7907. doi: 10.1126/science.aaf7907. Epub 2016 May 26. PMID: 27229144; PMCID: PMC4967023.
- Lancaster MA, Renner M, Martin CA, Wenzel D, Bicknell LS, Hurles ME, Homfray T, Penninger JM, Jackson AP, Knoblich JA. Cerebral organoids model human brain development and microcephaly. *Nature*. 2013 Sep 19;501(7467):373-9. doi: 10.1038/nature12517. Epub 2013 Aug 28. PMID: 23995685; PMCID: PMC3817409.
- Struhl G, Struhl K, Macdonald PM. The gradient morphogen bicoid is a concentration-dependent transcriptional activator. *Cell*. 1989 Jun 30;57(7):1259-73. doi: 10.1016/0092-8674(89)90062-7. PMID: 2567637.