

## BC565 - Molecular Regulation of Cell Functions

**Class time and place:** 3 – 5 PM, MW, AZ E210

**Instructors:** Chaoping Chen, MRB 233, 491-0726 (office), [Chaoping.Chen@colostate.edu](mailto:Chaoping.Chen@colostate.edu)  
 Santiago Di Pietro, MRB 281, 491-5302 (office), [santiago.dipietro@colostate.edu](mailto:santiago.dipietro@colostate.edu)  
 Steven Markus, MRB 241, 491-5979 (office), [steven.markus@colostate.edu](mailto:steven.markus@colostate.edu)  
 Jennifer DeLuca, MRB 237, 491-6718 (office), [Jennifer.DeLuca@colostate.edu](mailto:Jennifer.DeLuca@colostate.edu)  
 Soham Chanda, MRB 279, 491-7004 (office), [soham.chanda@colostate.edu](mailto:soham.chanda@colostate.edu)

**TA:** Sere Williams, [sere.williams@colostate.edu](mailto:sere.williams@colostate.edu)  
 office hours by appointment at Biology 2<sup>nd</sup> floor atrium

### Resources/Background reading:

*Molecular Biology of the Cell*, 6th Edition, Bruce Alberts et al, 2015 print  
*Cell Biology*, 3rd Edition, Thomas Pollard et al, 2016 print  
*Molecular Cell Biology*, 8th Edition, Harvery Lodish et al, 2016 print

### Prerequisites and Expectations:

- Previous coursework in Molecular Cell Biology (equivalent to BC465)
- CSU Graduate School anticipates that 3 additional hours of outside classwork will be completed each week per credit hour. BC565 students should thus expect to spend ~8-12 hours on assignments and reading material each week.

### Student learning outcome and goals:

- Master the fundamental concepts and mechanisms involving molecular regulation of cell functions. ***The material presented in this class is not meant to be a refresher of undergraduate coursework and assumes that you have already mastered the general concepts.***
- Understand the standard and state-of-the-art approaches for the study of molecular and cellular biology. Learn how to design experiments to address scientific questions, and how to interpret experimental results. The primary goal is to improve your ability to access, integrate, and evaluate the literature, not to have an encyclopedic knowledge of the field.
- To be able to critically analyze/evaluate experimental data in order to draw a conclusion based on your own, independent assessment
- Develop and establish communication (both oral and written) skills for effective and productive scientific discussions.

### Learning/teaching style

- This course will encompass a mixture of lectures, written assignments, and student-lead discussions of the primary literature.
- This course is designed for students who have been exposed to working in a wet lab, and who are actively participating in research projects. Those with no real-lab experience will find the contents rather abstract. Please consult the recommended reference textbooks (Resources/Background reading) if you need a refresher on the topics/concepts that will be discussed **prior to** the class.

### Grades:

- Grades will be out of a total of 500 points from five modules for the semester with each module being worth 100 points. There will be no comprehensive final exam.

- The point distribution for each module is shown below:
  - Pre-module assessment: 10 pts
  - 4 paper critiques (10 pts per assignment): 40 pts
  - In-class discussion activities (3 pts per lecture): 15 pts
  - Module exam\*: 35 pts  
(\*example questions will be posted prior to module assessment)
- Letter grades will be determined and distributed at the end of the semester. We reserve the right to ascribe "+" or "-" to any letter grade.

### Course organization:

Module #	Duration	Topic	Instructor
Module 1	Jan 22 – Feb 5	Membrane dynamics and cell signaling	Chaoping Chen
Module 2	Feb 10 – Feb 26	Intracellular compartments, protein sorting and membrane traffic	Santiago Di Pietro
Module 3	Mar 2 – Mar 26 (spring break Mar16-20)	The Cytoskeleton	Steven Markus
Module 4	Mar 30 – Apr 15	The Cell Cycle	Jennifer DeLuca
Module 5	Apr 20 – May 6	Stem Cells and Cellular Reprogramming	Soham Chanda

### Reading assignments

- For the primary literature reading assignments, each student will be tasked with describing a figure(s) from each manuscript and will lead the discussion on that figure in class. **\*\*Every student needs to be prepared to present each figure.\*\*** Figures will not be preassigned (and the flow of discussing the manuscripts will not *necessarily* follow the order of the figures).
- Each student must also be prepared to discuss the background and/or perspective for the manuscript; there is little point in discussing the experimental details of a manuscript without knowing the context of why the science under study is important.
- Each manuscript under discussion will require a student(s) to serve as a **critical evaluator** of the techniques employed. This individual would address questions such as: (1) Would the experimental details be better investigated with a different technique? (2) Would the data have been better analyzed with an alternative statistical approach? (3) How would funding restrictions (or unlimited funding) have changed the experimental workflow?
- The emphasis of the discussion should be on the hypotheses tested, and the methods utilized. Please be prepared to provide additional information beyond that provided solely in the manuscript.

### Guidelines for primary literature critiques (10 pts per critique; 40% of your total grade)

- A critique of the papers to be discussed in class will be due on Canvas **at noon of the class day** and will be graded. **Please target the overall length of your critiques to be approximately 400-600 words. Use Arial 12-point font with 1-inch margins.** These writing assignments will allow you to practice critically evaluating manuscripts. Each critique should answer the central question: **"Are the experimental rigor, novelty, presentation, and topic of the manuscript in question of sufficiently high quality to warrant its publication?"** Or, is the manuscript too flawed to be published in its present form? Whatever the recommendation, the review should highlight (1)

strengths/weaknesses of the paper, (2) the rationale for the recommendation chosen, and (3) suggestions for improvement.

- The written review must be your own thoughts, and it must be written using complete sentences (no bullets, abbreviations, or jargon may be used; however, a bulleted or numbered list of items may follow the summary paragraphs; see below). Your reviews should mimic reviews of manuscripts under consideration and should be drafted as such (examples will be provided by the instructors).
- Summary paragraphs: The first paragraph (5-6 sentences) should start by describing the field and the manner in which the manuscript might impact the field. You must communicate to the authors and editors that you are knowledgeable about the field, that you understand the knowledge gaps of the field, and that you understand the main techniques employed. Something akin to “*Proper gene regulation is necessary to permit cell differentiation, but the mechanisms underlying regulation at the level of transcription/translation/genome architecture/etc/etc are not completely understood. The current manuscript addresses a significant gap in the field, particularly x, y, or z*”. Conclude the first paragraph with a statement that declares whether you as a reviewer would recommend accepting the paper as is, accepting it with revisions (major and/or minor), or rejecting the paper.
- Use the second paragraph to explain your detailed assessment of the work. If there are significant flaws, state the flaw(s) and back up your criticism with specific points. You should comment on specific techniques, analyses and interpretations that you feel the manuscript fails to carefully or correctly address. The second paragraph typically makes broad statements to justify your recommendation (*i.e.*, to accept or reject) and is the core of your critique/review, and generally pinpoints the most significant advances or deficiencies in the work. Do not simply point out weaknesses, but rather devise alternative and/or improved methods to test the hypothesis (at least in your opinion).
- The overall goal of the critique is to evaluate the quality and importance of the work. Criticisms of the writing style, the format, or even suggestions for future experiments are okay, but do not substitute for a balanced scientific critique of the work that is presented in the manuscript. In a real review your summary paragraph(s) as described above would be followed with a specific list of items that support and clarify your position on the paper (this could be a bulleted or numbered list). In this list you should include both **major points** pertaining to the overall evaluation (usually first) and any **minor points** you wish to raise about format, writing, etc.
- Critiques will be evaluated on scientific content, **and** spelling and grammar. **Late critiques will not be accepted.**
- **Critiques are graded on a four-tier scale: 10 pts for excellent, 7 points for good, 4 points for fair, and 0 points for incomplete or poor work.**

## Module 1 - Membrane Dynamics and Cell Signaling

**Instructor:** Chaoping Chen ([Chaoping.Chen@colostate.edu](mailto:Chaoping.Chen@colostate.edu))

**Office:** 233 Molecular & Radiological Sciences Building

**Phone:** (970) 491-0726

**Office hours are immediately after each class or by appointment**

### Learning Objectives

#### Lecture 1 – membrane

- Membrane diversity and their underlying biochemical principles
- Membrane proteins

#### Lecture 2 – protein hardware for cell signaling

- Membrane receptors and activation mechanism
- Kinases and phosphatases
- GTPases
- Adaptors

#### Lecture 3 – second messages

- cAMP & cGMP
- Lipid-derived
- Ca<sup>++</sup>

#### Lecture 4 – signal integration

- Olfaction
- Light perception
- Insulin
- T-cell activation

### Class Schedule:

Date	Content	Assignments
Wed, Jan 22	Lecture 1: Introduction and Membrane Dynamics	Pre-lecture reading of a review article on membrane Pre-module assessment due 1/22 at noon
Mon, Jan 27	Paper 1 discussion Lecture 2: protein hardware for signaling	Paper 1 critique due 1/27 at noon
Wed, Jan 29	Paper 2 discussion Lecture 3: second messengers	Paper 2 critique due 1/29 at noon
Mon, Feb 3	Paper 3 discussion Lecture 4: signal integration	Paper 3 critique due 2/3 at noon
Wed, Feb 5	Paper 4 discussion In-class module exam Q&A of the module	Paper 4 critique due 2/5 at noon