



BC565 - Molecular Regulation of Cell Functions

Important information on COVID-19:

All students are required to follow public health guidelines in any university space and are encouraged to continue these practices when off-campus(es). Students also are required to report any COVID-19 symptoms to the university immediately, as well as if they have potentially been exposed or have tested positive at a non-CSU testing location. If you suspect you have symptoms, please fill out the COVID Reporter (<https://covid.colostate.edu/reporter/>). If you have COVID symptoms or know or believe you have been exposed, it is important for the health of yourself and others that you complete the online COVID Reporter. Do not ask your instructor to report for you; if you report to your instructor that you will not attend class due to symptoms or a potential exposure, you are required to also submit those concerns through the COVID Reporter. If you do not have access to the internet to fill out the online COVID-19 Reporter, please call (970)491-4600.

If you report symptoms or a positive test, your report is submitted to CSU's Public Health Office. You will receive immediate, initial instructions on what to do and will also be contacted by phone by a public health official. Based on your specific circumstances, the public health official may:

- choose to recommend that you be tested and help arrange for a test
- conduct contact tracing
- initiate any necessary public health requirements or recommendations and notify you if you need to take any steps

If you report a potential exposure, the public health official will help you determine if you are at risk of contracting COVID.

For the latest information about the University's COVID resources and information, please visit the **CSU COVID-19 site** (<https://covidrecovery.colostate.edu/>).

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Steven Markus, MRB 241, 491-5979 (office), steven.markus@colostate.edu
Jennifer DeLuca, MRB 237, 491-6718 (office), Jennifer.DeLuca@colostate.edu
Soham Chanda, MRB 279, 491-7004 (office), soham.chanda@colostate.edu

TA: Ryan Jeep, ryan.jeep@colostate.edu
Each Tuesday 4:30 – 5:30 pm via MS Teams or by appointment

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

Teaching/learning style/venue:

- This course will encompass a mixture of lectures, written assignments, and student-lead discussions of the primary literature.
- Lectures and “in-class” paper discussions will be conducted virtually via MS Teams synchronously per listed class time (3:00 – 4:50 PM, MW). Lecture slides and recordings will be posted to Canvas as references and for students who are unable to attend synchronously due to limitations or restrictions caused by COVID-19.

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 needed per credit hour each week. BC565 students should thus expect to spend ~8-12 hours on assignments and reading material each week.
- 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.

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.

Grades:

- Grades will be out of a total of 500 points from a total 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 quiz : 10 pts
 - 3 paper critiques (13 pts per assignment) : 39 pts
 - In-class discussion activities (5 pts per paper discussion): 15 pts
 - Module assessment: 36 pts(Module assessments will become available on Canvas during a scheduled time. These assessments are open book and open note with honor pledge – working independently, not giving or receiving any authorized assistance)
- 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 20 – Feb 3	Membrane dynamics and cell signaling	Chaoping Chen
Module 2	Feb 8 – Feb 24	Intracellular compartments, protein sorting and membrane traffic	Santiago Di Pietro
Module 3	Mar 1 – Mar 17	The Cytoskeleton	Steven Markus
Module 4	Mar 22 – Apr 7	The Cell Cycle	Jennifer DeLuca
	Apr 12-16	Spring break	
Module 5	Apr 19 – May 5	Cell Biology of Neurons	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.
- While preparing for paper discussion, students are highly recommended to critically read each manuscript by asking 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 (13 pts per critique; 39% 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?"** Also, 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: 13 pts for excellent, 10 points for good, 7 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)

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⁺⁺

Lecture 4 – signal integration

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

Class Schedule:

Date	Content	Assignments
Wed, Jan 20	Lecture 1: Introduction and Membrane Dynamics	Pre-module quiz due 1/20 at noon Pre-lecture reading of a review article on membrane diversity
Mon, Jan 25	Paper 1 discussion Lecture 2: protein hardware for signaling	Paper 1 critique due 1/25 at noon
Wed, Jan 27	Paper 2 discussion Lecture 3: second messengers	Paper 2 critique due 1/27 at noon
Mon, Feb 1	Paper 3 discussion Lecture 4: signal integration	Paper 3 critique due 2/1 at noon
Wed, Feb 3	Module review Q&A of the module	online module assessment

