BC565 - Molecular Regulation of Cell Function

CSU COVID Guidance
Covid protocol changed as of May 11, 2023, coinciding with the end of the Federal Covid-19 Public Health Emergency Declaration. For current guidance, visit the Centers for Disease Control’s About Covid-19 website. For local guidance, visit the Larimer County Health and Environment website. For Colorado State University offices outside of Larimer County, please consult your local health department.

If you have questions or concerns regarding Covid at Colorado State University, or if you need to report a positive Covid case, contact the CSU Public Health Covid line at 970-491-4600, or use the online Public Health Reporter on the Environmental Health Services’ Public Health website.

Instructors:
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TA:  Steven Graham, Steven.Graham@colostate.edu
9-10 am on Fridays at MRB 230

Resources / Background reading:

Teaching / Learning style / Venue:
- This course will encompass a mixture of lectures, written assignments, and instructor-led discussions of primary literature.
- Lectures and paper discussions will be in-person in AZ E210 3:00 – 4:50 PM on MW. Lecture slides and related materials will be posted to Canvas prior to class meetings.

Prerequisites and Expectations:
- Previous coursework in Molecular Cell Biology (equivalent to BC465)
- CSU Graduate School anticipates 3 additional hours of outside classwork needed per credit hour each week. BC565 students should thus be expected to spend ~8-12 hours on assignments and reading material each week.
- This course is designed for students who have previous wet lab experience and are actively participating in research projects. Those with no "real" lab experience will find the material 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 coming to class.
Student learning outcome and goals:
• Master the fundamental concepts regarding the molecular mechanisms underlying various cell functions. *The material presented in this class is not meant to be a reiteration of undergraduate coursework and assumes that you have already mastered the general concepts.*
• Be able to articulate and explain standard and state-of-the-art approaches used in the study of molecular and cellular biology. Learn how to interpret experimental results and how to design experiments to address scientific questions. The primary goal is to improve your ability to access, integrate, and evaluate literature.
• Be able to critically analyze/evaluate experimental data in order to draw a conclusion based on your own, independent assessment.
• Develop and improve communication (both oral and written) skills for effective and productive scientific discussions.

Grades:
• Grades will be determined from a total of 500 possible points from five modules taught throughout the semester, with each module being worth 100 possible points. There is NO comprehensive final exam.
• A typical point distribution for each module is shown below:
  o Pre-module quiz: 10 pts
  o 2 paper critiques (15 pts per assignment): 30 pts
  o In-class discussion activities (5 pts per paper discussion): 15 pts
  o Module assessment: 45 pts
• Letter grades will be determined at the end of the semester. We reserve the right to ascribe “+” or “-” to any letter grade.

Course organization:

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<th>Module #</th>
<th>Duration</th>
<th>Topic</th>
<th>Instructor</th>
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<tr>
<td>Module 1</td>
<td>Jan 17 – Jan 31</td>
<td>Cell membrane and signaling</td>
<td>Chaoping Chen</td>
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<td>Module 2</td>
<td>Feb 5 – Feb 21</td>
<td>Intracellular compartments, protein sorting and membrane traffic</td>
<td>Santiago Di Pietro</td>
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<td>Module 3</td>
<td>Feb 26 – Mar 20</td>
<td>The Cytoskeleton</td>
<td>Steven Markus</td>
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<td>Mar 11-15</td>
<td>Spring break within Module 3</td>
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<td>Module 4</td>
<td>Mar 25 – Apr 10</td>
<td>Nuclear Organization</td>
<td>Sarah Swygert</td>
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<td>Module 5</td>
<td>Apr 15 Woody Lecture</td>
<td>Cell Biology of Neurons</td>
<td>Soham Chanda</td>
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<td>Apr 17 – May 1</td>
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Instructions for paper reading and discussion:
• For the primary literature reading assignments, individual students will be tasked with describing a figure from each paper and will lead the discussion of that figure in class. Figures will not be preassigned to students. Therefore, every student needs to be prepared to present each figure of the article. Typically, the flow of the discussion will follow the order of the figures, but occasionally the order may be altered, or a particular figure may be skipped if superfluous.
• Students must also be prepared to answer questions about the background information for each paper. For example, if a particular paper employs a specific microscopy or next-gen sequencing technique, students are expected to understand the technique sufficiently to understand what the figures of the paper are describing.
• While preparing for paper discussion, students are highly recommended to critically read each manuscript and fully understand the methods and approaches. Additionally, students are encouraged to consider questions such as: (1) Are the controls included appropriate and sufficient? (2) Is data interpretation well justified? (3) are the conclusions fully supported by the presented data (4) Pros vs cons of other alternative approaches?

Guidelines for primary literature critiques (15 pts per critique; 30% of your total grade)
• For each module, three original research papers that are recently published will be posted to the Canvas. You can pick any two of them to write your literature critiques on.
• A critique of the papers to be discussed in class will be due to Canvas at 3pm of the class day and will be graded by the class GTA.
• Please target the overall length of your critiques to be between 400 and 600 words. Use Arial 12-point font with 1-inch margins. Each critique should contain the following key elements:
  A summary paragraph: The first paragraph (5-6 sentences) should start by describing the field and the related concepts/topics 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”.

In a typical manuscript review, the summary paragraph as described above would be followed with a specific list of items that support and clarify your assessment 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. Note that these bulleted points can be either positive (significant advancement/breakthrough) or negative (major flaw(s)/deficiencies in data interpretation or conclusions drawn). Do not simply point them out but rather justify them sufficiently in your own words.
Each critique should answer the central question: "Are the experimental rigor, novelty, presentation, and topic of the manuscript in question of sufficiently high quality? The written review must be your own thoughts. 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.
• 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: 15 pts for excellent, 13 points for good, 10 points for fair, and 0 points for incomplete or poor work.