Course Syllabus – BIOL 430

Course Information

Course Number: BIOL 430 WI24
Course Name: Cell Biology
Term: WI 2024
Start Date: 01/02/2024
End Date: 03/22/2024
Credits: 3.0

Meeting Days, Times, and Location

Tuesdays and Thursdays, 10:00-11:30am PT / 1:00-2:30pm ET
(See Calendar in Canvas for the most up-to-date schedule.)

Location

CA: Graduate Office Dining Room (Hazen Theory Building)
FL: C212

Course Managers

Role	Last Name	First Name	Email
Course Director	Droujinine	Ilia	idroujinine@scripps.edu | (858) 784-2907
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Course Description

This is a hybrid lecture/literature-based course that exposes students to important concepts and emerging issues related to cell biology. Cells are the fundamental unit of life. An appreciation for the underlying principles and complexities of the living cell is essential for any biomedical researcher. In particular, cell biology is the study of molecules, structural assemblies, and organelles in the context of the whole cell. The class will be presented with specific weekly topics that cover critical or emerging aspects of cell biology (see Class Lecture Schedule below). Each weekly topic will be presented on Tuesday by expert faculty to provide context for the students to understand critical aspects of cellular function highlighted below.

Thursday classes will involve student-led discussion on recent literature related to the weekly topic. Students will be asked to identify and discuss the strengths and weaknesses of papers discussed in the class, and to propose "Next Experiments" that arise from the work and the experimental means to address them. Written assignments will include the "Strengths/Weaknesses" and the "Next Experiments" for each paper discussed in class. Furthermore, students will take a final exam that covers the basics from each of the weekly topics as discussed in the faculty lectures.

Program Learning Outcomes

By the end of the program, students will have accomplished these objectives:
PLO1: Original Research – graduate students are expected to develop the skills critical for generating high-quality research output. This would include absorbing, recalling, and contextualizing scientific knowledge, evaluating scientific information and data, creating testable hypotheses and investigating hypotheses, mastering scientific tools and techniques, displaying ethical behavior, and receiving and giving feedback.
PLO2: Communication – graduate students are expected to demonstrate the oral, written, and media skills to effectively communicate the impact of a study or a body of work to the greater scientific community and to the public at large using a number of methods.
PLO3: Critical Thinking – graduate students are expected to develop a self-directed process to analyze information, form opinions or judgments, and use this process to improve the quality of their scientific thoughts, navigate problems, and make informed decisions.
PLO4: Intellectual Curiosity – graduate students are expected to acquire the capacity to build their intellectual curiosity and demonstrate problem solving approaches that serve their professional growth and ability to impact a field.
PLO5: Career and Professional Development – graduate students are expected to develop a variety of transferable skillsets throughout their graduate experience, including management and leadership, inclusiveness, resilience, scientific rigor, collaboration, accountability, time management, teamwork, networking, and career planning.

Course Learning Outcomes

By the end of this course, students will be able to:
CLO1: Establish a basic understanding of current emerging scientific fields pertaining to cell biology and to be able to critically evaluate the literature related to that field.
CLO2: Understand the strengths and limitations of various experimental approaches for studying cell structure and function.
CLO3: Judge when the stated scientific conclusions derived from original experimental data are justified, and when they are not justified.
CLO4: Devise alternative scientific approaches to allow more robust conclusions on specific cell biological questions.
CLO5: Identify and formulate important new questions that are inspired by specific scientific results, and design experiments to answer these questions.

CLO6: Develop and present succinct oral presentations describing the background of specific cell biology papers and their relationship to other work in the field.

Broad Objectives:

1) Students will gain an appreciation of exciting areas and emerging issues in cell biology research and the methods used to pursue them.
2) Students will learn how to critically and constructively read and review a paper.
3) Students will learn how new research projects emerge from existing literature.
4) Students will learn how to present critiques of papers from the primary literature, both orally and in writing.

Background Preparation (Prerequisites)

Most students will have taken a Cell Biology course (or the equivalent) as an undergraduate, but this is not required. Nonetheless, these students will find it helpful to read relevant background material for each class from the *Molecular Biology of the Cell* textbook (Alberts et al, 6th edition) as a refresher.

Course Materials

Required reading: One recent original research paper in the relevant area of cell biology will be provided for each Thursday class and will be the basis for the class discussion. The required reading list will be posted on the Canvas page.

Recommended Reading: One short, topical review to accompany each research paper will also be provided and posted on the website.

Useful to Consult: *Molecular Biology of the Cell* (Alberts et al, 6th Edition). Copies are available in the Graduate Office and the Library for anyone who needs to reference one. The Graduate Office may provide this textbook for anyone who requests it and doesn't already have one. *For students unfamiliar with cell biology methods, these are described in Chapters 8 and 9 of Alberts et al. Many of these methods will be integral to the course material.* In addition, chapters from this textbook have been suggested for the main topic of each class period. We recommend that you read this background, especially if you are new to Cell Biology.

Cell Biology Seminars

TSRI has a "Molecular Medicine Seminar Series". This is a major monthly seminar series on campus bringing eminent national and international scientists who speak about diverse Cell Biology topics. These seminars provide the very latest and most exciting developments in Cell Biology, many of which are still unpublished. Seminars are held on the 2nd and/or 4th Thursday of the month at 1 PM PST (4 PM EST). Attendance is strongly recommended and will be encouraged in class.

Course Requirements & Assignments

1) Class Paper Discussions: All students, not just the presenters, will be responsible for reading the Thursday discussion paper prior to class and should be prepared to discuss each figure and the strengths and weaknesses of the paper. Strengths might be important new insights emerging from the results, new methodologies and/or innovative application of existing methodologies, an innovative approach to addressing the question, the importance of the question being addressed, the integration of current and existing results to present a new model, etc. Weaknesses might be mis- or over-interpretation of presented data, lacking control experiments, sub-optimal choice of methodology. Note that a substantial portion of your grade will be based on class discussion and a demonstration that you a) have read and attempted to understand the paper, b) thought about the implications of the results and next experiments, and c) can articulate your thoughts on the paper's experiments and results.

2) Student Paper Discussion Team Presentations: Student teams (2 students each) will be responsible for leading the Paper Discussion for ~1 class (depending on enrollment numbers). Each team will prepare a short PowerPoint Presentation for the class. These presentations will be prepared with advice from the assigned faculty mentor. Each student team should plan meeting with the faculty mentor ~2 weeks prior to the assigned presentation date to discuss the paper and to prepare the presentation. Subsequent meetings will be defined by the faculty mentor and the students. The students' presentation will include an Introduction to the manuscript including previous work, the key Figures related to the manuscript, and discussion of the primary conclusions from the manuscript. The student team will lead the class discussion, eliciting comments from all members of the class to evaluate the data, its interpretation, the experimental approaches, validity of conclusions, etc.

3) Written "Strengths/Weaknesses" and "Next Experiments" due at each Thursday class: Each student will submit a written document on Canvas describing the "Strengths/Weaknesses" of the manuscript and one "Next Experiment" suggested for the assigned paper. This is due **before** the respective student-led discussion. The "Next Experiment" should produce an amount of data that would be expected to fit into one manuscript figure. The short description of each "Next Experiment" should include: a) a **rationale** for doing the experiment, b) a brief **description** of the experiment, including experimental methods, and c) the **expected outcome(s)** and reasons why they are expected. The description of the "Next Experiment" should be short so that together, the text for the "Next Experiment" is about ½ page of single-spaced printed text (11 point, Arial). Concise, focused descriptions that cover the points above will be rewarded. Inclusion of a diagram may be helpful but is not required.

4) Final Exam: A final exam will be given on the last day of the course. The questions from this exam will be derived from the faculty lectures given on the Tuesday of each week.

Attendance

Attendance is mandatory and a portion of the grade is based upon class participation. Unjustified class absence will be appropriately factored into the grade representing "participation in class discussions".

The "Next Experiment" must be submitted prior to the presentation of the paper to which they pertain. No late submission will be allowed, except under extenuating circumstances approved in advance by the course director. If a student does not submit the "next experiments" page for a particular class, the points for that portion of the material will be lost.

All students will be required to make the designated number of PowerPoint presentations (~1 depending on enrollment).

Grading

25%: **Written text for "Strengths/Weaknesses" and "Next Experiments", for each class discussion paper.**

Learning Purpose: Supports points 1, 2, 3, 4, 5 of learning outcomes, and allows assessment of mastery of course material**.**

25%: **Participation in class discussions of each paper**.

Learning Purpose: Supports points 1, 2, 3, 4, 5 of learning outcomes, involves active learning, and allows assessment of mastery of course material.

25%: **Short PowerPoint presentations for each Discussion Paper (Student Teams):** Each student will make 1 or 2 presentations during the course as described below.

Learning Purpose: Supports points 1-6 of learning outcomes, involves active learning and allows assessment of mastery of course material.

25%: **Final Exam**

Learning Purpose: Supports points 1 of learning outcomes, demonstrating a clear understanding of emerging topics in cell biology and the capacity to apply these concepts to address important scientific questions.

Late submissions of written assignments ("Next Experiments") will not be accepted.

Letter Grade	Grade Point	Numerical Range	Description	Learning Outcome
A	4.0	100-90	Superior Achievement	Exemplary
B	3.0	89-80	Satisfactorily demonstrated ability in field of study	Proficient
C	2.0	79-70	Below average,work not at level expected of a TSRI graduate student	Developing
F	0.0	69-below	Not acceptable	Fail

Scientific and Professional Ethics

The work you do in this course must be your own. You must be aware when you are building on someone else's ideas, including ideas of classmates, professors, and authors you read. You must explicitly acknowledge the ideas of others. Feel free to build on, react to, criticize, and analyze the ideas of others but, when you do, make it known whose ideas you are working with. The course instructors will address all questions concerning the line between others' work and the student's own work.

Expectations and Logistics

1) Student Paper Discussion Teams: The class will be divided into teams of two students each, who will present papers on specific weekly topics. These teams will rotate over the duration of the course, such that every team will lead at least 1 discussion. *The student team assigned to each paper will meet with the relevant faculty discussant as a team at least 1-2 weeks before the paper is presented* to get help and suggestions in identifying and understanding the literature that will be used to prepare the "Introduction" and the "Conclusions", and to select the key figures or parts of figures to present for class discussion. It is critical that students contact the faculty moderator early in the course to coordinate schedules as faculty can have busy travel schedules. The student teams will prepare the PowerPoint slides of the Introduction, Figures, and Conclusions for each class (see below), and should plan to send their PowerPoint presentation to the faculty discussant at a prearranged time before their presentation (at least 3 days), so the faculty can give them feedback for modifying it, if necessary.

2) Class Format: At the beginning of the Thursday discussion, one member of each student team will give an Introduction (~10-20 minutes; PowerPoint format) to provide the specific background material for the discussion paper and frame the problem being studied (i.e., the preceding experiments leading to this particular study and the relevance of this problem to the Cell Biology topic of the week). Next, the student team will project slides of selected figures or parts of figures from the paper and lead the class discussion. All students should be prepared to actively contribute to this ~60 min discussion, including identifying the main strengths and weaknesses of the experiments. After the figures have been discussed, the second member of the student team will make a short (~10 min) presentation of the Conclusions, in which the

overall conclusion, approaches used, and conflicting conclusions from other studies will be presented. Enrollent permitting, class TAs will serve as the student team members for the Model Paper Discussion Class so that students will have an example of the format (see above).

3) Class Preparation: Every student in the class will be responsible for reading the day's discussion paper prior to class. Every student should be prepared to discuss each figure. **If the "Next Experiment" assignment is not received prior to the start of class, the assignment will be considered missing, and a zero score will be received for that assignment**. A short review(s) related to the topic of the discussion paper will be provided for most papers on the reading list. More basic background may be obtained by reading relevant sections of the textbook, *Molecular biology of the Cell* (Alberts et al, 6th edition).

Strengths/Weaknesses and Next Experiments: For every Thursday class, students will submit a written document describing the strengths/weaknesses of the manuscript and one "Next Experiment" for the paper of the day (see above for details). These will be graded by the faculty discussant for that class, and the composite scores from these assignments (for a total of 15 classes) will comprise this portion of the course grade. *No late submission of these "Next Experiments" will be allowed, except under extenuating circumstances approved, in advance, by the course director (see grading).* If you do not submit the "Next Experiments" page for a particular class your grade will be diminished by 1/11th.

4) First Two Classes of the Course: The goal of these first two classes is 1) to provide an Introduction to the field of Cell Biology and to define the expectations of the course, and 2) to provide a clear sense of the class format by providing a guided template of a Paper Discussion Class. The first class will be didactic, taught by the Course Director, and the second class will be a Model Paper Discussion presented by the two TAs, enrollment permitting. A discussion paper will be assigned for the Model Paper Discussion Class (to be read by all class members beforehand), but our two student TAs (instead of class members) will perform the job of the student team. *However, all students will still be required to submit their "Next Experiments" assessment at the beginning of class*.

5) Selection of Papers/Student Teams: The discussion paper for each class (together with a related short review) will be posted on the Canvas page by December 14, 2023. Student teams and assigned papers will be determined in the first class. Everyone will have the chance to present ~1 time, depending on enrollment.

Final Exam

The exam will be administered on March 21st, 2024 and will include questions related to the topics discussed in the course.

CELL BIOLOGY CLASS LECTURE SCHEDULE:

Week 1- Organelle Dynamics (Danielle Grotjahn – CA)

Tues Jan 2nd, 2024 – Seminar

Thurs Jan 4th, 2024 – Manuscript Discussion

Manuscript: Connor OM, Matta SK, Friedman JR. (2023) "An intermembrane space protein facilitates completion of mitochondrial division in yeast (PMID: 37034761)

Review: Kraus F et al. (2021) "Function and regulation of the divisome for mitochondrial fission" (PMID: 33536648)

Week 2 – Proteostasis (Luke Wiseman - CA)

Tues Jan 9th, 2024 – Seminar

Thurs Jan 11th, 2024 – Manuscript Discussion

Manuscript: Samelson AJ et al. (2023) "CRISPR screens in iPSC-derived neurons reveal principles of tau proteostasis" (PMID: 37398204)

Review: van der Kant R, Goldstein LSB, Ossenkoppele R. (2020) "Amyloid-β-independent regulators of tau pathology in Alzheimer disease" (PMID: 31780819)

Papanikolopoulou K and Skoulakis EMC (2020) "Altered Proteostasis in Neurodegenerative Tauopathies" (PMID: 32274757)

Week 3 – Stress Signaling and Redox Regulation (Michael Bollong – CA)

Tues Jan 16th, 2024 – Seminar

Thurs Jan 18th, 2024 – Manuscript Discussion

Manuscript: Kang PY et al. (2021) "Non-canonical glutamate-cysteine ligase activity protects against ferroptosis" (PMID: 33357455)

Review: Jiang et al. (2021) "Ferroptosis mechanisms biology and role in disease" (PMID: 33495651)

Week 4 – Systemic Homeostasis (Ilia Droujinine – CA)

Tues Jan 23rd, 2024 – Seminar

Thurs Jan 25th, 2024 – Manuscript Discussion

Manuscript: Pierre JF et al. (2023) "Peptide YY: A Paneth cell antimicrobial peptide that maintains *Candida* gut commensalism" (PMID: 37535745)

Review: Manning S and Batterham RL. (2013). "The role of gut hormone peptide YY in energy and glucose homeostasis: twelve years on." (PMID: 24188711)

Week 5 – Endolysosomal Trafficking in Neuronal Function and Neurodegeneration (Sandra Encalada – CA)

Tues Jan 30th, 2024 – Seminar

Thurs Feb 1st, 2024 – Manuscript Discussion

Manuscript: Peter ATJ et al. (2022) "METALIC reveals interorganelle lipid flux in live cells by enzymatic mass tagging" (PMID: 35654841)

Discussion: Guillén-Samander A and De Camilli P. (2023) "Endoplasmic reticulum membrane contact sites, lipid transport, and neurodegeneration. (PMID: 36123033)

Week 6 – Cellular Differentiation (Luke Lairson – CA)

Tues Feb 7th, 2024 – Seminar

Thurs Feb 9th, 2024 – Manuscript Discussion

Manuscript: Wu et al. 2017 "Interspecies Chimerism with Mammalian Pluripotent Stem Cells" (PMID 28129541)

Review: Wu et al. 2016 "Stem cells and interspecies chimeras" (PMID 27905428)

Week 7 – Immune Cell Biology (Laura Solt – FL)

Tues Feb 13th, 2024 – Seminar

Thurs Feb 15th, 2024 – Manuscript Discussion

Manuscript: Soerens AG et al. (2023) “Functional T cells are capable of supernumerary cell division and longevity” (PMID: 36653453)

Review: McLane LM, Abdel-Hakeem MS, Wherry EJ. (2019) “CD8 T cell exhaustion during chronic viral infection and cancer” (PMID: 30676822)

Recent News & Views: Kriebs A (2023) “T cells proliferate beyond organismal lifespan” (https://doi.org/10.1038/s43587-023-00376-3); Nature Research Briefings (2023) “Immune cells’ ability to persist and replicate long outlives species lifespan” (doi: https://doi.org/10.1038/d41586-022-04529-z)

Week 8 – Cancer Cell Biology (Michalina Janiszewska – FL)

Tues Feb 20th, 2024 – Seminar

Thurs Feb 22nd, 2024 – Manuscript Discussion

Manuscript: Girish V, Lakhani AA et al. (2023) “Oncogene-like addition to aneuploidy in human cancers” (PMID: 37410869)

Review: Hanahan D. (2022) “Hallmarks of cancer: new dimensions” (PMID: 35022204)

Week 9 – Surfaceome and Glycocalyx (Peng Wu – CA)

Tues Feb 27th, 2024 – Seminar

Thurs Feb 29th, 2024 – Manuscript Discussion

Manuscript: Laughlin ST et al. (2008) “In vivo imaging of membrane-associated glycans in developing zebrafish” (PMID: 18451302)

Review:

Week 10 – Neuronal Cell Biology (Giordano Lippi – CA)

Tues March 7th, 2024 – Seminar

Thurs March 9th, 2024 – Manuscript Discussion

Manuscript: Veeraraghavan P et al. (2023) “Dynamic subtype- and context-specific subcellular RNA regulation in growth cones of neocortical projection neurons” (doi: https://doi.org/10.1101/2023.09.24.559186)

Review: Bourke AM, Schwarz A, Schuman EM. (2023) “De-centralizing the central dogma: mRNA translation in space and time” (PMID: 36669490)

Week 11 – Cell Biology of Anxiety (Hugh Rosen – CA)

Tues March 14th, 2024 – Seminar

Thurs March 16th, 2024 – Manuscript Discussion

Manuscript: Zhu Y et al., (2023) “Nucleus accumbens D1/D2 circuits control opoid withdrawal symptoms in mice” (PMID: 37561576)

Review: Kim CK, Adhikari A, Deisseroth K. (2017) “Integration of optogenetics with complementary methodologies in systems neuroscience” (PMID: 28303019).

Exam

Thu March 21, 2024

Course Summary:

Date	Details
Mon Jan 1, 2024	No Class (New Year's Day day off)
Tue Jan 2, 2024	Cell Biology (Organelle Dynamics (Danielle Grotjahn – CA))
Thu Jan 4, 2024	Cell Biology (Manuscript Discussion - Grotjahn)
	Next Experiment 1
Tue Jan 9, 2024	Cell Biology | Proteostasis (Luke Wiseman - CA)
Thu Jan 11, 2024	Cell Biology | Proteostasis | Manuscript Discussion (Luke Wiseman - CA)
	Next Experiment 2
Mon Jan 15, 2024	No Class (Martin Luther King Jr. Day)
Tue Jan 16, 2024	Cell Biology | Stress Signaling and Redox Regulation (Michael Bollong – CA)
Thu Jan 18, 2024	Cell Biology (Manuscript Discussion - Bollong)
	Next Experiment 3
Tue Jan 23, 2024	Cell Biology | – Endolysosomal Trafficking in Neuronal Function and Neurodegeneration (Sandra Encalada – CA)
Thu Jan 25, 2024	Cell Biology (Manuscript Discussion - Encalada)
	Next Experiment 4
Tue Jan 30, 2024	Cell Biology | Surfaceome & Glycocalyx (Mia Huang – CA)

Thu Feb 1, 2024	Cell Biology (Manuscript Discussion - Huang)
	Next Experiment 5
	Next Experiment 5
Tue Feb 6, 2024	Cell Biology | Cellular Differentiation (Luke Lairson – CA)
Thu Feb 8, 2024	Cell Biology (Manuscript Discussion - Lairson)
	Next Experiment 6
Tue Feb 13, 2024	Cell Biology (Immune Cell Biology - Laura Solt)
Thu Feb 15, 2024	Cell Biology (Manuscript Discussion - Solt)
	Next Experiment 7
Mon Feb 19, 2024	No Class (President's Day)
Tue Feb 20, 2024	Cell Biology | Cancer Cell Biology (Michalina Janiszewska – FL)
Thu Feb 22, 2024	Cell Biology (Manuscript Discussion - Janiszewska)
	Next Experiment 8
Tue Feb 27, 2024	Cell Biology (Cell Biology of Ozanimod - Hugh Rosen)
Thu Feb 29, 2024	Cell Biology (Manuscript Discussion - Rosen)
	Next Experiment 9
Tue Mar 5, 2024	Cell Biology | Systemic Homeostasis (Ilia Droujinine - CA)
Thu Mar 7, 2024	Cell Biology (Manuscript Discussion - Droujinine)
	Next Experiment 10
Tue Mar 12, 2024	Cell Biology Neuronal Cell Biology (Giordano Lippi – CA)
Thu Mar 14, 2024	Cell Biology (Manuscript Discussion- Lippi)
	Next Experiment 11
Tue Mar 19, 2024	Cell Biology
Thu Mar 21, 2024	Final Exam