BIO544: Laboratory in Diseases of the Cytoskeleton

Meeting time: Tuesdays and Thursdays, 3-4:15 pm

Meeting location: TBD, initially over Zoom

Course hours: 3

Instructors:

Kevin Slep	402 FordhamHall	kslep@bio.unc.edu	919-962-4858

Pronouns: he, him, his

Steve Rogers	421 Fordham Hall	srogers@bio.unc.edu	919-843-7788

Pronouns: he, him, his

Teaching Assistant:

Allie Skinkle	aaskinkle@live.unc.edu

Overview:

Biol 544 is a laboratory course offering students an opportunity to conduct cutting-edge biochemical, biophysical, and cell biological research on the cytoskeleton, with a focus on the cell biology of lipid droplet (LD) formation and dynamics. LDs are fat storage organelles integral to energy homeostasis and a wide range of cellular processes; evidence from human studies and animal models suggests that lipid accumulation in the heart, skeletal muscle, pancreas, liver, and kidney play an important role in the pathogenesis of heart failure, obesity and diabetes. Students in this three-credit course will spend class time engaging with the scientific literature to learn relevant background material about LDs, how they interact with the cytoskeleton, and their role in disease and develop hypotheses that will be tested during the semester. Students will work with the instructors and peers in groups to design experiments to test these hypotheses using approaches that build off ongoing research in the labs of two UNC faculty members and interpret experimental data to make conclusions. Students in the course will learn how to perform techniques commonly used in biochemical research, how to evaluate and discuss possible approaches to investigate the biological problem of study, and how to report their results at the end of the semester. Students will prepare detailed notes in their laboratory notebooks, and as their final exam, they will submit their laboratory books and each student will produce and present a poster on their collaborative work.

Target Audience: This course is designed for Undergraduates with an interest in Biochemistry and Cell Biology. Students must have completed Biol 205 Cell and Developmental Biology and Biochemistry (CHEM 430) or be excused from the Chem 430 requirement by permission of the instructors.

Course Goals and key learning objectives:
The course goals are to train students in the process of independent scientific research in the context of a laboratory class. Students will gain training in analysis of the published literature, formation of a hypothesis, investigating and designing modes of testing their hypotheses, training in theory, application, and limits of various techniques and the biological, physical, and chemical bases for these techniques, how to blind experiments and reproduce findings with rigor, how to analyze and quantitate data, and how to write-up and present data and conclusions in written and verbal form. Learning objectives include: be able to read and critique published scientific literature, be able to generate next-step hypotheses and means to test those hypotheses, effectively design and execute an experiment with rigor and reproducibility, effectively analyze, quantitate, and present data.

Textbook: The Digital Cell: Cell Biology as a Data Science (2020) by Stephen J Royle (https://www.cshlpress.com/default.tpl?cart=159692324558680458&fromlink=T&linkaction=full&linksortby=oop_title&--eqSKUdatarq=1282)

Attendance: Attendance at scheduled meeting times is required. Students should anticipate approximately 10 hours per week of research conducted either in the laboratory and/or remote data analysis in addition to didactic work. If students cannot attend an instruction period because of another commitment such as an interview for professional advancement, an arrangement can be made in advance with the instructor. Contact the instructors by email with the date you will have to miss, preferably in advance of that date. Students are excused in case of illness. The instructor must be informed of the circumstance to avoid losing participation points. Access to equipment may be a limiting factor which will require coordination with the instructional team and adjusting of hours. Everyone must try their best, within reason, to accommodate complex scheduling. Once an agreed-upon experimental time is set up, adherence to that schedule is critical/mandatory and should only be adjusted with sufficient advance notice (preferably 24 hours).

Pandemic Teaching Mode Statement: We are facing unprecedented challenges this school year for teaching at UNC that impact both students and faculty. This semester, UNC is offering a mix of in-person and online teaching. **This class has been designated as a hybrid course per official UNC policy.** It is possible that conditions on campus might change during this semester and create further challenges. As such, this course has been designed to reflect this very real possibility. Our guiding principles are fairness, flexibility, accessibility, and educational needs. Where possible we delineate the reasoning behind these changes for transparency. We ask that you recognize that there is a wide diversity of student and instructor situations during this time that will all need to be accommodated and that situations could change rapidly. We may choose to revisit some of these approaches as needed and will be clear about any changes in advance. Overall, expect the course to be a blend of remote and active in-person investigation and learning that can dynamically adjust to suit 1) the needs and level of comfort of

individual students and the teaching team, and 2) fluctuations in the status of the pandemic and UNC's official response to the challenges the pandemic presents.

Diversity, Equity, and Inclusivity: It is our intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let us know so that we can make arrangements for you.

Accessibility Statement:
As noted in the Diversity Statement, student accessibility and ability to engage in and optimize involvement in this laboratory course is a key goal in our department and thus we strive to enable accessibility. If you experience limited access to any component of this laboratory course, we request that you inform the instructors so that they can work to remove any unforeseen barrier to your access.

Pre-course assessment survey:
Each student is expected to complete the pre-course assessment survey during the first week of class. The link is here:
https://unc.az1.qualtrics.com/jfe/form/SV_5j7MWSv8zyaqdXD
Students are also expected to complete a post-course survey in November. LInks for that survey will be provided at a later date.

Grading:

Grading Scale: Grades will be determined from a 100-point scale (see relative breakdown of the contribution of these points from the respective percentages listed below). Final semester letter grades will be assigned based on the total number of points for the entire semester: A 93-100; A- 90-92; B+ 87-89; B 83-86; B- 80-82; C+ 77-79; C 73-76; C- 70-72; D+ 66-69; D 60-65; F <60. A curve will be used ONLY if the OVERALL class grade average is <75. Exam questions will be based on class meetings and assigned readings. **Grades will not round up**. B= 83, NOT 82.96.

Weekly participation in lab activities and group discussion: Participation grades will depend on discussion of answers to homework assignments and instructor questions in lecture and on active participation in laboratory exercises. 30% of final grade.

Homework assignments: Assignments will be designed to help students understand the research problem being investigated. Assignments will include reading primary research papers,

preparing descriptions and presentations on the papers, answering questions posed by the instructors, and solving representative problems. 10% of final grade.

Weekly laboratory plan: Each student will prepare a work outline for each lab period in their individual laboratory book to be examined before starting laboratory work. Students are encouraged to collaborate to produce the final work plan but each student must create their own initial work plan. 5% of final grade.

Unit report: A report on the results of Units 1, 2, and 3 will be submitted within 1 week of completing each unit. This will include 1) an introduction section, 2) a results section including figures and tables representing the experimental design used and the resulting data and 3) a discussion section summarizing the relevance of the result to the rest of the project. Students are expected to share data with their lab partners but they must prepare their own reports including their own figures and tables even though the figures and tables will have the same information as their lab partners. Students are encouraged to discuss the interpretation of their results with any member of the class and students may be requested to share data and interpretations with other class members by the instructor. See Course Information on Sakai site for instructions on how to prepare lab reports. 30% of final grade (10% each).

Final report: At the end of the semester, each student will prepare a poster on the results of the full semester. The poster will have the same format used for directed undergraduate research projects (Biol 395), which will have a similar content as the Unit reports, but will be condensed. The students will then present the posters during the Final Exam period. The rules on collaboration are the same as for Unit reports. The final report will be submitted at the beginning of exam week, TBA. **This report will be prepared outside of the final exam period but it will serve as the final exam.** 25% of final grade.

Penalty for late work: All homework, proposals and research reports must be ready to be handed in at the start of class on the day it is due. Work handed in late but within 24 hours of the due date will be graded for 50% of the points. Work submitted later will not be graded. Exceptions can be made in unusual circumstances by arrangement (email to instructor, preferably **before** due date).

Regrade requests: Lab reports and homework: Submit graded file with grader's comments to the instructor. Explain your complaint in writing on a separate piece of paper or in an email. You can submit the complaint by email with the graded PDF attached. The instructor reserves the right to regrade the entire paper, not just evaluate your complaint.

Publication of results: The work conducted in this laboratory course may be submitted by the instructors for publication in a peer reviewed journal. Students that successfully completed the course and contributed data to the manuscript will gain authorship on the manuscript should they agree to it. Because manuscript publication may occur far in the future, it is important that students who want authorship provide the instructors with email addresses with which we can

contact them years in the future as author consent is critical for publication of the manuscript. Prior to submission or resubmission of an article, if a student does not respond in a timely manner to provide or deny their consent to publish, then instructors and corresponding authors of the manuscript reserve the right to remove that student from the list of authors.

Timeline: This is a suggested timeline. It is essential to be time-flexible in the context of a laboratory course. Therefore, the instructors reserve the right to modify the timeline as the course progresses.

Schedule:
The semester will be divided into three Units each four weeks duration. The instructors will work with the students enrolled in the course to chart the direction and plan experiments for each unit.

WEEK	EXPERIMENT/ACTIVITY	ASSIGNMENT DUE BEFORE CLASS
UNIT 1		
Week 1: 8/11, 8/13	8/11: Introduction to the course 8/13: Discussion of Guo et al. 2008 and present hypotheses to the group.	8/13: Read Guo et al. 2008, Prepare 3 hypotheses to test experimentally. Watch videos about LDs by Farese & Walther. https://www.ibiology.org/biochemistry/lipid-droplets/#part-1
Week 2: 8/18, 8/20	8/18: Introduction to microscopy and image analysis. Refine hypotheses and assign supporting literature reading. 8/20: S2 cell culture, drug treatments, RNAi, and cellular imaging.	8/18: Read chapters 1-3. 8/20: Read chapter 4. Perform image analysis of LDs in fly cells.
Week 3: 8/25, 8/27	Experimental design, execution, analysis, and team meetings.	8/25: Watch S2 cell methods video.
Week 4: 9/1, 9/3	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 5: 9/8, 9/10	Experimental design, execution, analysis, and team meetings. Prepare experimental outline for Unit 2	Reading assignments to be announced.
UNIT 2		
Week 6: 9/15, 9/17	Experimental design, execution, analysis, and team meetings.	Submit Unit 1 report. Reading assignments to be announced.

Week 7: 9/22, 9/24	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 8: 9/29, 10/1	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 9: 10/6, 10/8	Prepare experimental outline for Unit 3	Reading assignments to be announced.
UNIT 3		
Week 10: 10/13, 10/15	Experimental design, execution, analysis, and team meetings.	Submit Unit 2 report. Reading assignments to be announced.
Week 11: 10/20, 10/22	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 12: 10/27, 10/29	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 13: 11/3, 11/5	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 14: 11/10, 11/12	Experimental design, execution, analysis, and team meetings.	Reading assignments to be announced.
Week 15: 11/17, 11/19* = Final Exam Date (meet at noon)	Experimental design, execution, analysis, and team meetings. Data storage and archiving.	Reading assignments to be announced.
Finals week (TBA)	Present poster.	Submit Unit 3 report. Poster assignment.