Course Syllabus – TRBIO 400

Course Information

Course Number: TRBIO 400 WI19
Course Name: Technologies Across Scale
Term: WI 2019
Start Date: 01/04/2019
End Date: 03/22/2019
Credits: 3.0

Meeting Days / Times

Mondays, 3:00-4:00pm PST/ Wednesdays, 2:00-5:00pm PST
(See Calendar in Canvas for the most up-to-date schedule.)

Locations

Monday: Graduate Office (Hazen Theory Building) Dining Room
Wednesday: Various Locations (Community Teaching Lab, Room 140, 3040 Science Park; Core Facilities)

Course Manager

Role	Last Name	First Name
Instructor	Wittenberg	Curt
Instructor	Ward	Andrew
TA	Cottrell	Christopher

Course Description

Technologies Across Scale introduces students to both the theoretical underpinnings and practical applications of powerful contemporary research technologies employed by research scientists across disciplines. The course is designed to arm students with skills necessary to implement these technologies in their research and to critically evaluate data generated through their application in the literature. Technologies covered in the course include flow cytometry, light microscopy, image analysis, EM structure determination, DNA sequencing and analysis, and metabolomics. These technologies will be applied to the analysis of Peripheral Blood Mononuclear Cells (PBMCs) and the HIV envelope glycoprotein.

Program Learning Outcomes

By the end of the program, students will have accomplished these objectives:
PLO1: Published research story.
PLO2: Generate creative approaches and methodologies for complex scientific questions.
PLO3: Master a potent set of technical research skills.
PLO4: Possess strong communication skills.

Course Learning Outcomes

Upon completion of this course students will be able to:
CLO1: Be able to explain the theoretical underpinnings of multiple cutting-edge technologies studied in the course.
CLO2: Know when to apply each of the technologies to address experimental questions.
CLO3: Have hands-on experience with, or will have knowledge of, the techniques necessary for preparation of samples for analysis by each of the technologies.
CLO4: Have hands-on experience with, or a general knowledge of, the procedures necessary to derive data from the application of the technologies in the course of their research.
CLO5: Be able to manipulate data derived from each of the techniques to provide useful information regarding the experimental sample being examined.
CLO6: Be prepared to effectively collaborate with experts in the technologies to derive useful experimental information or pursue more specific experience to directly apply the technologies to experimental problems.

Background Preparation (Prerequisites)

There are no courses that are prerequisites for this course. Students are expected to have or acquire a general undergraduate level background in cell and molecular biology.

Required Course Materials

N/A

Course Requirements and Assignments

Assessment of student performance will be evaluated via biweekly quizzes (25%) and laboratory reports (50%) and a final examination at the culmination of the course (25%). The laboratory reports will focus on reporting of activities and data generated from the application of the technologies. Quizzes will largely cover lecture material which will focus largely on the theoretical aspects of the technology under study. A comprehensive final examination will be taken at the end of the course to evaluate the ability to integrate various technologies learned during the course.

Attendance Statement

Students are expected to attend all classes. Students who are unable to attend class must seek permission for an excused absence from the course director or teaching assistant. Unapproved absences or late attendance for three or more classes may result in a lower grade or an "incomplete" for the course. If a student needs to miss a class, they should arrange to get notes from a fellow student and is strongly encouraged to meet with the teaching assistant to obtain the missed material. Missed extra-credit quizzes will not be available for re-taking.

Scientific and Professional Ethics

The work you do in this course must be your own. 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. You must explicitly acknowledge when your work builds on someone else's ideas, including ideas of classmates, professors, and authors you read. If you ever have questions about drawing the line between others' work and your own, ask the course professor who will give you clear guidance. Exams must be completed independently. Any collaboration on answers to exams, unless expressly permitted, may result in an automatic failing grade and possible expulsion from the Graduate Program.

Technology Requirements and Support

For issues related to Canvas, please contact the Graduate Office by email at: gradprgm@scripps.edu or by phone at: 858-784-8469.

Course Grading

Grading is in accordance with the academic policies of the Skaggs Graduate School.

Grade Point	Letter Grade	
4.00	A	Outstanding achievement. Student performance demonstrates full command of the course subject matter and evinces a high level of originality and/or creativity that far surpasses course expectations.
3.67	A-	Excellent achievement. Student performance demonstrates thorough knowledge of the course subject matter and exceeds course expectations by completing all requirements in a superior manner.
3.33	B+	Very good work. Student performance demonstrates above-average comprehension of the course subject matter and exceeds course expectations on all tasks as defined in the course syllabus. There is notable insight and originality.

3.00	B	Satisfactory work. Student performance meets designated course expectations and demonstrates understanding of the course subject matter at an acceptable level.
2.67	B-	Marginal work. Student performance demonstrates incomplete understanding of course subject matter. There is limited perception and originality.
2.33	C+	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.
2.00	C	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.
0.00	I	Incomplete is assigned when work is of passing quality but is incomplete for a pre-approved reason. Once an incomplete grade is assigned, it remains on student's permanent record until a grade is awarded.
0.00	P	Satisfactory work. Student performance demonstrated complete and adequate understanding of course subject matter. Course will count toward degree.
0.00	F	Unacceptable work/Failure. Student performance is unacceptably low level of knowledge and understanding of course subject matter. Course will not count toward degree. Student may continue in program only with permission of the Dean.
0.00	W	Withdrew from the course with Dean's permission beyond the second week of the term.

- All courses will be recorded and maintained in the student's permanent academic record; only courses that apply towards the degree will appear on the academic transcript. Non-credit or audited courses will not appear on the transcript.
- 4 core courses taken for a letter grade (pass = B- or higher for a core course)
- 2 elective courses taken pass/fail (pass = A, B, C for an elective)

Because students are encouraged to take electives outside their area of expertise, a "C" letter grade is passing.

Course Summary:

Date	Details
Fri Jan 4, 2019	Introduction to Technologies Across Scale - Wittenberg / Ward

Mon Jan 7, 2019	Introduction to Flow Cytometry - Saluk
Wed Jan 9, 2019	LAB: Flow Cytometry Acquisition and Data Analysis - Saluk
Mon Jan 14, 2019	Advanced Multicolor Analysis and Applications - Saluk
Wed Jan 16, 2019	LAB: Cell Sorting Applications and Experimental Design Concepts - Saluk
Mon Jan 21, 2019	Introduction to Nucleic Acid Sequencing - Head / Domissy
	Lab Report - Flow Cytometry
Wed Jan 23, 2019	LAB: DNA Sequencing for VDJ Rearrangements - Head / Domissy
Mon Jan 28, 2019	DNA Sequence Data Analysis - Head / Domissy
Wed Jan 30, 2019	LAB: DNA Sequence Analysis for identification of VDJ Rearrangements - Head / Domissy
Mon Feb 4, 2019	Microscopy Basics, Sample Preparation, and Modes of Imaging - Henderson
	Lab Report - Nucleic Acids
Wed Feb 6, 2019	Immunolabeling of Cells and Slide Preparation for Fluorescence Microscopy - Henderson
Mon Feb 11, 2019	Fluorescence-based Imaging, Molecular Localization, and Advanced Light Microscopy - Henderson
Wed Feb 13, 2019	LAB: Confocal Laser Scanning Microscopy (of slides prepared during Lab 1) - Henderson
Fri Feb 15, 2019	Quantitative Imaging, Image Processing, and Image Analysis - Henderson
Mon Feb 18, 2019	President's Day Holiday
Wed Feb 20, 2019	LAB: Quantitative Imaging, Image Processing and Image Analysis
	Lab Report - Microscopy
Thu Feb 21, 2019	Midterm Exam
Fri Feb 22, 2019	LAB: Segmentation based localization / co-localization analysis (of images collected during lab 2) - Henderson
Mon Feb 25, 2019	EM Structure Analysis and Data Collection - Cottrell / Ward
	Lab Report - Image Analysis
Wed Feb 27, 2019	LAB: EM Structure Analysis and Data Collection - Cottrell / Ward
Mon Mar 4, 2019	EM Structure Analysis - Cottrell / Ward
Wed Mar 6, 2019	LAB: EM Structure Analysis - Cottrell / Ward
Mon Mar 11, 2019	Basics of Mass Spectrometry - Siuzdak
	Lab Report - EM Structure
Wed Mar 13, 2019	LAB: Metabolomics Data Acquisition - Siuzdak
Mon Mar 18, 2019	Mass Spectrometry-Based Metabolomics - Siuzdak
Wed Mar 20, 2019	LAB: Metabolomics Data Analysis - Siuzdak
Fri Mar 22, 2019	Lab Report - Mass Spectrometry
	Final Exam