Mol Biol 254C: Genetic approaches to the study of metabolism

Instructors
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Time and Zoom links
Faculty/student sessions.
Zoom links for all sessions will be provided.
Tuesdays 10am-12pm, Fridays 10am-12pm
First session – Tuesday, January 12

Student-only sessions
Zoom links for all sessions will be provided.
Mondays/Thursdays 10am-12pm
First session - Thursday, January 14

Objective
This section is designed to introduce students to genetic concepts and approaches used to address cell metabolism in yeast, mice, and humans

- read and understand primary research articles in the area of genetics
- analyze experimental design, results and conclusions critically
- discuss how to solve biological problems creatively

General Format
The course is composed of nine 2 hr class meetings with faculty instructors and eight student discussion meetings in the day preceding each class. The first meeting will consist of assignment of student discussion leaders and an introductory lecture on yeast genetics. Following this session, each pair of student discussion and faculty-student class meetings will center around one research article.

Specific Format
Students are expected to have read the paper and have carefully considered the important advances in the paper, the approaches and data in all figures (including supplemental figures). During the faculty-student classes, all students are expected to be prepared to address any of the figures.

For each paper, 2 student discussion leaders will be assigned in the first meeting. Each student will be asked to volunteer as a discussion leader for at least two papers (preferably one paper on yeast and one on a mammalian system).

The leaders will direct the discussions at both the student-only and the faculty-student meetings. Student meetings should be an initial group consideration of the paper, students should work together to understand necessary background material, experimental design and approaches, results, conclusions, significance and next steps.
Faculty-student meetings: the discussion leaders are expected to present the necessary background material and to prepare a powerpoint with slides for the background presentation and for each figure (and any supplemental figures selected at the student-only meeting as worth discussing). Discussion leaders are also expected to lead a discussion of the significance of the work and what follow-up lines of investigation would be worth pursuing.

At the faculty-student class, the discussion leaders will present the background material. Students will then be chosen at random by the instructors to present each figure. Key to figure presentation will be: (1) to articulate the question the authors are addressing and why it is important, (2) to provide the appropriate background and context to the experiment, (3) to discuss the experimental approaches and critically evaluate results obtained, and (4) to summarize the main findings and conclusions. The final 15 minutes of each class will be reserved for the discussion leaders to engage the group in consideration of the overall significance of the work and what follow-up experiments should be pursued.

Class attendance
Mol Biol 254 should be considered a priority; attendance at all meetings is required.

Grades
Grades will be assigned based on class participation (50%) and a written exam (50%) to be given at the end of the class.

An open-book exam will be given on Feb. 12, the last day of class. The exam will consist of questions that ask you to interpret data or design experiments based on the studies presented in the class. The exam will be divided into two sections (50 points each), one addressing the papers on yeast and the other addressing papers on mammals.

Participation will be assessed based on the following criteria:
- On-time attendance
- Active participation in discussion of all figures, significance and next steps (not just assigned presentations).
- Ability to succinctly and accurately describe experiments and explain figures
- Ability to provide critical insight into the methodological soundness and significance of the experiments
- Ability to provide original insight into experimental implications and unanswered questions and point out issues/problems with the study.

Midcourse feedback
In the third week of the course the faculty instructors will meet with each student individually to provide feedback on the participation criteria.
PAPERS

All papers posted in CCLE according to session number.

Session 1
Tuesday, January 12
Course logistics; introductory lecture on yeast genetics

Reading
Yeast: an experimental organism for 21st Century biology.
Botstein D, Fink GR.

Session 2
Students only: Thursday, January 14
Faculty/students: Friday, January 15

Discussion paper
Engineering complex synthetic transcriptional programs with CRISPR RNA scaffolds.
Zalatan JG, Lee ME, Almeida R, Gilbert LA, Whitehead EH, La Russa M, Tsai JC, Weissman JS, Dueber JE, Qi LS, Lim WA.

Review
Engineering Cellular Metabolism.
Nielsen J, Keasling JD.

Session 3
Students only: Monday, January 18
Faculty/students: Tuesday, January 19

Discussion paper
Natural Diversity in Pentose Fermentation Is Explained by Variations in Histone Deacetylases.
Tamari Z, Barkai N.

Review
Glucose repression in Saccharomyces cerevisiae.

Session 4
Students only: Thursday, January 21
Faculty/students: Friday, January 22
**Discussion paper**  
*Genetic control of obesity and gut microbiota composition in response to high-fat, high-sucrose diet in mice.*  

**Session 5**  
Students only: Monday, January 25  
Faculty/students: Tuesday, January 26

**Discussion paper**  
*From noncoding variant to phenotype via SORT1 at the 1p13 cholesterol locus.*  

**Session 6**  
Students only: Thursday, January 28  
Faculty/students: Friday, January 29

**Discussion paper**  
*Changes of Cell Biochemical States Are Revealed in Protein Homomeric Complex Dynamics.*  

**Review**  
*Metformin: from mechanisms of action to therapies.*  
Foretz M, Guigas B, Bertrand L, Pollak M, Viollet B.  

**Session 7**  
Students only: Monday, February 1  
Faculty/students: Tuesday, February 2

**Discussion paper**  
*Exploring genetic suppression interactions on a global scale.*  

Review

Session 8
Students only: Thursday, February 4
Faculty/students: Friday, February 5

Discussion paper
A proteome- and lipidome-wide systems genetic analysis of hepatic lipid metabolism

Session 9
Students only: Monday, February 8
Faculty/students: Tuesday, February 9

Discussion paper
An integrative systems genetic analysis of mammalian lipid metabolism.

Session 10
Friday, February 12
Final Exam