Course syllabus

BIOL498/635 Cancer Evolution Fall 2024

Lectures: Wed & Fri 10:15 – 11:30 Room: CJ 1.125 LOY

Instructor: Elena Kuzmin

Office Hours: By appointment only

Prerequisite Biol 367 (Molecular Biology)

Course description: This course provides an overview of cancer evolution, including selective pressures exerted by tumor suppressors, oncogenes, large copy number variants and aneuploidies; large scale cancer genomic projects; phylogenetic analysis; passenger mutations; precision oncology approaches; large scale genetic interaction network mapping efforts using CRISPR, and parallels with genetic interaction networks in model organisms, such as yeast. We will also cover integration of cancer genetic networks with other biological networks.

Class format: Each class will consist of the overview of the course material by the instructor followed by two student presentations. One student will present a review of an assigned research article, while the other student will present a research proposal based on the same topic. There will be 10 min of class discussion following each presentation. The last week will consist of the recap of the course with an overview of the most recent advances in the field of cancer evolution presented by the instructor.

More specifically, the instructor will start each class with a 20-30 min **overview of the topic** to provide context, including highlighting one or two key papers.

Article review:

A student will give a 10 min presentation on a selected research paper (provided by the instructor), and act as a "reviewer" pointing out the novelty of the study as well as critique the shortcomings. The presentation will consist of a brief introduction, followed by selected key figures which will be distilled down the critical points. The presenter can raise general conceptual issues with the study. The class will then use 10 min to discuss the presented study. All students will be expected to have read the paper. The reviewer will email the instructor ~5-10 power point slides for the class presentation 24h before.

Research proposal (for graduate students only):

Graduate students will present a grant proposal for a 3-year grant ($200K per year) to further explore the most pressing questions arising from the selected paper (10 min presentation and 10 min discussion).

The student will present the question being explored and why it is important, followed by 3 aims that address the hypothesis with experimental approaches for each aim. The description of the methodology will include techniques, animals and cells etc that will be needed and why.

The student that will present the research proposal will write a 1-page single-spaced summary (12-point Times New Roman). The summary should contain an introductory paragraph to describe the rationale for the proposed question, hypothesis, main goal, 3 specific aims and an overall significance in one sentence. References and figures will be added as a 1-page appendix.

The research proposal presenter will email the instructor ~5-10 power point slides and the 1-pg summary for the class presentation 24h before. The proposals will be checked for plagiarism. The 1-pg summary and the presentation will be due in the last week of classes.

Academic Integrity and the Academic Code of Conduct
https://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html

Oral presentations must be presented as a Powerpoint or Keynote slideshow.

Midterm and final exams are based on the content provided by the instructor and guest lecturers.

Participation marks will be awarded to students that engage in the discussion by posting at least one question per lecture on Slido.

Evaluation

Evaluation type	% of final grade
Class participation (questions during article review and research proposal oral presentations)	10
Weekly readings	20
Article review (oral presentation)	20
Midterm exam	20
Final exam	30
Graduate students only: Research proposal (1 pg-summary and presentation replaces midterm and final exam)	50

Grading Scheme

A+	>=90	**A**	85-89	**A-**	80-84
B+	77-79	**B**	74-76	**B-**	70-73
C+	67-69	**C**	64-66	**C-**	60-63
D+	57-59	**D**	54-56	**D-**	50-53
F	<50				

For graduate students C = 60-69 and F<50 (there is no D).

Tentative schedule (subject to change)

Class no.	Date	Topic
1	September 4	Course overview
2	September 6	Reading scientific literature and writing research proposals
3	September 11	Genetic interaction networks in yeast model organism
4	September 13	Genetic interaction networks in yeast model organism
5	September 18	(Replaced by Gairdner talks on Oct 21st 3:30-5pm at Oscar Peterson Hall)
6	September 20	Tumor suppressors
7	September 25	Oncogenes
8	September 27	Large scale cancer genomic projects: TCGA, PCAWG
9	October 2	Large scale cancer genomic projects: TCGA, PCAWG
10	October 4	Aneuploidies
11	October 9	Aneuploidies
12	October 11	Phylogenetic analysis using bulk sequencing
13	October 23	Review
14	October 25	Midterm exam
15	October 30	Phylogenetic analysis using bulk sequencing
16	November 1	Phylogenetic analysis using single cell sequencing
17	November 6	Phylogenetic analysis using single cell sequencing
18	November 8	Synthetic lethality as precision oncology approach
19	November 13	Synthetic lethality as precision oncology approach
20	November 15	Mutations in duplicated genes
21	November 20	Mutations in duplicated genes
22	November 22	Large scale cancer genetic screens: DepMap
23	November 27	Large scale cancer genetic screens: DepMap
24	November 29	Recap and most recent advances in the field of cancer evolution

Required readings for each class will be provided on Perusall.

Recommended textbook: The Biology of Cancer, second edition, Robert A. Weinberg (available in course reserves)