Course syllabus

BIOL498/635 Cancer Evolution Winter 2022

Lectures: Tue & Thu 11:45 - 13:00 Room: CC 305 LOY

Zoom Meeting ID: 728 274 3753

Zoom Link: https://concordia-ca.zoom.us/my/elena.kuzmin

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 grant proposal based on the same topic. There will be 10 min of class discussion following each presentation. Undergraduate students will work in pairs for the assignments; graduate students will be individually responsible for the assignments. 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, and the instructor will share it electronically with the rest of the class.

Research proposal:

Undergraduate students will present a proposal for NSERC style graduate scholarship and a graduate student 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 can 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, and the instructor will share it electronically with the rest of the class. The proposals will be checked for plagiarism.

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.

Participation marks will be awarded to students that engage in the discussion.

Evaluation

Evaluation type	% of final grade
Article review (oral presentation)	25
Final project (research proposal and presentation)	50
Class participation (questions during article review and research proposal oral presentations)	25

Tentative schedule (subject to change)

Class no.	Date	Topic
1	January 6	Course overview
2	January 11	Large scale genomic projects such as the TCGA and PCAWG
3	January 13	Large scale genomic projects such as the TCGA and PCAWG
4	January 18	Tumor suppressors
5	January 20	Oncogenes
6	January 25	Large copy number variants
7	January 27	Large copy number variants
8	February 1	Aneuploidies
9	February 3	Aneuploidies
10	February 8	Phylogenetic analysis using bulk sequencing
11	February 10	Phylogenetic analysis using bulk sequencing
12	February 15	Phylogenetic analysis using single cell sequencing
13	February 17	Phylogenetic analysis using single cell sequencing
14	February 22	Passenger mutations
15	February 24	Passenger mutations
16	March 8	Synthetic lethality as precision oncology approach
17	March 10	Synthetic lethality as precision oncology approach
18	March 15	Mutations in duplicated genes
19	March 17	Mutations in duplicated genes
20	March 22	Large scale genetic vulnerabilities mapping efforts using CRISPR such as the DepMap
21	March 24	Large scale genetic vulnerabilities mapping efforts using CRISPR such as the DepMap
22	March 29	Parallels with genetic interaction networks in model organisms such as yeast
23	March 31	Parallels with genetic interaction networks in model organisms such as yeast
24	April 5	Integration of cancer genetic networks with other biological networks
25	April 7	Integration of cancer genetic networks with other biological networks
26	April 12	Recap and most recent advances in the field of cancer evolution

Required readings for each class will be provided on Moodle.

Recommended textbook: The Biology of Cancer, second edition, Robert A. Weinberg