

Biol 1290: Cancer Biology

Fall 2022

Tuesdays 3:00-6:00 p.m., virtual

Course Directors: Pat Dubielecka, Ph.D. & Joslyn Mills, Ph.D.

Contract Information

Dr. Pat Dubielecka: patrycja_dubielecka-szczerba@brown.edu

Office Hour: Day, Time, & Zoom link (TBA)

Dr. Joslyn Mills: Joslyn_Mills@Brown.edu

Office Hour: Day, Time, & Zoom link (TBA)

TA: TBD

Course Description

The prevalence and profound impact of cancer on society has resulted in intensive investment in research leading to numerous advances in cancer prevention, diagnosis, and treatment over the past decades. However, cancer still poses a unique biomedical puzzle as it is now recognized that cancer is not a single disease, but a collection of disorders with many manifestations that affect every tissue in the human body. Moreover, it has become apparent that cancer is initiated by cells that possess stem-like properties and reside within protective stromal and immune environment. This course will provide an introduction to the cellular and molecular mechanisms underlying the development of human cancer through interactive lectures and student-led discussions. The first half of the course will cover the genetic and molecular basis of cellular transformation. The second half will focus on the evolution of a tumor and the complex interactions that occur between cancer cells and other normal cells within the body. This course will also explore the challenges inherent to treating cancer and the role of “omic” technologies in tumor classification, patient prognosis, and therapy.

Course Format

The format for this course will be a mix of lecture, discussion of primary scientific literature, and in-class activities. Lectures will provide an overview of each topic while discussion of primary literature is intended to familiarize students with reading and critically analyzing cancer related peer-reviewed research. The discussions will be led by student teams and guided by student-

submitted questions. The in-class activities will be completed at the conclusion of each class to solidify understanding of that day's lecture material.

Course Objectives

1. Explain the mechanisms of DNA damage and how this process is linked to cellular transformation and cancer risk.
2. Understand the common cellular and molecular mechanisms that are deregulated in cancer cells.
3. Develop an understanding of how a cancer cell transforms into a malignant tumor.
4. Discuss the role of cancer stem cells or cancer-initiating cells and cancer stromal and immune microenvironments in tumor development and resistance to therapy.
5. Illustrate how basic research translates into novel therapeutic approaches.
6. Encourage the development of critical thinking and analytical skills that enable critical interpretation of cancer-focused scientific literature.

Course-Related Work Expectations

Students will spend 3 hours per week in class. Reading and other 'out of class' work is estimated at 4.5 hours per week. A midterm take-home assignment will require time outside of class, but a full session will be offered strictly to complete the assignment. Your final project will be completed outside of class time.

Assignments & Grading

Weekly Literature Discussions. There will be weekly reading assignments of primary scientific literature or review articles. It is **essential** that everyone **reads the papers before coming to class** as they will be discussed by students, figure-by-figure during class in a "Journal Club" format led by a small (2-3) team of students. The success of class depends on everyone being prepared. Students will use Perusall as a group annotation tool to interact with classmates over the article and **will be required to submit one question via the Perusall discussion board for each assigned paper**. The questions will be due by noon on the Tuesday before class. These questions may be related to general background, technical aspects, or interpretation of the data in the paper and should be used by the Journal Club leaders to guide the discussion.

Perusall Access: [Create Account](#) Class code: MILLS-HFHJ9

Weekly Participation. Most class sessions will include a pre- and post-topic self-assessment quiz to be answered in class via Kahoot, as well as an in-class activity at the conclusion of the class.

The self-assessments will be used to test your understanding and will be graded for participation only; however, maximizing effort put into answers is encouraged. Each self-assessment will include up to five questions before the start of a lecture on a new topic (pre-lecture), and then modified versions of the questions after the associated Journal Club (post-concept.) You will use this as a means to assess your own learning and decide where you would like to invest effort to improve.

The in-class activities will be interactive and engaging, ranging from minute essays to sketchnoting to Think-Pair-Repair debates, and must be submitted online to receive participation credit.

Writing Assignment. Each student will select a relevant primary article from a peer-reviewed journal to critically analyze. A brief summary of the article will be written in the style of Nature's New and Views. The summary will be approximately 1 page in length and must include an introduction, brief description of methods, interpretation of the results, and discussion on how the paper advances the current state of the field. The rubric will be shared in class.

Midterm Concept Mapping Project. Your midterm will be a take-home assignment. It will entail mapping the topics from the first part of the semester into a connected web of concepts, with narrative highlighting causative relationship. This Concept Mapping Project Must include concepts from all 6 lectures, with at least 15 concepts connected with narratives discussing the rationale behind presented connections. The rubric will be shared in class.

Cumulative Final Project. Your final exam will be a project that encompasses the overall concept of "Cancer Biology." The rubric will be shared in class.

Grade breakdown

1. Weekly discussion (1 article as co-leader)	20%
2. Weekly Participation (self-assessments and activities)	15%
3. Written Assignment	15%
4. Midterm Concept Mapping Project	25%
5. Cumulative Final Project	25%

Readings

1. Weinberg RA. The Biology of Cancer, 2nd Edition. Garland 2013.

2. Selected reviews and primary scientific literature

Class Schedule

Subject to change. Any changes will be announced in class.

Topic	Faculty	Reading
Sept. 13 Course Introduction, Characteristics of cancer cells, cachexia (molecular mechanisms brain, fat liver), standard therapies, epidemiology	Prof. Mills	New Hallmarks of Cancer
Sept. 20 Transformation and Mutagenesis (oncogenes & tumor suppressors (Rb & p53))	Prof. Mills	
Sept. 27 Cancer Signaling, I: Cross talk, kinase inhibitors (tyrosine kinases,), targeted therapies, therapeutic resistance	Prof. Mills	
Oct. 4 Cancer Signaling II: DNA damage/apoptosis: therapies aimed at DDR pathways, BRCA2, PARP, TP53 (repair/apoptosis)	Prof. Mills	
Oct. 11 Epigenetics, non-coding RNAs and genome fluidity in cancer, methylation, enhancers, (bioinformatics)	Prof. Mills	
Oct. 18 Cancer metabolism	Prof. Mills	Hallmarks of Cancer Metabolism
Oct. 25 Midterm Review (1.5h)	Prof. Mills	
Take home concept mapping assignment due by Oct 31st 11:59pm		
Nov. 1 Cancer cell cycle & senescence	Prof. Dubielecka	
Nov. 8 Cancer microenvironment	Prof. Dubielecka	
Nov. 15 Invasion and metastasis (with angiogenesis)	Prof. Dubielecka	
Nov. 22 Tumor immunology and immunotherapy	Prof. Dubielecka	
Nov. 29 Cancer stem cells	Prof. Dubielecka	
Dec. 6 Cancer treatment & therapeutic resistance	Prof. Dubielecka	
Dec. 13 Final Review (1.5h)	Prof. Dubielecka	
Final project: Due via online submission on Friday, Dec. 21st 11:59		

Academic Support and Disability Services Statement

Brown University will provide appropriate, reasonable accommodations to students who have documented learning, physical, cognitive, or psychiatric disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to meet with the course instructors.

Statement on Physical/Emotional Health

A range of issues can cause barriers to learning, such as strained relationships, increased anxiety, health issues, alcohol/drug problems, feeling down, difficulty concentrating, lack of motivation or feeling ill. These concerns or other stressful events may lead to diminished academic performance or may reduce your ability to participate in daily activities. University resources can help you address these and other concerns.

Supporting a Diverse + Inclusive Community

Members of our community are expected to demonstrate respect and show sensitivity to differences in others. All members of the community are entitled to and responsible for maintaining an environment of civility that is free from disparagement, intimidation, discrimination, harassment, and violence of any kind. We expect each member of the community to take responsibility for building and improving the quality of our community. We expect that as an educated community we will have a tolerance for others' opinions and openness to their perspectives. We expect that every member of the Brown community will accept diversity, value inclusivity, and be civil in dealings with each other. The University does not tolerate racism, sexism, classism, or discrimination based on sexual orientation. We hope that all members of our community will model and teach respect for the differences among us and celebrate the similarities that unite us as a people worthy of dignity. (Adapted from Community Standards at Emmanuel College)

Accessibility and Accommodations Statement

Brown University is committed to full inclusion of all students. Please inform us early in the term if you may require accommodations or modification of any of course procedures. You may speak with us after class, during office hours, or by appointment. If you need accommodations around online learning or in classroom accommodations, please be sure to reach out to [Student Accessibility Services \(SAS\)](#) for their assistance (seas@brown.edu, 401-863-9588). Undergraduates in need of short-term academic advice or support can [contact an academic dean in the College](#) by emailing college@brown.edu.

Class Recording and Distribution of Course Materials

We would like to record our synchronous discussions because some students may be in different time zones, have poor internet connections, or have health issues. This means that we will record all classes to make them available to all students that are enrolled but cannot be present. If you have questions or concerns about this protocol, please contact us so that we can talk through those to also ensure your full participation in this course.

Lectures and other course materials are copyrighted. Students are prohibited from reproducing, making copies, publicly displaying, selling, or otherwise distributing the recordings or transcripts of the materials. The only exception is that students with disabilities may have the right to record for their private use if that method is determined to be a reasonable accommodation by Student Accessibility Services. Disregard of the University's copyright policy and federal copyright law is a Student Code of Conduct violation.

Use of Technology to Support Your Learning in This Course

This course will use the following technological platforms: WebEx, Canvas, and Google Drive. We are committed to ensuring access to online course resources by students. If you have any concerns or questions about access or the privacy of any of these platforms, please reach out to us. The IT Service Center (<https://it.brown.edu/get-help>) provides many IT Services including remote assistance, phones, tickets, and chat. Please also see the [Online and Hybrid Learning Student Guide](#).