

## RXRS 410: Cancer Biology and Pharmacotherapy Fall 2024

<b>Instructor:</b>	Amanda M. Burkhardt, PhD <a href="mailto:aburkhar@usc.edu">aburkhar@usc.edu</a>
<b>Course Weight:</b>	4 Units
<b>Office Hours:</b>	See announcement on course Brightspace page
<b>Day/Time/Location:</b>	Tuesday & Thursday 9:30a-10:50a, GFS 229

### Catalogue Description

Cancer is a heterogenous group of diseases that strikes fear in many people and is a diagnosis that is becoming more common over the course of a standard lifetime. This course introduces students to the molecular basis of oncogenesis and potential metastasis of transformed cells. By understanding this process, we can begin to understand what chemotherapeutic agents are used to manage different cancers, how they exert their anti-cancer effects, what side effects can be expected, and why some are more appropriate than others in different types of cancer. Furthermore, this course will discuss cutting edge, emerging chemotherapeutic agents that are continuing to transform the treatment landscape of this complex group of diseases.

### Learning Objectives

- Understand the molecular and genetic basis of tumorigenesis, invasion, and metastasis
- Understand the types of gene mutations and they can contribute to cancer formation
- Understand what oncogenes are and the role they play in cancer development
- Understand how tumors evade detection and destruction by the immune system
- Apply knowledge of the molecular basis of cancer to understand the target site(s) and mechanisms of action of therapeutic modalities
- Apply the preclinical and clinical drug development process from therapeutic target to marketable drug
- Evaluate the risk versus benefits of various anticancer therapeutic modalities
- Understand the role of clinical trials in cancer drug development
- Evaluate why so many experimental cancer therapeutics fail to reach the market

### Evaluation and Grading

Evaluation will be based on one Midterm Exam, one Final Exam, three Learning Checks and five drug pitch activities.

<i>Description</i>	<b>Points</b>	<b>Weight</b>
<i>Learning Checks (3 at 10 points each)</i>	30 pts	15%
<i>Midterm Exam</i>	50 pts	25%
<i>Final Exam</i>	70 pts	35%
<i>Drug Pitch Presentations (5) at 10 points each</i>	50 pts	25%
<b>Total</b>	<b>200 pts</b>	<b>100%</b>

### **Exams**

**15% Learning Checks:** There will be three Learning Checks throughout the semester. These “no stakes” exams are designed to provide students with feedback on how they are processing the course material ahead of “high stakes” exams (midterm, final). Students will receive full credit on the Learning Checks if they complete the exam in full, regardless of how many questions a student answers correctly. Students are strongly encouraged to use the information from these exams to guide their study of course material and “high stakes” exam preparation. Learning Checks exams will be completed asynchronously, outside of class meeting time and accessed through the course Brightspace page. Question styles can include multiple choice, multiple answer, True/False, and fill-in-the-blank. Each Learning Check will test material prior to the day it is given (i.e. Learning Check 1 will test material in Lectures 1-4, Learning Check 2 will test material in Lectures 1-11, etc). The quiz will be administered asynchronously on Brightspace and will be open 2:00pm – 7:00pm PST. Students will have 20 minutes to complete the Learning Check after the quiz is started.

**25% Midterm:** There will be one Midterm exam for this course that will test material covered through the first seven weeks of the course. The exam can include multiple choice, multiple answer, True/False, fill-in-the-blank, and short answer style questions. This exam will allow students to assess their own comprehension of course material and, if necessary, make adjustments in their exam preparation ahead of the Final exam.

**35% Final:** The Final exam will text material covered in the entire course (i.e. a comprehensive exam), with a focus on untested material from Weeks 8 to 15. The content of the student-led discussions will also be tested. The exam can include multiple choice, multiple answer, True/False, fill-in-the-blank, and short answer style questions.

**Drug Pitch Presentations:** Starting the Tuesday Week 10 of class and continuing weekly until the end of the semester, students will participate in an activity to evaluate new chemotherapeutic drugs for their potential impact in the broad and ever evolving market that is chemotherapeutic drugs. A novel or newly approved chemotherapeutic drug will be presented each week and will correlate with the general broad class of chemotherapeutic drugs that was covered in the prior Thursday lecture.

Students will sign up for the feature of the pitch they want to complete for EACH week of the activity (5 weeks total) by end of Week 4 (on Brightspace). See Brightspace for full assignment description. An alternative assignment is available for students who are unable to attend class for the live Pitch Presentation.

## Grading Scale

93% to 100%: A	79% to 81%: B-	65% to 67%: D+
90% to 92%: A-	76% to 78%: C+	62% to 64%: D
87% to 89%: B+	71% to 75%: C	55% to 61%: D-
82% to 86%: B	68% to 70%: C-	0% to 54%: F

## Course Readings

The textbook for this course is Robert A Weinberg's *The Biology of Cancer* (2<sup>nd</sup> or 3<sup>rd</sup> edition). The textbook is not required, but is recommended for students who want access to readings that supplement what is covered in lecture and in the student-led discussions.

An electronic version of the 3<sup>rd</sup> edition of *The Biology of Cancer* is available for purchase from the publisher (W.W. Norton) at a discounted price from the physical textbook.

## Course Attendance

Attendance at all classes is expected. Due to the unpredictability of technology, it cannot be guaranteed that a Zoom recording will be available for each class meeting.

Students who are unable to attend class on their assigned presentation day will complete an Alternative Assignment (see assignment description on Brightspace).

## Late Assignment/Exam Policy

Assignments that are submitted past the due date/time will be eligible for a maximum of 80% credit in the first 24 hours that they are late. For each subsequent week, an additional 5% credit will be deducted from the possible score (i.e. an assignment that is submitted 2 weeks late will be worth a maximum of 75% total points, an assignment that is submitted 3 weeks late will be worth a maximum of 70% total points, etc).

## Course Outline

Week	Date	Lecture	Deliverable
<b>Week 1</b>	Tues. Aug. 27	Introduction to course, biology and genetics of cells review	
	Thur. Aug. 29	The nature of cancer	
<b>Week 2</b>	Tues. Sept. 3	Tumor viruses	
	Thur. Sept. 5	Cellular oncogenes	
<b>Week 3</b>	Tues. Sept. 10	Growth factors and receptors	Learning Check 1 Asynchronously Exam open on Brightspace 2:00p-7:00p PST
	Thur. Sept. 12	Cytoplasmic signaling	
<b>Week 4</b>	Tues. Sept. 17	Tumor suppressor genes	
	Thur. Sept. 19	pRb and cell cycle control	Deadline to sign up on Brightspace for role/group for each drug pitch activity
<b>Week 5</b>	Tues. Sept. 24	P53 and apoptosis	
	Thur. Sept. 26	Cell immortalization and tumorigenesis	
<b>Week 6</b>	Tues. Oct. 1	Multi-step tumorigenesis	Learning Check 2 Asynchronously Exam open on Brightspace 2:00p-7:00p PST
	Thur. Oct. 3	Maintenance of genetic integrity and the development of cancer I	
<b>Week 7</b>	Tues. Oct. 8	Maintenance of genetic integrity and the development of cancer I	
	Thur. Oct. 10	<b>FALL RECESS</b>	
<b>Week 8</b>	Tues. Oct. 15	Heterotypic interactions and the biology of angiogenesis	
	Thurs. Oct. 17	<b>MIDTERM EXAM</b> In class	Bring testing device to class to complete exam
<b>Week 9</b>	Tues. Oct. 22	Invasion and metastasis	
	Thurs. Oct. 24	Tumor immunology	
<b>Week 10</b>	Tues. Oct. 29	Chemotherapy & Cancer Treatment Overview	
	Thurs. Oct. 31	Cancer therapeutics I	
<b>Week 11</b>	Tues. Nov. 5	<b>Drug Pitch Presentation I</b>	
	Thurs. Nov. 7	Cancer therapeutics II	Learning Check 3 Asynchronously Exam open on Brightspace 2:00p-7:00p PST
<b>Week 12</b>	Tues. Nov. 12	<b>Drug Pitch Presentation II</b>	

	Thurs. Nov. 14	Cancer therapeutics III	
<b>Week 13</b>	Tues. Nov. 19	<b><i>Drug Pitch Presentation III</i></b>	
	Thurs. Nov. 21	Cancer therapeutics IV	
<b>Week 14</b>	Tues. Nov. 26	<b><i>Drug Pitch Presentation IV</i></b>	
	Thurs. Nov. 28	<b>THANKSGIVING HOLIDAY</b>	
<b>Week 15</b>	Tues. Dec. 3	Cancer therapeutics V	
	Thurs. Dec. 5	<b><i>Drug Pitch Presentation V</i></b>	
<b>Saturday, December 7 to Tuesday, December 10, 2024 – Study Days</b>			
<b>FINAL EXAM: THURSDAY 12/12/24 11:00AM-1:00PM</b>			

## Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment. Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

### Academic Integrity:

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

## **Course Evaluations**

Course evaluation occurs at the end of the semester university-wide. It is an important review of students' experience in the class.

## **Statement on Academic Conduct and Support Systems**

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### **Students and Disability Accommodations:**

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at [osas.usc.edu](https://osas.usc.edu). You may contact OSAS at (213) 740-0776 or via email at [osasfrontdesk@usc.edu](mailto:osasfrontdesk@usc.edu).

### **Support Systems:**

[Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

[988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.



[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or [otfp@med.usc.edu](mailto:otfp@med.usc.edu)

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.