



BIOE 498/598 TC1: Technologies for Cancer Diagnosis and Therapy

Meeting time: Tuesdays and Thursdays, 2:00 – 3:20 PM

Location: Everitt Lab, 2310

Credit hours: 3 (498) or 4 (598)

CRN: 56513 (498) or 65893 (598)

Semester: Fall

Instructor Information

Name	Professor Andrew M. Smith
Contact Information	smi@illinois.edu
Office Hours	Tuesdays and Thursdays, 3:20 – 4:00 PM (in person), and by appointment (online or in person)
Office Location	2316 Everitt Laboratory

Course Description

Technologies for Cancer Diagnosis and Therapy provides an introduction to how cancer is diagnosed and treated, focusing on fundamental concepts in cancer biology and bioengineering. One major goal is for students to become comfortable integrating principles from physics, chemistry, engineering, and biology related to current strategies for understanding, detecting, and treating cancer. A second major goal is for students to understand and assess innovative solutions to current challenges in the field, and to use this information to generate a research proposal in the format of an NIH R21, which will be written and reviewed through NIH-style study sections throughout the course term. The materials and content are designed for graduate students and senior undergraduate students from diverse majors.

This course has five components:

1. Fundamentals of cancer biology
2. Practices of clinical oncology
3. Therapeutic technologies
4. Diagnostic technologies
5. NIH R21 proposal evaluation and development

There is a wide range of materials available for this class. Time in class will focus on key concepts, discussions, and projects. You should do the following **prior to each class** using the content on the course website:

1. Read any assigned materials.
2. Review the homework assignment.
3. For R21 study sections, read the proposal assigned to you in-depth and prepare for the discussion as described by the instructor.

For some modules, recorded lectures and slides from previous course offerings are available, covering content at different levels of depth. However, the scope may not be identical to our current course modules, so consider these as supplemental resources and defer to the content of the current course when preparing for exams.

Course Objectives

1. **Apply** terminology from cancer biology and clinical oncology.
2. **Identify** how cellular processes, tissue processes, and exogenous events lead to carcinogenesis.
3. **Evaluate and construct** cellular pathway maps related to carcinogenesis.
4. **Identify and analyze** diagnostic and therapeutic decision-making steps in clinical oncology.
5. **Analyze** mechanisms, strengths, and limitations of different classes of cancer therapies.
6. **Analyze** mechanisms, strengths, and limitations of different diagnostic technologies for cancer.
7. **Critically evaluate** research proposals and research reports related to cancer technologies in terms of significance, innovation, and approach.
8. **Conceptually design** technologies for cancer, formulated as an NIH R21 research proposal.

Course Format

- Two 80-min classes per week that mix lecture delivery with discussions.
- Four times during the semester, 80-min mock-NIH study sections will focus on critical evaluation of research proposals.
- Weekly, students are expected to spend ~3 hours in class and 6–8 hours outside of class.

Recommended Prerequisites

- CHEM 232 or equivalent knowledge
- BIOE 206 or equivalent knowledge

Course Website: <https://canvas.illinois.edu/courses/37094>

Textbook and Reading Materials

No textbooks are required. Electronic texts will be provided through the course website. The following reference texts are recommended for supplementary reading.

Principles of Cancer Biology, Lewis J. Kleinsmith [Grainger Library reserve]
Publisher: Benjamin Cummings; 1st edition (2005)
ISBN-10: 0805340033 ISBN-13: 978-0805340037

The Biology of Cancer, Robert A. Weinberg [Grainger Library reserve]
Publisher: Garland Science; 1st edition (2006)
ISBN-10: 0815340788 ISBN-13: 978-0815340782

The Emperor of All Maladies A Biography of Cancer, Siddhartha Mukherjee [not on reserve]
Publisher: Scribner (2010)
ISBN-10: 1439170916 ISBN-13: 978-1439170915

Course Policies

- **Attendance:** Students are expected to attend every class with the exception of authorized absences or unavoidable emergencies. Roll will be compiled from written attendance logs or Zoom chat comments in the event that class periods are remote.
- **Course-related communications:** Course announcements will be sent via Canvas Announcements and Discussions; please check these regularly. For general course questions and information, first consult the syllabus. Use the Canvas Discussion forum for all communications related to class. In case of emergencies, email the instructor via email at smi@illinois.edu.

Approximate Course Schedule

Week	Date		Topic or Activity	Module / HW #
Cancer Biology				
1	Aug 22	T	Introduction and overview of cancer	1
	Aug 24	Th	Overview of cancer	1
2	Aug 29	T	Tumor viruses and oncogenes	2
	Aug 31	Th	R21 study section 1	–
3	Sep 5	T	Growth factors and intracellular signaling	3
	Sep 7	Th	Tumor cell cycle regulation	4
4	Sep 12	T	Tumor cell cycle regulation	4
	Sep 14	Th	Apoptosis and immortalization	5
5	Sep 19	T	Apoptosis and immortalization	5
	Sep 21	Th	Multistep tumorigenesis and genomic integrity	6
6	Sep 26	T	Metastasis and microenvironment	7
	Sep 28	Th	Metastasis and microenvironment	7
7	Oct 3	T	R21 study section 2	–
	Oct 5	Th	Metastasis and microenvironment	7
Clinical Oncology				
8	Oct 10	T	Clinical oncology practices 1 & CBTF Exam 1 (Oct 8–10)	8
	Oct 12	Th	No class (exam equivalent day)	–
9	Oct 17	T	Clinical oncology practices 1	8
	Oct 19	Th	Clinical oncology practices 1	8
10	Oct 24	T	Clinical oncology practices 2	9
	Oct 26	Th	Clinical oncology practices 2	9
11	Oct 31	T	Clinical oncology practices 2	9
	Nov 2	Th	Clinical oncology practices 2	9
12	Nov 7	T	Clinical oncology practices 2	9
	Nov 9	Th	Cancer study design and models	10
Technology Specifics				
13	Nov 14	T	Classical therapies	11
	Nov 16	Th	Immunotherapies	11
14	Nov 21	T	No class (fall break)	–
	Nov 23	Th	No class (fall break)	–
15	Nov 28	T	No class (exam equivalent day)	–
	Nov 30	Th	R21 study section 3	–
16	Dec 5	T	Diagnostics & CBTF Exam 2 (Dec 3–15)	12
	Dec 7	Th	No class (Reading Day)	–
17	TBA		R21 study section 4	–

Grading

Category	Assignment	Percent of Category	Percent Contribution to Final Grade	
			498	598
Exams	Exam 1	50%	35%	30%
	Exam 2	50%		
R21 proposal	Assignment	2.73%	40%	40%
	Abstract	5.45%		
	Presentation 1	5.45%		
	Presentation 2	5.45%		
	Specific Aims	5.45%		
	Outline	5.45%		
	Full proposal	35.0%		
	Revision proposal	35.0%		
R21 reviews	Oral 1	16.67%	20%	20%
	Written 1	16.67%		
	Oral 2	16.67%		
	Written 2	16.67%		
	Oral 3	16.67%		
	Written 3	16.67%		
Paper reviews		100%	0%	5%
Participation		100%	5%	5%
Extra credit *		100%	Added to final grade	

* Extra credit is available by attending cancer technology-related seminars and writing a 1-page report. A report template will be provided. An additional +1% will be added to final grades for each passing report.

Academic Integrity

The university’s policy on Academic Integrity can be found in the *Code of Policies and Regulations Applying to All Students* under Article One, Part IV which can be found at: <https://studentcode.illinois.edu/>. The following policies support and reinforce that policy.

1. All students are expected to hold the highest standards of scientific and academic conduct. Any form of cheating on any graded work in this course is unacceptable and will be dealt with as outlined below, and in accordance with the University-wide standards in the *Code of Policies and Regulations Applying to All Students*.
2. It is a requirement that all graded work be entirely your own, and that anything you write using the words of other writers be correctly attributed. Some specific points follow:

Artificial intelligence text generation: Generative AI-based tools such as ChatGPT may be used in this course as desired by students, however, prompts related to content in this course in 2023 have been found to commonly yield contradictory and incomplete information. In addition, essay-style writings do not yield accurate citations and the citations are often fabricated. For R21 project submissions, all information must come from trusted sources as described in the project descriptions. **If fabricated citations are detected in submitted materials, significant grade deductions will occur.** If these tools are used in any submitted material in the class, this should be indicated in the submission together with a brief indication of how the tools were applied.

Plagiarism: On all assignments, exams, and presentations, all written and verbally communicated content must be your own words, formulated from your own understanding of the material, and not copied from any other material. If the work you submit resembles that of another work or that from another student/team (including work from previous offerings of this course or other courses), it may be concluded that it was not your original work. Turnitin reports will be used to determine the degree to which submitted materials resemble previously written work. If you use the *ideas and/or opinions* from another author or source, you must provide the appropriate citation. That is, you must, using APA format, place a parenthetical reference to the source that provided you this information.

Figures, schematics, and graphical content will be required for R21 proposals and related materials, including presentations. These materials may be acquired from the literature or other sources, however *the*

source must be cited in all cases, and none of the describing information, including figure legends, may be copied directly. Instead, this information must be paraphrased in your own words.

Direct quotations: Direct quotations should not be used in your assignments; they should be used ONLY in the two cases below:

- A definition of a term. In this case, you must put the text in quotes and, using APA format, place a parenthetical reference to the source at the end of the quote.
- A profound statement made by an expert in the field. In this case, you must put the text in quotes and, using APA format, place a parenthetical reference to the source at the end of the quote.

3. Group work will be an important part of this class. Some specific points follow:

Group work: *On all assignments and presentations*, you must contribute demonstrably to the group's effort and not just have one or some individuals do all the work. Since group work cannot be monitored directly, the appearance of your work is the only means to determine the contribution of each member to the team.

Failure to adhere to these standards may result in a grade of zero for the entire assignment, for all persons involved.

COVID Policies

Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols. All students, faculty, staff, and visitors are required to wear face coverings in classrooms and university spaces. Please refer to the [University of Illinois Urbana-Champaign's COVID-19 website](#) for further information on face coverings. This is in accordance with CDC guidance and University policy and is expected in this class.

Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.

Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

In order to implement COVID-19-related guidelines and policies affecting university operations, instructional faculty members may ask students in the classroom to show their Building Access Status in the Illinois app or the Boarding Pass. Staff members may ask students in university offices to show their Building Access Status in the Illinois app or the Boarding Pass. If the Building Access Status says "Granted," that means the individual is compliant with the university's COVID-19 policies—either with a university-approved COVID-19 vaccine or with the on-campus COVID-19 testing program for unvaccinated students.

Emergency response recommendations can be found at the following website:

<http://police.illinois.edu/emergency-preparedness/>

Diversity and Inclusivity

The Department of Bioengineering is committed to the creation of a diverse, anti-racist, and inclusive community. Our departmental and professional communities promote and benefit substantially from diversity of race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, and religious beliefs. The effectiveness of this course is dependent upon each of us to create an encouraging learning environment that encourages the open exchange of ideas while also ensuring equitable opportunities and respect for each individual. All individuals involved in this class are expected to actively maintain an environment in which students, staff, and faculty can contribute without fear of personal ridicule or provocative language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course instructor. You can also report these behaviors to the Bias Assessment and Response Team (BART) at <https://bart.illinois.edu/>. Based on your report, BART members will follow up and reach out to students to make sure they have the support needed to be healthy and safe. If the reported behavior violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Disability Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu, or go to <https://www.disability.illinois.edu>. If you are concerned that you may have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnose a previously undiagnosed disability. You may access these by visiting the DRES website and selecting "Request an Academic Screening" at the bottom of the page.

Family Educational Rights and Privacy Act

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be completed in the first two weeks of classes.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In response, an individual from the Title IX Office will provide information regarding rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options. A list of designated University employees who do not have this reporting responsibility and can maintain confidentiality as counselors, confidential advisors, and medical professionals can be found here: <https://wecare.illinois.edu/resources/students/#confidential>. Other information about resources and reporting is available here: <https://wecare.illinois.edu/>.