

**CANCER BIOLOGY AND BIOTECHNOLOGY (BIOS 4015)  
CANCER BIOLOGY AND TECHNOLOGY (BIOL 7015)**

**FALL 2022 DRAFT**

*This syllabus is subject to change*

**Course description:** This course introduces the major concepts of cancer biology and state-of-the-art approaches/technologies towards improved cancer diagnostics and therapeutics.

**Where:** Ford Environmental Sci & Tech L1205

**Time:** Tue/Thurs 3:30-4:45 PM

**Instructors:**

Dr. Yuhong Fan

Email: yuhong.fan@biology.gatech.edu

Office: IBB 2313

And invited guest lecture speakers from Georgia Tech and other institutions.

**Teaching Assistant:**

Ruiqiao Yang

Email: ryang325@gatech.edu

Weekly TA review sessions: Thursday 5-6 PM starting the week of 8/29/2022

**Office hours:** by appointment

**Course objectives:** This course is designed to provide students with a basic foundation in the molecular basis of cancer onset and progression. Particular emphasis is placed on the integration of computational and engineering technologies for improved cancer diagnostics and therapeutics.

**Course format:** The course will consist of lectures on basic concepts of cancer molecular biology complimented with research presentations by invited experts in the field.

**Textbook and other required materials:**

**Textbook:** Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics, 5<sup>th</sup> Edition by Lauren Pecorino (Oxford University Press, 2021). An eBook version is available from the bookstore or the website <https://www.redshelf.com/> at a relatively modest rental price. The printed, paperback version appears to be about twice the rental (but you have a copy forever).

**You will also need access to Learning Catalytics** (<https://www.pearsonhighered.com/products-and-services/course-content-and-digital-resources/learning-applications/learning-catalytics.html>) (the price for 6 months is \$12; if you already have an account for another course, you do not need to have a separate account for this class). Learning Catalytics will be used for pre-class or in-class assessments and participation activities.

**Lecture ppts:** Slides used in each lecture will be posted on Canvas before each lecture.

Supplemental materials and course announcements will be posted on the Canvas web site for this course.

**Class Attendance/grading policy:** Final grades will be determined on the basis of 3 exams (75% of final grade for BIOL 4015 students; 60% of final grade for BIOL 7015 students) and unannounced quizzes/class participation (25% of final grade for BIOL 4015 students; 20% of final grade for BIOL 7015 students). Biol 7015 students are additionally required to submit a mini-grant proposal (15% of final grade) and a review of 5

de-identified student mini-grant proposals (5% of final grade). The summary of grading is listed in the following table:

<b>Grading</b>	<b>BIOS 4015</b>	<b>BIOS 7015</b>
Exam 1	25%	20%
Exam 2	25%	20%
Exam 3	25%	20%
Class participation*	25%	20%
Proposal/review	N/A	15%/5%

**Final grading scale:** The final mean class score will be the breakpoint between B's and C's. A's will be assigned to students with scores >10% above the mean, D's to students with scores > 10% points below the mean and F's to students with scores >20% below the mean. If the final mean class score is > 80%, the following grading criteria will apply: > 90% (A); 80-89% (B); 70-79% (C); 60-69% (D); Less than 60% (F).

**\*Learning Catalytics (quizzes/class activities):** Quiz/class activity scores will constitute 25% of final grade for BIOS 4015 students and 20% of final grade for BIOS 7015 students. Students will receive full points (25 points for BIOS 4015 and 20 points for BIOS 7015) if they have participated in >75 % of these activities; 90% points for >65% participation; 80% points for >55% 70% points for >45% participation, etc. The requirements for these participation activities allow for some to be missed; therefore, it should be unnecessary to grant extensions unless a student misses class for an extended period, such as due to illness.

There are no make-up exams. There will be 3 exams (multiple choice, 40 questions) equally weighted and covering only material presented after the previous exam (the 3<sup>rd</sup> exam will be given during the final exam period on the date/time set by the registrar's office for the course, but this exam is non-cumulative and equally weighted with the other exams). If you miss an exam, you will receive a "0" score unless your absence is for a validated medical or other reason deemed acceptable by the Dean of Students. In that case, you will be excused for that exam and your exam grade will be averaged over 2 rather than 3 exams. If you miss 2 or more exams, you will receive an "I" for the course and you will have 1 year to retake the course, otherwise your grade will revert to an "F".

**Hints for doing well in this class:** Attend and pay attention to the lectures. Lecture slides will be available on CANVAS prior to each lecture. Unannounced quizzes will be periodically conducted (see above: Learning Catalytics) prior to the beginning of a lecture. The quiz questions will be "obvious" (*i.e.*, not complicated) questions based on material presented in the previous lecture.

Most exam questions will be identical to or derived from assigned homework questions (See Modules for each Lecture); homework assignments will not be turned in or graded-they are provided to you as a learning tool and as a guide to the content to be tested on exams). Thus, if you understand (not merely memorize) the content/concepts underlying the assigned questions, you will do very well on the exams. If you don't understand the concepts underlying the answers to any of the assigned questions, be sure to attend the weekly TA review sessions (TBD) to resolve these issues. Keep in mind that you are not necessarily responsible for knowing all of the material presented in lectures or in every book chapter. Use the assigned questions to guide you to the topics/concepts/material you will be responsible for on the exams.

---

**BIOL 7015 Students:** In addition to the above, students registered for BIOL 7015 will be required to submit a mini-grant proposal (see below for details) and a brief review of 4 de-identified grant proposals submitted by other students in the class (see below).

**PROPOSAL:** You are required to prepare a proposal on a topic related to cancer biology. The proposal should be 3 pages in length (Single space, Times New Roman 12 font) and describe an experimental project to be completed in 3 years. Proposals should include a description of project aims, significance, innovation, research

plan/key methods, alternative approach, and the long-term impact/goals of the work. A reference page(s) should be added and is not included as part of the 3-page limit. **The deadline for proposal submission is Nov 11, 2022.**

**REVIEW:** You will be assigned 4 de-identified student proposals to review by Nov 16 and **completed reviews must be submitted no later than Nov 29.** Reviews of each proposal should be no more than one page in length and should be scored from 1 (best) to 5 (less-best) for each of the following topics: 1) Significance- how significant do you think the impact of the study will be if successful?; 2) Innovation- how innovative is the proposed study relative to previous work in the field?; 3) Feasibility- how likely do you think it is that the proposed study can be successfully carried out in 3 years?

For each of these 3 scoring categories, provide a brief justification of your score of 3-5 sentences). In a cover letter, present the average score for each proposal and rank each of the 4 proposals in order of merit for funding.

---

## **Course Expectations & Guidelines**

### **COVID-19 Related Expectations**

*This is an unprecedented time. Georgia Tech recommends that everyone who is eligible will be vaccinated; vaccination significantly reduces likelihood of severe disease from SARS-CoV-2. Because the omicron variant can be spread by vaccinated individuals, we also recommend masking when indoors based on your preference and assessment of personal risk. Both of these expectations are based on recommended CDC guidance. As that guidance is updated, we will communicate any new expectations.*

### **Student-Faculty Expectations**

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. We are committed to creating a learning environment in which all students feel safe and included. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectations—that you can have of us, and that we have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, we encourage you to remain committed to the ideals of Georgia Tech, while in this class.

### **Honor policy:**

Your conduct in the course should conform to Georgia Tech Academic Honor Code (<http://www.osi.gatech.edu/>). Individual exam questions may be randomized for each student (i.e., the same questions but in randomized numerical order). Violations and plagiarism will be reported to the Dean of Students and result in automatic failure (F) in the course.

### **Learning Accommodations:**

Necessary accommodations for students with documented disabilities will be made as appropriate. These accommodations must be arranged in advance and in accordance with the Office of Disabilities Services office (<http://disabilityservices.gatech.edu/>).

# Tentative Lecture Schedule

	<b>Aug 23</b>	Welcome		Fan
<b>Lec 1</b>	<b>Aug 25</b>	Introduction/Overview	Chap 1	Fan
<b>Lec 2</b>	<b>Aug 30</b>	The cancer genome: mutations versus repair	Chap 2	Fan
<b>Lec 3</b>	<b>Sept 1</b>	Regulation of gene expression	Chap 3	Fan
<b>Lec 4</b>	<b>Sept 6</b>	Regulation of gene expression	Chap 3	Fan
<b>Lec 5</b>	<b>Sept 8</b>	Growth factor signaling and oncogenes	Chap 4	Fan
<b>Lec 6</b>	<b>Sept 13</b>	The cell cycle	Chap 5	Fan
<b>Lec 7</b>	<b>Sept 15</b>	Guest Lecture 1 “Cellular Senescence, Telomerase, and Cancer”		Prof. Zhu/WSU
<b>Lec 8</b>	<b>Sept 20</b>	Guest Lecture 2 “Cellular Senescence as a double edge sword in cancer”		Prof. David/NYU
	<b>Sept 22</b>	<i>Review for Exam I</i>		Fan
	<b>Sept 27</b>	<i>Exam I (Chapters 1-5)</i>		
<b>Lec 9</b>	<b>Sept 29</b>	Tumor suppressor genes	Chap 6	Fan
<b>Lec 10</b>	<b>Oct 4</b>	Guest Lecture 3 "Epigenetic Drug Design for Cancer Treatment"		Prof. Oyelere/GT
<b>Lec 11</b>	<b>Oct 6</b>	Apoptosis	Chap 7	Fan
<b>Lec 12</b>	<b>Oct 11</b>	Cancer stem cells and the regulation of self-renewal and ...	Chap 8	Fan
<b>Lec 13</b>	<b>Oct 13</b>	Metastasis	Chap 9	Fan
	<b>Oct 18</b>	<b>Fall break</b>		
<b>Lec 14</b>	<b>Oct 20</b>	Angiogenesis	Chap 10	Fan
	<b>Oct 25</b>	Guest Lecture 4 “Engineering immunotherapy”		Prof. Thomas/GT
	<b>Oct 27</b>	<i>Review for Exam II</i>		Fan
<b>(Withdrawal deadline Oct 29, 2022)</b>				
<b>Lec 15</b>	<b>Nov 1</b>	<i>Exam II (Chapters 6-10)</i>		
<b>Lec 16</b>	<b>Nov 3</b>	Reprogrammed metabolism and diet	Chap 11	Fan
<b>Lec 17</b>	<b>Nov 8</b>	Tumor Immunology & Immunotherapy	Chap 12	Fan
<b>Lec 18</b>	<b>Nov 10</b>	Inflammation, infection and the microbiome	Chap 13	Fan
<b>Lec 19</b>	<b>Nov 15</b>	Guest lecture 5: “Pediatric cancer in the nervous system”		Prof. Zhu/National Children’s
<b>Lec 20</b>	<b>Nov 17</b>	Guest lecture 6: “Cancer immunotherapy & drug development”		Prof. Liu/Zheng/UMB /OncoImmune/OncoC4
<b>Lec 21</b>	<b>Nov 22</b>	TBD		
	<b>Nov 24</b>	<b>Thanksgiving Break</b>		
<b>Lec 22</b>	<b>Nov 29</b>	Guest Lecture 7: “Integrated systems approach to cancer research”		Prof. McDonald/GT
<b>Lec 23</b>	<b>Dec 1</b>	Strategies and tools for research and clinical development	Chap 14	Fan
<b>Lec 24</b>	<b>Dec 6</b>	<i>Review for Exam III</i>		Fan
	<b>Dec 13</b>	<b>Final exam 2:40-5:30</b> (Exam III, chapters 11-14)		