

Biol. 334, Biology of Cancer
Spring, 2022
M, W, F 11:30 – 12:20

This course looks at the molecular origins of cancer with emphasis on understanding oncogenes and tumor suppressor genes and their role in signal transduction and the cell cycle. The course will examine the discovery of viral oncogenes, cellular oncogenes and tumor suppressor genes and relate them to current therapeutic approaches. The course will also cover topics in cancer prevention and treatment and look at some of the most common tumor types. Prerequisites: Biol. 300 or 335.

Purpose and Learning Outcomes:

This course is an upper-level elective within the Biology and Biochemistry Majors. It is meant for students who have an interest in the cell and molecular aspects of biology. It provides students the opportunity to see where many of the basic principles of biology have application to a very important disease process and covers some areas in more depth than is currently covered in other offerings such as the cell cycle, cell signaling and virology as it relates to tumor biology. In addition, the topics of oncogenes and tumor suppressor genes are not only important to cancer but are also important to students interested in many other areas of biological research and medicine.

Upon completion of this course, through essay and short answer questions, class presentations and recitations students will:

1. Identify what cancer is and gain insight into the complexity of cancer.
2. Appreciate the historical foundations and biomedical research that led to discovery of tumor suppressor genes, proto-oncogenes and oncogenes in the context of both normal and abnormal cell function by using information from class and from independent reading assignments.
3. Understand how these “genes” interact to account for the multi-step nature of cancer.
4. Demonstrate how this knowledge relates to cancer prevention, cancer diagnosis and cancer treatment. Apply the knowledge of the molecular basis of cancer to explain the complex behaviors of human cancers such as breast, colon and skin cancer.
5. Actively participate in class and recitations by interacting with and listening to classmates and exploring and responding to questions posed by the instructor/presenter.

Evaluation Procedures:

Exams	- 80%
Paper Presentations	- 10%
Paper Quizzes	- 5%
Participation	- 5%

There will be four in class exams. Each in-class exam will be worth 20% of the final grade. In addition, groups of 2 students will be responsible for summarizing a scientific paper related to the lecture material in a way that will stimulate discussion. The discussion leaders must be prepared to answer questions and are responsible for keeping the discussion going. They will

also be responsible for providing questions for a follow-up quiz. This activity will be worth 10% of your grade and the grade will be peer and instructor based. The quiz that follows each paper discussion will be given online the following day and be worth 5% of your grade.

Participation will be evaluated by the instructor based on interactions during class and paper discussions. To get full credit you must participate during the class discussions of the paper by reflecting on some aspect of the presentation through a thoughtful question or comment. You can receive partial credit by submitting 3 questions regarding the paper at least 2 hours before class. These questions cannot simply be such questions as “what was the authors’ hypothesis” but must show some reflection on the material as it relates to material covered in class and/or some question about the results presented in paper. It must go beyond questions such as, “what does figure 1 reveal”? Participation credit will be 10 points per class. Submitting questions prior to coming to class will be 5 pts per class. You will get the entire 10 points for participation each week only if you participate in class and you can submit both the pre-class questions and ask these during class to get the full 10 points.

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Tentative schedule (subject to change).

Date	Topics	Unit	Chapter	Weekly assignment
1/26	The Nature of cancer and cancer statistics	1	2	Cancer types and treatment
1/28	The nature of cancer continued and the biology and genetics of cells and organisms	1	2, 1	
1/31	Report on Cancer types and treatment presentations	1	2, 1	
2/02	Tumor Viruses	1	3	Paper #1
2/04	Tumor Viruses	1	3	
2/07	Paper #1 presentation	1	3	
2/09	Cellular Oncogenes	1	4	Paper #2

2/11	Cellular Oncogenes	1	4	
2/14	Paper #2 Discussion	1		
2/16	Diversity Summit No classes			
2/18	Exam #1 Chapters 1 - 4			
2/21	Growth Factors, Receptors and Cancer	2	5	Paper #3
2/23	Growth Factors, Receptors and Cancer	2	5	
2/25	Paper #3 Discussion	2		
2/28	Cytoplasmic Signaling Circuitry Programs Many of the Traits of Cancer	2	6	Paper #4
3/02	Cytoplasmic Signaling Circuitry Programs Many of the Traits of Cancer	2	6	
3/04	Paper #4 Discussion	2		
3/07	Tumor Suppressor Genes	2	7	Paper #5
3/09	Tumor Suppressor Genes	2	7	
3/11	Paper #5 Discussion	2		
3/14 To 3/18	Spring Break No classes			
3/21	pRb and Control of the Cell Cycle Clock	3	8	
3/23	pRb and Control of the Cell Cycle Clock	3	8	
3/25	Exam #2 Chapters 5-7			

3/28	P53 and Apoptosis: Master Guardian and Executioner	3	9	Paper #6
3/30	P53 and Apoptosis: Master Guardian and Executioner	3	9	
4/01	Paper #6 Discussion	3	9	
4/04	Eternal Life: Cell Immortalization and Tumorigenesis	3	10	Paper #7
4/06	Eternal Life: Cell Immortalization and Tumorigenesis	3	10	
4/08	Paper #7 Discussion	3		
4/11	Multi-step Tumorigenesis	4	11	
4/13	Exam #3 Chapters 8-10	3	11	
4/15	Multi-step Tumorigenesis	4		
4/18	Maintenance of Genomic Integrity and the Development of Cancer	4	12	Paper #8
4/20	Maintenance of Genomic Integrity and the Development of Cancer	4	12	
4/22	Paper #8 Discussion	4		
4/25	Dialogue Replaces Monologue: Heterotypic Interactions and the Biology of Angiogenesis	4	13	Paper #9
4/27	Dialogue Replaces Monologue: Heterotypic Interactions and the Biology of Angiogenesis	4	13	
4/29	Paper #9 Discussion	4		
5/02	Moving Out: Invasion and Metastasis	4	14	Paper #10
5/04	Moving Out: Invasion and Metastasis	4	14	
5/06	Paper #10 Discussion	4	14	

5/09	Catch up on loose ends			
5/11	Ethics of cancer research			
5/20	Final Chapters 11 - 14 <u>Note time change</u> 12:00 - 2:30			

Papers to be covered

Paper #1 Stehelin, D., Varmus, H.E., Bishop, J.M, and Vogt, P.K. 1976. DNA related to the transforming gene(s) of avian sarcoma viruses is present in normal avian DNA. *Nature*. 260:170-173.

Paper #2 Yong Sun Lee and Anindya, 2007. The tumor suppressor microRNA let-7 represses the HMGA2 oncogene. *Genes & Development*. 21:1025-1030.

Paper #3 Tsang, I., Kong, S., and Kwok, T. 2006. Epidermal growth factor induction of resistance to topoisomerase II toxins in human squamous carcinoma A431 cells. *Oncology Reports*. 16:789-793.

Paper #4 Chin, L., Tam, A., Pomerantz, J., Wong, M., Holash, J., Bardeesy, N., Shen, Q., O'Hagan, R., Pantginisk, J., Zhouk, H., Horner, J. W., Cordon-Cardo, C., G., Yancopoulos, G. D., and DePinho, R. A. 1999. Essential role for oncogenic Ras in tumor maintenance. *Nature*. 400:468-472.

Paper #5 Cavenee, W.K., Dryja, T.P., Philips, R.A., Benedict, W.F., Godbout, R., Gallie, B.L., Murphree, A.L., Strong, L.C. and White, R.L. 1983. Expression of recessive alleles by chromosomal mechanisms in retinoblastoma. *Nature*. 305:779-784.

Paper #6 Bossi, G., Lapi, E., Strano, S., Rinaldo, C., Blandino, G., and Sacchi, A. 2006. Mutant p53 gain of function: reduction of tumor malignancy of human cancer cell lines through abrogation of mutant p53 expression. *Oncogene*. 25: 304-309.

Paper #7 Zongaro, S., de Stanchina, E., Colombo, T., D'Incalci, M., Giulotto, E. and Mondello, C. 2005. Stepwise Neoplastic Transformation of a Telomerase Immortalized Fibroblast Cell Line. *Cancer Research*. 65: 11411-11418.

Paper #8 Farmer, H., McCabe, N., Lord, C., Tutt, A., Johnson, D., Richardson, T., Santarosa, M., Dillon, K., Hickson, I., Knights, C., Martin, N., Jackson, S., Smith, G., and Ashworth, A. 2005. Targeting the DNA repair defect in BRCA mutant cells as a therapeutic strategy. *Nature*. 434:917-921.

Paper #9 Kodera, Y., Katanasaka, Y., Kitamura, Y., Tsuda, H., Nishio, K., Tamura, T., and Koizumi, F. 2011. Sunitinib inhibits lymphatic endothelial cell functions and lymph node metastasis in a breast cancer model through inhibition of vascular endothelial growth factor receptor 3. *Breast Cancer Research*. 13:R66.

Paper #10 Wang M, Ren D, Guo W, Huang S, Wang Z, Li Q, Du H, Song L, Peng X. 2016. N-cadherin promotes epithelial-mesenchymal transition and cancer stem cell-like traits via ErbB signaling in prostate cancer cells. *International Journal of Oncology*. 48:595-606.

IMPORTANT POLICIES (in alphabetical order)

Academic Integrity and Plagiarism

Milne Library offers frequent workshops to help students understand how to paraphrase, quote, and cite outside sources properly. These sessions are meant to educate about the importance of using original ideas and language, and how to incorporate paraphrases and quotes into writing. The complete list of library workshops can be found at www.geneseo.edu/library/library-workshops.

Academic dishonesty includes cheating, knowingly providing false information, plagiarizing, and any other form of academic misrepresentation. College policies and procedures regarding academic dishonesty are available at www.geneseo.edu/handbook/academic-dishonesty-policy.

Academic dishonesty

Academic dishonesty devalues the work of other students. Cheating on exams is a serious breach of trust and will be treated accordingly. Examples of cheating on tests include (but are not limited to) collaboration or communication with others in any form. Plagiarism is the misrepresentation of the originality of your work. Collaborating on a test will result in a failing grade for the test and may result in a failing grade for the course. Ignorance of the policy or of the definition of cheating will not serve to excuse the behavior. Because academic dishonesty is defined in detail here, claiming ignorance of the policies cannot serve as an excuse. Should serious academic cheating be identified the procedures addressing these incidents are addressed in detail through the [Dean of Academic Planning and Advising's](#) webpage.

Academic Support Services

The campus provides a range of support services to help students thrive in their classes. These services include:

- Tutoring, both drop-in and by-appointment, with student tutors in the Writing Learning Center, the Math Learning Center, and a range of department-based tutoring centers

- Online tutoring through the SUNY-wide STAR-NY system (www.starny.org/tutoring_schedule)
- Supplemental Instruction, in which trained student assistants review lecture material from specific classes

Information on times and locations is available through the Center for Academic Excellence website at www.geneseo.edu/library/center-academic-excellence.

Accessibility

SUNY Geneseo is dedicated to providing an equitable and inclusive educational experience for all students. The Office of Accessibility will coordinate reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities, as well as medical conditions related to pregnancy or parenting. Students with letters of accommodation should submit a letter to me at the beginning of the semester and discuss specific arrangements. Please contact the Office of Disabilities

Office of Accessibility Services

Erwin Hall 22

(585) 245-5112

access@geneseo.edu

www.geneseo.edu/accessibility-services

- *Student responsibility:* Please submit your letter of accommodations to me at the beginning of the semester and make an appointment to discuss arrangements.
- *Instructor responsibility:* I am committed to working with you to figure out how to create a just learning environment while meeting the learning outcomes of the course. Unless you communicate otherwise, I will keep all accommodations confidential.

Appealing grades

Any graded work may be submitted for re-evaluation along with a written appeal submitted via email and should include a brief explanation of your concerns, including your understanding of the test question or assignment directions and why you believe your work meets the requirements. Appeals should be sent in within one week of receiving the graded work. When you submit your appeal, we will schedule an individual conference to go over my response.

Bias-Related Incidents

“We are here to listen, to learn, to teach, to debate, to change, to grow. We should all be safe to pursue these goals at SUNY Geneseo while being who we are. Together, we commit ourselves to pluralism, cultivating a community that respects difference and promotes a sense of inclusion and belonging.”

As this excerpt from our Community Commitment to Diversity, Equity, and Inclusion states, here at SUNY Geneseo, we want to provide a space where everyone feels welcome to learn and grow in their identities as well as in their role as students, faculty, and staff. If in the unfortunate

instance you experience an incident of bias, we encourage you to reach out to the Chief Diversity Officer (routenberg@geneseo.edu) and/or our University Police Department. In trying to create an environment that facilitates growth through diverse thoughts and ideas, reporting incidents of bias - including threats, vandalism, and microaggressive behaviors - can help bring a better understanding of our campus climate as well as provide opportunities for learning and restoring harm.

Communication

Set up Canvas to provide daily updates via email or text message to ensure that you receive any updates or changes to the schedule. Check the announcements section regularly. Besides office hours, the fastest way to get in touch with me is via e-mail. Please include your name (not just your email address) and the course name or number (Biol 354) in all e-mails sent to me. To preserve work-life balance, I reserve the option to delay answering emails sent after 5 pm or on the weekends until the start of the next business day.

Computer and Technology Support

For assistance with your computer or mobile device, visit the CIT HelpDesk in Milne Library. CIT provides self help guides on a range of computer issues, including access to the campus network, Canvas, printing, software guides, and other resources. The CIT Self Help Guides at wiki.geneseo.edu/display/cit/CIT+Self+Help can be helpful in finding quick solutions to basic technology issues.

CIT also provides free access to over 7,500 online tutorials for software, digital tools, web development, programming, and design through lynda.com training resources available at wiki.geneseo.edu/display/cit/Lynda.com+Training+Library.

Copyright notice

Many of the materials that are provided to students in this course have been created by myself or by the publisher of our textbook. Students would be best to assume that all course materials are protected by legal copyright. Copyright protection means that reproduction of this material is prohibited without the author's consent. Thus, students are prohibited from sharing or posting copyrighted material to any websites outside our course Canvas site. Students are also prohibited from reproducing material to be shared with other more limited groups (eg. sorority/fraternity test bank). Be aware that UUP (Union of University Professionals, the union representing faculty on this campus) is seeking to take legal action against these and other sites, and that posting or selling copies of materials to such sites may put a student in legal jeopardy.

Food Security for SUNY Geneseo Students

SUNY Geneseo students who find themselves in a position of food insecurity and do not have the financial resources to support their food and nutrition needs can access the Geneseo Groveland Food Pantry located at the First Presbyterian Church, 31 Center Street in Geneseo. Students can utilize the pantry once with no referral or contact with the College. At this visit they will be provided items that will address their basic needs for several days. If a student continues to face difficulties providing for their own nutritional needs beyond their first visit to

the pantry they should connect with Susan Romano, Director of Financial Aid to receive a brief letter that they will present to the staff at the pantry that verifies their need. If students do not have a FAFSA on file for any reason they should contact Dr. Leonard Sancilio, Dean of Students, to discuss their particular situation and options. The Geneseo Groveland Food Pantry is open on the following days and times:

Tuesday: 10 AM - 2 PM

Wednesday: 4 PM - 6:30 PM

Thursday: 10 AM - 2 PM

If you have any questions please contact Dr. Leonard Sancilio, Dean of Students at: sancilio@geneseo.edu or 585-245-5706.

Geneseo Mission and Values

SUNY Geneseo has several core documents that articulate our shared commitments and learning objectives. These include:

- SUNY Geneseo Mission, Vision and Values: <https://www.geneseo.edu/about/mission-vision-and-values>
- Community Commitment to Diversity, Equity, and Inclusion: <https://www.geneseo.edu/diversity/commitment>
- Geneseo Learning Outcomes for Baccalaureate Education: <https://www.geneseo.edu/provost/globe-geneseo-learning-outcomes-baccalaureate-education>

Library Research Help

Milne Library has an award-winning staff trained in finding the best information. They have created online research guides, self-help databases, and are available for individual consultation. Research Librarians are available for walk-in consultations and students may request appointments with staff experts in particular fields. Full information on Milne Library research resources, hours, and consultation options is available at www.geneseo.edu/library/ask-us.

Makeup exams

I will not provide makeup exams unless you have a valid excuse such as an illness or a family emergency. To be fair to everyone in class and to follow departmental and university policies, documentation for such emergencies will be required. If you miss an exam for any of the above stated exceptions, you must contact me as soon as possible to make alternate arrangements.

Policy exceptions and changes

Policies are designed to address common issues and concerns. I cannot anticipate every possible problem that may arise, and therefore policies can have limits and exceptions! If you are experiencing problems in completing class work for any reason, please make an appointment to talk with me. Please note that in light of the current pandemic it is also possible that I will have to return to a fully online format. In that case policies may change and I will post those changes if and when they occur.

Professionalism

Policy for this semester requires all students wear a face mask in instructional spaces including classrooms, lecture halls, and laboratories, and all common areas including residence halls and all buildings. There is misinformation circulating about exemptions from face mask requirements connected to interpretations of the Americans with Disabilities Act (ADA). At this time, the ADA does not cite a blanket exemption from face covering requirements for individuals with disabilities and has not issued documentation to support this exemption (e.g., "ADA cards"/letters/flyers). Please refer to the [ADA and Facemask Policy Guide \(Links to an external site.\)](#) for more information. Please also note that there is absolutely no drinking or eating in the classroom. If you have health related issues that require you to eat and/or drink during the in-class portion, I ask that you leave the classroom temporarily to do so. You will not be penalized for doing so. Thank you for your cooperation in this matter.

Anytime you feel ill we ask that you do not come to the in-class sessions. If you are feeling ill, please email me as soon as possible so we can discuss what was done in class and how you can possibly make up this work.

For your scheduled class please arrive on time, stay through class, turn off your cell phone (including vibration mode), and use laptops and other technology only for class-related activities. It is understood that the continuing development of new technology can be beneficial to the process of education. For this reason, laptops and smartphones are permitted for notetaking and viewing classroom materials. Unacceptable classroom use of technology includes, but is not limited to social media websites, e-mail, playing games, and cell phone photography. These diversions not only reduce your class participation, they can also distract those around you. If you disrupt the lecture or are distracting others around you, you may be asked to leave. If the behavior of other students around you is affecting your learning please tell us.

If you have an emergency for which you need your cell phone to be turned on, talk to me before the beginning of in class sessions. Only then will you not be asked to leave if your cell phone rings/vibrates during the in-class session.

Religious Observations and Class Attendance

Student attendance in classes on religious holidays is governed by New York State Education Law 224-a (see <https://www.geneseo.edu/apca/classroom-policies>). Students who anticipate an absence due to religious observations should contact their faculty member as soon as possible in advance to arrange make up plans. A calendar of major religious observations may be found at: https://www.geneseo.edu/hr/hr_legal_holidays

Safeguarding your mental health

Diminished mental health, including significant stress, mood changes, excessive worry, or problems with eating and/or sleeping can interfere with optimal academic performance. The source of symptoms might be strictly related to your course work; if so, please speak with me. However, problems with relationships, family worries, loss, or a personal struggle or crisis can also contribute to decreased academic performance.

SUNY Geneseo provides mental health services to support the academic success of students. Counseling Services, a part of the Lauderdale Center for Student Health & Counseling, offers

free, confidential psychological services to help you manage personal challenges that may threaten your well-being (health.geneseo.edu).

In the event I suspect you need additional support, I will express my concerns and the reasons for them, and remind you of resources (e.g., Counseling Services, Career Services, Dean of Students, etc.) that might be helpful to you. It is not my intention to know the details of what might be bothering you, but simply to let you know I am concerned and that help, if needed, is available. Getting help is a smart and courageous thing to do for yourself /and /for those who care about you.

Well-Being

Prioritizing well-being can support the achievement of academic goals and alleviate stress. Eating nutritious foods, getting enough sleep, exercising, avoiding drugs and alcohol, maintaining healthy relationships, and building in time to relax all help promote a healthy lifestyle and general well-being.

Concerns about academic performance, health situations, family health and wellness (including the loss of a loved one), interpersonal relationships and commitments, and other factors can contribute to stress. Students are strongly encouraged to communicate their needs to faculty and staff and seek support if they are experiencing unmanageable stress or are having difficulties with daily functioning. The Dean of Students (585-245-5706) can assist and provide direction to appropriate campus resources. For more information, see www.geneseo.edu/dean_students.