Biol. 334, Biology of Cancer
Spring, 2021

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. 3(2-1).

A. 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. 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.
2. Understand how these "genes" interact to account for the multi-step nature of cancer.
3. Demonstrate how this knowledge relates to cancer prevention, cancer diagnosis and cancer treatment.
4. 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.

B. Evaluation Procedures:

There will be three in-class exams and a cumulative final. Each in-class exam will be worth 18% of the final grade and the final exam will be worth 26%. In addition, each student will be responsible for summarizing a scientific paper related to the lecture material on one of the Fridays in a way that will stimulate discussion. The discussion leader must be prepared to answer questions and is responsible for keeping the discussion going. This activity will be worth 10% of your grade and the grade will be peer and instructor based. The final 10% of your grade will be based on participation during the discussion classes throughout the semester and you will be graded by two students in your discussion class and by yourself (by participating in the discussion it will help the person leading the discussion and in turn they might help you out when you lead).

C. Instructor: Robert W. O'Donnell

Office: ISC 332A Telephone 245-5313
Campus E-mail odonnell Internet Address odonnell@geneseo.edu
Office Hours: M-W and F, 9:30 to 10:30, other times by appointment

D. Text: the biology of CANCER, SECOND EDITION Author: Robert A. Weinberg
Publisher: Garland Science Publishing, ISBN: 9780815342205

E. Detailed Content Outline

Day of the Week	Day	Lecture/Exam Dates	Topic/Chapters (Subject to adjustment)
M	1	February 1, synchronous online	Cancer Statistics 2021, The Nature of Cancer, Ch. 2
W	2	February 3, synchronous online	The Nature of Cancer, Ch. 2 Tumor Viruses, Ch. 3
F	3	February 5, synchronous online 12:30 and 1:30	1st Reading: The Biology and Genetics of Cells and Organisms, Ch. 1
M	4	February 8,	Tumor Viruses, Ch. 3
W	5	February 10,	Tumor Viruses, Ch. 3 Cellular Oncogenes, Ch. 4
F	6	February 12,	2nd and 3rd Readings: "Differences between the ribonucleic acids of transforming…" "DNA related to the transforming gene(s) of avian…"
M	7	February 15,	Cellular Oncogenes, Ch. 4
W	8	February 17,	Growth Factors, Receptors and Cancer, Ch. 5
F	9	February 19,	4th and 5th Readings: "Transforming activity of human tumor DNAs…" "The tumor suppressor microRNA let-7 represses the... "
M	10	February 22,	Growth Factors, Receptors and Cancer, Ch. 5
W	11	February 24,	Cytoplasmic Signaling Circuitry Programs Many of the Traits of Cancer, Ch.6
F	**12**	**February 26,**	**Exam 1 (1-5)**
M	13	March 1,	Cytoplasmic Signaling Circuitry Programs Many of the Traits of Cancer, Ch.6 Tumor Suppressor Genes, Ch. 7
W	14	March 3,	Tumor Suppressor Genes, Ch. 7
F	15	March 5,	6th and 7th Readings: “Essential role for oncogenic Ras in tumor maintenance.” "Activation of mitogen-activated protein kinase..."

M	16	March 8,	pRB and Control of the Cell Cycle Clock, Ch. 8
W	17	March 10,	pRB and Control of the Cell Cycle Clock, Ch. 8 p53 and Apoptosis: Master Guardian and Executioner, Ch. 9
F	18	March 12,	8th and 9th Readings: "Expression of recessive alleles by chromosomal mechanisms…" "Cytoplasmic relocalization and inhibition of the cyclin…"
M	19	March 15,	p53 and Apoptosis: Master Guardian and Executioner, Ch. 9
W	20	March 17,	p53 and Apoptosis: Master Guardian and Executioner, Ch. 9
F	**21**	**March 19**	**Exam II (6-9)**
M	22	March 22	Eternal Life: Cell Immortalization and Tumorigenesis, Ch. 10
W		March 24,	Rejuvenation Day, No class
F	23	March 26,	10th and 11th Readings: "Mutant p53 in Cancer:**…"** "Stepwise neoplastic transformation of a telomerase..."
M	24	March 29,	Eternal Life: Cell Immortalization and Tumorigenesis, Ch. 10 Multistep Tumorigenesis, Ch. 11
W	25	March 31,	Multistep Tumorigenesis, Ch. 11 Maintenance of Genomic Integrity and the Development of Cancer, Ch.12
F	26	April 2,	12th and 13th Readings: "A compendium of mutational cancer driver genes" " Cancer stem cells in glioblastoma"
M	27	April 5,	Maintenance of Genomic Integrity and the Development of Cancer, Ch 12 Dialogue Replaces Monologue: Heterotypic Interactions and the Biology of Angiogenesis, Ch. 13
W	28	April 7**,**	Dialogue Replaces Monologue: Heterotypic Interactions and the Biology of Angiogenesis, Ch. 13
F	**29**	April 9**,**	**Exam III (10-13)**
M	30	April 12,	Moving Out: Invasion and Metastasis, Ch. 14
W	31	April 14,	Cancer Prevention

F	32	April 16,	14th and 15th Readings: "Low expression of PDK1 inhibits renal cell carcinoma cell proliferation…" "Activation of miR-31 function in already-established metastases…"
M	33	April 19,	Early Detection & Diagnosis
W	34	April 21,	Treatment: Crowd Control: Tumor Immunology and Immunotherapy, Ch. 15 The Rational Treatment of Cancer, Ch. 16
F	35	April 23,	Virtual Guest Speaker Greg Roloff, MD Hematologic Malignancies.
M	36	April 26,	Treatment: Crowd Control: Tumor Immunology and Immunotherapy, Ch. 15 The Rational Treatment of Cancer, Ch. 16
W	37	April 28,	Overview of Major Types of Cancer: Colon Cancer
F	38	April 30,	VIRTUAL Guest Speaker: Dawn K. Riedy, MD, Director of Cytopathology, Rochester General Hospital, "The Pathologist's Role in Caring for Patients with Breast Cancer
M	39	May 3,	Overview of Major Types of Cancer: Lung Cancer
W	40	May 5,	Overview of Major Types of Cancer: Skin Cancer
F	41	May 7,	16th and 17th Readings "Variation in cancer risk among tissues can be explained by …" "Strategies to Prevent "Bad Luck" in Cancer …"
M		May 10,	No class Tuesday schedule
T	42	May 11,	Wednesday Schedule Debate: "If I had a million dollars"
W		May 12	No Class, follow Thursday schedule
R		**May 20, 12 to 2:30**	**Final Exam**

F. Course Materials (Lecture notes, Readings, old exams) are available in: Canvas

February 5, 2021

1. The Biology and Genetics of Cells and Organisms, Ch. 1 of your text "the biology of CANCER," 2nd edition, Robert A. Weinberg

February 12, 2021

2. Duesberg, P.H., P. Vogt. 1970. Differences between the ribonucleic acids of transforming and nontransforming avian tumor viruses. PNAS 67:1673-1680.

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

February 19, 2021

4. G.M., and T.G. Krontiris. 1981. Transforming activity of human tumor DNAs. Proc. Natl. Acad. Sci. USA 78:1181-1184.

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

March 5, 2021

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

7. Dent, P., W. Hasser, T.A.J. Haystead., L.A. Vincent, T.M. Roberts, and T.W. Sturgill. 1992. Activation of mitogen-activated protein kinase by v-Raf in NIH 3T3 cells and in vitro. Science 257:1404-1407.

March 12, 2021

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

9. Viglietto, G.M. L. Motti, P. Bruni, R. M. Melillo, A. D'Alessio, D. Califano, F. Vinci, G. Chiappetta, P. Tsichlis, A. Bellacosa, A. Fusco and M. Santoro. 2002. Cytoplasmic relocalization and inhibition of the cyclin dependent kinase inhibitor p27Kip1 by PKB/Akt-mediated phosphorylation in breast cancer. Nature Medicine 8(10):1136-1144.

March 26, 2021

10. Patricia AJ Muller and Karen H. Vousden, 2014. Mutant p53 in Cancer: New Functions and Therapeutic Opportunities Cell Volume 25, Issue 3, p304–317, 17 March 2014.

11. Zongaro, S., E de Stanchina, T. Colombo3, M. D'Incalci, E. Giulotto and C. Mondello. 2005 Stepwise Neoplastic Transformation of a Telomerase Immortalized Fibroblast Cell Line. Cancer Research 65, 11411-11418.

April 5, 2021

12. Francisco Martínez-Jiménez, Ferran Muiños, Inés Sentís, Jordi Deu-Pons, Iker Reyes-Salazar , Claudia Arnedo-Pac , Loris Mularoni1 Oriol Pich, Jose Bonet, Hanna Kranas , Abel Gonzalez-Perez and Nuria Lopez-Bigas 2020 A compendium of mutational cancerdriver genes Nature Reviews Cancer 20, 555-572.

13. Lathia, J. D., Mack, S. C., Mulkearns-Hubert, E. E., Valentim, C. L. L., & Rich, J. N. (2015). Cancer stem cells in glioblastoma. Genes & Development, 29(12), 1203–1217. http://doi.org/10.1101/gad.261982.115

April 16, 2021

14. Zhou, W., Wu, G., Huang, J., Li, J., Hao, C., He, Q., Chen, X., Wang, G. and Tu, X. 2020. Low expression of PDK1 inhibits renal cell carcinoma cell proliferation, migration, invasion and epithelial mesenchymal transition through inhibition of the PI3K-PDK1-Akt pathway. Cellular Signalling 56: 1-14.

15. Scott Valastyan, Amelia Chang, Nathan Benaich, Ferenc Reinhardt, and Robert A. Weinberg, 2011. Activation of miR-31 function in already-established metastases elicits metastatic regression. Genes & Development, 25: 646-659.

May 7, 2021

16. Cristian Tomasetti and Bert Vogelstein. Variation in cancer risk among tissues can be explained by the number of stem cell divisions Science 2 January 2015: 78-81. [DOI:10.1126/science.1260825]

17. Adriana Silvio Cavuto, Giovanni Apolone, and Douglas M. Noonan. Strategies to Prevent "Bad Luck" in Cancer JNCI J Natl Cancer Inst (2015) djv213 [doi:10.1093/jnci/djv213]

April 30, 2021

*Guest Speaker: Dawn Riedy, MD Petra van der Groep & Elsken van der Wall & Paul J. van Diest, 2011. Pathology of hereditary breast cancer. Cell Oncol 34:71–88.

*Background Reading(s) for Guest Seminar- subject to change

STUDENT SUCCESS RESOURCES

Listed below are a number of resources that can help support students' academic success and individual well-being. These statements may be shared through course syllabi as a way to inform students about campus resources.

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

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.

Accessibility

SUNY Geneseo will make reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities. Accommodations will be made for medical conditions related to pregnancy or parenting. Requests for accommodations including letters or review of existing accommodations should be directed to the Office of Accessibility in Erwin 22 (disabilityservices@geneseo.edu or 585-245-5112). Students with accommodation letters should contact their faculty members as early as possible in the semester to discuss specific

arrangements. Additional information on the Office of Accessibility is available at www.geneseo.edu/dean_office/disability_services.

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.

Mental Health

As a student, you may experience a range of challenges that can impact your mental health and thus impact your learning; common examples include increased anxiety, shifts in mood, strained relationships, difficulties related to substance use, trouble concentrating, and lack of motivation, among many others. These experiences may reduce your ability to participate fully in daily activities and affect your academic performance.

SUNY Geneseo offers free, confidential counseling for students at the Lauderdale Center for Student Health and Counseling, and seeking support for your mental health can be key to your success at college. You can learn more about the various mental health services available on campus at health.geneseo.edu.

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.

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.

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.

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.

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.

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.cs.ny.gov/attend_leave_manual/030Appendices/B-CalendarofLegalHolidays/2021calendar.html