

BIO 5640, Cancer Biology
3 credits
Department of Biological Sciences
Wayne State University

Instructor: Andrei Borisov, Ph.D.

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Office hours: by appointment – please schedule by email

Class hours: 1:00 pm - 2:15 pm, Mon & Wed., Room 1109 Science Hall

Prerequisites: BIO1510 Basic Life Mechanisms,
BIO 2600 Introduction to Cell Biology (desirable).

Textbooks: There should be no need to buy any paper copies or order them for the bookstore. Textbooks for this course are available at Wayne State libraries as electronic resources using the same login students use for email.

You will have what is called *unlimited access* to these textbooks. This means they can get access to full texts with all illustrations from any device including their laptops and phones, download PDFs of the whole book or individual chapters, and print paper copies whenever they need them.

Both textbooks are published by Oxford University Press:

- 1) *Biology of Cancer* by RW Ruddon.
- 2) *Introduction to Cellular and Molecular Biology of Cancer* by RA Knowles.

As additional resources, we will use selected chapters from two other texts also electronically available from the WSU library as:

Primer of the Molecular Biology of Cancer, Edited by DeVita V et al., Kluwer, 2015

Principles of Stem Cell Biology and Cancer. Edited by T.Regal et al, Willey-Blackwell, 2015

I also recommend that students rent or buy electronic access to *The Biology of Cancer* by Robert Weinberg, Garland Science, 2014, as a good additional resource(optional): *Weinberg RA. The Biology of Cancer*, 2nd Edition, 2014, Garland Science, Taylor & Francis Group, New York and London.

Course Objectives and Description:

The objective of this course is to learn the principles of cancer biology and identify the main cellular and molecular mechanisms underlying the initiation and progression of neoplastic growth. The main focus of this course is on the comparative overview of proliferation control and signal transduction in malignant cells and normal cells. We will explore the molecular pathways responsible for genome instability in cancer cells and the multi-step process of tumor

progression leading to invasive metastatic growth. The course will also examine the role of stem cells and their potential for differentiation in different types of malignancies. Class discussions will include recent advances in molecular diagnostics and therapy of cancer and the modern methods in cancer research using molecular probes, genomics and high resolution cell imaging.

Learning Outcomes:

Upon successful completion of this course students should be able to:

- 1) Identify the main cellular mechanisms leading to initiation and progression of cancer growth. Describe the characteristics of cancer cells that explain high mortality rate.
- 2) Define the role of oncogenes and mutations in cancer and explain why several types of cancer have heritable traits and family history.
- 3) Discuss the cellular signaling pathways that are deregulated in tumor cells compared to normal cells.
- 4) Define the main factors contributing to metastatic growth. Identify the role of stem-like cells, their properties and contribution to tumor progression. List and describe the main factors controlling the evolution of cancer cell populations.
- 5) Develop a solid understanding of the main methods used in the modern studies of cellular and molecular mechanisms of cancer.
- 6) Demonstrate core knowledge of the cellular targets and molecular mechanisms of traditional and novel cancer therapies.
- 7) Demonstrate the basic ability to comprehend and interpret main conclusions drawn from publications and experimental studies in cancer research.

Exams:

Three exams and the final. The lowest score of one exam will be waived and will not contribute to the final grade. Review questions will be provided for each exam. Honors: Term paper. 12 pages double spaced plus illustrations and reference list.

The list of the lectures and topics can be changed and presented for information purposes only. Feel free to contact the instructor if you have any questions.

Grading

A total of **350** points can be earned. There will be NO opportunities for extra credit. Exams may be curved to the second highest grade earned, however if more than one person earns 100 there will be no curve applied. The overall course will NOT be curved. Course grades are determined from total point accumulation at the end of the semester. Final letter grades will be assigned according to the following grading scale:

| Percent | Grade |
|----------------|-------|
| 93-100 | A |
| 90-92.99 | A- |
| 87-89.99 | B+ |
| 83-86.99 | B |
| 80-82.99 | B- |
| 77-79.99 | C+ |
| 73-76.99 | C |
| 70-72.99 | C- |
| 67-69.99 | D+ |
| 63-66.99 | D |
| 60-62.99 | D- |
| 59.99 or below | F |

| | Points |
|--------------|--------|
| Exam I | /100 |
| Exam II | /100 |
| Exam III | /100 |
| Final Exam | /150 |
| Drop exam | |
| Course Total | /350 |
| | |

Date/Time of the Final exam: during the exam week in the mid-December, according to the university schedule. **Location:** TBA

Exam Grade Disputes

Given that exams are curved to the second highest grade, I do not accept challenges to exam questions. However, if you believe your score has not been added up properly please see me immediately.

Add / Drop Policy

Students may not be added after the second week of class. Refer to the registrars calendar for the last day to drop this course. **Dropping a course is done electronically through your pipeline account.** If you officially withdraw from this course, it will appear on your transcript with a mark of “WP” (withdrawal with a passing grade earned to date), “WF” (withdrawal with a failing grade earned to date) or “WN” (withdrawal given to students who did not attend any classes and / or did not complete any assignments and / or did not participate in credit-earning activities by the withdrawal date). An “F” grade will be assigned to students who stop attending class without officially withdrawing. Further information regarding WSU’s grading policy can be found at (<http://sdcl.wayne.edu/RegistrarWeb/Registrar/policies.htm>).

General Policies

- There will be **zero-tolerance** for cheating. If you are caught cheating, you will get a zero for that exam. University disciplinary action may be pursued. Any inappropriate behavior will simply not be tolerated in lecture OR in the laboratory.
- Cell phones must be turned off or placed on a silent mode of notification

before entering the lecture hall AND laboratory. Yes, this means no texting! Wrist watches may not be worn during exams.

- I am happy to write a letter of recommendation for any student that earns an "A" in my course and also demonstrates strong personal characteristics that I have been made aware of during the semester.

Special Considerations for Individuals with Disabilities

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. The SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Religious Holiday Conflicts

If you have a conflict with any of the scheduled class or exam times due to religious reasons, you must notify me in writing by **01/20/18.** No special considerations will be considered unless I am notified in writing by this date.

Unexpected University Closures

If the University is officially closed on an exam day, the exam will be held on the next regularly scheduled class day. Closure of the University is announced by the following mechanisms:

1. University Newline (313) 577-5345 *
2. WSU Homepage (www.wayne.edu) *
3. WSU Pipeline (www.pipeline.wayne.edu) *
4. WDET-FM (Public Radio 101.9)
5. other local radio and television stations

Disclaimer

This course syllabus is subject to modification at the discretion of the instructor without prior notice. Lecture topics and/or scheduled times may be changed to accommodate class progress. Students must keep regular attendance and take note of any such changes as appropriate. Any specific issue not covered by this syllabus will be resolved using University policies. Disputes that cannot be resolved following the guidelines present in this syllabus will be resolved by following the guidelines of the University "Student Due Process."

Course Content (the final version of the syllabus will be posted on September 2):

| Lecture # | Lecture Topics |
|------------------|---|
| Lecture 1 | The Nature, Etiology and Epidemiology of Cancer as a Disease. Susceptibility to Cancer of Different Organs and Tissues. Overview and Terminology. |
| Lecture 2 | Differences in Cell Biology of Normal Cells and Cancer Cells. Oncogenes, Tumor Suppression Genes and Control of Cell Cycle. |
| Lecture 3 | Cellular and Molecular Mechanisms of Cancer Initiation and Progression. Premalignant and Malignant Cell Characteristics. Tumorigenesis as a Multi-Step Process. Role of Mutations and Genetic Instability in Neoplastic Growth. |
| Lecture 4 | Hypothesis of Clonal Origin of Tumors. Development of Invasive Properties and Mechanisms of Metastatic Growth. |
| Lecture 5 | Cellular and Molecular Mechanisms Underlying the Evolution of Malignant Cell Populations. |
| Lecture 6 | Responses of Cancer Cells to Extracellular Signals. Role of Growth Factors, Growth Factor Receptors and Hormones in Neoplastic Growth. Signal Transduction and Control of Apoptosis in Normal and Malignant Cells. |
| Exam 1 | Material of Lectures 1 – 6 |
| Lecture 7 | Cytoplasmic Signaling Circuitry in Cancer Cells. Functional Activity of Cytoplasmic Structures and Organelles in Cancer Cells: Cytoskeleton, Lysosomes and Mitochondria, Changes in Energy Metabolism and Warburg Effect. |
| Lecture 8 | Role of Stem / Precursor Cells in Cancer Initiation and Progression. Origin and Markers of Cancer Stem Cells. Malignancies in Developing and Continuously Renewing Tissues: of Embryonic, Neonatal and Adult Tumors. |
| Lecture 9 | Cancer Cell Differentiation and Epigenetics. Interrelations of Cell Proliferation and Differentiation during Progression of Different Tumor Types. |
| Lecture 10 | Chromosomal Changes and Gene Amplification in Cancer Cells. Karyotyping in Diagnostics of Different Types of Tumors. Molecular Methods for Studies of Chromosome Rearrangements in Cancer Cells. |
| Lecture 11 | Interrelations between Parenchymal and Stromal Cells during Malignant Growth. Role of Angiogenesis in Tumor Progression. |
| Lecture 12 | Experimental Models for Studies of Malignant Growth and Progression <i>in vivo</i> and in Cell Culture. |

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| Exam 2 | Material of Lectures 6-12 |
| Lecture 13 | Tumor Antigens, Immunology and Immunotherapy of Cancer. |
| Lecture 14 | Cancer and Aging. |
| Lecture 15 | Modern Methods in Studies of Cellular and Molecular Mechanisms of Neoplastic Growth. Cancer Genomics and Proteomics. |
| Lecture 16 | Modern Methods and Probes for Differential Cellular and Molecular Diagnostics of Cancer. |
| Lecture 17 | Cellular and Molecular Targets of Traditional and Novel Therapies for Cancer. |
| Lecture 18 | Synopsis and Prospects: Challenges and Opportunities on the Road Ahead. |
| Exam 3 | Material of Lectures 13 – 18. |
| Honors Section | Review and discussion of Work Presentation by Students Enrolled in Honors Section |
| Final Exam | Exam week according to the University schedule |