Name: Cancer Biology 2023/24 (other name Molecular Oncology)

Codes: BIO436/636

When/Where: Class 8:40 am - 10:30 am Monday FENS L061
Class 11:40 am - 12:30 pm Friday FENS L045

Instructor: Alex Lyakhovich

Subject to change, please see final schedule

Aim: The course aims to provide a comprehensive overview of the molecular oncology

Course Description: The course is divided into four parts: basic theory of cancer biology (Lectures 1-6), molecular mechanisms of cancer development and progression (Lectures 7-13), molecular mechanisms of tumor suppressors (Lectures 14-20) and hot topics of cancer research (Lectures 21-24). This course is designed for both graduate and undergraduate students* and provides them with a basic understanding of the molecular and cellular mechanisms of cancer initiation, development and progression. In the part describing molecular mechanisms of tumor suppression, the fundamental principles of cancer diagnosis, prevention, and therapeutic interventions are also discussed.


Sustainable Development: the course is related to sustainable development goal 3 as part of health-related global issues and the trends in public health

Levels: Undeclared, Doctorate, Masters, Exchange - Erasmus Mundus DR, MA, UG, Special Student, Scientific Preparatory, Undergraduate, Exchange - Socrates Erasmus DR, MA, UG

Course Attributes: Lang. of Instruction: English, 3.000 Credit hours, 10 ECTS, Course Offered by FENS

Prerequisites: A basic level understanding of biology, molecular and cell biology, chemistry, biochemistry and statistics is a highly prerequisite.

Attendance and participation: Required in at least 80% of the lectures

Evaluation criteria: T1- 15%, T2-15%, Midterm-20%, Final – 30%, quizzes – 20%

LEARNING OUTCOME: Knowledge on how Cancer is formed, develops, progresses, cured
Any of the following books can be used as supportive materials:


- Introduction to Cancer Biology textbook by Robin Hesketh, University of Cambridge ISBN: 9781107601482 LENGTH: 352 pages

- Oxford Textbook of Cancer Biology (Oxford Textbooks in Oncology) Illustrated Edition by Francesco Pezzella (Editor), Mahvash Tavassoli (Editor), David Kerr (Editor)

- The Biology of Cancer, 2nd Edition and up by Robert A. Weinberg (Author)

### EARNING GRADES

| • EARNING GRADES                                                                 | A 100 – 90 %               |
|                                                                                 | A - 89 – 85 %              |
|                                                                                 | B + 84 – 80 %              |
|                                                                                 | B 79 – 75 %                |
|                                                                                 | B - 74 – 70 %              |
|                                                                                 | C + 69 – 65 %              |
|                                                                                 | C 64 - 60 %                |
|                                                                                 | C - 59 – 55 %              |
|                                                                                 | D + 54 - 50 %              |
|                                                                                 | F Less than 49             |

- 2 tests 15x2 = 30 points  
- 1 midterm 20 points  
- 1 final 30 points  
- quizzes and article questions 20 points

- A few bonus points will be awarded for class participation and will be added to each upcoming test.

**Grading:** If the first decimal place is 5 and larger, then the number will be rounded up to the next integer (e.g., 67.5 → 68). Failing to take one of the exams without a medical excuse will result in failing the course. The letter grade ranges are provided in the table below.

**Attendance:** all tests get points; all bonus questions get points; no attendance, no points. If you score less than 70% on any of the tests, you must physically attend class
Academic Integrity Policy -- YOU MUST READ AND FOLLOW

Each student will be evaluated only for her/his own work. Students are encouraged to work and study together; however, what you put down on your problem sets, lab reports, and exam papers should be your own work in your own words. Be aware that you will not be helping your friends by allowing them to copy.

Do not allow your friends to make use of your problem sets or, lab reports and exams, allowing them to copy will not help them in the long run. Such behavior, as all forms of cheating, is unfair and disrespectful to yourself, to all the students in the class, to your instructors and teaching assistants, and to the University.

A student involved in cheating has misused the trust extended to him or her. If discovered, such behavior will have DISCIPLINARY consequences for all parties involved. Violations of academic integrity will result in zero grades for that worksheet or exam, both for those who cheat and those who allow and help them cheat. In all such situations we will ask you to have a face-to-face meeting with the instructor. We have mutual trust and respect for each other as individuals while sharing a collaborative learning experience. This is very valuable for all of us, and having to lose this trust and respect would be very regrettable.

Class Participation: Participation will be based on the quality of your comments during discussions and the questions you ask during lecture. To get a C in participation you should be asking a question or speaking once every few weeks. Of course, asking questions every class does not insure a high participation grade, rather, an A is earned by asking thoughtful questions about material that may be confusing and making comments that move discussions forward.

You can ask me to evaluate your participation at any point in the semester.

NA Policy: If you miss one of the exams, you will automatically receive NA for the course. If you otherwise fail the course, you will receive NA

Cell/Mobile phone policy: Cellular phones that ring during lecture are extremely disruptive to a productive learning environment—distracting both the professor and the other students. Individuals that allow their phones to ring during class may be asked to leave. This also covers constant texting and vibrating phones. Please do not text during my lectures. I don’t text with anyone during any part of the class but the break and I ask you to also refrain for the 160 minutes of class, even during group work or discussions. Honestly, I find it insulting and rude. Any communication via an electronic device during an exam or quiz will be considered cheating. There is no problem if you would like to use them during the breaks in class. However, if your phone becomes a distraction then I reserve the right to confiscate your phone and return it back at the end of the lecture😊
Tentative topics by week

Please note that these are preliminary topics based on a previous course that we have restarted. In the new edition, I may (and will) change some topics or implications, but not dramatically.

Week 1


Week 2


Week 3


Week 4

Lecture 7 TEST1 (most likely March 8). Lecture 8 The transformation of a cancer cell into a malignant tumor. DNA/RNA sequencing, clustering. VEGF and vascularization. Molecular
mechanisms of cancer development and progression: angiogenesis, metastasis. Tumor microenvironment, metastatic niches. EMT vs. MET. Role of Wnt pathway. TGFβ, CAF and TAM – who are those guys? Discussion of original papers.

Week 5

**Lecture 9** Cancer metabolism. Glycolysis vs. OXPHOS. **Lecture 10** Metabolic shift. Molecular pathways contributing to metabolic reprogramming. Original research papers to discuss.

Week 6

**Lecture 11** Cancer resistance. Modern theories of cancer resistance. Do we really die from primary cancer? Metastasis. **Lecture 12** Cancer stem or tumor initiating cells – do they really exist? Original research papers to discuss.

Week 7


Week 8 or **Midterms (most likely April 2-5)**

Practical lessons. The audience is divided into two groups - a support group and a critics group. We discuss 4 articles in leading journals (two in leading medical journals and two in scientific journals). Then the groups switch places. The goal is to develop critical thinking. Bonuses are for clever questions, for insightful insights, and for a non-trivial approach to interpreting results.

Week 9

Molecular mechanisms of cancer development and progression: telomere biology and immortalization. Aging vs. cancer, who comes first? Discussion of original papers.

Week 10
Molecular mechanisms of cancer development and progression: more on defects in DNA repair genes. Error-prone and error-free repair (part 2, the first one was in Lec. 6). Rare cancers and rare diseases. Cancer predisposition. Discussion of original papers.

**Week 11**


**Week 12**


**Week 13**

Molecular mechanisms of tumor suppressors: novel molecular targets for anticancer therapy. Discussion of original papers. Conclusion remarks - the current state of cancer research in the world.

**Week 14-15 final test/assignments**

Most likely, the final exam will be composed of 2 equally important parts – final test and final assignment.