

# CELL BIOLOGY LECTURE

## MSc in Molecular Biology

### Division of Cell Biology

Subject: CELL BIOLOGY LECTURE

Year, Semester: 1st year/2nd semester

Number of teaching hours:

Lecture: 28

#### 1st week:

Lecture: 1. Introduction. Origin of life. Basic functions and constituents of cells

2. Cell membrane, intracellular compartmentalization

#### 2nd week:

Lecture: 3. Passive transport processes

4. Active transport processes

Seminar: Material related to lectures 1-2.

#### 3rd week:

Lecture: 5. Ca homeostasis

6. Osmo-, volume and pH regulation

Seminar: Material related to lectures 3-4.

#### 4th week:

Lecture: 7. Cytoskeleton I. (microtubules)

8. Cytoskeleton II. (intermediary and microfilaments)

Seminar: Material related to lectures 5-6.

#### 5th week:

Lecture: 9. Cell-cell and cell-matrix contacts

10. Cellular energetics, mitochondrion, endosymbiosis

Seminar: Material related to lectures 7-8.

#### 6th week:

Lecture: 11. Nucleus, chromatin

12. Transport of proteins synthesized on free ribosomes. Nuclear envelope, transport through nuclear pores

Seminar: Material related to lectures 9-10.

#### 7th week:

Lecture: 13. Vesicular transport I.

14. Vesicular transport II.

Seminar: Material related to lectures 11-12.

#### 8th week:

Lecture: 15. Cell division (mitosis, meiosis).

Mechanics of cell division.

16. Cell cycle and its regulation

Seminar: Material related to lectures 13-14.

#### 9th week:

Lecture: 17. Cell signaling I. General concepts.

Nuclear receptors. G-protein coupled receptors

18. "Cell signaling II. Receptor tyrosine kinases.

The Ras/MAPK, PI3K/Akt and PLC/CaMK pathways

Seminar: Material related to lectures 15-16.

#### 10th week:

Lecture: 19. Cell signaling III. Proteolytic

Signals. Pathways to the nucleus

20 Cell-cell communication in the nervous and the immune system

Seminar: Material related to lectures 17-18.

#### 11th week:

Lecture: 21. Cell fates: Differentiation

22. Cell fates: Oncogenes, tumor cells

Seminar: Material related to lectures 19-20.

#### 12th week:

Lecture: 23. Cell fates: Cell senescence, apoptosis

24. Cell fates: Stem cells

Seminar: Material related to lectures 21-22.

#### 13th week:

Lecture: 25. From genes to cell function:

overview of the main regulatory mechanisms

26. Cell and gene therapies

Seminar: Material related to lectures 23-24.

**14th week:**

Lecture: 27. Cell motility  
28. Consultation

Seminar: Material related to lectures 25-26.

**Reading materials:**

Alberts et al.: Essential Cell Biology.  
6th edition. W. W. Norton & Company, 2023.  
ISBN-13: 978-1324033356  
Lodish et al.: Molecular Cell Biology.  
8th edition, W. H. Freeman, 2016.

Alberts et al.: Molecular Biology of the Cell.  
7th edition. W. W. Norton & Company, 2022.  
Cell Biology Laboratory Manual – latest version  
on the subject's eLearning site.

## Requirements

Department: Department of Biophysics and Cell Biology, Cell Biology Division

Recommended semester: 1st year 2nd semester.

Prerequisites of the course: No prerequisites.

Teaching staff: Prof. Dr. György Vereb and the members of the Department

Subject officer: Dr. Árpád Szöőr

Education manager: Dr. Enikő Nizsalóczki (e-mail: cellbioedu@med.unideb.hu)

**Aims of the course:** The course gives an overview of the functional anatomy of higher eukaryotic animal cells with examples of the paradigmatic molecular mechanisms. Students successfully completing the course will have acquired an active professional vocabulary minimally required for studying biochemistry, molecular biology, genetics, histology and physiology. In addition, the course aims to provide a thorough knowledge base which serves to understand the functions and dysfunctions of the human body in their broader context.

**Course synopsis:** Structure and constituents of eukaryotic cells, the most important cellular functions: membrane transport, vesicular transport, cell signaling, cell division (mitosis, meiosis), differentiation, cell death

**Material to be studied:**

**Compulsory sources:** 5th ed. of Essential Cell Biology (Alberts et al., Garland Publ Inc. 2019. ISBN-13: 978-0393-6803-62). Chapters 1 and 11 through 20 are studied in depth during the course. Chapters 2 through 10 contain explanations for basic molecular concepts. There is additional core material that is available only in the lectures.

**Cell biology Lab Notes:** the currently required, up-to-date version is available at the course home page (@ elearning.unideb.hu).

**Recommended:** The in depth full-text version of the course material can be found in: Alberts et al.: Essential Cell Biology., 6th edition. W. W. Norton & Company, 2023. ISBN-13: 978-1324033356; Lodish et al.: Molecular Cell Biology. 8th edition, W. H. Freeman, 2016.; Alberts et al.: Molecular Biology of the Cell. 7th edition. W. W. Norton & Company, 2022.

The 4th editions of these are also available online:

<http://www.ncbi.nlm.nih.gov/books/NBK21475/>

<http://www.ncbi.nlm.nih.gov/books/NBK21054/>

**Knowledge that will be examined in this course** is comprised in the slides presented in the lectures. It is recommended to download these slides before the lectures and take notes on them during the lecture. Slides of central importance will be marked accordingly.

**Course home page:** <https://biophys.med.unideb.hu/en/node/635>

<https://elearning.med.unideb.hu/>

**Type of exam:** Final exam

**Exemptions:** In order to get exemption from the complete Cell Biology course, the student has to apply to the Education Office. Applications for exemption from part of the courses are handled by the Department. The deadline for such applications is Monday on the second week of education. No application will be considered after this date. The following documents have to be submitted to the

Educational Advisor: 1. application with an explanation why the student thinks that he/she is eligible for an exemption; 2. certificates about the courses the student has taken; 3. a reliable description of the curriculum of the courses taken. Applicants may be interviewed before the decision is made.

#### Requirements:

1. Lectures: Attendance of lectures is indispensable for acquiring the knowledge required to pass, understanding which parts of the material have the highest importance, and finding the proper sources for preparing for the exam.

2. Seminars: Students should attend the seminars together with those in the General Medicine Course. A suitable class should be selected based on the timetables posted on the department website / eLearning.

Seminars serve to discuss the lecture material. Use them well, study the material before the seminar and arrive with your questions.

3. Labs: Labs are done under a separate subject code and need to be passed for acquiring a signature in for this course.

#### 4. Self-control Tests (SCT-s):

There will also be two SCT-s (comprised of test and essay questions) during the semester. The dates and topics for SCT-s are announced in the beginning of the semester. These SCT-s will have a strong focus on keywords and definitions.

Writing the tests is not compulsory; tests cannot be made up for, even in the case of a justified absence. Missed tests carry a score of 0.

SCTs are scored on a 0-100% scale, averaged (=SCTave) and this average is used for offering exemptions and bonus points towards the final grade (see 5.2 and 5.4.1.).

#### 5. Final Exam (written):

5.1. Parts of the Final Exam. The exam is a written exam of two parts (A and B).

Part A of the written test is a minimum level test. It consists of a set of 10 true-or-false questions about basic cell biology knowledge (1 point each) and 5 questions asking for a brief description of basic terms (molecules, concepts). These terms are listed among the key-words published on the subject's website. The answers are scored on a 0-2 scale in increments of 0.5 points. The student has to score 16 or above out of the total 20 points in part A to pass. Below 16 points the grade of the exam is a fail (1) and part B is not marked. For writing Part A, 20 minutes are allocated. A successful passing of Part A (or exemption from writing Part A, see 5.4.2) is valid for B and C exams throughout the given exam period, but not in consecutive semesters.

Part B is a 85 minute complex exam, including short essays, fill-in, short answer, multiple choice, relation analysis, sketch-recognition, term-matching, definition recognition, etc.

5.2. Calculating the exam score. As per 5.1., exam score is only calculated if Part A is passed.

1. % result of Part B expressed as points, 100 points maximum. If score on Part B is greater or equal to 50%, the following bonus points are added to the score of Part B:

2. Average % result of SCTs (SCTave):

4 points for reaching 30%, +1 for each additional 10% reached, 10 points maximum

Total: 110 points maximum

N.B. Bonuses are only valid in the semester they were obtained.

### 5.3. Assigning grades to exam scores

Part A below 16 points: fail (1)

Exam score (see 5.2.):

below 50 points: fail (1)

50-59.9 points: pass (2)

60-69.9 points: satisfactory (3)

70-79.9 points: good (4)

reaching, and above 80 points: excellent (5)

### 5.4. Exemptions

5.4.1. For those who achieve SCTave  $\geq 50\%$  at the self-control tests, a final grade offering score is calculated as follows:

SCTave % expressed as points, 100 points maximum

Grades are offered as listed under "5.3. Assigning grades to exam scores". (Part A is considered to be passed in this case without writing a Part A test.)

5.4.2. Those who achieve SCTave  $\geq 66\%$  at the self-control tests and do not accept the offered grade calculated as under 5.4.1. and therefore take the final exam, are exempted from Part A of the written final exam during the given semester.

### 6. Rules for repeating the course

6.1. Repeaters taking again a regular Cell Biology course need to attend seminars and can do presentations as regulated normally (see 2.). We encourage repeaters to write the SCTs since this is the only way to receive bonuses and exemptions based on SCTave scores.

6.2. Repeaters can apply for a Cell Biology exam course in the third semester, if they have taken at least one exam in the previous exam period and in that exam have passed the minimum requirements (Part A), and have scored at least 35% on Part B). The above items 1.-4., 5.4 and 6.1. are irrelevant to the exam course and consequently no bonuses can be earned during the exam course. Otherwise the final exam proceeds as detailed under 5. If Part A is passed in the exam, the % result of Part B expressed as points is converted to a grade as per 5.3.