# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Cell biology [S1IFar2>BK]

## Course

Field of study
Pharmaceutical Engineering

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

3,00

## Coordinators

prof. dr hab. Błażej Rubiś
blazej.rubis@put.poznan.pl

## Lecturers

## Prerequisites

Students entering the course should have a basic knowledge of cell biology, molecular biology and biochemistry. Before commencing experimental work, they should be familiar with the principles of health and safety and fire protection.

## Course objective

The aim of the course is to introduce the student to basic issues in the field of cell biology. During the course, the students learn the diversity, structure and basic principles of cell functioning. The course indicates the cell as a highly dynamic, basic structure that builds all living organisms, as well as describes the functional and structural levels of the basic physiological processes that are running in a living cell.

## Course-related learning outcomes

Knowledge:
1. The student has knowledge in the field of physicochemical and biological foundations of health sciences within the scope appropriate to pharmaceutical engineering, including basic issues within the scope of subjects such as biology, pharmaceutical botany, biotechnology, biochemistry, molecular biology, human anatomy and physiology. [K-W5]

2. The student has knowledge of the basic techniques, methods for characterizing and identifying pharmaceutical products and research tools used in pharmaceutical engineering, knows the classical and instrumental methods used in assessing the quality of substances for pharmaceutical purposes and in quantitative analysis in medicinal products, knows the physicochemical properties of substances for pharmaceutical use that affect the biological activity of drugs, knows the classification of analytical techniques along with the criteria for the selection of methods application and method validation. [K_W7]
3. The student knows the basic principles of safety at work. [K_W27]

Skills:
1. Student understands literature in the field of pharmaceutical engineering in Polish; reads and understands uncomplicated scientific and technical texts in a foreign language, is able to obtain information from literature, databases and other sources related to pharmaceutical engineering, also in a foreign language, integrate them, interpret them, draw conclusions and form opinions. [K_U1]
2. Uses basic techniques, research equipment and apparatus useful in biotechnology, synthesis and analysis of pharmaceutically active substances, drug form technology and toxicology, appropriate for pharmaceutical engineering, uses pharmacopoeial methods, prepares documentation. [K_U8]
3. Selects and applies analytical methods and techniques in qualitative and quantitative analysis as well as is able to control processes and assess the quality of raw materials and products. [K_U11]
4. Has the ability to self-study. [K_U24]
5. In a professional and research environment, he/she can plan and organize individual and team work as well as work both individually and as a team. [K_U25]

Social competences:
1. The students are ready to critically assess their knowledge, understand the need for further education, supplementing their field knowledge and raising their professional, personal and social competences, understand the importance of knowledge in solving problems and are ready to seek expert opinions. [K_K1]

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratories. Students are required to pass an introductory test checking knowledge of material from the scope of the planned laboratories. After completing all the laboratory tasks, students prepare a report covering basic theoretical issues, methodology, results obtained and their interpretation. Such report is delivered to the teacher during the next laboratory meeting or on the set date. The condition of passing the subject is passing the material included in the colloquium and delivering the protocols. Lectures and passing the subject. The final exam includes the content presented in lectures and exercises. Positive assessment is given to students who obtained a minimum of 60% of correct answers.

## Programme content

The program covers the following topics:
1. The cell - the basic unit of life.
2. Cell proliferation.
3. The role of the cell nucleus in cell physiology.
4. Selected cytosolic processes and the role of cell membranes in physiological processes of the cell.
5. Cell parameters evaluated in the context of therapeutic markers.
6. Aging of the cell.
7. Cell death.
8. Tumor cells.

## Course topics

Lectures
1. Cell - the basic unit of life. Cell theory. Cell morphology - cell organelles and their role in cell physiological processes. Selected methods for assessing cell structure and function. Comparison of microscopic methods, examples of markers and indicators used in microscopy. Fractionation of cell organelles.
2. Cell proliferation. From diploid to haploid cell - meiosis. Biology of germ cells. Zygote as the first

diploid cell of the new organism. The cell cycle and its regulation. Mechanisms of cytostatic drug action. Disturbances of the proliferation process as a cause of diseases.
3. The role of the cell nucleus in cell physiology. Differentiated gene expression as the basis for structural and functional specialization of cells. Nuclear-cytosol transport; nuclear receptors, hormonal regulation of gene expression profile; transcription regulation - transcription factors. Mechanisms for cell differentiation. Genes that regulate cell differentiation. Dimensions and shape of different types of cells and their function.
4. Selected cytosolic processes and the role of cell membranes in cell physiological processes. Phospholipids and membrane proteins as elements of the structure of biological membranes. Surface and integral membrane proteins - types and function (adhesive proteins, protein channels, transporting proteins, cytoskeleton forming proteins, ATP-dependent ion pumps, enzymes, receptor proteins - ionotropic, metabotropic, catalytic receptors). Cell compartments.
5. Cell parameters evaluated in the context of therapeutic markers. Extracellular and intracellular proteins - examples and role. Intercellular connections.
6. Cell aging - Theories of cell aging. Molecular basis of the process - mechanisms of cell aging. Telomeres and telomerase. Exponents of cell aging. The role of cellular aging. The role of cell aging in aging and age-related diseases. Aging markers.
7. Cell death. Programmed cell death - apoptosis. Other types of cell death. Detection methods for apoptosis, autophagy and necrosis. Induction and inhibition of programmed cell death as a therapeutic method.
8. Tumor cells - Properties of tumor cells. Theories of cancer development. Theory of cancer stem cells. Mechanisms of tumor cell resistance. Cellular molecular targets for anti-cancer drugs.
Laboratories
1. Cell cultures - working principles in the cell culture laboratory (work in aseptic conditions); apparatus and equipment used in working with cell cultures; cell storage principles, growth conditions; cell line types; cell passaging procedures depending on the type of growth; assessment of cell viability.
2. Evaluation of cell response to cytotoxic / cytostatic factors - comparison of tests assessing cell response to cytotoxic / cytostatic factors; tests using changes in cell membrane permeability of dying cells, methods for assessing DNA synthesis, radioisotope method. Performing MTT test.
3. Morphological assessment of cells in culture. Review and comparison of methods: labeling and detection of DNA in cells using a flow cytometer, detection of proteins associated with a specific phase of the cell cycle; methods for assessing markers of apoptosis, colorimetric and immunofluorescent methods.

## Teaching methods

Lectures, experimental cases.

## Bibliography

Basic:
Molecular Biology of the Cell, Sixth Edition, by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter
Biochemistry, 5th edition, Jeremy M Berg, John L Tymoczko, and Lubert Stryer.

Additional:
The Cell: A Molecular Approach 7th Edition, by Geoffrey M. Cooper, Robert E. Hausman

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 75 | 3,00 |
| Classes requiring direct contact with the teacher | 38 | 1,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 37 | 1,50 |