

<b>2023/2024. ACADEMIC YEAR</b>							
<b>PROGRAM OF STUDY (FOR STUDENTS OF 3RD YEAR)</b>							
<b>Full (Hungarian) name of the subject: Biotechnológia (elmélet)</b>							
<b>Program: Undivided program (pharmaceutical)</b>							
<b>Schedule: full-time</b>							
<b>Short name of the subject:</b>							
<b>English name of the subject:</b> Biotechnology (theory)							
<b>German name of the subject:</b> Biotechnologie (Vorlesung)							
<b>Type of registration: obligatory/obligatory elective/elective/criteria requirement</b>							
<b>Neptun code of the subject:</b> GYKGYI074E1A							
<b>Responsible Department:</b> Semmelweis University, Department of Pharmaceutics							
<b>Responsible tutor</b> Dr. Krisztina Ludányi				<b>Title, academic degree:</b> associate professor, PhD			
<b>Contact information:</b> Phone: 36 1 476-3600/53017 E-Mail: ludanyi.krisztina@semmelweis.hu							
<b>Name of the persons responsible for the teaching of the subject:</b> Dr. Krisztina Ludányi Dr. Borbála Dalmadi-Kiss Dr. Zsófia Pápay Prof. György Marosi (Budapest University Technology and Economics, Department of Organic Chemistry and Technology)				<b>Title, academic degree:</b> associate professor, PhD research fellow, PhD senior lecturer, PhD professor, DSc			
<b>Class per week:</b> 1 hour lectures				<b>Credit point(s):</b> 1 credit			
<b>Professional content, intent of acquirement and it's function in order to implement the goals of the program:</b> The aim of the course "Biotechnology" is to introduce basics of biotechnology: the basic biotechnological processes; the operation of bioreactors; and basics of industrial enzyme based technologies. It also aims to provide insight into various applications of biotechnology using practical examples.							
<b>Short description of the subject:</b> The course "Biotechnology" reviews the basic biotechnology operations, which include the creation of producer cell lines, their culturing, recovery of products, the operation of reactors suitable for culturing cells; the basics of cell-free, enzyme-based industrial technologies, enzyme kinetics, enzyme reactions. The course, in addition to basic theoretical knowledge, shows the application of biotechnology through practical examples, focusing mainly on the field of pharmaceutical biotechnology (eg antibiotics, steroids, vaccines, amino acids, peptides, recombinant proteins, monoclonal antibodies, organic acid derivatives and glycerol derivatives).							
<b>Course data</b>							
<b>Recommend ed term</b>	<b>Contact hours (lecture)</b>	<b>Contact hours (practice)</b>	<b>Contact hours (seminar)</b>	<b>Individual lectures</b>	<b>Total number of contact hours/semester</b>	<b>Normal course offer</b>	<b>Consult ations</b>
5th semester	1	0	0	0	14	Autumn semester* Spring semester Both semesters (* Please underline)	--

**Program of semester\*\***

**Lecture topics/week**

1. Biochemical, cytological, microbiological aspects (macromolecules, processes, reactions, cell constituents, organells, division of living organisms, microbiological methods)
2. Definition and section of biotechnology  
History and development of biotechnology
3. Fermentation, influencing factors (nutrient solutions, nutrient demand, energy source), mathematical models
4. Biotechnological operations: reproduction, microbial culture methods
5. Biotechnological operations: aeration, mixing
6. Biotechnological operations: sterilization, exploration
7. Bioreactors
8. Enzymes: basic concepts, structure, properties, nomenclature, enzyme groups, enzyme activity  
Enzyme kinetics (Michaelis-Menten, Briggs-Haldane)
9. Regulation of enzyme reactions: inhibition / activation, influencing factors
10. Heterogeneous phase enzyme reactions, enzyme fixation methods, kinetics of immobilized systems  
Enzyme utilization
11. Biotechnological applications: antibiotics, steroids, vaccines, amino acids, peptides
12. Biotechnological applications: recombinant proteins, monoclonal antibodies, derivatives of organic acids, glycerol derivatives
13. Biotechnology applications in practice I.
14. Biotechnology applications in practice II.

**Topics of practical classes (pro week):**

**Other subjects (both compulsory and optional) relating to the transversal issues of the subject. Possible overlaps between subjects:**

Biology, Biochemistry, Microbiology

There is no overlap

**Schedule of consultations:**

According to individual student demand, at an agreed time

**Course requirements**

**Prerequisites:**

Biochemistry I.

**Conditions of attending the classes, amount of acceptable absents, way of presentation of leave, opportunity for makeup:**

According to the Examination and Studies Regulation.

<p><b>The grading method; the conditions for getting the signature; the number, topic(s) and date(s) of the mid-term assessments, (reports, term tests), and the process in which they contribute to the final grade; and the possibility of their retake or their upgrading retake (as provided in §§ 25-28 of the STUDY AND EXAMINATION REGULATIONS):</b></p>
<p><b>Requirements of signature (as provided for in STUDY AND EXAMINATION REGULATIONS § 29):</b></p>
<p><b>Number and type of projects students have to perform independently during the semester and their deadlines:</b></p>
<p><b>Type of the semester-end examination:</b> signature*/practical grade*/ comprehensive examination*/final/end-term examination*</p> <p><b>Examination requirements:</b> as published by the education-research department on the MOODLE interface by the start of the academic term.</p>
<p><b>Form of the semester-end examination:</b> written*/<u>oral</u>*/combined examination/<b>practical examination/the assessment of completing project work (according to STUDY AND EXAMINATION REGULATIONS 30.§)*</b> (<i>Please underline</i>)</p> <p>Topic list:</p> <ol style="list-style-type: none"> <li>1. Concept and grouping of biotechnology, biological drugs</li> <li>2. Fermentation process, kinetic curve, growth curve, influencing factors</li> <li>3. Significance of mixing during fermentation</li> <li>4. Importance of aeration in fermentation processes</li> <li>5. Possibilities and significance of sterilization</li> <li>6. Factors influencing exploration</li> <li>7. Characteristics and types of bioreactors, upstream-downstream operations</li> <li>8. Kinetics and regulations of enzyme actions</li> <li>9. Heterogeneous phase enzyme reactions, methods of enzyme immobilization</li> <li>10. Kinetics of immobilized enzyme systems, use of enzymes</li> <li>11. Biotechnological production of steroids, antibiotics (penicillin)</li> <li>12. Biotechnological production of recombinant proteins, monoclonal antibodies, vaccines</li> </ol>
<p><b>The possibility and conditions for offering grades: -</b></p>
<p><b>A list of the basic notes, textbooks, resources and literature that can be used to acquire the knowledge necessary to master the curriculum and to complete the assessments, <del>****</del>with exact description about which of them is required to acquire which part of the syllabus (e.g. description based on topics)), as well as the main technical and other aids and study aids that can be used:</b></p> <p>Slides presented at lectures</p> <p>Recommended literatures:</p> <p>D. J. A. Crommelin, R. D. Sindelair, B. Meibohm: Pharmaceutical Biotechnology: Fundamentals and Applications, Springer-Verlag New York Inc. (2016)</p> <p>D. Clark, N. J. Pazdernik: Biotechnology, Elsevier Science (2015)</p>
<p><b>In the case of a subject lasting more than one semester, the position of the teaching/research department on the possibility of parallel enrolment and the conditions for admission****:</b></p> <p>yes*/no*/on and individual assesment basis* (<i>Please underline</i>)</p>
<p><b>The course description was prepared by:</b></p> <p>Dr. Krisztina Ludányi associate professor, Prof. István Antal professor</p>