MEDBIOT-09:	**DRUG DEVELOPMENT**
GENERAL INFORMATION	
Course Coordinator(s)	Katarina Mišković Špoljarić, PhD, Assist. Prof. Hrvoje Brkić, PhD, Assist. Prof.
Associate(s)	Suzana Mimica Matanović, MD, PhD, Assist. Prof. Teuta Opačak-Bernardi, PhD, Assist. Prof.
Study Programme	Interdisciplinary Graduate Study Programme in English: Biotechnology
Course Status	Obligatory
Year of Study, Semester	2nd Year / 4th Semester
Credits (ECTS)	**4**
Teaching Method (number of classes)	Lectures: 30; Seminars: 5; Exercises:20
Expected Number of Students in the Course	25-30

COURSE DESCRIPTION

Course Aims

Introduce students to an interdisciplinary research approach to new drug development. Application and development of models based on aimed molecular targets and interactions, and contemporary approaches in the evaluation of biological activity. In terms of its content, the course is an upgrade to the knowledge gained in the course Molecular Modeling, Molecular Enzymology, Genetics and Genomics and connects with the course Experimental Models *in vivo* and *in vitro*.

Prerequisites for Enrolment and the Entry Competencies Required for the Course

Completed undergraduate university study programme from the area of natural sciences (chemistry, biology) or biotechnical sciences, or biomedicine and healthcare. Completed and passed courses from 1st year of study.

Learning Outcomes at the Programme Level Contributed by the Course

BIOTECH-1; BIOTECH-7; BIOTECH-10; MEDBIOT-1; MEDBIOT-2; MEDBIOT-4

Learning Outcomes at the Course Level

After completing the course, the student will be able to:

1. Predict the physicochemical properties of the designed molecule
2. Apply acquired knowledge in analyzing and creating / modifying new medicines at the level of personalized medicine.
3. Identify the parts in the structure of the drug that are important for the action (pharmacophores) and physicochemical properties of the drug
4. Calculate and predict the activity, metabolism and toxicity of the new molecule using computer programs
5. Suggest computer programs for fitting of ligand into the active site (docking)
6. Critically evaluate laboratory experiments and statistical analyzes that appear in the professional literature

Course Content

Lectures. I) basics in drug development: drug development yesterday, today, tomorrow; the classic approach to development; protein-ligand interaction as the basis of activity; optical activity and biological effect; screening technology in drug development; prodrug design, peptidomimetics; II) experimental and theoretical methods: determination of the energetically most favorable position of the small molecule at the end target (scoring function); molecular modeling and 3D structure; protein visualization; protein databases; gene technology in drug development; III) drug activity: pharmacophore significance and molecular comparison; the link between structure and activity; in vitro and in vivo activity; ADME optimization and toxicology; activity of drugs by groups (metalloenzymes, hydrolases inhibitors, proteases, oxidoreductases, transferases, agonists and

antagonists of core receptors, membrane receptors)
Seminars. (Problem seminar) protein modeling based on end target; inhibitor modeling for t-RNA-guanine transglycosylase
Exercises. PDB database search, structure editing, homologous modeling, comparison of the primary structure of the protein (sequence similarity), tools for scoring function, protein visualization tools (pymol, WMD), AMES test.

Teaching Methods

Lectures; Seminars; Laboratory exercises

Students' Obligations

Attendance at all forms of classes is mandatory and the students are obligated to attend all knowledge tests. The students may be absent from 30% (full-time students) and 50% (part-time students) of each of the forms of classes, provided that the absence is justified. An exercise or a seminar which has not been completed must be made up through a midterm exam.

Monitoring the Activity of the Students *(Connecting Learning Outcomes, Teaching Methods, and Grading)*

Class-related activity	ECTS	Learning outcome	Student activity	Evaluation method	Grade points	
					Min.	Max.
Attending classes	0.25	1-6	Attendance	Keeping records	0.5	4
Seminars	1.0	5	Seminar drafting and presentation	Seminar presentation	8	20
Exercises	0.75	6	Practical exercises	Keeping records	5.5	16
Final exam	2.0	1-6	Studying for the final exam	Written exam	36	60
Total	**4**				**50**	**100**

Evaluation of the written part of the final exam:

Percentage of correct answers (%)	Grade
>95.00	60
90.00-94.99	57
85.00-89.99	54
80.00-84.99	51
75.00-79.99	47
70.00-74.99	43
65.00-69.99	39
60.00-64.99	36

Forming the final grade:
The points granted for the final exam are added to the grade points awarded during class attendance. The grading process is conducted by absolute distribution, i.e. based on total achievements, and compared to the numerical system in the following manner:
A – Excellent (5): 90-100 grade points; B – Very Good (4): 80-89.99 grade points; C – Good (3): 65-79.99 grade points; D – sufficient (2): 50-64.99 grade points

Mandatory Literature (available in the library and via other media)

Title	Number of copies in the	Availability via other media

	library	
Gerhard K: Drug design: Methodology, Concepts, and Mode-of-Action. Springer-Verlag Berlin Heidelberg, 2013.		yes
Di L, Kerns EH: Drug-Like Properties: Concepts, Structure Design and Methods from ADME to Toxicity Optimization. 2nd Ed., Academic Press, 2016.		no
Additional Literature		
1. Drugs: From Discovery to Approval. 3rd Ed., Wiley-Blackwell, 2015. 2. Fischer J, Childers WE: Successful Drug Discovery. 1st Ed., Wiley-VCH, 2017. 3. Scientific and professional papers related to particular chapters (available online)		
Quality Assurance Procedures Designed to Ensure the Acquisition of Outcomes and Competencies		
Anonymous, quantitative, standardised student survey on the course and the teacher's work implemented by the Quality improvement office of the Faculty of Medicine Osijek and/or the Faculty of Food Technology Osijek.		
Note		
E-learning is not included in the class quota, but it is used in teaching and it contains links to various sites and video and audio materials available on websites.		