

Structural Biochemistry and Bioinformatics

1. GENERAL			
SCHOOL	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
DEPARTMENT	Materials Science and Engineering		
LEVEL OF STUDIES	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
COURSE CODE	MSEN 833	SEMESTER	8th Semester
COURSE TITLE	Structural Biochemistry and Bioinformatics		
TEACHING ACTIVITIES	Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.	TEACHING HOURS PER WEEK	ECTS CREDITS
		4	6
COURSE TYPE	Background and Scientific Area		
PREREQUISITES	none		
TEACHING AND EXAMINATION METHODS	English		
COURSE OFFERED TO ERASMUS STUDENTS			
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	<p>By the end of this course, students will be able to:</p> <ul style="list-style-type: none"> Analyze protein and nucleic acid structures and relate them to biological function Use bioinformatics databases and tools to retrieve, compare, and interpret biomolecular data Perform basic computational modeling and structure prediction Evaluate experimental structural data and understand its limitations Apply structural and computational principles to biomedical and biotechnological problems
General Skills	<ul style="list-style-type: none"> Searching, analyzing and synthesizing data and information Decision-making Independent work Teamwork Generate new research ideas Project planning and management emphasizing materials science Promoting free, creative and inductive thinking

	<ul style="list-style-type: none"> • Modeling and solving real-world problems • Working in a multidisciplinary environment
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3. COURSE CONTENT

1. Levels of protein structure: primary, secondary, tertiary, quaternary
2. Non-covalent interactions in biomolecules: hydrogen bonds, hydrophobic effect, electrostatics
3. Protein folding and stability
4. Structure and dynamics of nucleic acids (DNA, RNA, hybrid structures)
5. Lipid membranes and supramolecular assemblies
6. NMR spectroscopy for biomolecular structure
7. Cryo-electron microscopy and single-particle analysis
8. Mass spectrometry for structural analysis
9. Protein modeling from experimental data
10. Introduction to Bioinformatics (Biological databases: UniProt, PDB, GenBank, Sequence alignment: BLAST, FASTA, multiple sequence alignment, Genome annotation and functional prediction)
11. Structural Bioinformatics (Protein structure prediction: homology modeling, threading, ab initio, Molecular visualization, Structure–function relationships, Active sites and ligand binding)
12. Computational Tools and Algorithms (Molecular dynamics simulations, Docking methods for protein–ligand and protein–protein complexes, Machine learning in structural biology e.g., AlphaFold)

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face.	
Use of ICT	Use of ICT in Course Teaching, Use of ICT in Communication with Students Description: Use of Information and Communication Technologies (ICT) in teaching the course with tools of modern distance learning (ZOOM) and asynchronous education (eclass). Use of learning aids based on ICT: Excel, Word, Power Point Use of ICT in student assessment: Electronic grading (eclass, universis). <ul style="list-style-type: none"> • Use of ICT in communication with students: eclass, email, ZOOM. 	
Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).	
	Activity	Workload/semester (hours)
	Lectures	52
	Tutorial	13
	Bibliographic Research	57
	Written assignments	25
	exam	2
	Total	150

Student evaluation	<p>Assessment Language: English Assessment Methods:</p> <ul style="list-style-type: none"> • Short Answer Questions, • Essay Development Questions, • Multiple Choice Test • Problem Solving • Oral Exam • Written exams
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5. SUGGESTED BIBLIOGRAPHY

EUDOXUS

Structural Bioinformatics, Jenny Gu, Philip E. Bourne, (2nd Edition). ISBN: 9780470181058
 Introduction to Protein Structure, Carl Branden, John Tooze, (2nd Edition), ISBN: 978-0815323051

Additional bibliography for study

Teaching material slides