Universitat Autònoma de Barcelona

2020/2021

Membrane Biophysics

Code: 100906
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Ramón Barnadas Rodríguez
Alex Peralvarez Marin

Prerequisites

General concepts related to physiology and biochemistry.

Objectives and Contextualisation

Study of the components of biological membranes and their molecular organization.

Structural and dynamic features of the two main components of biological membranes: lipids and proteins.

Establishing the links between their molecular structure and physiological functions and possible associated pathologies.

Unravel the molecular mechanisms of vital functions like the propagation of nerve impulse and signal transduction through cellular envelopes or the transport of molecules across biological membranes.

Methods and techniques used for the study of biomembranes.

Competences

- Be able to self-evaluate.
- Clearly perceive current advances and possible future developments by reviewing scientific and technical literature in the area of biochemistry and molecular biology.
- Collaborate with other work colleagues.
- Define the structure and function of proteins and describe the biochemical and molecular bases of their folding, intracellular traffic, post-translational modification and replacement.
- Design experiments and understand the limitations of experimental approaches.

- Explain the structure of cell membranes and their role in signal transduction processes, the transport of solubles and the transduction of energy.
- Interpret experimental results and identify consistent and inconsistent elements.
- Read specialised texts both in English and ones own language.
- Think in an integrated manner and approach problems from different perspectives.
- Understand the language and proposals of other specialists.
- Use the basics of mathematics, physics and chemistry that are required to understand, develop and evaluate the chemical procedures of living matter.

Learning Outcomes

1. Be able to self-evaluate.
2. Collaborate with other work colleagues.
3. Compare the methods and findings that have led to the establishment of the structure and function of biological membranes.
4. Design experiments and understand the limitations of experimental approaches.
5. Explain in detail the biophysical methods used to reveal the dynamic structure and properties of proteins.
6. Identify fundamental issues in present-day biophysics.
7. Identify scientific and technical advances in biophysics.
8. Interpret experimental results and identify consistent and inconsistent elements.
9. Read specialised texts both in English and ones own language.
10. Think in an integrated manner and approach problems from different perspectives.
11. Understand the language and proposals of other specialists.

Content

Membrane Biophysics*

1. Introduction

2. Biomembranes

2.1. Structure and function of biological membranes

2.2. Biophysical properties of biological membranes

2.3. Classification and composition of biologigal membranes

3. Lipids and tensioctives

3.1. Structural and biophysical properties of membrane lipids

3.2. Preparation and types of lipid vesicles

3.3. Tensioactives: effects on biological membranes

4. Membrane proteins

4.1. Classification and types of membrane proteins

4.2. Structural principles of membrane proteins

4.3. Biogenesis and folding of membrane proteins

4.4. Modification of membrane proteins

4.5. Membrane proteins-biologcal membranes interactions

4.6. transport across membranes

4.7. Membrane fluidity amd membrane protein function

5. Methods in biomembranes

6. Specialized seminars performed by students

* Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

The theory classes will be in complete groups.*

There will be seminars in which students will present individually or in small groups, subjects related to different aspects of the structure and function of the biological membranes.

Attendance at the seminars will be monitored, and the mark obtained will be considered only when attendance is equal to or greater than 80 % of the seminars.

The practical classes will consist of:

A) 2 laboratory sessions:

Obtaining phospholipid / surfactant phase diagram (4 hours)
Quantification of the entrapment of a hydrophilic molecule into liposomes (4 hours)

B) 1 supervised non-contact bioinformatic work.

* The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Master class with IT support	35	1.4	2, 3, 4, 11, 5, 7, 6, 8, 9, 10, 1
Seminars regarding subject main topics. Discussion of topics.	7	0.28	2, 3, 11, 5, 7, 6, 9, 10
Type: Supervised			
Laboratory practical sessions	8	0.32	3, 4, 5, 7, 6, 10, 1
Tutoring sessions	6	0.24	3, 11, 5, 7, 6, 9, 10
Type: Autonomous			
Autonomous study	53	2.12	
Bibliography search and seminar preparation	30	1.2	
Deliverables	2	0.08	2, 8, 9, 10, 1

Assessment

The evaluation will consist of four parts that make up a continuous evaluation process which includes:*

a) two partial exams of the theoretical knowledge subject (70 %).

b) the laboratory practices (14 %).

c) the works proposed throughout the course (10 %).

d) the seminars (6 %), in the case of complying with the assistance indicated in *Methodology* (equal to or greater than 80 % of the seminars).

A minimum passing grade of 4 in each one of the two theoretical exams is required to pass the subject.

Students who have not passed some of them will take a new exam about of the parts not passed.

Students who want to upload the grade can take a global exam of the whole subject, which will provide the final grade.

Test
The exams will combine multi-choice test questions (60 %) with short questions (4 0%) about the master classes.

Laboratory practices will be evaluated by a report (14 %).

In relation to the evaluation of works to be delivered throughout the course and a bioinformatic work supervised with a questionnaire that must also be submitted (10 % of the final grade).

The seminars will be evaluated based on the work presented by the student (6 % of the final grade).

Final mark

Weighted mean of a) to d). To pass the subject the overall mark should be 5.0 or higher.

Exam Review

On-demand exam reviewing will be done individually with the student.

* Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of deliverables	10%	2	0.08	2, 3, 5, 9, 10, 1
Evaluation of oral presentations	6%	3	0.12	2, 3, 11, 5, 7, 6, 9,

				10, 1
Evaluation of practical sessions	14%	1	0.04	2, 3, 4, 11, 5, 8, 10, 1
Evaluation of theoretical knowledge. Short answer test and multiple-choice test.	70% (Multiple-choice 60% + Short-answer 40%)	3	0.12	3, 11, 5, 7, 6, 9, 10

Bibliography

The Structure of Biological Membranes (2nd edition)

Editor: P. Yeagle. *CRC Press, (2005)*: Biblioteca Ciències

Biomembranes

Gennis, R.B. *Springer-Verlag, (1989)*: Biblioteca Ciències

Liposomes: a practical approach

Editor: R.R.C. New, *IRL Press (Oxford) (1990)*

Dynamics of Biological Membranes

Houslay, M.D., Stanley, K.K. *John Wiley & Sons, (1982)*

Introduction to Biological Membranes

Jain, M.K. *John Wiley & Sons, 2nd ed., (1988)*: Biblioteca Ciències

Biophysical Chemistry of Membrane Functions

Kotyk, A., Janácek, K., Koryta, J. *John Wiley & Sons, (1988)*: Biblioteca Ciències