

**Membrane biophysics**

Code: 101899  
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OT	4	0

**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**

- Contribute to public discussions on cultural matters.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning habits and motivation to continue training at postgraduate level.
- Develop independent learning strategies.
- Develop scientific knowledge, critical reasoning and creativity.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Generate innovative and competitive proposals for research and professional activities.
- Identify and understand the advances and challenges of research.

- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Learning Outcomes

1. Analyse the molecular mechanisms of compartmented intracellular transport by means of molecular motors and of their extrapolation to cell and tissue motility.
2. Contribute to public discussions on cultural matters.
3. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
4. Develop independent learning habits and motivation to continue training at postgraduate level.
5. Develop independent learning strategies.
6. Develop scientific knowledge, critical reasoning and creativity.
7. Generate innovative and competitive proposals for research and professional activities.
8. Identify and understand the advances and challenges of research.
9. Identify the molecular and cellular mechanisms for transporting different types of substances (lipids, gases, metals) between tissues.
10. Identify the molecular principles that are common to the selective transport of substances through the plasma membrane and their regulation.
11. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Content

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 biological membranes
3. Lipids and tensioactives
  - 3.1. Structural and biophysical properties of membrane lipids
  - 3.2. Preparation and types of lipid vesicles
  - 3.3. Tensioactives and detergents: 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-biological membranes interactions
  - 4.6. Transport across membranes
  - 4.7. Membrane fluidity and membrane protein function

5. Methods in biomembranes

6. Specialized seminars performed by students

## 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.

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.

## Activities

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

## 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%).

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 (40%) 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.

### Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of deliverables	10%	2	0.08	2, 1, 6, 4, 10, 8
Evaluation of oral presentations	6%	3	0.12	6, 5, 4, 3, 7, 9, 10, 8, 11
Evaluation of practical sessions	14%	1	0.04	6, 5, 4, 3, 7, 10, 11
Evaluation of theoretical knowledge. Short answer test and multiple-choice test.	70% (Multiple-choice 60% + Short-answer 40%)	3	0.12	5, 4, 3, 7, 9, 8, 11

### Bibliography

The Structure of Biological Membranes (2nd edition)

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

The Structure of Biological Membranes.

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