



Universidad
de Navarra

Molecular Physiology (F. Ciencias)

Teaching guide 2025-26

PRESENTATION

Course description: In this course we will study the molecular mechanisms that explain physiological processes and their regulation, that are the basis for understanding how their alterations are at the origin of many pathologies.

- **Degree:** BIOCHEMISTRY
- **Module in the Degree Program:** Module VI. Physiological Integration and Application of Biochemistry and Molecular Biology.
- **Number of credits:** 6 ECTS
- **Year:** Third year, second semester
- **Type of course:** Required
- **Language:** English
- **Professors:** M. Pilar Lostao, course director (plostao@unav.es); Jaione Barrenetxe (jaiobar@unav.es); Rosa Castilla Madrigal (rcastilla@unav.es)
- **Department:** Nutrition, Food Science and Physiology (*Departamento de Ciencias de la Alimentación y Fisiología*). School of Pharmacy and Nutrition.
- **Lectures schedule:**
 - Monday and Thursday 10:00-11:00 am
 - Wednesday 11:00 am -12:00 noon
 - Friday 9:00 -10:00 am
- **Classroom:** 12

[AQP.jpg](#)

LEARNING OUTCOMES (Competencies)

Specific Competences

CE5. Understand, analyze, discuss, write and present scientific arguments in English as a reference language in the field of science.

CE10. Understand the importance and complexity of the regulation and integration of the various functions of the organism so as to apply them in Biomedicine. Acquire interpretative skills in relation to the molecular alterations that cause human pathologies, and regarding clinical results in various forms

CE12. Acquire an in-depth understanding of the aspects of biomedical sciences that complement education and training.

CE13. Apply knowledge, concepts and theories of molecular biosciences and biomedicine in practice.

General and Basic Competences

CG1. Plan and organize one's time; manage one's own learning and continuous education by keeping up-to-date with innovations in science; know how to analyze future trends.



CG3. Teamwork. Select the work methodology and distribute roles and tasks. Know how to listen and participate with positive and constructive ways.

CB1. Students should demonstrate knowledge and understanding in a field of study based on general secondary education, at a level that (albeit supported by advanced textbooks) also includes some aspects that involve knowledge of the latest developments in their field of study.

CB4. Students can communicate information, ideas and solutions to both specialist and non-specialist audience.

SYLLABUS

1. **Introduction.** What is molecular physiology? Methods in molecular physiology. Overview of the mechanisms of cellular communication and signal transduction.
2. **Molecular basis of the transport of solutes across the cell membrane.** Channels and transporters.
3. **Water transport and regulation of cell volume.** Aquaporins.
4. **Molecular bases of the electrical excitability and action potentials.** Structure and function of voltage-gated channels. Cardiac action potential.
5. **Molecular mechanisms of synaptic transmission.** Synaptic transmission at the neuromuscular junction. Termination of neurotransmitter action.
6. **Molecular physiology of skeletal, cardiac and smooth muscle.** Excitation-contraction coupling in skeletal, cardiac and smooth muscle.
7. **Molecular bases of sensory transduction.** Taste receptors cells and taste transduction. Olfactory receptor cells and olfactory transduction. Auditory transduction.
8. **Cardiovascular function.** Molecular mechanism of vasoconstriction by endothelin. Glial and neuronal control of brain blood flow.
9. **Respiratory function.** Chemical control of breathing: oxygen and CO₂/pH sensing by the carotid bodies. Cystic fibrosis transmembrane conductance regulator (CFTR) function.
10. **Gastrointestinal function.** Acid secretion by the parietal cells and its regulation. P-glycoprotein. Protein secretion by the pancreatic acinar cells.
11. **Renal function.** Regulation of the extracellular fluid: sodium and water transport in the kidney. Tubuloglomerular feedback regulation of glomerular filtration.
12. **Endocrine system.** The thyroid gland: molecular physiology of the sodium/iodide symporter (NIS). Adipose tissue and muscle as endocrine organs.

LEARNING ACTIVITIES

I. In-class

1. Lectures



Universidad de Navarra

Lectures are given by the professor on the themes indicated in the syllabus with the help of the blackboard, power point presentations and animation movies. The professor will post on ADI the power point presentations, some notes for each lesson and some reading recommendations, as well as some videos, which will help the comprehension of the lesson.

2. Seminars (mandatory)

Attending the corresponding seminars is mandatory.

The seminars consist on oral presentations by a team of students of a review article proposed by the professor. The article will be posted on ADI two weeks before the date of the presentation (see "Seminars" folder). At the end of the presentation, the students will have to answer questions from the professor and classmates.

Detailed instructions for the presentations are posted in the folder "Seminars".

Odd teams will attend odd seminars, and even teams will attend even seminars. At the end of the presentation, the students attending the seminar will have to complete a questionnaire.

3. Activities (mandatory)

Attending all the team activities is mandatory.

The teams will be the same as for the seminar presentations.

Team activities will consist on the discussion and problem solving on the content of videos, relevant topics explained in class or readings. Instructions for each activity will be posted on ADI.

4. Exams

A midterm exam and a final exam will assess successful completion of the learning objectives.

II. Out of class

5. Personal and group study

Students will have to be able to integrate the material learnt throughout the course. Therefore, it is important that they do not fall behind and try to work on the course material on a daily basis.

a. Students will have to conduct personal study using the professor's notes, notes taken during the lectures, videos posted on ADI and recommended readings. Being familiar with the topics beforehand will allow students to get the most out of the lectures.

b. For the oral presentation of the seminar, students will have to read and study the assigned article, and prepare the presentation as a team.

c. For the team activities, students will have to study, think, search and integrate knowledge to answer the questions.

Credits/hours distribution of the activities. 6 ECTS= 150 h (25 h/ECTS)

In-class	ECTS	Hours
----------	------	-------



Lectures	1.3	32
Seminars and activities	0.48	12
Exams	0.16	4
Subtotal	1,92	48
Out of class		
Personal and group study	3.9	102
Total	6.0	150

ASSESSMENT

There will be a midterm exam and a final exam. Both exams will be multiple choice tests. Exams questions will be drawn directly from lectures and class discussions. Negative points will be counted: a wrong answer will subtract 0.25 points from the exam mark.

To calculate the final grade, course performance and grading will be determined as follows:

- Midterm exam.....40 %
- Final exam40 %
- Seminar presentation (team and individual marks)10 %
- Activities (team mark) and responses to seminars questions (individual mark).....10 %

Participation in class will be taken into account for the final grade.

Students who pass the midterm exam with 5 points or more are exempt from taking this part again in the final exam (*those who pass the midterm exam but are not happy with the grade, can be examined of all the material in the final, exam provided they have informed the professor at due time*)

Students who do not pass the midterm exam will be examined of **all the material** of the course in the final exam. This final exam will account for **80 %** of the final grade.



Universidad
de Navarra

The exam mark must be at least 4 (out of 10) to be considered for the calculation of the final grade.

Seminars will be graded considering the oral presentation (content and skills to communicate), teamwork and responses to the questions. Rubrics for the evaluation of the seminars are posted in the folder "Seminars".

Students who would like to improve the final exam mark will have the option of responding to an essay question in the final exam. This question will be drawn from indicated articles and may increase the final exam mark up to 0.5 points.

Criteria to pass the course

Students whose final grade is 5 points (out of 10) or more will pass the course.

Students whose final grade is below 5 points will not pass the course and will be graded as *Suspense*.

Students who do not take the final exam will not pass the course and will be graded as *No presentado*.

If during an exam, any student copies from another student or from notes or electronic devices, the exam grade will be 0.

The grade of the seminar presentation of the previous academic year will be kept for those students who have to enroll in the course again.

Exams review

Students will be able to review the exams in an interview with the professor, after publication of the grades, in the dates and place that will be indicated by the professor.

Special assessment

For those students who do not pass the course in May or did not take the exam (grades *Suspense* or *No presentado*), there will be an extraordinary multiple choice test exam in June which will account for 80 % of the final grade.

Students with special learning needs

For students with special learning needs, exceptions will be allowed regarding the methodology and/or the evaluation of the subject. Possible alternatives will be considered as long as they guarantee the effective acquisition of all the competences.

OFFICE HOURS

Dr. M. Pilar Lostao (plostao@unav.es)

- Office 1430 *Edificio de Investigación*. Floor 1
- Tutoring schedule: By appointment through email

BIBLIOGRAPHY AND RESOURCES

Textbook:



Universidad
de Navarra

- Boron, W.F. and Boulpaep E.L.: "Medical Physiology". Elsevier. Philadelphia, 3rd Edition. 2017. [Find it in the Library](#)

Other

- Fox, S.I.: "Human Physiology", 16th Edition. McGraw-Hill, New York, 2022. [Find it in the Library](#)

- Sherwood, L.: "Human Physiology: From cells to system", Brooks/Cole, USA, 2016. [Find it in the Library](#)

- Review articles from the scientific journal "Physiology" <http://physiologyonline.physiology.org/> (Free access from the University intranet)