



Universidad
de Navarra

Applications of Molecular Biology to Medicine (Minv.B)

Guía docente 2024-25

INTRODUCTION

Applications of molecular biology to medicine

The course aims to introduce students to the role of Molecular Biology, Genetics and Epigenetics in the pathophysiology of human organs and systems, and to the diagnosis and treatment of diseases. Molecular mechanisms of gene expression (chromatin remodeling, non-coding RNAs, epigenetics, regulation of translation and post-translational processing) will be highlighted on the context of normal cell function and on the pathophysiology of human diseases. In addition, new targeted genome edition tools (CRISPR cas9) will be analyzed in detail. The role of metabolomics in the diagnosis and pathogenesis of human diseases will be also overviewed. Moreover, new insights on the most notorious topics of the moment (extracellular microvesicles, microRNAs, long non-coding RNAs, SNPs) and their main application in the field of biomedicine will be included.

Professor:

Dr. Jesús M^a. Bañales (jmbanales@unav.es), Biochemistry and Genetics Department of the University of Navarra.

Ikerbasque Professor

Professor Titular

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http://www.biodonostia.org/en/areas_investigacion/gastrointestinal-and-liver-diseases/liver-diseases/

Credits: 3

Degree: Master in Biomedical Research

Module: Module II: Specialty in traslational research

Area: Fundamental aspects in the specialty of traslational research

Department and School: Biochemistry and Genetics, School of Sciences

Calendar description: first semester



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Classroom and schedule: Specified in the [Calendario del Máster](#)

Type of subject: required in the specialty of Traslational Research and elective for the other specialties

Language: English

COMPETENCES

Basic competences

- BS6: Possess and understand knowledgeable facts that serve as a basis or opportunity for being original in the development and/or application of ideas, frequently within the context of research.
- BS7: The students will be able to apply acquired knowledge and problem solving abilities to fields outside this program, including that which is new and scarcely known, within a more ample or multidisciplinary context related to the research, development and innovation of drugs.
- BS8: The students will be able to integrate concepts and manage the complex task of drawing valid conclusions from information which, in spite of being incomplete or limited, includes reflections regarding social and ethical responsibilities linked to the application of general knowledge, specific concepts and common sense to the research, development and innovation of drugs.
- BS9: The students will learn to relay their conclusions -and the most recent facts and reasoning supporting said conclusions- to specialized personnel and to the general public in a clear and precise manner.
- BS10: The students will have acquired learning abilities that will permit them to continue studying in a self-directed and autonomous manner.

General competences

- CG1: Ability to deal with biomedical challenges in depth, from different viewpoints, identifying the state of present-day science.
- CG2: Identification of significant questions or hypotheses regarding biomedical issues or problems and definition of the steps necessary to resolve such questions.
- CG3: Possession of creative ability and originality in order to be able to respond to the questions raised in biomedical research.
- CG4: Ability to select and use appropriate techniques in order to efficiently and accurately carry out biomedical research work.
- CG5: Possession of technical ability to obtain precise and reproducible results which can be used to draw valid and objective conclusions in the field of biomedicine.
- CG6: Possession of critical ability, both when reading scientific biomedical literature and when interpreting the results of experiments.
- CG7: Ability to orally communicate biomedical research matters or data in a fluent way, in both Spanish and English, taking into account the audience for which the presentation is intended.
- CG8: Ability to write correct, precise and well-structured texts about different types of biomedical research work.
- CG9: Ability to work in a team with allocated tasks and participate in work meetings, contributing to the solution of biomedical problems and achievement of working group objectives.

Traslational research specialty competences



- CEE1: Overall view of physiopathological processes that take place in the context of infectious, liver and cardiovascular diseases and knowledge of the most relevant clinical aspects that a researcher must master in these fields.
- CEE4: Understanding of functional ontologies of genes and proteins and the basis for microarray technology and biological networks and their different topologies.
- CEE5: Understanding the technologies behind genomic and proteomic studies and knowledge of their main applications in the field of biomedicine.
- CEE6: Understanding of the fundamentals and main applications of gene therapy, cellular therapy and immunotherapy.
- CEE7: Knowledge of new protein supply systems, different routes of administration and pathologies in which they are used. Familiarization with the concept of intellectual property and patents for biopharmaceutical products, as well as procedures for carrying out clinical trials involving therapeutic proteins.
- CEE8: Ability to select appropriate techniques in order to respond to questions posed within the field of translational research and to use said techniques to obtain precise and reproducible results which allow valid and objective conclusions to be drawn.

PROGRAM

Lectures (11h)

1. Genetic predispositions & COVID-19 (3h)
2. RNA Interference (RNAi) and microRNAs (miRNAs) (2h)
3. Long non-coding RNAs (lncRNAs) (1h).
4. CRISPR/Cas9 technology: edition of the genome (1h)
5. Role of extracellular microvesicles (exosomes) in the pathophysiology of human diseases: new potential diagnostic and therapeutic tool (2h).
6. Role of metabolomics in the diagnosis and pathogenesis of human diseases (2h).

Seminars (8h)

1. Practical examples on the application of miRNAs, lncRNAs and extracellular vesicles in Medicine (3h).
2. Bioinformatic tools for the study of genomics, miRNAs, lncRNAs and extracellular microvesicles: practical course (Informatics room) (5h).

Workshops (5h)

Exhibition of each student of an article about any of the following topics:

- I.COVID-19
- II. MicroRNAs.
- III. Long non-coding RNAs
- IV. Extracellular vesicles
- V. Metabolomics.

The exhibitions will be moderated by *Dr. Bañales*.

EDUCATIONAL ACTIVITIES



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The work is distributed as follows:

1. Class activities: (0,96 ECTS, 24h)

- Lecture format (0,44 ECTS, 11h)

Lectures will follow the theory program. Power point slides will be available for students in advance through ADI.

- 8 lectures.

- Seminars (0,32 ECTS, 8 h)

Seminars will provide theoretical and practical examples of key relevant topics in biomedicine that are stated in the program.

- Workshops: Individual oral presentations (0,2 ECTS, 5 h)

Every student prepares and presents a workshop with recommended bibliography about a particular topic considered at the course.

2. Personal work: (1,04 ECTS, 26h)

Student's personal work is part of the learning process. It involves the use of scientific sources of information to go into detail about the contents explained in the lectures and the developing of analysis capacity in the comments of the paper provided.

ASSESSMENT

To obtain a pass in this subject it is necessary to obtain a final grade of 5 (50%) or above.

Learning outcomes to assess:

- Continuously in response to participation in seminars (20%).
- Bioinformatic report on genetic/epigenetic tools (Informatics room) (30%).
- Final examination: oral presentation about a particular article during the workshops (50%).

Re-sit examinations

The re-sit examination offers students another opportunity to orally present another article.

HORARIOS DE ATENCIÓN

- To contact with the professors ask for an appointment by e-mail:
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BIBLIOGRAPHY AND RESOURCES



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1. Lawrie CH. MicroRNAs in Medicine [Publisher: John Wiley & Sons, Inc. (Hoboken, NJ, USA)], 2014. [Find it in the Library](#)
2. López-Otín C, Blasco MA, Partridge L, Serrano M, Kroemer G. *The hallmarks of aging*. *Cell* 2013;153(6):1194-217. [Find it in the Library](#)
3. Théry C, Zitvogel L, and Amigorena S. Exosomes: composition, biogenesis and function. *Nature Reviews Immunology* 2002;2: 569-579. [Find it in the Library](#)
4. Lemoinne S, Thabut D, Housset C, Moreau R, Valla D, Boulanger CM, Rautou PE. *The emerging roles of microvesicles in liver diseases*. *Nat Rev Gastroenterol Hepatol*. 2014; doi: 10.1038/nrgastro.2014.7. [Find it in the Library](#)
5. Khan FA, Pandupuspitasari NS, Chun-Jie H, Ao Z, Jamal M, Zohaib A, Khan FA, Hakim MR, ShuJun Z. *CRISPR/Cas9 therapeutics: a cure for cancer and other genetic diseases*. *Oncotarget*. 2016 May 26. [Find it in the Library](#)
6. Vora S, Tuttle M, Cheng J, Church G. *Next stop for the CRISPR revolution: RNA guided epigenetic regulators*. *FEBS J*. 2016 Jun 1 [Find it in the Library](#)