



Universitat de Lleida

DEGREE CURRICULUM  
**ADVANCED MICROBIOLOGY**

Coordination: DE LA TORRE RUIZ, M. ANGELES

Academic year 2021-22

## Subject's general information

|   |   |               |                        |
|---|---|---------------|------------------------|
| <b>Subject name</b>   | ADVANCED MICROBIOLOGY   |               |                        |
| <b>Code</b>   | 101528  |               |                        |
| <b>Semester</b>   | 2nd Q(SEMESTER) CONTINUED EVALUATION  |               |                        |
| <b>Typology</b>   | <b>Degree</b>   | <b>Course</b> | <b>Character</b>       |
|   | Bachelor's Degree in Biomedical Sciences  | 3             | OPTIONAL               |
|   | Master's Degree in Biomedical Research  |               | COMPLEMENTARY TRAINING |
| <b>Modality</b>   | Attendance-based  |               |                        |
| <b>Course number of credits (ECTS)</b>  | 6   |               |                        |
| <b>Type of activity, credits, and groups</b>                                    | <b>Activity type</b>  | PRALAB        | TEORIA                 |
|   | <b>Number of credits</b>  | 3             | 3                      |
|   | <b>Number of groups</b>   | 2             | 1                      |
| <b>Coordination</b>   | DE LA TORRE RUIZ, M. ANGELES  |               |                        |
| <b>Department</b>   | BASIC MEDICAL SCIENCES  |               |                        |
| <b>Teaching load distribution between lectures and independent student work</b> | 3 ECTS (Master class+Seminars) on-line<br>3 ECTS Practices on-line/face to face (depending of pandemic situation) |               |                        |
| <b>Important information on data processing</b>                                 | Consult <a href="#">this link</a> for more information.   |               |                        |
| <b>Language</b>   | Spanish<br>Catalan<br>English (when required)   |               |                        |
| <b>Distribution of credits</b>  | 2,2 ECTS Master class<br>0,8 ECTS Seminars<br>3 ECTS Practices  |               |                        |

| Teaching staff                 | E-mail addresses               | Credits taught by teacher | Office and hour of attention |
|--------------------------------|--------------------------------|---------------------------|------------------------------|
| COLOMINA GABARRELLA, M. NIEVES | neus.colomina@udl.cat          | ,4                        |                              |
| DE LA TORRE RUIZ, M. ANGELES   | mariaangeles.delatorre@udl.cat | 5,6                       |                              |
| PUJOL CARRION, NURIA           | nuria.pujol@udl.cat            | 3                         |                              |

## Learning objectives

1. Know the concept of toxin and mechanisms of microbial pathogenicity
2. Be able to describe the specific and nonspecific defense systems against microbial infection mediated by the human body.
3. Understand general responses to stress.
4. Understand the molecular basis of response to stress and virulence in microbial cell models.
5. Know how to apply the theoretical knowledge learned in this subject to specific experimental situations as well as to elaborate results and conclusions of the same.
6. Know how to solve biological problems derived from the topics covered in the subject, autonomously.
7. Learn to work as a team in a basic research laboratory.
8. Prepare the experimental results obtained during the practical development of the subject, individually and in teams
9. Know the mechanisms of action of the main antibiotics and antimicrobials of the last generation and be able to infer an application.

## Competences

CB1 That students have demonstrated that they have and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

CB2 That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

CB3 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.

CB4 That students can transmit information, ideas, problems and solutions to both specialized and non-specialized

audiences.

CB5 That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

CG1. Have a correct oral and written expression

CG2 Master a foreign language.

CG4 Respect the fundamental rights of equality between men and women, the promotion of Human Rights and the values of a culture of peace and democratic values.

CG5 Apply the gender perspective to the tasks of the professional field

CE15. Differentiate the biology of microorganisms in their structural, physiological and genetic aspects, as well as their diversity.

CE16. Describe the main infectious agents and their mechanisms of action.

CE17. Apply basic techniques for handling microorganisms.

CE45. Define the molecular bases and mechanisms of the flow of genetic information and its regulation.

CE51. Define the fundamentals and apply the methodology used in the genetic modification of organisms.

CE65. Analyze scientific information through specialized publications, as well as be able to summarize and present it in different formats.

CE66. Recognize the scientific methodology of research.

## Subject contents

### THEORETICAL CLASSES

Master classes on-line

Temary:

1. POSITIVE INTERACTIONS PARASITE (MICROORGANISM) -HOSPEDADOR (HUMAN). Autochthonous microbial flora.
2. NEGATIVE PARASITE-HOSPEDADOR INTERACTIONS. Toxin concept. Endotoxin and Exotoxin. Nonspecific and specific defense system mediated by the immune system. Serological tests for the detection of infectious diseases. Microbial models of exotoxins and endotoxins. Bacterial secretion systems.
3. MICROBIAL SIGNALLING: Quorum sensing. Two component system.
4. MOLECULAR AND BIOCHEMICAL APPROACH TO SOME VIRULENCE MECHANISMS DEVELOPED BY MICROORGANISMS.
5. GENERAL RESPONSES TO STRESS. Responses in prokaryotes. SOS system. DNA damage repair mechanisms. Eukaryotic responses. Consequences of the stress response and development of resistance. Types of microbial adaptations to stress and response mechanisms.
6. ROUTES OF SIGNALING MAP KINASES IN FUNGI (model *Saccharomyces cerevisiae*). IMPORTANCE IN VIRULENCE AND POSSIBLE TARGETS OF REGULATION.
7. MOLECULAR MECHANISMS OF ANTIBIOTIC RESISTANCE AND CURRENT PRODUCTION OF BIOPHARMACS. Main mechanisms of antibiotic resistance characterized at the molecular level to date. Multi-resistant strains. New antimicrobials, biomedical and biotechnological perspectives.

## PRACTICAL CLASSES

- Seminars. They will be online activities. A. Collaborative work seminar. B. Small group seminar (4-5 people). Thematic development of review works related to new antimicrobials. A group summary and a Power Point presentation must be made to the entire class by videoconference.

-Laboratory practices. They will be presented with a face-to-face part and an on-line part. The variations of these modalities will come imposed by the development of the pandemic and the sanitary and security conditions. The on-line practices will be complemented with synchronous classes of problems and discussion after fifteen to carry out a work of analysis of the practices.

Students will learn to:

Obtain plasmid DNA

Transform bacteria

Analyze antibiotic resistance

Transform yeasts

Identify interactions between proteins in vivo, using the Double Hybrid technique

## Methodology

### THEORETICAL CLASSES

1. On-line mostly through video conference
2. Presentations with explanatory audio incorporated + synchronous tutorials to discuss and resolve doubts
3. Flipped classroom

### PRACTICAL CLASSES

Laboratory practices. In the laboratory+ on-line or fully online, depending on pandemic situation.

Part of the practices will be done in small groups in the laboratory and part through online explanatory pills or explanatory audio presentations. Online practices will be accompanied by synchronous and participatory online seminars and problems.

Seminars: All will be carried out in small groups of 4 people preferably.

A. The collaborative learning technique will be applied if the situation allows

B. Groups will work on reviews related to latest antimicrobials. They will make a summary, power point presentation that they will have to present each of the group members. Then there will be a mandatory discussion.

## Evaluation

| ASSESSMENT OF LEARNING | GRADING (%) | ASSESSMENT TYPE  |
|------------------------|-------------|--|
| Master class           | 50          | Short questions exam and test if it is face-to-face. Test exam if it is on-line. |

|                  |    |  |
|------------------|----|--|
| <b>Practices</b> | 25 | The theoretical part will be divided into two evaluable parts in each of the two available courses for the subject. The average will only be made with a grade equal to or greater than 5. To pass the course, it is necessary to obtain at least a 6 in this test.                |
| <b>Seminars</b>  | 25 | Written test on contents and practical concepts. Presence is compulsory in those parts of the subject that require it according to the circumstances of the pandemic, it will be indicated in due course. To pass the subject it is necessary to obtain at least a 6 in this test. |

## Bibliography

- M.T. Madigan, J.M. Martinko y J. Parker. Addison-Wesley, Madrid (2009).  
 Prescott, Harley y Klein. 2009. Microbiology. McGraw-Hill Interamericana, Madrid.  
 R.E. Chen and J. Torner. 2007. Function and regulation in MAPK signalling pathways. *Biochim Biophys Acta*.1773(8): 1311–1340.  
 C. Walsh. Antibiotics, actions, origins, resistance. ASM press, Washington, D.C.  
 G. San-Blas and R.A. Calderone. Pathogenic Fungi. Caizer Academic Press, Norfolk, UK.  
 M. Schaechter, J.L. Ingraham y F.C. Neidhardt. Microorganismes. Reverté.  
 E.A. Groisman. Principles of bacterial pathogenesis. Academic Press, California, USA.  
<http://www.ncbi.nlm.nih.gov/pubmed>  
<http://www.yeastgenome.org/>