Molecular and Cellular Mechanisms of Bacterial Pathogenesis

CU characterization:

CU name:
Molecular and Cellular Mechanisms of Bacterial Pathogenesis

Scientific area acronym:
BCM

Duration:
Semiannual/Modular

Working hours:
168 h

Contact hours:
T17.5, TP7, PL17.5.

ECTS:
6

Observations:
NA

Teacher in charge and respective teaching load in the CU:
Professor Luís Jaime Mota, 0.25h T

Other teachers and respective teaching load in the CU:
Professor Sérgio Filipe, 0.5h T, 0.25h TP, 0.5h PL
Professor Irina Franco, 0.5h T, 0.25h TP, 0.75h PL

Intended learning outcomes (knowledge, skills and competences to be developed by the students):

This curricular unit will provide competences in the understanding of molecular and cellular aspects of bacterial infections, on the interplay between bacterial pathogens and eukaryotic host cells. This implies the acquisition of knowledge on mechanisms underlying bacterial virulence, and on the methods used to study it, as well as the acquisition, or strengthening, of knowledge on eukaryotic cell biology and on immunology. Upon completion of this curricular unit, the students should be able to: i) know the general mechanisms used by bacterial pathogens to resist host cell defenses; exemplify host cell processes and molecules that are manipulated by bacterial virulence proteins; iii) understand experimental data related to microbe-host cell interactions.

Syllabus:

Overview of bacterial pathogenesis: host defenses and countermeasures deployed by bacteria. Identification of different infection models frequently used in bacterial pathogenesis. Definition of virulence factors and how they are identified. Mechanisms of gene transfer in bacteria and selection of strains with different capacity to cause disease. Recent cases associated with outbreaks by certain bacterial strains. General bacterial mechanisms of avoidance or resistance to host defenses. Actin cytoskeleton and its manipulation by bacterial pathogens; intracellular motility, invasion and anti-phagocytosis. Vesicular transport and its manipulation by bacterial pathogens: proteins and lipids involved in vesicular transport; examples of rupture and release from the phagosome, of subversion of the phagolysosomal pathway and of survival within a phagolysosome.

Evidence of the syllabus coherence with the CU intended learning outcomes:

At first, an overview is presented of the mechanisms used by animals to resist bacterial infections. Then, experimental infections models and virulence factors are defined. It is mentioned how mechanisms of genetic transfer facilitate the emergence of novel strains. Examples of recent outbreaks and mechanisms by which bacteria resist the host immune system are presented. Subsequently, the structures and processes of an animal cell targeted by pathogens are described, focusing on experiments that led to our understanding of subversion of the host actin cytoskeleton and of vesicular trafficking. This will cover the indicated specific and the general objectives.

Teaching methodologies (including assessment):

In the lectures, the students will receive all the essential information required for a global understanding of molecular and cellular aspects of microbial infections. The interaction with students will be promoted. In the laboratory classes, the students will execute experiments that led to an understanding of virulence mechanisms of bacterial pathogens and will discuss problems based on specific experimental data sets. This will help to develop their capacity to interpret experimental results related to host-microbe interactions. The evaluation of the knowledge, skills and competences acquired in the lectures and in the laboratory classes will be done through a written exam and quizzes. The need to attend a minimal number of laboratory classes and to be evaluated with the proposed quizzes to be accepted at the final exam ensures that the students follow the syllabus subjects.

Evidence of the teaching methodologies coherence with the CU intended learning outcomes:

In the lectures, the students will receive all the essential information required for a global understanding of molecular and cellular aspects of microbial infections, at the level of the pathogenic bacterium-eukaryotic host interaction. In these lectures, the interaction with the students will be promoted, which will help in the acquisition of the subjects taught. In the laboratory classes, students will execute experiments that lead to an understanding of virulence mechanisms of bacterial pathogens and will discuss problems based on specific experimental data sets. This will help to develop their capacity to interpret experimental results related to host-microbe interactions. The evaluation of the knowledge, skills and competences acquired in the lectures and in the labs will be done through written tests (or by a final Exam) and presentation of quizzes. The need to attend a minimal number of labs and to be evaluated by small quizzes to be accepted at the final Exam intends to ensure that the students follow the different subjects.

References for consultation / mandatory existence:

- *Cellular Microbiology, P. Cossart, P. Boquet, S. Normark, R. Rappuoli (Eds), American Society of Microbiology 2nd edition, 2004.*
- *Bacterial Pathogenesis: a Molecular Approach, B. A. Wilson, A. A. Salyers, D. D. Whitt, and M. E. Winkler, American Society of Microbiology, 4th edition, 2019.*
- *Cellular and Molecular Immunology, A. K. Abbas, A. H. Lichtman, S. Pillai, Elsevier, 6th edition, 2007.*
- *Selected review articles covering the topics presented in the lectures (provided by the lecturers).*