VNIVERSITAT DE VALÈNCIA

# Course Guide
# 43466 Molecular and cellular biology of pathogen-host interaction

## COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 43466 |
| **Name** | Molecular and cellular biology of pathogen-host interaction |
| **Cycle** | Master's degree |
| **ECTS Credits** | 3.0 |
| **Academic year** | 2023 - 2024 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 2210 - M.D. in Research in Molecular, Cellular and Genetics Biology | Faculty of Biological Sciences | 1 | First term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 2210 - M.D. in Research in Molecular, Cellular and Genetics Biology | 11 - Molecular and cellular biology of pathogen-host interaction | Optional |

**Coordination**

| Name | Department |
|---|---|
| GONZALEZ BIOSCA, ELENA | 275 - Microbiology and Ecology |

## SUMMARY

The main object of this subject is the study of host-pathogen relationship at cellular and molecular level. The course is divided into two parts.

**Part I**
**Molecular mechanisms of bacterial pathogenicity in humans**: Major bacterial pathogens accoding to their lifestyles, and molecular mechanisms of extra/intracellular residence, tissue damage, cell death and resistance to innate immune defenses.

**Part II**

**Plants and pathogens**: host-pathogen interactions in plants; *Agrobacterium* spp. as a model. Main virulence factors; Plasmids and plant-pathogen interaction; Reservoirs and transmission routes; Preventive and control measures of plant diseases.

# PREVIOUS KNOWLEDGE

## Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

## Other requirements

# OUTCOMES

## 2210 - M.D. in Research in Molecular, Cellular and Genetics Biology

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Be able to make quick and effective decisions in professional or research practice.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Be able to access to information tools in other areas of knowledge and use them properly.
- To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.

# LEARNING OUTCOMES

1. To know and apply correctly the vocabulary and specific terminology of microbiology and molecular pathogenesis.

2. To understand the role of bacteria as infectious agents.

3. To Acquire basic knowledge about the mechanisms of microbial pathogenicity, virulence factors, their expression and regulation.

4. To know the importance of mobile genetic elements in the host-pathogen interaction.

5. To understand the overall functioning of the immune system of humans against a bacterial infection.

6. To acquire an overview of the molecular mechanisms involved in the interaction between the pathogen and host cells (particularly the defense cells).

7. To know the general measures for prevention and control of some bacterial infectious diseases of plants and humans.

8. To know the areas of application and social outreach and future research in microbiology and molecular pathogenesis.

9. To understand that the study of host-pathogen interaction is a current research area is in full expansion and development with implications for Public Health and Agriculture

## DESCRIPTION OF CONTENTS

### 1. Tema 1

Introduction. Sistema immune in humans: an overview. Innate immunity: complement and phagocytosis. Acquired Immunity: humoral and cellular immunity. Vaccines and immunostimulants.

### 2. Item 2

Obligate intracellular pathogens: Chlamydia, Coxiella, Ehrlichia, Rickettsia, Mycobacterium leprae.

### 3. Item 3

Facultative intracellular pathogens that parasitize phagocytes: Legionella and Mycobacterium tuberculosis

### 5. Item 5

No sporulating extracellular pathogens (I): Bordetella, Borrelia, Treponema, Corynebacterium, Haemophilus, Escherichia coli, Helicobacter, Neisseria

### 6. Item 6

Staphylococcus, Streptococcus, Vibrio cholerae, Yersinia

### 7. Item 7

Sporulating extracellular pathogens: Bacillus anthracis, Clostridium

### 8. Tema 8.

Introduction to the Human Microbiome: What is the microbiome and what are its functions. Study forms and sample types. Microbial communities: enterotypes and pneumotypes. Transmission and development of the microbiota. Microbiota of the different human niches. Bacteroima, mycobiome and viroma.

### 9. Tema 9

Microbiome Applications: Deciphering the etiology of various diseases. Search for new bioactive substances. Search and development of new probiotics. The microbiome as a biomarker for diagnosis. Microbiome tests. Prebiotics, probiotics, symbiotics and postbiotics.

### 10. Tema 10

Interaction of the Microbiome with the Human Host: Infection prevention through antagonistic effects.Human Milk Oligosaccharides as prebiotics. Role of the microbiota in immune modulation. Hypothesis of immunological tolerance. Microbiome and cancer. Microbiome and metabolic diseases. Future perspectives

### 11. Theme 11

Host-pathogen interactions in plants.

### 12. Theme 12

Phytopathogenic bacteria: mechanisms of pathogenesis:Agrobacterium tumefaciens, Erwinia amylovora, Ralstonia solanacerum, Xylella fastidiosa.

### 13. Theme 13

Agrobacterium plant interactions: importance of the Ti plasmid.

### 14. Theme 14

Reservoirs and transmission routes of phytopathogenic bacteria. Survival strategies:Erwinia amylovora, Ralstonia solanacerum, Xylella fastidiosa.

### 15. Theme 15

Preventive and control measures of plant diseases: quarantine, treatments and integrated control:Agrobacterium tumefaciens, Erwinia amylovora, Ralstonia solanacerum, Xylella fastidiosa.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theory classes | 26,00 | 100 |
| Other activities | 4,00 | 100 |
| Development of group work | 10,00 | 0 |
| Study and independent work | 25,00 | 0 |
| Readings supplementary material | 10,00 | 0 |
| **TOTAL** | **75,00** | |

## TEACHING METHODOLOGY

1. Lectures. Method based on the exhibition / lecture and study and resolution of issues related to the exposed area.
2. Seminar / research articles comments: implementation and class presentation of work / research article on current issues related to the subject. This activity is optional.
3. Tutoring Group. Assist and guide students in relation to the problems that arise during the development of activities and non-contact
4. Lectures by experts in the field. This activity is optional

## EVALUATION

There will be no exam as such, the students will present a work that will be evaluated based on the content, the presentation and the defense. Participation in the discussion session of the seminars of the other students will also be evaluated.

## REFERENCES

### Basic

- Cossart, P., P. Boquet, S. Normark, R. Rappuoli. 2004. Cellular Microbiology, 2nd Edition. ASM, Washington D.C.
- Persing D.H. et al., (ed.) 2011. Molecular Microbiology: diagnostic, principles and practice. ASM, Washington D.C.

- Locht, C. and M. Simonet. 2012. Bacterial pathogenesis: molecular and cellular mechanisms. Caister Academic Press. London.
- Seifert H.S. and V. J. Rita. 2006. Evolution of microbial pathogens. ASM, Washington D.C.
- Gnanamanickam, S. S. (ed.) 2007. Plant-associated bacteria. Springer, Dordrecht, the Netherlands.
- Jackson, R.W. (ed.). 2009. Plant Pathogenic Bacteria. Genomics and Molecular Biology. Caister Academic Press