COURSE DATA

DATA SUBJECT

Code: 33153
Name: Microbial pathogenesis
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Facultat de Ciències Biològiques	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	Materia de asignaturas optativas	ELECTIVES

COORDINATION

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SUMMARY

Microbial pathogenesis is an elective course on the degree of Biochemistry and Biomedicine consisting of a total of 6 credits. It was preceded by courses that provide the student with a basic understanding of microbiology, genetics, biochemistry and cell biology that will be used in this discipline.

The course's main objective is the knowledge of the molecular mechanisms by which pathogenic microorganisms, mainly bacteria, cause infectious diseases and control measures. The course has a theoretical and practical part where students will become familiar with laboratory techniques used for diagnosis, treatment and control of infectious diseases as well as the valuation methodology of virulence factors.

The syllabus includes 8 theoretical thematic units and 8 practical units to be taught by the teachers of the subject plus 10 seminars to be taught by students.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

Basic Microbiology, Immunology and Cell Biology

COMPETENCES / LEARNING OUTCOMES

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Conocer los mecanismos de interacción hospedador-patógeno para entender factores de virulencia en enfermedades infecciosas y parasitarias.

Conocer los organismos patógenos de humanos, las patologías que provocan y conocer los fundamentos de las principales estrategias terapéuticas.

Conocer los principales métodos y técnicas experimentales aplicadas al estudio de la salud y enfermedad humanas, su etiología y la efectividad de los tratamientos.

Conocimiento de las enfermedades y disfunciones más frecuentes.

Know how to apply the knowledge gained in the diagnosis, prevention and treatment of human diseases.

DESCRIPTION OF CONTENTS

General concepts

U1. Introduction. Pathogen and infectious disease. Host-pathogen relationship and classification of pathogens. Virulence and clone. Virulence factor. Epidemiology: reservoirs and transmission. Genome, accessory genome and Pangenoma: importance of mobile genetic elements and TGH in the evolution of pathogens.

U2. Vaccines and passive immunization. Vaccines: definition and types. Comparison between live and dead vaccines. First, second and third generation vaccines. Fourth and fifth generation vaccines. Strategies to increase and redirect conferred immunity: adjuvants and immunostimulants. Ideal vaccine. Vaccines in use and calendars. Clinical trials for the development of a human vaccine. Passive immunization.

U3. Host colonization. Mucosal colonization. Bacterial adhesion: types of adhesins. Biogenesis and assembly of fimbriae. Afimbrial adhesins and invasins. Strategies for residing intracellularly. Biofilms. Bacterial multiplication: siderophores and exoenzymes. Resistance to the immune system.

U4. Aggresins. Bacterial aggressions and types. Bacterial secretion systems. Extracellular toxins: superantigens, cytolysins, toxins A + B. Injectable toxins. Toxins and mobile genetic elements. Modulins: LPS and septic shock.

U5. Regulation of virulence genes. Introduction. Operons and regulones. Directional regulation: two- component systems, global regulators, sigma factors, regulatory networks, H-NS proteins, regulatory RNA and Quorum sensing.

Random regulation: gene duplications and rearrangements.

Some host-pathogen interaction models

U6. *Vibrio cholerae*. Cholera: transmission, reservoirs and pandemics. Epidemiology of cholera: first studies; CTXfi phage and cholera toxin; islands of pathogenicity; genomes and evolutionary steps; Faruque's hypothesis. Virulence factors: cholera toxin; structure, receiver and mode of action; type VI secretion system. Coordinated regulation of virulence. Diagnosis, treatment and prevention. Cholera vaccines.

U7. *Shigella*. Dysentery and hemolytic uremia syndrome (HUS). Is *Shigella* a *coli* ?: intraspecific classification. Phylogeny and evolution. Origin of virulent strains: virulence plasmids. Animal models. Invasion and expansion to neighboring cells: molecular mechanisms. Toxin Shiga: SUH. Pathogenicity islands. Evolution of Shigella. Regulation dependent on Vir R. Genomes. Diagnosis, treatment and prevention. Vaccines.

U8. *Yersinia*. Pathogenic species. Diseases caused by yersinias. The plague: types and current situation. Fish pandemics. Phylogeny. Important events in its evolution. Virulence factors: adherence, colonization and invasion. Antiphagocytic system: SST3 and injectable toxins. Phases of bubonic and pneumonic plague. Diagnosis, treatment and prevention. Vaccines.

Seminars

S1: *Helicobacter pylori*.

S2 *Neisseria meningitidis*

S3: *Staphylococcus*

S4*: Listeria*

S5. *Legionella.*

S6. *Mycobacterium*

S7. Cell death caused by bacteria

S8. Microbiome and infectious diseases: *Clostridium difficile*

S9. Pandemic diseases

S10. New vaccines

Laboratory practices

P1. *Vibrio vulnificus* and human vibriosis. The pathogen and vibriosis. Risk factors. Epidemiology. Isolation and identification methodology. Phylogeny. Virulence factors. Chemotherapy. Prevention.

P2. Isolation of the pathogen from environmental and clinical samples. Enrichment, selective and differential media. Sampling and processing. Identification of presumptive colonies and purification on general media.

P3. Identification by multiplex PCR: identification of the species and discrimination of dangerous strains in Public Health. DNA extraction. PCR, electrophoresis and interpretation of results.

P4. Treatment and control. Antibiogram and MIC of quinolones and fluoroquinolones. Discussion of control measures proposed by the FDA.

P5. Virulence factors: toxins and exoenzymes. Obtaining toxins: cellophane paper technique. Assessment of the titer of Vvha toxins, MARTX and VVP protease using as control deficient mutants.

P6. Resistance to the innate immune system: iron and complement in sepsis. Assessment of human serum resistance using VuuA and capsule production as deficient mutant controls.

P7. Triparental conjugation. Introduction of a plasmid with marker genes (*gfp* and kanamycin resistance) by triparental conjugation in *V. vulnificus.* Usefulness of the procedure.

P8. Prophages in *V. vulnificus*. Induction of the lithic cycle, isolation and strain specificity. Identification and detection in silico. Potential as therapeutic agents.

P9. Research methods in microbial pathogenesis: Methodological discussion seminars on a selection of scientific articles

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00
Theory	37,00
Laboratory	20,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	30,00
Independent study and work	45,00
Preparation of lessons	10,00
Preparation for assessment activities	5,00

Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

Theoretical classes. The teacher will present the topics of the syllabus using the expository method / master class. Students will present the theoretical seminars that appear in the syllabus (an average of two students / seminar) and will also be able to propose alternative seminars. The seminars will be presented in Aula Virtual power point spoken of 15-20 min of duration 1 week before his exhibition and discussion in class

Practical classes. The internship teacher will be in charge of showing the student how to work in the laboratory with pathogens of biological risk 2. The laboratory practices will be complemented with resolution of exercises and problems (exercise, test and implementation of previous knowledge). The teacher will distribute a series of scientific articles to groups of 2-4 students and the students will make a 5 min speech in power point that will be presented in Aula virtual 2 days before their discussion in class.

Group / personal tutorials. Assist and guide students in relation to problems that arise during the development of face-to-face and non-face-to-face activities. The Aula Virtual Tutorials tool will be used and discussion forums will be created

EVALUATION

1. Objective tests on the course content (total 55%): 55 points in the form of an exam, 40 for the final exam on the theoretical content of the syllabus, and 15 points for the exam on the presented seminar.
2. Individualized tracking in practical activities (total 15%): 10 points for daily tasks and 5 points for solving a practical problem.
3. Class participation evaluation (25%): Presentation of a seminar and participation in the debate.
4. Objective tests on the handling of computer programs (5%).

It will be necessary to obtain 50% in the final grade to pass the course.

REFERENCES

- Bacterial pathogenesis: a molecular approach (fourth edition). Wilson B.A. et al. ASM, Washington. D.C. 2019.

- Recent reviews on each topic