

**COURSE DATA****DATA SUBJECT****Code:** 33062**Name:** Pathogens and Illnesses**Cycle:** Undergraduate Studies**ECTS Credits:** 5**Academic year:** 2025-26**STUDY (S)**

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Facultat de Ciències Biològiques	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1100 - Degree in Biology	Fundamentals of health biology	ELECTIVES

COORDINATION

FOUZ RODRIGUEZ BELEN

MONTERO ROYO FRANCISCO ESTEBAN

SUMMARY

This is an optional subject belonging to the intensification Fundamentals of Health Biology (FSB) which is both theoretical and practical and is located in the second semester with the subjects Neurobiology and Immunology. This course is perfectly complemented by Immunology, laying the basis for the functioning of the immune system in response to pathogens. The objects of study in P&D are pathogens and how they cause infectious diseases. The objective of a substantial part of the subject is to give the student the basic knowledge about the main infectious diseases of bacterial origin and their epidemiology, as well as about the molecular mechanisms that pathogens use to cause these diseases. The program is completed with the study of the mechanisms of regulation of the expression of virulence genes so that the student understands that it is the microenvironment in tissues that determines the transcription and repression of virulence genes. Finally, the vaccines are explained, those currently used in vaccination campaigns as well as the main lines of research aimed at improving them. This topic emphasizes the importance of vaccination on a global scale for our protection as a species, mainly against emerging pandemic diseases such as COVID-19.

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**



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

OTHER REQUIREMENTS

You must have passed 120 ECTS

COMPETENCES / LEARNING OUTCOMES

-

Apreciación del rigor, el trabajo metódico, y la solidez de los resultados.

Aprendizaje autónomo y adaptación a nuevas situaciones.

Capacidad de análisis crítico de textos científicos.

Capacidad de elaborar artículos, informes o proyectos y de exponerlos a diferentes auditorios.

Capacidad de organización, planificación y gestión de la información usando bases de datos bibliográficas adecuadas.

Capacidad de resolución de problemas y toma de decisiones.

Capacidad de utilización de herramientas matemáticas y estadísticas.

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 las enfermedades humanas, su etiología y la efectividad de los tratamientos.

Conocer y saber aplicar el método científico.

Conocimiento de bases de legislación relacionada con la Biología.

Conocimiento de las enfermedades y disfunciones más frecuentes durante las distintas etapas de la vida.

Conocimiento de sistemas de gestión en tareas profesionales en Biología sanitaria.

Entender la genómica de patógenos y sus implicaciones para el diseño de fármacos y vacunas.

Habilidad para el trabajo en equipo y en contextos multidisciplinares.

Potenciación de la capacidad de liderazgo.

Potenciar la creatividad, iniciativa y espíritu emprendedor.



Reflexión ética sobre la actividad profesional.

Saber analizar datos usando herramientas estadísticas apropiadas.

Saber diseñar y preparar vacunas y saber realizar las vacunaciones.

Utilización del vocabulario específico de la Biología sanitaria.

DESCRIPTION OF CONTENTS

1. Bacteria and viruses. Generalities

Topic 1. Bacterial diseases and Epidemiology. Epidemiology; transmission and reservoirs; Group immunity; characteristics of epidemic diseases. Main bacterial diseases: airborne (streptococcal diseases, diphtheria, whooping cough, tuberculosis and meningitis); transmitted by contact (staphylococcal diseases, leprosy, STDs); vector-borne (plague, diseases caused by *Rickettsia*); associated with soil (anthrax, gangrene); Associated with water and food (cholera, sigellosis and salmonellosis).

Topic 2. Pathogens and pathogen evolution. Pathogen concept and classification of pathogens. Host-pathogen relationship. Pathogenicity and virulence; LD50. Horizontal gene transfer and pangenome. Pathogenicity islands. *Vibrio cholerae* vs *Yersinia pestis* evolution.

Topic 3. How pathogens cause infectious diseases. Colonization: adherence (fimbrial and afimbrial adhesins); Invasion and entry into a eukaryotic cell; Biofilm and polysaccharides; multiplication and iron uptake systems; Resistance to the immune system. Bacterial secretion systems. Extracellular and injectable toxins: structure and molecular mechanism of action of cholera toxin vs injectable *Shigella* toxins. Modulins and septic shock. Toxins and mobile genetic elements.

Topic 4. Regulation. Operons and regulons; regulon Prf of *Listeria*. Two-component systems, physical-chemical signals and autoinductors. Activators, repressors and alternative sigma factors. DNA topology and supercoiling. RNA regulator. Quorum sensing. Random regulation. Virulence regulation in *Vibrio cholerae* and *Shigella*.

Unit 5. Vaccines. Types of vaccines and immunopotentiators. First generation vaccines: alive and dead vaccines. Second generation vaccines. Third and fourth generation vaccines. Strategies to redirect and boost immunity; immunopotentiators. Vaccines in use and vaccine schedules in Spain. Vaccine approval phases. Vaccines against COVID-19.

2. Parasites. Generalities

Topic 6. Animal associations. Parasites and guests. Terminology in parasitology. Extension of Parasitism in the animal kingdom. Types of parasites. Origin and evolution of parasitism. Adaptations i preadaptations Parasitic-host co-evolution.



Topic 7. Life cycles of parasites. Direct cycles Indirect cycles. Importance of the guests intermediaries in the epidemiology of * parasitosis.

Topic 8. Meeting and acknowledgment of the host. Mechanisms of invasion of parasites. Outbound tracks. Effects of the parasite on the host. Host countermeasures.

3. Parasites Parasitic / host interaction models.

Based on the teaching methodology ABP (problem-based learning) students, by groups, they will study a specific case stated by the teacher, from different points of view of the parasite-host relationship.

That is, in preparing their work they will have to refer to the following aspects: Hosts.

Location of the parasite: Life cycle and mode of transmission. Pathogenesis Epidemiology. Prevention, control and treatment of parasitosis.

4. Practices

Block I Bacteria and viruses

P1. Vibriosis: Serum and genetic variability of *V. vulnificus*. Diagnosis of the disease. Epidemiology. Control and prevention. Mechanisms of pathogenicity.

P2. Isolation on different selective and non-selective media. Purification

P3. Identification through conventional methods. Gram, oxidase and API20I multiprocess system.

P4. Identification through genetic methods. Multiple PCR

P5. Resistance to human serum.

P6. Treatments: antibiogram.

Block II Parasites

P7. Anisakidosis: isolation and identification of Anisakis simplex larvae from fish.

P8. Teniasis and ascariasis: recognition of spores of grapes and lizards.

P9. I. Coprological analysis: identification of parasitic forms. II. Microscopic analysis: Plasmodium identification and several Flagellates.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	1,00
Theory	29,00
Laboratory	20,00
Total hours	50,00

**NON PRESENCIAL ACTIVITIES**

Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	10,00
Preparation of lessons	12,50
Preparation for assessment activities	32,50
Resolution of case studies	0,00
Total hours	75,00

TEACHING METHODOLOGY

The following teaching methods will be used for activities of this course:

1. **Lectures.** Method based on the exhibition / lecture and the study and resolution of issues related to the matter exposed.
2. **Practical classes.** Solving exercises and problems (testing and implementation of knowledge).
3. **Group/ personal mentoring.** Assist and guide students with regard to issues that arise during development of all kind of activities.

EVALUATION

1. **Evaluation of the knowledge of theory** will be an evaluation of the concepts worked in the theoretical sessions by conducting an exam based on short, multiple-choice questions.
2. **Assessment of practical skills** will take place continuously during the laboratory work and using a test that is conducted together with the theory test. This test will contain questions and problems on the practices.

The test exam will last 2 hours (part 1-Bacteria) and 1 hour (part 2-Parasites).

La **final course grade** will be calculated considering that obtained in **part 1-Bacteria (70%)** and that obtained in **part 2-Parasites (30%)**.

The % of the theory/practices mark in the final course grade is 70/30 , respectively.

Attendance at lab sessions is a prerequisite to pass the course.

To pass the course it will be required to pass in the theory and practices from the two parts of the subject, independently.



Students who do not assist to any part of the final examination (theory and/or practical skills) in the first call and do not pass the course, will have the qualification of NOT EVALUATED in the records.

Call 2: Students who fail the course in the first call, will keep the note of passed parts for the second call.

Laboratory notes of 5 or greater (of 10) obtained during an academic year will be saved for the calls of the following academic year.

REFERENCES

- BROCK-BIOLOGÍA DE LOS MICROORGANISMOS. Madigan, M.T., J.M Martinko, P.V. Dunlap & D.P. Clark. 12ª edición, Pearson. Addison Wesley. 2019
- MICROBIOLOGÍA de Prescott, Harley y Klein. Willey, J.M., Sherwood, L.M. y Woolverton, C.J. 7ª edición. McGraw-Hill-INTERAMERICANA DE ESPAÑA, S.A.U. 2009
- Cheng, T. 1986. Parasitología General. A.C. Barcelona.
- Gállego-Berenguer, J. 1998. Manual de Parasitología. Edicions de la Universitat de Barcelona. Barcelona
- Cordero del Campillo, M. & Rojo-Vázquez, F.A. 1999. Parasitología veterinaria. McGraw-Hill. Madrid



- Ewald , P.W. 1994. Evolution of Infectious Diseases. Oxford University Press. Oxford
- Grenfell, B.T. & Dobson, A.P. 1998. Ecology of infectious diseases in natural populations. Cambridge University Press. Cambridge
- Cellular Microbiology. Cossart, P., P. Boquet, S. Normar, R. Rappuoli. 2nd edition. ASM, Washington D.C. 2004
- Bacterial pathogenesis: a molecular approach. Salyers, A.A. and D.D. Whitt. 4th edition. ASM, Washington D.C. 2019.
- Bush, A.O., Fernández, J.C., Esch, G.W. & Seed, J.R. 2001. Parasitism. The diversity and ecology of animal parasites. Cambridge University Press. Cambridge
- Combes, C. 1995. Interactions durables. Écologie et évolution du parasitisme. Masson. Paris
- Flint, S.J., L.W. Enquist, R.M. Krug, A. Racaniello, and A.M. Skalka. 2000. Principles of virology: molecular biology, pathogenesis, and control. ASM, Washington D.C.
- Kaufmann, S.H.E., A. Sher and R. Ahmed. 2002. Immunology of infectious diseases. ASM, Washington D.C.



- Kaufmann, S.H.E., R. Medzhitov and S. Gordon. 2004. The innate immune response to infection. ASM, Washington D.C.
- Noble, E.R. & Noble, G.A. 1982. Parasitology. The biology of animal parasites. Lea & Febiger. Philadelphia
- Riley, L.W. 2004. Molecular epidemiology of infectious diseases: principles and practices. ASM, Washington DC.
- Seifert, H.S., H. Steven and V. J. DiRita. 2006. Evolution of microbial pathogens. ASM, Washington D.C.
- Singleton, P. and D. Sainsbury. 2001. Dictionary of Microbiology and Molecular Biology. 3rd ed. Wiley-Blackwell
- Shetty, N., J. W. Tang, and J. Andrews. 2010. Infectious Disease: Pathogenesis, Prevention and Case Studies. Wiley-Blackwell.
- The "Bacterial part" will be completed with reviews updated every year).