

**COURSE DATA****Data Subject**

Code	33062
Name	Pathogens and Illnesses
Cycle	Grade
ECTS Credits	5.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Faculty of Biological Sciences	4	Second term

Subject-matter

Degree	Subject-matter	Character
1100 - Degree in Biology	16 - Fundamentals of health biology	Optional

Coordination

Name	Department
AMARO GONZALEZ, CARMEN	275 - Microbiology and Ecology
FOUZ RODRIGUEZ, BELEN	275 - Microbiology and Ecology
ROCA VELASCO, VICENTE	355 - Zoology

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

OUTCOMES

1100 - Degree in Biology

- Conocer y saber aplicar el método científico.
- Capacidad de organización, planificación y gestión de la información usando bases de datos bibliográficas adecuadas.
- Utilización del vocabulario específico de la Biología sanitaria.
- Capacidad de resolución de problemas y toma de decisiones.
- Capacidad de elaborar artículos, informes o proyectos y de exponerlos a diferentes auditorios.
- Habilidad para el trabajo en equipo y en contextos multidisciplinares.
- Capacidad de análisis crítico de textos científicos.
- Aprendizaje autónomo y adaptación a nuevas situaciones.
- Potenciar la creatividad, iniciativa y espíritu emprendedor.
- Apreciación del rigor, el trabajo metódico, y la solidez de los resultados.
- Potenciación de la capacidad de liderazgo.
- Capacidad de utilización de herramientas matemáticas y estadísticas.
- Reflexión ética sobre la actividad profesional.
- Conocimiento de bases de legislación relacionada con la Biología.
- Saber analizar datos usando herramientas estadísticas apropiadas.
- Conocimiento de sistemas de gestión en tareas profesionales en Biología sanitaria.
- Conocer los principales métodos y técnicas experimentales aplicadas al estudio de las enfermedades humanas, su etiología y la efectividad de los tratamientos.
- Conocimiento de las enfermedades y disfunciones más frecuentes durante las distintas etapas de la vida.
- Conocer los organismos patógenos de humanos, las patologías que provocan y conocer los fundamentos de las principales estrategias terapéuticas.



- Conocer los mecanismos de interacción hospedador-patógeno para entender factores de virulencia en enfermedades infecciosas y parasitarias.
- Saber diseñar y preparar vacunas y saber realizar las vacunaciones.
- Entender la genómica de patógenos y sus implicaciones para el diseño de fármacos y vacunas.

LEARNING OUTCOMES

- Know the procedure for isolating a microorganism and / or a pathogenic parasite from a clinical specimen.
- Distinguishing between common pathogenic bacteria and parasites.
- Understand the practical application of serological and genetic methods in diagnosis and epidemiology of infectious diseases.
- Know the main methods used to study the effectiveness of treatments for infectious diseases.
- Know the usefulness of animal models for studying human diseases.
- Mastering basic microbiological techniques needed to identify pathogenic bacteria.
- Mastering basic parasitological techniques necessary to identify pathogenic parasites.
- Knowing how to properly interpret an antibiogram and its outcome.

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, shigellosis 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 7. 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 8. Life cycles of parasites. Direct cycles Indirect cycles. Importance of the guests intermediaries in the epidemiology of * parasitosis.

Topic 9. 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 ascaridosis: recognition of spores of grapes and lizards.

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

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	29,00	100
Laboratory practices	20,00	100
Tutorials	1,00	100
Development of group work	20,00	0
Study and independent work	10,00	0
Preparation of evaluation activities	32,50	0
Preparing lectures	11,50	0
Preparation of practical classes and problem	1,00	0
TOTAL	125,00	

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 a test exam. The exam of "Bacterial part" will be conducted a week after the end of the sessions. The other part, at the end of the course,
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 (75%)** and that obtained in **part 2-Parasites (25%)**.



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

Basic

- 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
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- Cellular Microbiology. Cossart, P., P. Boquet, S. Normat, 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.

Additional

- 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.
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- 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.
- La parte de Bacterias se completa con artículos de revisión actualizados todos los años (The "Bacterial part" will be completed with reviews updated every year).