



COURSE DATA

Data Subject

Code	33062
Name	Pathogens and Illnesses
Cycle	Grade
ECTS Credits	5.0
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1100 - Graduado/a en Biología	Faculty of Biological Sciences	4	Second term

Subject-matter

Degree	Subject-matter	Character
1100 - Graduado/a en Biología	16 - Fundamentals of health biology	Optional

Coordination

Name	Department
AMARO GONZALEZ, CARMEN	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. A substantial part of the subject is the analysis of pathogen-host interaction in its various forms (virulence factors, virulence genes, evasion of immune response, regulation of virulence, etc.) Analysis allows to understand, not only the infectious process, but also the strategies designed for its control.

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 - Graduado/a en Biología

- 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. General aspects.

Item 1. Microbial pathogens: classification and types. Transmission routes and reservoirs. Pathogenicity and virulence. Virulence factor and clone. Epidemiology. Mobile genetic elements and evolution of pathogens. Genomes. Item 2. Bacterial colonization factors. Fimbrial and non-fimbrial adhesins. Biofilm. Iron uptake systems of high affinity. Invasion and intracellular residence: invasins. Adhesion and invasion of virus.

Item 3. Agresinas. Toxins. Toxins A + B, cholera toxin, pertussis toxin, diphtheria toxin, botulinum toxin, Shiga toxin. Cytotoxins. Superantigens. Toxin injections. Moduline; septic shock. Viral immunopathology. Item 4. Regulation of virulence. Gene organization in prokaryotes. Random directional regulation. Two-component systems. Niche marker signals. Regulatory proteins, activators and repressors. Sigma factors. HN-S protein. Quorum sensing. Amplifications and gene rearrangements.

Item 5. Vaccines. Types of vaccines. Dead and live vaccines: differences. Subunit vaccines. Recombinant vaccines and vectors. DNA vaccines. Peptide vaccines. Edible vaccines. Trials to test a human vaccine.

2. Bacteria and viruses. Host-pathogen interaction models.

Item 6. *Vibrio cholerae*: biotypes. Cholera, transmission routes and reservoirs. Pandemics of cholera. Phylogeny *V. cholerae*. Genomes.  CTC phage. Faruque hypothesis. Colonization factors. Cholera toxin: structure and mode of action. RTX toxin: structure and mode of action. Iron uptake systems. Diagnosis, treatment and vaccines. *Yersinia*

Item 7. Pathogenic, pathogenesis, transmission and reservoir. The Plague. Pandemics of plague. Evolution of *Yersinia pestis*: genetic events. Genomes. Virulence factors: adhesion and invasion, resistance to phagocytosis, complement resistance and iron uptake systems. Regulation. Diagnosis, treatment and vaccines.

Item 8. *Shigella*. Dysentery: transmission routes and reservoirs. *Shigella*: intraspecific classification. Phylogeny and evolution. Origin of virulent strains, virulence plasmids. Invasion phases. Shiga toxin: structure and mode of action. Hemolytic uremia syndrome. R. Vir-dependent regulation Genomes. Diagnosis, treatment and prevention. Vaccines.

Item 9. *Neisseria*. Pathogenic species. Meningitis and gonorrhoea epidemiology and reservoirs. Phylogeny of *Neisseria*. Genomes. Adhesion and invasion. Antigenic hypervariability. Capsule and serum resistance. Diagnosis, treatment and vaccines. HIV

Item 10. Concepts. History. Epidemiological data. Transmission. Evolution of the virus. Structure of the virus particle. Provirus. Life cycle: latency, productive replication and lysis. Reservoirs cell and tissue. Evasion of the immune response. Stages of the disease. Opportunistic infections. Diagnosis, treatment and vaccines.

Item 11 of the hepatitis virus. Hepatitis A, B and C. Epidemiology and reservoirs. Structure of the virion. Viral genome. Virus cycle. Pathogenesis. Secondary complications. Diagnosis, treatment and vaccines.

Item 12 influenza virus. Avian influenza and human swine. Pandemics of human influenza. Epidemiological data. Human influenza virus, evolution. Structure of the virion. Genome. Genes and regulation. Life cycle.



3. Parasites. General aspects.

Item 13. Animal associations. Parasites and hosts. Terminology in parasitology. Extension of parasitism in the animal kingdom. Types of parasites. Origin and evolution of parasitism. Adaptations and preadaptations. Host-parasite coevolution.

Item 14. Life cycles of parasites. Cycles Direct. Indirect cycles. Importance of intermediate hosts in the epidemiology of parasitic diseases.

Item 15. Meeting and recognition of the host. Mechanisms of invasion by the parasites. Exit routes. Effects of the parasite on the host. Countermeasures of the host.

4. Parasites. Models of interaction parasite / host.

Based on PBL methodology (problem-based learning), groups of students must work on a case from different points of view of the host-parasite relationships. This work must refer to different aspects as: Hosts. Site of the parasite. Life cycle. Pathogeny. Epidemiology. Prevention, control and treatment of the parasite infection.

5. Laboratory

Block I. Bacteria and viruses

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

P2. Insulation on various selective and nonselective media. Purification.

P3. Identification by conventional methods. Gram, oxidase and API20E multitest system.

P4. Identification by genetic methods.

P5 multiplex PCR. Resistance to human serum.

P6. Treatments: antibiogram.

Block II Parasites

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

P8. Taeniasis and ascaridosis: recognition of species of tapeworms and roundworms.

P9. I. Stool analysis: identification of parasite forms. II. Microscopic analysis: identification of *Plasmodium* and various flagellates.

WORKLOAD

ACTIVITAT	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, at the end of the course, a test exam lasting 1 ½ hours. The value of this test is or **70%** of the final course grade.
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 and will last half an hour. This test will contain questions and problems on the practices and the mark obtained will represent **30%** of the final course grade.

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

To pass the course it will be required to obtain a rating higher than 5 out of 10 both 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. 2009
- 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. Normar, R. Rappuoli. 2nd edition. ASM, Washington D.C. 2004
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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.
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- 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
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