UAB
Universitat Autònoma de Barcelona

Host-Microbial Interactions

2026/2027

Code: 107545
Credits: 6

Degree programme	Type	Course
Microbiology	OP	4

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

Students enrolling in Host-Microbial Interactions (IMHo) should have achieved the learning competencies in Microbiology and Cell Biology, as well as in subjects related to Molecular Biology, Clinical Microbiology, Epidemiology of Infectious Diseases, Virology, and Microbial Ecology within their degree program; or similar subjects for exchange program students.

Objectives

The elective course Host-Microbial Interactions (IMHo) delves into the cellular, molecular, and ecological interactions between microorganisms and their hosts. It also covers the methods and models used to study these interactions, as well as their evolutionary and co-evolutionary dynamics and implications.

Learning outcomes

- CM14 (Integrate knowledge and skills in the field of microbiology applied to health, working individually and in groups, to prepare and present in writing or orally and publicly a scientific work either in English or in one's own language or others.) Integrate knowledge and skills in the field of microbiology applied to health, working individually and in groups, to prepare and present in writing or orally and publicly a scientific work either in English or in one's own language or others.
- KM19 (Identify the cellular and molecular relationships established between a microorganism or parasite and its host, including physiological and pathological mechanisms of defence and host response.) Identify the cellular and molecular relationships established between a microorganism or parasite and its host, including physiological and pathological mechanisms of defence and host response.
- KM20 (Describe the most important groups of infectious agents, their biological cycles, the molecular mechanisms of pathogenesis and toxicity and the epidemiology of the diseases they cause.) Describe the most important groups of infectious agents, their biological cycles, the molecular mechanisms of pathogenesis and toxicity and the epidemiology of the diseases they cause.
- SM19 (Use bibliography or internet tools, both in English and in one's own language or others, for the study of pathogenic microorganisms and their control.) Use bibliography or internet tools, both in English and in one's own language or others, for the study of pathogenic microorganisms and their control.
- SM21 (Relate the characteristics of pathogens and their mechanisms of virulence and pathogenicity with the type of infection, the pathology and the immune response that develops and with the mechanisms of action of vaccines and antimicrobial agents.) Relate the characteristics of pathogens and their mechanisms of virulence and pathogenicity with the type of infection, the pathology and the immune response that develops and with the mechanisms of action of vaccines and antimicrobial agents.

Contents

THEORETICAL CONTENTS

Block 1. An introduction to the host microbiome: Definition of microbiome. Aspects to consider in the study of the microbiome. Methods for studying the microbiome: Types and integration of omics. Future perspectives in the study and research of the microbiome. Structure, functions and diversity of the microbiome: Composition of the plant, animal and human microbiomes. Modulating factors of its diversity and key functions.

Block 2. The history of virology and viral pathogenesis. Emergence of viral diseases. Pandemics and epidemics. Metagenomics and viral microscopy in natural environments and healthy individuals. The human virome and the universal virome. Viral titers. Non-pathogenic viruses. Impact on the health and evolution of hosts. Symbiosis, mutualism, and commensalism. Beneficial viral infections. Genetic cross-talk between individuals and between species; viruses in the exposome and exosome of the host. The origin of viruses. The Gaia hypothesis and viruses. Molecular and experimental view of the coevolution of viruses and hosts. Viruses as mobile genetic elements. Genes of cellular origin in viruses and genes of viral origin in the host. Gene regulation in the host. How to study the evolution of viruses and hosts in the laboratory.

Block 3. Host-microorganism contact: Signaling through innate immune system receptors: activation and/or immune response evasion mechanisms. Antigens and toxins. Binding, adherence, internalization and intracellular persistence. Microbiota and health: influence of the microbiome on the host immune system, metabolism, and behavior. Communication systems. Microbiota andinfections. Modulation of disease with microorganisms: use of microorganisms as therapeutic agents. Experimental models for the study of host-microorganism interaction: *in silico*, *in vitro*, *ex vivo*, and animal models (invertebrates, vertebrates). Experimental objectives and selection of analytical methods in the different models.

Block 4. Molecular mechanisms that allow pathogens to establish, maintain and adapt infection within the host: Key virulence factors: nutritional immunity, secretionsystems, mechanisms of resistance to antibacterials, and appendages related to adhesion, invasion and motility. Horizontal gene transfer of virulence factors and antibacterial resistance. Intracellular adaptation and gene expression in the host: regulation of genes involved in virulence, resistance, and response to cellular stress. Critical pathogens in human health (ESKAPE) and in the agri-food and livestock sectors. Models for studying bacterial virulence in plants.

Block 5. Population and evolutionary aspects of microorganism-host interactions. Population growth and communication among microorganisms: quorum sensing (QS) and biofilm formation. Stress response during population growth and its role in pathogenesis: QS mediated, stringent response, etc. Co-evolution with the host and population genomics. Evolution of virulence/pathogenicity factors. Genetic and omics methods for their study. Antimicrobial resistance as a population phenomenon: hetero-resistance, adaptive resistance, phenotypic resistance, and persistence in microbial populations.

LABORATORY PRACTICE CONTENTS

Non-pathogenic microorganisms as modelsfor pathogen-host interaction. Role of virulence and pathogenicityfactors in the interactions. Study of biofilms formation and bacterial motility. Cell culture and *in vitro* models of bacterial infection. Animal models of bacterial infection and determination of cultivable microbiota.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Seminars	10	0.4	CM14, KM19, KM20, SM19, SM21
Seminar planning and preparation	20	0.8	CM14, KM19, KM20, SM19, SM21
Lectures	30	1.2	KM19, KM20, SM21
Text reading	20	0.8	CM14, KM19, KM20, SM19, SM21
Laboratory practices	15	0.6	CM14, KM19, KM20, SM19, SM21
Individual study	47	1.88	CM14, KM19, KM20, SM19, SM21
Individual and group tutorial sessions	4	0.16	CM14, SM21

Participatory Theoretical Classes: The delivery of each thematic block will be based on the lecture format, where active student participation will be encouraged. To teach some topics, activities such as self-learning, active learning, and/or short formative assessments may be included. Students are expected to acquire the knowledge specific to this subject by attending these classes and complementing them with personal study of the topics explained.

Seminars: These will be based on group work to solve problems, discuss scientific results, and/or experimental models related to each thematic block, which will be presented in class. Attendance at seminar sessions is mandatory. Instructions for each seminar will be published on the virtual campus at the beginning of each thematic block.

Laboratory Practical Classes: These are mandatory sessions (see faculty evaluation criteria) conducted in the teaching laboratories. Students will receive lab guide before the start of the sessions. For the practical sessions, students will work in small groups. At the beginning of each session, the teaching team will provide a brief theoretical explanation of the content of the practice and the experiments to be carried out by the students. To achieve good performance and acquire the competencies required for this subject, it is essential that students read and understand the lab guide beforehand, familiarizing themselves with the practices to be performed in each session and with the methodology they need to apply in each one.

Supervised Activities: The subject may include group and individual tutorials to support the formative activities mentioned earlier. Individual tutorials will generally take place in the faculty offices.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Theory Assessment II	25%	2	0.08	KM19, KM20, SM19, SM21
Assessment of seminar sessions	20%	0	0	CM14, KM19, KM20, SM19, SM21
Assessment of laboratory practices	20%	0	0	CM14, KM19, KM20, SM19, SM21
Theory assessment I	35%	2	0.08	KM19, KM20, SM19, SM21

Continuous Assessment

1. Evaluation module for theoretical classes (60% of the overall grade). Two written evaluation tests (midterms) will be scheduled throughout the course. The first test will account for 35% and the second for 25% of the overall grade. These partial evaluations are combined tests that may include multiple-choice questions, short-answer questions, written responses, and/or problem solving. To pass these evaluations, it is necessary to achieve a minimum score of 5.0 in each of them.

2. Evaluation module for seminars (20% of the overall grade). Attendance, participation, and class discussion of the problems posed will be evaluated at the end of each thematic block. Absence from seminar sessions could be penalized. To pass this module, a minimum score of 5 is required on the final module grade.

3. Evaluation module for laboratory practical classes (20% of the overall grade). This evaluation will consist of two tests: a) Practical skill, which will involve submitting various practical results during each lab session. b) A written test consisting of up to 15 multiple-choice questions about the work performed in the laboratory. These tests will weigh 4 and 6 points out of 10, respectively. To pass this module, a minimum score of 5 on the written test is required. Attendance at laboratory sessions is mandatory according to faculty evaluation criteria for integrated laboratories.

General Issues:

To pass the subject, a global grade of 5 or higher must be obtained, as well as individually in each evaluation module. Students who do not pass some of the evaluation modules may retake them on the scheduled date at the end of the semester. Likewise, on that same date, students who have passed the subject but wish to improve their grade may take a comprehensive exam covering all the evaluation modules. Taking the grade improvement exam implies forfeiting the previously obtained grade.

To participate in the retake, students must have previously been evaluated in a set of activities that account for at least two-thirds of the total subject or module grade. Therefore, students will receive a grade of \"Not Evaluated\" when the evaluation activities completed represent less than 67% of the final grade.

From the second enrollment onwards, it will not be necessary for the student to complete the practical module if they achieved the competencies of this part of the subject in the previous course.

Single Evaluation

For students opting for the single evaluation system, this consists of a single synthesis test evaluating the content of the entire subject program. It will consist of three parts:

- Evaluation of the theory module: This will consist of a synthesis test covering all the contents of the theoretical module. The score obtained in this test will represent 60% of the final subject grade.
- Evaluation of the seminar module: A written test with questions related to problem solving, discussion of

results, or experimental proposals. The score obtained in this part will represent 20% of thefinal grade.
- Evaluation of the practical module: Based on a written test about the activities carried out during the practical sessions, accounting for 12% of the final grade, and on the student's practical skills, accounting for 8% of the final grade. The latter will be assessed during each lab session, so attendance is mandatory for all practical sessions.

All written tests will take place on the same day, coinciding in date and time with the 2nd written test established for continuous assessment.

To pass the subject, each part of the test must be passed separately with a grade equal to or greater than 5 out of 10. In case of failing the subject, the student may take a recovery evaluation with the same characteristics as described, and to pass the subject it will be necessary to obtain a grade equal to or higher than 5 in the parts that were not previously passed.

Use of Artificial Intelligence

For this subject, the use of Artificial Intelligence (AI) technologies is permitted exclusively in support tasks, such as bibliographic or information searches, text correction or translations, or others at the discretion of the teaching staff. The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. The lack of transparency in the use of AI in evaluable activities and seminars will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

IMPORTANT: Any irregularity committed during an assessment activity (such as academic fraud, plagiarism, or the improper use of AI, unless such use is expressly authorised in the course guide) that may lead to a significant change in the grade will result in that assessment activity being awarded a grade of 0. If the course guide establishes that obtaining a minimum grade in that assessment activity is an essential requirement for passing the course, or if several irregularities occur in assessment activities within the same course, the final grade for the course will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

Bibliography

Recommended books

- Aquino de Muro, Marilena. (2023). Virus-Host Interactions : Methods and Protocols. (1st ed.) Imprint Humana / Springer. Disponible en línia

- Domingo, Esteban. (2020). Virus as populations : composition, complexity, quasispecies, dynamics, and biological implications. (2nd ed.) Elsevier. Disponible en paper a la biblioteca. Disponible en línia.

- Domingo, Esteban. (2023). Viral Fitness and Evolution : Population Dynamics and Adaptive Mechanisms. (1st ed.) Springer Disponible en línia

- Gnanamanickam, S. S. (2006). Plant-associated bacteria. (1st ed.) Springer Disponible en línia

- Leitão, Jorge H. (2020). Microbial Virulence Factors. MDPI - Multidisciplinary Digital Publishing Institute Disponible en línia

- Rappuoli, Rino [i altres]. (2005). Cellular Microbiology. (2nd ed.) ASM Press. Disponible en línia

- Singh, Vijai & Mani, Indra. (2024). Multi-Omics Analysis of the Human Microbiome : From Technology to Clinical Applications. (1st ed.) Springer Nature Singapore. Disponible en línia

- Tennant, Paula & Foster, Jerome E. & Fermin, Gustavo. (2018). Viruses: molecular biology, host interactions,

and applications to biotechnology. Academic Press Disponible en línia

- Weaver, Scott C. (2016). Virus evolution : current research and future directions. (1st ed.) Caister Academic Press Disponible en línia

Software

Specific software are not needed.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	74	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	741	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	741	Catalan/Spanish	first semester	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	741	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	742	Catalan/Spanish	first semester	afternoon
(PLABs) Suport a les pràctiques de laboratori	742	Catalan/Spanish	first semester	afternoon