Universitat de Lleida

DEGREE CURRICULUM

MICROBIOLOGY II

Coordination: COLOMINA GABARRELLA, M. NIEVES

Academic year 2023-24

MICROBIOLOGY II 2023-24

Subject's general information

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<tr><td>Subject name</td><td>MICROBIOLOGY II</td></tr>
<tr><td>Code</td><td>101614</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>1.4</td><td>0.8</td><td>3.8</td></tr>
<tr><td>Number of groups</td><td>4</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>COLOMINA GABARRELLA, M. NIEVES</td></tr>
<tr><td>Department</td><td>BASIC MEDICAL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>60 hours lectures
90 hours independent student work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan 95%
English 5% (in some slides, as part of the didactic material)</td></tr>
<tr><td>Distribution of credits</td><td>Producció Vegetal i Ciència Forestal 2.6 credits
Ciències Mèdiques Bàsiques 7.6 credits</td></tr>
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MICROBIOLOGY II 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BASSIÉ , LUDOVIC RENÉ BERTIL	ludovic.bassie@udl.cat	1,4	
CAPELL CAPELL, MARIA TERESA	teresa.capell@udl.cat	1,2	
CASTELLS ROCA, LAIA	laia.castells@udl.cat	1,8	
COLOMINA GABARRELLA, M. NIEVES	neus.colomina@udl.cat	5,7	
PUJOL CARRION, NURIA	nuria.pujol@udl.cat	,1	

Subject's extra information

The subject of Microbiology II, together with Microbiology I, is intended to form students in the knowledge of microorganism biology, including viruses, and specific technological applications.

Microbiology II consists of two different parts. One of them is dedicated to the knowledge of the diversity of microorganisms with cellular structure, and the other to the properties of viruses. All knowledge acquired will be important for the full comprehension of other subjects as Immunology, Biotechnological Processes and Products or Alimentary Fermentations.

Although it is not an administrative requisite, it is recommended that the student has passed the subject of Microbiology I.

Learning objectives

Once the subject is passed, students must be able to:

• To interpret scientific information and to elaborate technical informs about this information.

• To solve problems using the knowledge acquired in theoretical classes.

• To know practically the functioning of a microbiology laboratory and the manipulation of microorganisms.

• To find genomic and proteomic information about microorganisms in data bases, and be able to interpret it.

Students must demonstrate knowledge on:

• The diversity of bacteria, fungi and protozoa, and their most important biological properties.

• The role of microorganisms in an ecological, biomedical, agro-alimentary and industrial level.

• The main structural characteristics of viruses, and their multiplication strategies in relation to the type of the host cell.

• The role of viruses in animal and vegetal pathologies, and how to relate these strategies with the multiplication cycles of viruses.

• Immunological viral structures and their relevance in antiviral vaccination.

• The role of viruses in recombinant DNA technology, and the corresponding genetic bases, as a foundation for their biotechnological applications.

Competences

General skills

GC1 Being able to selectively search for and use sources of information necessary to achieve the training objectives.

GC3 Working in a team, with a multidisciplinary vision and with the ability to make a rational and efficient distribution of tasks among team members.

GC4 Knowing and adequately using the scientific and technical vocabulary of the different areas of Biotechnology.

GC5 Working in the laboratory applying criteria of quality and good practice.

GC6 Knowing and knowing how to use the specific software and databases in the different fields of biotechnology.

GC7 Using the scientific method to analyze data and design experimental strategies with biotechnological applications.

GC8 Being able to form a critical judgment on the ethical, legal and environmental implications of biotechnology.

GC9 Being able to carry out a professional activity in accordance with safety regulations and respect for the environment and with ethical criteria.

GC11 Acquiring criteria for choosing the most appropriate analytical techniques for each specific practical case.

Transversal skills

CT1 Being able to produce comprehensible written and oral reports on the work carried out, with a justification based on the theoretical-practical knowledge obtained.

CT4 Respecting the fundamental rights of equality between men and women, the promotion of Human Rights and the values of a culture of peace and democratic values.

Specific skills

CE23 To know the fundamental aspects of the structure, metabolism, genetics and ecology of microorganisms, relating them to their possible technological use.

CE24 To know the principles of the immune response at molecular, cellular and physiological level, and the use of antigen-antibody reactions at analytical and diagnostic level.

CE25 To know the practice of microbial cell culture.

CE26 Be able to use experimental techniques for molecular, cellular and physiological analysis.

Basic skills of the Biotechnology Degree

CB1 Students have to demonstrate to possess and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually at a level that, although it is supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

CB2 The students have to know how to apply their knowledge to their work or vocation in a professional manner and possess the competencies and the skills that are usually demonstrated through the development and defense of arguments and problem solving within their field of study.

CB3 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

Subject contents

BLOC 1. MICROBIAL DIVERSITY (theoretical classes 15 hours , problems 3 hours, laboratory practices 2 hours)

1.1. MICROBIAL TAXONOMY (1 h). Basic concepts. Phenetic and phylogenetic classifications. Molecular taxonomy. Evolution of microorganisms. Comparison of archea, bacteria and eukaryotes.

1.2. ARCHEA (2 h). Structural, biochemical and ecological characteristics. Adaptations to the extreme environments. Taxonomic groups. Biotechnological applications.

1.3. BACTERIA (9 h). Classification criteria. Main bacterial groups with biotechnological interest (agro-alimentary, biomedical, industrial): Proteobacteria, gram positive bacteria, Cyanobacteria, Chlamydia, Spirochetes, Deinococci, green photosynthetic bacteria.

1.4. FUNGI (2 h). General characteristics. Physiology. Biological cycle. Nutrition and metabolism. Ecology. Reproduction. Taxonomy. Antifungal agents. Fungi of biotechnological interest.

1.5. PROTOZOA (1 h). General characteristics and biological cycles. Cell structure. Nutrition and metabolism. Forms of resistance. Reproduction. Pathogenesis.

BLOC 2. VIROLOGY (theoretical classes 23 hours, laboratory practices 12 hours, problems 5 hours)

2.1. INTRODUCCION AND TAXONOMY OF VIRUSES (1 h). Concept of virus. Viruses, mobile elements and other submicroscopic structures. Comparison between viruses and cellular organisms. Relevant facts in history. Virology: animal, vegetable and bacterial viruses. Hypothesis on origin and evolution of viruses. Classification system from the International Committee on Taxonomy of Viruses.

2.2. STRUCTURE OF VIRUSES (1,5 h). Morphology and virions size. Methods to study viruses. Capsid architecture: types of symmetry. Enveloped viruses. Complex viruses. Interaction capsid/nucleic acid.

2.3. VIRAL GENOMES (1.5 h). Structure and complexity of viral genomes. Segmented and fragmented genomes. Viral mutants. Genetic interactions between viruses. Defective viruses. Satellite viruses. Recombination between viral genomes.

2.4. PURIFICATION AND ANALYSIS OF VIRUSES (2 h). Obtention of viral particles. Cellular culture. Methods of purification. Quantification of viral particles: direct and indirect methods. Biochemical analysis of components. Working methods in the laboratory of virology. Obtention of viral vaccines.

2.5. BACTERIAL VIRUSES (3 h). Classification of bacteriophages. Morphology of phage capsids. Multiplication of DNA and RNA bacteriophages: lytic cycle. Attenuated bacteriophages and lysogeny. Phage conversion. Bacteriophages of bacteria of biotechnological interest.

2.6. PLANT VIRUSES AND VIROIDS (6 h). Introduction-Symptoms induced by plants viruses - Main plant viral diseases. Organization and expression of the genome of plant viruses. Viral transport: infection, spread and translocation of viruses in plants. Transmission of plant viruses. The immune system of plants. Subviral infectious agents in plants.

2.7. MULTIPLICATION OF ANIMAL VIRUSES (3.5 h). Cell specificity. Receivers. Decapsidation. Effects on cellular metabolism. Synthesis of RNA, DNA and viral proteins. Processing of the proteins. Assembly. Cytopathic effects. Exit of viral particles. Retrotranscription. Viral oncogenes in RNA and DNA viruses: cell transformation. Antiviral drugs: mechanisms of action. Use of animal viruses in recombinant DNA technology: biotechnological applications.

2.8. PATHOGENICITY BY ANIMAL VIRUSES (3.5 h). Characteristics of viral infections. Persistent, latent and slow infections. Routes of entry and extension inside the body. Mechanisms of transmission. Type of reservoir. Main families and genera of pathogenic viruses in humans and other animals: pathological effects. Viral vaccines. Insect virus. Fungal virus.

2.9. PRIONS (1 h). Prions as infectious particles. Molecular aspects: PrPc and PrPsc particles. Propagation of prions. Phenotypic diversity. Prion diseases in animal species. Interspecific barriers. Prions in other organisms. Delta agents.

Practical activities

Laboratory practices (14 hours):

Practice 1: Treatment of *Saccharomyces cerevisiae* with toxic agents: measure of viability.

Practice 2: Obtaining phage lysates

Practice 3. Quantification of bacteriophage suspensions

Practice 4: Semi-quantitative analysis of viral antibodies by ELISA

Practice 5: Introduction of viral genes in plants by agroinfection and mechanical inoculation

Practice 6: Electron and confocal microscopy of plant viruses and immunoelectromicroscopy

Problems and cases classes (8 hours):

-3 problem classes on microbial diversity, 2 class general virus problems, 1 class bacterial virus problems, 2 class animal virus problems

Methodology

		Presential activity of the student		No presential activity of the student		Evaluation	Total time	
		Objectives	Hours	Student work	Hours	Hours	Hours	ECTS
Type of activity	Description							

Master lesson	Master class. Large group. The course 2021-22 will be mainly face-to-face sessions in the classroom. In case pandemic situation is worsen, classes will be combined with virtual sessions. The degree of attendance in each time will depend on the guidelines of the UdL at that particular time.	Explanation of the main concepts	38	Study: To know, understand and synthesize knowledges	60	3	101	4,1
Problems and cases	Face-to-face participatory class (Classroom. Large group)	Resolution of problems and cases	8	To learn to solve problems and cases	14	2	24	0,9
Seminar	Face-to-face participatory class (Classroom. Large group)	Discussion or application activities		Scientific discussion. To solve problems and cases				
Laboratory	Laboratory Practice (Small Group)	Ejecución de la práctica: comprender fenómenos, medir...	14	To study and prepare the report	10	1	25	1

Evaluation

Theory exams: Block 1 Diversity + 2.1-2.3 Viruses: 30% Block 2 2.4-2.9 Viruses: 30%

Laboratory practices: 20%

Analysis of cases and problems: 20%

Observations

There will be two written assessments, coinciding respectively with the two assessment periods. The subject to be evaluated will be:

1ª assessment: theoretical knowledge up to topic 2.3 (included) + knowledge acquired in the first classes of

problems (30 + 10 = 40%)

2ª assessment: rest of theoretical knowledge + knowledge acquired in practical classes + knowledge acquired in the rest of problem classes (30 + 10 + 10 = 50%)

The rest will correspond to the written report of the practical sessions (10%). The written report will be scored with the following ponderation: formal correction (20%), method and results description (50%), conclusions (30%).

In the theoretical knowledge part: each assesment will be considered passed with a minimum grade of 5 over 10. A minimum of 4 is required to average the grade of each assesment.

Each exam to overcome the grade, will include the subject of one of the two previous assessments, and may be averaged with the rest of the subject assessed. In case that neither the first nor the second assessment have been passed, both assesments will be included in the overcome exam.

The minimum mark to pass the subject is equal to or higher than 5 (over 10) in the theoretical knowledge part, and equal to or higher than 5 in the final grade. Both requisites have to be fulfilled.

ALTERNATIVE EVALUATION

Students will take a single exam that will coincide with the date and time of the exam scheduled for the second assessment, according to the schedule published for the subject. This exam will account for 80% of the mark.

In this exam, all the theoretical knowledge of the subject (60%) and the problems and cases (20%) will be evaluated.

The student will be exempt from the obligation to attend the laboratory practices, but will have to submit a short report (2 pages) of a bibliographical review on a biotechnological application of a microorganism or virus, chosen from among the examples studied in the theoretical contents (20%). The presentation will be in written form, at most, 5 days before the single exam.

The single exam can be overcomed in the case of having obtained a mark of less than 5 out of 10, on the same date as the one scheduled for the overcome exam, according to the schedule published for the subject.

Bibliography

Basic bibliografy

• Cann, A.J. Principles of Molecular Virology (4th ed.). Elsevier Academic Press (2005)
• Madigan, M.T. i altres. Brock Biología de los microorganismos (12ª ed.). Addison Wesley, (2009)
• Schaechter, M. I altres. Microorganismes. Ed. Reverté (2008)
• Shors, T. Virus. Ed. Panamericana (2008)
• Willey, J.M. i altres. Microbiología de Prescott (7ª ed.). McGraw Hill (2009)

Complementery bibliografy

• Carrasco, L. i J.M. Almendral. Virus patógenos. Ed. Hélice (2006)
• Flint, S.J. i altres. Principles of Virology: Molecular biology, pathogenesis and control (3rd ed.). ASM Press (2009)
• Granoff, A. i Webster, R.G. Encyclopedia of Virology (2nd ed.). Academic Press (1999)
• Hull, R. Matthew's Plant Virology (4th ed.). Academic Press (2002)
• Wagner, E.K. i Hewlett, M.J. Basic Virology (3ª ed.). Blackwell Publishing (2008)