UAB
Universitat Autònoma de Barcelona

Virology

Code: 101002
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500502 Microbiology	OB	2

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Teachers

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Teaching groups languages

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

Prerequisites

Is essential to have a general background in Biochemistry, Molecular Biology, Cell Biology, Microbiology and Immunology.

Objectives and Contextualisation

The teaching objectives of the subject are to provide the students with fundamental knowledge as well as skills and competences related to the biology, structure, genetics and evolution of viruses within the framework of their pathogenesis and the pharmacological and research possibilities offered by the virology.

Learning Outcomes

1. CM09 (Competence) Critically review the scientific contributions of women to the study of microorganisms and other sciences related to microbiology.
2. CM10 (Competence) Integrate knowledge and skills from the field of microbiology, 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.
3. KM14 (Knowledge) Indicate the structural characteristics of microorganisms, paying special attention to the differences between acellular entities, prokaryotic organisms and single-cell eukaryotes.

4. KM15 (Knowledge) Describe the metabolic and functional diversity of the microbial world, distinguishing the characteristics that define the different taxonomic groups.
5. KM16 (Knowledge) Identify the main relationships established by microorganisms with each other, with other living beings, with their environment and in general with the ecosystem, and the methods for studying these interactions.
6. SM13 (Skill) Relate the basic genetic components, structures and processes of replicative microorganisms and entities with their functions and the different ecophysiological mechanisms of adaptation to their environment.
7. SM14 (Skill) Discover the role of microorganisms as causative agents of diseases in humans, animals and plants and the processes used to control them.

Content

1. Nature and multiplication of viruses

The world of viruses. Strict parasitism, multiplication and transmission. Viral disease and the iceberg concept. Viral diversity and virome. The viral particle: dimensions, chemical composition, morphology and nomenclature. Functions of the capsid; stability and recognition. Chemical composition, structure and organization of the viral genome: structural and non-structural genes. The polarity of the nucleic acid. The viral cycle: extra- and intracellular phases. Viral multiplication: productive and non-productive infections. Sequential expression of viral genes. Viruses, mobile genetic elements and living things.

2. Origins of Virology

The hypotheses about the maintenance of life and spontaneous generation. Pasteur's work. Microscopic infectious agents and Koch postulates. The nineteenth century: the discovery of viruses. The tobacco mosaic: the concept of filterable poison. Discovery of animal viruses. 20th century: chemical, structural and genetic characterization of viruses. Relevant facts in the history of Virology. Smallpox eradication and the risk of re-emergence. Clinical and biotechnological aspects of Virology. Bioterrorism.

3. Structure of viral particles

Morphology of viral particles. Architectural study of viral particles: electron microscopy and three-dimensional reconstructions. X-ray diffraction: resolution level. Molecular architecture in helical and icosahedral symmetries. Trans-membrane proteins in viral envelopes. Receptor- binding sites. Viral antigens and epitopes B and T. Neutralization and evasion of neutralization. Genetic and epitopic variability.

4. Viral genetics and viral genomes

Diversity of viral genomes. Principle of economics and complexity of viral genomes; gene overlapping. Segmented and split genomes. Information encoding the viral genome. Viral genome types and gene expression and replication strategies; time-regulation strategies. The infectious clone. Principles of reverse genetics. Defective viruses.

5. Methods in Virology

Obtaining viral particles. Cell culture at small and medium scale. Purification. Quantitative and qualitative analysis of viral particles. Detection of viral components and applications in diagnostic methodology. The Virology laboratory: areas and distribution. Biological safety. Containment levels: P1 to P4. Air treatment. Effluent treatment.

6. Principles of viral taxonomy

First virus classifications: Baltimore classification of animal viruses. The International Committee on Taxonomy of Viruses and the classification system. Viral properties used in taxonomy. Families of animal viruses and unclassified viruses. Nomenclature changes. Main human pathogens and their diseases.

7. Viral multiplication

Cell recognition. Nature and function of receptors. Internalization. Disassembly. Biosynthetic shutdown. Stimulation of cellular functions: papovaviruses and adenoviruses. RNA, DNA and viral protein synthesis: time sequences. Cytopathic effects. Exit of viral particles with and without lysis. Apoptosis. Cell transformation into RNA viruses: cellular oncogenes; activation and transduction. Cell transformation into DNA viruses: oncogenes and viral oncoproteins. Viral protein processing. Antiviral drug targets. Interfering RNA.

8. Pathogenesis of viral infections

"Good" viruses. Virus-host coexistence. Asymptomatic infections. Characteristics of viral infections. Entrance gates. Transmission routes: horizontal and vertical. Localized and systemic infections. Dissemination. Viremia. Nerve transmission. Target tissues: tropism. Acute and persistent infections. Dissemination. Viremia. Nerve transmission. Target tissues: tropism. Acute and persistent infections. Latent infections. Viral and non-viral factors influencing pathogenesis. Virulence. Evasion of the immune response by viruses. Immunopathology.

9. Response to viral infections and vaccines.

Types of vaccines; attenuated and inactivated. Molecular basis of attenuation. New generation vaccines. Recombinant vaccines and synthetic peptides. Vaccination with nucleic acids. New vectors in vaccines. SARS-CoV-2 vaccines. Herd immunity. Innate and adaptive immune response. Sentinel cells, complement, inflammation, interferons. Communication between innate and adaptive response. Adaptive immune response: humoral and cellular. The importance of the antiviral cellular immune response. The bacterial immune system CRISPR / Cas.

10. Origin and evolution of viruses

Origin of viruses; regressive theories and those in favor of a cellular origin. Mechanisms for the generation of diversity. Mutation frequencies and relative abundance of mutants. Fixation of mutations. Viral replicases and fidelity of copy. Variability and evolution in RNA and retrovirus viruses. Viral quasi-species. Evolution and evolutionary potential. Darwinian and non-Darwinian selection of mutations. Foundational effects and bottlenecks.

11. New viral diseases and emerging viruses

Emergence of new viral diseases. Host jump and viral reservoirs. Viral emergency and re-emergence. Determining environmental, social and technological factors. Importance of arthropod vectors. The human species as a terminal host. New viruses and emerging viral diseases. Hemorrhagic fevers. Ebola virus and human immunodeficiency virus. The continuous re-emergence of the influenza virus.

12. The virome

The concept of virome and methods for its study. Viruses in the planet. The iceberg concept and the Global Virome Project. Acquisition of viruses in humans. Horizontal transmission of the viruses. The horizontal transmission of phenotypes. The human holobiont. The role of the virome in biology of the holobiont, in health and disease. Virome and sexuality.

13. Peculiar infectious agents

Prions: Infectious proteins. Development of the concept of prion. The amyloid. PrPc synthesis and processing. PrPsc formation and prion propagation. Spongiform encephalopathies:inheritance and infection. Phenotypic diversity of prions; the strains. "Scrapie" and bovine spongiform encephalopathy. Interspecific barriers. Human spongiform encephalopathies: Kuru, Creutzfeldt-Jakob syndrome and hereditary diseases. Prions in yeast. Viroids: structure and constancy of domains. Possible mechanisms of pathogenesis. The Satellites. The delta hepatitis virus. Virophages.

14. Bacteriophages

Use of bacteriophages in molecular genetics and biotechnology. The "phage display". The generation of antibodies without immunization and the search for new ligands. Directed molecular evolution. Drug selection systems.

15. Artificial viruses

Viruses as new editable nanomaterials. Viral gene therapy; important features and biological risks. Gene therapy products on the market. Artificial viruses as alternatives to viral gene therapy. Types of artificial viruses and used biomolecules. Modular strategies. Selection of virus-inspired functional domains. Examples and applications of artificial viruses.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Active learning activities	15	0.6	CM09, CM10, KM14, KM15, KM16, SM13, SM14, CM09
Lectures	30	1.2	KM14, KM15, KM16, SM13, SM14, KM14
Type: Supervised			
Personal tutorial guidance sessions	2	0.08	CM10, KM14, KM15, KM16, SM13, SM14, CM10
Type: Autonomous			
Group work: preparation of written reports	2	0.08	CM10, CM10
Literature search	28	1.12	KM14, KM15, KM16, SM13, SM14, KM14
Personal study	44	1.76	KM14, KM15, KM16, SM13, SM14, KM14
Preparation of oral and written presentation of reports	2	0.08	CM10, KM16, SM13, SM14, CM10
Reading	23	0.92	CM09, KM15, KM16, SM14, CM09

The course will comprise classroom lectures and active learning activities with scientific problems and cases by which students will acquire skills necessary to perform literature research, propose experimental approaches and design problem solving strategies. Oral presentations of active learning activities will encourage teamwork, coordination of activities and rational presentation of work plans and results. Active learning activities will be focused on methodological aspects and biomedical, biotechnology, pharmaceutical and nanotechnological applications of virus as well as derived viral structures. Personal tutorial guidance sessions will be available by email appointment and will be held in the office C3/331. In those sessions, students will have the opportunity to receive individual guidance according to their needs.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of 3 group assignements: written report and oral presentation in situ or recorded	30 %	0	0	CM09, CM10, KM14, KM15, KM16, SM13, SM14
Final exam: multiple choice	40 %	2	0.08	CM09, KM14, KM15, KM16, SM13, SM14
First midterm exam: multiple choice	15 %	1	0.04	KM14, KM15, KM16, SM13, SM14
Second Midterm exam: multiple choice	15 %	1	0.04	KM14, KM15, KM16, SM13, SM14

The evaluation will be done through 3 exams, two non-eliminatory partials and a final exam that will include the third partial and a synthesis part. The exams will be distributed during the course, with a total weight over the final qualification of 70% (15%, 15% and 35 + 5% respectively). Furthermore, 30% of the qualification will be obtained through oral presentations of problems, resolution of classroom problems or presentation of written exercices (in teams). For these activities (30%) no remedial test is programmed.

The remedial exam will be a multiple-choice test and will have questions from the entire syllabus. The exam will be open to students who have failed in the global score of the subject, but also to those who want to improve their scores. Prior registration is required. Separate remedial exams for each part examination cannot be made. The remedial will cover the whole subject and the score obtained will be that of the recovery exam (70%), regardless of the scores obtained in the previous exams. In compliance with article 112 ter point 2 of the current Academic Regulations of the UAB, to be eligible for the remedial test, students must have been previously evaluated in a set of activities equaling at least two thirds of the final qualification of the course. Therefore, the students will obtain the "No Avaluable" qualification when the evaluation activities carried out have a weight lower than 67% in the final score.

For those who have voluntarily chosen the single evaluation, this will consist of a single multiple-choice exam in which the contents of the entire program of theory and seminars of the subject will be evaluated. The score obtained in this test will account for 70% of the final score. The single evaluation test will coincide in the calendar with the last test of the continuous evaluation and the same make-up test will be applied. The evaluation of the
seminars will follow the same process than the continuous evaluation and the score obtained will represent 30% of the final score of the subject.

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Software

No specific software is foreseen

Language list

Name	Group	Language	Semester	Turn
(SEM) Seminars	721	English	second semester	afternoon
(TE) Theory	72	English	second semester	afternoon