Universitat Autònoma de Barcelona

Guia Docent de Virologia

Dades de l'assignatura

Any acadèmic	Codi d'assignatura	Nom	Crèdits	Plans on pertany	Idiomes
2010 - 2011	101002	Virologia	6	816 - Graduat en Microbiologia	Català,Anglès

Professor/a de contacte

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Prerequisits

Is essential to have a good level of spoken and written English and a general background in Biochemistry, Molecular Biology, Cell Biology, Microbiology and Immunology.

Contextualització i objectius

The teaching objectives of the course are the acquisition by the students of basic knowledge about biology, structure, genetics and evolution of viruses within the framework of its pathogenesis and pharmacological possibilities and research opportunities Virology can offer in those fields. It will be also focussed on emerging applications of the viruses in biotechnology and nanotechnology, and the need for constant updating of information through bibliographic databases.

Competències i resultats d'aprenentatge de l'assignatura

Codi	Tipus	Nom de la competència	Resultats d'aprenentatge
1260:E06	E	Aplicar les metodologies adequades per aïllar, analitzar, observar, cultivar, identificar i conservar microorganismes d'ambients, aliments i productes o objectes elaborats per l'home	1260:E06.17 - Identificar les tècniques utilitzades per a la multiplicació, la detecció i la identificació de virus 1260:E06.22 - Identificar les tècniques utilitzades per conservar i emmagatzemar microorganismes
1260:E11	E	Caracteritzar els agents causals de malalties microbianes en l'home, en els animals i les plantes per diagnosticar-les i controlar-les, fer estudis epidemiològics i conèixer la problemàtica actual i les estratègies de lluita contra aquestes malalties	1260:E11.02 - Conèixer els grups més importants de microorganismes patògens 1260:E11.03 - Identificar i descriure els microorganismes utilitzats per al bioterrorisme
1260:E13	E	Identificar els mecanismes moleculars de la patogènia i relacionar-los amb la resposta contra la infecció per dissenyar i desenvolupar estratègies de diagnosi i de lluita contra les malalties causades per microorganismes	1260:E13.08 - Conèixer les bases moleculars de la invasivitat i la virulència vírica i reconèixer el valor de les variants víriques atenuades en el disseny de vacunes 1260:E13.09 - Conèixer els processos moleculars del cicle víric i identificar les dianes potencials de fàrmacs antivírics

1260:E17	E	Aplicar microorganismes o els seus components al desenvolupament de productes d'interès sanitari, industrial i tecnològic	1260:E17.01 - Comprendre les bases microbiològiques que s'utilitzen per desenvolupar productes d?interès sanitari 1260:E17.02 - Identificar els elements vírics útils per al disseny d'antígens, immunògens i vacunes 1260:E17.03 - Identificar els elements vírics útils per dissenyar reactius de diagnòstic 1260:E17.04 - Conèixer i identificar les aplicacions biotecnològiques i nanomèdiques dels virus en microelectrònica, com a biosensors i per al lliurament dirigit de fàrmacs 1260:E17.05 - Utilitzar les tècniques de les òmiques per identificar gens i proteïnes diana relacionats amb la patogenicitat i virulència i utilitzables en el disseny de vacunes i compostos antimicrobians
1260:T01	T	Utilitzar bibliografia o eines d'Internet, específiques de microbiologia i d'altres ciències afins, tant en llengua anglesa com en la llengua pròpia	1260:T01.00 - Utilitzar bibliografia o eines d'Internet, específiques de microbiologia i d'altres ciències afins, tant en llengua anglesa com en la llengua pròpia
1260:T02	T	Obtenir, seleccionar i gestionar la informació	1260:T02.00 - Obtenir, seleccionar i gestionar la informació
1260:T07	T	Saber treballar individualment, en grup, en equips de caràcter multidisciplinari i en un context internacional	1260:T07.00 - Saber treballar individualment, en grup, en equips de caràcter multidisciplinari i en un context internacional

Continguts de l'assignatura

1. An introduction to viruses and Virology

The world of viruses. Strict parasitism, multiplication and transmission. The viral disease and the concept of "iceberg". Viral diversity. The viral particle: size, 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: extracellular and intracellular phases. Virus multiplication: productive and not productive infection. Sequential expression of viral genes. Viruses, mobile genetic elements and living beings.

2. Historical overview of Virology

Hypotheses about the maintenance of life and spontaneous generation. The work of Pasteur. Microscopic infectious agents and Koch's postulates. The nineteenth century: the discovery of viruses. The tobacco mosaic virus: the concept of “filtrable infectious agent”. Discovery of animal viruses. The twentieth century: characterization, chemical and genetic structure of viruses. Significant events in the history of virology. The eradication of smallpox and the risk of re-emergence. Clinical aspects of virology and biotechnology. Bioterrorism.

3. Methods in Virology

Obtaining viral particles. The cell culture. Small and medium scale cell culture. Purification. Quantitative analysis of viral particles. Detection of viral components and applications in the diagnostic methodology. The virology laboratory: areas and distribution. The biological safety levels of containment: P1 to P4. Air treatment. Tributary treatment. Vaccine factories: industrial-scale up production of viral particles.

4. Viral structure

Morphology of viral particles. Architectural study of viral particles: electron microscopy and three-dimensional reconstructions. The X-ray diffraction: requirements and level of crystallographic resolution. Architecture molecular of helical and icosaedrical symmetry. Trans-membrane proteins in viral envelopes. Receptor binding sites. The viral antigens and epitopes B and T. The neutralization and evasion of antibody neutralization. Genetic and epitopic variability.

5. Viral genomes and genetics

Principle of economy and complexity of the viral genome, overlapping genes. Segmented and multipartite genomes. Sequencing of viral genomes and function prediction. Recombination, rearrangement and phenotypic mixing. Types of viral mutants. Defective viruses: integrated genomes, satellite virus and defective interfering particles. Complementation. The infectious clone. Gene expression in different types of viruses, temporary regulation strategies. Principles of reverse genetics. Tools for viral gene transfer and gene therapy. Presentation of antigen and peptides in recombinant viruses. Gene cloning and expression vectors of viral origin.

6. Viral taxonomy

Early classifications of viruses: Baltimore classification of animal viruses. The International Committee on Taxonomy of Viruses and the classification system. Properties used in viral taxonomy. Families of animal viruses and viruses not classified. The major human pathogens and their diseases.

7. Origin and evolution of viruses

Origin of viruses and regressive theories for a cellular origin. Mechanisms of generation of diversity. Mutation frequencies and relative abundance of mutants. Fixation of mutations. Viral replicases and copying fidelity. Variability and evolution in RNA viruses and retroviruses. The viral quasispecies. Evolution and evolutionary potential. Darwinian selection and Darwinian

mutations. Founding effects and bottlenecks. Genetic and antigenic divergence, the influenza virus. Analysis of the viral phylogeny

8. Emerging viruses and viral diseases

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

9. Viral multiplication

Cell recognition. Nature and function of receptors. Internalization. Uncoating. The cellular shutdown. Stimulation of cellular functions: papovavirus and adenovirus. Synthesis of RNA, DNA and viral proteins: temporal sequences. Cytopathic effects. Exit of viral particles with and without lysis. Apoptosis. Cellular transformation in RNA virus: cellular oncogenes, activation and transduction. Cellular transformation in DNA virus: viral oncogenes and oncoproteins. Processing of viral proteins. Targets for antiviral drugs. RNA interference.

10. Viral pathogenesis

Characteristics of viral infections. Entry routes. Localized and systemic infections. Invasiveness. Viremia. Nerve transmission. Target tissues: tropism. Virulence. Role of organic response in the pathogenesis. Infection: transmission routes. Vectors and reservoirs. Persistent viral infections, mechanisms of persistence. The measles virus. The Epstein-Barr virus. Viral hepatitis. HIV infection; dynamic aspects of persistence. The movement of plant viruses.

11. Responses to viral infection

Nonspecific antiviral mechanisms. Induction and activity of interferons. Induction and evolution of the immune response. Role of antibodies and T cells. Prophylaxis of viral infections: vaccination. Types of vaccines: attenuated and inactivated. Polio vaccines. Molecular basis of attenuation. New generation vaccines. Antigens and immunogenes. Recombinant proteins and peptides. Pseudo-capsid vaccine. The vaccine against hepatitis B and papilloma viruses. Vaccination with DNA.

12. Prions and viroids

Infectious proteins: the prion. Development of the prion concept. The amyloid. Synthesis and processing of PrP^{c}. PrP^{sc} formation and propagation of prions. Spongiform encephalopathies: inheritance and contagion. Phenotypic diversity of prions; strains. The "scrapie" and bovine spongiform encephalopaty. Interspecific barriers. The human spongiform encephalopathies: Kuru, Creutzfeldt-Jakob disease and hereditary diseases. Prions in yeast. Viroids: structure and consistency of domains. Possible pathogenetic mechanisms. The hepatitis delta.

13. 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. Systems of selection of antiviral drugs: the case of protease inhibitors.

14. Artificial viruses

Viral gene therapy; important features and biological risks. Artificial viruses as alternatives to viral gene therapy. Type of artificial viruses and used biomolecules. Modular strategies. Selection of functional domains. Examples and applications of artificial viruses.

Metodologia docent i activitats formatives

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. Personal tutorial guidance sessions will be available by Email appointment and will be held in the office C3/037/039. In those sessions, students will have the opportunity to have individual guidance according to their needs.

Tipus	Activitat	Hores	Resultats d'aprenentatge
Dirigida	Active learning activities	15	1260:T01.00 1260:T02.00 1260:T07.00

Dirigida	Lectures	30	1260:E06.17 1260:E06.22 1260:E11.02 1260:E11.03 1260:E13.08 1260:E13.09 1260:E17.01 1260:E17.02 1260:E17.03 1260:E17.04 1260:E17.05
Autònoma	Literature search	28	1260:T01.00 1260:T02.00
Autònoma	Personal study	45	1260:E06.17 1260:E06.22 1260:E11.02 1260:E11.03 1260:E13.08 1260:E13.09 1260:E17.01 1260:E17.02 1260:E17.03 1260:E17.04 1260:E17.05
Supervisada	Personal tutorial guidance sessions	2	1260:E06.17 1260:E06.22 1260:E11.02 1260:E11.03 1260:E13.08 1260:E13.09 1260:E17.01 1260:E17.02 1260:E17.03 1260:E17.04 1260:E17.05 1260:T01.00 1260:T02.00 1260:T07.00
Autònoma	Reading	20	1260:T02.00 1260:T07.00

Avaluació

The evaluation will be done through two partial exams which will eliminate contents. For those students that fail one or borth partial exams or those willing to improve their grades, a final recovery exam will be also scheduled. The sum of the evaluation of both parts will represent 70% of final grade. In addition, 30% of the grade will be obtained by an oral presentation of work and/or classroom problem solving activities.

Evaluation of classroom lecture competencies (70% of final grade)

During the course Two written tests will be scheduled for this evaluation form. The first test will have a maximum weight of 40% and the second a maximum weight of 40% of final grade. If the student doesn't pass one or both tests, or wants to improve the grade of previous exams, a recovery test for both parts will be also scheduled after the second exam. The best score obtained for each part will be used for the final grade.

Evaluation of oral presentations (30% of final grade)

Students will present the reports of the assigned active learning exercises in classroom sessions. Oral presentations will be evaluated on content, organization and communicative skills.

We consider that a student will be graded as NOT PRESENTED if the assessment of all conducted evaluation activities does not allow the student to achieve the overall grade of 5 on the assumption that he had obtained the highest grade in all of them.

Activitat	Hores	Pes	Resultats d'aprenentatge
First part exam	1.50	maximum of 40%	1260:E06.17 1260:E06.22 1260:E11.02 1260:E11.03 1260:E13.08
Public presentation of reports	4	maximum of 30%	1260:T01.00 1260:T02.00 1260:T07.00

Recovery exam	3	maximum of 70%	1260:E06.17 1260:E06.22 1260:E11.02 1260:E11.03 1260:E13.08 1260:E13.09 1260:E17.01 1260:E17.02 1260:E17.03 1260:E17.04
Second part exam	1.50	maximum of 40%	1260:E13.09 1260:E17.01 1260:E17.02 1260:E17.03 1260:E17.04 1260:E17.05

Bibliografia i enllaços web

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