KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI

Projekt współfinansowany przez Unię Europejską w ramach Europejskiego Funduszu Społecznego

UNIA EUROPEJSKA
EUROPEJSKI FUNDUSZ SPOŁECZNY

Course title	ECTS code
Molecular virology (lecture)	13.4.0084

Name of unit administrating study

null

Studies

faculty	field of study		
Intercollegiate Faculty of Biotechnology UG-MUG	Biotechnology	type	second tier studies (MA)
		form	full-time
		specialty	all
		specialization	all

Teaching staff

prof. dr hab. Krystyna Bieńkowska Szewczyk

Forms of classes, the realization and number of hours

Forms of classes

Lecture

The realization of activities

classroom instruction

Number of hours

Lecture: 30 hours

ECTS credits

3

The academic cycle

2021/2022 winter semester

Type of course

obligatory

Language of instruction

english

Teaching methods

- Presentation of results of scientific research; Individual consultation with course tutor
- multimedia-based lecture

Form and method of assessment and basic criteria for eveluation or examination requirements

Final evaluation

Examination

Assessment methods

written exam with open questions

The basic criteria for evaluation

Written exam with open questions (tasks)

Method of verifying required learning outcomes

Required courses and introductory requirements

A. Formal requirements

Completion of the course in Biochemistry and General Microbiology

B. Prerequisites

Aims of education

The subject matter of the lectures is molecular biology of animal and human viruses. The aim of the lecture is acquainting students with the variety of viral world and the methods used in virology, and subsequently, presenting particular families of viruses, selected due to their significance as pathogens or tools in molecular biology. Strategies of gene replication and expression in particular viruses are discussed, as well as the mechanisms of their spread and impact on the host's organism. Social and economic aspects of potentially the most dangerous viral diseases are also discussed. Students will learn the basics of classical virology and acquire knowledge from the field of molecular virology. Lectures will allow them to understand the complexity and hazards connected with viral diseases (AIDS, HCV, flu). They will acquire an ability to plan and perform complicated virological experiments (respecting safety rules). The acquired knowledge should prepare students to work in scientific laboratories, clinical virological laboratories and other medical facilities, as well as to relay the acquired knowledge in schools and other educational institutions.

Course contents

1. General characteristics and classification of eukaryotic viruses

The variety of viral world, history of virology (only the main facts), the main features of viruses (differentiating them from other microorganisms), the size of viruses, RNA and DNA viruses, classification of viruses according to genome structure, kinds and functions of viral proteins, basic stages of replication cycle of viruses, processes of viral entry into cells (fusion, endocytosis, receptors), host range
2. Structure and morphology of viruses
Basic notions (capsid, etc) and structural elements of viral particle, enveloped and non-enveloped viruses, capsid structure (icozaedral and helical), the structure of envelope
3. Methods of viral breeding and characteristics of viruses in a laboratory - cell cultures, diagnostic methods
Methods of replicating viruses - chick embryos, cell cultures (primary/ continuous); cell cultures - media, conditions, one- layer and liquid cultures, confluence; infecting a cell with a virus - method and results; cytopathic effect, viral titer and ways of titer determination, MOI, TCID50, plaque, plaque assay, PFU, methods of identification and characteristics of viruses: electron microscopy, detection of viruses as live infectious particles, detection and identification of viral proteins, detection and identification of viral nucleic acids, serological diagnostic methods, ELISA, hemagglutination test
4. Picomaviruses - family of RNA viruses of positive polarity
Classification, structure, diseases triggered by various picomaviruses, poliovirus as a model in virology, poliovirus capsid structure, translation initiation mechanism, IRES, proteolytic processing of precursor protein, viral proteases of polio vaccine
5. Orthomyxoviruses – RNA viruses of negative polarity
Structure of the flu virus, cell entry methods, hemagglutinin and neuraminidase, structure of segmented genome, variability of flu virus, multifunctionality of proteins necessary for replication, vaccine
6. Retroviruses: oncogenic and lentiviruses (HIV)
History, classification, RSV virus, organization of genome and structure of viral particle, unique mechanism of replication by means of reverse transcription, reverse transcriptase and its activity, simple and complex retroviruses, oncogenesis, regulatory proteins of HIV, pathogenesis of HIV, retroviral vectors
7. Poxviruses - the largest DNA viruses, vaccinia virus as a tool for gene expression
8. Herpesviruses as the most widespread human viral pathogens:
Alpha, beta, gamma subfamilies, representatives, neurotropic and other viruses, pathogenesis of HSV-1, CMV, virion structure, genome structure, different classes - unique and repetitive regions, control of gene expression regulation, latency, lytic cycle, functions of some proteins (HVS, VP16, envelope glycoproteins), the phenomenon of immune evasion , VZV, CMV, EBV virus, herpesvirus vectors
9. Hepatitis viruses, type A, B, C:
HAV, HBV, HCV, strategies of development, pathogenesis, hazards
10. Adenoviruses: widespread infections of respiratory system, model viruses, oncogenesis, vectors used for construction of vaccines
11. Methods of fighting viral infections:
new and old generation vaccines: vaccines history, methods of making vaccines, search for new methods of exciting resistance; therapy: antiviral medicines exemplified by the case of medicines used in fighting HIV and herpesviruses, search for new drugs
12. Viruses as tools in molecular biology and gene therapy (viral vectors)

Bibliography of literature

1. Podstawy wirusologii molekularnej, Andrzej Piekarowicz.
2. Wirusologia. Podręcznik dla studentów medycyny, stomatologii i mikrobiologii, Leslie Collier i John Oxford.
3. Fields - Virology by Bernard N. Fields (Editor), Peter M. Howley (Editor), Diane E. Griffin (Editor), Robert A., Ph.D. Lamb (Editor), Malcolm A., M.D. Martin (Editor), Bernard Roizman (Editor), Stephen E. Straus (Editor), David M. Knipe (Editor).
4. Principles of Virology Molecular Biology, Pathogenesis, and Control of Animal Viruses by Flint. S. J., L. W. Enquist, V. R. Racaniello, A. M. Skalka (editor).

The learning outcomes (for the field of study and specialization)

K_W01
K_W02
K_W04
K_K04

Knowledge

K_W01 Understands complex biological phenomena on the molecular level, knows their significance for biotechnology and their relationships with other areas and disciplines of science
K_W02 Possesses a deepened knowledge in the field of related scientific areas and disciplines allowing him to see connections and dependencies in nature, in particular those essential for biotechnology
K_W04 Knows the basic rules of safety at work, understands the hazards of lab work, knows the hazards connected with conducting lab research, knows the hazards of working with pathogenic organisms and GMO

Skills

Social competence

K_K04 Is aware and understands hazards and dilemmas connected with conducting scientific research and implementing advanced technologies that make use of biotechnological achievements, recognizes and formulates ethical problems concerning biotechnology; is aware of the social role of a biotechnology graduate, and understands the necessity of relaying the knowledge and opinions about the achievements of biotechnology to the society; understands and recognizes the

	significance of intellectual property; behaves ethically

Contact

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