University of Gdańsk

Subject card

Subject name and code	Molecular virology, PG_00153610		
Field of study	Biotechnology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	academic	Assessment form	exam
Conducting unit	Laboratory of Virus Molecular Biology -> UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Krystyna Bieńkowska-Szewczyk	
	Teachers	prof. dr hab. Krystyna Bieńkowska-Szewczyk	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	5.0	40.0	75

Subject objectives

The lectures present in-depth knowledge of molecular biology of human and animal viruses. The aim of the course is the demonstration of enormous diversity of virus world and introduction to methods and techniques used in virology. The individual virus families are presented , focusing of their specific molecular mechanisms of replication, gene expression, spread and transmission as well as pathogenesis, therapies and vaccines. The social and economic aspects of dangers connected with virus infections are also discussed.

The students will deepen knowledge of both classical and molecular virology. The lectures will help to understand the complexity and variety of viral infections , on the examples of e.g. HIV, SARS, hepatitis and influenza viruses. The experimental skills required in virology research will be presented together with discussion about safety issues. The students will gain virology knowledge needed for their future work in scientific and clinical laboratories. The knowledge gained at the course can be also transferred by the students to schools and to the general public .

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHMU2_W06] The graduate has in-depth knowledge and understands the risks associated with conducting laboratory works, including those resulting from working with infectious material, GMOs and GMMs.	The student recognizes potential sources of biological risk in molecular virology research and their importance for laboratory safety. Describes the biological hazards associated with working with viruses in research and diagnostic laboratories. Explains the principles of biosafety applicable when working with infectious materials, including viruses of varying degrees of pathogenicity, including viral genetic vectors as GMMs	[SW4] test/exam - oral or written
[BIOTECHMU2_W01] The graduate has in-depth knowledge of complex biological phenomena at the molecular level and knows their importance for biotechnology, is able to analyze them in an interdisciplinary approach and assess their ethical, social and environmental implications.	The student characterizes the structure and organization of viral particles and genomes, explains the molecular mechanisms of viral replication, gene expression, and evolution in host cells, and describes virus-host cell interactions at the molecular level. She/he analyzes biological phenomena related to viral infections from an interdisciplinary perspective, taking into account biological, biotechnological, and medical aspects, understands the ethical, social, and environmental implications of viral research and their use in biotechnology.	[SW4] test/exam - oral or written
[BIOTECHMU2_K06] The graduate understands the impact of biotechnological achievements on health and quality of life and is aware of their risks, is able to critically and responsibly communicate them to society and engage in pro-social activities.	The student explains the importance of molecular virology research for the development of diagnostics, prevention, and therapy for viral diseases. Discusses the impact of advances in virological biotechnology (e.g., vaccine technology, viral vectors) on public health and quality of life, and understands the need to responsibly communicate virological scientific advancements to the public.	[SK4] test/exam - oral or written
[BIOTECHMU2_W02] The graduate has in-depth knowledge of the application of laboratory techniques and methods of genetic modification of cells and organisms and their use in biotechnology.	The student describes laboratory techniques used in virological research, particularly methods for identifying, isolating, and analyzing viruses at the molecular level. Explains the importance of molecular virology techniques in the development of modern biotechnological and biomedical tools.	[SW4] test/exam - oral or written

Subject contents	***1. General characteristics and classification of eukaryotic viruses*** The diversity of viral world, history of virology (only the main facts), the main properties of viruses (differentiating them from other microorganisms), the size of viruses, RNA and DNA viruses, classification of viruses according to genome structure, characteristics 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*** Terminology used in virology (capsid, etc) , structural elements of a viral particle, enveloped and non-enveloped viruses, icosahedral and helical capsid structure, the structure of viral envelopes ***3. Methods of viral propagation and characteristics of viruses in a laboratory - cell cultures, diagnostic methods*** Methods of virus propagation - chick embryos, cell cultures (primary/ continuous); cell cultures - media, conditions, monolayer and suspension cultures, confluence; infecting a cell with a virus techniques and results; cytopathic effect, viral titer and methods 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. Picornaviruses - family of RNA viruses of positive polarity*** Classification, structure, diseases caused by various picornaviruses, poliovirus as a model in virology, poliovirus capsid structure, translation initiation mechanism, IRES, proteolytic processing of precursor protein, viral proteases, 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, Rous sarcoma 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***, general characteristics, complex structure , variola, vaccinia virus as a tool for gene expression ***8. Herpesviruses as the most widespread human viral pathogens***: Alpha, beta, gamma subfamilies and their representatives, neurotropic and other viruses, pathogenesis of HSV-1, CMV, virion structure, genome structure - 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. Mononegavirales :*** many viruses (families and species) with ss RNA of negative polarity. Common strategy of gene expression, numerous important pathogens : measles virus , mumps, parainfluenza, respiratory syncytial virus, rabies, Ebola. ***10. Hepatitis viruses, type A, B, C:***

	HAV, HBV, HCV, strategies of replication, structure of viral particles , pathogenesis, hazards and challenges in Cepatitis control, therapy, vaccines ***11. Adenoviruses***: widespread infections of respiratory system, model viruses, oncogenesis, adenoviruses as vectors ***12 Coronaviruses*** : replication, transmission, SARS-CoV2 , vaccines ***13. Methods of control of viral infections (therapy and vaccines)*** : new and old generation vaccines: vaccines history, methods of making vaccines, search for new methods of exciting resistance; therapy: antiviral chemotherapeutics (drugs used in fighting HIV and herpesviruses, search for new drugs) ***14. Viruses as tools in molecular biology and gene therapy (viral vectors)***
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
exam (written)	51.0%	100.0%

Recommended reading	Basic literature	1. Podstawy wirusologii molekularnej, Andrzej Piekarowicz. 2. Wirusologia. Anna Goździcka-Józefiak 3. Wirusologia. Podręcznik dla studentów medycyny, stomatologii i mikrobiologii, Leslie Collier i John Oxford. 4. 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). 5.Principles of Virology Molecular Biology, Pathogenesis, and Control of Animal Viruses by Flint. S. J., L. W. Enquist, V. R. Racaniello, A. M. Skalka
	Supplementary literature	
	eResources addresses	
Example issues/ example questions/ tasks being completed	What is the difference between viruses and other microorganisms?	
Work placement	Not applicable	

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