University of Gdańsk

Subject card

Subject name and code	Application of viruses in biotechnology, PG_00153637		
Field of study	Biotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	Master's studies	Subject group	
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish Polish/English if needed.
Semester of study	2	ECTS credits	2.0
Learning profile	academic	Assessment form	
Conducting unit	UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Andrea Lipińska	
	Teachers	dr hab. Andrea Lipińska dr Alicja Chmielewska dr hab. Ewelina Król	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15	5.0	30.0	50

Subject objectives	To provide advanced knowledge regarding modern techniques of constructing recombinant viral vectors, the applications of viruses as vectors in molecular biology, biotechnology, and medicine, as well as to discuss current trends in the development of antiviral drugs and vaccines, and to provide knowledge about the interactions between viruses and the host's immune system. The course will expand knowledge in virology, particularly at the molecular level, with a special emphasis on the applied aspects of viral vectors. Throughout the course, students will: understand and comprehend the molecular foundations and complexities of virus interactions with host cells, appreciate the significance of integrating knowledge from various fieldsvirology, immunology, molecular biology, and pharmacologyfor the development of methods to combat viruses, and on the other hand, for utilizing viruses in biotechnology and medicine. They will gain detailed knowledge about the main strategies for the genetic modification of viruses to enable their use in biotechnology and medicine. They will acquire an in-depth understanding of molecular virology, molecular biology, and cell biology, and will be able to grasp the importance of knowledge about virus-host cell interactions and the insights from molecular virology for developing methods to combat infections and the application of viruses in biotechnology and medicine.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHMU2_W01] The graduate knows and understands complex biological phenomena at the molecular level, their importance for biotechnology	The student understands complex biological phenomena related to virus modification and virus applications at a molecular level, knows their significance for biotechnology, and is able to determine how to select molecular targets for combating viral diseases.	[SW4] test/exam - oral or written
[BIOTECHMU2_W02] The graduate knows and understands the use of laboratory techniques and methods of genetic modification of cells and organisms and their use in biotechnology	The student has an expanded knowledge of modern laboratory techniques and methods for constructing recombinant viral vectors, the use of viruses as vectors in molecular biology, biotechnology, and medicine, and is familiar with current trends in the development of antiviral drugs and vaccines.	[SW4] test/exam - oral or written

Subject contents

Rules and safety in laboratory work with viruses. Techniques for virus amplification and titer determination. Recombinant viral vectors: techniques for the recombination of DNA and RNA viruses. Viral genetic elements in molecular biology. Construction of retroviral and lentiviral vectors. The application of retro/ lentiviral vectors for obtaining stem cells and gene silencing. DNA vectors: adenoviral, AAV, poxviral, herpesviral, and baculoviral. Genetics and recombination of RNA vectors. Antiviral immune response. Evasion and suppression of the immune response by viruses. Epidemiology of viral infections. Viral vaccine vectors and antiviral vaccines existing and new trends in the development of vaccine vectors and antiviral vaccines. Antiviral therapeutics: existing (reminiscent) and new trends. Viral vectors in gene therapy. Oncolytic viral therapy and phage therapy. Genetic variability of viruses.

Prerequisites and co-requisites

Basic molecular biology and virology courses (separate or within other courses).

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Points from the final written test (within semester)	51.0%	100.0%

Recommended reading

Basic literature	Knowledge provided during lectures.
Supplementary literature	1. Viral vectors for gene therapy: the art of turning infectious agents into vehicles of therapeutics; 2001, Nature Medicine, Vol 7 No.7 2. Viral vectors: a look back and ahead on gene transfer technology; 2013, New Microbiologica, 36, 1-22, 3. Introduction for Safety Considerations for Retroviral Vectors: A Short Review; 2004 Applied Biosafety, 9(2) pp. 68-75 4. Oncolytic Viruses for Cancer Therapy: Overcoming the Obstacles; 2010, Viruses, 2, 78-106 5. Recombinant viral vectors: Cancer vaccines; 2006 Advanced Drug Delivery Reviews 58, 931947 6. Gene-delivery systems for iPS (induced pluripotent stem cells) cell generation; 2010, Expert Opin Biol Ther.; 10(2): 231242 7. Viruses-from pathogens to vaccine carriers; 2011, Curr Opin Virol.; 1(4): 241245 8. Viral immune evasion: a masterpiece of evolution; 2002, Immunogenetics, 54:527542 9. Rychlowska M, Gromadzka B, Bienkowska-Szewczyk K, Szewczyk B (2011): Application of baculovirus-insect expression system for human therapy. Curr Pharm Biotechnol 12(11):1840-9. 10.Szewczyk B, Bieńkowska-Szewczyk K, Król E. Introduction to molecular biology of influenza a viruses. Acta Biochim Pol. 2014;61(3):397-401. 11. Król E, Rychłowska M, Szewczyk B. Antivirals--current trends in fighting influenza. Acta Biochim Pol. 2014;61(3):495-504.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Multiple choice questions.

Work placement

Not applicable

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