GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	MOLECULAR VIRUSOLOGY, PG_00063477		
Field of study	Biotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group 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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Beata Zalewska-Piątek	
	Teachers	dr hab. Beata Zalewska-Piątek	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	15.0	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	2.0	18.0	50

Subject objectives

The aim of the course is to familiarize with the basic issues concerning molecular virology, such as pathogenicity mechanisms of animal and plant viruses, unusual subviral factors and the use of bacteriophages in medicine and biotechnology.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U06] plans research and designs biotechnological products and processes taking into account legal regulations and bioethical principles	The student defines the use of phage preparations in the treatment of antibiotic-resistant bacterial infections, with particular emphasis on experimental therapy and current research directions.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K7_W05] identifies crucial developments in research, apparatus and technology in biotechnology and related fields	The student analyzes available biotechnological solutions, including vaccine technologies, identifying their role in the development of modern methods of prevention and health protection.	[SW3] Assessment of knowledge contained in written work and projects
[K7_K02] is aware of the potential risks and opportunities associated with the development of science and technology for the natural environment and society	The student analyzes the potential risks and benefits resulting from the development of science and technology, with particular emphasis on the risk of global epidemics associated with newly emerging viral infections.	[SK3] Assessment of ability to organize work [SK2] Assessment of progress of work

Subject contents	**LECTURE** 1. Protective viral vaccines in the context of emerging viral diseases. 2. Atypical pathogenic forms of viruses - subviral factors (Satelites, Viroids, Prions - genetic organization, replication mechanisms, pathogenicity - examples of diseases). 3. Atypical pathogenic forms of viruses, subviral factors - prions (characteristics of prion proteins, species specificity, prion diseases, transmission of infections). 4. Bacteriophages and phage therapy as a potential method of prevention and treatment of infectious diseases in humans and animals. 5. Bacteriophages as a tool of modern biotechnology, potential applications. 6. Pathogenicity mechanisms of plant viruses (circulating and non-circulatory viruses) and animal viruses (inhibition of transcription and translation, cell membrane fusion, apoptosis, immune deficiency, immortalization and virus-induced cell transformation mechanisms). 7. Final test. **SEMINAR** 1. Studying viral genome sequences. Analysis of viral nucleotide sequences and amino acid sequences of viral proteins. 2. Viral evolution. The concept of pseudospecies, the role of mutation, recombination, pseudorecombination, gene duplication, genetic variability of viruses, and natural selection. 3. Using the immunostimulatory and adjuvant properties of phages in cancer therapy (as gene therapy carriers in lung and colon cancer models, as tumor antigens or anticancer drugs, and as adjuvants in therapeutic vaccines for breast cancer). 4. Personalized phage therapy as a "last resort" treatment method for resistant bacterial infections in the human population (analysis of selected therapeutic cases, e.g., *Pseudomonas aeruginosa* bone, joint, and implant-related infections, *Klebsiella pneumoniae* chronic urinary tract infections). 5. Treatment of bacterial infections using bacterial viruses in transplant patients (analysis of selected cases, e.g., after bone marrow transplantation or solid organ transplantation, such as kidney or liver, and phages for postoperative wound treatment). 6. Treatment of resistant and recurrent urinary tract infections with phages in the face of increasing drug resistance of uropathogenic bacterial strains. Phage monotherapy and polytherapy, genetically modified phages, phage and antibiotic-based therapy. Clinical trials determining the safety and validity of experimental phage treatments. 7. Baculoviruses as an insecticide for plant protection. Enzootic and epizootic viral diseases. Production of viral insecticides. 8. Vaccines protecting against COVID-19 types, design, and effectiveness. 9. Viruses contributing to the decline of the bee population. Phenomena and mechanisms of anti-infective immunity illustrated by the example of the honeybee (clinical symptoms, diagnosis, treatment, and prevention). 10. Hemorrhagic fevers and tropical viruses: a contemporary challenge for infectious medicine (a group of serious diseases caused by RNA viruses from the families: *Arenaviridae, Filoviridae, Bunyaviridae,* and *Flaviviridae* (selected virus examples, route of infection, diagnosis, pathomechanism, and treatment). 11. Viral zoonotic diseases and zoonotic viruses threatening humans (rabies, avian and swine influenza, severe acute respiratory syndrome, SARS, West Nile virus infection, Nipah disease). 12. Global viral epidemics as an emerging threat to humanity (definition of epidemics and pandemics, a brief historical background, examples of contemporary viral epidemics, factors contributing to new epidemics, bioethical and social aspects). 13. Occurrence, genetic variability, and significance of Usutu virus (USUV) infections. Human infections, diagnostics, specific prevention, and treatment. 14. Genetic modifications of viruses (e.g., through the CRISPR genome editing system, homologous recombination, RNA interference, and other genetic engineering-based methods) and their potential use in the treatment of bacterial infections. 15. Orpuche virus (OROV) and Orpuche fever (transmission routes, symptoms, treatment and prevention, preventing spread, first cases in Europe).
Prerequisites and co-requisites	Fundamentals of virology and molecular biology.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
The composite mark including seminar and lecture. FINAL SCORE (%) = Seminar score - evaluation for the presented paper and the classes activity (%) x 0.5 + Lecture score - test of choice (%) x 0. 5.	60.0%	100.0%

Recommended reading	Basic literature	Piekarowicz A. Basics of molecular virology. PWN. 2021.
	Supplementary literature	Flint S.J., Enquist L.W., Racaniello V.R., Skalka A.M. Principles of virology. ASM Press. 2009.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Antiviral vaccines. The use of bacteriophages in phage therapy and biotechnology. Prions - spongiform encephalopathies, diagnostics and potential therapy. Sequence analysis of viral genomes.	
Work placement	Not applicable	

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