GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Methodology and Safety in Bionanotechnological Laboratory, PG_00069334		
Field of study	Nanotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional 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	Department of Chemistry Technology and Biotechnology of Food -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Szymon Mania	
	Teachers	dr inż. Szymon Mania	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	15.0	0.0	0.0	15

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/modedit.php?update=14535&return=1

Moodle ID: 1173 Metodologia i bezpieczeństwo pracy w laboratorium bionanotechnologicznym https://enauczanie.pg.edu.pl/2025/course/view.php?id=1173

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

The course aims to familiarize students with the principles of work organization in bionanotechnology laboratories, the methodology for planning and conducting research, and the safety regulations applicable to working with nanomaterials and biological materials. The course develops skills in hazard recognition, the use of protective measures, risk assessment, laboratory documentation, and the implementation of good laboratory practices consistent with GLP, GMP, and occupational health and safety.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	The student knows the classification of laboratories, safety rules for working with nanomaterials and biological organisms, and formal and legal requirements.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K6_U01] can learn independently, obtain information from literature, databases and other properly selected sources	The student is able to search for and analyze safety procedures and good laboratory practices, and apply them in his/her own work.	[SU5] Assessment of ability to present the results of task [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

Subject contents	Laboratory Outline Number of Hours: 15 1. Work Organization and Safety in a Bionanotechnology Laboratory Occupational Health and Safety Regulations, Laboratory Classification (BSL, CL), Hazard Labeling (GHS, CLP) Duties and Responsibilities of Laboratory Workers Practical Exercise: Analysis of Sample Safety Data Sheets (MSDS) for Nanomaterials and Biological Reagents 2. Nanomaterials in Laboratory Practice Types of Nanomaterials Used in Bionanotechnology (e.g., Nanocellulose, Ag Nanoparticles, TiO) Hazards Associated with Nanoparticle Aerosols Practical Exercise: Preparation of Simple Nanoparticle Suspensions and Assessment of Their Stability (Visual Observation, Measurement of UV-Vis Absorbance Over Time) 3. Elements of Microbiology and Aseptics Basic Principles of Working with Microorganisms in a BSL-1 Laboratory Techniques Aseptic: working with a burner, in a laminar flow cabinet, principles of decontamination Practical experiment: surface inoculation of yeast/non-pathogenic bacteria, observation of colony morphology, comparison of the effects of various disinfection methods (alcohol, UV, autoclave) 4. Simple spectrophotometric assays and assessment of biological activity Basics of UV-Vis spectrophotometry in assessing compound concentrations and biomass Practical experiment: measuring the optical density of a yeast suspension (growth curve) Additionally: dye test (e.g., Trypan blue) for assessing cell viability 5. Rheological properties of bionanotechnology materials Introduction to the rheology of hydrogels and bioinks The importance of viscosity and gelation for bioprinting and biomaterial applications Practical experiment: viscosity measurement using simple methods (pipette runoff time, Brookfield viscometer if available) for: polymer solutions (e.g., polyvinylpyrrolidone) chitosan, alginate) simple hydrogels (gelatin, agar, agar + nanoparticles)
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Labs reports	60.0%	60.0%
test	60.0%	40.0%

Recommended reading	Basic literature	**WHO, *Laboratory Biosafety Manual*, 4th ed.** aktualne zasady BSL, procedury aseptyczne i postępowanie awaryjne. **CDC/NIH, *Biosafety in Microbiological and Biomedical Laboratories (BMBL)*, 6th ed.** praktyczne standardy pracy w BSL-1/2. **OECD, *Principles of Good Laboratory Practice (GLP)*** fundamenty jakości i dokumentowania badań w laboratorium. **Regulacja (WE) nr 1272/2008 (CLP) + GHS (ostatnia rewizja)** klasyfikacja i oznakowanie zagrożeń chemicznych, piktogramy, karty charakterystyki. **NIOSH, *Approaches to Safe Nanotechnology*** identyfikacja ryzyka i środki kontroli przy pracy z nanocząstkami (aerozole, inżynieryjne środki ochrony). **Mezger T., *The Rheology Handbook*** przystępne wprowadzenie do reologii roztworów i hydrożeli; metody proste i przyrządowe. **Skoog D., Holler F., Crouch S., *Principles of Instrumental Analysis*** podstawy spektrofotometrii UV-Vis, przygotowanie próbek, walidacja pomiarów. **Harris D., *Quantitative Chemical Analysis*** praktyka oznaczeń absorbancyjnych, niepewność, kalibracja i krzywe wzorcowe. **Cappuccino J., Welsh C., *Microbiology: A Laboratory Manual*** techniki aseptyczne, posiewy, proste testy żywotności. **Wytyczne BHP Politechniki Gdańskiej / WCh (lokalne regulaminy, instrukcje stanowiskowe)** wymagania i procedury obowiązujące na PG (obowiązkowe do stosowania na zajęciach).

	Supplementary literature	**Royal Society of Chemistry, *Nanoscience: Safety and Ethics*** omówienie zagadnień bezpieczeństwa i odpowiedzialności etycznej w badaniach z użyciem nanomateriałów. **Morrison R., Boyd R., *Chemia organiczna. Podstawy i zastosowania*** rozdziały dotyczące polimerów i biomateriałów jako wprowadzenie do pracy z hydrożelami i bioatramentami. **Barnes H.A., *An Introduction to Rheology*** przystępne wprowadzenie do podstawowych pojęć reologicznych i metod pomiarowych stosowanych w badaniach biomateriałów.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. What are the differences between BSL-1 and BSL-2 laboratories? Give examples of organisms that can be cultured in them. 2. What hazards do nanoparticles in the form of powders and aerosols pose? 3. List the basic principles of working in a laminar flow cabinet when culturing microorganisms. 4. What does the GHS09 pictogram mean and how is it used when working with nanomaterials? 5. Why is the colloidal stability of nanoparticle suspensions crucial for the safety and quality of research? 6. What are the most common errors when conducting simple spectrophotometric assays? 7. Give examples of emergency situations in a bionanotechnology laboratory and suggest a procedure.	
Work placement	Not applicable	

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