University of Gdańsk

Subject card

Subject name and code	Alternative Bio-protection - tutorials, PG_00201394		
Field of study	Marine 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
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Office of the Dean of the Intercollegiate Faculty of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Robert Czajkowski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	12.0	0.0	0.0	0.0	12

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	12	1.0	12.0	25

Subject objectives

The course will introduce the students to alternative biological control methods used to protect marine organisms from diseases in their natural environment (natural habitats). These methods include promising and novel biological control approaches such as (oral) vaccines, probiotics, bacteriophage therapy, and the application of light and photosensitizers (photodynamic inactivation) to minimize the impact of pathogens. Likewise, students will also be introduced to the issues of social aspects of industrial (marine) food, enzyme, metabolite production, and related risks

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KK03] Is ready to apply the principles of occupational health and safety, especially in the laboratory and at sea; is responsible for their own and others' safety; can recognize hazards and take appropriate action	The student is aware of possible hazards in the workplace, is able to recognize them and take appropriate actions to counteract them.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report [SK5] implementation of a problem task [SK8] observation of student's independent or team work
[MBMU2-KU02] Can collect and interpret empirical data; applies statistical methods and computer tools in data analysis; formulates conclusions based on empirical data	The student is able to collect, develop and interpret empirical data, is able to apply statistics and computer tools in their work. The student is able to formulate conclusions based on observations and results.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU8] observation of student's independent or team work
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	The student is able to plan scientific research and has knowledge of how to document the results of such research.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU5] implementation of a problem task [SU8] observation of student's independent or team work

Subject contents	**Biological control:** - the idea of biological control / biological protection history, aim, examples - the concept of biological protection with the focus on marine (natural and artificial) environments **Bacteriophages:** - the discovery of viruses infecting bacteria, - the use of bacteriophages in therapy (from the past to the future) - marine environment as a source of valuable bacteriophage isolates and their enzymes - bacteriophage-centered biological control in (natural and artificial) marine environments **Vaccines:** - the history and significance of vaccinations - the basics of operation and production of classic and new generation vaccines - antibacterial and antiviral vaccines - vaccination of aquatic organisms, - the role of adjuvants with the focus on adjuvants of marine origin **Photobiology:** - basic biological mechanisms at the molecular level occurring under the influence of light - demonstration of photobiology's importance for biotechnology, medicine, and connection with other fields and disciplines of science. - characterization of modern research tools and measurement methods used in photobiology, related fields, and scientific disciplines
Prerequisites and co-requisites	basic knowledge of microbiology, molecular biology, genetics
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
activity during classes	51.0%	100.0%

Recommended reading	Basic literature	T. W. Fisher & Thomas S. Bellows & L. E. Caltagirone & D. L. Dahlsten & Carl B. Huffaker & G. Gordh "Handbook of Biological Control: Principles and Applications of Biological Control" (Academic Press) Male, J. Brostoff, D. B. Roth, I. Roitt "Immunology" (Mosby Inc.) I. M. Hamblin and G. Jori "Medical and Environmental applications (RSC Publishing) E. Kutter, A. Sulakvelidze "Bacteriophages biology and application" (CRC Press)
	Supplementary literature	Before the classes, the students will be provided with appropriate, relevant learning materials (experimental and review publications, book chapters, reports
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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University of Gdańsk

Subject card

Subject name and code	Alternative Bio-protection - lecture, PG_00192667		
Field of study	Marine 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	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	exam
Conducting unit	Office of the Dean of the Intercollegiate Faculty of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Robert Czajkowski	
	Teachers		

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	1.0	9.0	25

Subject objectives

The course will introduce the students to alternative biological control methods used to protect marine organisms from diseases in their natural environment (natural habitats). These methods include promising and novel biological control approaches such as (oral) vaccines, probiotics, bacteriophage therapy, and the application of light and photosensitizers (photodynamic inactivation) to minimize the impact of pathogens. Likewise, students will also be introduced to the issues of social aspects of industrial (marine) food, enzyme, metabolite production, and related risks

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KK04] Is ready to assess and understand the risks and dilemmas, including ethical dilemmas associated with conducting scientific research and introduction of advanced technologies; understands and appreciates the importance of intellectual property; acts ethically	The student understands the ethical dilemmas and risks associated with conducting research in the field of marine biotechnology. The student understands the importance of intellectual property in marine biotechnology.	[SK4] test/exam - oral or written
[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences	The student knows and understands the research methods used in marine biotechnology	[SW4] test/exam - oral or written

Subject contents	**Biological control:** - the idea of biological control / biological protection history, aim, examples - the concept of biological protection with the focus on marine (natural and artificial) environments **Bacteriophages:** - the discovery of viruses infecting bacteria, - the use of bacteriophages in therapy (from the past to the future) - marine environment as a source of valuable bacteriophage isolates and their enzymes - bacteriophage-centered biological control in (natural and artificial) marine environments **Vaccines:** - the history and significance of vaccinations - the basics of operation and production of classic and new generation vaccines - antibacterial and antiviral vaccines - vaccination of aquatic organisms, - the role of adjuvants with the focus on adjuvants of marine origin **Photobiology:** - basic biological mechanisms at the molecular level occurring under the influence of light - demonstration of photobiology's importance for biotechnology, medicine, and connection with other fields and disciplines of science. - characterization of modern research tools and measurement methods used in photobiology, related fields, and scientific disciplines.
Prerequisites and co-requisites	basic knowledge of microbiology, molecular biology and genetics
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
writtten test	51.0%	100.0%

Recommended reading	Basic literature	T. W. Fisher & Thomas S. Bellows & L. E. Caltagirone & D. L. Dahlsten & Carl B. Huffaker & G. Gordh "Handbook of Biological Control: Principles and Applications of Biological Control" (Academic Press) Male, J. Brostoff, D. B. Roth, I. Roitt "Immunology" (Mosby Inc.) I. M. Hamblin and G. Jori "Medical and Environmental applications (RSC Publishing) E. Kutter, A. Sulakvelidze "Bacteriophages biology and application" (CRC Press)
	Supplementary literature	Before the classes, the students will be provided with appropriate, relevant learning materials (experimental and review publications, book chapters, reports
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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University of Gdańsk

Subject card

Subject name and code	Blue biotechnology industry - tutorials, PG_00192668		
Field of study	Marine 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 Humanistic-social 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	1	Language of instruction	English
Semester of study	2	ECTS credits	3.0
Learning profile	academic	Assessment form	credit
Conducting unit	Faculty of Oceanography and Geography Office -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Anna Dziadkiewicz	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	30.0	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	3.0	42.0	75

Subject objectives

During the lecture, students will learn the basic issues related to the protection of intellectual property. The objectives of the lecture are to gain theoretical and practical knowledge of intellectual property protection, to increase creativity and innovation and for students to be aware of the basics of the law. The industrial biotechnology industry is a growth area, attracting more and more young people who see this industry as a career opportunity. Therefore, education in how to run and manage a business, as well as a team, plays a key role. The Management module will include education in soft skills (communication skills, teamwork, marketing and PR) and project and process management skills.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW02] Has an in-depth knowledge of the possibilities of biotechnological use of marine resources	The student has knowledge, focused on the biotechnological use of marine resources.	[SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
[MBMU2-KW05] Possesses knowledge in the fields of social sciences and humanities necessary for the responsible conduct of research and innovation activities, taking into account ethical, legal, and social aspects.	The student has knowledge of the social sciences, the fundamentals of law and the principles of intellectual property protection, helpful in managing a biotechnology enterprise and operating effectively in this industry. He/she understands ethical principles and responsibility in conducting research and innovation in marine biotechnology.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[MBMU2-KU03] Can use and critically analyze available scientific information; can prepare and present - orally or in writing - a paper covering detailed problems in the field of marine biotechnology on the basis of the scientific information or their own work, with the use of scientific language, including specialized terminology and conceptual apparatus; has the ability to conduct discussions	Students will be able to analyse and use scientific sources of information and the results of their own work in order to prepare oral and written presentations on marine biotechnology, using adequate scientific terminology. The student is able to lead a substantive discussion, presenting arguments and using the knowledge of intellectual property protection, project management, creativity and innovation.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
[MBMU2-KK02] Is ready to effectively plan and organize his individual and team work, especially in the laboratory and at sea; is ready to plan his individual career and act in an entrepreneurial manner	Students are prepared to plan and organise their own work and that of their teams effectively, particularly in the context of protecting intellectual property and implementing innovations; they are aware of the legal requirements and entrepreneurial principles in marine biotechnology, which enables them to plan their careers effectively and to act creatively and innovatively.	[SK5] implementation of a problem task [SK8] observation of student's independent or team work

Subject contents

1. The concept of intangible goods and intellectual property

2. Classification of intangible goods

3. Copyright - the basis - the subject of copyright, copyright holders

4. Industrial property solutions (inventions, utility models, industrial designs, integrated circuit topographies, rationalisation projects, geographical indications, trademarks).

5. Inventions in the field of pharmacy and biotechnology - specificity of the subject and protection

6. Communication Skills in biotechnology industry

7. Problem Solving in organization

8. Project and Process Management

9. Introduction to marketing and PR

10. Ethics aspects in science and business

Prerequisites and co-requisites

Marine biotechnology knowledge

<table>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>final presentation</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>essays</td><td>51.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">A.1 Literature used in classA.2 Literature studied independently by the student</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Materials provided by the lecturer.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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University of Gdańsk

Subject card

Subject name and code	Reproductive biotechnology - laboratory classes, PG_00192672						
Field of study	Marine 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	English			
Semester of study	2		ECTS credits	2.0			
Learning profile	academic		Assessment form	credit			
Conducting unit	Laboratory of Aquaculture -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Konrad Ocalewicz				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	20.0	0.0	0.0	20
	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	20		2.0	28.0	50	
Subject objectives	The overall aim of the course is to provide students with practical knowledge of advances in marine vertebrate reproductive technology freshwater along with practical aspects and biotechniques used in reproductive biotechnology, mainly in fish. The student will acquire skills in the practical use of biotechnological tools for assisted reproduction of fish in aquaculture their use and connections with other fields and disciplines of science, e.g. developmental biology, molecular biology, genetic engineering.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW03] Has an in-depth knowledge and understanding of complex biological phenomena at the molecular level, understands their significance for an organism, marine environment and marine biotechnology	Knows and understands complex biological phenomena related to fish reproduction processes at the molecular level, understands their importance for organism, marine environment and marine biotechnology	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	Is able to plan and conduct research in the laboratory in the field of reproductive biotechnology and document activities and results; can pod use laboratory equipment under the supervision of a supervisor; applies the rules occupational health and safety	[SU2] presentation/project/paper/ report [SU8] observation of student's independent or team work
[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology	Is willing to assess and understand threats and dilemmas, including: ethical dilemmas related to conducting scientific research and introducing advanced technologies for the reproduction of aquatic vertebrates, including mainly fish; understands and appreciates the importance of intellectual property; progresses ethically	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work

Subject contents

The laboratories will cover practical aspects of modern reproductive biotechnology techniques in marine organisms and will be divided into 3 main experimental blocks: B1: Assessment of the quality of eggs and sperm and the stage of oocyte development; gamete storage, sperm cryopreservation. B2: in vitro fertilization and assessment of the developmental stage of the embryo after fertilization. B3: Production of triploid fish embryos using temperature/pressure shock for polyploidization. Ploidy level assessment: karyotyping of diploid and triploid fish embryos.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test	51.0%	55.0%
report 2	51.0%	15.0%
report 1	51.0%	15.0%
report 3	51.0%	15.0%

Recommended reading

Basic literature	Zwierzchowski L (ed). 1997. Animal biotechnology. Ed. Scientific PWN.. Demska-Zakęś K. 2008. Innovative techniques for biological assessment and protection of valuable species of farmed fish and crayfish. IRŚ Publishing House. A.2. studied independently by the student Exercise instructions prepared by the instructor. Marek Maleszewski. Exercises in the biology of animal development. Hwa Jin Y et al. 2021. Surrogate broodstock to enhance biotechnology research and applications in aquaculture. Aquaculture Advances 49(2021)107756 Artykuły naukowe opublikowane w czasopismach z obszaru inżynierii genomowej I genetycznej.
Supplementary literature	Artykuły naukowe opublikowane w czasopismach z obszaru inżynierii genomowej I genetycznej.
eResources addresses	

Example issues/ example questions/ tasks being completed

Collection of gametes from spawning salmonids, analysis of sperm motility and in vitro fertilization.

Work placement

Not applicable

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University of Gdańsk

Subject card

Subject name and code	Reproductive biotechnology - lecture, PG_00192673		
Field of study	Marine 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	English
Semester of study	2	ECTS credits	2.0
Learning profile	academic	Assessment form	exam
Conducting unit	Laboratory of Aquaculture -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Konrad Ocalewicz	
	Teachers		

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	2.0	18.0	50

Subject objectives	The general aim of the course is to provide students with in-depth knowledge of the biological basis of reproduction of fish and aquatic invertebrates as well as information on progress in the reproductive technology of organisms bred in aquaculture and model organisms. The student will gain knowledge about the tools used for assisted fish reproduction in aquaculture and the connections between biotechnological reproductive methods and research in the area of developmental biology, molecular biology, and genetic engineering.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW02] Has an in-depth knowledge of the possibilities of biotechnological use of marine resources	Has extensive knowledge and understanding of vertebrate reproduction water and reproductive technologies used for their breeding in control conditions.	[SW4] test/exam - oral or written
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	Has the ability to plan and conduct research on fish reproduction and gamete biotechnology in the laboratory, documenting experiments and their results; is able to draw conclusions based on the results obtained during work laboratory.	[SU6] demonstration of practical skills
[MBMU2-KK04] Is ready to assess and understand the risks and dilemmas, including ethical dilemmas associated with conducting scientific research and introduction of advanced technologies; understands and appreciates the importance of intellectual property; acts ethically	Has the ability to assess and understand ethical dilemmas and threats related to research focusing on reproductive biotechnology and modern reproductive techniques.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report

Subject contents

A1: Embryogenesis of fish and marine invertebrates. Maternal-embryonic transition. A2: Gametogenesis in fish. A3: Gamete quality and short- and long-term sperm storage/preservation. A4: Molecular and physiological aspects of fertilization. A5: Genetic and environmental sex determination. A6: Gonadal differentiation and sexual maturation. A7: Hormonal and environmental control of gonadal differentiation and sexual maturation. A8: Induced androgenesis, gynogenesis and polyploidization. A9: Transgenesis in invertebrates and aquatic vertebrates. A10: Genome editing from morpholino to CRISPR. A11: Chimerism and primary transfer of germ cells. A12: Production of single-sex fish stocks. A13. Interspecific hybridization. A14: Production of clonal and isogenic fish lines. A15: Stem cells and their use in fish reproductive biology

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam part 2	51.0%	50.0%
exam part 1	51.0%	50.0%

Recommended reading

Basic literature	Wang H et al. 2018. Sex control in aquaculture. Wiley-Blackwell. Pandian T,J. Koteeswaran R. 1998. Ploidy induction and sex control in fish. Hydrobiologia 384, 167-243. Piferrer F. et al. Polyploid fish and shellfish: production, biology and application to aquaculture for performance improvement and genetics containment. Okoli A.S. et al. 2021. Sustainable use of CRISPR/Cas in fish aquaculture: the biosafety perspective. Transgenic Research 31:1-21. Overturf K. 2007. Molecular research in Aquaculture. Wiley-Blackwell Dunham R.2004. Aquaculture and Fisheries Biotechnology. Genetic approach. CABI Publishing. John Liu. 2007. Aquaculture Genome Technologies. Wiley-Blackwell De Siqueira-Silva et al. 2018. Biotechnology applied to fish reproduction: tools for conservation. Fish Physiology and Biochemistry 44, 1469-1485. Zwierzchowski L (ed). 1997. Animal biotechnology. Ed. Scientific PWN.. Demska-Zakęś K. 2008. Innovative techniques for biological assessment and protection of valuable species of farmed fish and crayfish. IRŚ Publishing House.
Supplementary literature	Hwa Jin Y et al. 2021. Surrogate broodstock to enhance biotechnology research and applications in aquaculture. Aquaculture Advances 49(2021)107756 Scientific articles published in journals in the field of genomic and genetic engineering.
eResources addresses	

Example issues/ example questions/ tasks being completed

Presentation of two-step method for generation of clonal lines in fish using genome engineering apprach

Work placement

Not applicable

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University of Gdańsk

Subject card

Subject name and code	Marine Pharmacology - laboratory classes, PG_00192674						
Field of study	Marine 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		English		
Semester of study	2		ECTS credits		4.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Laboratory of Marine Biotechnology -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Hanna Mazur-Marzec				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	55.0	0.0	0.0	55
	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	55		5.0		40.0	100
Subject objectives	Familiarizing with main methods used for activity and drugability assessment of drug candidates; Acquisition by students understanding of threats and ethical dilemmas related to in vivo assays						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	The student will be able to design and safely perform basic bioassays evaluating marine bioproducts as potential drugs and perform experiments with model organisms and microorganisms.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
[MBMU2-KK04] Is ready to assess and understand the risks and dilemmas, including ethical dilemmas associated with conducting scientific research and introduction of advanced technologies; understands and appreciates the importance of intellectual property; acts ethically	The students can evaluate the ethical dilema related to clinical trials.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences	The student will understand and will be able to describe the principles of advanced methods used to evaluate pharmaceutical potential of marine natural products, including toxicity, enzymatic, stability and activity assays, mammalian cell cultures, organoid cultures, nematode C. elegans, animal models.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report

Subject contents

Familiarizing with main methods used for biological activity assessment and the assessment of pharmaceutical potential of marine natural products.

Prerequisites and co-requisites

Knowledge about cell structure and functioning. Basic knowledge about marine natural products.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
tests	51.0%	40.0%
activity during laboratories	51.0%	30.0%
reports	51.0%	30.0%

Recommended reading

Basic literature	Schumacher Alexander, Hinder Markus, Gassmann Oliver, 2016. Value Creation in the Pharmaceutical Industry: The Critical Path to Innovation, Wiley-VCH, ISBN-10: 3527339132; ISBN-13: Tozer N. Thomas, Rowland Malcolm, 2006. Introduction to Pharmacokinetics and Pharmacodynamics: The quantitative basis of drug therapy. Lippincott Williams & Wilkins; ISBN-13 : 978-0781751490
Supplementary literature	Marine Pharmacology https://www.marinepharmacology.org/
eResources addresses	

Example issues/ example questions/ tasks being completed

In vitro assessment of cytotoxic activity, enzymatic assays, antimicrobial activity, quorum quenching, assessment of drug stability under physiological conditions, selected ADME assays, effect on cytochrome P450 enzymes, from discovery to commercialization, principles of mammalian cell culture, principles of work with a model organism *C. elegans*, antiviral activity of marine bioproducts

Work placement

Not applicable

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University of Gdańsk

Subject card

Subject name and code	Marine Pharmacology - lecture, PG_00192676		
Field of study	Marine 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	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Marine Biotechnology -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Hanna Mazur-Marzec	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	10.0	0.0	0.0	0.0	0.0	10

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	10	1.0	14.0	25

Subject objectives

Acquisition by students knowledge on pharmaceutical potential of marine bioproducts and technologies used to evaluate their drugability; bioassays; pharmakokinetics and pharmacodynamics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW02] Has an in-depth knowledge of the possibilities of biotechnological use of marine resources	The student will possess knowledge about the pharmaceutical application of marine natural products.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences	Knows and understands the role of preclinical and clinical tests in development of new drug.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[MBMU2-KK04] Is ready to assess and understand the risks and dilemmas, including ethical dilemmas associated with conducting scientific research and introduction of advanced technologies; understands and appreciates the importance of intellectual property; acts ethically	The student will be able to discuss and evaluate the hazards and ethical dilemmas related to the development of marine products as bio-pharmaceuticals.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written

Subject contents

Principles of development of marine bioproducts as potential drugs. Rationale, adventages and disadventages of different in vitro assays, cell-culture assays, organoids and model organisms. Purpose and stages of pre-clinical and clinical trials. Examples of drugs developed from marine bioproducts.

Prerequisites and co-requisites

Assessment methods and criteria

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

Recommended reading	Basic literature	Schumacher Alexander, Hinder Markus, Gassmann Oliver, 2016. Value Creation in the Pharmaceutical Industry: The Critical Path to Innovation, Wiley-VCH, ISBN-10: 3527339132; ISBN-13: Graham Patric., 2018. An Introduction to medicinal chemistry. Oxford University Press, UK, ISBN: 9780198796589
	Supplementary literature	Selected articles from scientific journals e.g..: Marine Drugs (MDPI), Marine Biotechnology (Springer)
	eResources addresses	
Example issues/ example questions/ tasks being completed	Pharmacokinetics, pharmacodynamics, ADME assays, preclinical and clinical trials, marine drugs	
Work placement	Not applicable	

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Subject card

Subject name and code	Cosmeceuticals and nutraceuticals - laboratory classes, PG_00192678		
Field of study	Marine 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	English
Semester of study	2	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Physical Biochemistry -> UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Bogdan Banecki	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	30.0	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	2.0	18.0	50

Subject objectives

The aim of the classes is to familiarize students with the practical aspects of marine biotechnology and methods used in laboratories to develop dietary supplements and medicinal products. Students learn about biotechnological processes, analytical techniques, and acquire skills necessary for laboratory work. The classes include obtaining and using active substances from marine organisms in the pharmaceutical and cosmetics industries. The emphasis is on teamwork and individual planning of experiments and contact with modern equipment.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW02] Has an in-depth knowledge of the possibilities of biotechnological use of marine resources	Demonstrates in-depth knowledge of the potential and various methods for the biotechnological utilization of marine resources, taking into account innovative solutions and the latest research trends.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[MBMU2-KU03] Can use and critically analyze available scientific information; can prepare and present - orally or in writing - a paper covering detailed problems in the field of marine biotechnology on the basis of the scientific information or their own work, with the use of scientific language, including specialized terminology and conceptual apparatus; has the ability to conduct discussions	Is capable of independently searching for, critically evaluating, and interpreting various scientific sources, and subsequently preparing and presenting (orally or in writing) a study on selected aspects of marine biotechnology, using specialized terminology and scientific argumentation. Also possesses the ability to conduct a substantive discussion grounded in the gathered data.	[SU2] presentation/project/paper/ report [SU8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td>These exercises are intended to familiarize students with the process of creating medicinal or cosmetic products using the potential of marine organisms, from the design stage, development of analytical methods, through formulation development, method validation, to quality control of finished products:

• Extraction of oil from chlorella and spirulina. Quality control of oil.
• Extraction of a natural active compound of marine origin (fucoxanthin) from Fucus vesiculosus
• Determining the release profiles of active pharmaceutical ingredients (APIs) of marine origin from tablets
• Formulation and permeation study of red algae extract gels using franz cell diffusion testing
• Validation of measurement apparatus and equipment
• Determination of collagen content in cosmetics and nutraceuticals commercially available</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of the basics of operation of biophysical equipment: UV VIS spectrometer, gas and liquid chromatograph, mass spectrometry. Knowledge of basic processes of molecular biology, biotechnology, microbiology. Ability to operate laboratory equipment.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>practical implementation of the experiment</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>reports</td><td>51.0%</td><td>25.0%</td></tr>
<tr><td>entry tests</td><td>51.0%</td><td>25.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. Importance of algae oil as a source of biodiesel; A. Demirbas, M. F. Demirbas; Energy Conversion and Management, 2011, 52(1): 163-170, 10.1016/j.enconman.2010.06.055
2. Lipid and morphological changes in developing rapeseed, brassica napus; D. B. Fowler, R. K. Downey; Canadian journal of plant science, 1970, 50(3): 233-247, 10.4141/cjps70-047
3. The effect of temperature on the oil content and fatty acid composition of the oils from several oil seed crops; David T. Canvin; Canadian journal of botany, 1965, 43(1): 63-69, 10.1139/b65-008
4. Novel Separation Techniques for Isolation and Purification of Fatty Acids and Oil By-Products; Udaya N. Wanasundara1, P. K. J. P. D. Wanasundara, Fereidoon Shahidi; Published Online: 15 JUL 2005; DOI: 10.1002/047167849X.bio065
5. Colin Poole & Michael Cooke, 2000, Extraction, in Encyclopedia of Separation Science, 10 Vols., ISBN 9780122267703
6. A Rapid Method for the Determination of Fucoxanthin in Diatom. L. J. Wang,, Y. Fan, R. L. Parsons, G.R. Hu, P.Y. Zhang, F.L. Li; Mar Drugs, 2018, 22;16(1):33, 10.3390/md16010033
7. The Biochemical Composition and Antioxidant Properties of Fucus vesiculosus from the Arctic Region. E. D. Obluchinskaya, O. N. Pozharitskaya, D.V. Zakharov, E.V. Flisyuk, I. I. Terninko, Y. E. Generalova, I. E. Smekhova, A. N. Shikov; Marine Drugs, 2022; 20(3):193, 10.3390/md20030193
8. FDA Guidance for Industry: Documents such as "Dissolution Testing of Immediate Release Solid Oral Dosage Forms" provide regulatory perspectives and standardized methodologies, which can be very instructive for students.
9. USP-NF and EP Monographs: The United States Pharmacopeia and European Pharmacopeia contains standardized methods and specifications for drug substances, including detailed procedures for dissolution testing and other analytical techniques.
10. Percutaneous Absorption: Drugs, Cosmetics, Mechanisms, Methods" by Robert L. Bronaugh and Howard I. Maibach</td></tr>
<tr><td>Supplementary literature</td><td>1. "Topical Drug Bioavailability, Bioequivalence, and Penetration" by Vinod P. Shah, Howard I. Maibach
2. "Pharmaceutical Skin Penetration Enhancement" edited by Kenneth A. Walters and Jonathan Hadgraft
3. "Skin Barrier: Chemistry of Skin Delivery Systems" by Johann Wiechers
4. "Methods for Skin Absorption" by William G. Reifenrath
5. Recent research articles from journals such as the Journal of Controlled Release, International Journal of Pharmaceutics, and European Journal of Pharmaceutics and Biopharmaceutics
6. "Fundamentals and Applications of Controlled Release Drug Delivery" by Juergen Siepmann, Ronald A. Siegel, Michael J. Rathbone</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>

University of Gdańsk

Subject card

Subject name and code	Project planning and management - tutorials, PG_00192757		
Field of study	Marine 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 Humanistic-social subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Hanna Mazur-Marzec	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	30.0	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	1.0	19.0	50

Subject objectives

The aim of the project laboratory course is to develop students knowledge and skills in planning and managing projects, including understanding funding structures, designing project components (substantive, organizational, and budgetary), and using project management tools throughout all phases: initiation, planning, execution, and closure.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW05] Possesses knowledge in the fields of social sciences and humanities necessary for the responsible conduct of research and innovation activities, taking into account ethical, legal, and social aspects.	Has an in-depth knowledge of selected issues related to project planning and management.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[MBMU2-KK02] Is ready to effectively plan and organize his individual and team work, especially in the laboratory and at sea; is ready to plan his individual career and act in an entrepreneurial manner	Possess advanced knowledge of selected aspects of project management and is able to present them clearly and effectively.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report

Subject contents

1. Introduction to project funding: Overview of national and international sources of project funding; criteria for selecting funding based on the applying institution and project objectives; basic rules and procedures for applying for research or development projects.
2. Project planning and organization: Defining project goals, objectives, and scope of tasks; formation of project teams and assignment of roles and responsibilities; planning the project structure, task division, and workflow; budget planning: determining the size, components, and allocation of resources; identifying and analysing potential risks.
3. Project management: project management tools; coordination of tasks and communication within the project team; critical assessment of project deliverables and their impact.

Prerequisites and co-requisites

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	test	51.0%	20.0%
	presentation	51.0%	40.0%
	discussion	51.0%	40.0%
Recommended reading	Basic literature	Materials provided by the lecturer	
	Supplementary literature		
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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Subject card

Subject name and code	Work Placement, PG_00192715		
Field of study	Marine 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 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	1	Language of instruction	English
Semester of study	2	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Marine Biotechnology -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Hanna Mazur-Marzec	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	30.0	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	2.0	18.0	50

Subject objectives

Students learn the specifics and organisation of work at different workplaces, developing occupational skills specific for the place of the apprenticeship, teaching soft skills

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	Acts in line with safety regulations	[SU8] observation of student's independent or team work
[MBMU2-KW05] Possesses knowledge in the fields of social sciences and humanities necessary for the responsible conduct of research and innovation activities, taking into account ethical, legal, and social aspects.	Acts with social responibility	[SW5] implementation of a problem task
[MBMU2-KK03] Is ready to apply the principles of occupational health and safety, especially in the laboratory and at sea; is responsible for their own and others' safety; can recognize hazards and take appropriate action	Acts in line with safety regulations	[SK7] entries and opinions in the internship diary

<table>
<tr><td>Subject contents</td><td colspan="3">Dependent on the place of the apprenticeship</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="3"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Based on the execution of orders/ tasks</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Does not apply</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Does not apply</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Apprenticeship in laboratories or companies which use methods applied in biotechnology.</td></tr>
</table>

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Subject card

Subject name and code	Pro-seminar - research papers, PG_00192702						
Field of study	Marine 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	English			
Semester of study	2		ECTS credits	4.0			
Learning profile	academic		Assessment form	credit			
Conducting unit	Laboratory of Marine Biotechnology -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Hanna Mazur-Marzec				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	0.0	0.0	30.0	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	65.0	100	
Subject objectives	Knowledge acquisition by students on current biotechnological scientific problems. Acquisition of the ability to prepare and make in English a short oral presentation, using scientific language, including specialist terminology and notional apparatus suitable for the conducted research, and to participate in a discussion. Acquisition of the ability to critically assess own knowledge and constantly improve it.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW02] Has an in-depth knowledge of the possibilities of biotechnological use of marine resources	Possesses knowledge in the field of selected issues currently discussed in marine biotechnological literature and problems concerning related scientific areas and disciplines significant for marine biotechnology	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW3] text preparation/written work
[MBMU2-KU03] Can use and critically analyze available scientific information; can prepare and present - orally or in writing - a paper covering detailed problems in the field of marine biotechnology on the basis of the scientific information or their own work, with the use of scientific language, including specialized terminology and conceptual apparatus; has the ability to conduct discussions	Understands an utterance and reads with understanding scientific literature and simple reviews in the fields of science and scientific disciplines connected with marine biotechnology; can prepare a short written review and an oral presentation in English (using scientific language), concerning particular issues of marine biotechnology and related scientific areas and disciplines, has an ability to participate in a discussion	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU3] text preparation/written work
[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology	Has an ability to critically assess his own knowledge on marine biotechnology and is willing to constantly improve and update it.	[SK1] oral statement/conversation/ discussion

Subject contents

The course covers issues concerning different aspects of marine biotechnology presented in the recent review and research papers

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
scientific project elaboration	51.0%	35.0%
multimedia presentation	51.0%	35.0%
group discussion	51.0%	30.0%

Recommended reading

Basic literature	Selected papers suggested by the teacher
Supplementary literature	Selected papers suggested by the teacher
eResources addresses	

Example issues/ example questions/ tasks being completed

National and international companies operating in marine biotechnology sector

Main tasks included in projects focusing on marine biotechnology issues

Marine product-based biomaterials

Marine aquacultures

Work placement

Not applicable

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Subject card

Subject name and code	Training cruise II , PG_00192713		
Field of study	Marine 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	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Robert Konkel	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	8.0	0.0	0.0	0.0	8

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	8	2.0	15.0	25

Subject objectives

The course aim is: providing students with knowledge of seasonal changes in the natural resources of the sea; developing students skills in conducting analyses and experiments at sea.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW01] Has an in-depth knowledge and understanding of the significance, limitations and potential applications of natural marine resources in the context of the complex biological, environmental and technological factors influencing the development of biotechnology.	Possesses knowledge on the seasonal changes in natural marine resources	[SW1] oral statement/ conversation/discussion
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	Possess the ability to use instruments and equipment used on research vessel for measurements and research experiments	[SU6] demonstration of practical skills
[MBMU2-KK03] Is ready to apply the principles of occupational health and safety, especially in the laboratory and at sea; is responsible for their own and others' safety; can recognize hazards and take appropriate action	Has an ability to work on board the research vessel in line with safety regulations	[SK8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td colspan="3">During the course students focus on organization of the research work at sea, sample collection and preservation</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="3"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Quality of work done by the student during the cruise</td><td>51.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Manuals of instruments and other equipment used on board the research vessels.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Other materials related to the subject matter.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Field exercises</td></tr>
</table>

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Subject card

Subject name and code	Statistics in marine biotechnology - laboratory classes, PG_00192716		
Field of study	Marine 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
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Plankton Biology -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Agata Weydmann-Zwolicka	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	20.0	0.0	0.0	20

E-learning hours included: 0.0

Additional information:

Computer laboratory classes

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	20	2.0	28.0	50

Subject objectives

At the end of the course Students will be able to:

- Plan scientific research and design experiments;

- Collect data and prepare basic data bases;

- Apply proper statistical methods and computer tools for data analysis;

- Explain differences between different data transformations, standarization and normalization, analysis of similarity and analysis of variance;

- Discuss possible errors;

<table>
<tr><td>Learning outcomes</td><td>
<table>
<tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr>
<tr><td>[MBMU2-KU02] Can collect and interpret empirical data; applies statistical methods and computer tools in data analysis; formulates conclusions based on empirical data</td><td>Student is able to collect and interpret empirical data; uses statistical methods and IT tools to analyze data; formulates conclusions based on empirical data</td><td>[SU4] test/exam - oral or written</td></tr>
<tr><td>[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences</td><td>Student kbows and understands advanced research methods used in marine biotechnology and marine biology</td><td>[SW4] test/exam - oral or written</td></tr>
<tr><td>[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology</td><td>Student is ready to critically evaluate their knowledge and constantly improve it, update it and improve his qualifications in the field of data analysis and statistical methods used in marine biotechnology</td><td>[SK4] test/exam - oral or written</td></tr>
</table>
</td></tr>
<tr><td>Subject contents</td><td>1. Introduction to statistics: basic terminology, steps of statistical research, measuring scales2. Data collection, manipulation, preparation and transformation; Experimental design; Presentation of scientific data3. Introduction to the methods of PRIMER4. Resemblance: similarities, dissimilarities and distances; Correlation and regression5. Clustering methods6. Ordination and Multi-dimensional scaling7. Analysis of Similarity (ANOSIM) and Analysis of Variance (ANOVA)8. Analyzing environmental variables and linking assemblage to environment</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic computer skills; Basics of statistics</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Practical test</td><td>51.0%</td><td>100.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Clarke, K.R., Gorley, R.N. (2015) PRIMER v7: User Manual/Tutorial. PRIMER-E: Plymouth

Clarke, K.R., Gorley, R.N., Somerfield, P.J., Warwick, R.M. (2014) Change in marine communities: an approach to statistical analysis andinterpretation, 3nd edition. PRIMER-E: Plymouth

Ruxton G.D., Colegrave N. Experimental design (2016) Experimental Design for the Life Sciences, 4th edition. Oxford University Press</td></tr>
<tr><td>Supplementary literature</td><td>Set of up-to-date scientific papers selected by the teaching staff</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>

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Subject card

Subject name and code	Microscopic techniques - labolatory classes, PG_00192683		
Field of study	Marine 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
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Magdalena Weidner-Glunde	
	Teachers		

Lesson types

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

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	1.0	9.0	25

Subject objectives

The specific objective of the course is to familiarise students with the physical basis of microscope operation, the limitations of microscope applicability and the research capabilities of different types of microscopers.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KU01] Can plan and conduct research in the laboratory and at sea, and to document procedures and results. Independently or under the supervision of an authorized staff member, carries out work using specialized equipment. Complies with occupational health and safety regulations.	The student knows the theoretical basis of the operation of different types of microscopes (light, fluorescence, elektron) and their applications in biological research	[SU2] presentation/project/paper/ report
[MBMU2-KU02] Can collect and interpret empirical data; applies statistical methods and computer tools in data analysis; formulates conclusions based on empirical data	The student knows the basis methods of quantitative and qualitative analysis of microscopic data and understands the importance of documentation of obserwation	[SU2] presentation/project/paper/ report

Subject contents	**Auditory classes** 1. Preparation, fixation and staining of specimens 2. Introduction to light microscopy 3. Contrast techniques in light microscopy 4. Fluorescence microscopy - operation and applications 5. Construction and operation of confocal microscopes 6. Stereoscopic microscopy 7. From whole organisms to single particles innovative imaging methods in confocal microscopy **Laboratory classes** 1. Setting up Kohler illumination 2. Operation of a light microscope with a camera 3. nterpretation of the microscopic image. Taking measurements. 4. Sample preparation, fixation and staining 5. Fluorescence microscope image acquisition 6. Fluorescence microscopy data processing 7. Imaging with simple and stereoscopic light microscopes 8. Live imaging 9. Imaging in three-dimensional demonstration
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
presentation/project paper/report	51.0%	100.0%

Recommended reading	Basic literature	Materials provided in class by the teacher
	Supplementary literature	Materiały provided in class by the instructor.
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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University of Gdańsk

Subject card

Subject name and code	Antibiotics and chemotherapeutics - lecture, PG_00192685		
Field of study	Marine 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 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	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Intercollegiate Faculty of Biotechnology Office -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Michał Obuchowski	
	Teachers		

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	1.0	9.0	25

Subject objectives

To familiarize students with biologically active substances belonging to antibiotics. Presentation of the mechanism of action and acquisition of antibiotic resistance by microorganisms. Historical outline of the use of antibiotics and the increase in antibiotic resistance.
To familiarize students with biologically active substances used in chemotherapy. Show mechanism of action and acquisition of resistance to used chemotherapy drugs.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW03] Has an in-depth knowledge and understanding of complex biological phenomena at the molecular level, understands their significance for an organism, marine environment and marine biotechnology	Students know the molecular basis of major biological processes and their potential usefulness.	[SW4] test/exam - oral or written
[MBMU2-KW02] Has an in-depth knowledge of the possibilities of biotechnological use of marine resources	Students know basic concepts and terms used in biotechnology and related disciplines.	[SW4] test/exam - oral or written

Subject contents

Definition of antibiotic. Division of antibiotics according to their chemical structure. Mechanisms of action of antibiotics with different chemical structures. Mechanisms of resistance. Definition of chemotherapy drugs. The drug development process. Division of chemotherapy drugs according to their chemical structure and spectrum of action. Mechanism of action of chemotherapy drugs. Antiviral chemotherapeutics. Acquiring resistance to therapies using chemotherapeutics.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test/exam	51.0%	100.0%

Recommended reading

Basic literature	Publications and other materials indicated by the instructor.

	Supplementary literature	Makarewicz Z, Kwiatkowski ZA, Bacteria, antibiotics, drug resistance, PWN 2018
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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University of Gdańsk

Subject card

Subject name and code	Photodegradation of pharmaceuticalis - lecture, PG_00192686		
Field of study	Marine 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 Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Toxic Substances Transformation -> Department of Chemical Oceanography and Marine Geology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Waldemar Grzybowski	
	Teachers		

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	1.0	9.0	25

Subject objectives

Providing knowledge about the importance of photochemical processes in the purification of natural waters and sewage

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences	Knows and understands photochemical processes in the aquatic environment	[SW4] test/exam - oral or written
[MBMU2-KU03] Can use and critically analyze available scientific information; can prepare and present - orally or in writing - a paper covering detailed problems in the field of marine biotechnology on the basis of the scientific information or their own work, with the use of scientific language, including specialized terminology and conceptual apparatus; has the ability to conduct discussions	Is able to use and critically analyze scientific publications in the field of environmental photochemistry	[SU1] oral statement/conversation/ discussion
[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology	Is ready to critically evaluate his knowledge and constantly improve and update it	[SK1] oral statement/conversation/ discussion

Subject contents

Basics of photochemistry - the impact of solar radiation on pharmaceuticals in seawater - wastewater treatment from pharmaceuticals supported by photodegradation

Prerequisites and co-requisites

<table>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>exam</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">The effects of UV radiation in the marine environment (s. de Mora, S. Demers, M. Vernet, Eds.), Cambridge University Press, Cambridge 2000.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Photocatalytic Detoxication of Polluted Waters. In Environmental Photochemistry (P. Boule, Ed.), Springer-Verlag, Berlin 1999.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
</table>

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Subject card

Subject name and code	Xenobiotics - lecture, PG_00192687		
Field of study	Marine 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 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	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Grzegorz Gołuński	
	Teachers		

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	1.0	9.0	25

Subject objectives

The course introduces several groups of the chemical compounds present in various forms in the environment. During the classes chemical structure, origin, metabolism and possible, positive as well as negative effects of xenobiotics are to be discussed. Short panel describing basic methods for xenobiotics detection and analysis is also included. Preparation and presentation of the short talk on the chosen subject will also promote searching and critical analysis of source materials and practice scientific discussion.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW03] Has an in-depth knowledge and understanding of complex biological phenomena at the molecular level, understands their significance for an organism, marine environment and marine biotechnology	The student knows the chemical structure, origin, metabolism and possible positive and negative effects of xenobiotics, as well as basic methods of detection and analysis of xenobiotics	[SW2] presentation/project/paper/ report
[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences	The student knows and understands the basic methods of detection and analysis of xenobiotics in a variety of biological material	[SW2] presentation/project/paper/ report
[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology	The student is able to prepare a presentation on a selected topic based on an independent and critical analysis of retrieved sources.	[SK2] presentation/project/paper/ report

<table>
<tr><td>Subject contents</td><td colspan="3">1. Mutagens and mutagenesis compounds directly or indirectly interacting with/on DNA (reactive oxygen species generators, alkylating agents,benzene, furanocoumarins, aromatic amines, proflavine). Use of mutagens in biotechnology.2. Toxins and poisons where and how do we use them? potential threats. Biocides, aflatoxin, botulinum toxin, heavy metals, polycyclic aromatichydrocarbons, chosen biological and chemical weapons.3. Antimutagens Potential uses of methylxanthines, flavonoids and other antioxidants in protection from mutagens.4. Medicines origin, use, metabolism and side effects of chosen medicines (Nonsteroidal anti-inflammatory drugs, classic anticancer drugs,corticosteroids, beta blockers, inhibitors of cellular receptors, benzodiazepines).5. Psychoactive substances and drugs of abuse mechanism of action, influence on organism, use in medicine (amphetamine, cannabinoids,chosen opiates, LSD, alcohol, nicotine, designer drugs)6. Performance enhancing drugs (doping) bane of professional sports anabolic steroids, hormones, stimulants.7. Physicochemical methods for detection of discussed substances.8. Biological methods for analysis of discussed substances.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Basic knowledge in biochemistry and molecular biology</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>presentation</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Curtis D. Klaasen, Casarett & Doulls Toxicology. The Basic Science of Poisons. 7thed. 2008, McGraw-Hill Medical Publishing Division Frank A. Barile, Clinical Toxicology. Principles and Mechanisms. 2nded. 2010 Informa Healthcare Pavel Anzenbacher, Ulrich M. Zanger, Metabolism of Drugs and Other Xenobiotics, 2012 Wiley-Vch Materials provided by the lecturer during course</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">VV Pilay, Modern Medical Toxicology, 4th ed. 2013, Jaypee Brothers Medical Publishers John A. Timbrell, Principles of Biochemical Toxicology, 4th ed. 2009, Informa Healthcare Ashraf Mozayani, Lionel Raymon, Handbook of Drug Interactions, 2nd ed., 2012, Humana Press</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
</table>

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University of Gdańsk

Subject card

Subject name and code	Recent findings in ocean research - lecture, PG_00192688		
Field of study	Marine 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 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	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Anna Panasiuk	
	Teachers		

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	1.0	9.0	25

Subject objectives

The aim of the course is to present students with the latest directions of research in the field of oceanography conducted in research centers in Poland and abroad, as well as to familiarize them with the latest scientific reports. Lectures will also be given by invited guests from various research institutions in Poland and abroad.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW03] Has an in-depth knowledge and understanding of complex biological phenomena at the molecular level, understands their significance for an organism, marine environment and marine biotechnology	Student possesses advanced knowledge about the current challenges of marine science	[SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task

Subject contents

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
esey or test	51.0%	100.0%

Recommended reading

Basic literature	
Supplementary literature	
eResources addresses	

Example issues/ example questions/ tasks being completed

Work placement

Not applicable

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University of Gdańsk

Subject card

Subject name and code	Sociomicrobiology - lecture, PG_00192690		
Field of study	Marine 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 Optional subject group Humanistic-social subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Intercollegiate Faculty of Biotechnology Office -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Michał Obuchowski	
	Teachers		

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	1.0	9.0	25

Subject objectives

The student understands the need to adopt a new way of perceiving microorganisms not as individual cells, but as a functionally connected community (BIOTECHL3_W01). Is capable of demonstrate the need to study certain processes and behaviors of microorganisms in the context of entire populations
bacteria and not single cells (BIOTECHL3_W03). Understands the limitations in understanding the collective bacteria caused by the use of laboratory methods of cultivating microorganisms (BIOTECHL3_K01).
Is able to plan a sequence of works enabling the analysis of the social behavior of microorganisms.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MBMU2-KW03] Has an in-depth knowledge and understanding of complex biological phenomena at the molecular level, understands their significance for an organism, marine environment and marine biotechnology	The student is aware of the limitations knowledge describing the world microorganisms. He needs her constant dredging.	[SW4] test/exam - oral or written
[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology	The student notices and understands interdependencies between microorganisms and between microorganisms and the environment.	[SK4] test/exam - oral or written
[MBMU2-KW04] Knows and deeply understands advanced research methods used in marine biotechnology and related sciences	The student understands the selected ones biological phenomena at the level molecular. He knows their capabilities applications in biotechnology.	[SW4] test/exam - oral or written

<table>
<tr><td>Subject contents</td><td>Revision of the dogma that bacteria are single-celled organisms in the light of the results
research in recent years. The issue of individuality of bacterial cells in a genetically homogeneous population.
The importance of the sense of density for group behavior of microorganisms and communication
interspecies. Biofim - a sessile community of bacteria. Functional specialization within the biofilm
bacterial. Coordinated movement of bacteria as a manifestation of collective pursuit of a goal. Cannibalism
as
how the population behaves. Altruistic death among bacteria.</td></tr>
<tr><td>Prerequisites
and co-requisites</td><td></td></tr>
<tr><td>Assessment methods
and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>test/exam</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Review articles on issues discussed during the lecture provided by the
instructor during the classes.
"Sociomicrobiology" script.</td></tr>
<tr><td>Supplementary literature</td><td>None</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/
example questions/
tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>

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Subject card

Subject name and code	Challenges of the modern word - lecture, PG_00192691		
Field of study	Marine 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 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	1	Language of instruction	English
Semester of study	2	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Aquaculture -> Department of Marine Biology and Biotechnology -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Konrad Ocalewicz	
	Teachers		

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	1.0	9.0	25

Subject objectives

The aim of the course is to present the main challenges facing the modern world and to analyze the global and local consequences of the violent and unpredictable events we are experiencing today.

<table>
<tr><td>Learning outcomes</td><td>
<table>
<tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr>
<tr><td>[MBMU2-KW01] Has an in-depth knowledge and understanding of the significance, limitations and potential applications of natural marine resources in the context of the complex biological, environmental and technological factors influencing the development of biotechnology.</td><td>has in-depth knowledge of global and current changes events.</td><td>[SW1] oral statement/ conversation/discussion
[SW3] text preparation/written work</td></tr>
<tr><td>[MBMU2-KK01] Is ready to critically evaluate his knowledge and continuously improve, update and upgrade his skills in the field of marine biotechnology</td><td>Is ready to critically evaluate his knowledge and constantly improve it,
updating and improving qualifications in the field of current world problems, with particular emphasis on changes in the natural environment.</td><td>[SK3] text preparation/written work</td></tr>
<tr><td>[MBMU2-KU03] Can use and critically analyze available scientific information; can prepare and present - orally or in writing - a paper covering detailed problems in the field of marine biotechnology on the basis of the scientific information or their own work, with the use of scientific language, including specialized terminology and conceptual apparatus; has the ability to conduct discussions</td><td>Is able to fluently use and critically analyze available information scientific issues relating to the modern world, the natural environment, natural resources and climate change; based on them and on the basis of your own work
is able to prepare and present an oral presentation and/or a written study covering detailed issues in the above-mentioned field. issues, using scientific language,
including specialized terminology and conceptual apparatus; has ability to conduct discussions</td><td>[SU2] presentation/project/paper/ report
[SU3] text preparation/written work</td></tr>
</table>
</td></tr>
<tr><td>Subject contents</td><td>A1: Development and application of "new generation" tools and methods in biotechnology. A2: Genetically modified organisms controversies, prospects and limitations. A3: Carbon footprint and food production globally and locally. A4: Pandemic in the world and its consequences. A5: Global energy crisis. A6: Climate change and its consequences. A7:Overexploitation of natural resources. A8: The development of artificial intelligence and the development of biotechnology.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>quiz</td><td>51.0%</td><td>40.0%</td></tr>
<tr><td>essay</td><td>51.0%</td><td>60.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Articles recommended by the instructor and independently selected by the student articles published in scientific and popular science press, documentaries, online resources and reports on current events.</td></tr>
<tr><td>Supplementary literature</td><td>Articles recommended by the instructor and independently selected by the student articles published in scientific and popular science press, documentaries, online resources and reports on current events.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Food production - how to reduce emission of CO2?</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>

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