University of Gdańsk

Subject card

Subject name and code	Modern research techniques in biology and medicine, PG_00207366						
Field of study	Biology						
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	Polish			
Semester of study	1		ECTS credits	3.0			
Learning profile	academic		Assessment form	exam			
Conducting unit	Faculty of Biology -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Małgorzata Kozieradzka-Kiszkurno				
	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		6.0		39.0	75
Subject objectives	1. Learning about the structure and operation of light and electron microscopes and the latest devices used in biological and medical sciences. 2. Ability to theoretically plan experiments using research tools. 3. Learning about the application possibilities of the latest research techniques in biology and medicine.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOLMU2_W08] has a thorough knowledge and understanding of the wealth of contemporary approaches and experimental techniques in biological sciences and their use to solve given tasks	-The graduate recognizes digital data and administrative tools in the biological sciences and transfers them to use for basic tasks.	[SW4] test/exam - oral or written
[BIOLMU2_W04] has in-depth knowledge of the chosen specialization in the biological sciences	- The graduate knows the use of modern research techniques in biology and medicine.	[SW4] test/exam - oral or written
[BIOLMU2_U01] is able to select and apply research techniques and tools appropriate to the problems of the studied speciality of biological sciences	- The graduate selects and uses microscopic techniques (at the level of light and electron microscopy) and research tools adequate to the problems of the studied biological and medical sciences.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU8] observation of student's independent or team work
[BIOLMU2_K07] is ready to systematically update biological knowledge and information on its practical applications	- The graduate updates knowledge of modern research techniques and knows their practical applications in various fields of biology and medicine.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work

Subject contents

Microscope theory,-characteristics and selection of microscope elements depending on the specificity of research. Types of microscopes. Contrast in microscopy. Fluorescence, confocal and high-resolution microscopy - similarities and differences. Light microscopy and electron microscopy (transmission and scanning): advantages and limitations. A modern solution in the field of microscopy - virtual microscopy. Computer image analysis. Preparing material for research in various types of microscopes. Freezing technique. Basics of cyto- and histochemistry. Immunocytochemistry. Autoradiography. Techniques used in molecular biology include: laser microdissection, fluorescence in situ hybridization (FISH), genomic in situ hybridization (GISH), comparative genomic hybridization (CGH). Types of diagnostic imaging techniques (including magnetic resonance tomography, positron emission tomography, ultrasonography, X-ray diagnostics, scintigraphy).

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test, oral statement	51.0%	100.0%

Recommended reading	Basic literature	Burry R.W. 2010. Immunocytochemistry - A practical guide for biomedical research. Springer, Cambridge. Hakat M.A. 2000. Principles and Techniques of Electron Microscopy. Biological Applications.l, wyd. Cambridge University Press. Lidish H. i inni. 2007. Student Solutions Manual for Molecular Cell Biology. 6 th edition, wyd. Palgrave Macmillan. Litwin JA. 2011. Podstawy technik mikroskopowych. Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków Maluszynska J. 2002. In situ hybridization in plants methods and application. Molecular techniques in crop improvement. Jain M.S., Brar D.S., Ahloowalia B.S. (ed.) Kluwer Academic Publisher, Dordrecht, 299-326. Vecchiotti C., Spaltro G., Bloise D,. Brunetli E., Sciacchitano S. 2004. Demonstration of a Gastric Bioptic Specimen Mix-up by Laser Capture Microdissection (LCM) and DNA Fingerprinting, American Journal of Forensic Medicine & Pathology 25 (2): 113. Pruszyński B. 2014. Diagnostyka obrazowa. Podstawy teoretyczne i metody badań. Warszawa. Skuza L., Słomińska-Walkowiak R., Filip E.,Achrem M., Kalinka A. 2008. Wybrane metody biologii i cytogenetyki molekularnej, Wydawnictwo Uniwersytetu Szczecińskiego, Szczecin Wang, Zhong Lin. 2006. Scanning Microscopy for Nanotechnology, Springer New York Wróbel B., Zienkiewicz K., Smoliński D.J., Niedojadło J., Świdziński M. 2005. Podstawy mikroskopii elektronowej - skrypt dla studentów Skuza L., Słomińska-Walkowiak R., Filip E., Achrem M., Kalinka A. 2008. Wybrane metody biologii i cytogenetyki molekularnej, Wydawnictwo Uniwersytetu Szczecińskiego, Szczecin

	Supplementary literature	Bozzola J. J., Russell L. D. 1992. Electron Microscopy (Principles and Techniques for Biologists). Jones and Barlett Pub lishers, Boston. Celis J. E. 1994. Cell Biology, A Laboratory Handbook. Academic Press, San Diego, New York, Boston, Sydney, Tokyo, Toronto. Gabriel B. L. 1982. Biological Scanning Electron Microscopy. Van Nostrand Reinhold Company, New York, Cincinnati, Toronto, London, Melbourne. - the latest scientific publications in the field of modern techniques used in biological sciences: Brzezicka E, Kozieradzka-Kiszkurno M. 2024 Callose deposition analysis with special emphasis on plasmodesmata ultrastructure during megasporogenesis in Sedum (Crassulaceae). Protoplasma 261(1): 31-41. Kozieradzka-Kiszkurno M, Majcher D, Brzezicka E, Rojek J, Wróbel-Marek J and Kurczyńska 2020: Development of Embryo Suspensors for Five Genera of Crassulaceae with Special Emphasis on Plasmodesmata Distribution and Ultrastructure. Plants 9,320
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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