Subject card

Subject name and code	Iron metabolism, PG_00153614		
Field of study	Metabolizm żelaza		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	Master's studies	Subject group	Optional subject group
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	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Evolutionary Biochemistry -> UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Rafał Dutkiewicz	
	Teachers	dr hab. Rafał Dutkiewicz	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	15	5.0	30.0	50

Subject objectives	The aim of the course is to acquaint students with the basic problems concerning the significance of iron in biological systems. Students will get to know complex biological phenomena concerning iron turnover, regulation of iron homeostasis in living organisms, will acquire an ability to analyze problems connected with iron metabolism; will acquire knowledge in the field of chemistry of iron, with the focus on the understanding of intracellular mechanisms in which iron is involved, and in the field of medicine, with the focus on pathologies causing the disturbance of iron metabolism

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHMU2_K01] The graduate is willing to constantly improve, update knowledge and raise qualifications in the field of biotechnology, he/she knows the limitations of his/her own knowledge	The student will justify his/her choice of subject in writing. The justification will be a condition for taking the exam.	[SK3] opracowanie tekstowe/ praca pisemna
[BIOTECHMU2_W02] The graduate knows and understands the use of laboratory techniques and methods of genetic modification of cells and organisms and their use in biotechnology	Student will gain the ability to analyze issues related to iron metabolism and the ability to analyze the results experimental studies on iron metabolism will acquire knowledge in the field of iron chemistry, with particular emphasis on understanding intracellular processes in which iron is involved and in the field of medicine, with particular emphasis on pathology causing disruption of iron metabolism in biological systems.	[SW4] test/egzamin - ustny lub pisemny
[BIOTECHMU2_W04] The graduate knows and understands selected problems of biotechnology currently discussed in the literature	Student will learn (and understand) complex biological phenomena regarding iron metabolism, regulation of iron homeostasis in living organisms at the molecular level.	[SW4] test/egzamin - ustny lub pisemny

Subject contents

1. Basic information concerning the chemistry of iron (water solutions of iron; generating free radicals, iron and Fentons reaction; mechanisms of cell defense against oxidative stress);

2. Issues concerning the significance of iron in biological systems and basic techniques used in examining iron metabolism in biological systems;

3. Mechanisms of iron assimilation by Prokaryotes (siderophores; systems involved in the transport of Fe2+, the bacterial system regulating iron absorption Fur protein, Fur regulon, genes regulated by Fur; bacterial virulence connected with iron metabolism);

4. Mechanisms of iron uptake by plants and yeasts (assimilation of iron Fe2+ by the roots of non-grass dicotyledons and monocotyledons;assimilation of Fe3+ iron by grasses; plant ferritins; iron uptake by yeasts; reductases; iron transport through cell membrane; mitochondrial irontransport; iron accumulation in Saccharomyces cerevisiae);

5. Mechanisms of iron uptake by mammalian cells (structure of transferrins, binding and releasing iron by transferrin, uptake of transferrin-Fecomplex by mammalian cells; uptake of iron pool non- transferrin- bound;

6. Ways of intracellular iron accumulation (ferritin structure, mechanism of iron accumulation in ferritins, mechanism of releasing iron bound toferritin);

7. Cellular metabolism and iron homeostasis (pool of free iron; hem biosynthesis, biosynthesis of Fe-S centers NIF, ISC, SUF system; Fredrich ataxia and mitochondrial iron metabolism; iron homeostasis; structural characteristics of IRE regions, translation regulators within IRE regions, mRNA IRE stability; IRP1 and IRP2 proteins);

8. Mammalian iron absorption strategies, with particular focus on humans: sources of iron in human diet, molecular mechanism of iron absorption through intestinal mucous membrane, mechanism of iron uptake by enterocyte;

9. Pathophysiology of deficiency or surplus of iron in the human organism; acquired and inborn diseases disturbing iron homeostasis, and an impactof infection on iron turnover in the host

Prerequisites and co-requisites

Inorganic chemistry, Organic Chemistry, Microbiology, Molecular Biology, Biochemistry, Written justification of the choice of the course

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written exam with open questions	51.0%	100.0%

Recommended reading	Basic literature	Inorganic Biochemistry of Iron Metabolism: From Molecular Mechanism to Clinical Consequences, 2nd edition (2001), Robert Crichton Iron metabolism: From Molecular Mechanism to Clinical Consequences, 3rd edition (2009), Robert Crichton Balk J. & Lill R., Chembiochem. 2004, 5:1044-1049 Hentze M.W., Muckenthaler M.U. and Andrews N.C., Cell 2004, 117: 285-297 Lill R. & Mühlenhoff U., Trends Biochem Sci. 2005, 30:133-141 Balk J. & Lobreaux S., Trends Plant Sci. 2005, 10: 324-331 Johnson D., Dean D.R., Smith A.D., and Johnson M.K. Annu. Rev. Biochem. 2005, 74: 247-281 Philpott C.C., Biochim Biophys Acta. 2006, 1763: 636-645 Ajioka R.S., Phillips J.D., Kushner J.P., Biochim Biophys Acta. 2006, 1763: 723-736 Lill R. & Mühlenhoff U., Annu Rev Cell Dev Biol. 2006, 22:457-486 Lill, Dutkiewicz, et al. (2006) BBA-Mol.Cell Res. 1763: 652-67 Lill , Dutkiewicz, et al. (2015) Eur. J. Cell Biol. 94(7-9): 280-91 Dutkiewicz et al. (2017) Methods Enzymol. 595: 161-184 Dutkiewicz, R. and Nowak, M. (2017) JBIC Journal of Biological Inorganic Chemistry, (doi: 10.1007/s00775-017-1504-x)
	Supplementary literature	not applicable
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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