KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI

Projekt współfinansowany przez Unię Europejską w ramach Europejskiego Funduszu Społecznego

UNIA EUROPEJSKA
EUROPEJSKI
FUNDUSZ SPOŁECZNY

Course title	ECTS code
Iron metabolism (lecture)	13.1.0833

Name of unit administrating study

null

Studies

faculty	field of study		
Intercollegiate Faculty of Biotechnology UG-MUG	Biotechnology	type	second tier studies (MA)
		form	full-time
		specialty	all
		specialization	all

Teaching staff

dr hab. Rafał Dutkiewicz, profesor uczelni

Forms of classes, the realization and number of hours

Forms of classes

Lecture

The realization of activities

classroom instruction

Number of hours

Lecture: 15 hours

ECTS credits

2

The academic cycle

2021/2022 winter semester

Type of course

an elective course

Language of instruction

english

Teaching methods

- Individual consultations with the course tutor
- multimedia-based lecture

Form and method of assessment and basic criteria for eveluation or examination requirements

Final evaluation

Graded credit

Assessment methods

written exam with open questions

The basic criteria for evaluation

The contents contained in the box „Course Contents" will be assessed.
The assessment is performed according to percentage index (compliant with the Rules and Regulations for Studies at the UG)
Assessment will be based on a written task with ten open questions, out of which 50% will refer to the understanding of the complex biological phenomena referring to iron metabolism on the molecular level, and 50% will check if the student has deepened his knowledge in the related fields of science and scientific disciplines, such as chemistry or medicine, which research iron metabolism. To complete the course, it is required to reach at least 51% of correct answers in each question pool.
In order to take an exam, it is formally required to present, prior to the course of lectures, a justification of the selection of this course

Method of verifying required learning outcomes

Required courses and introductory requirements

A. Formal requirements

Inorganic chemistry, Organic Chemistry, Microbiology, Molecular Biology, Biochemistry, Written justification of the choice of the course (100 words)

B. Prerequisites

Aims of education

The aim of the course is to acquaint students with the basic problems concerning the significance of iron in biological systems. Students (K_W01) will

get to know (and understand) complex biological phenomena concerning iron turnover, regulation of iron homeostasis on the molecular level in living organisms, will acquire an ability to analyze problems connected with iron metabolism and an ability to analyze experimental results concerning iron metabolism; (K_W02) will acquire knowledge in the field of chemistry of iron, with particular focus on the understanding of intracellular mechanisms in which iron is involved, and in the field of medicine, with particular focus on pathologies causing the disturbance of iron metabolism in biological systems.

Course contents

1. Basic information concerning the chemistry of iron (water solutions of iron; generating free radicals, iron and Fenton's 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 iron transport; 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-Fe complex 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 to ferritin);
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 impact of infection on iron turnover in the host

Bibliography of 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)

The learning outcomes (for the field of study and specialization)

K_W01
K_W02
K_K01
K_K03

Knowledge

K_W01 Understands complex biological phenomena on the molecular level, knows their significance for biotechnology and their relationships with other areas and disciplines of science

K_W02 Possesses a deepened knowledge in the field of related scientific areas and disciplines allowing him to see connections and dependencies in nature, in particular those essential for biotechnology

Skills

Social competence

K_K01 Knows limitations of his/her knowledge, is willing to constantly upgrade and update his/her knowledge and raise qualifications within the field of biotechnology and related scientific areas and disciplines

K_K03 Effectively plans his/her work, professional career, organizes his/her work, in particular in the lab or concerning reviews in the field of biotechnology and related scientific areas and disciplines

Contact

dutkiew@biotech.ug.gda.pl