

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	BIOANORGANSKA KEMIJA
<b>Course Title:</b>	BIOINORGANIC CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Biokemija, 2. stopnja	/	1.	2.
USP Biochemistry, 2 <sup>nd</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BI215

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Iztok Turel / Dr. Iztok Turel, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Osnove bioanorganske kemije (definicije, izomerija, koordinacijsko število, teorija polja ligandov, reaktivnost/stabilnost). Bioligandi in njihove koordinacijske lastnosti pri vezavi kovinskih ionov. Lastnosti kovinskih ionov in njihov pomen pri reakcijah v organizmih. Prezem-transport kovinskih ionov. Delovanje pomembnejših kovinskih ionov v organizmih-primeri. Osnove bioanorganske medicinske kemije. Tematika vaj se smiselno povezuje z vsebinami. Študenti spoznajo različne sintezne poti med kovinskimi ioni in raznimi bioligandi ter ugotavljajo vplive na strukturo/sestavo nastalih koordinacijskih spojin.

**Content (Syllabus outline):**

Fundamentals of Inorganic Biochemistry (introduction, isomerism, coordination number, ligand field stabilisation energy, reactivity/stability...). Bioligands and their coordination properties in the binding of metal ions. Properties of metal ions and their importance in the biological systems. Storage/transport of metal ions. Illustration of functioning of some metal ions in the living systems (examples). Basics of bioinorganic medicinal chemistry. The content of lab course is complementary to lectures. The students meet different synthetic approaches between metal ions and various bioligands and study the influences that affect structure and composition of isolated

coordination compounds.

### Temeljna literatura in viri / Readings:

#### Temeljni učbenik: / Basic literature:

- R.R. Crichton, Biological Inorganic Chemistry: an introduction, Elsevier, Amsterdam, 2008, 369 strani/pages (50 %).

#### Dodatna literatura: / Additional literature:

- J.A. Cowan, Inorganic Biochemistry, An Introduction, Wiley, 1997, pp 1-63, 133-163, 357-417 od 430 strani/pages.

- J. J. R Frausto da Silva, R. J. P. Williams, The Biological Chemistry of the Elements (The Inorganic Chemistry of Life), 2nd Ed., Clarendon Press, Oxford, 2001, pp 315-500 of 561 strani/pages.

### Cilji in kompetence:

#### Cilj predmeta:

Poglobitev in nadgradnja znanja kemije kompleksov v nekaterih bioloških sistemih ter seznanitev študentov s kovinskimi ioni, ki jih najdemo v živih organizmih in njihov pomen za delovanje le-teh.

#### Predmetno specifične kompetence:

Pri predmetu študent utrjuje strategijo reševanja problemov in pridobi zmožnost predstavitve znanstvenih problemov pred strokovno javnostjo.

### Objectives and Competences:

#### Aim of course

To get more knowledge about the chemistry of complexes in biological systems. Additionally, the students are informed about metal ions which are found in living organisms and their role for the functioning of the latter.

#### Specific competences

The student is trained in strategy of solving complex problems. He/she is able to present scientific results/problems in front of the expert public.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študent spozna osnovne trende razvoja bioanorganske kemije. Sposoben je demonstrirati znanje in razumevanje bistvenih podatkov, konceptov in teorij, ki so povezane s pojmi vsebovanimi v opisu vsebine.

#### Uporaba

Študent naj bi znal uporabiti svoje znanje za reševanje interdisciplinarnih praktičnih primerov. Laboratorijsko delo je nadgradnja osnovnih praktikumov in študenta uvaja v večjo samostojnost v laboratoriju kot tudi v timsko delo.

#### Refleksija

Tematika vaj je tesno povezana s seminarскими temami, zato se študent nauči kritičnega razmišljanja o skladnosti med teoretičnimi načeli in prakso.

### Intended Learning Outcomes:

#### Knowledge and Comprehension

The student is acquainted by basic trends in the development of bioinorganic chemistry. He/she is able to demonstrate the knowledge and understanding of essential data, concepts and theories which are described in the description of Contents.

#### Application

Student should be able to use the knowledge to solve interdisciplinary practical problems. The lab course is the continuation of basic courses and introduces the student towards self-dependence and also into team work.

#### Analysis

The topics of seminars are closely related with lab course. The student is learned about critical thinking between theoretical and practical principles.

### Prenosljive spretnosti

Poznavanje vsebin omogoča tudi boljše razumevanje zakonitosti pri drugih predmetih študija (npr. biokemija) kar omogoča širši vpogled na celoto.

### Skill-transference Ability

The learned contents enable better understanding of the processes in other courses of study (e.g. Biochemistry) which enables broader view of the whole picture.

### **Metode poučevanja in učenja:**

Predmet se izvaja v obliki predavanj, seminarjev in praktičnih vaj, ki jih študentje v skupinah izvedejo v laboratorijih. Študentje pripravijo seminarje o izbranih temah, ki jih nato predstavijo pred svojimi kolegi. Praktični del predmeta je zasnovan izrazito projektno. Študentom se zastavi konkretni problem, ki ga nato na osnovi zbranih podatkov iz literature in z aktivnim sodelovanjem s pedagoškim osebjem, tudi rešijo. Svoje delo opišejo v poročilu in ga tudi predstavijo.

### **Learning and Teaching Methods:**

The course consists of lectures, seminars and practical exercises which are performed in the lab. The students prepare seminars on selected topics which are then presented to the colleagues. Practical part of the course is truly project based. Students have to solve a problem. They first analyse the literature and then they solve it with the help of assistants. Their work is described in the report which is also presented at the end.

### **Načini ocenjevanja:**

Delež (v %) /  
Weight (in %)

### **Assessment:**

Kolokvij iz vaj (pisni in ustni)	30 %	Laboratory exercise (written and oral)
Seminar	20 %	Seminar
Ustni izpit	50 %	Oral exam

### **Reference nosilca / Lecturer's references:**

1. **I. Turel**, P. Živec, A. Pevec, S. Tempelaar, G. Psomas, Compounds of antibacterial agent ciprofloxacin and magnesium- Crystal structures and molecular modeling calculations, Eur. J. Inorg. Chem., 3718-3727 (2008).
2. **I. Turel**, J. Kljun, F. Perdih, E. Morozova, V. Bakulev, N. Kasyanenko, J. A. W. Byl, N. Osheroff, First ruthenium organometallic complex of antibacterial agent ofloxacin. Crystal structure and interactions with DNA, Inorg. Chem., 49, 10750-10752 (2010).
3. J. Kljun, A. K. Bytzek, W. Kandioller, C. Bartel, M. A. Jakupec, C. G. Hartinger, B. K. Keppler, **I. Turel**, Physicochemical Studies and Anticancer Potency of Ruthenium( $\eta^6$ -p-cymene) Complexes Containing Antibacterial Quinolones, Organometallics, 30, 2506-2512 (2011).