

(Table 5.2) Course unit description

Study program: Chemistry			
Type and level of studies: Master academic studies			
Course unit: Metal complexes in medicine			
Teacher in charge: Prof. Dr. Miloš I. Djuran, Dr. Biljana Đ. Glišić			
Language of instruction: <i>English</i>			
ECTS: 6			
Prerequisites: Student of master academic studies			
Semester: <i>Summer Semester</i>			
Course unit objective			
Acquiring the students with the role of metals in biological systems and potential application of metals and metal complexes in medicine.			
Learning outcomes of Course unit			
After this course students should be able to recognize the role of metals and metal complexes in biological systems and their potential applications in medicine.			
Course unit contents			
<i>Theoretical classes</i>			
Medicinal inorganic chemistry: State of the art and new trends. Metals in the body: essential elements and diseases of metabolism. Metal complexes as therapeutic agents. Platinum-based anticancer drugs. Ruthenium anticancer complexes. Gold complexes as anticancer agents. Antitumor titanium compounds and related metallocenes. Gallium and other main group metal compounds as antitumor agents. Metal complexes as antibacterial, antifungal and antiviral agents. Metal complexes in the treatment of tropical diseases. Gold(I) complexes as antiarthritic agents. Metal chelating agents.			
Metal complexes as diagnostic agents. MRI contrast agents. Metal-based radiopharmaceuticals.			
Platinum(II) and palladium(II) complexes as artificial metallopeptidases.			
<i>Practical classes</i>			
Synthesis and structural characterization of the anticancer platinum(II) complexes: cisplatin, $cis\text{-}[\text{PtCl}_2(\text{NH}_3)_2]$ and carboplatin, $[\text{Pt}(\text{cbdca-}O,O')(\text{NH}_3)_2]$ (cbdca = cyclobutane-1,1-dicarboxylate). Synthesis and structural characterization of the $[\text{Pt}(\text{dien})\text{Cl}]\text{Cl}$ complex (dien = tridentate coordinated diethylenetriamine). Investigation of the reactions of the $[\text{Pt}(\text{dien})\text{Cl}]\text{Cl}$ complex with sulphur- and nitrogen-containing ligands (L-methionine, L-Met and guanosine-5'-monophosphate, 5'-GMP) by using NMR and UV-Vis spectroscopy. Mechanism of the antitumor and toxic activity of the anticancer platinum(II) complexes. Synthesis and structural (NMR and UV-Vis) characterization of the anticancer ruthenium(III) complex, $\text{HInd}\{\text{trans-}[\text{RuCl}_4(\text{Ind})_2]\}$ (Ind is indazole). Synthesis and structural characterization of the antitumor active $[\text{Au}(\text{dien})\text{Cl}]\text{Cl}_2$ complex (dien = tridentate coordinated diethylenetriamine). Investigation of the reactions of ruthenium(III) and gold(III) complexes with some sulphur- and nitrogen-containing amino acids (L-methionine, L-Met and L-histidine, L-His) by using NMR and UV-Vis spectroscopy.			
Literature			
1. Bioinorganic Medicinal Chemistry, Ed. by Enzo Alessio, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2011.			
2. The Biological Chemistry of the Elements: The Inorganic Chemistry of Life, Ed. by J. J. R. Fraústo da Silva and R. J. P. Williams, Clarendon press, Oxford, New York, 1991.			
3. Principles of Bioinorganic Chemistry, Ed. by S. J. Lippard and J. M. Berg, Univesity Science Books, Mill Valley, California, 1994.			
4. Gold Chemistry: Applications and Future Directions in the Life Sciences, Ed. by Fabian Mohr, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2009.			
Number of active teaching hours			Other classes
Lectures: 2	Practice: 2	Other forms of classes:	
			Independent work:
Teaching methods			
Lectures, seminars and practical classes.			
Examination methods (maximum 100 points)			

Exam prerequisites	No. of points:	Final exam	No. of points:
Student's activity during lectures	10	oral examination	<i>30</i>
practical classes/tests	30	written examination	<i>30</i>
Seminars/homework		
Project			
Other			
Grading system			
Grade	No. of points:	Description	
10	91-100	Excellent	
9	81-90	Exceptionally good	
8	71-80	Very good	
7	61-70	Good	
6	51-60	Passing	
5	0-50	Failing	