-Doplňte, prosím, bílá pole anglickou verzí českého textu.			
1	**Course**		
		Bioinorganic Chemistry & Biophysics of Plants I	
2	**Coordinator**	Hendrik Küpper	
4	**Department**	Experimental Plant Biology	
5	**Course number**		
6	**Semester**	Summer	
7	**Since**	2017	
8	**Credits**	8	
9	**Prerequisites**	students should be at least in their 4th semester of a BSc in Biochemistry or Biophysics, or already have a BSc in any field of Biology	
10	**Hours of lecture**	4 (2x90min)	
11	**Units of lecture**	1	1 – hours per week 2 – hours per semester 3 – days per semester 4 – weeks per semester
12	**Hours of practicals**	0	
13	**Units of practicals**		see Units of lectures
14	**Type of examination**	2	1 – written 2 – oral 3 – combined 4 – "zápočet" only 6 – state exam
15	**Schedule**	3	1 – odd years (01/02) 2 – even years (00/01) 3 – every year 4 – once per 3 years (01/02) 5 – once per 5 years
16	**Objectives**	Students will be introduced to basic aspects of bioinorganic chemistry and biophysics, as well as selected research topics, such as metal uptake & transport, metals as essential trace elements e.g. for active centres of proteins (incl. effects of metal deficiency), mechanisms of metal toxicity, metal resistance/detoxification. They will furthermore learn various methods employed in this kind of research, as well as getting training in presentation of research data.	

17	**Content of lectures**	

Lecture (2x90min per Week)	Title	Themes
1	Introduction into themes of this course	(a) What is "Bioinorganic chemistry & Biophysics of Plants"?
		(b) Biophysics of Photosynthesis as the fundamental process in plants
2	Basics, selected important methods (I)	(a) Basics of coordination chemistry in biological Systems
		(b) Magnetic Resonance Spectroscopy (EPR, NMR) as structural tools
3	Selected important methods (II) - methods in vivo and in situ	(a) Methods for analysing photosynthesis (fluorescence kinetics, absorption changes, O2/CO2 measurements)
		(b) Further methods of UV-VIS absorption and fluorescence spectroscopy *in vivo* and *in situ*
4	Selected important methods (III) - in vitro work on metalloproteins and low molecular weight biomolecules	(a) Work with metalloproteins: expression, isolation, purification and characterisation by biochemical assays; metalloproteomics
		(b) Chromatographic methods: basics, advanced HPLC methods
5	Selected important methods (IV) - X-ray spectroscopy	(a) X-ray emission spectroscopy (EDX, PIXE, µXRF) for analysing element distribution
		(b) X-ray absorption spectroscopy (XANES, EXAFS) for analysing metal complexes
6	Metal uptake and transport, Metals as essential elements (incl. metal deficiency stress) (I)	(a) Biogeochemical cycles of elements, in particular metals
		(b) Trace element nutrition in plants: uptake and transport of transition metals
7	Metal uptake and transport, Metals as essential elements (incl. metal deficiency stress) (II) - from ions to photosystems	(a) From physiology to biochemistry to spectroscopy and protein structure: copper and iron proteins
		(b) Introduction to the essential role of metals in photosynthesis: Mg in Chl, Mn in the Mn-cluster of PSII, non-heme iron in PSII, Fe in hemes and FeS-clusters in the Cytb6f-complex, copper in plastocyanin, FeS-centres in PSI, Ferredoxin, ...
8	Metal uptake and transport, Metals as essential elements (incl. metal deficiency stress) (III) - further examples:	(a) Nitrogen fixation and regulation of photosynthesis for nitrogen fixation
		(b) Ultra-Micronutrients Cr, Ni
9	Metal toxicity stress (I) - basics and a first example:	(a) Metal Toxicity: basic principles (where do metals bind under toxic conditions, what are the physiological consequences, how can metal toxicity be analysed mechanistically)
		(b) Copper as an essential, but also highly toxic, biologically redox-active metal: from deficiency to toxicity
10	Metal toxicity stress (II) - further examples	(a) Arsenic toxicity and speciation in plants, incl. implications for human nutrition
		(b) Cadmium as a highly toxic but possibly also beneficial, biologically redox-inert metal
11	Metal resistance and detoxification	(a) Principles of metal detoxification in plants: Detoxification by strong ligands, by sequestration / exclusion, etc.
		(b) Biotechnological use of metal accumulation in plants (Phytoremediation, Phytomining)
		(c) Metallothioneins: structure, biochemistry, physiological function
12	Generally important scientific skills	(a) Literature searches and scientific writing
		(b) How to give a good talk, how to prepare a good poster

18	**Content of practicals**	

19	**Literature**	Selected chapters from the following textbook: Crichton RC (2008) Biological Inorganic Chemistry – An Introduction. Elsevier B.V., Amsterdam, 369S Reviews: Küpper H, Andresen E (2016) Mechanisms of metal toxicity in plants. Metallomics 8, 269-285 Küpper H, Kroneck PMH (2005) Heavy metal uptake by plants and cyanobacteria. In: Metal Ions in Biological Systems, Band 44, Kapitel 5. (Hrsg.: Sigel A, Sigel H, Sigel RKO). Marcel Dekker, Inc., New York; pp. 97-142 Leitenmaier B, Küpper H (2013) Compartmentation and complexation of metals in hyperaccumulator plants. Frontiers in Plant Science, doi: 10.3389/fpls.2013.00374
20	**Additional information**	**- Important: Students interested in the lecture series should contact Prof. Küpper (Hendrik.Kuepper@umbr.cas.cz) as soon as possible to find a time for the lecture series that interferes least with obligatory lectures and practicals of the students! Based on this, a final decision about the timing of the lecture series will be made one week before the end of the enrolment period.** - Oral examination: Literature seminar - each participant explains a self-chosen original scientific publication related to the themes of the lectures to the other participants of the course, including a critical assessment of the methods, results and conclusions of that study. - Some of the lectures will be given by invited guests (researchers from other universities and research institutes inside and outside Czech Republic)