

(Table 5.2) Course unit description

<b>Study program:</b> Chemistry				
<b>Type and level of studies:</b> Doctoral academic studies in Chemistry				
<b>Course unit:</b> Biochemistry of natural antioxidants				
<b>Teacher in charge:</b> Vladimir Mihailović, PhD, Assistant Professor				
<b>Language of instruction:</b> English				
<b>ECTS:</b> 10				
<b>Prerequisites:</b> Students should be enrolled in the doctoral academic studies in Chemistry				
<b>Semester:</b> Optional (Winter or Summer semester)				
<b>Course unit objective</b> Explaining the origin and chemical properties of reactive species, in particular free radicals and their metabolic role and fate in the organism. Introducing students with reactive oxygen molecular species and their reactions with cell molecules. Getting to know the types of structures and mechanisms of action of natural antioxidant compounds. Oxidative stress. Molecular sensors and signaling pathways initiated by oxidative stress, redox status, overall redox state of cells and redox regulation.				
<b>Learning outcomes of Course unit</b> Knowledge about conditions of formation of various reactive species in a living organism. Understanding the mechanisms of antioxidant activity of chemical compound and their recognition in various natural compounds. On the basis of the acquired theoretical and practical knowledge, the student should analyze the application of natural compounds in antioxidant protection.				
<b>Course unit contents</b>  <i>Theoretical classes:</i> Chemistry of free radicals, types and distribution of free radicals. Reactive oxygen species (ROS), reactive nitrogen species (RNS) and non-radical forms involved in oxidative damage of cells. Production of radical non-enzymatically (UV-radiation, radionuclides, thiol auto oxidation, metal ions) and enzymatic production of free radicals (xanthine oxidase, NAD(P)H oxidase redox cycles). Mechanisms of harmful effects of free radicals: lipid peroxidation, oxidative damage to proteins, carbohydrates and nucleic acids. Oxidation products of lipids, proteins, nucleic acids, carbohydrates. Natural antioxidants, oxidation of low molecular weight: lipoic acid, vitamin C, vitamin E, glutathione, coenzyme Q, natural phenol compounds. Antioxidant protection of cells: enzymatic and non-enzymatic antioxidants, natural antioxidants and mechanism of action. Antioxidant defense system. Superoxide dismutase, catalase, glutathione peroxidase, glutathione-S-transferase, glutathione reductase. Free radicals in the disease and the application of natural antioxidants (neurodegeneration and sepsis). <i>Practical classes:</i> /				
<b>Literature</b>				
<ol style="list-style-type: none"> <li>1. D. Armstrong. <i>Free radical and Antioxidant Protocols</i>, Humana Press, Totowa, New Jersey</li> <li>2. K. Hensley, R.A. Floyd . <i>Methods in Biological Oxidative Stress. In Methods in molecular biology</i>. Humana Press Inc., New Jersey, 2003.</li> <li>3. T. S. Tracy, R. L. Kingston, <i>Herbal product: Toxicology and clinical pharmacology</i>, Second edition, Humana Press Inc. Tptowa, NJ, 2007.</li> <li>4. W. Vermerris, R. Nicholson, <i>Phenolic compound biochemistry</i>, Springer, Dordrecht, The Netherlands. 2006.</li> </ol>				
<b>Number of active teaching hours</b>				Other classes:
Lectures:5	Practice: 0	Other forms of classes:	Independent work:	

<b>Teaching methods</b>			
<b>Examination methods (maximum 100 points)</b>			
<b>Exam prerequisites</b>	<b>No. of points</b>	<b>Final exam</b>	<b>No. of points</b>
Practical classes	/	Written examination	20
Tests	/	Oral examination	30
Homework	/	Other	/
Seminars	20		
Project	30		
<b>Grading system</b>			
<b>Grade</b>	<b>No. of points</b>	<b>Description</b>	
10	$\geq 91$	Excellent	
9	81-90	Exceptionally good	
8	71-80	Very good	
7	61-70	Good	
6	51-60	Passing	
5	$\leq 50$	Failing	