Study program : Chemistry

Type and level of studies: PhD studies of chemistry - BIOCHEMISTRY

Course unit: Biochemistry of natural antioxidants

Teacher in charge : Vladimir Mihailović, PhD, Scientific Associate

Language of instruction : English

ECTS: 10

Prerequisites: Entered PhD studies of chemistry - BIOCHEMISTRY

Semester: Optional (winter or summer semester)

Course unit objective

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 signalling pathways initiated by oxidative stress, redox status, overall redox state of cells and redox regulation.

Learning outcomes of Course unit

Knowing the 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. The student should be based on the acquired theoretical and practical significance with the application of natural compounds in antioxidant protection.

Course unit contents

Theoretical classes

Chemistry of free radicals, types and distribution of free radicals. Reactive oxygen species (ROS) and 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 (xntin / 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 defence 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).

Practical classes

Literature

1. D. Armstrong. Free radical and Antioxidant Protocols, Humana Press, Totowa, New Jersey,

2. K. Hensley, R.A. Floyd . Methods in Biological Oxidative Stress. In Methods in moleular biology. Humana Press Inc., New Jersey, 2003.

3. T. S. Tracy, R. L. Kingston, Herbal product: Toxicology and clinical pharmacology, Second edition, Humana Press Inc. Tptowa, NJ, 2007.

4. L. J. Cseke, A. Kirakosyan, P. B. Kaufman, S. L. Warber, J. A. Duke, H. L. Brielmann, Natural Products from Plants, CRC Press Taylor & Francis Group, 2006.

5. W. Vermerris, R. Nicholson, Phenolic compound biochemistry, Springer, Dordrecht, The Netherlands. 2006.

Number of active teaching hours				**Other classes**
Lectures: 5	Practice:	Other forms of classes*: mentoring system*	Independent work:	

Teaching methods

Lectures, seminars, 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	
practical classes/tests	20	written examination	50
Seminars/homework	20	.....	
Project			
Other			

Grading system		
Grade	**No. of points**	**Description**
10	**90-100**	Excellent
9	**80-90**	Exceptionally good
8	**70-80**	Very good
7	**60-70**	Good
6	**50-60**	Passing
5	**<50**	Failing