Course Unit Descriptor

Study Programme: Doctoral Academic Studies in Biochemistry

Course Unit Title: Biochemistry of free radicals and natural antioxidants,

Course Unit Code: DSB-705

Name of Lecturer(s): full professor Neda Mimica-Dukić, associate professor Marija Lesjak

Type and Level of Studies: PhD degree

Course Status (compulsory/elective): elective

Semester (winter/summer): winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 15

Prerequisites: None

Course Aims:

The aim of this course is to: (1) provide integrated knowledge about the phenomenon of toxicity of free radicals, the ways of their production and the pathological changes caused by free radicals; (2) Introduce students to the latest scientific achievements in the field of biochemical and medical research related to oxidative stress and mechanisms of antioxidant protection, with special reference to natural antioxidants; (3) develop critical thinking about the application of antioxidants in the prevention of diseases and nutrition.

Learning Outcomes:

After completing the course, students should be able to: (1) demonstrate wide knowledge of the causes and consequences of the formation of free radical species in living organisms and foodstuffs; (2) understand the harmonized functioning of antioxidant protection systems at different cellular levels; (3) predict potential antioxidant activity of different natural compounds, based on the knowledge of structure/activity relationships; (4) critically analyze the application of natural compounds in the antioxidant protection; (5) independently set up and conduct the original experiment, based on acquired theoretical knowledge, critically interpret the results and present them in a scientifically acceptable way.

Syllabus:

Theory

The phenomenon of oxygen toxicity in aerobic organisms. Activation of oxygen and reactive oxygen species: superoxide anion radical, hydroxyl radical, singlet oxygen, organic peroxides and peroxy- and alkoxy radicals, nitrogen oxides. Cellular sources of free radicals. Mechanisms of free radical toxicity: lipid peroxidation, oxidative damage to proteins, DNA and carbohydrates. Free radicals and aging. Pathological changes in the cell and the organism as a result of oxidative stress. Antioxidant mechanisms of cells: antioxidant enzymes and non-enzymatic cellular antioxidants. Antioxidant plants. Instrumental techniques and protocols to determine the antioxidant activity of natural compounds and mixtures.

Practice

Independent student's laboratory work in the frame of scientific research project related to the evaluation of antioxidant capacity of selected natural products.

Required Reading:

1. Evgeny T. Denisov: Oxidation and Antioxidants in Organic Chemistry and Biology. Taylor & Francis Group, CRC Press, 2005.
2. Methods in Biological Oxidative Stress. In Methods in moleular biology. Edited by Kenneth Hensley and Robert A. Floyd . Humana Press Inc., 2003
3. M. K. Eberhardt: Reactive Oxygen species. Chemistry and Medical Consequence. CRC Press, 2001.

4. Neda Mimica-Dukić et al. Essential Oils as Powerful Antioxidants: Misconception or Scientific Fact In: Medicinal and Aromatic Crops: Production, Phytochemistry, and Utilization. Ed.: Valtcho D. Jeliazkov, Charles L. Cantrell. *ACS Symposium series*, Volume 1218 (12), pp.187-208 (2016).

Weekly Contact Hours: 10 (150)	**Lectures:** 5 (75)	**Practical work:** 5 (75)

Teaching Methods: consultative teaching, research project, seminars, journal club

Knowledge Assessment (maximum of 100 points): 100

Pre-exam obligations	points	**Final exam**	points
Active class participation		written exam	
Research project	50	oral exam	50
Preliminary exam(s)		…….	
Seminar(s)			

The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.