UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Celični senzorji v toksikologiji
Course title:	Whole-Cell Biosensors in Toxicology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Senzorske tehnologije, 3. stopnja	/	1	1
Sensor technologies, 3rd cycle	/	1	1

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: ST3-542

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
5	**5**			**15**	**125**	**5**

**Navedena porazdelitev ur velja, če je vpisanih vsaj 10 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 10 students are enrolled. Otherwise the contact hours are linearly reduced and transfered to individual work.*

Nosilec predmeta / Lecturer: Prof. dr. Metka Filipič

Jeziki / Languages:	
Predavanja / Lectures:	Slovenski ali angleški / Slovene or English
Vaje / Tutorial:	Slovenski ali angleški / Slovene or English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Zaključen študij druge stopnje ustrezne (naravoslovne ali tehniške) smeri ali zaključen študij drugih smeri z dokazanim poznavanjem osnov področja predmeta (pisna dokazila, pogovor).

Prerequisits:

Completed second cycle studies in natural sciences or engineering or completed second cycle studies in other fields with proven knowledge of fundamentals in the field of this course (certificates, interview).

Vsebina:

- Principi in vrste celičnih biosenzorjev.
- Področja aplikacij celičnih biosenzorjev v toksikologiji in ekotoksikologiji.
- Konstrukcija celičnih biosenzorjev glede na namen uporabe (izbira ustreznih odzivnih celičnih elementov, načini zaznavanja odzivov, občutljivost in specifičnost za zaznavanje določenega specifičnega toksičnega učinka ali analita).
- Praktični primeri uporabe celičnih biosenzorjev v (eko)toksikologiji.
- Delo na primerih glede na doktorsko nalogo kandidata.

Content (Syllabus outline):

- Principles and types of whole-cell biosensors.
- Fields of application of whole-cell biosensors in toxicology and ecotoxicology.
- Construction of whole-cell biosensors related to the intended application (selection of relevant responsive cell elements, detection of responses, sensitivity and specificity for selection of specific toxic effect or analyte).
- Case studies of the application of whole-cell based biosensors in (eco)toxicology.
- Case studies related to the PhD study of the candidate.

Temeljni literatura in viri / Readings:

Knjiga / Book:

- Biosensors and Environmental Health, 2012 VR. Preedy, V. Patel (eds), Taylor&Francis group, CRC Press.
- Cell based biosensors: Priciples and applications, 2010. P.Wang, Q. Liu (eds) Artech House, Boston/London, Norwood, MA, USA.

Članki / Journal articles:

- Blagus, T, Žager Marciuš, V, Čemažar, M, Serša, Gr, Kamenšek, U, Žegura, B, Nunić, J, Filipič, M. (2014) The cell-based biosensor system HepG2CDKN1A-DsRed for rapid and simple detection of genotoxic agents. Biosensors & bioelectronics, 2014, 61, 102-111
- Palmer, A.E., Qin, Y., Park, J.G., McCombs, J.E., 2011. Design and application of genetically encoded biosensors. Trends in Biotechnology 29, 144-152.
- Zhong, J.-J., Gu, M., Mitchell, R., Kim, B., 2004. Whole-Cell-Based Biosensors for Environmental Biomonitoring and Application, In Biomanufacturing. pp. 269-305. Springer Berlin Heidelberg.
- Park, M., Tsai, S.L., Chen, W., 2013. Microbial Biosensors: Engineered Microorganisms as the Sensing Machinery. Sensors 13, 5777-5795.

Cilji in kompetence:

- razumevanje stanja razvoja in uporabe celičnih biosenzorjev,
- osvojiti znanja in spretnosti za oblikovanje novih celičnih biosenzorjev na področju toksikologije in ekotoksikologije,
- razvoj in/ali uporaba celičnih biosenzorjev na konkretnih primerih povezanih z usmeritvijo študentovega doktorskega dela

Objectives and competences:

- understanding of current state of the art in the field of development and applications of whole-cell biosensors,
- to obtain knowledge and skills for design of new whole-cell biosensor in the fields of toxicology and ecotoxicology,
- development and/or application of whole-cell biosensors on specific cases related to directions of students PhD thesis.

Predvideni študijski rezultati:

- Sposobnost združevanja znanj s področij celične fiziologije, biokemije, molekularne biologije, kemije in sodobnih merilnih tehnik.
- Načrtovanje, konstrukcija in uporabo celičnih biosenzorjev za zaznavanje specifičnih toksičnih učinkov ter za okoljski biomonitoring.
- Samostojno reševanje problemov, povezanih s tematiko doktorske disertacije, ki se nanaša na vsebino predmeta ter povezovanje interdisciplinarnih vsebin.

Intended learning outcomes:

- Ability of the integration of knowledge in the fields of cell physiology, biochemistry, molecular biology, chemistry and modern measurement techniques
- Design, construction and use of whole-cell biosensors for detecting specific toxic effects and for environmental biomonitoring.
- Independent solving of the problems related to the topic of the doctoral dissertation, which refer to the content of the course and the integration of interdisciplinary content.

Metode poučevanja in učenja:

Prek interaktivne komunikacije med profesorjem in študentom, v obliki diskusij in študentovega samostojnega dela. Reševanje problemov povezanih s potrebami po razvoju novih in/ali uporabo obstoječih celičnih biosenzorjev.

Learning and teaching methods:

Via interactive communication between professor and student, in form of discussions and individual work. Case studies related to the need for the development and/or application of existing whole-cell biosensors.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminar	50 %	Seminar
Reševanje konkretnega primera	50 %	Case study

Reference nosilca / Lecturer's references:

- Blagus, T, Žager Marciuš, V, Čemažar, M, Serša, Gr, Kamenšek, U, Žegura, B, Nunić, J, Filipič, M. (2014) The cell-based biosensor system HepG2CDKN1A-DsRed for rapid and simple detection of genotoxic agents. Biosensors & bioelectronics, 2014, 61, 102-111. [COBISS.SI-ID 1771131],
- Novak, M, Žegura, B, Nunić, J, Gajski, G, Gerić, M, Garaj-Vrhovac, V, Filipič, M. (2017) Assessment of the genotoxicity of the tyrosine kinase inhibitor imatinib mesylate in cultured fish and human cells. Mutation research, Genetic toxicology and environmental mutagenesis, 814, 14-21,
- Gajski, G., Geric, M., Žegura, B., Novak, M., Nunić, J., Bajrektarević, D., Garaj-Vrhovac, V., and Filipič, M. (2016). Genotoxic potential of selected cytostatic drugs in human and zebrafish cells. Environmental Science and Pollution Research, 23, 14739-14752.
- ŠTRASER, Alja, FILIPIČ, Metka, ŽEGURA, Bojana. Cylindrospermopsin induced transcriptional responses in human hepatoma HepG2 cells. *Toxicol. in vitro*, 2013, str. 1-9 [in press], doi: 10.1016/j.tiv.2013.05.012. [COBISS.SI-ID 2805327]
- PEZDIRC, Marko, ŽEGURA, Bojana, FILIPIČ, Metka. Genotoxicity and induction of DNA damage responsive genes by food-borne heterocyclic aromatic amines in human hepatoma HepG2 cells. *Food chem. toxicol.*, 2013, vol. 59, str. 386-394, doi: 10.1016/j.fct.2013.06.030. [COBISS.SI-ID 2827087]