

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	Vloga in pomen živalskih modelov pri razumevanju raka
<b>Course title:</b>	Role and Relevance of Animal Models in Understanding Tumor Progression

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Nanoznanosti in nanotehnologije, 3. stopnja	Bioznanosti	1	1
Nanosciences and Nanotechnologies, 3 <sup>rd</sup> cycle	Biosciences	1	1

**Vrsta predmeta / Course type** Izbirni / Elective

**Univerzitetna koda predmeta / University course code:** NANO3-840

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
<b>15</b>	<b>15</b>			<b>15</b>	<b>105</b>	<b>5</b>

*\*Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

**Nosilec predmeta / Lecturer:** Prof. dr. Olga Vasiljeva

**Jeziki / Languages:** **Predavanja / Lectures:** Angleščina, slovenščina / English, Slovenian  
**Vaje / Tutorial:** Angleščina, slovenščina / English, Slovenian

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

Končan študij druge stopnje biokemije, biologije, medicine ali katerekoli druge naravoslovne smeri.

**Prerequisites:**

Second cycle degree in biochemistry, biology, medicine or any other natural sciences discipline.

**Vsebina:**

Študij zajema naslednje teme:

- Mehanizmi tumorske progresije in metastaz
- Značilnosti raka
- Koncept tumorskega mikrookolja
- Živalski modeli raka (transgene, xenografti)
- Vloga proteaz pri različnih stopnjah razvoja raka in pri interakcijah med tumorji in okoljem
- Metode študija raka

**Content (Syllabus outline):**

The subject comprises the following themes:

- Mechanisms of tumor progression and metastasis
- The hallmarks of cancer
- The concept of tumor microenvironment
- In vivo animal cancer models (transgenic, xenograft, PDX models)
- Role of proteases in different stages of tumor progression and in tumor-stroma interactions
- Cancer biology methods

**Temeljni literatura in viri / Readings:**

Nicolas Gengenbacher, Mahak Singhal & Hellmut G. Augustin, Preclinical mouse solid tumour models: status quo, challenges and perspectives. Nature Reviews Cancer volume 17, pages 751–765 (2017)  
 Hanahan D, Weinberg RA. Hallmarks of cancer: the next generation. Cell. 144(5):646-74. (2011)

Vasiljeva, O., et al., Tumor cell–derived and macrophage-derived cathepsin B promotes progression and lung metastasis of mammary cancer. *Cancer Res.* 66, 5242-5250 (2006)

Richmond A, Su Y. Mouse xenograft models vs GEM models for human cancer therapeutics. *Dis Model Mech.* Sep-Oct;1(2-3):78-82 (2008)

Laurence Zitvogel, Jonathan M. Pitt, Romain Daillère, Mark J. Smyth & Guido Kroemer. Mouse models in oncoimmunology. *Nature Reviews Cancer* volume 16, pages 759–773 (2016)

Sevenich L, Joyce JA. Pericellular proteolysis in cancer. *Genes Dev.* (21):2331-47 (2014)

Marion de Jong, Jeroen Essers & Wytske M. van Weerden. Imaging preclinical tumour models: improving translational power. *Nature Reviews Cancer* volume 14, pages 481–493 (2014)

### **Cilji in kompetence:**

Namen predmeta je seznaniti študente z živalskimi modeli raka ter mehanizmi tumorske progresije in metastaz in vloge proteoliznih encimov pri različnih stadijih maligne rasti.

Splošne kompetence:

- Študent bo spoznal metode in procedure, ki se uporabljajo na področju biologije raka, med katere spadajo in vivo metode (transgenski živalski modeli raka, eksperimentalni modeli metastaz), imunohistokemijske metode in ex vivo metode tumorske celične biologije (testi migracije in invazivnosti, proliferacije, ...),
- razvoj kritične in samokritične presoje,
- sposobnost uporabe znanja v praksi,
- razvoj komunikacijskih sposobnosti in spretnosti, posebej komunikacije v mednarodnem okolju,
- kooperativnost, delo v skupini (in v mednarodnem okolju),
- seznanil se bo z multidisciplinarnim pristopom k reševanju znanstvenih problemov.

### **Objectives and competences:**

The aim of this course is to acquaint the students with the mechanisms of tumor progression and metastasis, animal cancer models to study it and the example of the research of impact of proteolytic enzymes at different stages of cancer.

General Competences:

- The student will get to know research methods and procedures used in the field of cancer biology, which comprise in vivo methods (transgenic animal cancer models, experimental metastasis models), immunohistochemistry and ex vivo methods of tumor cells biology (migration and invasion assay, proliferation, etc.).
- The student will develop critical thinking.
- The student will develop communications skills to present research achievement in the international environment.
- Work in team (in international environment).
- He will gain insight in multidisciplinary approach to solve scientific problems.

### **Predvideni študijski rezultati:**

Študent se bo seznanil s principi mehanizmov razvoja raka in z vlogo proteaz pri teh procesih. Poleg tega se bo seznanil s principi evalvacije funkcije posameznih genov z uporabo transgenskih živalskih modelov.

### **Intended learning outcomes:**

The student will learn the mechanisms of tumor progression and metastasis and the roles of proteolytic enzymes in those processes. In addition, he will become familiar with the principles of specific gene function evaluation by use of transgenic animal models.

**Metode poučevanja in učenja:**

- Predavanja (v primeru več od 5 študentov)
- Individualne konzultacije
- Seminarji (pregled literature)
- Laboratorijsko delo (samo v primeru mentorstva)

**Learning and teaching methods:**

- Lectures (for 5 students or more)
- Individual consultations
- Seminar work (overview of the literature)
- Laboratory work (if supervising the student)

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
Seminar	40 %	Seminar
Ustno preverjanje	30 %	Oral assessment
Predlog raziskav	30 %	Term paper

**Reference nosilca / Lecturer's references:**

- Butinar M, Prebanda MT, Rajkovic J, Jeric J, Stoka V, Peters C, Reinheckel T, Kruger A, Turk V, Turk B, and Vasiljeva O. Stefin B deficiency reduces tumor growth via sensitisation of tumor cells to oxidative stress in a breast cancer model. *Oncogene* (2014) 33(26):3392-3400.
- Mikhaylov G, Klimpel D, Schaschke N, Mikac U, Vizovisek M, Fonovic M, Turk V, Turk B, and Vasiljeva O. Selective targeting of tumor and stromal cells by lipidated cathepsin B inhibitor-based nanocarrier-system. *Angewandte Chemie* (2014) 53(38):10077-81.
- Wong KR, Menendez E, Craik CS, Kavanaugh WM, Vasiljeva O. In vivo imaging of protease activity by Probody therapeutic activation. *Biochimie*. (2016) Mar;122:62-7.
- Završnik J, Butinar M, Prebanda MT, Krajnc A, Vidmar R, Fonović M, Grubb A, Turk V, Turk B, Vasiljeva O. Cystatin C deficiency suppresses tumor growth in a breast cancer model through decreased proliferation of tumor cells. *Oncotarget*. (2017) Apr 24;8(43):73793-73809.
- Kramer L, Renko M, Završnik J, Turk D, Seeger MA, Vasiljeva O, Grütter MG, Turk V, Turk B. Non-invasive in vivo imaging of tumour-associated cathepsin B by a highly selective inhibitory DARPIn. *Theranostics*. (2017) Jul 8;7(11):2806-2821.