

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Proteoliza
Course title:	Proteolysis

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

Vrsta predmeta / Course type

Izbirni / Elective

Univerzitetna koda predmeta / University course code:

NANO3-826

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	30			30	210	10

**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. Vito Turk

Jeziki /

Predavanja / Lectures:

slovenščina, angleščina / Slovenian, English

Languages:

Vaje / Tutorial:

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

Poznavanje osnov biokemije, molekularne in celične biologije ter poznavanje osnov analitskih metod s področja.

Prerequisites:

Basic knowledge of biochemistry and molecular and cell biology, as well as basic knowledge of analytical methods from the field.

Vsebina:

Uvod v proteolizo: osnove proteolize in njena vloga pri fizioloških procesih

- **klasifikacija proteoliznih encimov**
- **priprava, izolacija in karakterizacija proteoliznih encimov:** priprava s pomočjo rekombinantne DNA tehnologije v primerjavi z izolacijo iz naravnih virov, analitske in preparativne metode, katalitske aktivnosti
- **analitske nanometode pri identifikaciji proteinov in peptidov**
- **struktura in mehanizem delovanja proteinaz**
- **inhibitorji proteoliznih encimov:** naravni in sintetski inhibitorji
- **intracelularna in ekstracelularna proteoliza, preprečevanje nezaželene proteolize**

Content (Syllabus outline):

Introduction to proteolysis: basics of proteolysis and its role in physiology

- **Classification of proteolytic enzymes**
- **Preparation, purification and characterization of proteolytic enzymes:** recombinant production vs. purification from natural sources, analytical and preparative methods, catalytic activities, ...
- **Analytical nanomethods for the identification of proteins and peptides**
- **Structure and mechanism of action of proteases**
- **Protease inhibitors:** natural and synthetic
- **Intracellular and extracellular proteolysis, the prevention of unwanted proteolysis**
- **Role of the proteolytic enzymes in disease:** cancer, neurodegeneration, cardiovascular

- **vloga proteoliznih encimov pri boleznih:** rak, nevrodegeneracija, kardiovaskularna obolenja, vnetja obolenja, ...

diseases, inflammation, ...

Temeljni literatura in viri / Readings:

A. J. Barrett, N. D. Rawlings, J. F. Woessner: Handbook of Proteolytic Enzymes, 3rd Edition, Elsevier, Academic Press, 2012.

R. Beynon, J. S. Bond: Proteolytic Enzymes, 2nd Edition, Oxford Univ. Press, 2001.

Turk B., Turk D., Turk V. (2012) Protease signalling: the cutting edge. EMBO J. 31:1630-43.

Turk V., Stoka V., Vasiljeva O., Renko M., Sun T., Turk B., Turk D. (2012) Cysteine cathepsins: from structure, function and regulation to new frontiers. Biochim Biophys Acta. 1824:68-88.

Tekoča relevantna literatura iz problematike/ Relevant current articles from the field (Nature, Science, Cell, Nature Reviews, ...)

Cilji in kompetence:

Seznani študente s procesom proteolize, ki ima ključno vlogo pri razgradnji proteinov v normalnih in patoloških stanjih. Poudarek bo dan na poznavanju posameznih razredov proteoliznih encimov, njihovi karakterizaciji, strukturi in bioloških lastnosti.

Splošne kompetence:

- obvladanje raziskovalnih metod in postopkov, 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 tudi v mednarodnem okolju

Predmetnospecifične kompetence:

Študent se bo seznanil s teoretičnimi osnovami problematike proteolize in njenim pomenom za aplikacije v biomedicinskih raziskavah.

Pri svojem delu bo uporabljal najnovejšo tujo strokovno literaturo, kar bo izboljšalo njegove sposobnosti uporabe tujega jezika in kritičnega pogleda na objavljeno raziskovalno delo.

Priprava na pripravo projektov s področja proteolize v povezavi z biomedicino

Objectives and competences:

The aim is to acquaint students with the process of proteolysis which has a key role in the degradation of proteins in normal and pathological states. Emphasis will be placed on the knowledge of individual classes of proteolytic enzymes, their characterization, structure and biological properties.

General Competences:

- the student will master research methods and procedures and develop skills for critical assessment of his activities,
- the student will be able to put his knowledge into practice
- the student will develop communications skills to present research achievement in the international environment
- training for team work including the work in international environment

Course Specific Competences:

Student will learn theoretical background of proteolysis and its relevance for application in biomedical research.

During his study he will use the newest scientific literature, which will improve his foreign language skills and his ability to critically view the published research.

Preparation for implementation into project preparation from the field of proteolysis linked to biomedicine.

Predvideni študijski rezultati:

Poznavanje in razumevanje pojmov iz celične in molekularne biologije s poudarkom na proteolizi. Študent se seznani z različnimi razredi proteaz in njihovim mehanizmom delovanja.

Študent se seznani z načini regulacije proteaz s poudarkom na inhibitorjih.

Poznavanje in razumevanje osnov nekaterih bolezni s poudarkom na raku in nevrodegenerativnih obolenjih ter vloge proteaz.

Razumevanje in pregled različnih analitskih metod ter njihovih zmožnosti in omejitev.

Intended learning outcomes:

Knowledge and understanding of the basic phenomena in cell and molecular biology with emphasis on proteolysis.

Student gets acquainted with different classes of proteases and their mechanism of action.

Student gets acquainted with different means of protease regulation with emphasis on inhibitors.

Knowledge and understanding of the basics of selected diseases with emphasis on cancer and neurodegeneration and the role of proteases.

Understanding and overview of analytical methods, their capabilities and limitations.

Metode poučevanja in učenja:

- Predavanja
- Seminarji
- Konzultacije
- Individualno delo

Learning and teaching methods:

- Lectures
- Seminar work
- Consultations
- Individual work

Delež (v %) /

Weight (in %)

Assessment:

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminar	50 %	Seminar
Ustni izpit	50 %	Oral exam

Reference nosilca / Lecturer's references:

TURK, Vito, STOKA, Veronika, TURK, Dušan. Cystatins: biochemical and structural properties, and medical relevance. *Frontiers in bioscience*, ISSN 1093-9946, 2008, vol. 13, no. 13, str. 5406-5420

UNANUE, Emil R., TURK, Vito, NEEFJES, Jacques. Variations in MHC class II antigen processing and presentation in health and disease. *Annual review of immunology*, ISSN 0732-0582, 2016, vol. 34, str. 365-297, doi: [10.1146/annurev-immunol-041015-055420](https://doi.org/10.1146/annurev-immunol-041015-055420)

BUTINAR, Miha, TRSTENJAK-PREBANDA, Mojca, RAJKOVIĆ, Jelena, JERIČ KOKELJ, Barbara, STOKA, Veronika, PETERS, Christoph, REINHECKEL, Thomas, KRÜGER, Achim, TURK, Vito, TURK, Boris, VASILJEVA, Olga. Stefin B deficiency reduces tumor growth via sensitization of tumor cells to oxidative stress in a breast cancer model. *Oncogene*, ISSN 0950-9232, 2014, vol. 33, no. 26, str. 3392-3400, doi: [10.1038/onc.2013.314](https://doi.org/10.1038/onc.2013.314)

SOBOTIČ, Barbara, VIZOVIŠEK, Matej, VIDMAR, Robert, VAN DAMME, Petra, GOČEVA, Vasilena, JOYCE, Johanna A., GEVAERT, Kris, TURK, Vito, TURK, Boris, FONOVIĆ, Marko. Proteomic identification of cysteine cathepsin substrates shed from the surface of cancer cell. *Molecular & cellular proteomics*, ISSN 1535-9476, 2015, vol. 14, no. 8, str. 2213-2228, doi: [10.1074/mcp.M114.044628](https://doi.org/10.1074/mcp.M114.044628)

MIKHAYLOV, Georgy, KLIMPEL, D., SCHASCHKE, Norbert, MIKAC, Urška, VIZOVIŠEK, Matej, FONOVIĆ, Marko, TURK, Vito, TURK, Boris, VASILJEVA, Olga. Selective targeting of tumor and stromal cells by a nanocarrier system displaying lipidated cathepsin B inhibitor. *Angewandte Chemie : International edition*, ISSN 1433-7851. [Print ed.], 2014, vol. 53, no. 38, str. 10077-10081, doi: [10.1002/anie.201402305](https://doi.org/10.1002/anie.201402305)