UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Izbrana poglavja iz sinteze proteinov
Course title:	Advanced Topics in Protein Synthesis

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, 3rd cycle	Biosciences	1	1

Vrsta predmeta / Course type	Izbirni / Elective
Univerzitetna koda predmeta / University course code:	NANO3-803

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
15	**15**			**15**	**105**	**5**

**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 transfered to individual work.*

Nosilec predmeta / Lecturer:		Prof. dr. Nenad Ban
Jeziki / Languages:	**Predavanja / Lectures:**	angleščina / English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključen študij druge stopnje ali ekvivalenten univerzitetni študij. Osnovno poznavanje biologije, kemije s poudarkom na biokemiji, organski kemiji, molekularni biologiji na dodiplomskem nivoju.	Completed Bologna second level study program or an equivalent pre-Bologna university study program. Basic knowledge in biology, chemistry, and in particular biochemistry, organic chemistry, molecular biology at the undergraduate level.

Vsebina:	**Content (Syllabus outline):**
Strukture visoke resolucije male ribozomske podenote • Zgradba male ribozomske podenote • Interakcije med proteini in RNA • Vloga in natančnost translacije – dekodiranje Struktura visoke resolucije velike ribozomske podenote • Zgradba velike ribozomske podenote • Vloga ribozoma pri prenosu peptidne vezi • Tunel v ribozomu in primer mehanizma	High resolution structure of the small ribosomal subunit • Overall architecture • Protein RNA interactions • Role in translational fidelity - decoding High resolution structure of the large ribosomal subunit • Overall structure of the large ribosomal subunit • The role of the ribosome in the peptidyl transferase reaction

delovanja antibiotika

Struktura visoke resolucije bakterijskega 70S ribozoma
- Konformacija mRNK
- Interakcije tRNK z ribozomom

Usmerjanje proteina med njegovo sintezo
- Prepoznavanje signalnega zaporedja
- Translokon – usmerjevalni kanal za proteine

Z ribozomom povezani čaperoni in ko-translacijsko zvijanje in procesiranje proteinov
- Sprožitveni faktor – z bakterijskim ribozomom povezani čaperon
- Peptidna deformilaza – mehanizem ko-translacijskega procesiranja nastajajoče verige

- The tunnel of the ribosome and an example of antibiotic action

High resolution structure of the bacterial 70S ribosome
- Conformation of the mRNA
- Interactions of tRNAs with the ribosome

Co-translational protein targeting
- Signal recognition particle
- Translocon – protein conducting channel

Ribosome associated chaperones and co-translational protein folding and processing
- Trigger factor – bacterial ribosome associated chaperone
- Peptide deformylase – mechanism of co-translational nascent chain processing

Temeljna literatura in viri / Readings:

- Copies of lecture notes
- Kramer G, Boehringer D, Ban N, Bukau B. (2009) The ribosome as a platform for co-translational processing, folding and targeting of newly synthesized proteins. Nat Struct Mol Biol. 6:589-97.
- Schmeing, T.M., and Ramakrishnan, V. (2009). What recent ribosome structures have revealed about the mechanism of translation. Nature 461, 1234-1242.
- Klinge S, Voigts-Hoffmann F, Leibundgut M, Ban N. (2012) Atomic structures of the eukaryotic ribosome. Trends Biochem Sci. 2012 May;37(5):189-98.

Cilji in kompetence:

Cilj predmeta je, da se študent seznani s trenutnim stanjem raziskav na področju proteinske sinteze na podlagi podane literature. Študenti naj bi nato napisali sestavek, v katerem predlagajo raziskovalni projekt, ki naj bi privedel do novih odkritij na tem področju. Po poslušanju predavanj bodo študenti predstavili svoj raziskovalni projekt.

Splošne kompetence:
- Študenti bodo usposobljeni za kritično spremljanje literature in povzemanje najbolj pomembnih podatkov, bistvenih za razumevanje publikacij.
- Pridobili bodo sposobnosti za znanstveno izražanje in diskusije.
- Pridobili bodo osnove nekaterih metod strukturne biologije (rentgenska kristalografija in elektronska mikroskopija).
- Možnost predstavitve in obrambe njihovih

Objectives and competences:

The goal of the course is to familiarize the student with the current state of research in the field of protein synthesis using as a help a script that will be provided. The students are then supposed to prepare a paper in which they propose a research project that would have potential for new discoveries in the field. After hearing the lectures the students present and defend their research proposal paper.

General competences:
- Students will develop skills to evaluate the literature and extract the most important data for understanding of the subject.
- Students will also develop skills for scientific writing and for scientific discussions.
- Students will also learn the basics of some methods used in structural biology (x-ray crystallography and electron microscopy).

znanstvenih idej bo vzpodbudila njihovo neodvisno razmišljanje. Predmetno specifične kompetence: Študenti se bodo naučili kritične presoje literature s tega področja in spoznali prednosti in omejitve vrste metod strukturne biologije. Pouk, raziskovalni projekt in diskusije bodo v angleškem jeziku. To bo doprineslo k usposobljenosti študentov za izvajanje znanstveno raziskovalnega dela na mednarodnem nivoju.	• Students will have an opportunity to present and defend their scientific ideas fostering independent thinking in science. Course specific competences: The student will learn to critically evaluate the literature in a particular field. They will also learn the advantages and the limitations of various methods in structural biology. The class, the research paper and the discussions will be held in English providing additional training and preparation for conducting science at an international level.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študenti se bodo usposobili za kritično razumevanje literature na področju strukturne biologije in proteinske sinteze. Pridobili bodo širok pregled polja in predstavili svoje razumevanje polja s pisanjem prispevka, v katerem bodo predlagali raziskovalni projekt, ki bi lahko doprinesel k nadaljnjemu razvoju področja.	Knowledge and Understanding: The students will learn to evaluate scientific literature in the field of structural biology and protein synthesis. They will acquire broad overview of the field and attempt to provide a critical opinion by writing a paper that suggest future projects that would advance the field.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja, seminar in diskusija	• Lectures, seminar and discussion.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustni izpit Seminarska predstavitev raziskovalnega projekta	50 % 50 %	Oral exam Seminar presentation of the research proposal paper

Reference nosilca / Lecturer's references:

- Greber BJ, Bieri P, Leibundgut M, Leitner A, Aebersold R, Boehringer D, Ban N. (2015) The complete structure of the 55S mammalian mitochondrial ribosome. Science. 348(6232):303-8.
- Greber BJ, Boehringer D, Leibundgut M, Bieri P, Leitner A, Schmitz N, Aebersold R, Ban N. (2014) The complete structure of the large subunit of the mammalian mitochondrial ribosome. Nature. 515(7526):283. (16 cit
- Erzberger JP, Stengel F, Pellarin R, Zhang S, Schaefer T, Aylett CHS, Cimermančič P, Boehringer D, Sali A, Aebersold R, and Ban N. (2014) Molecular Architecture of the 40S•eIF1•eIF3 Translation Initiation Complex. Cell 158(5):1123-35.
- Greber BJ, Boehringer D, Leitner A, Bieri P, Voigts-Hoffmann F, Erzberger JP, Leibundgut M, Aebersold R, Ban N. (2014) Architecture of the large subunit of the mammalian mitochondrial ribosome. Nature. 505(7484):515-9.
- Klinge S, Voigts-Hoffmann F, Leibundgut M, Arpagaus S, Ban N. (2011) Crystal structure of the eukaryotic 60S ribosomal subunit in complex with initiation factor 6. Science, 334, 941-8.