

Medicinski fakultet u Rijeci

**IZVEDBENI NASTAVNI PLAN  
2024/2025**

Za kolegij

**Experimental Antibody Development**

Studij:	<b>Medical Studies in English (R)</b> (izborni) Sveučilišni integrirani prijediplomski i diplomski studij
Katedra:	<b>Centar za proteomiku</b>
Nositelj kolegija:	<b>prof. dr. sc. Lenac Roviš Tihana</b>
Godina studija:	<b>5</b>
ECTS:	<b>1.5</b>
Stimulativni ECTS:	<b>0 (0.00%)</b>
Strani jezik:	<b>Mogućnost izvođenja na stranom jeziku</b>

## **Podaci o kolegiju:**

### Course Overview:

The elective course on advanced topics in immunology and antibody development is designed to provide fifth/sixth-year medical students with a comprehensive understanding of immunization processes and the development of monoclonal antibodies. The course explores cutting-edge techniques and applications in antibody research and immunotherapy. Students will have the opportunity to engage in hands-on laboratory exercises and seminars, enabling them to gain practical experience and contribute to the advancement of immunotherapy research.

The course is intended primarily for students who are oriented towards molecular medicine and branches that include immunology, infectology, microbiology, oncology, pathology, pharmacology, molecular diagnostics, etc.; also to those students who want to understand the molecular basis on which the processes of immunization and antibody production are based, such as future epidemiologists and experts involved in vaccine development. The aim of the course is to integrate acquired theoretical knowledge from immunology and infectology using examples and to empower the student in experimental work in the laboratory using the example of the development of monoclonal antibodies to a protein antigen.

### Course Structure:

L1 (1h) Introduction to immunization processes and the production of proteins as immunogens

L2 (2h) The process of producing monoclonal antibodies using the hybridoma technique and the phage display technique

L3 (1h) Recombinant antibodies, protein-based vaccines and vaccines using proteins as carriers

L4 (2h) Development of antibodies for the needs of immunotherapy with examples of own patents in the immunotherapy of tumors (1h) and viruses (1h)

Exercises (14 h): The maximum number of students is limited to three due to the experimental nature of the course and the use of several scientific laboratories. The exercises will include 14 hours of experimental work with supervision of procedures involved in the development and characterization of murine monoclonal antibodies, including but not limited to: BCA assay of immunogen concentration in a sample; ELISA assay of supernatant of hybridoma cell lines (1/3 of 96-well plate) for immunogen of interest; test of positive supernatants of hybridoma cell lines to identify native immunogens by immunofluorescence or flow cytometry or immunoblotting method - exercises are adapted to current laboratory activities.

Seminars (5h): Presentations of the students' experimental results in the form of a report which, in addition to the achieved results, will contain a short theoretical introduction to the research problem and the possibility of exploiting the antibodies in the development of which they participated.

## **Popis obvezne ispitne literature:**

Selected review, scientific or applicative papers related to an individual experimental task (immunogen of interest)

## **Popis dopunske literature:**

## **Nastavni plan:**

### **Predavanja popis (s naslovima i pojašnjenjem):**

#### **L1 (1h) Introduction to immunization processes and the production of proteins as immunogens**

The student will be able to:

1. Applies knowledge of molecular and cellular mechanisms that are important in the process of immunogen preparation and immunization.

#### **L2 (2h) The process of producing monoclonal antibodies using the hybridoma technique and the phage display technique**

The student will be able to:

Defines the steps in the production of monoclonal antibodies  
Discusses the merits of different methods for obtaining antibodies

#### **L3 (1h) Recombinant antibodies, protein-based vaccines and vaccines using proteins as carriers**

student will be able to:

1. Defines the concept of recombinant antibody and subunit (protein) vaccine
2. Describe the reasons for using proteins as a carrier in vaccine development

#### **L4 (2h) Development of antibodies for the needs of immunotherapy with examples of own patents in the immunotherapy of tumors (1h) and viruses (1h)**

The student will be able to:

Discuss some current principles of immunotherapy  
Describe the concept of antibody-based intellectual property

### **Vježbe popis (s naslovima i pojašnjenjem):**

#### **E1 (5h). Hybridoma technique, ELISA-analysis**

Exercises (14 h): The maximum number of students is limited to three due to the experimental nature of the course and the use of several scientific laboratories.

The student will be able to:

Create a plan for the rational selection of laboratory tests and the interpretation of their results for the validation of antibodies used in medicine.

**0-7 hours:** The exercise will include 7 hours of experimental work under supervision, focusing on procedures involved in the development and characterization of murine monoclonal antibodies. This includes performing ELISA assays on the supernatants of hybridoma cell lines to detect the immunogen of interest (in 2024: DNAM-1; 2h sample preparation + 5h analysis).

**8-14 hours:** The exercise will include 7 hours of experimental work under supervision, focusing on testing positive supernatants from hybridoma cell lines to identify native immunogens using methods such as immunofluorescence, flow cytometry, or immunoblotting (in 2024: flow cytometry, human peripheral blood mononuclear cells 5h (3h sample preparation + 2 h analysis) + Immunohistochemistry 2h).

#### **E2 (3h). Validation Technique for Selected Developed Antibodies - Flow Cytometry-preparation**

Exercises (14 h): The maximum number of students is limited to three due to the experimental nature of the course and the use of several scientific laboratories.

The student will be able to:

Create a plan for the rational selection of laboratory tests and the interpretation of their results for the validation of antibodies used in medicine.

**0-7 hours:** The exercises will include 7 hours of experimental work under supervision, focusing on procedures involved in the development and characterization of murine monoclonal antibodies. This includes performing ELISA assays on the supernatants of hybridoma cell lines to detect the immunogen of interest (in 2024: DNAM-1).

**8-14 hours:** Testing positive supernatants from hybridoma cell lines to identify native immunogens using methods such as immunofluorescence, flow cytometry, or immunoblotting (in 2024: flow cytometry, human peripheral blood mononuclear cells 5h + Immunohistochemistry 2h).

### **E3 (2h). Validation Technique for Selected Developed Antibodies - Immunohistochemistry**

Exercises (14 h): The maximum number of students is limited to three due to the experimental nature of the course and the use of several scientific laboratories.

The student will be able to:

Create a plan for the rational selection of laboratory tests and the interpretation of their results for the validation of antibodies used in medicine.

**0-7 hours:** The exercises will include 7 hours of experimental work under supervision, focusing on procedures involved in the development and characterization of murine monoclonal antibodies. This includes performing ELISA assays on the supernatants of hybridoma cell lines to detect the immunogen of interest (in 2024: DNAM-1).

**8-14 hours:** Testing positive supernatants from hybridoma cell lines to identify native immunogens using methods such as immunofluorescence, flow cytometry, or immunoblotting (in 2024: flow cytometry, human peripheral blood mononuclear cells 5h + Immunohistochemistry 2h).

### **E2b (2h). Validation Technique for Selected Developed Antibodies - Flow Cytometry-analysis**

#### **E1 (2h) ELISA sample preparation**

Exercises (14 h): The maximum number of students is limited to three due to the experimental nature of the course and the use of several scientific laboratories.

The student will be able to:

Create a plan for the rational selection of laboratory tests and the interpretation of their results for the validation of antibodies used in medicine.

**0-7 hours:** The exercise will include 7 hours of experimental work under supervision, focusing on procedures involved in the development and characterization of murine monoclonal antibodies. This includes performing ELISA assays on the supernatants of hybridoma cell lines to detect the immunogen of interest (in 2024: DNAM-1; 2h sample preparation + 5h analysis).

**8-14 hours:** The exercise will include 7 hours of experimental work under supervision, focusing on testing positive supernatants from hybridoma cell lines to identify native immunogens using methods such as immunofluorescence, flow cytometry, or immunoblotting (in 2024: flow cytometry, human peripheral blood mononuclear cells 5h (3h sample preparation + 2 h analysis) + Immunohistochemistry 2h).

### **Seminari popis (s naslovima i pojašnjenjem):**

#### **Seminars (4+1 hours): Results Presentation, 4 h Online Sessions & 1 h In-person**

Ishodi učenja

Seminars (4+1h): Presentations of the students' experimental results in the form of a report which, in addition to the achieved results, will contain a short theoretical introduction to the research problem and the possibility of exploiting the antibodies in the development of which they participated.

**Obveze studenata:**

regular attendance of classes (lectures, seminars, exercises)

preparing a seminar /passing the final exam

**Ispit (način polaganja ispita, opis pisanog/usmenog/praktičnog dijela ispita, način bodovanja, kriterij ocjenjivanja):****Ostale napomene (vezane uz kolegij) važne za studente:**

The maximum number of students is limited to three due to the experimental nature of the course and the use of several scientific laboratories.

# SATNICA IZVOĐENJA NASTAVE 2024/2025

Experimental Antibody Development

<b>Predavanja</b> (mjesto i vrijeme / grupa)	<b>Vježbe</b> (mjesto i vrijeme / grupa)	<b>Seminari</b> (mjesto i vrijeme / grupa)
<b>26.11.2024</b>		
L1 (1h) Introduction to immunization processes and the production of proteins as immunogens: <ul style="list-style-type: none"><li>• Centar za proteomiku (08:00 - 08:45) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul> L2 (2h) The process of producing monoclonal antibodies using the hybridoma technique and the phage display technique: <ul style="list-style-type: none"><li>• Centar za proteomiku (08:45 - 10:15) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul> L3 (1h) Recombinant antibodies, protein-based vaccines and vaccines using proteins as carriers: <ul style="list-style-type: none"><li>• Centar za proteomiku (10:15 - 11:00) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>	E1 (2h) ELISA sample preparation: <ul style="list-style-type: none"><li>• Centar za proteomiku (11:00 - 12:30) [180] [1412] [1625]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul> E1 (5h). Hybridoma technique, ELISA-analysis: <ul style="list-style-type: none"><li>• Centar za proteomiku (12:31 - 16:30) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>	
prof. dr. sc. Lenac Roviš Tihana [180] · Malić Suzana [1625] · Miklič Karmela [1412]		
<b>05.12.2024</b>		
L4 (2h) Development of antibodies for the needs of immunotherapy with examples of own patents in the immunotherapy of tumors (1h) and viruses (1h): <ul style="list-style-type: none"><li>• ONLINE (15:30 - 17:00) [204]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>	E2 (3h). Validation Technique for Selected Developed Antibodies – Flow Cytometry-preparation: <ul style="list-style-type: none"><li>• Centar za proteomiku (13:00 - 15:15) [1324]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul> E2b (2h). Validation Technique for Selected Developed Antibodies – Flow Cytometry-analysis: <ul style="list-style-type: none"><li>• Centar za proteomiku (17:15 - 18:45) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>	
Karner Dubravka, mag.biotech.in med. [1324] · Kučan Brlić Paola, PHD [204] · prof. dr. sc. Lenac Roviš Tihana [180]		
<b>06.12.2024</b>		
		Seminars (4+1 hours): Results Presentation, 4 h Online Sessions & 1 h In-person: <ul style="list-style-type: none"><li>• ONLINE (14:00 - 20:00) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>
prof. dr. sc. Lenac Roviš Tihana [180]		
<b>09.12.2024</b>		
	E3 (2h). Validation Technique for Selected Developed Antibodies – Immunohistochemistry: <ul style="list-style-type: none"><li>• Centar za proteomiku (14:00 - 15:30) [3286]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>	Seminars (4+1 hours): Results Presentation, 4 h Online Sessions & 1 h In-person: <ul style="list-style-type: none"><li>• Centar za proteomiku (16:00 - 17:00) [180]<ul style="list-style-type: none"><li>◦ EAD</li></ul></li></ul>
asistentica Bellulovich Ema [3286] · prof. dr. sc. Lenac Roviš Tihana [180]		

**Popis predavanja, seminara i vježbi:**

<b>PREDAVANJA (TEMA)</b>	<b>Broj sati</b>	<b>Mjesto održavanja</b>
L1 (1h) Introduction to immunization processes and the production of proteins as immunogens	1	Centar za proteomiku
L2 (2h) The process of producing monoclonal antibodies using the hybridoma technique and the phage display technique	2	Centar za proteomiku
L3 (1h) Recombinant antibodies, protein-based vaccines and vaccines using proteins as carriers	1	Centar za proteomiku
L4 (2h) Development of antibodies for the needs of immunotherapy with examples of own patents in the immunotherapy of tumors (1h) and viruses (1h)	2	ONLINE

<b>VJEŽBE (TEMA)</b>	<b>Broj sati</b>	<b>Mjesto održavanja</b>
E1 (5h). Hybridoma technique, ELISA-analysis	5	Centar za proteomiku
E2 (3h). Validation Technique for Selected Developed Antibodies - Flow Cytometry-preparation	3	Centar za proteomiku
E3 (2h). Validation Technique for Selected Developed Antibodies - Immunohistochemistry	2	Centar za proteomiku
E2b (2h). Validation Technique for Selected Developed Antibodies - Flow Cytometry-analysis	2	Centar za proteomiku
E1 (2h) ELISA sample preparation	2	Centar za proteomiku

<b>SEMINARI (TEMA)</b>	<b>Broj sati</b>	<b>Mjesto održavanja</b>
Seminars (4+1 hours): Results Presentation, 4 h Online Sessions & 1 h In-person	5	Centar za proteomiku ONLINE

**ISPITNI TERMINI (završni ispit):**

1.	16.12.2024.
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