

Faculty of Medicine in Rijeka

**Curriculum
2024/2025**

For course

Experimental Antibody Development

Study program: **Medical Studies in English (R)** (elective)
University integrated undergraduate and graduate study
Department: **Centre for Proteomics**
Course coordinator: **prof. dr. sc. Lenac Roviš Tihana**

Year of study: **5**
ECTS: **1.5**
Incentive ECTS: **0 (0.00%)**
Foreign language: **Possibility of teaching in a foreign language**

Course information:

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.

List of assigned reading:

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

List of optional reading:

Curriculum:

Lectures list (with titles and explanation):

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

Practicals list (with titles and explanation):

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).

Seminars list (with titles and explanation):

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.

Student obligations:

regular attendance of classes (lectures, seminars, exercises)

preparing a seminar /passing the final exam

Exam (exam taking, description of the written/oral/practical part of the exam, point distribution, grading criteria):**Other notes (related to the course) important for students:**

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

COURSE HOURS 2024/2025

Experimental Antibody Development

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

List of lectures, seminars and practicals:

LECTURES (TOPIC)	Number of hours	Location
L1 (1h) Introduction to immunization processes and the production of proteins as immunogens	1	Center for Proteomics
L2 (2h) The process of producing monoclonal antibodies using the hybridoma technique and the phage display technique	2	Center for Proteomics
L3 (1h) Recombinant antibodies, protein-based vaccines and vaccines using proteins as carriers	1	Center for Proteomics
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

PRACTICALS (TOPIC)	Number of hours	Location
E1 (5h). Hybridoma technique, ELISA-analysis	5	Center for Proteomics
E2 (3h). Validation Technique for Selected Developed Antibodies - Flow Cytometry-preparation	3	Center for Proteomics
E3 (2h). Validation Technique for Selected Developed Antibodies - Immunohistochemistry	2	Center for Proteomics
E2b (2h). Validation Technique for Selected Developed Antibodies - Flow Cytometry-analysis	2	Center for Proteomics
E1 (2h) ELISA sample preparation	2	Center for Proteomics

SEMINARS (TOPIC)	Number of hours	Location
Seminars (4+1 hours): Results Presentation, 4 h Online Sessions & 1 h In-person	5	Center for Proteomics ONLINE

EXAM DATES (final exam):

1.	16.12.2024.
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