Faculty of Medicine in Rijeka

Curriculum
2026/2027

For course

Local Anesthetics and Immune System

Study program:	**Medical Studies in English (R)** (elective) University integrated undergraduate and graduate study
Department:	**Department of Physiology, Immunology and Pathophysiology**
Course coordinator:	**izv.prof. dr. sc. Župčić Miroslav, dr. med.**
Year of study:	**3**
ECTS:	**1.5**
Incentive ECTS:	**0 (0.00%)**
Foreign language:	**Possibility of teaching in a foreign language**

Course information:

1. *Course objectives*

The immune system includes specific and non-specific immunity. The inherited immune response is a nonspecific immune defense present at birth. It is the first line of defense and refers to the protective mechanisms that are present even before the infection. Its main components are epithelial membranes (which block pathogenic inputs), phagocytic cells (neutrophils and macrophages), dendritic cells, killer (NK) cells, and several plasma proteins, including the complement system. The most important cellular reaction of innate immunity is inflammation - a process mediated by dendritic and NK cells, whereby phagocytic cells are recruited and activated to remove the intruder. Adaptive immunity, also called specific or acquired immunity, consists of mechanisms that have been created by recognizing specific pathogen antigens. The specific immune system is mediated primarily by lymphocytes and its function can be classified into two types: humoral immunity, mediated by B lymphocytes and their antibodies and cellular immunity, mediated mainly by T lymphocytes and their cytokines, which play an important role in immune cell activation, regulation and communication. Local anesthetics are substances which by reversible effect prevent the membrane depolarization by blocking the flow of sodium (Na +) ions while not influencing too much potassium (K +) ions. Therefore, the longer the frequency of stimulation, the greater the possibility of binding local anesthetic to the ion channel inside and its inactivation. They affect all the tissues but have a special affinity for nervous tissue. In order to understand well the effects of local anesthetics' metabolic activity, we will clarify their pharmacodynamic and pharmacokinetic activity. We will try to explain how local anesthetics (intravenous, topical, infiltrative, regional) affect the number and activity of immune cells (NK cells, T lymphocytes, leukocytes, etc.) in the body. The aim is also to investigate the effect of local anesthetics on neurotransmitters and other systemic opioid and neopioid analgesics.

- General competencies :.
  To know general principles of local anesthetics on cellular and humoral immune response
- Specific competencies:

At the end of the course, the student is expected to be able to: independently analyze the effect of local anesthetics on the immune response, to see ways in which local anesthetics can be applied, and the influence of local anesthetics on individual organic systems To develop students' self-expanding knowledge through a database search (PubMed and Ovid) and the otheraddresses on the Internet, and for transferring new knowledge to other members of the group (presentation of the treated area). Encourage studentsto group work, discussion about the given topicand to draw conclusions based on presented facts.

Course content ;

- Local anesthetics and clinical pharmacology
- Types of local anesthetics
- The effect of local anesthetics on signal transmission
- Local anesthetic application methods
- The influence of the technique of application at the plasma concentration of local anesthetics
- Non-pharmacological factors that affect the activity of local anesthetics
- Changes in innate immunity caused by local anesthetics
- Changes in acquired immunity caused by local anesthetics
- The effect of local anesthetics on the immune system in various pathological conditions
- Influence of inflammatory tissue on the action of local anesthetics
- Side effects of local anesthetics

Student's obligations :

Regular attendance to lectures and seminars and exercises. Preparation of course material to be discussed during seminars

Assessment and evaluation of student's work during classes and on final exam:

Evaluation will be performed according to the Legal act of evaluation of University of Rijeka and of School of medicine.

Students' performance will be evaluated thorugh entire duration of the course (70% of the evaluation) as well as on the final exam (30% of the evaluation).

Literature:

1. Abbas Abul K., Lichtman Andrew H., Pillai S. Stanična i molekularna imunologija (skupina prevoditelja, ur. hrv. izdanja prof. dr. sc. Drago Batinić i doc. dr. sc. Vesna Lukinović-Škudar). 8. Izdanje, Medicinska naklada Zagreb 2017.

2. Andreis i suradnici. Imunologija, Medicinska naklada, Zagreb, 2010.

3. B. Katzung: Bazična i klinička farmakologija, 11. izdanje, McGraw Hill, New York, 2011.

4. Jukić M, Husedžinović I, Kvolik S, Kogler Majerić V, Perić M, Žunić J. Klinička anesteziologija. Medicinska naklada Zagreb, drugo, dopunjeno i izmjenjeno izdanje, Zagreb, 2013.

5. Medicinska fiziologija, A. C. Guyton i J. E. Hall, Medicinska naklada Zagreb, trinaesto izdanje, 2017.

6. Delves PJ. Martin SJ, Burton DR, Roitt IM, Roitt's Essential Immunology, 13th edition. Wiley-Blackwell, 2017.

7. Murphy K., Weaver C. Janeway's Immunobiology, 9th edition. New York: Garland Publishing; 2016.

8. Rang HP, Dale MM, Ritter JM, Moore PK. FARMAKOLOGIJA, 5.izdanje,Churchill Livingstone, London, 2003.

9. Hadzic A, Carrera A,editors.Hadzic's peripheral nerve blocks and anatomy for ultrasound – guided regional anesthesia. 2 nd ed. New York: McGraw – Hill,2012.

All content not covered by mandatory literature will be published on the course website.

List of assigned reading:

Abbas Abul K., Lichtman Andrew H., Pillai S. Stanična i molekularna imunologija (skupina prevoditelja, ur. hrv. izdanja prof. dr. sc. Drago Batinić i doc. dr. sc. Vesna Lukinović-Škudar). 8. Izdanje, Medicinska naklada Zagreb 2017.
Andreis i suradnici. Imunologija, Medicinska naklada, Zagreb, 2010.
B. Katzung: Bazična i klinička farmakologija, 11. izdanje, McGraw Hill, New York, 2011.

List of optional reading:

Supplementary literature (at the time of submitting the study programme proposal)

Jukić M, Husedžinović I, Kvolik S, Kogler Majerić V, Perić M, Žunić J. Klinička anesteziologija. Medicinska naklada Zagreb, drugo, dopunjeno i izmjenjeno izdanje, Zagreb, 2013.
Medicinska fiziologija, A. C. Guyton i J. E. Hall, Medicinska naklada Zagreb, trinaesto izdanje, 2017.
Delves PJ. Martin SJ, Burton DR, Roitt IM, Roitt's Essential Immunology, 13th edition. Wiley-Blackwell, 2017.
Murphy K., Weaver C. Janeway's Immunobiology, 9th edition. New York: Garland Publishing; 2016.
Rang HP, Dale MM, Ritter JM, Moore PK. FARMAKOLOGIJA, 5.izdanje,Churchill Livingstone, London, 2003.
Hadzic A, Carrera A,editors.Hadzic's peripheral nerve blocks and anatomy for ultrasound – guided regional anesthesia. 2 nd ed. New York: McGraw – Hill,2012.

Svi sadržaji koji nisu obuhvaćeni obveznom literaturom biti će objavljeni na Internet stranici kolegija.

Curriculum:

Lectures list (with titles and explanation):

Local anesthetics and the immune system (literature review)

General competences:

Know the general principles of action of local anesthetics on the cellular and humoral immune response

Specific competences:

Training the student to independently expand knowledge by searching databases (PubMed or Ovid) and other addresses on the Internet, and to transfer new knowledge to other members of the group (presentation of the covered area). Encourage the student to work in groups, discuss the given topic, and draw conclusions based on the facts presented.

The influence of different anesthesia techniques on the immune response (literature review)

After the lecture, students will be able to:
Independently analyze how the use of general anesthetics and morphine suppresses cellular and humoral immunity
Observe how regional analgesia is superior to other analgesic methods and reduces the amount of postoperative bleeding
Observe the immunosuppressive effects of regional anesthesia and analgesia versus the effects of intravenous opioids or general anesthesia

Types of local anesthetics

After the lecture, students will be able to:
Independently analyze the difference between individual groups of local anesthetics
Learn how to apply different types of local anesthetics
To see the advantages of using certain local anesthetics

The influence of local anesthetics on innate and acquired immunity

After the lecture, students will be able to:
Independently analyze how the use of local anesthetics affects cellular and humoral immunity
Observe how regional anesthesia and analgesia in everyday practice affects certain parts of the immune system
Observe the immunomodulating effects of regional anesthesia and analgesia versus general inhalation anesthesia

Seminars list (with titles and explanation):

Local anesthetics, pharmacokinetics and toxicity

After the lecture, students will be able to:
Independently analyze the characteristics of local anesthetics
To observe the pharmacokinetic factors of nerve blockade in regional anesthesia
To analyze the systemic toxicity of local anesthetics

The influence of the application technique on the level of plasma concentration of local anesthetics

After the mentioned seminar, the student will be able to

Independently analyze the influence of local anesthetics depending on the place of application on plasma concentrations,

Observe the rules in which local anesthetics can be applied,

Learn how local anesthetics are distributed after administration

Non-pharmacological factors affecting the activity of local anesthetics

After the mentioned seminar, the student will be able to

Independently analyze the influence of various factors on the activity of local anesthetics,

Recognize different conditions that lead to an atypical response to local anesthetics,

Learn how the physical condition of the patient affects the action of local anesthetics

Student obligations:

Regular class attendance, writing a term paper.

Exam (exam taking, description of the written/oral/practical part of the exam, point distribution, grading criteria):

Student assessment is conducted in accordance with the University of Rijeka's valid Regulations on Studies and the Regulations on Student Assessment at the Faculty of Medicine in Rijeka (adopted by the Faculty Council).
Student performance in a course is evaluated and graded both during the teaching period and via a final exam. The student's overall performance during the teaching period accounts for up to 70% of the grade, while the final exam accounts for 30%.

Other notes (related to the course) important for students:

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COURSE HOURS 2026/2027

Local Anesthetics and Immune System

Lectures (Place and time or group)	**Seminars** (Place and time or group)

List of lectures, seminars and practicals:

LECTURES (TOPIC)	Number of hours	Location
Local anesthetics and the immune system (literature review)	4	
The influence of different anesthesia techniques on the immune response (literature review)	5	
Types of local anesthetics	3	
The influence of local anesthetics on innate and acquired immunity	3	

SEMINARS (TOPIC)	Number of hours	Location
Local anesthetics, pharmacokinetics and toxicity	4	
The influence of the application technique on the level of plasma concentration of local anesthetics	3	
Non-pharmacological factors affecting the activity of local anesthetics	3	

EXAM DATES (final exam):