[Medicinski fakultet u Rijeci]

Curriculum
2023/2024

[Za kolegij]

Epigenetics in Health and Disease

Study program:	**Medical Studies in English (R)** (elective) [Sveučilišni integrirani prijediplomski i diplomski studij]
Department:	**[Katedra za medicinsku biologiju i genetiku]**
Course coordinator:	**izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing.**
Year of study:	**3**
ECTS:	**1.5**
Incentive ECTS:	**0 (0.00%)**
Foreign language:	**Possibility of teaching in a foreign language**

Course information:

Epigenetics in Health and Disease is an elective course conducted in the 3rd year of the Integrated undergraduate and graduate university study of Medicine in English. It consists of 5 hours of lectures and 20 hours of seminars.

The aim of the course is to describe and explain the fundamental principles of epigenetics (the mechanisms of epigenetic regulation and the role of the epigenome in the development of various diseases and disorders) through the critical evaluation and discussion of current scientific articles in the form of Journal Club meetings.

Course content:
To achieve the planned learning outcomes, course classes are organized into lectures and seminars:
LECTURES:
L1 Introduction to epigenetics: basic concept and historical development. The relationship between the genome and the epigenome.
L2 Mechanisms of epigenetic modifications: DNA methylation, histone modifications, chromatin remodeling, non-coding RNA molecules.
L3 Inheritance of epigenetic information: inheritance of DNA methylation pattern, inheritance of histone tags, chromatin replication.
L4 Epigenetic control of gene expression. Experimental approaches to epigenome research.
L5 Genomic imprinting disorders. Epigenome changes in health and disease.
SEMINARS:
S1 Introductory seminar: Instructions for using academic research databases. Selection of the scientific research for presentation. Topics assignment.
S2 Journal Club topic 1: The impact of aging on the epigenome
S3 Journal Club topic 2: The impact of environmental factors on the epigenome
S4 Journal Club topic 3: Epigenetics and the development of diseases and disorders
S5 Journal Club topic 4: Epigenetics and disease prevention and treatment

Course learning outcomes:
The approach to teaching is based on learning outcomes that determine what students will be able to do after they have completed all study work and requirements for the course.
I. COGNITIVE DOMAIN – KNOWLEDGE
1. Describe and explain the structure of epigenome, including DNA methylation, histone modifications, chromatin remodelling, and noncoding RNA molecules
2. Describe and explain the function of the epigenome, including the regulation of gene transcription and its connection to the genome
3. Describe the basic epigenetic principles and the role of epigenetic variations in health and disease
4. Give examples of medical conditions and diseases caused by changes in the epigenome
5. Assess the applicability of epigenomics to the diagnosis, treatment, or follow-up of disease
6. Compare different methods of epigenome research in the context of human health and disease
7. Connect previously acquired knowledge from cell biology, genetics and molecular biology and apply it to the level of the genome of the whole organism.
II. PSYCHOMOTORIC DOMAIN - SKILLS
1. Independently search available literature databases (PubMed, Scopus, Web of Science, ScienceDirect)
2. Present the results of the conducted epigenetic research in written and oral form according to structured questions
3. Critically assess the impact of aging and environmental factors on epigenome variability
4. Critically evaluate the role of epigenome in the prevention and/or treatment of diseases and disorders
5. Actively discuss and critically comment on conducted research of the epigenome role in the context of human health and disease
6. Argue the advantages and disadvantages of existing epigenome research in the context of human health and disease

Teaching:
Teaching is conducted in the form of **lectures and seminars** according to the "flipped classroom" principle, in which students learn new content independently by going through and solving prepared materials asynchronously in an online environment in order to then apply the acquired knowledge in more active forms of on-site teaching.
All lectures are prepared in the form of interactive video materials or lessons that are uploaded to the Merlin e-learning system for students to access at a time that suits them.
All seminars, with the exception of the introductory seminar, are conducted in the form of Journal Club. Each seminar includes an asynchronous online preparation and an on-site session.
In the introductory seminar, students will be divided into 4 teams, each focusing on one of the Journal Club topics (The impact of aging on the epigenome, The impact of environmental factors on the epigenome, Epigenetics and the development of diseases and disorders, and Epigenetics and disease prevention and treatment). The students within the team work together to choose a specific issue to be addressed at the Journal Club seminar (e.g. DNA methylation changes in breast cancer), which they then present to the rest of the group. The other students then each ask a question about the stated issue, which the

team will try to answer when presenting their work in the Journal Club seminars (S2-S5).
In the S2-S5 seminars, each student presents an independently selected scientific article that deals with the seminar topic and the chosen issue and on the basis of which they can provide answers to some of the questions. All students actively participate in the discussion of the research presented.
The conduction of the S2-S5 seminar includes:
1. Independent search for available scientific articles on a given topic and reasoned selection of the article.
2. Preparation of a PowerPoint presentation of the selected research with a clear presentation of the aims, results and conclusions.
3. Oral presentation of the selected research.
4. Peer review of colleagues' oral presentations.
4. Group discussion on the topic presented.

List of assigned reading:

1. Worksheets that will be handed out to students during the course

List of optional reading:

2. Epigenetic influence and disease [Internet]. Nature Education; c2014. [cited 2020 Jul 10]. Available from: https://www.nature.com/scitable/topicpage/epigenetic-influences-and-disease-895/
3. Learn.Genetics [Internet]. Genetic Science Learning Center; University of Utah; c2020. [cited 2020 Jul 10]. Available from: https://learn.genetics.utah.edu/content/epigenetics/
4. Bitesize Bio [Internet]. Science Squared; c2020. A Crash Course in Epigenetics Part 1-Part4. 2012 Jun [cited 2020 Jul 10]. Available from: https://bitesizebio.com/8807/a-crash-course-in-epigenetics-part-1-an-intro-to-epigenetics/

Curriculum:

[Predavanja] list (with titles and explanation):

Lecture 1. Introduction to epigenetics: basic concept and historical development. The relationship between the genome and the epigenome.

• define the epigenome
• describe and explain the structure of the epigenome
• explain the differences between the genome and the epigenome

Lecture 2. Mechanisms of epigenetic modifications: DNA methylation, histone modifications, chromatin remodeling, non-coding RNA molecules.

• list the mechanisms of epigenetic modifications
• distinguish between mechanisms of epigenetic modifications
• describe and explain individual mechanisms of epigenetic modifications

Lecture 3. Inheritance of epigenetic information: inheritance of DNA methylation pattern, inheritance of histone tags, chromatin replication.

• distinguish the mechanisms of inheritance of epigenetic information
• describe and explain the mechanisms of inheritance of epigenetic information

Lecture 4. Epigenetic control of gene expression. Experimental approaches to epigenome research.

• describe and explain the function of the epigenome in the context of the regulation of gene expression
• describe ways of controlling gene expression by epigenetic mechanisms
• differentiate between experimental approaches to epigenome research

Lecture 5. Genomic imprinting disorders. Epigenome changes in health and disease.

• describe the role of epigenetic variations in health and disease
• give examples of medical conditions and diseases caused by changes in the epigenome

[Seminari] list (with titles and explanation):

Seminar 1. Introductory seminar: Instructions for using academic research databases. Selection of the scientific research for presentation. Topics assignment.

• independently search literature databases (PubMed, Scopus, Web of Science, ScienceDirect...)
• evaluate the applicability of epigenomics to the diagnosis, treatment or monitoring of diseases
• compare different epigenome research methods in the context of human health and disease

Seminar 2. Journal Club topic 1: The impact of aging on the epigenome

• present the results of epigenetic research in written and oral form, according to structured questions
• critically assess the impact of aging on epigenome variability
• actively discuss and critically comment on research conducted on the impact of aging on the epigenome
• argue the advantages and disadvantages of the conducted research on the impact of aging on the epigenome

Seminar 3. Journal Club topic 2: The impact of environmental factors on the epigenome

• present the results of epigenetic research in written and oral form, according to structured questions
• critically assess the impact of environmental factors on epigenome variability
• actively discuss and critically comment on research conducted on the impact of environmental factors on the epigenome
• argue the advantages and disadvantages of the conducted research on the impact of environmental factors on the epigenome

Seminar 4. Journal Club topic 3: Epigenetics and the development of diseases and disorders

• present the results of epigenetic research in written and oral form, according to structured questions
• critically assess the role of the epigenome in the development of diseases and disorders

• actively discuss and critically comment on research conducted on the role of the epigenome in the development of diseases and disorders
• argue the advantages and disadvantages of the conducted research on the role of the epigenome in the development of diseases and disorders

Seminar 5. Journal Club topic 4: Epigenetics and disease prevention and treatment

• present the results of epigenetic research in written and oral form, according to structured questions
• critically assess the role of the epigenome in the disease prevention and treatment
• actively discuss and critically comment on research conducted on the role of the epigenome in the disease prevention and treatment
• argue the advantages and disadvantages of the conducted research on the role of the epigenome in the disease prevention and treatment

Student obligations:

Students are required to attend class regularly, prepare for classes and actively participate in classes. All information about the course as well as teaching materials will be available in the Merlin e-learning system. Students are obliged to regularly check the said platform for all relevant information or changes in the INP.

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

Evaluation of students is carried out according to the current University of Rijeka Study Regulations and the Ordinance on Student Assessment and Evaluation at the Faculty of Medicine in Rijeka (adopted by the Faculty Council of the Faculty of Medicine in Rijeka). Students are evaluated according to the ECTS (%/A-F) and numerical grading system (1–5).

Students' work will be assessed and evaluated during the course and on the final exam. Out of a total of 100 grade points, the student can obtain 70 points during classes and 30 points on the final exam.

During the course, the knowledge acquired in the lectures as well as the preparation and assignments related to the Journal Club seminars will be assessed. The knowledge acquired in the lectures is assessed by an examination in the form of a **written test** with multiple-choice questions, where each correctly answered question is worth 1 grade point. The criterion for obtaining grade points is at least 50% of correctly answered questions, and the range of possible grade points is between 15 and 30. The test is administered via the Merlin platform. Passing the test is a prerequisite for participation in the Journal Club seminars.
Preparations and assignments related to the Journal Club seminars include selecting research for the Journal Club and preparing a structured PowerPoint presentation. T**he research selection for Journal Club** is worth a maximum of 20 grade points and involves completing the "Research Selection for the Journal Club" form and uploading it to Merlin by the specified deadline. **Preparing a PowerPoint presentation** for an oral presentation of the selected research for the Journal Club seminar is also worth a maximum of 20 grade points and includes creating a presentation according to the efined instructions and uploading the presentation to Merlin by the specified deadline.

The final exam can be taken by students who:
• have achieved at least 15 grade points (50% or more of the questions answered correctly) in the written test,
• have achieved at least 35 grade points (50% or more of the possible 70 grade points) through continuous assessment
• have justifiably missed less than 30% of classes.
The final exam involves an oral presentation of the selected research as a part of the Journal Club seminar. During the oral presentation, each student will be peer reviewed by their fellow students, who will complete the " **Peer Review** Form" after the presentation and assign a maximum of 25 grade points. The final grade for the oral presentation is calculated as the average of all peer review grades collected. In addition, at the end of each Journal Club seminar, a maximum of 5 grade points will be awarded for the **success of the Journal Club**, taking into account the answering and/or discussion of the questions posed in the introductory seminar.

The final grade of the course is determined according to the total sum of grade points achieved during classes and on the final exam:

Activity	Maximum grade points
Continuous assessment:	**70**
Written test	30
Research selection for the Journal Club	20
Preparation of a PowerPoint presentation	20
Final exam:	**30**
Peer review of the oral presentation	25
Success of the Journal Club	5
Total	100

Grading in the ECTS system is based on final success and is converted into the numerical grading system as follows:

% of obtained grade points	ECTS grade	Numerical grade
90 - 100	A	excellent (5)
75 - 89,9	B	very good (4)
60 - 74,9	C	good (3)
50 - 59,9	D	sufficient (2)
0 - 49,9	F	insufficient (1)

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

Academic integrity
The teachers are obligated to respect the University of Rijeka Code of Ethics, and the students are obligated to respect the University of Rijeka Code of Ethics for Students.
Availability of teaching content
All course materials are available on the Merlin e-learning platform.
Contacting teachers
Teachers are available every day during working hours via their e-mail addresses (available on the website of the Faculty of Medicine, University of Rijeka) for all questions regarding the course. Individual or group consultations are possible online via the MS Teams digital platform or onsite at the Faculty of Medicine.

COURSE HOURS 2023/2024

Epigenetics in Health and Disease

[Predavanja] (Place and time or group)	**[Seminari]** (Place and time or group)
17.01.2024	

Lecture 1. Introduction to epigenetics: basic concept and historical development. The relationship between the genome and the epigenome.:
• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (09:00 - 12:45) [330]
  ○ EIHAD
 	
Lecture 2. Mechanisms of epigenetic modifications: DNA methylation, histone modifications, chromatin remodeling, non-coding RNA molecules.:
• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (09:00 - 12:45) [330]
  ○ EIHAD
 	
Lecture 3. Inheritance of epigenetic information: inheritance of DNA methylation pattern, inheritance of histone tags, chromatin replication.:
• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (09:00 - 12:45) [330]
  ○ EIHAD
 	
Lecture 4. Epigenetic control of gene expression. Experimental approaches to epigenome research.:
• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (09:00 - 12:45) [330]
  ○ EIHAD
 	
Lecture 5. Genomic imprinting disorders. Epigenome changes in health and disease.:
• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (09:00 - 12:45) [330]
  ○ EIHAD
	Seminar 1. Introductory seminar: Instructions for using academic research databases. Selection of the scientific research for presentation. Topics assignment.:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (13:00 - 13:45) [330]
	  ○ EIHAD

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]	
19.01.2024	
	Seminar 1. Introductory seminar: Instructions for using academic research databases. Selection of the scientific research for presentation. Topics assignment.: • [ONLINE] (17:00 - 19:15) [330] ○ EIHAD
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]	
24.01.2024	

	Seminar 2. Journal Club topic 1: The impact of aging on the epigenome:
	• [ONLINE] (08:00 - 12:30) [330]
	  ◦ EIHAD
	
	Seminar 3. Journal Club topic 2: The impact of environmental factors on the epigenome:
	• [ONLINE] (08:00 - 12:30) [330]
	  ◦ EIHAD
	
	Seminar 4. Journal Club topic 3: Epigenetics and the development of diseases and disorders:
	• [ONLINE] (08:00 - 12:30) [330]
	  ◦ EIHAD
	
	Seminar 5. Journal Club topic 4: Epigenetics and disease prevention and treatment:
	• [ONLINE] (08:00 - 12:30) [330]
	  ◦ EIHAD

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]	
25.01.2024	

	Seminar 2. Journal Club topic 1: The impact of aging on the epigenome:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD
	
	Seminar 3. Journal Club topic 2: The impact of environmental factors on the epigenome:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD
	
	Seminar 4. Journal Club topic 3: Epigenetics and the development of diseases and disorders:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD
	
	Seminar 5. Journal Club topic 4: Epigenetics and disease prevention and treatment:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]	
26.01.2024	

	Seminar 2. Journal Club topic 1: The impact of aging on the epigenome:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD
	
	Seminar 3. Journal Club topic 2: The impact of environmental factors on the epigenome:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD
	
	Seminar 4. Journal Club topic 3: Epigenetics and the development of diseases and disorders:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD
	
	Seminar 5. Journal Club topic 4: Epigenetics and disease prevention and treatment:
	• [Katedra za medicinsku biologiju i genetiku - Biblioteka] (08:00 - 11:45) [330]
	  ◦ EIHAD

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]	

List of lectures, seminars and practicals:

[PREDAVANJA] (TOPIC)	Number of hours	Location
Lecture 1. Introduction to epigenetics: basic concept and historical development. The relationship between the genome and the epigenome.	1	[Katedra za medicinsku biologiju i genetiku - Biblioteka]
Lecture 2. Mechanisms of epigenetic modifications: DNA methylation, histone modifications, chromatin remodeling, non-coding RNA molecules.	1	[Katedra za medicinsku biologiju i genetiku - Biblioteka]
Lecture 3. Inheritance of epigenetic information: inheritance of DNA methylation pattern, inheritance of histone tags, chromatin replication.	1	[Katedra za medicinsku biologiju i genetiku - Biblioteka]
Lecture 4. Epigenetic control of gene expression. Experimental approaches to epigenome research.	1	[Katedra za medicinsku biologiju i genetiku - Biblioteka]
Lecture 5. Genomic imprinting disorders. Epigenome changes in health and disease.	1	[Katedra za medicinsku biologiju i genetiku - Biblioteka]

[SEMINARI] (TOPIC)	Number of hours	Location
Seminar 1. Introductory seminar: Instructions for using academic research databases. Selection of the scientific research for presentation. Topics assignment.	5	[Katedra za medicinsku biologiju i genetiku - Biblioteka] [ONLINE]
Seminar 2. Journal Club topic 1: The impact of aging on the epigenome	5	[Katedra za medicinsku biologiju i genetiku - Biblioteka] [ONLINE]
Seminar 3. Journal Club topic 2: The impact of environmental factors on the epigenome	5	[Katedra za medicinsku biologiju i genetiku - Biblioteka] [ONLINE]
Seminar 4. Journal Club topic 3: Epigenetics and the development of diseases and disorders	5	[Katedra za medicinsku biologiju i genetiku - Biblioteka] [ONLINE]
Seminar 5. Journal Club topic 4: Epigenetics and disease prevention and treatment	5	[Katedra za medicinsku biologiju i genetiku - Biblioteka] [ONLINE]

EXAM DATES (final exam):