



Detaljni izvedbeni nastavni plan za izborni kolegij:
Biology of stem cells

Akadska godina: 2020/2021

Program: Biotechnology for the Life Sciences (1st year)
Medicinal chemistry (2nd year)
Max – 14 students

Course code: EBIL146

ECTS points: 3

Jezik na kojem se izvodi kolegij: hrvatski jezik

Language of the course: English

Teaching hours: 30 hours (14 lectures + 10 seminars + 7 practical work)
Online: **6 hours (20%)**

Pre-requisites for enrolment: Cell biology

Course leader and contact information:

Title and name: izv. prof. dr. sc. Antonija Jurak Begonja
Address: Department of Biotechnology, O-245, R. Matejčić 2, Rijeka
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Time period: February 1st – February 12th 2021

Teaching stuff:

izv. prof. dr. sc. Antonija Jurak Begonja (14 lectures + 10 seminars)

mag. biotech. Ivana Bertović (7 hours practical work)
mag. biotech. Ana Bura (7 hours practical work))

Required literature:



1. Students will be supplied with lecture presentations. All readings will be from primary research articles, review articles, selected book chapters.

2. Essentials of Stem Cell Biology, R. Lanza, Academic Press 2009.

Recommended additional literature: (optional):

1. Stem Book

www.stembook.org

2. NIH

<http://stemcells.nih.nih.gov/info/basics/basics1.asp>

Course description:

Stem cells have the unique characteristic that they can be regenerated or differentiated into other specialized cells. There are different types of stem cells such as embryonic stem cells or hematopoietic stem cells in the bone marrow where they produce blood cells.. The course consists of lectures followed by seminars based on original scientific papers presented by students. Students will be introduced to the basic functions of stem cells and to the potential use of stem cells in tissue repair and regeneration. Course topics will include basic stem cell concepts, stem cell research methodology, embryonic and adult stem cells, stem cell reprogramming, and potential clinical applications. Students will have the opportunity to learn about current developments in the field.

Learning outcomes:

By the end of the course, students will:

- be familiar with the basic terms in the stem cell biology
- understand basic processes of embryology
- understand the types of stem cells and how they are derived
- describe how a niche can regulate stem cells
- explain the specific characteristics of stem cells
- critically assess scientific experiments and ethical questions
- understand complex molecular, cellular, and genetic techniques used to investigate stem cell biology
- read and analyze the primary research literature
- understand key implications of stem cell research and ethical questions

General competencgained on the course:

A1, A2, A3, A6, A7, B1, B2, C1, C2, C3, C4.

Detailed course content:



A. *Lectures:*

1. (1) Introduction into stem cell biology:

- What are stem cell
- Totipotency, pluripotency and multipotency
- Classification and sources of stem cells

2. (1) Cellular differentiation:

- Transcription factors and DNA methylation
- Epigenetics
- Regulation and function of small RNAs in embryonic stem cells

3. Embryonic stem cells:

- Characteristics of embryonic stem cells
- Pluripotency of embryonic stem cells
- Genetic manipulation of embryonic stem cells

4. (1) Sources of embryonic stem cells

5. (3) Cell reprogramming:

- Transfection vectors
- Nuclear transfer
- Cell fusion
- Direct reprogramming - induced pluripotent cells

6. (1) Adult stem cells

- Biology of stem cell microenvironment (niches)
- Homing and migration of hematopoietic stem cells
- Microenvironment of neural stem cells
- Clinical use of stem cells

7. (1) Hematopoietic stem cells:

- Hematopoietic stem cell markers
- Renewal, differentiation, migration
- Sources of hematopoietic stem cells
- Development of hematopoietic cells in mouse and human embryos (primitive and definitive hematopoiesis)
- Transcription factors

8. (2) Development of erythrocytes and platelets:

- Molecular mechanisms of erythropoiesis
- Megakaryopoiesis and endomitosis
- Development of platelets from megakaryocytes
- Cytokines and transcription factors

9. (1) Mesenchymal stem cells:

- Identification and characterization of mesenchymal stem cells
- Development of bone cells
- Development of adipocytes



10. (1) Stem cells and aging

B. Seminars:

S1. (2) Cellular differentiation

S2. (1) Embryonic stem cells

S3. (3) Cell reprogramming

S4. (2) Hematopoietic stem cells

S5. (1) Megakaryopoiesis

C. Practical work

V1. (4) Isolation of cells from mouse bone marrow

V2. (3) Differentiation, isolation and analysis of primary megakaryocytes from the bone marrow culture

Requirements, methods of assessment and evaluation:

Students are required to attend classes, seminars and practical work are required.

Qualification and grades (according to Pravilniku o studijima Sveučilišta u Rijeci):

Assesment during the course (50%):

Student's activity - 5 %. Student commitment through work assignments, participation in discussions at lectures and seminar classes is assessed.

Practical work - 5 %. Participation in practical part, written report.

Knowledge tests (test) - 40 %. Continuous assessment is carried out through 3 short work assignments (WA) that are taken in writing.

Final exam - 50 %. Eligibility to approach the final exam will be based on scores achieved during the course (out of a maximum of 50%):

- Students scoring between 0 and 24.9% will not be allowed to approach the final exam
- Students scoring between 25% and 50% will be allowed to approach the final exam

The final exam is taken in writing, and contains 20 questions that are scored individually. If no points are earned, the exam will be graded FX.

Examination deadlines:

1. The final exam will be **12.02.2021. u 12:00 u O-269**
2. The final exam, second round (for those who need to retake the test) will be **15.7.2021.**
3. Additional final exams (maximum two more) will be by arrangement between the students and teacher.



Final grades

The following grades will be awarded based on the final score:

Percentage score	ECTS grade	Numerical grade
90% do 100%	A	Excellent (5)
75% do 89,9%	B	Very good (4)
60% do 74,9%	C	Good (3)
50% do 59,9%	D	Satisfactory (2)
0% do 49,9%	F	Unsatisfactory (1)

The final grade is based on the sum of percentage points accumulated during the course and on the final exam. Passing grades are excellent (5), very good (4), good (3) and satisfactory (2).

To complete the course students must attain a passing mark for the entire course (50% or higher) as well as achieving at least 25% of the 50% available on the final exam.

Additional information:

Academic integrity

Students are required to respect the principles of academic integrity, and refer to the documents: Ethical rules of the University of Rijeka and Ethical rules for students.

Schedule of classes:

Week 1					
Date	Group	Time	Room	Activity	Teacher
01.02.2021.	all	12-13:30	O-269	P1 (1) Introduction P2 (1) Cellular differentiation	Antonija Jurak Begonja
01.02.2021.	all	13:35-15:05	O-269	P3 (2) Embryonic stem cells	Antonija Jurak Begonja
02.02.2021.	all	12-13:30	O-269	S1 (1) Cellular differentiation - WAI	Antonija Jurak Begonja



02.02.2021.	all	13:35-14:20	O-269	P4 (1) Sources of embryonic stem cells P5 (1) Cell reprogramming (Transfection vectors)	Antonija Jurak Begonja
03.02.2021.	all	12-13:30	online	P6 (1) Adult stem cells P7 (1) Hematopoiesis	Antonija Jurak Begonja
03.02.2021.	all	13:35-14:20	online	P8 (1) Megakaryopoiesis	Antonija Jurak Begonja
04.02.2021.	1	9 - 12 h	O-352	V1 (4)	Ivana Bertović
04.02.2021.	2	13-16 h	O-352	V1(4)	Ana Bura
05.02.2021.	all	12-13:30	O-269	S2 (1) Embryonic stem cells - WA 2 S1 (1) Reflection on WA 1	Antonija Jurak Begonja
05.02.2021.	all	13:35-15:05	O-269	P5 (2) Cellular reprogramming	Antonija Jurak Begonja
Week 2					
08.02.2021.	1	9 – 11:30 h	O-352	V2 (3)	Ivana Bertović
08.02.2021.	all	12:00-13:00	O-269	S3 (1) Cellular reprogramming – WA 3 S2 Reflection on WA 2	Antonija Jurak Begonja
08.02.2021.	2	13-15:30 h	O-352	V2 (3)	Ana Bura
09.02.2021.	all	12-12:45	online	P10 (1) Mesenchymal stem cells	Antonija Jurak Begonja
09.02.2021.	all	13:35-15:05	online	S4 (2) Hematopoetic stem cells	Antonija Jurak Begonja
10.02.2021.	all	12-12:45	O-269	P11 (1) Stem cells and aging	Antonija Jurak Begonja
10.02.2021.	all	12:45-13:30	O-269	S3 (1) Reflection on WA 3	Antonija Jurak Begonja



10.02.2021.	all	13:35- 14:20	O-269	S5 (1) Megakaryopoiesis	Antonija Jurak Begonja
11.02.2021.	all	12:00- 13:30	O-269	S3 (2) Cellular reprogramming	Antonija Jurak Begonja
12.02.2021.	all	12:00- 13:00	O-268	Final exam	Antonija Jurak Begonja