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FORM I. DESCRIPTION OF THE STUDY PROGRAMME

GENERAL INFORMATION	
1. *Name of the study programme*	Doctoral School of Biomedicine and Health
2. *Provider of the study programme*	University of Rijeka, Faculty of Medicine
3. *Institution implementing the study programme*	University of Rijeka, Faculty of Medicine
4. *Scientific/artistic area of the study programme*	Biomedicine and health
5. *Type of the study programme*	University
6. *Level of the study programme*	Doctoral study
7. *Duration of the study programme (indicate whether there is a possibility of studying on a part-time basis - part-time study, distance learning)*	All study programmes of the Doctoral School last 3 years
8. *ECTS credits – minimum number of credits required for the completion of the study programme*	180 ECTS credits
9. *Academic /vocational title awarded upon completion of the study programme*	Doctor of Science in the area of biomedicine and health (PhD)
10. *Name and code of the qualification in the CROQF Register for which the study programme meets the requirement of minimum common learning outcomes (if applicable)*[1]	

11. *Reasons for starting the study programme*[3]
11.1 *Demands of the labour market* YES *(yes/no)*
11.1.1. *Name and code of the occupational standard in CROQF for which the study programme provides education (if applicable)*
Name and code are not applicable.
11.1.2. *Assessment of usefulness in relation to the demands of the labour market in the public and private sector (usefulness of the study programme in relation to strategic goals and selected labour market indicators, compatibility with the requirements of professional associations)*[4]

[1] Registration in accordance with the Request for verification of programme compatibility – Article 34 of the Ordinance on CROQF Register (Official Gazette of the Republic of Croatia, 62, 2014).
[3] The usefulness of the study programme is shown in relation to the role of the qualification acquired upon completion of the study programme; it is possible to choose one or more reasons (demands of the labour market, a continuation of education, other individual and societal needs).
[4] The usefulness of the study programme in relation to strategic goals may be corroborated by relevant sector strategies and other strategically relevant documents. Usefulness in relation to selected labour market indicators may be corroborated by the analysis of current and previous supply and demand, that is, by the projection of supply and demand for certain qualification in the future (grounds for expertise can be downloaded from CROQF Portal).

Shaping high-quality doctors of science within the Doctoral School study programmes (*Biomedicine, Health and Environmental Engineering, Public Health, Clinical Medicine, Dental Medicine*) is a basic prerequisite for the regeneration of the scientific-teaching staff and the development of the Faculty of Medicine, University of Rijeka, but also for the development of medicine in the wider region. Without the development of quality biomedical staff and constant strengthening of the research potential, the future of the highly differentiated medicine and the stability of the Faculty of Medicine in Rijeka becomes questionable when taking into consideration the nearby academic medical centres (Zagreb, Ljubljana, Maribor, Trieste, Udine, and Graz). On the other hand, the need for sustainable development of the ecologically sensitive Primorje-Gorski Kotar County and the wider region, where industrial development and tourism are intertwined, requires experts in the field of public health and ecology. Every human activity influences the environment, either directly by harmful effects or indirectly by creating harmful products that are harmful to the environment. Also, changing the environment and the population's habits has an impact on public health and the epidemiology of various diseases. The *Health and Environmental Engineering* and *Public Health* study programmes would produce interdisciplinary scientific research staff capable of offering the solutions necessary for sustainable development and public health prosperity in the region. These experts would be trained to work in the healthcare system, with a particular focus on protecting the population from negative environmental impacts, developing health care and rehabilitation, health tourism, protecting the environment from the potentially negative impacts of human activity and improving the quality of the environment. The *Biomedicine* study programme is designed for the development of scientific research staff and is intended for basic research in medicine. The *Clinical Medicine* study programme is designed for the research needs of the departments and/or clinics of the teaching hospitals of the Faculty of Medicine, and the study programme in *Dental Medicine* is designed for departments' specific research needs within the Clinic for Dental Medicine of the Clinical Hospital Centre Rijeka.

We should also be aware of the brain drain of high-quality graduates, doctors of science and professors from the Faculty of Medicine, which inevitably started after Croatia had joined the EU. The current number and the quality of the doctors of science do not meet the current needs of the Faculty of Medicine, i.e., overall health care in this region, especially considering the biomedicine development plans at the University of Rijeka that are outlined in the University of Rijeka Strategy, the Strategic Development Plan of the Faculty of Medicine and the Science Strategic Plan of the Faculty of Medicine in Rijeka 2016–2020. The development of the Centre for Research in Translational Medicine – TransMedRi, future university hospital and biotechnology companies supported by the University (StepRi Science and Technology Park), existing pharmaceutical companies (Jadran Galenic Laboratory) and health tourism (Thalassotherapia Opatija, Istria Health Spa Resort, etc.) puts great demands on the quality scientific and research staff, which can be achieved thanks to the proposed reorganisation of doctoral study programmes with the aim of raising the quality of scientific doctoral education. The production of high-quality staff and a healthcare complex at the University of Rijeka, where the main backbone is the Faculty of Medicine, the Clinical Hospital Centre Rijeka and the aforementioned institutions, is also aimed at developing the healthcare industry as a new promoter of the economic development in the region, as outlined in the Development Strategy of the Healthcare Industry of the Primorje-Gorski Kotar County 2013–2020 and in line with the Smart Specialization Strategy (S3) of the Republic of Croatia 2016–2020, especially with the priority thematic field *Health and Life Quality*. The programme of the Doctoral School is in line with the requirements of the Croatian Medical Association, the Croatian Medical Chamber, the Croatian Dental Chamber, the Croatian Dental Society, the Croatian Association for Environmental and Public Health, the Croatian Microbiological Society, the Croatian Immunological Society, the Croatian Society of Chemical Engineers, the Croatian Chemical Society and the Croatian Society for Biochemistry and Molecular Biology.

11.2 Continuation of education NO *(yes/no)*

11.2.1. Names of qualifications of higher level which can be obtained by a continuation of education (names and codes of qualifications standards in the CROQF Register, if applicable)

The doctoral study is the highest level of education in the higher education system, so continuation of studies is not possible. However, further postgraduate scientific training, especially in research centres abroad, is necessary

so that doctors of science can acquire experience in conducting independent research and mentoring PhD students and conduct research in new scientific areas.

11.3 Other individual or societal needs YES *(yes/no)*

11.3.1. Explain how the study programme contributes to meeting other societal and individual needs, increases welfare and leads to benefits that are not only based on profit, and how it contributes to personal development, freedom, independence, and creativity of the individual.

The proposed Doctoral School programme encourages critical thinking and problem-solving, collecting and analysing relevant information and analytical approach, which makes the candidate more competent and competitive in society. The purpose of this programme is to produce creative and free-thought future scientists who will encourage scientific reasoning in their surroundings.

11.3.2. Relationship with the local community (economy, entrepreneurship, civil society, etc.)

The precondition for the development of medicine is the development of basic, clinical and translational biomedical research and biotechnology. This contributes to the building of new knowledge and technological solutions that contribute significantly to the development of the biomedical profession and that can be used as protected intellectual property in the development of specific forms of entrepreneurship in medicine (developing new treatment methods, starting smaller biotechnology and pharmaceutical companies). All this contributes to the local community development, on the one hand by improving the population's health using different medical procedures and on the other hand by strengthening entrepreneurship in the field of biomedicine based on new knowledge and biotechnological innovations. In addition, the wider region of Rijeka, whose development is mostly based on the maritime sector and tourism, requires the quality development of medical procedures as an important export product (health tourism) that can contribute to the improvement of the current national and private capacities in that segment.
Partnership with the industry and the business sector is an especially important segment of doctoral training. The Doctoral School programme offers a compulsory training course on entrepreneurship in biomedicine. The training should enable PhD students, besides science education in a specialised field, to better understand and implement new technologies for economic development in the public and private sectors. Therefore, we expect the PhD students will acquire competencies that will enable them to participate in public projects important to the wider community.

11.4 Name potential partners outside the higher education system that expressed interest in the study programme

The goal of the Doctoral School is to produce doctors of science capable of conducting independent scientific and developmental research, which will result in new knowledge and values. Accordingly, we expect that this type of doctoral education will primarily be of interest to pharmaceutical (e.g., Jadran Galenic Laboratory, Pliva, Belupo, etc.) and biotechnological companies, private and state healthcare institutions, scientific institutes, higher education institutions such as faculties and university departments in the field of biomedicine and health and local community organisations responsible for the development of biomedicine and health (Primorje-Gorski Kotar County and other neighbouring counties, the City of Rijeka, the City of Opatija, etc.).

12. Comparability of the study programme with similar programmes of accredited higher education institutions in the Republic of Croatia and the EU (name two programmes, of which at least one is from an EU country, that are comparable with the proposed study programme and provide their web addresses)

The Doctoral School study programme is predominantly based on the experiences and doctoral programmes of the **Spemann Graduate School of Biology and Medicine (SGBM) of the University in Freiburg, Germany** (http://www.sgbm.uni-freiburg.de/).
This institution's doctoral study programme is based on the following components: selection of mentors as active and successful scientists, selection of PhD candidates after their interest expressed in a particular topic/mentor and after interaction with the potential mentor (interview), relatively small scope of classes (20 ECTS credits) that are oriented on acquiring general competencies ("generic skills") and a focussed scientific training in certain

research fields that is organised through several elective courses, as well as the monitoring of PhD students and their progress throughout the study. The proposed programme of our Doctoral School follows the principle of selecting mentors and PhD candidates upon enrolment in the SGBM doctoral programme, adjusting it to our system and current scientific and financial situation. Likewise, in accordance with the SGBM programme, classes are reduced to the smallest extent possible (30 ECTS credits in accordance with the regulations of the University of Rijeka), and a system has been developed for monitoring PhD students during their doctoral studies.
In addition, the Doctoral School programme is also based on several other doctoral study programmes such as **Life Science Graduate School in Zurich, ETH Zurich and the Universities of Zurich, Switzerland** (http://www.lifescience-graduateschool.uzh.ch/en.html), whose study programmes served as the basis for creating the study programmes for our Doctoral School, **The European Molecular Biology Laboratories (EMBL)** programme, which also partly served as a model for creating the procedure for selecting PhD candidates upon enrolment in the Doctoral School (https://www.embl.de/training/eipp/mission/index.html), but also based on the common standards for doctoral education in biomedicine and health (http://www.orpheus-med.org/) set up by the **Organization of PhD Education in Biomedicine and Health Sciences in the European System (ORPHEUS)**, **the Association of Medical Schools in Europe (AMSE)** and **the World Federation for Medical Education (WFME).**
All the aforementioned programmes imply a special procedure for selecting mentors and candidates similar to the one planned in this study programme, based on which the enrolment quota is adjusted to the actual research capacities of the institutions. There are certain differences in the methodology of selecting mentors and general research topics, and these differences arise from the fact that our criteria of scientific excellence are relatively low, the funding of scientific research is often insufficient and irregular and PhD students are often not paid by the university or directly paid from projects but are financed through other sources (employees of the CHC in Rijeka and other healthcare institutions, employees of the Faculty, etc.). These factors were all taken into account to create a relatively flexible system that nevertheless respects the excellence principle based on the aforementioned study programmes. The aforementioned doctoral study programmes have a relatively small number of classes (from 12 to 30 ECTS credits), with an emphasis on quality selection and continuous monitoring and evaluation of PhD students in the laboratory or other research units. This is precisely what we want to change with the Doctoral School programme compared with the previous doctoral study programmes (*Biomedicine* and *Health and Environmental Engineering*), which is reflected through a different system of evaluating and selecting mentors and PhD candidates, reducing classes to 30 ECTS credits (from current 60), which should be almost exclusively scientifically oriented, establishing a teaching quality control system and objective continuous monitoring of PhD thesis in the making. Following the example of the aforementioned doctoral study programmes, flexibility is planned regarding the selection of courses and other activities, which enables the adjustment of teaching to the PhD student's research field, as well as multidisciplinarity and interdisciplinarity of the study programme. The duration of the aforementioned study programmes is 3–4 years with the possibility of extending it up to 6 years, which is similar to our proposal for the Doctoral School programme (3 + 3 years).

13. Comparability with the University of Rijeka mission and strategy, as well as with the mission and strategy of the proposer of the study programme

The study programmes of the proposed Doctoral School are in accordance with the Science Development Strategy of the Faculty of Medicine in Rijeka for the period 2016–2020. The scientific mission of the Faculty of Medicine in Rijeka is to provide the opportunity to acquire new and relevant knowledge based on the results of competitive scientific research and to improve the training of PhD students, future teachers, researchers and clinicians, that is, to contribute to the development of the wider community through the improvement of medical practice. The concept of the Doctoral school includes educational content based on scientific research and increases the opportunity for new research. The proposed five study programmes enable flexibility and multidisciplinarity of doctoral training tailored to the actual needs of PhD students, who should be the main drivers in improving medical practice. The study programmes are in line with the second strategic goal of the Science Development Strategy of the Faculty of Medicine in Rijeka, which includes encouraging clinical, preclinical and public health groups that did not fully achieve their research potential. The third strategic goal of the Science Development Strategy is to improve doctoral studies by adjusting the enrolment quota to the actual research potential of the institution,

improving teaching through modern teaching methods customised for the doctoral study level, improving the quality of PhD thesis, increasing the mentoring capacity and developing systematic monitoring of PhD students' progress. The development of the biomedical profession through the promotion of priority research areas, including translational research, is embedded in the Science Development Strategy of the Faculty of Medicine in Rijeka. The elective courses planned for the *Biomedicine* study programme are focused on the aforementioned priority research directions, while partly covering other areas. One of the strategic goals defined by the Strategy is the development of translational medical research towards priority directions (infectious diseases, tumours, immune disorders, neuroscience) that would be largely conducted by the Centre for Translational Medical Research (TransMedRi), which is planned to be built within the University Campus near the location for the future University Hospital. This research centre of the future University Hospital should be the backbone of the development of medicine in Rijeka, and the Doctoral School should produce scientific staff for the development of new research groups and research topics.

The development of medicine in the region with the purpose of raising the resident population's health care and developing a recognisable healthcare product (health tourism) is also part of the Strategic Development Plan of the Faculty of Medicine and the development strategy documents of the Primorje-Gorski Kotar County and the University. This also implies the development of high-quality scientific staff in the public health and ecology sectors. The *Public Health* and *Health and Environmental Engineering* study programmes are designed to produce such a staff, and the Faculty of Medicine with its teaching hospitals (CHC Rijeka, Teaching Institute of Public Health, Thalassotherapy Opatija, Lovran Special Orthopedic Hospital) represents an excellent base for research and education of such staff.

By accepting the National Environmental Health Action Plans (NEHAP), the Republic of Croatia has become one of the countries that have embarked on an organised struggle to preserve quality interrelations of health, the environment and self-sustaining development. Agenda 21 (Rio de Janeiro, 1992) emphasises that national development strategies need to move towards increasing the number of skilled experts, the lack of which is the main reason for the slow progress in reducing ecological risks. The education of the staff dealing with this activity should be based on ecological health and public health interest. After the adoption of the Global Strategy, the Environmental Action Plan for Europe (WHO/EURO and CEC, Copenhagen, 1995) has been adopted as well, which highlights the need for educating experts who will deal with environmental health at all levels. The International Federation of Environmental Health (IFEH), the umbrella organisation that brings together environmental health professionals and practitioners, also stressed the importance of educating doctors of science in the field of environmental health, who would effectively face water supply problems, waste management, food hygiene, disease control, improvement of housing conditions, etc. By launching *Health and Environmental Engineering* and *Public Health* doctoral programmes, the Faculty of Medicine in Rijeka has accepted the challenge of educating future experts whose main task is preserving and improving the health of individuals, families and societies, preventing diseases, applying measures to maintain hygienic and epidemiological levels in the working and living environment, which implies the identification, definition and rehabilitation of environmental factors that may harmfully affect the health of an individual and the wider community.

The Doctoral School programme is fully aligned with the mission, vision and strategy of the University of Rijeka. The University's mission is defined in Article 3 and Article 53 of the Act on Science and Higher Education of the Republic of Croatia. The University's vision is the development of a research university, which implies strengthening research potential and integration in the European Research Area. Among other scientific disciplines, biomedical sciences are one of the most significant and developed areas of science at the University, so further scientific development and strengthening of this area is one of the prerequisites for fulfilling the aforementioned vision. The scientific training of PhD students the Doctoral School programmes offer is an important element in strengthening the University's scientific potential in the fields of biomedicine and health.

The Doctoral School programme is also in line with the University in Rijeka Strategy, whose Goal 2 states: "Research University with an established profile, centres of excellence, collaborative research, institutional care for research career development and twice as much scientific production." Within this strategic goal, doctoral training is referred to in Task 1: "Increase the number of PhD theses fourfold", Task 5: "Double the number of full-time PhD

students, of which at least 10% of students funded by the University of Rijeka." and Task 9: "At least 2/3 of professors holding a scientific-teaching rank are active mentors in at least one PhD thesis."
The programme is also in line with the Strategy for the Healthcare Industry of Primorje-Gorski Kotar County, which is based on the development of public and private partnerships.
The proposed study programme is in line with the mission, vision and strategy of the University of Rijeka for the period 2014–2020. The University's vision includes the development of the research University with a high level of scientific, artistic and innovation activities, which implies strengthening research potential and integration into the European Research Area. The Strategy aims to increase the number and quality of doctors of science, which should increase the number and quality of scientific papers produced by these doctors of science. The Strategy encourages the establishment of integrated doctoral schools. One of the important goals is to increase funding opportunities for research through competitive funds, establish a research support fund and evaluate scientific activity in the employee's portfolio. Among other scientific disciplines, biomedical sciences are one of the more important and well-developed areas of science at the University, so further scientific development and strengthening of this area are some of the preconditions for fulfilling this vision. The scientific training of PhD students offered by Doctoral School programmes is an important element in strengthening the University's scientific potential in the fields of biomedicine and health.

14. Openness of the study programme towards horizontal and vertical student mobility within national and international higher education area

The Doctoral School is open to all PhD students of biomedical and public health professions, as well as other related areas at the national and international levels. Upon enrolment in the study programme, it is planned to offer PhD candidates a number of preselected general topics, i.e., research synopses, on an internationally visible site (Faculty and University websites, EURAXESS website, etc.) in Croatian and English language to allow applications from domestic and foreign PhD students. All courses from the study programmes can also be conducted in English, depending on the foreign students enrolled. Furthermore, students will be able to enrol in elective courses worth up to 50% of ECTS credits from other doctoral study programmes (from the Doctoral School of Biomedicine and Health, as well as from doctoral study programmes within our and other universities). Professors participating in our study programmes are scientists partly employed at national or foreign universities. Also, the curriculum foresees that one part of compulsory elective courses is comprised of guest lectures given mostly by eminent scientists from abroad. PhD thesis can be written and defended in the English language. PhD students from other institutions and universities will be able to enrol in some courses at our Doctoral School with the prior approval of the Doctoral School Council.

15. Enrollment requirements and student selection procedure

The inclusion in the doctoral study is one of the key components of the reform that aims to align **candidate enrolment with the scientific research capacity of the Faculty of Medicine and its teaching hospitals** through the following selection process:

- Selecting mentors according to the given criteria and determining their mentoring capacity.
- Selecting general research topics that can be objectively conducted at the Faculty of Medicine in Rijeka.
- Announcing an internationally visible call for applications that provides a list of general research topics (number within the enrolment quota), of which potential candidates select and rank a maximum of three topics.
- Selecting candidates based on the minimum input criteria that each candidate must meet and an interview with the potential mentors (interest and motivation for a particular general topic).
- Enrolling the selected candidates in the Doctoral School and proposing a list, including those who are funded from other sources.

Selection of topics/mentors/candidates		
Procedure	**Responsible for implementation**	**Timeline**
Invitation to mentors for assessment of mentoring capacity	Faculty Council at the proposal of the Doctoral School Council	January to February
Evaluation of mentors and determination of their mentoring capacity	Committee for Scientific Research Activity	January to February
Registration of general topics/mentors	Potential mentors	March to April
Evaluation of general topics	Committee for Scientific Research Activity	April to May
List of general topics/mentors	Faculty Council at the proposal of the Doctoral School Council and Committee for Scientific Research Activity	June
Call for applications for enrolment in the Doctoral School based on the list of general topics/mentors	Faculty Council at the proposal of the Doctoral School Council	June/July
Registration of candidates according to general topics (ranking list with a maximum of three topics)	Candidates	June/July
Candidate interviews with potential mentors	Mentors (organised by the Doctoral School Council)	July
Mentors form their own ranking list of candidates by topics	Mentors	July
Final list of candidates for enrolment	Faculty Council at the proposal of the Doctoral School Council and Committee for Scientific Research Activity	September
Appeals	Doctoral School Council	September
Enrolment of candidates	Office of Science, Projects and Doctoral Studies	September

Selection of mentors and general research topics (preliminary procedure)

At least three months (90 days) before the announcement of the call for applications for enrolment in the study programme the Faculty Council of the Faculty of Medicine in Rijeka announces a **public invitation** (published on the Faculty and University websites) for registration of potential mentors and general research topic. **A potential (co)mentor** must have a PhD degree and hold a scientific or scientific-teaching rank at the Faculty of Medicine in Rijeka and its research and teaching hospitals (see below). If the (co)mentor is employed at another university, then the other (co)mentor must be an employee of the University of Rijeka. Candidates for the (co)mentor position must submit the following:

- application form with a list of general PhD thesis topics
- CV

- certificate on the fulfilment of criteria for acquiring mentoring capacity (issued by the Library of the Faculty of Medicine in Rijeka)
- list of ongoing projects led or co-led by the candidate with information on project duration and annual value (this refers to domestic and international scientific and development projects, projects with the industry and projects with the local and wider social community) and information about whether the projects include remuneration for PhD students, for how many PhD students and for which period.

Moreover, the mentors are required to propose the **general research topics**, for which they will have a maximum of 3 pages of text to present the following:

- a brief description of the general research topic accompanied by the citation of the relevant literature (recent findings and research proposal)
- clearly defined hypothesis, objectives and originality of a research,
- the plan and the specific role of the PhD student in the research throughout 3 years,
- a description of the facilities and equipment planned to be used in the home and host institutions
- which funds are planned for the financing of the proposed research
- in case of a co-mentor application (two co-mentors), it is necessary to clearly specify their individual role, contribution, and responsibility in PhD student guidance.

Upon receiving the materials, the Committee for Scientific Research Activity shall:

- determine the mentoring capacity of each mentor applicant according to the given criteria
- evaluate the proposed general research topics
- propose a list of general topics/mentors to the Doctoral School Council

Determination of a mentoring capacity

A mentoring capacity defines the number of candidates that the mentor can simultaneously supervise. It is determined based on the points obtained by evaluating three criteria. For the purpose of determining mentoring capacity, scientific papers indexed into Web of Science Core Collection (WoSCC) and Scopus databases are evaluated. Only articles published in journals for which the IF (JCR) or SJR impact factor is calculated are taken into account.

1. criterion: A scientific activity of the mentor as the lead author in the last 5 years

Each paper is evaluated according to the formula: $N_1 = k_1 \times IFč_1$ or SJRč1 / IFmp or SJRmp
where
N = index (obtained by adding individual indices for each work; $N = N_1 + N_2 + N_n$)
k = weight coefficient of the author's contribution
Lead author is considered to be the author of who is the first, the last, or correspondent in the order of stating (if different from the first or the last one), or is listed elsewhere but their contribution is equal to or leading in relation to the authors listed on the first place, the last place, or correspondent (if different from the first or the last one), which is determined by insight into the paper *in extenso*).
According to the given criteria, the **weight coefficient (k)** is assigned to the author as follows:

- the first or the last author with correspondence **k = 2**
- the first or the last author without correspondence **k = 1.**

IFč or **SJRč** = **journal impact factor** determined according to the base of Journal of Citation Reports (JCR) – IFč, i.e. SCImago Journal Report – SJRč, depending on the indexation of the paper.
IFmp or **SJRmp** = medians of the relevant subject field, depending on the base in which the paper has been indexed and the category in which the journal has been classified. If a journal in which the paper was published falls within several subject fields, then the average impact factor of the area (IFmp) that is most favourable for the main author

will be taken. The overall index is obtained by the sum of all paper indices (**$N = N_1 + N_2 + Nn$**). Points 0-7 are assigned on the basis of the overall index as follows:

Index:	Points:
< 2	0 points
2.00 – 4.00	1 point
4.01 – 6.00	2 points
6.01 – 8.00	3 points
8.01 – 10.00	4 points
10.01 – 12.00	5 points
12.01 – 14.00	6 points
> 14.00	7 points

2. criterion: Quality of the mentor's overall scientific work

Identified by the Hirsch index (h-index), which relates the number of publications to the number of citations per paper. This index is a quality indicator of the overall mentor's scientific work. The author's h-index is calculated according to the WoSCC and Scopus database. When calculating points, the index that is more favourable for the author is taken into account.
Points 0-7 are assigned as follows:

h factor:	Points:
< 4	0 points
4 – 7	1 point
8 – 11	2 points
12 – 15	3 points
16 – 19	4 points
20 – 23	5 points
24 – 26	6 points
> 26	7 points

3. criterion: Success in guiding PhD students in the last 5 years

Determined by the number of defended PhD theses, taking into account **joint** mentor and PhD student **publications** that arose from the PhD theses defended in the last five years.
Each PhD thesis is evaluated according to publications deriving from it by the following formula:
N1 = (ka x IFč or **SJRč / IFmp) + (kb x IFčb / IFmp) + (kn x IFčn / IFmp),**
where
N_1 = PhD thesis 1 index
k = weight coefficient of the author's contribution
Assigned according to the mentor's order of stating:
mentor is the lead author **k = 2**;
mentor is the first author **k = 1**,
mentor is one of the co-authors when not listed as the first author, nor the lead author **k = 0.5**.
a = paper a from a PhD thesis, b = paper b from a PhD thesis, n = paper n from a PhD thesis
IFč or **SJRč** = **journal impact factor** determined according to the base of Journal of Citation Reports (JCR) – IFč, i.e. SCImago Journal Report – SJRč, depending on the indexation of the paper.
IFmp or **SJRmp** = medians of the relevant subject field, depending on the base in which the paper has been indexed and the category in which the journal has been classified. If a journal in which the paper was published falls within several subject fields, then the average impact factor of the area (IFmp) that is most favourable for the main author

will be taken. The overall index is obtained by the sum of all paper indices (N = N1 + N2 + Nn). Points 0-7 are assigned on the basis of the overall index as follows:

Index:	Points:
• < 2	0 points
• 2.00 – 4.00	1 point
• 4.01 – 6.00	2 points
• 6.01 – 8.00	3 points
• 8.01 – 10.00	4 points
• 10.01 – 12.00	5 points
• 12.01 – 14.00	6 points
• > 14.00	7 points

Obtaining a Certificate on the fulfillment of criteria for acquiring mentoring capacity
For the mentor, the candidate must submit to the Library of the Faculty of Medicine:

- list of all published papers
- a list of mentored defended PhD theses in the last 6 years with a list of joint mentor and PhD student publications that derived from the PhD theses
- papers *in extenso* published in the last 6 years, which derived from the previously mentored PhD theses.

Certificates are issued 10 days upon receiving the aforementioned documentation.

Determining mentoring capacity
Based on the above-mentioned criteria, the Committee for Scientific Research Activity determines mentor's mentoring capacity according to the following key and **providing they obtain points in at least two of the three criteria:**

- 0 points – cannot be either mentor or co-mentor
- 1 points – can be only a co-mentor
- 2 –5 points – can be a **mentor to 1 PhD student** and **a co-mentor to 1 PhD student**
- 6–9 points – can be a **mentor to 2 PhD students** and **a co-mentor to 2 PhD students**
- 10–13 points – can be a **mentor to 3 PhD students** and **a co-mentor to 2 PhD students**
- 14–17 points – can be a **mentor to 4 PhD students** and **a co-mentor to 3 PhD students**
- > 17 points – can be a **mentor to 5 PhD students** and **a co-mentor to 3 PhD students.**

Mentoring capacity is determined in each call for applications.

A mentor must have a minimum of **2 points** and fulfill at least **two criteria**.

Mentor or co-mentor must be an employee of the study program holder, hold **a scientific rank and have at least 2 years** of postdoctoral research experience (preferably postdoctoral training abroad).
If a mentor candidate meets **only one criterion** of the three (at least 1 point), he/she can then only be a **co-mentor** with mentors who have a specific mentoring capacity within or above their quota.
Researchers from **other institutions** can have a status of a **mentor/co-mentor**, but have to meet all the mentoring criteria issued by the Faculty of Medicine in Rijeka, and pass the evaluation procedure of the proposed topic.

A Register of Mentors of the Doctoral School is established with all data on their previous supervisions of PhD students. The data from the Register will be used by the Doctoral School Council and the Committee for Scientific Research Activity when deciding upon granting or revoking mentorship.

A mentor with a certain mentoring capacity (number of PhD students) can, each year during the selection process of topics, submit the number of general topics up to fulfilling their mentoring capacity. For example, if their mentoring capacity is four PhD students in the first year and they have submitted and been assigned with two topics (thereby receiving two PhD students), then in the following year they can submit a maximum of two topics (unless their mentoring capacity has been re-assessed and changed in the meantime).

If a mentor's mentoring capacity has been reduced in a subsequent assessment or lost, they cannot submit new general topics (or get a new PhD student). They will, however, continue to supervise the existing PhD students as long as they make satisfying progress (Report of the Committee for Scientific Research Activity).

A mentor who is a leader or an associate on an international or domestic scientific (or developmental) project, which provides funding for the remuneration of one or more PhD students, can submit general topics for all the secured places and will be given priority on the list of topics for the competition, regardless of their determined mentoring capacity.

Mentors' and co-mentors' work will be continuously monitored and evaluated through the mentor's and the PhD student's annual reports, and through the annual report by the Committee for Scientific Research Activity on the PhD student's and mentor's work (see under *Monitoring the quality of PhD students and mentors*).

Evaluation and selection of a general research topic
General research topics are evaluated by the Committee for Scientific Research Activity based on:

The quality of a general topic (grades 1-5)
• Is the topic a logical sequence of (or within the scope of) the mentor's research?
• Is there a clear hypothesis and research objectives?
• Is the proposed research original?
• Are the research objectives realistically achievable in the period of 3-6 years?
• Are the mentor's (institution's) space and equipment adequate for conducting the proposed research (minimum 50%) and to what extent is the research threatened by dependence on other institutions?
• Is the financial coverage of the proposed research ensured
• Are the proposed cooperation and contribution level equal for each co-mentor? (applicable to co-mentors only)
• Is there a logical work complementation of both co-mentors in the context of the proposed topic? (applicable to co-mentors only)

Each item is rated on a scale of 1 - 5 with the possibility of assigning a half-grade (i.e. 1.5; 2.5; 3.5; 4.5). The passing threshold for each item is 3.5, if the grade for any item is lower than that, the topic cannot receive a passing grade.

- Grade 1 - negative;
- Grade 2 - the item is poorly defined and requires substantial modification;
- Grade 3 - the item requires modifications;
- Grade 4 - the item is well-defined and requires minor modifications;
- Grade 5 - the item is perfectly defined.

The Committee for Scientific Research Activity will select 3 of its members to form a working group which will assess the general topics. In the first round, each member of the working group will individually and independently grade each general topic according to the above-mentioned items. The grades given for items by all the group members will be coordinated in the second round to a maximum difference of 1.0 grade, and then the average grade will be given for each item, i.e. each topic. A passing grade will be given to any topic with a

minimum average score of 3.5 provided that the average grade of all individual items is equal to or above the passing threshold (≥3.5).

- Fitting into the research priorities of the Faculty of Medicine (Infectious diseases, Tumours, Immunological Disorders, Neuroscience) – Yes or No

Final grade of the general topic:

- all the topics that have received an average grade of ≥ 3.5 (with all the individual items rated at least 3.5!) and fitting into the research priorities of the Faculty of Medicine will be accepted;

- if a topic receives a positive grade (≥ 3.5), but does not fit the research priorities of the Faculty of Medicine, then the Commission assesses whether or not it will be placed on the final list on the basis of the needs of the Faculty of Medicine and the number of applications under item 1;

- all the topics that have received an average grade of <3.5 (or if any single item has been assessed with grade <3.5) will not be accepted.

Topics previously evaluated within a project implemented by the institution providing funding shall not be evaluated twice but must undergo the procedure established by the program.

Forming the list of general topics / mentors
The Doctoral School Council adjusts the accepted general topics to the mentoring capacity of a mentor and ultimately forms a list of general topics and their respective mentors. If a mentor has a lower mentoring capacity than the number of submitted and accepted topics, the mentor will be given the possibility to choose the topics in line with their mentoring capacity. The list of general topics must not exceed the allowed annual enrollment quota of the Doctoral School (60 candidates), and if this should happen, the Doctoral School Council will decide which topics will be discarded from the list, taking into account the mentor's effectiveness and the needs of the institution. The list of general topics that relate to a specific research area will also determine the number of candidates within the quota (60) who will enroll in a certain study programme of the Doctoral School. However, by choosing a certain general topic given upon the competition for enrollment, the candidates also choose the study programme of the Doctoral School.

Competition for enrollment of PhD candidates
Announcement of competition
The competition for enrollment of PhD candidates in the Doctoral School is announced by the Faculty Council of the Faculty of Medicine at the proposal of the Doctoral School Council subsequent to a pre-selection of mentors and general topics. The competition features a list of general research topics with respective mentors. It also defines the minimal requirements and documentation (in Croatian and English language) that each candidate must fulfill and submit:
• The application to the competition, which must contain a rank list of a maximum of three general topics chosen out those proposed in the competition according to their own preferences, along with an explanation (motivation letter). The candidate must also clearly state their employment status.
• The candidate's CV (European format) with a list of scientific publications and activities, if possible, and belonging documentation proving it.
• The diploma of the undergraduate and graduate (or integrated graduate) study of one of the faculties of biomedical orientation listed in the chosen study programme (medicine, dentistry, veterinary medicine, pharmacy, biology, biotechnology, biochemistry, nursing, midwifery, sanitary engineering, etc.)
• A copy of grades obtained in the undergraduate and graduate (or integrated graduate) study

• **Good knowledge of English**, both spoken and written (at least B1 level)
• **Two references** from professors

The competition shall be announced **in both Croatian and English language** and will be published in an **internationally visible site** (the websites of the Faculty and the University, EURAXESS websites, etc.).

Candidates' interviews with potential mentors
All applicants who meet the minimum criteria will **have an interview with the mentors** whose general topics they have opted for. Based on these **interviews** (which may be arranged in the form of video-teleconferencing) and a **review of the candidate's documentation, the mentors will make their own rank list of candidates by each submitted topic**. All interviews between mentors and candidates must be completed within a maximum of 10 days after completion of the competition.

Enrollment of candidates in the Doctoral School
After each mentor has interviewed and ranked the PhD candidates by a general topic, the **Doctoral School Council** shall meet with all the mentors and **compile the final list** of doctoral candidates who can be enrolled in the study. The list shall be formed taking into account the total enrollment quota, the availability of quality general topics and the representation of individual study programmes. The available and approved general topics should also define the distribution of students in individual programmes of study within the approved quota. The total planned enrollment quota for the Doctoral School in *Biomedicine and Health* would be 60 students. After the formation of **the final list**, the Doctoral School Council shall **invite the candidates to enroll**, and propose to the Faculty Council the **verification of the list of the enrolled candidates.** If a candidate decides not to enroll, the next candidate on the list who has not been previously invited shall be invited following prior agreement with the relevant mentor.

Signing a contract
Upon enrollment to doctoral studies, the **PhD student / mentor / Faculty of Medicine** sign the **Contract on Rights and Obligations** during the studies in which the rights and obligations of all signatories shall be defined in detail. The contract is signed for **3 years** with the possibility of extension of **up to another 3 years** (a total of 6 years). The contract can be extended by one year on the basis of the **positive annual report and recommendation** of the Committee for Scientific Research Activity, and after a public presentation of the results of working on the PhD thesis at the end of the 3rd, 4th or 5th year of studies.

Tuition fee and enrolment cost
The annual tuition fee and the enrolment cost are stipulated by the enactments of the University of Rijeka and the Faculty of Medicine. Currently, the tuition fee is EUR 2,700.00 per academic year. The cost of enrolment in the first year of study is EUR 55.50. The cost of enrolment in the higher years of study and re-enrolment in the same year of study is EUR 40.

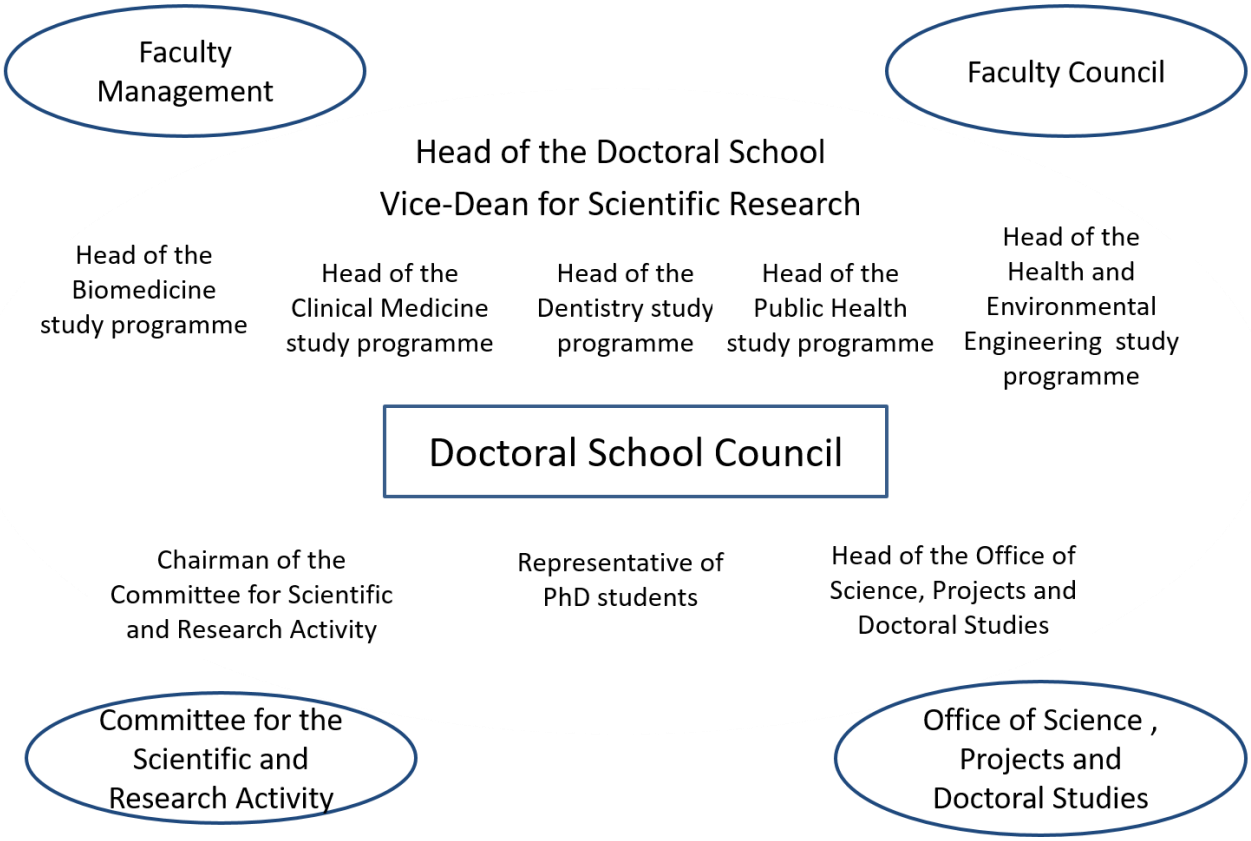
Mentor's benefits
Given that active **supervision and education** of PhD students is a demanding and responsible **job of highest interest to the institution**, a mentor's teaching load could be **reduced by 10% (and by 5% for a co-mentor**) per each doctoral student.

Conditions for registration of the PhD thesis with an exemption from attending the doctoral studies
Registration of a PhD thesis with an exemption from attending the doctoral studies should be allowed to **exceptional candidates** who have objectively earned this right through their scientific work and activities. The conditions for granting registration of a PhD thesis with **exemption from attending** the doctoral studies should are as follows:

- Application for enrollment in the doctoral studies, along with a **request for exemption from attending** doctoral studies accompanied with the appropriate documentation
- Registration of the **topic of the PhD thesis**, giving **the name of the potential mentor or co-mentors** (who meet the criteria for the (co)mentorship), with the potential **mentor's written consent**
- A proof of **at least three first-author original *in extenso* scientific papers** published in the **last five years,** indexed in the WoS Core Collection (WoSCC) or Scopus **in the topic field of the PhD thesis**. **One paper** must be published in a **journal that is classified in the Q1 according to IF or SJR for the candidate's research field in the JCR or SJR database, depending on the journal indexation**, while **the other two** must be published in **journals belonging to Q1 or Q2 for the candidate's research field, according to JCR or SJR databases** (papers belonging to WoSCC and Scopus database categorized as case reports, *in extenso* abstract papers, and review papers are not accepted)
- A certificate of working in **another scientific institution** for at least 6 months
- A proof of **active participation** in at least **two international symposia** (at least one oral and one poster presentation in the topic field of the PhD thesis.

On the basis of the submitted documentation and evaluation of the submitted topic, the **Doctoral School Council**, in cooperation with the **Committee for Scientific Research Activity**, shall submit a draft decision to the Faculty Council for its approval, upon which the decision will be sent to the University.

The administrative structure of the Doctoral School in Biomedicine and Health



Council of the Doctoral School in Biomedicine and Health

The Council of the Doctoral School in ***Biomedicine and Health*** is the administrative body of the Doctoral School which consists of the following members:

1. Head of the Doctoral School
2. Vice Dean for Scientific Research
3. Head of the study programme *Biomedicine*
4. Head of the study programme *Public Health*
5. Head of the study programme *Clinical Medicine*
6. Head of the study programme *Dental Medicine*
7. Head of the study programme *Health and Environmental Engineering*
8. Chairman of the Committee for Scientific Research Activity
9. 2 PhD student representatives who attend different study programmes
10. Head of the Office of Science, Projects and Doctoral Studies

The Doctoral School Council closely cooperates with the Management of the Faculty of Medicine, Committee for Scientific Research Activity, and the Office of Science, Projects and Doctoral Studies. The Doctoral School Council submits to the Faculty Council draft decisions concerning the Doctoral School for its approval. It monitors all activities relevant for the Doctoral School, such as: class organization, the candidates' progress in the preparation

of their PhD theses, mentors' work, international visibility of the Doctoral School, and other administrative and financial aspects of the Doctoral School. The Doctoral School Council meets at least once a month, two weeks prior to the session of the Faculty Council. The jurisdictions of the Doctoral School Council are as follows:

- It supervises the organization and delivery of classes and analyzes their quality.
- It approves study plans for each registered candidate and a detailed curriculum for each academic year at the proposal of the head of a study programme.
- It proposes verification of invited lectures to the Faculty Council.
- It resolves all PhD students' and teachers' requests and complaints submitted during the teaching process.
- It proposes to the Faculty Council possible amendments to the study programmes of the Doctoral School.
- It proposes to the Faculty Council election and changes in the teaching staff for the needs of the Doctoral School.
- It proposes to the Faculty Council announcements of public invitations for submission of general topics and mentors.
- It proposes to the Faculty Council announcements of competition for enrollment in the Doctoral School, based on the list of general topics / mentors proposed by the Committee for Scientific Research Activity.
- It organizes interviews of potential candidates and mentors, coordinates the final list of candidates for admission to the Doctoral School and proposes it to the Faculty Council.
- It supervises enrollment of candidates.
- It proposes to the Faculty Council candidates for exemption from attendance at the Doctoral School, based on the opinion of the Committee for Scientific Research Activity and attached documents.
- It grants PhD students from other doctoral studies enrollment in some courses at the Doctoral School.
- It grants PhD students from other doctoral studies permission to continue their studies in a study programme of the Doctoral School.
- It monitors public defense of PhD topics.
- It organizes and supervises public group presentations of PhD students and, on the basis of the report of the Committee for Scientific Research Activity, proposes appropriate decisions to the Faculty Council.
- It supervises the work of mentors (based on the report of the Committee for Scientific Research Activity and the Register of Mentors) and proposes appropriate decisions to the Faculty Council.
- It determines whether a candidate fulfills the criteria for registration of the PhD thesis.
- It organizes and supervises public defense of PhD theses.
- It supervises the monitoring of a PhD's career in the postdoctoral period.
- It controls the financial and administrative aspects of the Doctoral School.
- It takes care of the international visibility of the Doctoral School (creation and updating web pages of the Doctoral School, international advertising, international mobility of the Doctoral School students and teachers, etc.)
- It submits to the Faculty Council the annual report on the effectiveness of implementation of the doctoral training at the Doctoral School.

Head of the Doctoral School

The head of the Doctoral School is in charge of monitoring activities of the Doctoral School and coordinating activities of the Doctoral School Council by performing the following tasks:
- takes care of the organization and implementation of compulsory courses at the Doctoral School and coordinates the invited lectures
- manages and coordinates the organization and implementation of the entire teaching (on all study programs) and quality analysis in cooperation with the heads of study programs
- organizes meetings of the Doctoral School Council at least once a month and resolves possible difficulties in performing certain teaching and scientific research activities

- resolves inquiries and complaints of PhD students and teachers during the teaching process
- takes care of the financial and administrative aspects of the Doctoral School
- creates opportunities for cooperation with other doctoral studies
- closely cooperates with the Office of Science, Projects and Doctoral Studies, especially with enrollment and monitoring the fulfillment of requirements for continuation of studies
- submits an annual report to the Faculty Council on the success of conducted doctoral education at the Doctoral School.

The head of the Doctoral School is elected based on an internal call for applications, for a period of four (4) years. Besides the application, the applicants are required to submit a work plan for the mandate period in accordance with the Strategy for the Development of Science at the Faculty of Medicine in Rijeka.
The Doctoral School Council appoints the Committee for the selection of the head, which reviews the applications and decides on the selection of candidates for the head of the Doctoral School. At the proposal of the appointed Committee, the head of the Doctoral School is confirmed by the Faculty Council.
The head of the Doctoral School must be an employee of the Faculty, have a scientific-teaching position and a positively assessed mentoring capacity.

Committee for Scientific Research Activity

The Committee for Scientific Research Activity is an advisory body that is primarily responsible for: the quality of scientific research, the quality of PhD theses topics, mentors' scientific research and quality, the quality of PhD theses, and candidates' scientific publications. The Committee for Scientific Research Activity meets at least once a month two weeks prior to the session of the Faculty Council and prior to a meeting of the Doctoral School Council. It has the following jurisdictions:

- It conducts an evaluation of mentors based on the documentation with a certificate from the Library of The Faculty of Medicine in Rijeka.
- It conducts an evaluation of general topics.
- It proposes to the Doctoral School Council the list of general topics for the enrollment competition.
- It examines the registration of topics of PhD students and assesses whether they met the basic scientific and technical criteria laid down in the Rules on Composition of PhD Thesis.
- It reviews the reports of the Commission for Biomedical Ethics of the Faculty of Medicine and of ethics committees of other institutions in which the work is performed, and determines whether authorization for the respective research has been given.
- It proposes to the Faculty Council an expert committee for topic assessment if the registered topic meets the basic scientific and technical criteria, and participates in the public defense of topics (representatives of the Committee for Scientific Research Activity).
- It reviews the reports of expert committees for topic assessment and proposes appropriate decisions to the Faculty Council.
- Based on public presentations of a mentor's and a PhD student's reports, it compiles its own report on the PhD student’s progress and submits it to the Doctoral School Council along with recommendations.
- It checks whether a candidate fulfills all the scientific requirements for registration of a PhD thesis (scientific publications).
- It checks whether a PhD thesis meets the basic scientific and technical prerequisites for the continuation of the procedure.
- It proposes to the Faculty Council an expert committee for assessment of a PhD thesis if it evaluates that it meets the basic scientific and technical criteria specified in the Rules on Composition of PhD Thesis.
- It reviews the reports of the Expert Committee for assessment of PhD theses and submits a draft decision to the Faculty Council.
- It proposes to the Faculty Council an expert committee for the defense of a PhD thesis.

- It submits to the Doctoral School Council an annual report on the success of defense of submitted PhD topics, and on the success of defense of PhD theses.

Office of Science, Projects and Doctoral Studies

The Office of Science, Projects and Doctoral Studies is a unit responsible for all administrative and financial matters related to the Doctoral School. The Office cooperates closely with the Doctoral School Council, the Committee for Scientific Research Activity, and heads of study programmes of the Doctoral School. The jurisdictions of the Office are as follows:

- It carries out all administrative tasks concerning the announcement of competition, registration, and enrollment of candidates in the Doctoral School.
- It keeps records of students, professors and mentors, and their follow-up (Student Register, Teacher Register, and Mentor Register).
- It keeps records of individual learning plans and other activities of PhD students.
- It organizes classes in cooperation with heads of study programmes of the Doctoral School (informing students, professors and mentors).
- It updates the websites of the Doctoral School in cooperation with the Doctoral School Council.
- It is in charge of organizing, record keeping and notifying on defenses of PhD topics and the PhD theses.
- It organizes annual public presentations of PhD students' concerning their work together with the Doctoral School Council and the Committee for Scientific Research Activity.
- It prepares and conducts periodic anonymous surveys among students in collaboration with the heads of studies and the Office for Assurance and Enhancement of Quality of the Faculty of Medicine.
- In cooperation with the Scientific Research Commission and heads of studies, it prepares performance indicators for individual study programmes (class attendance, analysis of success in examinations, analysis of success in defense of PhD topics, analysis of the time required for completion of a PhD thesis, performance analysis of defense of a PhD thesis, etc.) which it submits to the Doctoral School Council.
- It organizes the visit and schedules classes of visiting lecturers (in cooperation with the heads of study programmes, mentors, and PhD students).
- It monitors the financial aspects of the Doctoral School (enrollment fees, costs of teaching and bringing visiting lecturers, other costs) in cooperation with the Financial Department of the Faculty of Medicine, and prepares periodic reports for the Doctoral School Council.

Heads of study programmes of the Doctoral School

The heads of study programmes are directly responsible for the organization and delivery of classes for their respective study programme and cooperate closely with the Office of Science, Projects and Doctoral Studies. Immediately prior to their enrollment, the PhD students are required to submit to the head of the study programme a list of elective courses for all three years of study, on the basis of which the heads compile and define performance plans for a given study programme. The heads contact individual professors and coordinate their timetable, classroom reservation, keep records of lectures delivered and, together the Office of Science, Projects and Doctoral Studies and the Office for Assurance and Enhancement of Quality, conduct a survey among students after completion of each course. The heads of study programmes must attend the annual public presentations on PhD students' work. They submit periodic oral reports on the progress of teaching and other activities, and an annual written report to the Doctoral School Council.

16.Study programme learning outcomes

16.1. List of mandatory and elective learning outcome units at the level of the study programme

COMPULSORY SET OF LEARNING OUTCOMES

Knowledge and understanding:

- creating and evaluating knowledge and understanding of the research area
- acquiring advanced and specialized knowledge in a given field
- evaluating the procedures and principles of research methodology

Competencies and skills:

- implementation of independent and critical analyzes and synthesis
- the ability to review and research new and complex phenomena, problems and situations
- creating the ability to set and differentiate problems with a critical, creative and independent approach
- planning, using and evaluating a suitable method in research and other tasks with precise deadlines for delivery
- making a contribution to the research area through the dissertation

Independence:

- expressing the ability to present and discuss the results of a research at domestic and international conferences in academia and the other medium
- ability to write scientific papers
- expressing interest in further cognition, knowledge, and research

Responsibility:

- taking the ethical and social responsibility for contributing to social development
- success in conducting the education of others through research
- taking intellectual autonomy and attitude
- the ability of ethical reflection in research
- taking ethical and social responsibility through self-analysis and critical thinking in research, taking a role in the society, and responsibility to use research results

ELECTIVE SET OF LEARNING OUTCOMES (*Biomedicine, Clinical Medicine, Dentistry, Public Health, Health and Environmental Engineering* study programmes)

Knowledge and understanding:

- differentiating different types of epidemiological methods and organization of basic, epidemiological, clinical investigations, methods for monitoring orofacial growth, efficiency and effectiveness of dental therapy
- knowledge of issues in multicentric clinical research, methods for monitoring efficiency and evaluating results of experimental testing, and possibilities for diagnostic and therapeutic application
- understanding the mechanisms involved in etiology, pathogenesis, and progression of the disease
- understanding the software for making experimental models in medicine, using scanners and 3D printers
- evaluating the possibilities for testing biocompatibility and mechanical stability of dental biomaterials
- understanding the neurobiology of orofacial pain and the mechanisms for perception and modulation

Competencies and skills:

- designing a methodology for basic, epidemiological and clinical examinations
- critical adoption of scientific results
- handling devices for planning the research and dental therapy
- understanding methods for analyzing and planning in health care
- designing public health interventions based on the analysis of health needs and the health system, independent selection of measures for the control of oral health, disease, and quality of life

Independence:

- interpreting and presenting the results of own research
- interpreting and discussing published studies
- conducting measurements, for example, of orofacial pain, oral health degree, disease, and quality of life
- interpreting the mechanisms involved in the emergence and course of the disease, for example, in the regeneration process of the orofacial region tissue
- evaluating produced experimental models for the study of etiology, pathogenesis, and therapeutic effect
- theoretical application of the model in clinical examples

Responsibility:

- respecting ethical norms in research work
- obtaining permission from an institutional Ethical Committee of a scientific and health institution
- informing patients about the research protocol
- obtaining consent from the patient
- ethics in working with laboratory animals, self-analysis

16.2. Multidisciplinarity/interdisciplinarity of the study programme

Interdisciplinarity of the study programme is ensured through elective courses and invited lectures that cover different areas of biomedicine (infectious diseases, immune disorders, tumors, neuroscience, public health, environmental health, etc.), while multidisciplinarity is enabled through the possibility of choosing elective courses from other doctoral study programmes (up to 50%).

17.If a graduate study programme is proposed, specify undergraduate study programmes delivered by the proposer or other Croatian higher education institutions that qualify for admission to the proposed study programme

Admission to the Doctoral School in *Biomedicine and Health* is open to candidates who have obtained a degree in one of the following studies:

- University integrated undergraduate and graduate study of Medicine
- University integrated undergraduate and graduate study of Dental Medicine
- University integrated undergraduate and graduate study of Veterinary Medicine
- University graduate study of Pharmacy
- University graduate study of Medical Biochemistry
- University graduate study of Experimental Biology
- University graduate study of Molecular Biology
- University graduate study of Environmental Sciences
- University graduate study of Ecology and Nature Conservation
- University integrated undergraduate and graduate study of Biology and Chemistry
- University graduate study of Biochemistry
- University graduate study of Biotechnology
- University graduate study of Sanitary Engineering
- University graduate study of Nursing
- University graduate study of Medical Laboratory Diagnostic

- University graduate study of Midwifery
- and other related areas.

If the students meet the minimum criteria (see above), they may compete for the proposed general research topics prior to enrollment in the Doctoral School, by doing which they determine the study programme of their choice. In fact, each study programme will offer an adequate number of general topics (within the total enrollment quota) from a respective area.

18. If an integrated study programme is proposed, specify reasons for integration of undergraduate and graduate level of the study programme

Not applicable to this study programme.

19. List of mandatory and elective courses and/or modules (if any) with the number of class hours required for their implementation and the number of ECTS credits (appendix: Table 1)

Total student workload during the study (30 ECTS) has been designed according to the following model:

- Compulsory courses (12 ECTS credits)

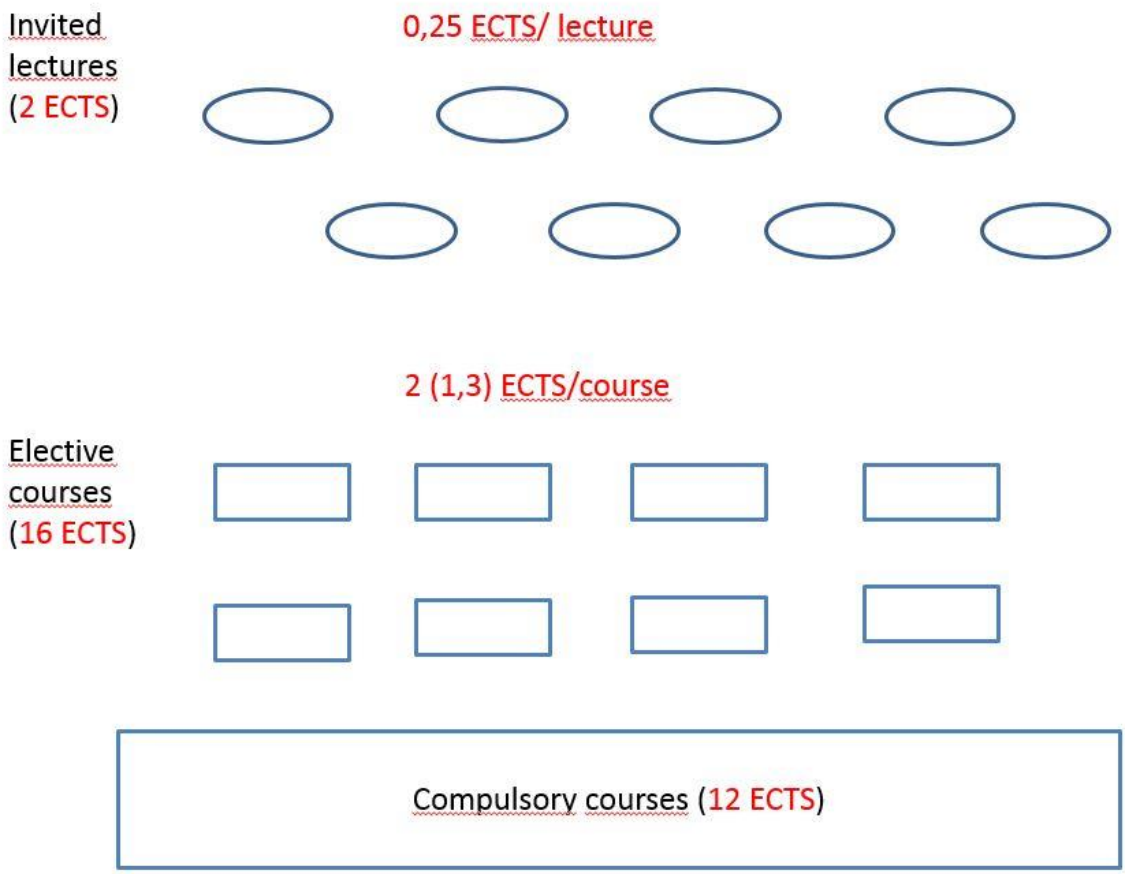
Compulsory courses are mostly designed with a workload of 1.5 ECTS or 3 ECTS credits and are dedicated to acquiring basic knowledge necessary for creating a scientific paper and developing generic skills (transferable skills) in PhD students. Compulsory courses (a total of 6) are common for all five study programmes of the Doctoral School.

- Invited lectures (2 ECTS credits)

Each student must attend 8 invited lectures of their choice during the course of study (3 years). These lectures are a specific supplement to each student's elective curriculum. Each invited lecture should be verified by the Doctoral School Council (based on the previously submitted abstract of the lecture and the lecturer's CV and list of works) and confirmed by the Faculty Council. Invited lecturers must be internationally recognized and respectable scientists in their field. PhD students, mentors or professors of a given study programme may suggest inviting a specific lecturer to the head of the study, who will then evaluate the justification for the invitation (which must comply with the programme), contact the lecturer (in cooperation with the proponent) and initiate verification of their lecture. Each invited lecture should last one hour (with discussion) and would carry 0.25 ECTS credits. Attendance of PhD students at the lecture will be registered in order for them to obtain the given amount of ECTS credits. The record of candidates' attendance will be kept by the head of the study programme in cooperation with the Office of Science, Projects and Doctoral Studies.

- Elective courses (16 ECTS)

Elective classes consist of elective courses (a total of 16 ECTS credits). Each student should choose at least 50% of the courses (≥8 ECTS credits) from a group of elective courses offered in their chosen study programme. A maximum of 50% of the courses (a maximum of 8 ECTS credits) can be chosen from those offered in other study programmes of the Doctoral School, or from other doctoral programmes of the University of Rijeka or other universities, depending on the PhD student's research field.



20.Description of each course (*appendix: Table 2)*

Description of each course is presented individually in Table 2.

21.Structure and workflow of the study programme and student obligations

The Doctoral School study programmes consist of:

1. Compulsory courses (12 ECTS credits)
2. Elective courses (16 ECTS credits)
3. Verified invited lectures (2 ECTS) - (structured as a compulsory course)
4. Preparation, presentation, and publication and defense of the PhD thesis (a minimum of 150 ECTS credits).

Ad 1. Compulsory courses (12 ECTS credits) provide PhD students with basic knowledge concerning: the methodology of compiling a scientific paper, ethical standards in scientific research, statistical analysis of scientific results, and the protection of intellectual property rights and entrepreneurship in biomedicine. It is also planned that PhD students, through a set of compulsory courses, acquire knowledge and skills in critical analysis and presentation of the results of scientific work, and in the implementation of specific scientific methods (selection) that are important for the development of their thesis. The classes in a majority of compulsory courses are planned to be completed until the end of the first year. The course on Presenting and analyzing scientific publications extends through all three years of study (3 x 1 ECTS), within which students learn how to critically analyze and present results of scientific research (Journal Club). The course on Application of research methods in scientific work is conducted in the first and the second year of study (2 x 1,5 ECTS credits). The course on Research

Management in Biomedicine is offered in the third year of the study, when the students are already at an advanced stage of preparation of their PhD thesis and when they have already acquired a set of knowledge and skills in setting and solving scientific problems. Most of the compulsory courses are structured in a way where several professors are involved in giving classes in order to cover and full address all relevant aspects of a given area.

Ad 2. **Elective courses** are courses that a PhD student chooses in collaboration with their mentor, and in accordance with the area of work and interest. Elective courses are generally arranged according to the priority research fields and study programmes. Elective courses usually have a workload of 2 ECTS credits (exceptionally 1 or 3 ECTS credits), and are conducted in such way that a particular topic is processed from the molecular and experimental level to the level of translational and clinical research. Each student is required to select a total of **16 ECTS credits** in elective courses (8 courses), of which they have to take and pass exams for at least 4 ECTS credits during each year of the study. PhD students can choose up to 50% (up to 8 ECTS credits) of elective courses from other doctoral programmes within the Doctoral School, as well as from other doctoral programmes of our or some other university. In the latter case, it is necessary to obtain a prior consent of the Doctoral School Council.

Ad 3. **Invited verified lectures** are lectures given by respectable scientists in a given field (mostly foreign) at the invitation of PhD students and professors from the Doctoral School as a supplement to their elective subjects. The lectures have to be verified by the Doctoral School Council and by the Faculty Council of the Faculty of Medicine in order to be recognized as classes at the doctoral study. Verification is performed based on the attached summary and the lecturer's brief CV with a list of relevant papers. During the three years of study, the students are required to attend 8 invited lectures (8 x 0.25 ECTS = **2 ECTS credits**).

Ad 4. **Preparation, presentation, and defense of the PhD thesis** is the most important part of the study programme. PhD student is required to dedicate most of their time during the study (at least **150 ECTS credits**) to quality preparation, presentation, and defense of their PhD thesis, which includes the following activities:

• *Public presentation of the PhD thesis* - **5 ECTS credits**
- The registration of the topic of the thesis by the end of the first year of (a requirement for entry into the second year) - 1 ECTS
- The defense of the topic of the thesis by the end of the second year of study (a requirement for entry into the third year) - 1 ECTS
- First public presentation of the thesis (at the latest 10 -12 months after enrollment (a requirement for entry into the second year) - 1 ECTS
- Second public presentation of the thesis (at the latest 22 -24 months after enrollment (a requirement for entry into the third year) - 1 ECTS
- Third public presentation of the thesis (at the latest 36 months after enrollment (a requirement for the registration of the PhD thesis or extension of time period) - 1 ECTS
- (option - fourth and fifth public presentation of the thesis 48 and 60 months after enrollment if the Doctoral School Council, based on the presented results and explanation, approves an extension of the study up to a maximum of 6 years upon enrollment)

• *Publication of the results from the topic of the PhD thesis* (at the latest by the time of registration of the PhD thesis): the candidate must publish at least one original first-author scientific paper from the topic of the PhD thesis in a journal indexed in the WoSCC and Scopus database, which belong to Q1 or Q2 group in JCR or SJR database, for the research field according to the topic of the PhD thesis. Alternatively, the candidate must publish at least two original scientific papers from the topic of the PhD thesis in journals quoted in Web of Science Core Collection (WoS Core Collection) database, with an impact factor higher than 1, one of which has to be a first-author paper. The paper must be published at least in an electronic form and have its DOI index by the time of registration of the PhD thesis.

• *Mandatory elective activities relevant to the PhD thesis* - a total of **5 ECTS credits**

a) Oral presentation of the results at an international conference - 3 ECTS
b) Poster presentation of the results at an international conference - 2 ECTS
c) Oral presentation of the results at a national conference - 2 ECTS
d) Poster presentation of the results at a national conference - 1 ECTS
e) Participation in an international summer school or a course with the presentation of the results - up to 4 ECTS (with prior accreditation of the summer school within the framework of the Doctoral School)
f) Participation in other courses relevant for the making of the PhD thesis (cultivating and working with experimental animals) – up to 2 ECTS (with a prior accreditation of the course within the framework of the Doctoral School)

• *Work on research* - a total of **120 ECTS credits**

- at another institution or an alternative form of international work - at least 20 ECTS
- at a home institution - up to 100 ECTS

• Registration and defense of the PhD thesis - **10 ECTS credits**

Structure of the study by year of study

1. *First year of study (60 ECTS)*

• Compulsory courses (7 ECTS)
• Elective courses (6 ECTS)
• Invited lectures (1 ECTS)*
• Preparation and presentation of the PhD thesis (46 ECTS)
- Registration of the topic of the PhD thesis (1 ECTS)
- First public presentation of the work results (1 ECTS)
- Research work (44 ECTS)

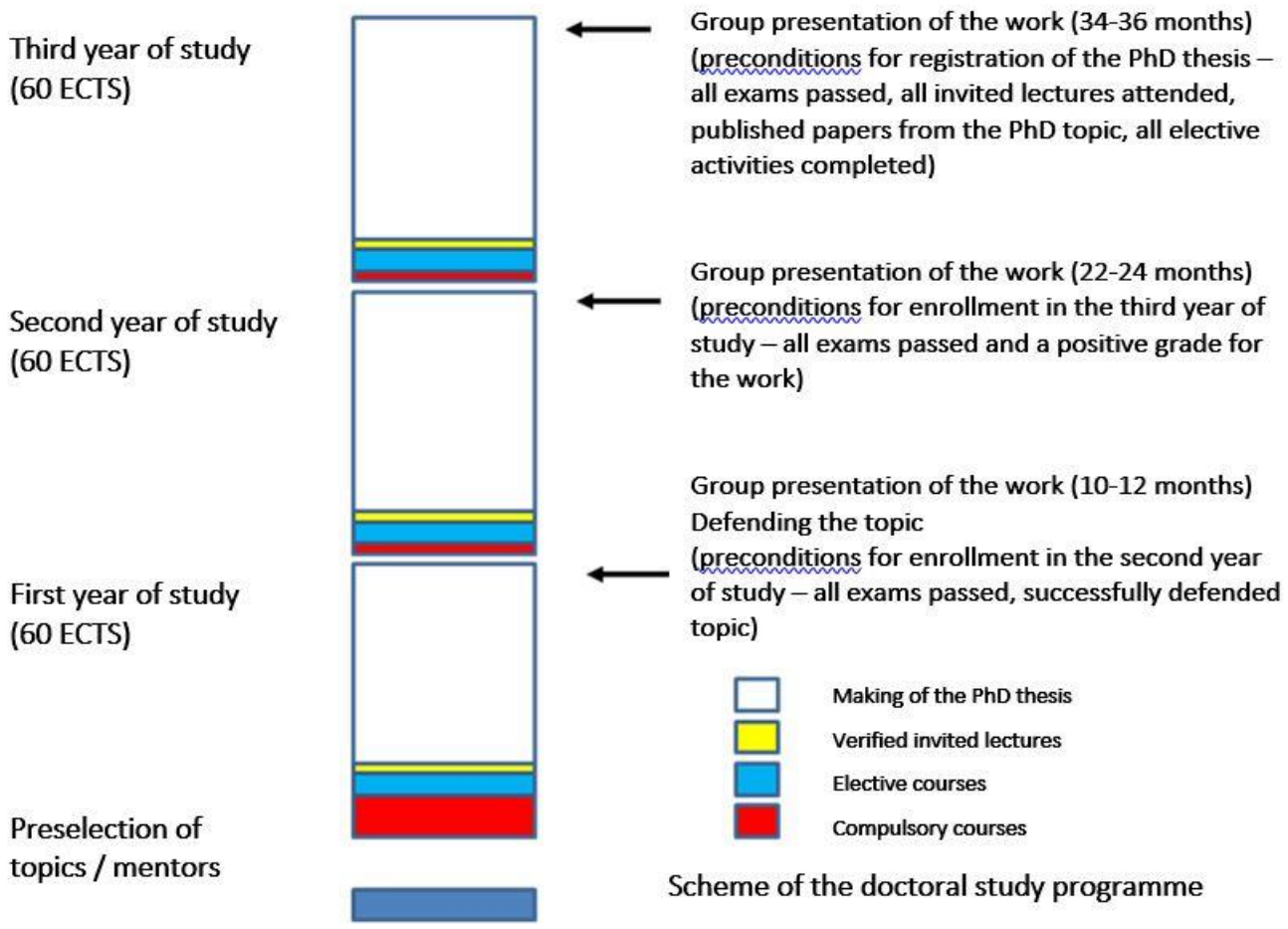
2. *Second year of study (60 ECTS)*

• Compulsory courses (2,5 ECTS)
• Elective courses (6 ECTS)
• Invited lectures (0,5 ECTS)*
• Preparation and presentation of the PhD thesis (51 ECTS)
- Defense of the topic of the PhD thesis (1 ECTS)
- Second public presentation of the work results (1 ECTS)
- Mandatory elective activities (2 ECTS)*
- Research work (47 ECTS)

3. *Third year of study (60 ECTS)*

• Compulsory courses (2.5 ECTS)
• Elective courses (4 ECTS)
• Invited lectures (0,5 ECTS)*
• Preparation, presentation, and defense of the PhD thesis (53 ECTS)
- Publication of the work results from the PhD topic (10 ECTS) *
- Mandatory elective activities (3 ECTS)*
- Third public presentation of the work results (1 ECTS)
- Research work (29 ECTS)
- Registration and defense of the PhD thesis (10 ECTS)

*The workload of the Invited lectures, Mandatory elective activities, and Publication of results may be distributed in a different (more flexible) manner during the course of study, but the complete fulfillment of these items is the precondition for registration of the PhD thesis.



Scheme of the doctoral study programme

Special Notes

PhD students - are required, immediately prior to enrollment and in agreement with their mentors, to choose elective courses for all three years of study and inform the head of the study programme. PhD students are also required to attend classes regularly and pass the exams for all compulsory and elective courses that end in the given year of study. They are also required to attend to all the invited verified lectures and publicly present their work results in front of the Committee for Scientific Research Activity in order to be eligible for enrollment in the next year of study (as specified under 3.3.1). Similarly, PhD students are required to regularly perform their obligations concerning work on their PhD thesis. PhD students must submit an annual report (which includes a review of their work and their mentor's work) to the Office of Science, Projects and Doctoral Studies at least 1 week prior to the scheduled public group presentations of their work.

Mentors – are obligated to supervise and direct the work of PhD students through individual consultations (at least 1 hour per week), regular group meetings (at least 1 hour per week), and control of the work in the lab/work site on a weekly basis. Mentors are also required to submit an annual report (which includes the review of the student's

work and their own work) to the the Office of Science, Projects and Doctoral Studies no later than **1 week** prior to the scheduled public group presentation of the students' work.

Leaders (coordinators) of compulsory and elective courses - are obligated to organize course classes in continuity (all block courses must be completed within a **maximum of one week**). Course coordinator **arranges the time** of classes in agreement with the **head** of a given study programme. Course coordinator and the the Office of Science, Projects and Doctoral Studies, along with the Office for Quality Control, are obliged to organize a survey among students concerning the classes after the completion of courses, but before the exams. Course coordinator **must organize** a written and/or oral exam immediately after completion of their respective course, or at the latest **within 2 weeks** of the completion of the course.

Quality control of the study

Monitoring the quality of teaching activities

Those responsible for the quality control of the teaching activities within individual courses are the course leader (coordinator), the head of the given doctoral programme, and the Committee for Assurance and Enhancement of Quality. The course leader takes care of the organization and delivery of classes in a planned timeframe, and monitors the quality of classes through internal surveys and analysis of the exam results. If they estimate that some of the professors fail to fulfill their obligations, they can suggest some amendments to the course to the head of the study programme. The Office of Science, Projects and Doctoral Studies in cooperation with the head of the study programme conducts an anonymous survey about the quality of classes held at the end of each course. The survey results are submitted to the course leader, the head of the study programme and the Vice-Dean for Scientific and Research Activity, who is also the head of the Doctoral School Council.

Monitoring the quality of work of PhD students and mentors

Monitoring the quality of work of PhD students is one of the important parts of the programme and part of the ongoing activities of employees of the Doctoral School. Each PhD student is required to register and defend the topic of their PhD thesis in front of the Expert Committee and at least two representatives of the Committee for Scientific Research Activity by the end of the first year of study. The candidates will publicly present their respective work before the Committee for Scientific Research Activity as part of their public group presentation organized annually for all PhD students. At least one week prior to the presentation, the candidates and their mentors are required to separately submit to the Committee their annual reports on an appropriate form (Mentor's Report and PhD Student's Report). In their annual report, a PhD student presents a report about the research they have conducted, their evaluation of the working conditions, their progress, and their mentor's work. The mentors, on the other hand, present in their annual report an evaluation of their candidate's progress, their creativity, independence, technical and social capacity, and an opinion about their contribution in the student's guidance. Based on these reports and public presentations by PhD students (along with appropriate questions addressed to the PhD students and their respective mentors), the Committee compiles a report on the work of each candidate and their mentor and submits it to the Doctoral School Council. The Committee for Scientific Research Activity may propose in its report: a) **continuation of work on the topic of the PhD thesis**; b) **continuation with a revision of the research plan**; c) **complete discontinuation of work on the proposed topic**. The Office of Science, Projects and Doctoral Studies attaches the periodic report to each student's and mentor's personal file. As part of **the third report** (third year of study), the Committee for Scientific Research Activity may recommend to the Doctoral School Council **extension of the period for completion of a PhD thesis by one year** (i.e. contract extension) if it concludes that the work is progressing well towards completion of the thesis, but due to the complexity of the project or objective circumstances (for example, work at the clinic) needs an extension of the deadline. The Committee may do the same thing in its fourth (fourth year of study) and fifth (fifth year of study) report. In the event of **recommendation to discontinue work on a topic**, it has to be specified whether this is due to **lack of commitment on the part of the student or the mentor**, or due to some **objective difficulties in research.** Depending on the justification, the Committee for Scientific Research Activity may propose to the Doctoral School Council to either:

a) **interrupt the student's study with termination of the contract**; b) **change the topic while keeping the same mentor with the necessary modification of the contract**; c) **change the topic and the mentor, thus concluding a new contract**; d) **extend the period for completion of a PhD thesis by one year, thus extending the contract** (third, fourth or fifth report); e) **continue working with adjustments to the plan and research focus**; f) **continue the research without any adjustments to the plan**. PhD students whose study has been interrupted because of their negligence, **lose their right to study in the doctoral programmes** of the Doctoral School in *Biomedicine and Health*. **Mentors (co-mentors)** whose negligence threatens the completion of a PhD thesis will **lose the right to obtain new mentorship over the next three years,** which will be registered in the Mentor Register.

Monitoring the candidate's career upon completion of doctoral studies

Monitoring the career development of PhD students is a measure which verifies the success of the doctoral programme (Doctoral School) in scientific and other forms of education of PhD students through their contribution to the development of their immediate and wider community, and their national and international recognisability. All PhD students who successfully complete their studies by defending their PhD thesis will be contacted once a year and interviewed by the Office of Science, Projects and Doctoral Studies in order to keep the appropriate records. The Office of Science, Projects and Doctoral Studies, together with the head of the study programme, has to analyze the success of PhD students once a year, which they have to submit to the Doctoral School Council in their regular annual report.

Preparation of the PhD thesis

Registration and defense of the topic of the PhD thesis

PhD students are required to **register** their PhD thesis topic by the end of the first year of study at the latest, which is also a requirement for entry into the second year of study. The topic should be defended by the end of the second year of study as a condition for entry into the third year. After the registration of the topic, the Committee for Scientific Research Activity will check the scientific foundation of the topic and the technical correctness of the registration. It will also verify whether the Committee for Biomedical Ethics of the Faculty of Medicine and ethics committees of other institutions in which the respective research will be carried out have given a positive report. If the registration is in line with all the requirements, the Committee will propose to the Faculty Council the list of members for the Expert Committee for assessment and public defense of the topic. The Expert Committee must consist of at least three members in the scientific or scientific and teaching vocation, one of whom must be from another institution (preferably from another university). There is also a substitute member in case one of the members is for some reason unable to attend the defense of the PhD topic. The mentor **cannot be** a member of the Expert Committee. After that, based on the report of the Expert Committee, the Committee for Scientific Research Activity will either: a) return the material to the candidate for amendment in line with the attached comments of the Expert Committee and the Committee for Scientific Research Activity. In this case, the candidate has to amend the topic accordingly and submit it for inspection to the Expert Committee and Committee for Scientific Research Activity by the end of the second academic year; b) accept the topic and make such proposal to the Faculty Council; or c) reject the topic and make such proposal to the Faculty Council. If the candidate's PhD thesis topic is rejected, the Doctoral School Council will decide whether the candidate will have to terminate their study or they will be given, due to objective conditions (e.g., poor mentor's performance, other circumstances), the possibility to change their topic and/or mentor.

Monitoring the progress of the PhD thesis

Each candidate's progress on the work on their PhD thesis will be monitored by: 1) the candidate's annual report; 2) the mentor's annual report, 3) group annual public presentation of PhD students. On the basis of these annual reports and the group public presentations, the Committee for Scientific Research Activity will compile a report on each PhD student and submit it to the Doctoral School Council. The report must specify the grade of the candidate's performance: a) the work on the PhD thesis is progressing well and is in accordance with the research

plan; b) there are some deviations from the research plan, in which case specific adjustments are recommended, and c) the work on the completion of the PhD thesis is not progressing, in which case a change of the topic and/or mentor is suggested. In the last case, the finding should be accompanied by an opinion on whether the student's work on the thesis is not progressing due to: a) negligent performance of the student, b) negligent performance of the mentor, or c) some objective circumstances (illness, lack of resources, etc.). Based on the report of the Committee for Scientific Research Activity, the Doctoral School Council will propose to the Faculty Council the appropriate decision on the continuation of work for a given candidate or mentor.

Registration and defense of the PhD thesis

The candidate may submit their PhD thesis for evaluation only upon fulfillment of all the necessary requirements (see below). After the PhD thesis is registered, the Committee for Scientific Research Activity will check whether it fulfills the basic scientific and technical criteria and will propose to the Faculty Council three members of the Expert Committee for assessment of the thesis, of whom at least one must be from another institution (university). The mentor cannot be a member of the Expert Committee. The Expert Committee will submit a report (jointly or separately) to the Committee for Scientific Research Activity, which will then submit its draft decision to the Faculty Council for approval. If the Faculty Council accepts the positive decision on the thesis, the candidate will be invited to defend it publicly before the Thesis Committee of the same composition as the Expert Committee for assessment of the thesis. The mentor is present during the defense, but is not allowed to be a member of the Thesis Committee.

Defense of PhD topics and PhD theses is organized on-site, with the option that one member of the appointed committee, based on the request submitted to the Committee for Scientific Research Activity, can attend the defense online.

21.1. Enrollment requirements for each semester or trimester (list of courses)

Requirements for enrollment in the next academic year are successfully passed exams in all courses (compulsory and elective) planned in the curriculum for that year of study, as well as a positive review from the Doctoral School Council after the public presentation of the students' work results.

21.2. List of courses and/or modules that can be implemented in a foreign language (specify the language of implementation)

All courses in the doctoral programme can be delivered in English.

21.3. Criteria for recognition of courses completed in other study programmes

The Doctoral School Council decides on the recognition of the courses completed/passed in other study programmes at the proposal of the Committee for Scientific and Research Activity and the head of the study programme that the PhD student has enrolled in.

21.4. Number of ECTS credits that can be obtained in national and international mobility programmes

The study programme provides the PhD students to stay at another scientific institution (national or foreign) for the purpose of preparation of their PhD thesis (20 ECTS), and in accordance with the Rules of Doctoral Studies of the University of Rijeka.

22.Final requirement for completion of the study programme

The study will be completed with the public defense of the PhD thesis in front of the Expert Committee, the mentor, and the representative of the Committee for Scientific Research Activity.

22.1. Criteria for approval of PhD thesis submission and/or access to doctoral exam

The criteria for approval of a PhD thesis are:

- Successfully passed all compulsory and elective courses (28 ECTS)

- Attended all invited lectures (8) of student's choice (2 ECTS)
- Completed work on the PhD thesis at another institution for a period of 3 months or an alternative form of internationalization (20 ECTS)
- Performed all elective activities (5 ECTS)
- Publication of at least one first-author original scientific paper from the field of the PhD thesis in journals indexed in the WoSCC and Scopus database, which belong to Q1 or Q2 group in JCR or SJR database, for the research field according to the topic of the PhD thesis. Alternatively, the candidate must publish at least two original scientific papers from the topic of the PhD thesis in journals quoted in Web of Science Core Collection (WoS Core Collection) database, with an impact factor higher than 1, one of which has to be a first-author paper.

22.2. Writing and formatting of the PhD thesis

The PhD thesis must be composed and formatted in accordance with the Rules of Doctoral Studies of the University of Rijeka. A PhD thesis can be written in the monograph form or according to the Scandinavian model (bound publications with an introductory and a concluding part), which will be more closely defined by the Faculty Rules. The thesis may be written in English or Croatian. If the thesis is written in Croatian, the abstract has to be written in English, and vice versa.

22.3. Evaluation and defense procedure for PhD thesis

The PhD degree will be awarded upon the public defense of the thesis in front of a three-member Expert Committee and a representative of the Committee for Scientific Research Activity. The mentor is present during the defense, but is not allowed to be a member of the Committee, nor participate in the evaluation of the PhD thesis defense. The procedure of the thesis defense is stipulated by the Rules of Doctoral Studies of the University of Rijeka.

23. Quality monitoring with the aim of ensuring the acquisition of exit knowledge, skills and competencies is required at the University of Rijeka and is implemented at the level of constituent units (as described in Form IV.).

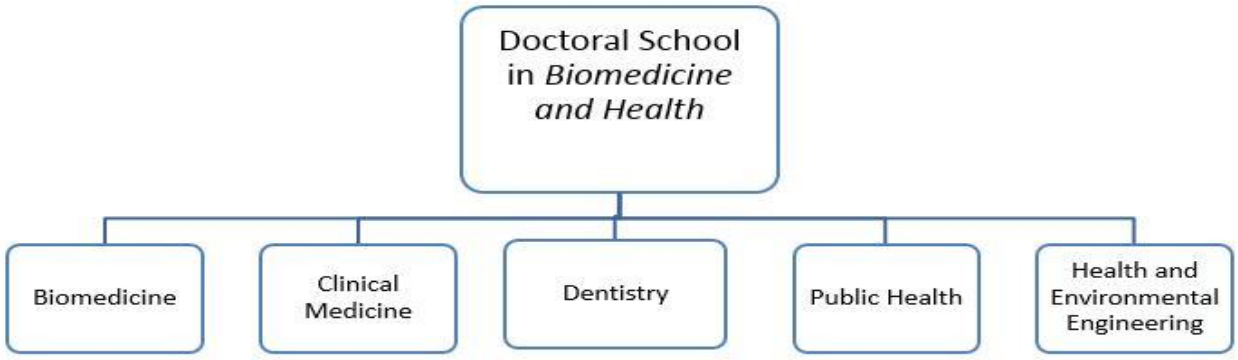
24. Other important information – according to the proposer

The establishment of the Doctoral School allows easier integration of new doctoral programmes, at the same time simplifying the organization of classes and quality control of the studies. The reform of the existing doctoral study programmes and the formation of the Doctoral School lies on three main pillars:

- Enrollment Criteria - entry adaptation of the doctoral candidates to the real capacity of the research institution, setting clear criteria for the selection of mentors that also determine the mentoring capacity of each mentor, the choice of general topics, and clear criteria for the selection of PhD candidates with an obligatory interview with each potential candidate.
- Reform of teaching - a significant reduction in class activities of the existing doctoral studies from 60 to 30 ECTS credits, scientifically-oriented classes, introduction of new teaching contents, common compulsory courses in all three study programmes, elective courses in line with the strategic priorities of the institution and the actual needs of the PhD students, invited lectures introduced as an obligatory form of elective classes, teaching quality control through analysis of the final exam results in all courses, and anonymous student surveys.
- Continuous and objective supervision of the work on the PhD thesis and of the doctoral career after graduation - This doctoral programme expects the PhD students to report the topic of their PhD thesis by the end of the first year and defend the topic by the end of the second year of study. It also provides a periodic supervision (once a year) of the work on the PhD thesis through group presentation of research results in front of the Committee for Scientific Research Activity, which will compile a report on each PhD student and mentor. Alongside this objective monitoring, the programme envisages periodic progress reports by the mentors and their PhD students (once a year) concerning their work.

Upon completion of the study programme, permanent contact with the PhDs (Alumni) will be maintained and periodical surveys will be conducted. The results thus obtained will be analyzed and used for further improvement in the programme of the Doctoral School.

The existing Postgraduate University Doctoral Study in *Biomedicine*, which will be completely replaced by the Doctoral School, has been performed at the University of Rijeka at the Faculty of Medicine since the 2005/06 academic year. The study consists of compulsory courses (30 ECTS), elective courses (30 ECTS), elective activities (30 ECTS) and compilation of a PhD thesis (90 ECTS), totaling 180 ECTS over the three years course of study. The study has been designed as a two-mode system: as a full-time study, which includes a three-year programme with an annual workload of 60 ECTS credits intended primarily for PhD students at pre-clinical departments, and as a part-time study, which includes a five-year programme with an annual workload of 36 ECTS credits, primarily intended for residents employed in health facilities. During the year 2015, a re-evaluation and revision of the existing doctoral studies have been conducted, which resulted in a significant reduction in the number of courses. During the year 2017, the Agency for Higher Education has conducted an evaluation of doctoral studies. The Committee that was engaged consisted of the following members: prof. Daniel W Lambert, University of Sheffield, United Kingdom; prof. Gabor Gerber, Semmelweis, Hungary; prof. Albert Selva O'Callaghan, Autonomous University of Barcelona, Arturo Moncado Torres, PhD student, KU Leuven, Belgium. It is clear from the final opinion (July 2017) that the main disadvantages of both the existing doctoral studies in *Biomedicine* and *Health and Environmental Engineering* are related to the mentor capacity and the competencies of individual professors. It was established that criteria for mentors are insufficiently elaborated, there is a weak scientific activity of individual mentors and an overload in several mentors resulting in an unacceptably low rate of completion of the PhD students. There is also a low level of scientific activity of individual professors at the doctoral study. The students' overload and insufficient class flexibility were also noted, with the recommendation to reduce the number of ECTS credits for classes and allow additional time for research. The remark was placed on the mechanisms of monitoring the progress of the PhD students and assessing the success of the mentors. Rigorous recruitment of clinical PhD students was required, along with the alignment of doctoral programmes with the actual needs of candidates, the mentors' abilities and the available financial resources.
With this reform, we want to include both studies with a common curriculum (especially compulsory courses), identical entry criteria, and methods of monitoring the PhD students. Due to the similarity of these two doctoral study programmes performed at the Faculty of Medicine of the University of Rijeka, and the need to introduce new programmes, we propose the establishment of the Doctoral School in *Biomedicine and Health*, which, in addition to the reformed existing study programmes, would include three new programmes: *Public Health, Clinical Medicine and Dentistry*. They would become Doctoral School programmes, which would allow balanced criteria for selecting candidates and monitoring their work, better use of teaching resources, interdisciplinarity, and multidisciplinarity.



Specific objectives of the Doctoral School are:

- Set clear and measurable criteria of excellence for the selection of mentors
- Establish a system of training and monitoring of the performance and effectiveness of a mentor (Mentor Register)
- Adjust the number of PhD candidates to actual scientific and research capacity of the institution
- Ensure quality selection of PhD candidates
- Ensure the international character of the Doctoral School
- Provide an objective and continuous supervision of work on the PhD thesis during the study
- Reduce credits (from 60 to 30 ECTS) and modernize the courses, which must be scientifically oriented
- Enable flexibility and interdisciplinarity in teaching
- Train students in generic skills (transferable skills), such as: presentation of a scientific paper, critical review of a scientific paper, planning and writing a project, communication with other scientists, intellectual property protection and entrepreneurship in biomedicine, etc., which should ensure better scientific adaptability and success in postdoctoral careers of PhD students (in academic institutions, businesses, etc.)
- Reduce the two-mode system of study to a unique study regime (3 years) with the possibility of extension of the deadline for supervised completion of the PhD thesis to a maximum of 6 years.
- Increase the quality of PhD theses (supervision of the work on the PhD thesis and quality of publications resulting from work).
- Establish a system of monitoring the careers of PhD students after graduation

All enrolled candidates must complete all teaching obligations (30 ECTS credits) during the first three years of study, regardless of their employment status (scholars, specialists, health care workers in institutions or companies outside the system of the Faculty of Medicine, etc.). Given the significant reduction in the teaching load compared to the existing study programmes (from 60 to 30 ECTS credits), there is no need for the existing two-mode system (in full-time and part-time), which makes it unnecessarily difficult to organize a study and monitor the PhD students, and damages the generational homogeneity of students. The expected time for preparation and defense of the PhD thesis for candidates who are dedicated to full-time work in completing the PhD thesis would be 3-4 years, while for candidates who, besides scientific activities, also perform professional work (e.g., specialists) would be a little longer (4-6 years).

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Table 1

List of compulsory and elective courses and/or modules with the number of class hours required for their implementation and the number of ECTS credits

LIST OF COMPULSORY COURSES							
COURSE OF STUDY	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS[5]
	Scientific research methodology	Prof. Lidija Bilić-Zulle, PhD	6	0	6	1,5	C
	Ethics of scientific research	Prof. Iva Rinčić, PhD	12	0	0	1,5	C
	Application of research methods in scientific work	Assoc. Prof. Ita Hadžisejdić, MD, PhD, Assoc. Prof. Koviljka Matušan Ilijaš, MD, PhD	0	52	8	3	C
	Presenting and analyzing scientific publications	Prof. Felix M. Wensveen, PhD	16	0	44	3	C
	Research management in biomedicine	Academician Stipan Jonjić, MD PhD Assoc. Prof. Vanda Juranić Lisnić, PhD	6	3	3	1,5	C
	Statistical design of scientific work	Prof. Lidija Bilić-Zulle, PhD	6	0	6	1,5	C
	Chosen invited lectures	Heads of study programmes of Biomedicine, Clinical medicine, Dentistry, Public Health and Health and Environmental Engineering	16	0	8	2	C
			62	55	75	14	

LIST OF ELECTIVE COURSES – course of study: Biomedicine							
COURSE OF STUDY	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Biomedicine	Experimental models and translational medical research	Prof. Bojan Polić, MD, PhD	12	0	8	2	E
	Viral pathogenesis I	Academician Stipan Jonjić, MD PhD	10	0	6	2	E
	Viral pathogenesis II	Prof. Astrid Krmpotić, MD, PhD	10	0	6	2	E
	Bacterial pathogenesis	Prof. Maja Abram, MD, PhD	16	0	0	2	E

[5] IMPORTANT: Insert C for compulsory courses or E for elective courses.

	Highly pathogenic microorganisms	Prof. Marina Šantić, PhD, Prof. Alemka Markotić, MD, PhD	12	0	4	2	E
	Sepsis – from bench to bedside	Prof. Vlatka Sotošek Tokmadžić, MD, PhD	8	0	8	2	E
	Innate immunity	Academician Stipan Jonjić, MD, PhD	10	0	6	2	E
	Disorders in the development, homeostasis and effector functions of T and B cells	Prof. Bojan Polić, MD, PhD	12	0	4	2	E
	Disorders of local immunity	Prof. Zlatko Trobonjača, MD, PhD	16	0	0	2	E
	Molecular basis of tumor important for clinical practice	Assoc.. Prof. Emina Babarović, MD, PhD	16	0	0	2	E
	Brain trauma and spinal cord injury: translational studies	Prof. Kristina Pilipović, MD, PhD	16	0	0	2	E
	Endocytosis and disorders of membrane trafficking	Prof. Hana Mahmutefendić Lučin, PhD	10	0	6	2	E
	Bone morphogenetic proteins	Prof. Sanja Zoričić Cvek, MD, PhD	8	0	8	2	E
	Monoclonal antibodies in medicine	Prof. Tihana Lenac Roviš, PhD	13	0	3	2	E
	Nanoparticles as drug delivery systems	Assoc. Prof. Damir Klepac, PhD	10	0	6	2	E
	Pathobiology of ageing and neurodegenerative disorders	Prof. Jasenka Mršić-Pelčić, MD, PhD	12	0	4	2	E

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LIST OF ELECTIVE COURSES – course of study: Clinical Medicine							
COURSE OF STUDY	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Clinical Medicine	Autoimmunity in gastroenterology	Prof. Sandra Milić, MD, PhD	6	0	6	2	E
	Endocrine biomarkers: from scientific investigation to clinical use	Prof. Dubravka Jurišić-Eržen, MD, PhD	10	0	2	2	E
	Imaging in personalized medicine	Prof. Damir Miletić, MD, PhD	12	0	4	2	E
	Biomechanical reconstruction of the locomotor system	Prof. Veljko Šantić, MD, PhD	12	0	4	2	E
	Molecular biology in urology- practical aplication and modern research	Prof. Josip Španjol, MD, PhD	10	0	6	2	E
	Inflammatory skin diseases - from immunopathogenesis to targeted therapy	Prof. Sandra Peternel, MD, PhD	12	0	0	2	E
	Neurostimuation and neuromodulation from bench to bedside	Assoc. Prof. Vladimira Vuletić, MD, PhD	6	4	6	2	E

LIST OF ELECTIVE COURSES – course of study: Dentistry							
COURSE OF STUDY	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Dental medicine	Pathophysiology of orofacial pain	Prof. Ivone Uhač, DMD, PhD Assoc. Prof. Sunčana Simonić-Kocijan, DMD, PhD	8	0	8	2	E
	Regeneration of the orofacial region	Prof. Tomislav Ćabov, DMD, PhD Asst. Prof. Romana Peršić Bukmir, DMD, PhD	8	0	8	2	E
	Efficacy and efficiency of dental treatments	Assoc. Prof. Davor Kuiš, DMD, PhD	9	0	7	2	E
	Properties and effects of dental biomaterials	Prof. Sonja Pezelj Ribarić, DMD, PhD	8	0	8	2	E
	Public health aspect of dentistry	Prof. Stjepan Špalj, DMD, PhD	12	0	4	2	E
	Experimental models in dentistry	Prof. Alen Braut, DMD, PhD	8	0	8	2	E

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LIST OF ELECTIVE COURSES – course of study: Public Health							
COURSE OF STUDY	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Public Health	Epidemiological research	Prof. Branko Kolarić, MD, PhD	12	4	8	3	E
	Epidemiology of malignant disease	Prof. Vanja Tešić, MD, PhD	8	0	8	2	E
	Infectious diseases as a modern public health challenge	Prof. Tomislav Rukavina, MD, PhD	5	0	10	2	E
	Public health interventions	Prof. Vanja Vasiljev, PhD	6	4	6	2	E
	Vaccination	Asst. Prof. Morana Tomljenović, MD, PhD	8	0	8	2	E
	Health economics	Prof. Gordana Blagojević Zagorac, MD, PhD	16	8	0	3	E
	Public healthcare and the sustainable development concept in the first half of the 21st century: from global towards local	Assoc. Prof. Aleksandar Racz, MD, PhD	10	0	6	2	E
	Global health	Prof. Ozren Polašek, MD, PhD	4	4	8	2	E
	Health inequalities	Assoc. Prof. Lovorka Bilajac, PhD	6	4	6	2	E
	Genetic epidemiology	Prof. Nada Starčević Čizmarević, PhD	6	2	2	1	E
	Noninvasive and invasive prenatal testing of chromosomal aneuploidies	Assoc. Prof. Jadranka Vraneković, PhD	8	0	2	1	E
	New technologies in public health	Assoc. Prof. Sven Maričić, PhD	6	4	6	2	E

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LIST OF ELECTIVE COURSES – course of study: Health and Environmental Engineering							
COURSE OF STUDY	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Health and Environmental Engineering	Mathematical modelling and computer simulations of environmental systems	Prof. Dalibor Broznić, PhD	5	10	5	2	E
	Environmental information systems	Assoc. Prof. Jadranka Pečar-Ilić, PhD	15	5	0	2	E
	Drug toxicology	Prof. Jasenka Mršić-Pelčić, MD, PhD	4	0	6	1	E
	Ecotoxicology	Assoc. Prof. Aleksandar Bulog, PhD	10	0	10	2	E
	Food safety	Prof. Olivera Koprivnjak, PhD	10	0	10	2	E
	Food risk analysis	Prof. Dražen Lušić, PhD	20	0	10	2	E
	Recent advances of nutrition application in health	Prof. Sandra Pavičić Žeželj, PhD	5	5	10	2	E
	Genetic diseases and environmental factors	Prof. Nada Starčević Čizmarević, PhD	12	0	2	2	E
	Water and air pollution	Prof. Darija Vukić Lušić, PhD	7	0	8	2	E
	Water resources in karst areas and their protection	Prof. Nevenka Ožanić, PhD	14	0	6	2	E
	Bioremediation	Prof. Jasna Hrenović, PhD	10	0	5	2	E
	Waste management	Prof. Luka Traven, PhD	7	0	3	2	E
	Microbial resistance in the environment	Prof. Ivana Gobin, PhD	5	0	15	2	E
	Outbreak control	Prof. Branko Kolarić, MD, PhD	10	0	10	2	E
	Bioterrorism	Prof. Vanja Tešić, MD, PhD	8	0	8	2	E
	Emerging zoonosis	Prof. Marina Šantić, PhD	10	0	10	2	E
	Rodents and the human health	Assoc. Prof. Dijana Tomić Linšak, PhD	6	7	7	2	E
	Characterization and degradation of polymeric materials	Prof. Srećko Valić, PhD	20	5	5	3	E
	Proteomics in the research of environmental agents toxicity	Prof. Gordana Čanadi Jurešić, PhD	6	2	2	2	E

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Courses by year of study

LIST OF COURSES							
Year of study: I							
Semester: I + II							
	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Compulsory courses	Scientific research methodology	Prof. Lidija Bilić-Zulle, PhD	6	0	6	1,5	C
	Ethics of scientific research	Prof. Iva Rinčić, PhD	12	0	0	1,5	C
	Application of research methods in scientific work	Assoc. Prof. Ita Hadžisejdić, MD, PhD, Assoc. Prof. Koviljka Matušan Ilijaš, MD, PhD	0	26	4	1,5	C
	Presenting and analyzing scientific publications	Prof. Felix M. Wensveen, PhD	6	0	14	1	C
	Statistical design of scientific work	Prof. Lidija Bilić-Zulle, PhD	6	0	6	1,5	C
	Chosen invited lectures (4)	Heads of study programmes	8	0	4	1	C
Elective courses	Elective course I						E
	Elective course II						E
	Elective course III						E

LIST OF COURSES							
Year of study: II							
Semester: III + IV							
	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Compulsory courses	Application of research methods in scientific work	Assoc. Prof. Ita Hadžisejdić, MD, PhD, Assoc. Prof. Koviljka Matušan Ilijaš, MD, PhD	0	26	4	1,5	C
	Presenting and analyzing scientific publications	Prof. Felix M. Wensveen, PhD	5	0	15	1	C
	Chosen invited lectures (2)	Heads of study programmes	4	0	2	0,5	C
Elective courses	Elective course IV						E
	Elective course V						E
	Elective course VI						E

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LIST OF COURSES							
Year of study: III							
Semester: V + VI							
	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
Compulsory courses	Presenting and analyzing scientific publications	Prof. Felix M. Wensveen, PhD	5	0	15	1	C
	Research management in biomedicine	Academician Stipan Jonjić, MD, PhD Assoc. Prof. Vanda Juranić Lisnić, PhD	6	3	3	1,5	C
	Chosen invited lectures (2)	Heads of study programmes	4	0	2	0,5	C
Elective courses	Elective course VII						E
	Elective course VIII						E

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Table 2

Course description

COURSE DESCRIPTION		
Course instructor	Prof. Lidija Bilić-Zulle, PhD	
Lecturers		
Name of the course	Scientific research methodology	
Study programme	Doctoral school Biomedicine and health	
Status of the course	compulsory course	
Year of study	I.	
ECTS credits and manner of instruction	ECTS credits	1,5
	Number of class hours (L+E+S)	6+0+6
1. Course objectives		
The aims of the course are to teach students: Basic knowledge on the structure of scientific research and scientific research projects; how to master the skills of writing a scientific research project, to shape a scientific hypothesis; to plan, prepare, conduct and conclude their own scientific research; and where to publish the results of their research.		
2. Course enrolment requirements		
Admission of doctoral study program.		
3. Expected learning outcomes		
• PhD students will acquire basic knowledge (facts, data) on the structure of scientific investigation: science, characteristics of biomedical science, scientific research and its structure, types of scientific research, scientific work as a written scientific report, rules of writing scientific report, search of existing scientific information and comparison with obtained results, what is allowed and what is not allowed in science-all for the purpose of understanding the basic glossary of scientific research methodology; • PhD students will learn how to conduct their own research in a way that they can: understand the problems, find published data, pose the research questions, formulate hypotheses, conduct a research, collect data with the understanding of statistics, information technology and data processing technology, define results, discuss about the investigation, criticaly review their own research (advantages and disadvantages); • Learning how to to shape their own scientific report (article) as a result of research: the logic of the scientific report, the general characteristics and the specifics of the scientific journals, the general rules of publication, forming the concept of the manuscript/report, the preparation of data for statistical analysis, presentation and interpretation of the results, writing the report, communicating with the publisher, reviewing and citing. • PhD students will develop a positive attitude towards scientific integrity and scientific methodology, which will enable them to conduct socially responsible and sustainable research.		
4. Course content		

- Concept and structure of the scientific article (Lidija Bilić-Zulle), 2 class hours
- organization of written reports
- IMRAD structure
- Research types (Lidija Bilić-Zulle), 2 class hours
- Observational research
- Experimental research
- Clinical trial
- Characteristics and Search of Medical Information (Lidija Bilić-Zulle), 2 class hours
- characteristics of biomedical literature
- informal and formal information transfer
- structure of literature
- library catalogs and electronic library of bibliographic data
- Research Projects (Lidija Bilić-Zulle), 2 hours
- definition and types of scientific research projects
- purpose of writing the project
- writing particular parts of scientific research projects
- project management
- Formulation of scientific research report (Lidija Bilić-Zulle, 4 hours)
- preparation of data and literature
- preparing manuscript and communication with the editorial board of a scientific journal
- check before submitting the manuscript

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Attending classes, active participation in teaching, independent writing of a research project during the course, seminar work.

8. Monitoring of student work[6]

Class attendance	0,2	Class participation	0,2	Seminar paper	0,6	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation and evaluation of the PhD during the course will be in accordance with the applicable regulations of the University of Rijeka (approved by the Senate) and the Regulations of the Faculty of Medicine (approved by the Faculty Council). Achievements during the course will be evaluated by continuous checking of knowledge and activities at the seminar. At the end of the course, each doctoral candidate will

[6] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

write a critical analysis of the scientific article - a written examination of the knowledge that will encompass the synthesis of the knowledge gained in the course.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Marušić M, ur. Uvod u znanstveni rad u biomedicini. Zagreb: Medicinska naklada (5. obnovljeno i dopunjeno izdanje), 2013.
2. Petrie A, Sabin C. Medical statistics at a glance. London: Blackwell Science, 2005.
3. ICMJE. Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals. Dostupno na: http://www.icmje.org/recommendations/ .

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Kern J, Petrovečki M, ur. Medicinska informatika. Zagreb: Medicinska naklada, 2009.
2. Ferenczi E, Muirhead N. Statistika i epidemiologija (doktor u jednom potezu). Medicinska naklada, Zagreb, 2012.
3. Lacković Z, ur. Struktura, metodika i funkcioniranje znanstvenog rada. Zagreb: Medicinska naklada, 2010.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Marušić M, ur. Uvod u znanstveni rad u biomedicini. Zagreb: Medicinska naklada (5. obnovljeno i dopunjeno izdanje), 2013.	10	30
Petrie A, Sabin C. Medical statistics at a glance. London: Blackwell Science, 2005.	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

By completing the course, the students, through an anonymous survey, express their attitudes on the organization of teaching, course content and teacher activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Iva Rinčić, PhD	
Lecturers	Prof. Amir Muzur, MD, PhD, Prof. Dinko Vitezić, Md, PhD, Asst. Prof. Gordana Pelčić, MD, PhD, Assoc. Vanja Pupovac, PhD	
Name of the course	Ethics of scientific research	
Study programme	Doctoral school Biomedicine and health	
Status of the course	compulsory course	
Year of study	I.	
ECTS credits and manner of instruction	ECTS credits	1,5
	Number of class hours (L+E+S)	12+0+0

1. Course objectives

The basic aim of the course is to inform the students on the specificities of scientific work ethics.
It is to be expected that the course participants have attended classes on „Introduction to scientific research" during their undergraduate schooling, including contents which have informed them about research methodology and elementary ethics. This course is supposed to build up their knowledge on basic documents regulating scientific work ethics, plagiarism, consent, vulnerable subjects, privacy, confidentiality, etc. By aquiring that knowledge, the participants would be ready to perform research of higher quality. The participants will as well be able to apply basic documents regulating research ethics in practice and to critically judge about ethical aspects of the research protocol.

2. Course enrolment requirements

No special requirements

3. Expected learning outcomes

Select, list and classify the most relevant questions of scinetific work reserach (plagiarism, consent, vulnerable subjects, privacy, confidentiality, etc.), analysis and compariosn of selected ethical principles; designing, critical judgement and validation of correlavtive arguments within evaluation of reserach protocols; acquiring and application of relevant skills related to submitting research protocol to ethial evaluation.

4. Course content

Research ethics (Iva Rinčić)
Science and society (Amir Muzur)
Bioethical research protocol (2 hours) (Nada Gosić)
Ethics in laboratory work (Iva Rinčić)
Ethics committee (Iva Rinčić)
Informed consent (Iva Rinčić)
Privacy and confidentiality (Gordana Pelčić)
Ethical aspects of clinical drug trials (Dinko Vitezić)
Plagiarism (Vanja Pupovac)
Ethics of scientific work publishing (Vanja Pupovac)
Vulnerable and incompetent subjects (Gordana Pelčić)

5. Manner of instruction	X lectures	x individual assignments

	☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	x multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Regular class attendance, preparing a seminar paper (research protocol analysis), final examination.

8. Monitoring of student work[7]

Class attendance	0,4	Class participation		Seminar paper	0,3	Experimental work	
Written exam	0,8	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Record will be kept of class attendance; seminar paper will be a condition to the admission to the final exam, and final examination questions will be announced (in form of a knowledge catalogue).

10. Mandatory literature (at the time of submission of study programme proposal)

Lecture materials (available to students)

11. Optional/additional literature (at the time of submission of the study programme proposal)

European Commission (2010). European Textbook on Ethics in Research. Bruxelles: EC.
Post SG, ed. (2004). Encyclopedia of Bioethics. 3rd. rd. Detroit: Gale (selected chapters).
Helsinki Declaration (2000). Acta stomatologica Croatica 34 (3): 341-2

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
European Commission (2010). European Textbook on Ethics in Research. Bruxelles:EC	30	30
Helsinki Declaration (2000). Acta stomatologica Croatica 34 (3): 341-2	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Anonimous questionnaire.
Seminar paper (0.7) is related to audit and evaluation of provided knowledges, skills and competences (research protocol to Ethics committee, evaluation of proposed ethical criteria).

[7] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Ita Hadžisejdić, MD, PhD, Assoc. Prof. Koviljka Matušan Ilijaš, MD, PhD	
Lecturers	Prof. Smiljana Ristić, PhD,Prof. Nada Starčević Čizmarević, PhD, Assoc. Prof. Jadranka Vraneković, PhD, Asst. Prof. Manuela Avirović, MD, PhD, Assoc. Prof. Ivana Gobin, PhD, Assoc. prof. Vanda Juranić Lisnić, PhD, Assoc. Prof. Slađana Bursać, PhD, Assoc. Prof, Berislav Lisnić, PhD, Prof. Tihana Lenac Roviš, PhD, Assoc. Prof. Gordana Čanadi Jurešić, PhD, Assoc. Prof. Kristina Grabušić, PhD, Assoc. Prof. Ilija Brizić, PhD, Prof. Zlatko Trobonjača, MD, PhD, Paola Kučan Brlić, PhD, Mijo Golemac, Prof. Dalibor Broznić, PhD, Marina Pribanić Matešić, PhD, Asst. Prof. Maja Cokarić Brdovčak, PhD, Jelena Železnjak, PhD, Prof. Tomislav Rukavina, PhD, Prof. Vanja Vasiljev, PhD, Assoc. Prof. Lovorka Bilajac, PhD, Prof. Kristina Pilipović, MD, PhD, Assoc. Prof. Emina Babarović, MD, PhD, Asst. Prof. Darko Roviš, PhD	
Name of the course	Application of research methods in scientific work	
Study programme	Doctoral school Biomedicine and health	
Status of the course	compulsory course	
Year of study	I., II.	
ECTS credits and manner of instruction	ECTS credits	3
	Number of class hours (L+E+S)	0+52+8

1. Course objectives

It is important to clearly identify the problem or the goal of our research to which we want to find an answer and to select the appropriate analytical methods in order to do so. It is therefore important for students to become familiar with practical ways of working in research laboratories as well as the equipment available at different Departments.
Objectives of this course:
1. To introduce students of postgraduate studies with methods and technologies available at Faculty of Medicine university of Rijeka
2. To train students for proper selection and independent performance of available biomedical methods
3. To introduce students of postgraduate studies with different laboratories at the Faculty of Medicine and thereby encourage future co-operation. Such enhanced networking of the scientific community would enable more efficient use of the available equipment as well as greater scientific productivity.

2. Course enrolment requirements

Enrolment at the postgraduate PhD programme

3. Expected learning outcomes

Upon completion of this tutorial, students will be trained:
1. To perform and describe in total 4 of the selected groups of the analyses, specify sample preparation methods, indicate necessary reagents and their preparation, enumerate and specify the equipment for their implementation.
2. To describe the advantages, disadvantages and specify limitations of selected research methods.

3. To specify how to standardize and set parameters for optimal performance of the selected research methods including incorporation of the controls as well as how to choose necessary controls.
4. To interpret and analyse the results obtained using selected research methods.

4. Course content

Each student chooses four groups of methods from the following list offered by the aforementioned persons, ie departments. The selection should be based on those analyzes that student will use to conduct his or her own research that should result in a doctoral dissertation. The student is obliged to keep notes of practical laboratory work related to the selected methods, which should be presented and handed in, later on, at the form of written report:

1. Chromosome analysis: karyotyping methods and FISH analysis in medical genetics, FISH analysis in neoplastic diseases
   Jadranka Vraneković (Department of Biology and Medical Genetics)
   Ita Hadžisejdić (Department of Pathology)
   Koviljka Matušan Ilijaš (Department of Pathology)
2. DNA analysis I: genomic DNA isolation, Southern blot, PCR, quantitative real-time PCR
   Jadranka Vraneković (Department of Biology and Medical Genetics)
   Ita Hadžisejdić (Department of Pathology)
3. DNA II analysis: DNA sequencing, mutation analysis and genomic polymorphisms in human diseases
   Nada Starčević Čizmarević (Department of Biology and Medical Genetics)
   Ita Hadžisejdić (Department of Pathology)
4. RNA I analysis: RNA isolation, Northern blot analysis, reverse transcription, quantitative PCR
   Kristina Grabušić (Department of Physiology and Immunology)
   Ita Hadžisejdić (Department of Pathology)
5. Research methods in public health – qualitative and quantitative approach
   Tomislav Rukavina (Department of Social Medicine and Epidemiology)
   Vanja Vasiljev (Department of Social Medicine and Epidemiology)
   Lovorka Bilajac (Department of Social Medicine and Epidemiology)
   Asst. Prof. Darko Roviš (Department of Social Medicine and Epidemiology)
6. Science Communication Essentials
   Danijela Poljuha
7. Recombinant DNA technology II: expression of genes in prokaryotes (construct design, cloning, expression and purification of recombinant proteins in bacteria)
   Berislav Lisnić (Center for Proteomics)
8. Recombinant DNA technology III: gene expression in eukaryotes (construct design, cloning, expression and purification of recombinant proteins in eukaryotic expression systems)
   Berislav Lisnić (Center for Proteomics)
   Vanda Juranić Lisnić (Center for Proteomics)
   Ilija Brizić (Center for Proteomics)
9. Protein analysis I: protein isolation, Western blot analysis, immunoprecipitation, biotinylation, detection of posttranslational modification (glycosylation, phosphorylation)
   Tihana Lenac Roviš (Center for Proteomics)
   Berislav Lisnić (Center for Proteomics)
   Ilija Brizić (Center for Proteomics)
   Vanda Juranić Lisnić (Center for Proteomics)
   Marina Pribanić Matešić (Center for Proteomics)
   Maja Cokarić Brdovčak (Center for Proteomics)
   Jelena Železnjak (Center for Proteomics)

10. Protein analysis II: ELISA, identification of soluble proteins in biological liquids, method development, tumor biomarkers detection
    Tihana Lenac Roviš (Center for Proteomics)
    Gordana Čanadi Jurešić (Department of Chemistry and Biochemistry)
    Paola Kučan Brlić (Center for Proteomics)
    Ilija Brizić (Center for Proteomics)
11. Protein analysis III: 2D protein electrophoresis, mass spectrometry
    Gordana Čanadi Jurešić (Department of Chemistry and Biochemistry)
    Dalibor Broznić (Department of Chemistry and Biochemistry)
12. Analysis of protein IV: production, characterization and quality control of monoclonal antibodies, development of their derivates
    Tihana Lenac Roviš (Center for Proteomics)
    Vanda Juranić Lisnić (Center for Proteomics)
    Paola Kučan Brlić (Center for Proteomics)
13. Cell and Tissue Analysis I: multiparametric flow cytometry and cell sorting
    Vanda Juranić Lisnić (Center for Proteomics)
    Zlatko Trobonjača (Department of Physiology)
14. Cell and Tissue Analysis II: immunofluorescence, immunohistochemistry, confocal microscopy (analyses on cells and tissue)
    Tihana Lenac Roviš (Center for Proteomics)
    Mijo Golemac (Department of Histology and Embryology)
    Koviljka Matušan Ilijaš (Department of Pathology)
    Manuela Avirović (Department of Pathology)
15. Biobank: storage and use of human biological material
    Manuela Avirović (Department of Pathology)
    Emina Babarović (Department of Pathology)
16. Lipid and vitamin analysis: thin layer / gas / liquid chromatography
    Gordana Čanadi Jurešić (Department of Chemistry and Biochemistry)
    Dalibor Broznić (Department of Chemistry and Biochemistry)
17. Methods and ethical aspects of laboratory animals research
    Ilija Brizić (Center for Proteomics)
    Kristina Pilipović (Department of Basic and Clinical Pharmacology and Toxicology)
18. Functional properties of bacteria
    Ivana Gobin (Department of Microbiology and Parasitology)Davorka Repac Antić (Department of Microbiology and Parasitology)

5. Manner of instruction	☐ lectures ☒ seminars and workshops ☒ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Students are obliged to actively participate in seminars and exercises. Upon completing the practical part of the exercise in the particular laboratory, they are obliged to write their own protocols by which they have performed the individual analyzes and the results they have obtained when performing them in the form of written report.

8. Monitoring of student work[8]

Class attendance	2,0	Class participation		Seminar paper		Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report	0,5	Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

During the course, the student's activity will be monitored, the referrals from the practical part (exercises) and the success of the course will be evaluated and marked. The final exam will be in the written form where we will evaluate students' knowledge of the chosen methods, including problem solving.

10. Mandatory literature (at the time of submission of study programme proposal)

Ambriović Ristov A. Metode u molekularnoj biologiji, Institut Ruđer Bošković 2007.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Selected research papers

1. Belančić A, Vranić L, Ševeljević I, Hadžisejdić I, Načinović AD, Jonjić N. Antiphospholipid antibodies associated with nodal marginal zone lymphoma and its progression to diffuse largeB-cell lymphoma-A case report. Pathol Res Pract 2018 Oct doi:10.1016/j.prp.2018.10.020 (Epub ahead of print)
2. Hadžisejdić I, Babarović E, Vranić L, Duletić Načinović A, Lučin K, Krašević M, Jonjić N. Unusual presentation of plasmablastic lymphoma involving ovarian mature cystic teratoma: a case report. Diagn Pathol 2017; 12 (1):83- CC
3. Rajković-MolekK, Mustać E, Hadžisejdić I, Jonjić N. The Prognostic Importance of Nuclear Factor κB and Hypoxia-inducible Factor 1α in Relation to the Breast Cancer Subtype and the Overall Survival.Appl Immunohistochem Mol Morphol. 2014;22 (6): 464-70.
4. Matušan-Ilijaš K, DamanteG, FabbroD, Đorđević G, Hadžisejdić I, Grahovac M, Avirović M, GrahovacB, Jonjić N, LučinK.EGFR expression is linked to osteopontin and Nf-κB signaling in clear cell renal cell carcinoma.Clin Transl Oncol. 2013;15(1):65-71.
5. Dorđević G, Matušan Ilijaš K, Hadžisejdić I, Maričić A, Grahovac B, Jonjić N.EGFR protein overexpression correlates with chromosome 7 polysomy and poor prognostic parameters in clear cell renal cell carcinoma.J Biomed Sci. 2012;19:40.
6. Matušan-Ilijaš K, Damante G, Fabbro D, Đorđević G, Hadžisejdić I, Grahovac M, Marić I, Spanjol J, Grahovac B, Jonjić N, Lučin K. Osteopontin expression correlates with nuclear factor-κB activation and apoptosis downregulation in clear cell renal cell carcinoma.Pathol Res Pract. 2011;207(2):104-10.
7. Valković T, Duletić-Načinović A, Stifter S, Hasan M, Hadžisejdić I, Zombori D, Grahovac B, Jonjić N. Macrophage chemotactic protein-1 mRNA levels in non-Hodgkin lymphoma.2010;10(4):229-35.
8. Hadžisejdić I, Mustać E, Jonjić N, Petković M, Grahovac B. Nuclear EGFR in ductal invasive breast cancer : correlation with cyclin D1 and prognosis.

12. Number of assigned reading copies in relation to the number of students currently attending the course

[8] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Title	*Number of copies*	*Number of students*
Ambriović Ristov A. Metode u molekularnoj biologiji, Institut Ruđer Bošković 2007.	10	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Students will evaluate the level of gained knowledge from the subject through an anonymous poll. In addition, the student's successes will be evaluated through the analysis of the exam results.

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COURSE DESCRIPTION		
Course instructor	Prof. Felix M. Wensveen, PhD	
Lecturers	Prof. Bojan Polić, MD, PhD, Academician Stipan Jonjić, MD, PhD, Prof. Siniša Volarević, MD, PhD, Assoc. Prof. Tamara Turk Wensveen, MD, PhD, Assoc. Prof. Đurđica Cekinović Grbeša, Prof. Ivana Munitić, PhD	
Name of the course	Presenting and analyzing scientific publications	
Study programme	Doctoral school Biomedicine and health	
Status of the course	compulsory course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	3
	Number of class hours (L+E+S)	16+0+44

1. Course objectives

The main goal of this course is to obtain critical reading skills and the ability to present your judgement to others. Specific goals are:

a. Education of students on recent developments in the fields discussed during the course
b. Education of students on how to critically analyze a scientific publication and to assess the appropriateness of its conclusions.
c. Education of students on how to present a scientific paper
d. Education of students on how to critically assess their own work and that of their peers through mutual assessment

2. Course enrolment requirements

Registration in one of the doctoral programs

3. Expected learning outcomes

At the end of the course, the students are expected to have better insights in the respective fields addressed during the course. More importantly, the students are expected to be able to critically assess fundamental and clinical research papers and evaluate the validity of its conclusions. Finally, the students are expected to be able to present their findings to their peers. Learning outcomes according to Bloom`s taxonomy will be: **Knowledge** – students are required to know how a research presentation should be structured. They should know how a research paper should be structured. They should know how the individual elements of presentations and papers should be formulated. **Comprehension** – The students are supposed to understand why research papers and presentations are structured in specific ways. **Application** – The students should be able to give a scientific presentation and critically analyze a research paper. **Analysis** – The student should be able to determine how a research presentation or research paper is perceived by a certain audience. **Synthesis** - The student should be able to adjust their presentation to the expected background knowledge of the audience. The student should be able to adjust the structure of a research paper to the requirements of a journal. **Evaluation** – The student should be able to identify the strengths and weaknesses in scientific presentations and papers.

4. Course content

Once per year, a number of introductory lectures will be given on research analysis and scientific data presentation. Attendance of these lectures is obligatory for enrolment in the seminar series. Seminars will

be held 5 to 7 times per year. Students must attend 8 seminars in total. The seminars will be led by experienced scientists with a fundamental scientific or clinical background. Each seminar will be started with a lecture from these scientists to introduce the topic. Before each seminar, participants are asked to prepare two research papers. During the seminar, the participants are divided in groups of 2-3 people. One of the groups is asked to present one of the papers to his peers. The discussion will be supervised by the session leader. Next, the second paper will be critically discussed by the session leader in an interactive way with the participants. Thus, participants will be introduced in the latest developments in a wide variety of scientific fields. Moreover, through an informal and interactive way, students will be educated to critically assess scientific papers and will learn to present the data to their peers. Lectures and some of the seminars will be in English.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Attendance of lectures and seminars. Preparation of two scientific papers, selected by the session host, for presentation and discussion.

8. Monitoring of student work[9]

Class attendance	1,5	Class participation	0,5	Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio		*Presentation*	1.0				

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students will be evaluated by the session leaders for their ability to present data and critically assess research papers.
Examination:
1. A written exam will be given in the form of a critical paper evaluation that has to be written by the student.
2. The oral presentation and subsequent answering of questions will function as an oral exam.

10. Mandatory literature (at the time of submission of study programme proposal)

Two selected scientific papers that will be sent to the students by email

11. Optional/additional literature (at the time of submission of the study programme proposal)

Reviews on the topic of the session, sent by the session leader.

12. Number of assigned reading copies in relation to the number of students currently attending the course

[9] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Title	*Number of copies*	*Number of students*
Scientific research papers	20	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Anonymous student surveys, tracking and rating of presentations and seminar papers and written exam. In addition, progress towards acquisition of expected learning outcomes will be monitored continuously during the programme and communicated back to the students..

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COURSE DESCRIPTION		
Course instructor	Academician Stipan Jonjić, MD, PhD Assoc. Prof. Vanda Juranić Lisnić, PhD	
Lecturers	Ani Gerbin, PhD, Prof. Tihana Lenac Roviš, PhD, Assoc. Prof. Ilija Brizić, PhD	
Name of the course	Research management in biomedicine	
Study programme	Doctoral school Biomedicine and health	
Status of the course	compulsory course	
Year of study	III.	
ECTS credits and manner of instruction	ECTS credits	1,5
	Number of class hours (L+E+S)	6+3+3
1. Course objectives		
The aim of the course is to increase the expertise of doctoral students in different areas of management and exploitation of research, including research funding, project management, knowledge and technology transfer process.		
2. Course enrolment requirements		
No special requirements		
3. Expected learning outcomes		
On completion of the course, students will: - independently use different tools for identifying research funding sources (agencies, funds, programmes and instruments), - draft a competitive research grant proposal (with strong and clear description of state of the art, objectives, methodology, work plan, budget, impact; feasibility, novelty and relevance), - explain knowledge and technology transfer processes in research institutions (protection and commercialisation of research findings), - prepare and successfully present an idea to business audience.		
4. Course content		
The course covers the following subjects: 1. Identification of appropriate opportunities for funding of research projects (1 hour lecture) 2. Understanding the grant lifecycle: proposal writing, evaluation, contracting and project implementation (2 hours lecture + 3 hours seminar/workshop in proposal preparation) 3. Exploitation of research: intellectual property rights, invention disclosing, patenting, licensing, industry collaboration, search for investors, spin-off founding (3 hours lecture + 3 hours exercise on evaluation of commercial potential of research results and idea pitching)		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Attendance, active participation and completion of course assignments

8. Monitoring of student work[10]

Class attendance	0,3	Class participation	0,1	Seminar paper		Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	0,6
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Assessment will be done by tracking the students' activity in class, attendance of the course and completion of the practical assignments (grant concept note preparation and review; idea pitching).

10. Mandatory literature (at the time of submission of study programme proposal)

Horizon 2020 Online Manual
http://ec.europa.eu/research/participants/docs/h2020-funding-guide/index_en.htm
Grants Management 101 Toolkit
http://www.grantsmanagement101.org/
European IPR Helpdesk: Guide to IP Commercialisation
https://www.iprhelpdesk.eu/sites/default/files/.../EU_IPR_Guide_Commercialisation.pdf
Harvard University's Startup Guide
https://otd.harvard.edu/upload/files/OTD_Startup_Guide.pdf

11. Optional/additional literature (at the time of submission of the study programme proposal)

Hackshaw, A.K., How to write a grant application, Chichester: Wiley-Blackwell (2011)
Arundel, A., N. Es-Sadki, F. Barjak, P. Perrett, O. Samuel and S. Lilischkis (2013). Knowledge Transfer Study 2010 – 2012 - Final Report. Brussels, European Commission.
Kneller, R. (2001). Technology transfer: A review for biomedical researchers. *Clinical Cancer Research, 7*(4), 761-774.
Perkmann, M., V. Tartari, M. McKelvey, E. Autio, A. Brostrom, P. D'Este, R. Fini, A. Geuna, R. Grimaldi, A. Hughes, S. Krabel, M. Kitson, P. Llerena, F. Lissoni, A. Salter and M. Sobrero (2013). Academic engagement and commercialisation: A review of the literature on university-industry relations. *Research Policy, 42*(2), 423-442.
Stevens, A., J. J. Jensen, K. Wyller, P. C. Kilgore, S. Chatterjee and M. L. Rohrbaugh (2011). The role of public-sector research in the discovery of drugs and vaccines. *The New England Journal of Medicine, 364*(6), 535-51.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
All literature is available online	30	0,2

[10] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Students' exit knowledge, skills and competences related to research management and exploitation will be monitored throughout the participation in the course (lectures, workshop and exercise) and the final exam. Students will anonymously fill up a questionnaire about the whole course after the lectures have been completed.

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COURSE DESCRIPTION		
Course instructor	Prof. Lidija Bilić-Zulle, PhD	
Lecturers		
Name of the course	Statistical design of scientific work	
Study programme	Doctoral school Biomedicine and health	
Status of the course	compulsory course	
Year of study	I.	
ECTS credits and manner of instruction	ECTS credits	1,5
	Number of class hours (L+E+S)	6+0+6

1. Course objectives

The aim of the course is to teach students (1) how to properly collect research data, (2) what are the characteristics of statistical hypothesis, and which mistakes may occur during its testing, how to properly formulate a statistical hypothesis, (3) how to calculate the power of research and how to determine the required sample size and (4) how results should be included in the report, ie scientific article.

2. Course enrolment requirements

Admission of doctoral study program.

3. Expected learning outcomes

After completing the course the student will be able to:

- break down the scientific hypothesis of research into a series of statistical hypotheses,
- determine and understand why type I and type II mistakes of hypothesis testing are reported,
- apply knowledge of measurement scales and variables in research,
- determine and calculate the power of research and sample size of prospective research,
- analyze the results of statistical analysis of data
- properly formulate the statistical report of research as an integral part of the scientific work.

4. Course content

- Testing of the statistical hypothesis (Lidija Bilić-Zulle), 2 class hours
  - scientific and statistical hypothesis
  - hypothesis testing errors, significance levels
  - selecting a statistical test
  - conclusion
- Collection, processing and data presentation (Lidija Bilić-Zulle), 2 class hours
  - writing and storing data
  - measurement scales
  - computer programs for statistical anaylsis
  - data presentation: text, tables, and images
- Descriptive statistics (Lidija Bilić-Zulle), 2 class hours
  - Measures of central tendency and variability
  - Non-parametric and parametric statistics
- Statistical testing (Lidija Bilić-Zulle), 2 class hours
  - Testing Differences and correlations

- The strength of the study (by Prof. Lidija Bilić-Zulle), 2 o'clock
  - strength of the study
  - parameters needed to calculate the strength of the study
  - sample size determination
- Statistical report of the scientific work (Lidija Bilić-Zulle), 2 hours
  - data for the Materials and Methods and Results of the scientific article
  - description of research, methodology of presentation, analysis and interpretation of data
  - a checklist for checking and reviewing the statistical and epidemiological methodology of biomedical research

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Regular attendance, seminar work.

8. Monitoring of student work[11]

Class attendance	0,2	Class participation	0,2	Seminar paper	0,6	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The evaluation and grading will be carried out in accordance with the applicable regulations of the University of Rijeka (approved by the Senate) and by the Regulations of the Faculty of Medicine (approved by the Faculty Council). Achievements during class will be evaluated by continuous checking of knowledge and activities in class. At the end of the course, the student will independently write their own example of the calculation of the sample size for an assumed study or an example of processing and displaying data for a newly developed survey.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Marušić M, ur. Uvod u znanstveni rad u biomedicini. Zagreb: Medicinska naklada (5. obnovljeno i dopunjeno izdanje), 2013.
2. Petrie A, Sabin C. Medical statistics at a glance. London: Blackwell Science, 2005.
3. Ferenczi E, Muirhead N. Statistika i epidemiologija (doktor u jednom potezu). Medicinska naklada, Zagreb, 2012.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Motulsky H. Intuitive biostatistics: A nonmathematical guide to statistical thinking. New York-Oxford: Oxford University Press, 2010.

[11] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

2. McHugh ML. Power analysis in research. Biochem Med 2008;18(3):263-74.
3. Petrovecki M. The role of statistical reviewer in biomedical scientific journal. Biochem Med 2009;19(3):223-30.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Marušić M, ur. Uvod u znanstveni rad u biomedicini. Zagreb: Medicinska naklada (5. izdanje), 2013.	10	30
Petrie A, Sabin C. Medical statistics at a glance. London: Blackwell Science, 2005.	30	30
Ferenczi E, Muirhead N. Statistika i epidemiologija (doktor u jednom potezu). Medicinska naklada, Zagreb, 2012.	2	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

By completing the course, the students, through an anonymous survey, express their attitudes on the organization of teaching, course content and teacher activities. Analysis of final exam results.

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COURSE DESCRIPTION		
Course instructor	Prof. Bojan Polić, MD, PhD	
Lecturers	Academician Stipan Jonjić, MD, PhD, Prof. Astrid Krmpotić, MD, PhD, Prof. Felix M. Wensveen, PhD, Assoc. Prof. Tamara Turk Wensveen, MD, PhD	
Name of the course	Experimental models and translational medical research	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+8

1. Course objectives

The main objective of this course is to introduce students with experimental approaches in research of different human diseases which enable faster translation of basic research into clinical practice. Students will be introduced with animal models, experimental design, appropriate use of genetically modified animals and basic principles of translational medical research.

2. Course enrolment requirements

The enrolment to the doctoral school.

3. Expected learning outcomes

General learning outcomes:

a) Students will define basic terms in translational medical research
b) Students will further develop communication skills
c) Students will further develop capabilities for team work and cooperation
d) Students will further develop skills to present research results

Specific learning outcomes:

a) Students will analyze scientific literature linked to a medical problem
b) Students will analyze and discuss usage of an appropriate experimental model for solving an appropriate problem
c) Students will analyze and discuss usage of different methods in solving molecular mechanism of a disease
d) Students will analyze and suggest possible clinical research based on experimental research on animal models.

4. Course content

This course will contain following subjects:

a) Laboratory animals and their use in experimental research – laboratory animal species, biological characteristics, maintenance and experimental use – Prof. Bojan Polić – L 2h
b) Design and use of genetically modified animals in biomedicine – transgenic animals, animals generated by gene targeting, use of genetically modified animals in research – Prof.dr. Bojan Polić- L 2h
c) Basic principles of translational medical research – Prof. Bojan Polić / Prof. Felix M. Wensveen, PhD – L2h/S2h

d) Experimental models of infective disease (example of murine cytomegalovirus infection) and an example of a translational research (development of CMV vaccine) – Academician Prof. Stipan Jonjić / Prof. Astrid KrmpotićMD, PhD – L 2h + S 2 h
e) Mouse models and translational research of Diabetes Mellitus type 2– Prof. Felix M. Wensveen, PhD / Doc. dr. Tamara Turk Wensveen – L 2h + S 2h,
f) Mouse models and translational research of non-alcoholic fatty liver disease (NAFLD)– Assoc. Prof. Tamara Turk Wensveen/ Prof. Felix M. Wensveen, PhD L 2h + S 2h

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Majority of the course (12h) will be covered by lectures, while the rest (8 h) will be taken by seminars where the students will present and discuss some examples of translational research from recent scientific literature.	

7. Student responsibilities

Students are obliged to attend and actively participate in discussions upon every subject presented. They are also obliged to attend the written exam at the end of the course and to fill up a survey about the course.

8. Monitoring of student work[12]

Class attendance	0,2	Class participation	0,5	Seminar paper	0,7	Experimental work	
Written exam	0,6	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The attendance to the course, acquired knowledge and activity of the students will be evaluated during the course (70% of the mark) as well as on the final written exam (30% of the mark). During the course there will be evaluated general skills (outcomes) of the students (30% of points), and specific outcomes (70% of points) as follows:

a) Acquired knowledge about the use of animal models in experimental biomedical research– 10% of points
b) Acquired knowledge about the design and use of genetically modified animal models in biomedicine– 20% of points
c) Acquired knowledge about methods in functional genomics and their use in translational medical research– 20% of points
d) Acquired knowledge about basic principles of translational medical research – 20% of points

The overall knowledge of the students acquired on the course will be tested with multiple-choice test (final exam). The final exam will contribute 30% to the final mark.

10. Mandatory literature (at the time of submission of study programme proposal)

[12] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

- Translational medicine: Tools and Techniques, edited by Aamir Shahzad, publisher: Associated Press -Elsevier Inc., 2016., ISSBN: 978-0-12-803460-6 (selected chapters)

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Wensveen FM, Jelenčić V, Valentić S, Šestan M, Wensveen TT, Theurich S, Glasner A, Mendrila D, Štimac D, Wunderlich FT, Brüning JC, Mandelboim O, Polić B. (2015) NK cells link obesity-induced adipose stress to inflammation and insulin resistance. Nat. Immunol. 16:376-385.
- Wensveen FM, Valentić S, Šestan M, Turk Wensveen T, Polić B. (2015) The "Big Bang" in obese fat: Events initiating obesity-induced adipose tissue inflammation. Eur. J. Immunol. 45:2446-56
- Šestan M, Marinović S, Kavazović I, Cekinović Đ, Wueest S, Turk Wensveen T, Brizić I, Jonjić S, Konrad D, Wensveen FM, Polić B. (2018) Virus-Induced Interferon-γ Causes Insulin Resistance in Skeletal Muscle and Derails Glycemic Control in Obesity. Immunity 49:164-177
- Polic B., Hengel H., Krmpotic A., Trgovchich J., Pavic I., Lucin P., Jonjic S. and Koszinowski U.H.. (1998). Hierarchical and Redundant Lymphocyte Subset Control Precludes Cytomegalovirus Replication during Latent Infection. J. Exp. Med. 188:1047-1054.
- A. Krmpotic, I. Bubic, B. Polic, P. Lucin and S. Jonjic (2003) Pathogenesis of murine cytomegalovirus infection. Microbes Infect. 5:1263-77.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Translational medicine: Tools and Techniques, edited by Aamir Shahzad, publisher: Associated Press -Elsevier Inc., 2016., ISSBN: 978-0-12-803460-6	2	30
Martin Wehling and Francesco M. Marincola „Principles of translational science in medicine: from bench to bedside“, Cambridge University Press, 2010, ISBN 978-0-521-88869-1	2	30
Bruce H. Littman and Rajesh Krishna „Translational medicine and drug discovery“, Cambridge University Press, 2011, ISBN 978-0-521-88645-1	2	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Analysis of the final exam results and students survey.

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COURSE DESCRIPTION		
Course instructor	Academician Stipan Jonjić, MD, PhD	
Lecturers	Prof. Astrid Krmpotić, MD, PhD, Assoc. Prof. Berislav Lisnić, PhD, Assoc. Prof. Ilija Brizić,Phd, Asst. Prof. Igor Jurak, PhD, Assoc. Prof. Vanda Juranić Lisnić, PhD, Prof., Prof. Tihana Lenac Roviš, PhD, Assoc. Prof. Đurđica Cekonović Grbeša, MD, PhD, Marija Mazor, PhD, Jelena Železnjak, PhD, Lea Hiršl, PhD, Maja Cokarić Brdovčak, PhD	
Name of the course	Viral pathogenesis I	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+6
1. Course objectives		
The main objective of this course is to provide the students with an introductory overview of viral pathogenesis with special focus on clinical applications and translational research.		
2. Course enrolment requirements		
Prior to the enrolment in the course the students must have a graduate degree in biomedical studies or biology / biotechnology. Students are expected to have basic knowledge in virology, microbiology and immunology. In addition, a basic background in cell biology is considered an advantage.		
3. Expected learning outcomes		
Explain molecular mechanisms of viral infections, virus-cell interactions and viral infections associated with malignant tumours. Analyze control of virus diseases by vaccination. Integrate acquired knowledge and competences for participation in advanced workshops/courses in related fields. Raise independence in reading and understanding of the relevant scientific literature in the field. Design experiments related to PhD program.		
4. Course content		
The course **Viral Pathogenesis I** is executed in four parts: The first part is focused on all the major aspects of viral pathogenesis, including the events in viral infection, virus dissemination and the cellular response to viral infection. The second part covers the host response to viral infection, including innate and specific immune response as well as immunopathology and the impact of ageing on antiviral immune response. The third part of the course will be dealing with viral virulence, persistence, viral oncogenesis and viral immunosupression. The last part will include the basics on viral vaccines and antiviral therapy. This part will also include the clinical relevance of viral pathogenesis.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

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7. Student responsibilities

The lectures are mandatory for all students. During the course students will also be required to prepare and orally present seminars.

8. Monitoring of student work[13]

Class attendance	0,4	Class participation	0,1	Seminar paper	1	Experimental work	
Written exam		Oral exam	0,5	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Seminar work is a prerequisite for the final exam. The final grade will be obtained on the final written and oral exam.

10. Mandatory literature (at the time of submission of study programme proposal)

Fields Virology, David Knipe, Peter Howley eds. 5th edition, Lippincot, Williams and Wilkins 2007
Medical Virology, Fourth Edition, D.E. White, Frank J. Fenner, Academic Press,

11. Optional/additional literature (at the time of submission of the study programme proposal)

Each student will receive several review articles covering various topics included in the lectures. Students will be encouraged to consult the recently published literature. Here is a list of few review articles:
Brizić I, Hiršl L, Britt WJ, Krmpotić A, Jonjić S: Immune responses to congenital cytomegalovirus infection. Microbes and Infection, 20(9-10):543-5, 2018
Lisnic B, Juranic Lisnic V, Jonjic S: NK cell interplay with cytomegaloviruses, Current Opinion in Virology, 15:9–18, 2015
Goodier MR, Jonjić S, Riley EM, Lisnić VJ: CMV and Natural Killer cells: shaping the response to vaccination. European Journal of Immunology, 48(1):50-65, 2018
Jonjic S, Babic M, Polic B, Krmpotic A: Immune evasion of natural killer cells by viruses. Current Opinion in Immunology, 20(1):30-8, 2008
Krmpotić A, Bubić I, Polić B, Lučin P, Jonjić S: Pathogenesis of murine cytomegalovirus infection. Microbes and Infection, 5(13):1263-1277, 2003

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Fields Virology, David Knipe, Peter Howley eds. 5th edition, Lippincot, Williams and Wilkins 2007	1	30
Medical Virology, Fourth Edition, D.E. White, Frank J. Fenner, Academic Press	30	30

[13] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences
Exit knowledge, skills and competences related to molecular mechanisms of viral infection, interaction of viruses and cells malignancies caused by viruses as well as control of viral diseases by vaccination will be monitored through student's class participation and final exam. Student's knowledge, skills and competences to revise relevant scientific literature and to design the research related to PhD programme will be assessed through a seminar paper.

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COURSE DESCRIPTION		
Course instructor	Prof. Astrid Krmpotić, MD, PhD	
Lecturers	Academician Stipan Jonjić, MD, PhD, Assoc. Prof. Vanda Juranić Lisnić, PhD, Prof. Tihana Lenac Roviš, PhD, Assoc. Prof. Berislav Lisnić, PhD, Assoc. Prof. Ilija Brizić, PhD, Assoc. Prof. Igor Jurak, PhD, Asst. Prof. Irena Slavuljica, MD, PhD, Marija Mazor, PhD, Jelena Železnjak, PhD, Lea Hiršl, PhD, Maja Cokarić Brdovčak, PhD	
Name of the course	Viral pathogenesis II	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+6
1. Course objectives		
The major objective of the course is to provide the students with a detailed overview of biology and pathogenesis of selected viral pathogens in humans with emphasis on their clinical significance. This course looks at mechanisms by which specific viruses cause disease in various tissues and organ systems as well as the molecular detection and identification of major human viral pathogens.		
2. Course enrolment requirements		
Participants should pass the course Viral Pathogenesis I.		
3. Expected learning outcomes		
The students will gain a better understanding of pathogenesis, prevention and control of major viral infections in humans. After finishing the course, the students should be able to design specific experiments related to their PhD program.		
4. Course content		
The course Viral Pathogenesis II includes: Herpesvirus family; Poxviruses; Hepatitis B virus (HBV), Hepatitis C virus; Retroviruses - HIV/AIDS; Influenza virus; Picornaviruses – Poliovirus; Emerging viral diseases. Each lecture and/or seminar will briefly review the biology and clinical feature of one specific viral pathogen or a group of them.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		
The lectures are mandatory for all students. Students will be asked to prepare seminars to be presented during the course.		

8. Monitoring of student work[14]

Class attendance	0,4	Class participation	0,1	Seminar paper	1	Experimental work	
Written exam		Oral exam	0,5	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student's activity will be monitored during the course. Seminar work is a prerequisite for the final exam. The final grade will be obtained on the final written and oral exam.

10. Mandatory literature (at the time of submission of study programme proposal)

Fields Virology, David Knipe, Peter Howley eds. 5th edition, Lippincot, Williams and Wilkins 2007
Medical Virology, Fourth Edition, D.E. White, Frank J. Fenner, Academic Press,

11. Optional/additional literature (at the time of submission of the study programme proposal)

Brizić I, Hiršl L, Britt WJ, Krmpotić A, Jonjić S. Immune responses to congenital cytomegalovirus infection. Microbes and Infection. 20(9-10):543-551, 2018.
Miletić A, Krmpotić A, Jonjić S. The evolutionary arms race between NK cells and viruses: Who gets the short end of the stick? European Journal of Immunology. 43(4):867-77. 2013.
Krmpotić A, Bubić I, Polić B, Lučin P, Jonjić S. Pathogenesis of murine cytomegalovirus infection. Microbes and Infection. 5(13):1263-1277, 2003.
Each student will receive several review articles covering various topics presented during lectures. Students are encouraged to consult the recently published literature.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Fields Virology, David Knipe, Peter Howley eds. 5th edition, Lippincot, Williams and Wilkins 2007	1	30
Medical Virology, Fourth Edition, D.E. White, Frank J. Fenner, Academic Press	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Exit knowledge, skills and competences related to pathogenesis of the most important viral infections of humans, modes of their detection, prevention and control will be monitored through student's class participation and final exam. Student's knowledge, skill and competence to design the research related to PhD programme will be monitored through seminar paper.

[14] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Maja Abram, MD, PhD	
Lecturers	Prof. Brigita Tićac, MD, PhD, Prof. Darinka Vučković, Prof. Marina Bubonja Šonje, Md, PhD	
Name of the course	Bacterial Pathogenesis	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	16+0+0

1. Course objectives

Bacterial pathogenesis depends on a variety of factors in both bacteria and the host, and the progress of pathogenesis can change at any point in response to environmental pressures and other issues. The molecular strategies used by bacteria to interact with the host can be unique to specific pathogens or conserved across several different species. Pathogenic bacteria, unlike innocuous commensals, alternate between free living and host associated states. To ultimately cause human infections, these pathogens must first find their environmental niche, often in association with higher organisms as free-living protozoa, or embedded in a slime layer in the form of resistant biofilm. Bacterial pathogens have evolved highly sophisticated mechanisms for sensing external conditions and respond by altering the pattern of gene expression with activation of a set of genes whose products assist in survival and turning off those products which are not necessary in a particular environment. The host usually offers an optimal environment for microbial growth, with large availability of nutrients, and the best degree of humidity and temperature. In spite of all that, each ecological niche, represented by single anatomic sites of the human body, induces further environmental stresses to which microorganisms should adapt. Therefore, one important scientific challenge is to identify the bacterial stress response mechanisms that contibute to their survival and allow free-living bacteria to adjust to and invade a host organism. A better understanding of the pathogens, stresses they encountered in the environment, as well as their interactions with hosts, have crucial roles in the introduction of effective control measures. The study of bacterial pathogenesis is important, as it shows how bacteria cause disease, and how this process might be interrupted to avoid or treat illness. Antibiotics commonly target and disrupt the metabolism of individual bacteria, with drug resistance arising via mutation of their metabolic pathways, acquisition of antibiotic resistance genes through horizontal gene transfer, or growth as complex biofilm communities.
The general aims are to gain information about bacterial infections, how they affect us, how pathogenic bacteria cause disease, how our body/behaviors/therapeutics help us fight against these agents, and how the pathogens fight back to survive. Special emphasis will be placed on recent advances in the molecular genetics of host pathogen interactions, various strategies microorganisms use to survive in the environment, and attach, invade and multiply in a host.

2. Course enrolment requirements

3. Expected learning outcomes

Upon completion of the course, the student will be able to identify the usual topics related to the pathogenesis of bacterial infections. By adopting new findings on the molecular mechanisms of bacterial infections, the relationship between the bacteria and the host cell / organism, as well as the relationship between bacteria and the environment, the understanding of pathogenesis and existing and potential preventative and therapeutic strategies will be improved.
4. Course content
Biofilms of medical importance: Biofilms are multicellular, structured communities of bacterial cells embedded in a self-produced polymeric matrix (slime) and adherent to an inert or living surface. It has been estimated that 60-80 percent of microbial infections in the body are caused by bacteria growing as a biofilm – as opposed to planktonic (free-floating) bacteria. This section describes the process of biofilm formation, highlights the importance of bacterial associations with surfaces in clinical settings and describes various methods for biofilm visualization and control. The particular topics to be covered: History of biofilm research; Prevalence of biofilm; Clinical implications of an infected biofilm; Bacteria involved in biofilm associated diseases; Life cycle of biofilm communities: Attachment/colonization, Growth and development, Movement, Detachment and external colonization; Behavior of bacteria in a biofilm: Quorum sensing; Advantages of biofilm: Antibiotic resistance, Persisters **Pathogenesis of food and waterborne bacteria**: The section will focus on selected bacteria responsible for food and water-transmitted diseasese covering the process of continuous changes in the relationship of pathogens to their environments from food/water to the human host. Topics include the molecular basis for enhanced transmissibility of food and waterborne pathogens, their mode of survival in the environment, and respons to stress situations encountered during transition from natural environment to the host with special reference to induction of virulence determinants which is of particular interest in the study of microbial pathogenesis. The course will also cover different bacterial virulence mechanisms that contribute to pathogenicity, as well as different defense mechanisms with which host organisms defend themselves against pathogens. **Mechanisms of bacterial resistance to biocides and antibiotics**: This section is designed to give students an in-depth understanding of how antibiotics inhibit growth in bacterial cells. Genetics of the mechanisms of resistance to multiple classes of antibiotics within both gram-negative and -positive bacteria will be covered extensively. The topics also include antimicrobial resistance in bacterial biofilms; Emergence of a new antibiotic resistance mechanism; epidemiology of metallo-beta-lactamases.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities
Students are expected to attend the lectures and read the additional material provided, as well as to actively participate in class discussions. Students will, using scientific papers, independently process and presented selected topics related to the pathogenesis of bacterial infections.
8. Monitoring of student work[15]

Class attendance	0,5	Class participation		Seminar paper	1	Experimental work	

[15] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Written exam		Oral exam	0,5	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students will be evaluated based on attendance records, participation in class discussions and presentation of seminar work. Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the project assignment, the seminar paper and the final written exam on which the issues will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

Mim's Pathogenesis of Infectious Diseases , C.A. Mims, Academic Press, London, 2001.
http://www.nios.ac.in/media/documents/dmlt/Microbiology/Lesson-08.pdf
http://biofilmbook.hypertextbookshop.com/v004/r003/index.html
https://www.nature.com/articles/nrmicro3380.pdf

11. Optional/additional literature (at the time of submission of the study programme proposal)

Antibiotic Resistance: Causes and Risk Factors, Mechanisms and Alternatives. Editors: Adriel R. Bonilla and Kaden P. Muniz, New York : Nova Science Publishers, c2009https://www.nature.com/articles/s41564-018-0107-9.pdf
https://www.nature.com/articles/nrmicro.2017.148.pdf
https://www.nature.com/articles/s41564-017-0031-4.pdf
http://mpkb.org/home/pathogenesis/microbiota/biofilm
Dunne WM Jr. Bacterial Adhesion: Seen Any Good Biofilms Lately? Clinical Microbiology Reviews, 2002, p. 155–166
Bubonja-Šonje M, Matovina M, Škrobonja I, Bedenić B, Abram M. Mechanisms of carbapenem resistance in multi drug resistant clinical isolates of Pseudomonas aeruginosa from a Croatian hospital. Microb Drug Resist. 2015;21(3):261-9
Klančnik A, Vučković D, Jamnik P, Abram M, Možina SS. Stress response and virulence of heat-stressed Campylobacter jejuni. Microbes Environ. 2014;29(4):338-45.
Guzvinec M, Izdebski R, Butic I, Jelic M, Abram M, Koscak I, Baraniak A, Hryniewicz W, Gniadkowski M, Tambic Andrasevic A. Sequence types 235, 111, and 132 predominate among multidrug-resistant pseudomonas aeruginosa clinical isolates in Croatia. Antimicrob Agents Chemother. 2014;58(10):6277-83.
Sonje MB, Abram M, Stenzel W, Deckert M. Listeria monocytogenes (delta-actA mutant) infection in tumor necrosis factor receptor p55-deficient neonatal mice. Microb Pathog. 2010;49(4):186-95.
Abram M, Schlüter D, Vuckovic D, Waber B, Doric M, Deckert M. Effects of pregnancy-associated Listeria monocytogenes infection: necrotizing hepatitis due to impaired maternal immune response and significantly increased abortion rate. Virchows Arch. 2002 Oct;441(4):368-79.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
All literature is available online	30	30

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13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

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COURSE DESCRIPTION		
Course instructor	Prof. Marina Šantić, PhD, Prof. Alemka Markotić, MD, PhD	
Lecturers	Ivan-Christian Kurolt, PhD	
Name of the course	Highly pathogenic microorganisms	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+4

1. Course objectives

The main objective of this course is to introduce to students the highly pathogenic microorganisms (HPM; e.g.Vibrio, Legionella, Francisella, hemoragic fever viruses, Poxvirusi, etc.). Highly pathogenic microorganisms can often cause naturally occurring diseases in animals and humans (infectious zoonotic diseases). In most European countries, as well as in Croatia, but also all over the world, the natural prevalence of these pathogens is endemic and from time to time some of the pathogens cause even large outbreaks in animal and human populations. They are all considered as emerging and re-emerging pathogens as well. A number of these agents have the potential for, or have been used, in bioterrorist attacks. The intentional release of infectious agents can result in serious public health consequences. A number of HPM were classified by CDC (Centers for Disease Control and Prevention) as category A, B or C comprising the highest concern for use in bioterrorist attacks. The effect of bacterial toxins, the penetration and spread of hemorrhagic viruses in host cells or the induction of cellular and humoral immunity through HPM are all research subjects of relevance both to the basic research and to the development of new diagnostics, therapeutics and vaccines. At the same time, however, it must be continuously concerned that there is also a danger that the results of work with HPM and their toxins could be used to develop biological weapons. The possibility of using scientific findings for both peaceful and non-peaceful purposes is known as the dual-use dilemma. The safety aspects of work with dual-use materials should be comprehensively regulated both at national and international level. Although the safety of the population is the prime concern, the great importance should be also directed to the freedom of scientific research, the publication of relevant research results and the exchange of material. In this course, the multidisciplinary approach on epidemiology and prevention, treatment and diagnosis of the disease caused by HPM will be applied. The special focus will be on immunopathogenesis and mechanism of the disease caused by these HPM.

2. Course enrolment requirements

No special requirements.

3. Expected learning outcomes

After the course, students will know and understand the importance of the highly pathogenic microorganisms. Participants will be able to recognize interdisciplinary scientific approaches in the prevention, treatment, diagnosis, and mechanisms of disease caused by highly pathogenic microorganisms.

4. Course content

This course will be based on the following topics:

1. Highly pathogenic microorganisms - Introduction: In the introductory chapter, students will be introduced to the etiological (microbiological and molecular) features of HPM, basics of epidemiology and prevention, diagnosis, immunopathogenesis, clinical manifestations of the disease and current therapeutic options.
2. Working with highly pathogenic microorganisms in the laboratories at the biosafety level 3 and 4 (BSL3 and BSL4): under this thematic unit, students will become familiar with the specifics of laboratory research work on HPM at the highest levels of biosecurity, practical problems and solutions, and provided internationally accepted procedures and codes of conduct in dealing with HPM.
3. Multiplex technologies in the discovery and detection of highly pathogenic microorganisms: this part of the course will focus on the latest technological developments in the fast HPM multiplex detection technology, the importance of tracing, detection and molecular characterization of HPM and their differentiation from other less pathogenic microorganisms.
4. Molecular epidemiology in the research of HPM: this section shall be subject to the value of modern molecular epidemiologic studies of HPM, their significance in the detection and characterization of HPM differences in different parts of the world, and the impact of molecular epidemiological features of HPM for the further development of diagnostic, preventive and therapeutic approaches to the disease caused by HPM.
5. Fundamentals of translational medicine in HPM research: this part of the course will focus on the elements of translational medicine and systems biology research in HPM, without which we cannot imagine a comprehensive research approach to biomedical problems; particular will be highlighted the complexity of the research in the field and all HPM research problems and advantages of this approach.
6. Animal models for the study HPM: students in this section will get comprehensive information on existing animal models for HPM research, new technologies in the development of animal models that could be applied to research of HPM immunopathogenesis and biosafety and ethical issues related to this subject.
7. Cell biology research in HPM infections: students in this section will get the latest and most relevant scientific information on the biological, immunobiological and signaling mechanisms that occur during cell infection with HPM; potential and possibilities of using acquired information in the preventive and therapeutic purposes; one part will also be dedicated to the known and potential cellular models for HPM research.
8. Mechanisms of inflammation and immunosuppression in infections caused by highly pathogenic microorganisms: students will be familiar with the state of the art research on inflammatory immune reactions and mechanisms of immunosuppression that occur in humans and animals at HPM infection; the potential use of acquired information in the therapy approaches and to development of biological markers that can be used for prediction of disease severity and outcome.
9. Using computer analysis, modeling, and biostatistics to study immune reactions caused by a highly pathogenic microorganisms: Students will gain a general insight into the cutting-edge computer technology that enable the analysis and prediction of various important biological pathways that are triggered in humans and animals at infection with HPM; will demonstrate the power of modeling and biostatistics particularly important for the research analysis of HPM due to a number of objective, primarily security restrictions in the practical work.
10. The development of modern vaccines against HPM: in this part of the course will be given a comprehensive analysis of existing HPM vaccines, vaccines that are in various stages of development and clinical trials, and will be analyzed the potential of today's technological advances in the development of vaccines in general and their application to the development of vaccines against HPM.

11. Ethical issues related to HPM research: this part of the classes will be focused on a comprehensive study of ethical problems in HPM research including clinical and animal studies, with particular emphasis on the problem of dual use research and current codes of conduct and national and international regulations.		
5. Manner of instruction	x lectures x seminars and workshops ☐ exercises x distance learning ☐ fieldwork	x individual assignments x multimedia and network ☐ laboratories x mentorship ☐ other
6. Comments		

7. Student responsibilities

Presence and active participation during the course, preparation of seminar papers on a given subject.

8. Monitoring of student work[16]

Class attendance	0,3	Class participation	0,2	Seminar paper	1	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the project assignment, the seminar paper and the final written exam on which the issues will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

- 21st Century Collection Centers for Disease Control (CDC) Emerging Infectious Diseases (EID): Comprehensive Collection from 1995 to 2002 with Accurate and Detailed Information on Dozens of Serious Virus and Bacteria Illnesses, Hantavirus, Influenza, AIDS, Malaria, TB, Pox, Bioterrorism, Smallpox, Anthrax, Vaccines, Lyme Disease, Rabies, West Nile Virus, Hemorrhagic Fevers, Ebola, Encephalitis (Core Federal Information Series) (CD-ROM)
- Emerging Infectious Diseases. Trends and Issues, Second Edition. Editors: Felissa R. Lashley, RN, PhD, ACRN; Jerry D. Durham, PhD, RN, FAAN. Pub Date: 05/2007

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Mihelčić, Mirna; Habuš, Josipa; Vucelja, Marko; Svodoba, Petra; Kurolt Ivan-Christian; Markotić, Alemka; Turk, Nenad; Margaletić, Josip; Šantić, Marina. Prevelence of Francisella tularensis in the population of small mammals species in conttinental forests of Croatia. Šumarski list:9 (2018), 10; 481-486.
- Tadin A, Bjedov L, Margaletic J, Zibrat B, Krajinovic LC, Svoboda P, Kurolt IC, Majetic ZS, Turk N, Rode OD, Civljak R, Kuzman I, Markotic A. High infection rate of bank voles (Myodes glareolus) with

[16] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Puumala virus is associated with a winter outbreak of haemorrhagic fever with renal syndrome in Croatia. Epidemiol Infect. 2014 Sep;142(9):1945-51.

- Kurolt IC, Krajinović V, Topić A, Kuzman I, Baršić B, Markotić A. First molecular analysis of West Nile virus during the 2013 outbreak in Croatia. Virus Res. 2014 Aug 30;189:63-6.
- Svoboda P, Dobler G, Markotić A, Kurolt IC, Speck S, Habuš J, Vucelja M, Krajinović LC, Tadin A, Margaletić J, Essbauer S. Survey for hantaviruses, tick-borne encephalitis virus, and Rickettsia spp. in small rodents in Croatia. Vector Borne Zoonotic Dis. 2014 Jul;14(7):523-30.
- Ozanic M, Marecic V, Abu Kwaik Y, Santic M. The Divergent Intracellular Lifestyle of Francisella tularensis in Evolutionarily Distinct Host Cells. PLoS Pathog. 2015 Dec 3;11(12). IF:7.562.
- Santic, Marina; Al-Khodor, Souhaila; Abu Kwaik, Yousef. Cell biology and molecular ecology of Francisella tularensis. Cellular Microbiology.12 (2010),2;129-139.IF: 5.625.
- Mandell GL, Bennett JE, Dolin R. Principles and practice of infectious diseases, 6. izdanje. Philadelphia: Elsevier, Churchil Livingstone, 2005, str. 242-700.
- National Research Council. *Research in the Life Sciences with Dual Use Potential: An International Faculty Development Project on Education About the Responsible Conduct of Science*. Washington, DC: The National Academies Press, 2012.
- National Research Council. *Biosecurity Challenges of the Global Expansion of High-Containment Biological Laboratories* . Washington, DC: The National Academies Press, 2012.
- Aktualni članci (smjernice) bit će osigurani u elektronskom obliku.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
21st Century Collection Centers for Disease Control (CDC) Emerging Infectious Diseases (EID): Comprehensive Collection from 1995 to 2002 with Accurate and Detailed Information on Dozens of Serious Virus and Bacteria Illnesses, Hantavirus, Influenza, AIDS, Malaria, TB, Pox, Bioterrorism, Smallpox, Anthrax, Vaccines, Lyme Disease, Rabies, West Nile Virus, Hemorrhagic Fevers, Ebola, Encephalitis (Core Federal Information Series) (CD-ROM)	30	30
Emerging Infectious Diseases. Trends and Issues, Second Edition. Editors: Felissa R. Lashley, RN, PhD, ACRN; Jerry D. Durham, PhD, RN, FAAN. Pub Date: 05/2007	30	30

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

COURSE DESCRIPTION	
Course instructor	Prof. Vlatka Sotošek, MD, PhD

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Lecturers		
Name of the course	Sepsis – from bench to bedside	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8

1. Course objectives

The objective of the course *Sepsis- from bench to bedside* is to introduce to the students the sepsis, one of the leading healthcare problems, affecting millions of the indiviudal around the world each year, ande which have high mortality rate.
Although many effrots have been made to clarify pathophysiology of sepsis and to improve its management, morbidity and moratlity rates, sepsis continue to increase. The objective of this course is to show students the importance of sepsis in terms of basic, translational and clinical research through three blocks of four lectures. During the first block of lectures basic knowledge of sepsis research will be introduced to the students. The latest knowledge about the cellular mechanisms and intracellular machanisms of inflammation, mecahnisms of oxygen transporatation in hypoxia, and recently descovered results of basic research of pathophysiologogy of sepsis will be discussed. During the second block of lectures translational research in sepsis will be presented to the students. During the second block of lectures, the role of various biomarkers in the prognosis of sepsis, the findings of the inflammatory response from animal to human models and the role of the genome in sepsis will be discussed. The thrid block of lectures will cover the clinical aspects of sepsis. During the third block of lectures, students will learn about the latest findings in definitions of sepsis, severe sepsis, septic shock and multiorgan failure. New insights into the diagnosis and treatment of sepsis, as well as changes in certain organs and organ systems in sepsis will be presented. Special attention will be focused on new guidelines and treatment options of sepsis.

2. Course enrolment requirements

Course enrolment requirements are determined by the rule book.

3. Expected learning outcomes

General and specific competencies (knowledge and skills):
At the end of this course student will be able to:
- describe the basic pathophysiological mechanisms of sepsis,
- apply the knowledge of basic science to clinical practice,
- recognize signs and symptomes of sepsis, severe sepsis, septic shock, multiorgan failure,
- apply the latest principles in the treatment of sepsis,
- recognize changes in certain organs and organ systems in sepsis,
- develop new insights into the diagnosis and treatment of sepsis.

4. Course content

Course content includes:
- a brief history and definition of sepsis,
- pathophysiology of sepsis,
- immunological aspects of sepsis,

- the role of the coagulation system in the pathophysiology of sepsis,
- transfer of oxygen to hypoxia,
- predictive biomarkers in sepsis,
- sepsis - from animal to human models,
- the role of the genome in sepsis,
- sepsis, severe sepsis, septic shock, multiorgan failure - new insights in diagnosis,
- pathophysiological changes of certain organs in sepsis,
- treatment of sepsis.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Classes are held in the form of lectures and seminars. In lectures and seminars students will actively discuss with the teacher lectures on the topic and express their views and opinions. The teacher is required to explain to every student issues arised form the subject presented.	

7. Student responsibilities

Students are required to attend lectures and seminars.

8. Monitoring of student work[17]

Class attendance	0,2	Class participation	0,3	Seminar paper	0,5	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The work of students is monitored throughout the lecutres, seminars and the final exam. During the course the following are evaluated: a) the acquired knowledge, b) the activity during the classes, c) attendance of the lecutres, d) seminar paper. The final exam consists of written and oral examination. A right of access to the exam has the student who has fulfilled his/her obligation.

10. Mandatory literature (at the time of submission of study programme proposal)

Rhodes A, Evans LE, Alhazzani W, Levy MM et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med 2017;43(3):304-377.
Ward NS, Levy MM. Sepsis: Definitions, Pathophysiology and the Challenge of Bedside Management. Springer, USA.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Valenčić L, Sotošek Tokmadžić V, Kuharić J, Šustić A. Incidence of nosocomial infections in patients with isolated severe traumatic brain injury. Sanamed 2015;10:185-92.

[17] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Biberić M, Zrna S, Juranić J, Sotošek Tokmadžić V, Kurtović B, Župan Ž. Acute Fulminant Chlamydia pneumoniae Myocarditis Treated with Mechanical Circulatory Support in a Female Adult: A Case Report. J Clin Anesth Res. 2018; 2(1): 1-5.
Sotošek Tokmadžić V. Pathophysiology of shock. EuSEM.
Sotošek Tokmadžić V. Immunomudulation in sepsis. Hot Topics.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Ward NS, Levy MM. Sepsis: Definitions, Pathophysiology and the Challenge of Bedside Management. Springer, USA.	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

1) Conducting student surveys and evaluation of the data.
2) Analysis of the results achieved in exams.
3) Assesment if the goals are achived.

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COURSE DESCRIPTION		
Course instructor	Academician Stipan Jonjić, MD, PhD	
Lecturers	Prof. Tihana Lenac Roviš, PhD, Assoc. Prof. Ilija Brizić, PhD, Assoc. Prof. Vanda Juranić Lisnić, PhD, Prof. Felix M. Wensveen, PhD, Prof. Astrid Krmpotić, MD, PhD, Assoc. Prof. Berislav Lisnić, PhD	
Name of the course	Innate immunity	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+6

1. Course objectives

The main objective of this course is to provide the students with basic cellular and molecular aspects of innate immunity mechanisms.

2. Course enrolment requirements

Prior to the enrolment in the course the students must have a graduate degree in biomedical studies or biology / biotechnology. Students are expected to have background knowledge in cell biology and immunology.

3. Expected learning outcomes

- Explain and compare cellular and molecual components of innate immunity
- Identify key molecules for induction and function of innate immune response
- Describe and differentiate experimental approaches for studying innate immune response
- Integrate acquired knowledge and competences for participation in advanced workshops/courses in basic and clinical immunology
- Raise independence in reading, understanding, critical thinking and evaluation of the relevant scientific literature in the field

4. Course content

The course will focus on basic cellular and molecular aspects of innate immunity with an emphasis on dendritic cells (DCs), NK cells and innate immune receptors and their ligands: pathogen-associated molecular patterns (PAMP), pattern-recognition receptors (PRR), NK receptors and others. The course ''Innate immunity'' is executed in four parts: The first part is focused on principles of innate immunity, the cells of innate immunity and their receptors. The second part will be dealing with innate immune signalling and cytokine response pathways. The third part covers the role of innate immunity in control of microbial infections and tumours. The last part will cover the interaction of innate and adaptive immune response.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other

6. Comments							
7. Student responsibilities							
The lectures are mandatory for all students. During the course students will also be required to prepare and orally present seminars.							
8. Monitoring of student work[18]							
Class attendance	0,1	Class participation	0,4	Seminar paper	1	Experimental work	
Written exam		Oral exam	0,5	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							
9. Assessment of learning outcomes in class and at the final exam (procedure and examples)							
Seminar work is a prerequisite for the final exam. The final grade will be obtained on the final written and oral exam.							
10. Mandatory literature (at the time of submission of study programme proposal)							
Janeway's Immunobiology and several review articles covering each of the course topic.							
11. Optional/additional literature (at the time of submission of the study programme proposal)							
There is a number of excellent review articles which are available free. Here is a list of some of them, but students may take many others. Kawai T & Akira S: Toll-like receptors and their crosstalk with other innate receptors in infection and immunity. Immunity, 34(5):637-50, 2011 Kawai T & Akira S: The role of pattern-recognition receptors in innate immunity: update on Toll-like receptors. Nat Immunol, 11(5):373-84, 2010 Sun JC & Lanier LL: NK cell development, homeostasis and function: parallels with $CD8^+$ T cells. Nat Rev Immunol, 11(10):645-57. 2011 Domínguez PM & Ardavín C: Differentiation and function of mouse monocyte-derived dendritic cells in steady state and inflammation. Immunol Rev, 234(1):90-104, 2010 Brizić I, Hiršl L, Britt WJ, Krmpotić A, Jonjić S: Immune responses to congenital cytomegalovirus infection. Microbes and Infection, 20(9-10):543-5, 2018 Goodier MR, Jonjić S, Riley EM, Lisnić VJ: CMV and Natural Killer cells: shaping the response to vaccination. European Journal of Immunology, 48(1):50-65, 2018 Lisnic B, Juranic Lisnic V, Jonjic S: NK cell interplay with cytomegaloviruses, Current Opinion in Virology, 15:9–18, 2015 Brizic I, Lenac Rovis T, Krmpotic A, Jonjic S: MCMV avoidance of recognition and control by NK cells. Seminars in Immunopathology, 36(6):641-50, 2014 Jonjic S, Babic M, Polic B, Krmpotic A: Immune evasion of natural killer cells by viruses. Current Opinion in Immunology, 20(1):30-8; 2008							
12. Number of assigned reading copies in relation to the number of students currently attending the course							

[18] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Title	*Number of copies*	*Number of students*
see above (no. 10)	1	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Exit knowledge, skills and competences related to cellular and molecular components of innate immunity, key molecules for induction and function of innate immune response and experimental approaches for studying innate immune response will be monitored through student's class participation and final exam. Student's knowledge, skills and competences to follow scientific literature in the field and to participate in advanced workshops/courses in basic and clinical immunology will be monitored through seminar paper.

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COURSE DESCRIPTION		
Course instructor	Prof. Bojan Polić, MD, PhD	
Lecturers	Prof. Felix M. Wensveen, PhD, Prof. Alenka Gagro, MD, PhD, Prof. Marijastefania Antica, PhD, Prof. Marc Schmidt Supprian, PhD	
Name of the course	Disorders in the development, homeostasis and effector functions of T and B cells	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+4

1. Course objectives

Maine objective of the course is that students acquire specific knowledge about disorders in various stages of development and differentiations of T and B cells which are basis for a number of diseases and medical syndromes. The teaching will be based on the current knowledge in the field as well as on the own research examples of the lecturers. The intention is to show students several molecular mechanisms that are leading to disorders of T and B cells and to raise their interest for scientific research in this field.

2. Course enrolment requirements

Enrolment to the Doctoral school.

3. Expected learning outcomes

General learning outcomes:

a) Students will further develop communication skills
b) Students will develop capabilities for critical reading of scientific publications
c) Students will further develop capabilities for team work and cooperation
d) Students will further develop capabilities to search relevant scientific literature
e) Students will develop capabilities to define and potentially solve a research problem

Specific learning outcomes:

a) Students will define key disorders in development of T and B cells (development of leukemias and lymphomas)
b) Students will identify and discuss molecular mechanisms of homeostasis of naïve and memory T and B cells
c) Students will identify and discuss functional disorders of T and B cells (hyperreactivity and hyporeactivity, autoimmunity)

4. Course content

a) Lymphopoiesis and disorders in development of lymphocytes – lymphatic leukemias – Prof. dr. Marijastefanija Antica (P-2h)
b) Development and developmental disorders of T cells – Prof. dr. Marijastefanija Antica (P-2h)
c) Differentiation, homeostasis and effector functions of CD4 T cells – Prof. Bojan Polić, MD, PhD (P-2h)
d) Differentiation, homeostasis and effector functions of CD8 T cells – Prof. Felix M. Wensveen, PhD (P-2h)

e) Development and developmental disorders of B cells– Prof. dr. sc. Alenka Gagro (P-2h)
f) Lymphomas and effector functions disorders of B cells– Prof. dr. Marc Schmidt Supprian (P-2h)
g) Hypersensitivity and autoimmunity– Prof. Bojan Polić, MD, PhD / Prof. Felix M. Wensveen, PhD (S-4h)

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Students are obliged to attend and actively participate in the course. They are also obliged to attend the written final exam and to fill up survey about the course.

8. Monitoring of student work[19]

Class attendance	0,2	Class participation	0,3	Seminar paper	0,1	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students will be obliged to do one seminar work which will be a condition to attend the final exam at the end of the course. Attendance, activity and acquired knowledge of the students will be evaluated during the course (70%) as well as on the final written exam (30%). General learning outcomes will be evaluated during the course and will comprise 40% of points, while the rest of points (60%) students will get working on specific learning outcomes like:

a) Acquired knowledge about the development and disorders in development of T and B cells, development of leukemias and lymphomas – 20% of points
b) Acquired knowledge about molecular mechanisms of homeostasis of naïve and memory T and B cells as well as about their disorders– 20% of points
c) Acquired knowledge about differentiation and effector function disorders of T and B cells; Hypersensitivity and autoimmunity – 20% of points

The final written exam will be a multiple-choice test which will mostly examine the acquirement of specific learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

- Abdul Abbas, Andrew H. Lichtman, Shiv Pillai „Cellular and Molecular Immunology“, 8. edition, Medicinska naklada, Zagreb, 2017.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- William E. Paul „Fundamental Immunology “, by Lippincot Williams & Wilkins, 2013

[19] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

- Kavazović I, Polić B, Wensveen FM (2018) Cheating the Hunger Games; Mechanisms Controlling Clonal Diversity of CD8 Effector and Memory Populations. Frontiers in Immunology 9:2831
- Wensveen FM, van Gisbergen KP, Derks IA, Gerlach C, Schumacher TN, van Lier RA, Eldering E. (2010) Apoptosis threshold set by Noxa and Mcl-1 after T cell activation regulates competitive selection of high-affinity clones. Immunity 32:754 -765
- Polic B, Kunkel D, Scheffold A, Rajewsky K. (2001) How alpha beta T cells deal with induced TCR alpha ablation. PNAS 98:8744 – 8749
- Lenartić M, Jelenčić V, Zafirova B, Ožanič M, Marečić V, Jurković S, Sexl V, Šantić M, Wensveen FM, Polić B. (2017) NKG2D Promotes B1a Cell Development and Protection against Bacterial Infection. J. Immunol. 198:1531 – 1542.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Abdul Abbas, Andrew H. Lichtman, Shiv Pillai „Cellular and Molecular Immunology“, 8. edition, Medicinska naklada, Zagreb, 2017.	*5*	*30*
William E. Paul „Fundamental Immunology“, by Lippincot Williams & Wilkins, 2013	*2*	*30*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

The quality monitoring methods will be analysis of the results of student evaluation and student survey at the end of the course.

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COURSE DESCRIPTION		
Course instructor	Prof. Zlatko Trobonjača, MD, PhD	
Lecturers	Prof. Jagoda Ravlić-Gulan, MD, PhD, Prof. Brankica Mijandrušić-Sinčić, MD, PhD, Prof. Srđan Novak, MD, PhD, Prof. Larisa Prpić Massari, MD, PhD, Asst. Prof. Tanja Batinac, MD, PhD, Prof. Gordana Laškarin, MD, PhD	
Name of the course	Disorders of local immunity	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	16+0+0

1. Course objectives

The main objective of this course is to introduce students the area of investigation of the mechanisms of local immunity and their disorders. As an elective course it represents logical extension to the compulsory courses in the study for those students who, in the study and/or research profile, require theoretical and practical knowledge about the function of the immune system and principles of immunological methods and techniques. According to the course contents and student's workload, this course corresponds to similar programs which are carried out at European universities as independent courses as part of postgraduate studies. Teaching in the course is very scientifically oriented and include an overview of research areas, applied research methodology and techniques, and scientific results of teacher-researcher with the presentation and explanation of the experimental protocols and results. This course will enable students to gain knowledge needed to successfully engage in research in the field of immunology or related fields. Since the course content covers the research methodology used in other scientific disciplines, it may be attractive not only to graduates of medical profession, but also other profiles of graduate students (biologists, biochemists, chemists, laboratory engineers, etc.).

2. Course enrolment requirements

Enrolment into the PhD study programme

3. Expected learning outcomes

General and specific competencies (knowledge and skills)
General competencies:
Over the course "Disorders of the local immunity", it is expected that the student will:

1. to recognize the importance of immunological techniques in research
2. to show the capability to independently use the scientific literature, to criticaly judge professional or media publications about the immunological topics, to correctly place the arguments and competently discuss about research topics
3. to use the Internet and other electronic information sources
4. to affirm the knowledge about the interdisciplinary nature of biomedical science
5. to develop the skills necessary for professional and research career development (independent work, work planning and time management, organizational skills)
6. to define the importance of the modern immunological methods and techniques for the development of science and entrepreneurship in the field of biotechnology

Specific competencies:
After completing the course, "Disorders of the local immunity," it is expected that the student will be able to:

1. to describe methods and techniques in the research of the digestive system mucosal immunity
2. to describe methods and techniques in the research of autoimmune mechanisms
3. to describe methods and techniques to investigate the mechanisms of immunity in the skin

4. Course content

1. Prof. Zlatko Trobonjača, MD, PhD: Overview of mucosal immunity research areas.
2. Prof. Zlatko Trobonjača, MD, PhD: Transplant model of the colitis research in mice.
3. Prof.dr.sc. Branka Mijandrušić-Sinčić: The role of local immunity in inflammatory bowel disease
4. Prof.dr.sc. Branka Mijandrušić-Sinčić: Coeliac disease: a typical autoimmune disorder
5. Prof.dr.sc. Jagoda Ravlić-Gulan: Overview of research areas of autoimmune disorder mechanisms
6. Prof.dr.sc. Jagoda Ravlić-Gulan: Immune mechanisms in the synovial membrane in rheumatoid arthritis
7. Prof.dr.sc. Srđan Novak: Mechanisms of autoimmunity in systemic lupus erythematosus –animal models
8. Prof.dr.sc. Srđan Novak: Mechanisms of autoimmunity in systemic sclerosis (sclerodermia)
9. Doc.dr.sc. Tanja Batinac: Overview of research areas of immune mechanisms in the skin
10. Doc.dr.sc. Tanja Batinac: Psoriasis – immune mechanisms and molecular therapeutic goals
11. Prof.dr.sc. Larisa Prpic Massari: Cytolytic mechanisms in psoriasis
12. Prof.dr.sc. Larisa Prpic Massari: TNF family cytokines – research models and pathogenetic mechanisms
13. Prof.dr.sc. Gordana Laškarin: Overview of the research area of immune mechanisms in the development of atherosclerotic plaque and ischemic heart disease. Acute and chronic immune mechanisms in the development of atherosclerotic plaque of coronary arteries
14. Prof.dr.sc. Gordana Laškarin: Immune mechanisms in the myocardium during acute coronary events. Reflection of local immune mechanisms during acute myocardial infarction to systemic immune response
15. Prof.dr.sc. Gordana Laškarin: Basic principles of application of stem cells in treating ischemic heart disease and kardiomiocitne regeneration.
16. Prof.dr.sc. Gordana Laškarin: Cardiac manifestations of systemic immune disease

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☒ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments		

7. Student responsibilities

Classes are held in the form of lectures. Students discuss with the teacher about the principles of immune mechanisms, methods and research techniques and experimental protocols. Attendance at lectures is mandatory.

8. Monitoring of student work[20]

[20] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Class attendance	0,5	Class participation		Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Examination of students will be carried out in the written form by the multiple choice test.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Zlatko Trobonjača, Frank Leithaeuser, Peter Moeller, Horst Bluethmann, Yasuhiko Koezuka, Robson MacDonald and Joerg Reimann: MHC-II-independent CD4+ T cells induce colitis in immunodeficient RAG-/- hosts. J. Immunol. 166: 3804-3812, 2001.
2. Leithauser Frank, Trobonjača Zlatko, Moller Peter, Reimann Jorg: Clustering of colonic lamina propria CD4(+) T cells to subepithelial dendritic cell aggregates precedes the development of colitis in a murine adoptive transfer model. Lab Invest. 2001 Oct;81(10):1339-49.
3. Leithauser Frank, Krajina Tamara, Trobonjača Zlatko, Reimann Jorg: Early events in the pathogenesis of a murine transfer colitis. Pathobiology. 2002-2003;70(3):156-63.
4. Krajina Tamara, Leithauser Frank, Moller Peter, Trobonjača Zlatko, Reimann Joerg: Colonic lamina propria dendritic cells in mice with CD4+ T cell-induced colitis. Eur J Immunol. 2003 Apr;33(4):1073-83.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Piemonti L., Bernasconi S., Luini W., Trobonjaca Z., Minty A., Allavena P., Mantovani A.: IL-13 supports differentiation of dendritic cells from circulating precursors in concert with GM-CSF. European Cytokine Network 6(4): 245-52, 1995.
2. Frank Leithaeuser, Zlatko Trobonjača, Joerg Reimann and Peter Moeller: In situ characterization of genetically targeted (green fluorescent) single cells and their microenvironment in adoptive host. Am. J. Pathol. 158(6):1975-1983, 2001.
3. Trobonjača Zlatko, Kroger Andrea, Stober Detlef, Leithauser Frank, Moller Peter, Hauser H, Schirmbeck Reinhold, Reimann Joerg.: Activating immunity in the liver. II. IFN-beta attenuates NK cell-dependent liver injury triggered by liver NKT cell activation: J Immunol. 2002 Apr 15;168(8):3763-70.
4. Trobonjača Zlatko, Leithauser Frank, Moller Peter, Schirmbeck Reinhold, Reimann Joerg.: Activating immunity in the liver. I. Liver dendritic cells (but not hepatocytes) are potent activators of IFN-gamma release by liver NKT cells. J Immunol. 2001 Aug 1;167(3):1413-22.
5. Stober Detlef, Trobonjača Zlatko, Reimann Jorg, Schirmbeck Reinhold: Dendritic cells pulsed with exogenous hepatitis B surface antigen particles efficiently present epitopes to MHC class I-restricted cytotoxic T cells. Eur J Immunol. 2002 Apr;32(4):1099-108.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Zlatko Trobonjača, Frank Leithaeuser, Peter Moeller, Horst Bluethmann, Yasuhiko Koezuka, Robson MacDonald and Joerg Reimann: MHC-II-	30	30

independent CD4+ T cells induce colitis in immunodeficient RAG-/- hosts. J. Immunol. 166: 3804-3812, 2001.		
Leithauser Frank, Trobonjača Zlatko, Moller Peter, Reimann Jorg: Clustering of colonic lamina propria CD4(+) T cells to subepithelial dendritic cell aggregates precedes the development of colitis in a murine adoptive transfer model. Lab Invest. 2001 Oct;81(10):1339-49.	30	30
Leithauser Frank, Krajina Tamara, Trobonjača Zlatko, Reimann Jorg: Early events in the pathogenesis of a murine transfer colitis. Pathobiology. 2002-2003;70(3):156-63.	30	30
Krajina Tamara, Leithauser Frank, Moller Peter, Trobonjača Zlatko, Reimann Joerg: Colonic lamina propria dendritic cells in mice with CD4+ T cell-induced colitis. Eur J Immunol. 2003 Apr;33(4):1073-83.	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Test results can provide information about specific shortcomings in the course content or difficulties in understanding certain content. The written examination will be carried out by multiple choice tests using an optical reader and computer program that allows subsequent evaluation of the quality and complexity of test questions, and analysis of questions that most students did not answer. This can help identify deficiencies in the teaching. Information about students' satisfaction and quality of teaching will be collected by questionnaire that will be offered to students before the exam.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Emina Babarović, MD, PhD	
Lecturers	Assoc. Prof. Ita Hadžisejdić, MD, PhD, Assoc. Prof. Koviljka Matušan Ilijaš, MD, PhD	
Name of the course	Molecular basis of tumor important for clinical practice	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	7+0+9

1. Course objectives

Course objectives are to introduce students to study molecular changes of tumor cells and stromal cells that play a role in the progression of the disease, but also in the diagnosis, monitoring and therapy of malignant diseases. The specific objectives of the subject are to highlight the basics of malignant transformation that ensure uncontrolled growth and progression of tumor cells. Furthermore, the subject emphasizes the importance of unlimited ability of malignant cells to replicate. It also aims to treat tumor angiogenesis and proteolytic digestion of the stroma, as important mechanisms for progression, invasiveness and tumor metastasis. Finally, the task of the subject emphasizes the importance of molecules in clinical practice, in example in tumor therapy.

2. Course enrolment requirements

The enrollment requirements are completed by the integrated undergraduate and graduate university and graduate university studies in Biomedicine and Health Sciences, Natural Sciences, Biotechnical Sciences (Biotechnology field) and the Interdisciplinary Field of Science (Biotechnology in Biomedicine).

3. Expected learning outcomes

After attending the course, attendees should recognize the importance of basic molecular events important for the diagnosis, progression and therapy of malignant diseases. Apart from theoretical mastery of the subject, students would also get acquainted with the practical application of knowledge in everyday practice.

4. Course content

To describe, explain and analyze basic molecular mechanisms of events important for the diagnosis, progression and therapy of malignant diseases. To present and describe the methods used in preclinical and clinical investigations and link them to different types of tumors and stages of malignancy. To show and analyze biomarker research results that have predictive and prognostic significance in tumor pathology. Appoint and describe the modern techniques used in diagnosing, treating, and monitoring malignant diseases. To show and critically analyze the results from the recent scientific literature and the findings achieved in the research projects of the subject of this course.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other

6. Comments	

7. Student responsibilities

Regular attendance.

8. Monitoring of student work[23]

Class attendance	0,5	Class participation		Seminar paper	0,5	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation in the ECTS system is done by absolute allocation. The total percentage of student success during the course is 70% and the final exam 30% of the grade. The final grade is the sum of the percentage achieved during the course and the percentage achieved in the final exam. The final exam is submitted in writing.

10. Mandatory literature (at the time of submission of study programme proposal)

Latest scientific articles from the field of study.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Jonjić N, Mustać E, Tomić S, Razumović JJ, Sarcević B, Blazicević V, Labinac LP, Svagelj D, Kopjar A, Sikić NL, Vrbicić B, Borić I. Acta Clin Croat. 2015 Dec;54(4):479-85.
- Oguić R, Mozetič V, Cini Tešar E, Fučkar Čupić D, Mustać E, Dorđević G. Patholog Res Int. 2014;2014:262195 doi: 10.1155/2014/262195. Epub 2014 Jul 6.
- Rajković-Molek K, Mustać E, Hadžisejdić I, Jonjić N. Appl Immunohistochem Mol Morphol. 2014 Jul;22(6):464-70.
- Hadžisejdić I, Mustać E, Krstulja M, Franjić N, Štimac D. Forensic Sci Med Pathol. 2012 Sep;8(3):327-9.
- Mustać E, Matusan-Ilijas K, Marijić B, Smokvina M, Jonjić N. Int J Surg Pathol. 2010 Feb;18(1):36-41
- Mustać E, Zamolo G, Petković M, Dordević G, Radić J, Grgurević E, Batinac T. Coll Antropol. 2008 Sep;32(3):741-6.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Latest scientific articles from the field of study	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

[23] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Analysis of final exam results and anonymous polls.

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COURSE DESCRIPTION		
Course instructor	Prof. Kristina Pilipović, MD, PhD,	
Lecturers	Prof. Željko Župan, MD, PhD, Prof. Damir Miletić, MD, PhD, Prof. Vlatka Sotošek Tokmadžić, MD, PhD, Prof. Miranda Mladinić Pejatović, MD, PhD, Assoc. Prof. Kristina Pilipović, MD, PhD, Asst. Prof. Slavica Kovačić, PhD	
Name of the course	Brain trauma and spinal cord injury: translational studies	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	16+0+0
1. Course objectives		
To acquire recent knowledge concerning pathogenesis, basic and clinical aspects as well as pharmacotherapy of the brain trauma and spinal cord injury.		
2. Course enrolment requirements		
Completed graduate university studies in the fields of biomedical, health care and natural sciences as well as in biotechnology		
3. Expected learning outcomes		
Describe, explain and analyse molecular and biochemical events, signalling pathways and other processes included in traumatic brain and spinal cord injuries Denominate and describe *in vitro* and *in vivo* models and methods which have been used in preclinical investigations Demonstrate and analyse the results of preclinical and clinical studies of immunological and biomarkers assays Denominate and describe recent clinical neuroimaging methods which have been used for mentioned entities Demonstrate and critically analyse the results of recent translational pharmacotherapeutic research studies in the field of brain trauma and spinal cord injury		
4. Course content		
Biochemical and molecular mechanisms of the brain damage (excitotoxicity, oxidative stress, inflammation, signaling pathways, neurodegeneration, etc.) and repair following brain trauma and spinal cord injury Roles of glia (microglia and astrocytes) in the brain trauma and spinal cord injury Models and methods used in preclinical investigations of the brain trauma and spinal cord injury Translational studies of biomarkers Translational studies of immunological responses following traumatic brain and spinal cord injuries Clinical neuroimaging Translational studies of neuroprotection and pharmacotherapy for the brain trauma and spinal cord injury		
5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises	☐ individual assignments ☒ multimedia and network ☐ laboratories

	☐ distance learning ☐ fieldwork			☐ mentorship ☐ other			
6. Comments							
7. Student responsibilities							
Course attendance							
8. Monitoring of student work[24]							
Class attendance	0,3	Class participation	0,2	Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							
9. Assessment of learning outcomes in class and at the final exam (procedure and examples)							
Knowledge will be checked by the written final exam.							
10. Mandatory literature (at the time of submission of study programme proposal)							
Recent scientific papers in the area of the course							
11. Optional/additional literature (at the time of submission of the study programme proposal)							

- Petrovic A, Veeraraghavan P, Olivieri D, Nistri A, Jurcic N, Mladinic M. Brain Res doi: 10.1016/j.brainres.2018.12.029, 2018.
- Petrović A, Kaur J, Tomljanović I, Nistri A, Mladinic M. Eur J Neurosci doi: 10.1111/ejn.14218, 2018.
- *Mršić-Pelčić J., Pilipović K., Pelčić G., Vitezić D., Župan G. Basic Clin Pharmacol Toxicol 121, 453-464, 2017.*
- *Pilipović K., Župan Ž., Dolenec P., Mršić-Pelčić J., Župan G. Prog Neuropsychopharmacol Biol Psychiatry 3, 8-20, 2015.*
- Dolenec P., Pilipović K., Rajič J., Župan G. J Neuropathol Exp Neurol 74(6), 512-526, 2015.
- Mršić-Pelčić J., Pilipović K., Pelčić G., Vitezić D., Župan G. Cell Biochem Funct 30, 597-603, 2012.
- *Župan Ž., Pilipović K., Dangubić B., Frković V., Šustić A., Župan G. Prog Neuropsychopharmacol Biol Psychiatry 35(8), 1846-56, 2011.*

Pilipović K., Župan Ž., Dangubić B., Mršić-Pelčić J., Župan G. Neurochem Res 36, 913-921, 2011.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Recent scientific papers in the area of the course	*30*	*30*

[24] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences		
Final exam and anonymous questionnaires		

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COURSE DESCRIPTION		
Course instructor	Prof. Hana Mahmutefendić Lučin, PhD	
Lecturers	Prof. Pero Lučin, MD, PhD, Prof. Gordana Blagojević Zagorac, MD, PhD, Asst. Prof. Ljerka Karleuša Mujkić, PhD	
Name of the course	Endocytosis and disorders of membrane trafficking	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+6

1. Course objectives

The aim of the course is to get insight into membrane trafficking in the hemisphere of the endosomal system, with up-to-date results in field of endocytosis, diseases that are based on endosomal disorders, translational research that include field of endocytosis, and with the opportunities of implementation of results of research in biotechnology and medicine.

2. Course enrolment requirements

3. Expected learning outcomes

To understand of biophysical characteristics of membranes and membrane trafficking.
To explain the structure of endosomal system and the principles of membrane proteins trafficking throughout the endosomal system.
To understand methods and techniques those are in use for investigations of endosomal system.
To understand principles of exogenous antigen presentation in endosomal system.
To explain mechanisms of diseases development that are based on endosomal system dosorders.
To explain endosomal transport disorders that arise after pathogen activity in infected cells.
To critically estimate the potential use of knowledge generated in the endosomal research for translational studies and drug development.

4. Course content

1. Biophysics of membranes, membrane structure, mechanisms of generation of membrane curvatures and membrane deformations.
2. Endosomal system and membrane dynamics. Membrane and endosomal domains. Mathematical modelling of endosomal trafficking.
3. The classification of endocytosis – constitutive end regulated endocytosis. Molecules that characterise endocytotic pathways.
4. Regulation of endosomal function and protein sorting in endosomal system.
5. Autophagy.
6. Methods and techniques in research of endosomal system.
7. Exogenous pathway of antigen presentation and construction of vaccines. The potential use of exosomes in drug targeting and gene therapy.
8. Adaptation of endosomal system to intracellular parasites – viruses and bacteria.

9. Lysosomal diseases and endosomal trafficking disorders.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		

8. Monitoring of student work[26]

Class attendance	0,1	Class participation	0,4	Seminar paper		Experimental work	
Written exam	1,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation will be carried in a following way:
1. Course attendance (5%), and presentation of scientific work on seminars (25%).
2. Student can achieve 70% of grade on final exam, but only if 50% of exam was answered correctly.

10. Mandatory literature (at the time of submission of study programme proposal)

Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, Walter P. Molecular Biology of the Cell (6th Revised edition). Garland Science , Taylor and Francis Group Ltd., 2015, New York – *elected chapters*

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Donaldson JG, Williams DB (2009). Intracellular Assembly and Trafficking of MHC Class I Molecules. Traffic 10:1745–1752.
2. Grant BD, Donaldson JG (2009). Pathways and mechanisms of endocytic recycling. Nature Rev. 10:597-608.
3. Huotari J, Helenius A. (2011). Endosome maturation. EMBO J. 30:3481-500.
4. Joffre OP, Segura E, Savina A, Amigorena S. (2012) Cross-presentation by dendritic cells. Nat Rev Immunol. 12:557-69.
5. Mayor S, Pagano RE (2007). Pathways of clathrin-independent endocytosis. Nature Rev. 8:603-612.
6. McMahon TH, Gallop JL (2005). Membrane curvature and mechanisms of dynamic cell membrane remodelling. Nature 438:590-596.
7. Rubinsztein DC, Codogno P, Levine B (2012). Autophagy modulation as a potential therapeutic target for diverse disease. Nat Rev Drug Discov. 11:709-30.
8. Théry C (2011). Exosomes: secreted vesicles and intercellular communications. F1000 Biol Rep. 3:15.
9. Futerman AH, and van Meer G (2004). The cell biology of lysosomal storage dosorders. Mat Rev Mol Cell Biol. 5:554.

[26] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

10. Marsh M, Helenius A. Virus Entry: Open Sesame. *Cell* 2006; 124:729-740.
11. Mercer J, Schelhaas M, Helenius A. Virus entry by endocytosis. *Annu Rev Biochem* 2010; 79:803-33.
12. Vale-Costa S, Amorim MJ. Recycling Endosomes and Viral Infection. *Viruses* 2016; 8, 64.
13. Lučin P., Mahmutefendić H., Blagojević Zagorac G., Ilić Tomaš M. (2014). Cytomegalovirus immune evasion by perturbation of endosomal trafficking. Cell Mol Immunol. 2015 Mar;12(2):154-69.
14. Mahmutefendić H, Blagojević Zagorac G, Grabušić K, Karleuša L, Maćešić S, Momburg F, Lučin P. Late endosomal recycling of open MHC-I conformers. J Cell Physiol. 2017 Apr;232(4):872-887. doi: 10.1002/jcp.25495.
15. Blagojević Zagorac G, Mahmutefendić H, Maćešić S, Karleuša L, Lučin P. Quantitative Analysis of Endocytic Recycling of Membrane Proteins by Monoclonal Antibody-Based Recycling Assays. J Cell Physiol. 2017 Mar;232(3):463-476. doi: 10.1002
16. Karleuša Lj, Mahmutefendić H, Ilić Tomaš M, Blagojević Zagorac G, Lučin P: Landmarks of endosomal remodeling in early phase of cytomegalovirus infection. Virology. 2018 Feb;525:108-122. doi: 10. 1016.
17. Lučin P, Kareluša L, Blagojević Zagorac G, Mahmutefendić Lučin H, Pavišić V, Jug Vučko N, Lukanović Jurić S, Marcelić M, Lisnić B, Jonjić S. Cytomegaloviruses Exploit Recycling Rab Proteins in the Sequential Establishment of the Assembly Compartment. Front Cell Dev Biol. 2018 Dec 4;6:165. doi: 10.3389/fcell.2018.00165. 2018. Review

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, Walter P. Molecular Biology of the Cell (6th Revised edition). Garland Science , Taylor and Francis Group Ltd., 2015, New York – elected chapters	2	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Content, learning methods used, course performance, and outcomes will be evaluated at the end of the course (after written exam). Learning outcomes will be checked through presentations on seminars, discussions, and through structured formation of multiple-choice questions for final exam.

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COURSE DESCRIPTION		
Course instructor	Prof. Sanja Zoričić Cvek, MD, PhD	
Lecturers	Prof. Ivana Marić, MD, PhD, Prof. Olga Cvijanović Peloza, MD, PhD	
Name of the course	Bone morphogenetic proteins	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8

1. Course objectives

The aim of the course "Bone morphogenetic proteins" is to achieve new theoretical knowledge from the field of molecular biology of the bone tissue. The special attention is focused on the role of the growth and differentiational factors during the key tissue processes such as bone remodelling and regeneration. Based on the molecular biology, a new approach in bone defect therapy and mode of bone augmentation was developed. Therefore, we would like to present new possibilities for using these principles in clinical practise. The goal of the course is to suggest the modern methods of bone induction by the use of the bone morphogenetic proteins in experimental and clinical medicine. Beside their regenerative potential, their role in neoplastic transition was determined and therefore the regulatory mechanism of bone morphogenetic proteins in certain (epithelial) tumorogenesis was in focus of experimental investigations of the neoplastic diseases.

2. Course enrolment requirements

There are no requirements.

3. Expected learning outcomes

The basic *competences*:

1. To define the theoretical considerations about structure and function of the bone tissue, to enlarge the knowledge about that with the results of the molecular biology investigations, to define the role of the bone morphogenetic proteins,
2. *To explaine the basic principles of the bone metabolism (the bone formation and bone resorption, cellular component involved in bone formation and resorption processes),*
3. To define the bone development, modeling, remodeling and fracture healing processes,
4. To explaine the clinical application of the (medicine and dentistry) basic bone metabolism principles in case of bone regeneration requirements, in case of bone mass deficit or bone defects,
5. To explaine the posibilities of curing bone defects in clinical medicine,
6. To define the theoretical knowledge about regulation of the proliferation and differentiation of th eepithelial and mesenchimal tissues,
7. To define the group of the bone morphogenetic proteins, to explaine their role in bone metabolism, to explaine the cellular processes involved in BMP signal propagation ,
8. To describe the possible clinical entities as a possible candidate for BMP application
1. *To evaluate the use of the BMP as s* new approaches in therapy of the bone defects in clinical practise

2. to explore the possibility of the use of the BMPs in bone defect therapy in maxillofacial surgery and dental practise.

4. Course content

1. The family of the bone morphogenetic proteins – structure, action, receptors, intracellular signal transducers, extracellular antagonists, target cells and tissues.
2. The structure and development of the bone tissue. The biomechanical property of the spongy and cancellous bone.
3. The metabolism of the bone tissue. Osteogenesis. The bone formation and bone resorption. The bone remodelling and bone regeneration.
4. The principles of the osteoinduction and osteoconduction in new bone formation and regeneration
5. The applications of the bone morphogenetic proteins in clinical practise (orthopaedics, dental medicine). The use of BMP-2 in bone reconstruction.
6. The impact of BMPs in tumorogenesis.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	The course is organised through the lectures and seminars. We would like to encourage the students for active participation in the course and to discuss the topics. The seminars will be perform by active presentations of the students with their critical review of the defined topics.	

7. Student responsibilities

Lecture and seminars attendance, active participation in the presentation of the defined topics.

8. Monitoring of student work[27]

Class attendance	0,2	Class participation	0,3	Seminar paper	0,5	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Assessment and evaluation of student's work will be performed according to the Book of rules for the studies at the University of Rijeka

10. Mandatory literature (at the time of submission of study programme proposal)

Vukicevic S., Sampath K.T. Bone Morphogenetic Proteins: From Local to Systemic Therapeutics. Birkhauser Verlag, Basel, Boston, Berlin, 2002.
Vukicevic S., Sampath K.T. Bone Morphogenetic Proteins: Regeneration of bone and Beyond. Birkhauser Verlag, Basel, Boston, Berlin, 2004.

[27] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Vukicevic S., Sampath K.T. Bone Morphogenetic Proteins: From Local to Systemic Therapeutics. Birkhauser Verlag, Basel, Boston, Berlin, 2008.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Bobinac D, Marić I, Zoričić S, Španjol J, Đorđević G, Mustać E, Fučkar Z. Expression of bone morphogenetic proteins in human metastatic prostate and breast cancer. Croat Med J. 2005 Jun; 46(3):389-96.
2.Mihelić R, Pećina M, Jelić M, Zoričić S, Kušec V, Šimi P, Bobinac D, Lah B, Legović D, Vukičević S. Bone morphogenetic protein-7 (osteogenic protein-1) promotes tendon graft integration in anterior cruciate ligament reconstruction in sheep. Am J Sports Med. 2004 Oct-Nov;32(7):1619-25.
3.Marić I, Poljak L, Zoričić S, Bobinac D, Bosukonda D, Sampath KT, Vukičević S. Bone morphogenetic protein-7 reduces the severity of colon tissue damage and accelerates the healing of inflammatory bowel disease in rats. J Cell Physiol. 2003 Aug;196(2):258-64.
4.Zoričić S, Marić I, Bobinac D, Vukičević S. Expression of bone morphogenetic proteins and cartilage-derived morphogenetic proteins during osteophyte formation in humans. J Anat. 2003 Mar;202(Pt 3):269-77.
5.Bobinac D, Španjol J, Zoričić S, Marić I. Changes in articular cartilage and subchondral bone histomorphometry in osteoarthritic knee joints in humans. Bone. 2003 Mar;32(3):284-90.
6.Marić I, Kučić N, Turk Wensveen T, Smoljan I, Grahovac B, Zoričić Cvek S, Ćelić T, Bobinac D, Vukičević S. BMP signaling in rats with TNBS-induced colitis following BMP7 therapy.
Am J Physiol Gastrointest Liver Physiol. 2012 May 15;302(10):G1151-62.
7.Šoša I, Cvijanović O, Ćelić T, Cuculić D, Crnčević-Orlić Z, Vukelić L, Zoričić Cvek S, Đudarić L, Bosnar A, Bobinac D. Hepatoregenerative role of bone morphogenetic protein-9. Med Sci Monit. 2011 Dec;17(12):HY33-5.
8.Vukelić L, Šoša I, Cvijanović O, Mađarević T, Jotanović Z, Vukelić Šarunić A, Štifter S, Zoričić Cvek S, Đudarić L, Šestan B, Bobinac D. Correlation of endothelin-1 mRNA expression and bone structure in advanced osteoarthritis. Med Hypotheses. 2011 Nov;77(5):927-9.
9.Bobinac D, Španjol J, Marinović M, Zoričić Cvek S, Marić I, Cicvarić T, Fučkar D, Markić D, Vojniković B. Expression of bone morphogenetic proteins, cartilage-derived morphogenetic proteins and related receptors in normal and osteoarthritic human articular cartilage. Coll Antropol. 2008 Oct;32 Suppl 2:83-7.
10.Đudarić L, Cvek SZ, Cvijanović O, Šantić V, Marić I, Crncević-Orlić Z, Bobinac D. Expression of the BMP-2, -4 and -7 and their antagonists gremlin, chordin, noggin and follistatin during ectopic osteogenesis. Coll Antropol. 2013 Dec;37(4):1291-8.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Vukicevic S., Sampath K.T. Bone Morphogenetic Proteins: From Local to Systemic Therapeutics. Birkhauser Verlag, Basel, Boston, Berlin, 2002.	5	10
Vukicevic S., Sampath K.T. Bone Morphogenetic Proteins: Regeneration of bone and Beyond. Birkhauser Verlag, Basel, Boston, Berlin, 2004.	5	10
Vukicevic S., Sampath K.T. Bone Morphogenetic Proteins: From Local to Systemic Therapeutics. Birkhauser Verlag, Basel, Boston, Berlin, 2008.	5	10

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13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences
1. students questionnaires 2. mentorship 3. evaluation of the e*xpected learning outcomes described in the course description.*

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COURSE DESCRIPTION		
Course instructor	Prof. Tihana Lenac Roviš, PhD	
Lecturers	Assoc. Prof. Berislav Lisnić, PhD, Assoc. Prof. Vanda Juranić Lisnić, PhD, Ani Gerbin, PhD	
Name of the course	Monoclonal antibodies in medicine	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	13+0+3

1. Course objectives

The aim of the course is to provide students with a deeper insight into the mechanisms of action of therapeutic monoclonal antibodies. In addition, to provide a general overview of the characteristics of monoclonal antibodies used in laboratory research and diagnostics and proper ways to validate them.

2. Course enrolment requirements

Before the enrolment in the course the students must have a graduate degree. Students are expected to have basic background knowledge in cell biology and immunology and a keen interest in immunoregulation or immunovisualization.

3. Expected learning outcomes

Students will be able to:

1. Define the following antibody-related terms: antigen, epitope, monoclonal, polyclonal, validation, cross-reactivity, variable and constant domain, phage and yeast display, humanized antibody, blocking antibody, recombinant antibody, antibody-drug conjugate, targeted drug delivery, immune-check point inhibitor, active and passive immunotherapy
2. Describe the structural characteristics of antibodies
3. Describe the basics of modern genetic engineering applied to the development of recombinant therapeutic antibodies
4. Describe the Intellectual property protection of monoclonal antibodies
5. Discuss the factors influencing preclinical development of monoclonal antibodies
6. Briefly explain mechanism of action of several antibody therapeutics

4. Course content

The course will briefly explain antibody structure and sequence, parameters of the antigen-antibody interaction, antibody engineering, humanization and antibody derivatives (2 hours).
In addition, an overview of the applications of monoclonal antibodies in basic research (starting from how to find antibody of interest) as well as of the applications of antibodies in clinical diagnostics (the most frequently used immunoassays) will be provided (2 hours).
The course will focus on monoclonal antibodies and antibody derivatives approved for therapeutic use with particular reference to their mechanism of action and specific molecular targets to which such therapeutics bind (tumor necrosis factor (TNF), immune-check points, growth factor receptors, tumor antigens and specific cell markers; such as EGFR, PD-1, HER2 or CD20; 6 hours).

Other topics include potential immunotherapeutic strategies for neurodegenerative diseases (protein misfolding disorders such as Alzheimer disease, Parkinson disease, Creutzfeldt-Jakob disease), designing a preclinical development strategy for the development of a recombinant antibody product (including suitable animal models and the protection of intellectual property; 4 hours).
Two additional topics related to antibody structure or function, which the students will choose according to their interest, will be covered (2 hours). During the course, the students will prepare short roundtable presentations and participate in discussions on the use of antibodies (2 hours)

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments		

7. Student responsibilities

The lectures are mandatory. During the course, students will prepare short roundtable presentations and participate in discussions.

8. Monitoring of student work[30]

Class attendance	0,2	Class participation	0,3	Seminar paper		Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio		Roundtable presentation and discussion	1				

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The class attendance is obligatory, with the possibility not to attend 30% (5 hours). The regular class attendance will bring 0,5 ECTS. Students will be monitored during the course by the lecturers, in terms of activity that will represent another 0,5 ECTS. Finally, students can earn a maximum of 0,5 ECTS for the roundtable presentation and for the written exam.

10. Mandatory literature (at the time of submission of study programme proposal)

Review articles:

1. Building better monoclonal antibody-based therapeutics, Nat Rev Cancer. 2015; 15(6):361-70.
2. Current progress in innovative engineered antibodies, Protein Cell. 2018; 9(1):86–120
3. Antibodies to watch in 2017, MAbs. 2017; VOL. 9, NO. 2, 167–181
4. Site-specific antibody drug conjugates for cancer therapy, MAbs. 2014; 6(1): 34–45.
5. The European antibody network's practical guide to finding and validating suitable antibodies for research; MAbs. 2016; 8(1): 27–36.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Monoklonska protutijela: humanizacija i imunogenost,

[30] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

LANGUAGE: CROATIAN; https://urn.nsk.hr/urn:nbn:hr:163:912991, Repozitorij Farmaceutsko-biokemijskog fakulteta Sveučilišta u Zagrebu, Ela Milčić, završni specijalistički rad

2. Antibodies to watch in 2015, MAbs. 2015;7(1):1-8.
3. P. Kučan Brlic, T. Lenac Rovis, G. Cinamon, P. Tsukerman, O. Mandelboim, S. Jonjić: Targeting PVR (CD155) and its receptors in **anti-tumor therapy**; Cellular & Molecular Immunology. 2018. Cell Mol Immunol. 2019 Jan;16(1):51-63. doi: 10.1038/s41423-018-0168-y.
4. J. Milbradt, E. Sonntag, S. Wagner, H. Strojan, C. Wangen, T. Lenac Rovis, B. Lisnic, S. Jonjic, H. Sticht, W. J. Britt, U. Schlötzer-Schrehardt M. Marschall: **Human Cytomegalovirus** Nuclear Capsids Associate with the Core Nuclear Egress Complex and the Viral Protein Kinase pUL97; Viruses. 2018 Jan; 10(1): 35. doi: 10.3390/v10010035
5. González-Motos V, Jürgens C, Ritter B, Kropp KA, Durán V, Larsen O, Binz A, Ouwendijk WJD, **Lenac Rovis T**, Jonjic S, Verjans GMGM, Sodeik B, Krey T, Bauerfeind R, Schulz TF, Kaufer BB, Kalinke U, Proudfoot AEI, Rosenkilde MM, Viejo-Borbolla A**: Varicella zoster virus** glycoprotein C increases chemokine-mediated leukocyte migration; PLoS Pathog 2017 May 25;13(5):e1006346.
6. Naschberger A, Fürnrohr BG, **Lenac Rovis T**, Malic S, Scheffzek K, Dieplinger H, Rupp B: The N14 **anti-afamin antibody Fab**: a rare VL1 CDR glycosylation, crystallographic re-sequencing, molecular plasticity and conservative versus enthusiastic modelling. IF 2015: 2,5; SJR 2016: Medicine (miscellaneous) Q1; Structural Bilogy Q1; Acta Crystallogr D Struct Biol. 2016 Dec 1;72(Pt 12):1267-1280. Epub 2016 Nov 29.
7. Trbojević-Akmačić, I., Nemec, B., Vidić, U.,Malić, S., Černigoj, U. Vidić, J., Lendero Krajnc, N:, Štrancar, A., Lauc, G., **Roviš, T.L.**, Pučić-Baković, M: Chromatographic monoliths for high-throughput immunoaffinity isolation of **transferrin from human plasma** Croatica Chemica Acta 2016 89 (2), pp. 203-211 – in 2016. not visible in PubMed.
8. A. Houston, JM. Williams, **TL. Rovis**, DK. Shanley, RT. O'Riordan, PA. Kiely, M. Ball, OP. Barry, J. Kelly, A. Fanning, J. MacSharry, O. Mandelboim, BB. Singer, S. Jonjic, T. Moore: **Pregnancy-specific glycoprotein** expression in normal gastrointestinal tract and in tumors detected with novel monoclonal antibodies, IF 2015/2016: 4,2; SJR 2016: immunology Q1, immunology and allergy Q1; MAbs, 2016 Apr;8(3):491-500. doi: 10.1080/19420862.2015.1134410.
9. W. Deng, BG. Gowen, L. Zhang, L. Wang, S. Lau, A. Iannello, J. Xu, **T. L Rovis**, N. Xiong, DH. Raulet: **Antitumor immunity**. A shed NKG2D ligand that promotes natural killer cell activation and tumor rejection, IF 2015: 34,7; SJR 2015: History and Philosophy of Science Q1; Multidisciplinary: Q1; Science, 2015 Apr 3;348(6230):136-9. doi: 10.1126/science.1258867. Epub 2015 Mar 5.
10. **T. L Rovis**, G. Legname: **Prion Protein-Specific Antibodies**-Development, Modes of Action and Therapeutics Application, IF 2014 3,4; SJR 2014: infectious diseases Q1, virology Q1; Viruses, 2014 Oct 1;6(10):3719-37. doi: 10.3390/v6103719.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	*30*	*30*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

At the end of the course, the students will evaluate a quality of the course by standard evaluation-test constructed for that purpose. A critical analysis of the final written exams. Evaluation during the roundtable discussions. Evaluation of the expected learning outcomes.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Damir Klepac, PhD	
Lecturers	Assoc. Prof. Duško Čakara, PhD	
Name of the course	Nanoparticles as drug delivery systems	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+6

1. Course objectives

The main objective of this course is to introduce the students to the clinically relevant properties of drug delivery nanoparticles. Nanoparticles have the great potential to revolutionize the drug development process and change the landscape of the pharmaceutical industry. The students will learn how the nanoparticles can be used to improve the therapeutic efficacy of the drugs and increase their tolerability in the body. A special emphasis will be given to the polymeric nanoparticles which can be formulated to deliver a wide range of drugs and that are adaptable to many clinical settings.

2. Course enrolment requirements

Enrollment in a doctoral degree program.

3. Expected learning outcomes

After attending classes and passing the final exam, the students will be able to distinguish the properties of different types of drug delivery nanoparticles, apply a nanoprecipitation process for the preparation of polymer nanoparticles, apply a dynamic light scattering method (DLS) to determine the hydrodynamic radius of nanoparticles, explain the interactions between nanoparticles and blood plasma, compare active and passive tumor targeting using nanoparticles and compare the advantages and disadvantages of certain types of nanoparticles.

4. Course content

This course will be based on the following topics:

1. Drug delivery nanoparticles - Introduction: The students will be introduced to the basic types and properties of nanocarriers used in drug delivery system such as liposomes, polymers, dendrimers, silica and carbon nanomaterials.
2. Preparation of nanoparticles: In this part of the course the students will learn various methods for the preparation of nanoparticles such as milling and nanoprecipitation.
3. Characterization of nanoparticles: In this part the students will be introduced to the most commonly used techniques for nanoparticle characterization such as dynamic light scattering (DLS), cryo transmission electron microscopy (cryo-TEM) and isothermal titration calorimetry (ITC).
4. Nanoparticle-protein interactions: The fate of the nanoparticles after intravenous injection will be discussed. Protein corona on the surface of the nanoparticles will be described and new corona-free nanoparticles will be introduced.

5. Biological transport of nanoparticles: In this part of the course it will be shown how the nanoparticles reach to the place of action. Both transcellular and paracellular routes will be described.
6. Applications of drug delivery nanoparticles: In the final part of the course it will be explained how the nanoparticles can be used for tumour targeting. The future of nanomedicine will be discussed based on the results of the latest research.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Regular attendance and active participation in classes. Students must also prepare a seminar on a given topic and present it during classes.

8. Monitoring of student work[31]

Class attendance	0,5	Class participation		Seminar paper	0,5	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	0,5
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student work will be followed during the course and in the laboratory; seminar paper will be a requirement for the final exam. The final grade is obtained on the written exam.

Differentiation of the properties of different types of nanoparticles, knowledge of the interaction between nanoparticles and blood plasma, comparison between active and passive approach to tumor targeting and knowledge of the advantages and disadvantages of certain nanoparticles will be evaluated through the preparation and presentation of the seminar work and on the written exam.

The application of the nanoprecipitation process and dynamic light scattering method (DLS) will be evaluated during the practical work in the laboratory.

10. Mandatory literature (at the time of submission of study programme proposal)

Drug Delivery Nanoparticles Formulation and Characterization; Pathak, Y., Thassu, D., Eds.; Drugs and the pharmaceutical sciences; Informa Healthcare: New York, 2009.
Nanoparticle Technology for Drug Delivery; Gupta, R. B., Kompella, U. B., Eds.; Drugs and the pharmaceutical sciences; Taylor & Francis: New York, 2006.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Klepac, D.; Kostková, H.; Petrova, S.; Chytil, P.; Etrych, T.; Kereïche, S.; Raška, I.; Weitz, D. A.; Filippov, S. K. Interaction of Spin-Labeled HPMA-Based Nanoparticles with Human Blood Plasma Proteins – the Introduction of Protein-Corona-Free Polymer Nanomedicine. *Nanoscale* 2018, *10* (13), 6194–6204.

[31] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Petrova, S.; Klepac, D.; Konefał, R.; Kereïche, S.; Kováčik, L.; Filippov, S. K. Synthesis and Solution Properties of PCL-*b*-PHPMA Diblock Copolymers Containing Stable Nitroxyl Radicals. *Macromolecules* 2016, *49* (15), 5407–5417.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Drug Delivery Nanoparticles Formulation and Characterization; Pathak, Y., Thassu, D., Eds.; Drugs and the pharmaceutical sciences; Informa Healthcare: New York, 2009.	*30*	*30*
Nanoparticle Technology for Drug Delivery; Gupta, R. B., Kompella, U. B., Eds.; Drugs and the pharmaceutical sciences; Taylor & Francis: New York, 2006.	*30*	*30*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

At the end of the course, an anonymous survey will be conducted among the students in which they will evaluate and give their opinion about the course and the teacher.

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COURSE DESCRIPTION		
Course instructor	Prof. Jasenka Mršić-Pelčić, MD, PhD	
Lecturers	Prof. Ivana Munitić, Phd, Prof. Kristina Pilipović, MD, PhD, Prof. Jasna Križ, MD, PhD, Prof. Jean-Pierre Julien, PhD	
Name of the course	Pathobiology of Ageing and Neurodegenerative Disorders	
Study programme	Doctoral school Biomedicine and health – course of study Biomedicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+4
1. Course objectives		
The main objective of this course is to acquire new knowledge in the field of Neuroscience with particular emphases on pathobiology of ageing and Neurodegenerative Disorders. This will be achieved through discussions of the latest results coming from prominent national and international laboratories.		
2. Course enrolment requirements		
The course will be presented to students with obtained MD degree, BSc/MS in Molecular Biology, and in general graduate students with biomedical/health sciences background.		
3. Expected learning outcomes		
It is expected that after course the students will: • acquire new knowledge in basic molecular mechanisms of aging and neurodegeneration • acquire new knowledge in pathobiology of neurological disorders including stroke, amyotrophic lateral sclerosis and frontotemporal dementia, Parkinson's and Alzheimer diseases (from bench to bedside) • learn about novel therapeutic strategies in the field neuro-immunology • Overall and more general expected outcome is to learn how to critically analyze and debate recent scientific data/papers and to acquire critical new knowledge in the field of neuroscience and neurology		
4. Course content		
Molecular mechanisms of neurodegeneration: mechanisms involved in cellular aging, molecular pathways involved into cell damage/death, immune system and brain, the role of non–neuronal cells such as astrocytes, microglia and peripheral immune cells in neurological disorders, genetics of neurological disorders Neurobiology of disease: comprises latest developments and new knowledge (basic and clinical) about pathobiology of cerebral ischemia, amyotrophic lateral sclerosis and frontotemporal dementia, Parkinson's and Alzheimer diseases. Novel therapeutic strategies including gene therapy will be discussed with respect to particular pathology. Journal Club: last bloc of teaching will comprise critical evaluation and analysis of one pre-selected article recently published in one of the top journals in the field.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises	☐ individual assignments ☐ multimedia and network ☐ laboratories

	☐ distance learning ☐ fieldwork			☐ mentorship ☐ other			
6. Comments							
7. Student responsibilities							
Attendance and active participation at the seminars/workshops.							
8. Monitoring of student work[32]							
Class attendance	0,2	Class participation	0,3	Seminar paper	0,5	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							
9. Assessment of learning outcomes in class and at the final exam (procedure and examples)							
Student assessment is carried out according to the Code of Study Programmes at the University of Rijeka (approved by the Senate of the University of Rijeka). Evaluation of individual learning outcomes will be ensured through discussion and presentation during the course and on the final written exam where the questions will be in line with the expected learning outcomes.							
10. Mandatory literature (at the time of submission of study programme proposal)							
Kandel E.R., Schwartz J.H. Jessel T.M.: Principles of Neural Science, 4th edition, Elsevire 2006 (5th Edition in October 2012) Dickson D, Weller RO: Neurodegeneration: The Molecular Pathology of Dementia and Movement Disorders, 2nd Edition, Willey-Blackwell, 2011 Ropper A.H. Brown B: Adams and Victor's Principles of Neurology 8th Edition, 2005, The McGraw-Hill Companies Inc. Mršić-Pelčić, J; Pilipović, K; Pelčić, G; Vitezić, D; Župan, G. Decrease in Oxidative Stress Parameters after Post-Ischaemic Recombinant Human Erythropoietin Administration in the Hippocampus of Rats Exposed to Focal Cerebral Ischaemia. Basic Clin Pharmacol Toxicol 2017; 121 453-464 Pilipović, K; Župan, Ž; Dolenec, P; Mršić-Pelčić, J; Župan, G. A single dose of PPAR agonist pioglitazone reduces cortical oxidative damage and microglial reaction following lateral fluid percussion brain injury in rats. Prog Neuropsychopharmacol Biol Psychiatry 2015; 59: 8-20 Mršić-Pelčić, J; Pilipović, K; Pelčić, G; Vitezić, D; Župan, G.Temporal and regional changes of superoxide dismutase and glutathione peroxidase activities in rats exposed to focal cerebral ischemia. Cell Biochem Funct 2012; 30: 597-603							
11. Optional/additional literature (at the time of submission of the study programme proposal)							
Recent original scientific papers and/or review articles relevant to the topic.							
12. Number of assigned reading copies in relation to the number of students currently attending the course							

[32] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Title	*Number of copies*	*Number of students*
Selected chapters	*30*	*30*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

The output knowledge will be evaluated on the final written exam. The learning outcomes evaluation will be additionally based on the analysis of the successful response to specific issues

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COURSE DESCRIPTION		
Course instructor	Prof. Sandra Milić, MD, PhD	
Lecturers	Assoc. Prof. Ivana Mikolašević, MD, PhD, Assoc. Prof. Goran Poropat, MD, PhD, Asst. Prof. Irena Hrstić, MD, PhD	
Name of the course	Autoimmunity in gastroenterology	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	6+0+6

1. Course objectives

The aim of the course is to familiarize students with the concepts and basic principles of functioning of the digestive system as an immune system that forms a functional role. Immunological reaction occurs on the mucosa of an organ is reflected on other mucous membranes and organs with memory and effector cells acting. Muscular immune system disorders not only allow the penetration of harmful factors into other parts of the body, but can also cause the cause and local disturbances. In the digestive system I are chronic intestinal, pancreatic and liver diseases. Understanding is defined as the ability to understand and interpret the meaning of the adopted facts. At this level, knowledge is defined as the ability to recall learned content that does not necessarily mean understanding. This recall refers to a wide range of content; adoption of terminology; recalling specific facts; recalling complex theories Refers to the basic knowledge a student must acquire to understand the meaning of the subject he learns. This educational goal is higher than the previous simple information recall andrepresents the lowest level of understanding. Application is defined as the ability to be taught rules, laws, methods or theories apply in new situations, eg application of ideas and concepts to solving problems. At this level the student should know how to solve the problem, construct a graph or curve,to demonstrate the correct use of some method or procedure. The analysis is defined as the ability to break downlearned content on constituents, understanding of organizational structure, their understandinginterrelationships, carrying out evidence and conclusions. At this level, students should know how to compare, oppose, recognize unforeseen assumptions, distinguish the facts from conclusions, distinguish the cause from the consequences, determine the relevance of the data. Synthesis can be explained as the ability to get out individual parts create a whole new entity. The educational goal in this case stands out creatively behavior with an emphasis on formulating new forms or structures. At this level, students should use existing knowledge to create a new entity: ability, combination, hypothesis, planning, reorganization, writing well-organized work, maintaining well-organized speech (lecture),to propose a research plan. Evaluation or evaluation is defined as ability, judgment of material values, evaluation, arguments or criticism. Processes must be based on accurately defined criteria. At this level, students should be able to judge the appropriateness of conclusions from the presented data, to judge the logical durability of written material or lectures. propose a research plan. Evaluation or evaluation is defined as ability, judgment of material values, evaluation, arguments or criticism. Processes must be based on accurately defined criteria. At this level, students should be able to judge the appropriateness of conclusions from the presented data, to judge the logical durability of written material or lectures.

2. Course enrolment requirements

Enrolled postgraduate university study programme; basic knowledge in hematology

3. Expected learning outcomes		
After completion of the course, students will be able to define the terms of autoimmunity in the field of digestive system and thus will approach the patients with the possible autoimmune diseases of the intestine, pancreas and liver		
4. Course content		
Students will be introduced with: - definitions and basic principles of autoimmunity in gastroenterology - basic principles and technology of pathohistological, genetic and molecular diagnostics as themain preconditiontreatment - practical examples of adequate treatment of autoimmune diseases in gastroenterology		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	-	
7. Student responsibilities		
Attendance of the lectures and seminars; active participation in seminars and workshops; taking exam		

8. Monitoring of student work[33]

Class attendance	0,2	Class participation	0,2	Seminar paper	1	Experimental work	
Written exam	0,6	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The work of students during the course and final exam will be evaluated in accordance with the current Rulebook on Student Assessment at the Faculty of Medicine in Rijeka. With the obligation of active participation and regular attendance, the knowledge of students will be checked through seminar and written exam.

10. Mandatory literature (at the time of submission of study programme proposal)

Sleisenger and Fordtran's Gastrointestinal and Liver Disease- 2 Volume Set, 10th Edition Pathophysiology, Diagnosis, Management, 2016.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Zakm M, Boyer L. Hepatology, ELsvier 2016.
Milić S, Mikolašević I, Orlić L, Devčić E, Starčević-Čizmarević N, Štimac D, Kapović M, Ristić S. The role of iron and iron overload in chronic liver disease. Med Sci Monitor 2016. ;22:2144-51.

[33] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Milić S, Lulić D, Štimac D, Ružić A, Zaputović L.Cardiac manifestations in alcocholic liver disease. Postgrad Med J 2016;92:235-239.
Milić S, Mikolašević I, Krznarić-Zrnić I, Stanić M, Poropat G, Štimac D, Vlahović-Palčevski V, Orlić L. Nonalcoholic steatohepatitis: emerging targeted therapies to optimize treatment options. Drug Des Devel Ther 2015;20;9:4835-45
Orlić L, Mikolašević I, Lukenda V, Rački S, Štimac D, **Milić S.** Nonalcoholic fatty liver disease (NAFLD) - is it a new marker of hyporesponsiveness to recombinant human erythropoietin in patients that are on chronic hemodialysis? Med Hypotheses 2014
Fišić E, Poropat G, Bilić-Zulle L, Licul V, **Milić S,** Štimac D. The role of IL-6,8 I 10, sTNFr, CRP and pancreatic elastase in the prediction of systemic complications in patients with acute pancreatitis. Gastroenterol Resarch Pract 2013
Milić S, Poropat G, Malić D, Štimac D. A case of postpartum eosinophilic gastroenteritis and review of the literature.
Milić S, Ristić S, Starčević- Čizmarević N. Brajenović-Milić B, Crnić-Martinović M, Kapović M, Peterlin B, Štimac D. Low frequency of HFE gene mutations in Croatian patients suspected of having hereditary hemochromatosis. Med Sci Monit;2011: 552- 556.
Čizmarević NS, Stepec S, Ristic S, **Milić S**, Brajenović-Milić B, Štimac D, KapoviĆ M,Peterlin B. Hemochromatosis gene mutations in patients with alcoholic cirrhosis. Clin Genet 2006;70:257-59
. Ristić S, Makuc J, Starčević N, Logar N, Brajenović-Milić B, Stepec S, Pleša I, Kapović M,
Milić S, Štimac D, Crnić-Martinović M, Peterlin B. Hemochromatosis gene mutations in the Croatian and Slovenian populations. Clin Genet 2003;64:444-446.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
the literature will be available on the Web for all students	*30*	*30*

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

Student Survey; Critical Analysis of Exam Results

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COURSE DESCRIPTION		
Course instructor	Prof. Dubravka Jurišić-Eržen, MD, PhD	
Lecturers	Assoc. Prof. Tamara Turk Wensveen, MD, PhD, Prof. Lidija Bilić-Zulle, PhD, Prof. Felix M. Wensveen, PhD, Assoc. Prof. Tatjana Bogović Crnčić, MD, PhD	
Name of the course	Endocrine biomarkers: from scientific investigation to clinical use	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+2

1. Course objectives

The course objectives are to teach the students of the significance and the new findings about endocrine biomarkers in endocrine and bone diseases from both clinical and laboratory perspectives in order to raise the standard in the diagnosis and management of endocrine and bone disorders. Furthermore the objectives are to explain the content and significance of recent clinical and basic research that encourage new and question the current assumptions about diagnosis and treatment of endocrine diseases.

2. Course enrollment requirements

As the requirements for enrollment of the entire study program.

3. Expected learning outcomes

Definition and classification of endocrine disorders according to the organs (brain, pituitary gland, thyroid, adrenal glands, reproductive glands, bone) and metabolic disorders (diabetes mellitus, metabolic syndrome, cardiovascular risk, hyperlipidemia).
Describe and explain current existing methods for determining hormones, biochemical markers and functional tests in endocrinology, with particular reference to the determination of these parameters in structured clinical testing scenario with aim to establish diagnose.
Describe and explain diagnostic procedures, clinical picture and treatment of endocrine diseases with their application in the individual clinical managment.
Describe and explain the development of potentially new endocrinological biomarkers.
Describe and review experimental models and recent clinical studies in the field of endocrine biomarkers.

4. Course content

Definition and Clinical Classification of Endocrine and Metabolic Disorders. Epidemiology and mechanism of disease - hypophysis, thyroid and adrenal glands, adrenal glands, bone diseases and most common metabolic diseases - diabetes, metabolic syndrome and hyperlipidemia.
Detailed analysis of existing endocrine and immunological biomarkers in each disease, practically determining their clinical relevance from period of scientific research to clinical application with presentation of individual clinical cases. Particular importance will be given to the pre analytical variables of each biomarker, depending on the disease, by determining the most important conditions for their qualitative determination. Presentation of current experimental models and clinical studies of endocrine and immunological biomarkers.

5. Manner of instruction	☒ lectures	☐ individual assignments

	☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Teaching is done in the form of lectures and seminars. Active participation of students in the curriculum where students at the seminars with the teacher actively discuss the pathophysiological mechanisms.	

7. Student responsibilities

Student's knowledge is evaluated on the final exam consisting of seminar paper and oral exam.

8. Monitoring of student work[35]

Class attendance	0,4	Class participation		Seminar paper	0,6	Experimental work	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students' knowledge is evaluated on the final exam consisting of seminar paper and oral exam.

10. Mandatory literature (at the time of submission of study programme proposal)

1.Harrison's Principals of internal medicine 19th Edition. New York: McGraw-Hill Co.Inc.,2015.; 2. Hossein Sadrzadeh, Gregory Kline: Endocrine Biomarkers, 1th Edition, Elsevier, 2017.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1.Melmed S, Polonsky KS, Larsen PR and Kronenberg HM: Williams Textbook of Endocrinology, 13th Edition, 2015.; 2. Gardner DG, Shoback D. Greenspan´s Basic & Clinical Endocrinology, 9th Edition, New York: McGraw-Hill Co.Inc., 2011.
2. Jurisic-Erzen D, Ljubić S, Jazbec A, Tomić M, Novak B, Kapelan S, Vučić Lovrenčić M, Brkljačić N Inverse Levels of Adiponectin in Type 1 and Type 2 Diabetes Are in Accordance with the State of Albuminuria, International Journal of Endocrinology (1687-8345) 372796 (2015).
3. Jurisic-Erzen D, Ljubić S, Boras J, Vucic Lovrencic M, Vidjak V, , Mileta D. Adiponectin has different mechanisms in type 1 and type 2 diabetes with C-peptide link. Clin Invest Med 2009; 32 (4): E271-E279.
4. Šestan M, Marinović S, Kavazović I, Cekinović Đ, Wueest S, Turk Wensveen T, Brizić I, Jonjić S, Konrad D, Wensveen FM, Polić B.Virus-Induced Interferon-γ Causes Insulin Resistance in Skeletal Muscle and Derails Glycemic Control in Obesity.Immunity. 2018 Jul 17;49(1):164-177.e6. doi: 10.1016/j.immuni.2018.05.005. Epub 2018 Jun 26.
5. Wensveen FM[1], Valentić S[2], Šestan M[2], Wensveen TT[3], Polić B[4] Interactions between adipose tissue and the immune system in health and malnutrition. Semin Immunol. 2015 Sep;27(5):322-33. doi: 10.1016/j.smim.2015.10.006. Epub 2015 Nov 18.
6. Wensveen FM[1], Jelenčić V[1], Valentić S[1], Šestan M[1], Wensveen TT[2], Theurich S[3], Glasner A[4], Mendrila D[5], Štimac D[2], Wunderlich FT[3], Brüning JC[3], Mandelboim O[4], Polić B[1] NK cells link obesity-induced adipose

[35] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

stress to inflammation and insulin resistance. Nat Immunol. 2015 Apr;16(4):376-85. doi: 10.1038/ni.3120. Epub 2015 Mar 2.
7. Pīrāgs V, El Damassy H, Dąbrowski M, Gönen MS, Račická E, Martinka E, Giaconia J, Stefanski A; B001 Study Investigators Low risk of severe hypoglycaemia in patients with type 2 diabetes mellitus starting insulin therapy with premixed insulin analogues BID in outpatient settings. Int J Clin Pract. 2012 Nov;66(11):1033-41. doi: 10.1111/j.1742-1241.2012.03001.x. Erratum in: Int J Clin Pract. 2013 Jun;67(6):e1
8. Wensveen FM[1,2], Valentić S[1], Šestan M[1], Turk Wensveen T[3], Polić B[1].The "Big Bang" in obese fat: Events initiating obesity-induced adipose tissue inflammation. Eur J Immunol. 2015 Sep;45(9):2446-56. doi: 10.1002/eji.201545502. Epub 2015 Aug 19

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
Harrison's Principals of internal medicine 19th Edition. New York: McGraw-Hill Co.Inc., 2015.; Hossein Sadrzadeh, Gregory Kline: Endocrine Biomarkers, 1th Edition, Elsevier, 2017.	10	30

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

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COURSE DESCRIPTION		
Course instructor	Prof. Damir Miletić, MD, PhD	
Lecturers	Assoc. Prof. Neva Girotto, MD, PhD, Assoc. Prof. Tatjana Bogović Crnčić, MD, PhD, Asst. Prof. Petra Valković Zujić, MD, PhD, Asst. Prof. Slavica Kovačić, MD; PhD, Asst. Prof. Danijela Veljković Vujaklija, MD, PhD, Asst. Prof. Maja Ilić Tomaš, MD, PhD	
Name of the course	Imaging in personalized medicine	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+4

1. Course objectives

The goal of the course is to acquaint students with advanced imaging methods in radiology including computed tomography (CT) and magnetic resonance imaging (MRI) and in nuclear medicine that applies open ionizing radiation sources (radionuclides and radiopharmaceuticals-RF) for diagnostic and therapeutic purposes. Students will learn about quantitative data extracted from images by high-throughput computing and their potential diagnostic, prognostic, and predictive value (radiomics). They will be acquainted with computer assisted diagnosis (CAD) and the potential use of artificial intelligence and machine learning. Students will encounter the concept of biomarkers obtained from imaging with RFs (SPECT and PET), CT or MRI. Hybrid imaging (SPECT/CT, PET/CT, PET/MRI) and multiparametric imaging will be explained, as well as their role in current and future clinical medicine. Theranostic approach with radiopharmaceuticals labelled with diagnostic and therapeutic radionuclides, providing personalized molecular radiotherapy (MRT), will be illustrated by typical examples. The recent developments in this field along with examples of technologies that hold promise for the future of cancer medicine will be highlighted.

2. Course enrolment requirements

Enrolment in the doctoral study programme.

3. Expected learning outcomes

- to explain the role of imaging in personalized medicine
- to differentiate diagnostic imaging features and radiomics
- to assess potential use of computer assisted diagnosis
- to evaluate the value of imaging biomarkers
- to review diagnostic, prognostic, and predictive value of imaging biomarkers
- to explain the role of the most often used radionuclides (99mTc, positron emitters, beta minus therapeutic emitters) and radiopharmaceuticals (RF)
- to understand the concept of biodistribution and in vivo visualization of radiopharmaceuticals
- to understand complementary role of morphologic (CT) and functional (RF) information achieved by hybrid imaging technology in general
- to review the importance of correlation of metabolic, morphologic and molecular information obtained by fused PET/CT and other hybrid images, including PET/MRI , resulting in multiparametric imaging (is it a lesion, is it metabolically active and how much, what is it)

- to list the most frequent and emerging clinical indications for PET/CT, SPECT/CT, PET/MRI
- to value the cooperation between different imaging and other clinical specialists (radiologist, nuclear medicine practitioner, oncologist etc.), as the best way to improve management of the patient and introduce personalized medicine

4. Course content

Radiomics as decision support of precision medicine. Individual databases of imaging features. Artificial intelligence in image analysis – potentials in future. Radiogenomics. Radiomics analyses to distinguish prostate cancer from benign hyperplasia and to assess cancer aggressiveness. Imaging prognostic biomarkers in patients with lung cancer and glioblastoma. Personalized imaging diagnostics and follow-up of patients with rectal cancer. The role of MRI in assessment of treatment response and behaviour of Crohn disease. Molecular signature of diseases and lesions, in particular in oncology, neurology and cardiology. Combined PET, SPECT, CT and MRI in hybrid and multi-parametric imaging. New innovative protocols and biomarkers to individually impact healthcare management, and especially for improving personal risk stratification in oncologic and non-oncologic patients. Individualized treatment planning with tracer (RF) diagnostics and verification of the absorbed doses delivered following therapy ("theranostic" approach). Molecular radiotherapy. Dosimetry-based treatment planning. A brief review of several most common theranostic procedures. Patient-specific dosimetry.
Image-based screening programmes for detection of asymptomatic disease. Overdiagnosis.

5. Manner of instruction	X lectures X seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Teaching is done in the form of lectures and seminars. Active participation of students in the curriculum where students through seminars, together with their teachers, actively discuss pathophysiological mechanisms, imaging techniques, diagnostic features and biomarkers.	

7. Student responsibilities

Attendance of the lectures and seminars; active participation in seminars and workshops; taking exam

8. Monitoring of student work[36]

Class attendance	0,2	Class participation	0,3	Seminar paper	0,3	Experimental work	
Written exam	0.4	Oral exam	0,3	Essay		Research	
Project		Continuous assessment	0,5	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation would be performed according the actual rules on studies of the University of Rijeka (approved by the Senate) and the Faculty of medicine (approved by the Faculty council). The overall students' outcome is made up from 70% of their achievements during the course itself and 30% of the success in the final exam.

[36] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Achievements during the course will be evaluated by: a) continuous knowledge assessment, b) activity during the course (class participation), c) seminar paper or presentation, and d) course attendance

10. Mandatory literature (at the time of submission of study programme proposal)

Gillies RJ, Kinahan PE, Hricak H. Radiomics: Images Are More than Pictures, They Are Data. Radiology 2016;278: 563-577.
Oakden-Rayner L, Carneiro G, Bessen T, Nascimento JC, Andrew P. Bradley AP, Palmer LJ. Precision Radiology: Predicting longevity using feature engineering and deep learning methods in a radiomics framework. Scientific Reports 2017.7: 1648 | DOI:10.1038/s41598-017-01931-w
Selected scientific publications, lectures (in Power Point or PDF format).

11. Optional/additional literature (at the time of submission of the study programme proposal)

Miletić D, Valković-Zujić P, Antulov R. The role of radiology in personalized medicine. In: Personalized Medicine. Springer 2016. ISBN 978-3-319-39347-6.
Selected scientific publications.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Gillies RJ, Kinahan PE, Hricak H. Radiomics: Images Are More than Pictures, They Are Data. Radiology 2016;278: 563-577.	10	10
Oakden-Rayner L, Carneiro G, Bessen T, Nascimento JC, Andrew P. Bradley AP, Palmer LJ. Precision Radiology: Predicting longevity using feature engineering and deep learning methods in a radiomics framework. Scientific Reports 2017.7: 1648 | DOI:10.1038/s41598-017-01931-w	10	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Results of the final exam will provide information on potential flaws in the delivery of lectures or difficulties in understanding of the course content. Students' feedback will be evaluated by means of regular end-of-course anonymous questionnaires. Results of the students' assessments will be used with the aim of future improvement of teaching and learning in this course.

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DESCRIPTION OF THE SUBJECT		
Course instructor	Prof. Veljko Šantić, MD, PhD	
Lecturers	Prof. Gordan Gulan, MD, PhD, Asst. Prof. Tomislav Prpić, MD, PhD, Assoc. Prof. Zdravko Jotanović, MD, PhD, Asst. Prof. Sven Maričić, PhD, Asst. Prof. Nikola Gržalja, MD, PhD,	
Name of the course	Biomechanical reconstruction of the locomotor system	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+4

1. .Targets of the subject

Achievement of knowledge on modern approach to patient's treatment of patients with biomechanical disturbances of the locomotor system as a consequence of degenerative processes, injury or condition by tumour resection. Instruct participants on the most recent cognitions on clinical characteristics of these disorders, diagnostics and therapeutic procedures in treating such patients.
Specific targets of the subject are to introduce participants with new surgical techniques, materials and endoprosthesis used in reconstruction of joints. To this end, the students will be presented with a scientific approach to the examination of the development of new surgical techniques, the use of different materials, endoprosthesis and transplants, as well as the examination of their clinical outcomes.

2. Conditions for the registration of the subject

Enrolment in doctoral studies.

3. Expected outcomes of learning for the subject

Development of general competences:
- Develop knowledge on modern approaches and methods of treatment of biomechanical disorders of the locomotor system
- Develop the ability to scientifically reflect on a particular problem, to research and critically use scientific literature
- Develop the ability to analyse the results of scientific work and its presentation

Development of specific competences:
- Acquiring knowledge about new surgical techniques in the reconstruction of the locomotor system
- Acquiring knowledge about biological bone tensile grafts, artificial grafts and endoprosthesis in reconstruction of joints
- Acquiring knowledge about the application of the scientific approach in the examination of the development of joint reconstruction techniques and their clinical outcomes

4. Content of the subject

Through the course of lectures the participants will get acquainted with the approach and the way of biomechanical reconstruction of the individual parts of the locomotor system:
- Biomechanical assessment, planning and reconstruction in the ankle and foot region
- Biomechanical reconstruction of the locomotor system when installing the artificial knee
- Anatomical vs mechanical vs. kinematic alignment in the total knee prosthesis
- Hand wrist biomechanics and carpal instability - Possibility of reconstruction

- Biomechanics of the shoulder joint in the sport
- Biomechanical reconstruction of hip joints
- Personalized approach to planning hip endoprosthesis with the aim of establishing the best possible biomechanical relationship between hip joints
- Using 3D technology with an emphasis on biomechanical systems
- Transplantation and treatment of bone grafts in the bone-tissue bank

5. Types of lecture's performance	☒ lectures	☒ independent work
	☒ seminars and workshops	☒ multimedia and network
	☐ exercises	☐ laboratory
	☐ education on distance	☐ mentor`s work
	☐ terrain lecture	☐ other _____
6. Comments	Most of the lessons will take place in the form of lectures, and in a smaller capacity, there will be seminars. The participant is obliged to prepare the teaching material that is treated on the seminars, thus the subject of the seminar can be discussed and analysed from a clinical and scientific point of view.	

7. Students` obligations

Attending to all lectures and seminars, active preparation and participation for seminars, successful presentation of the final examination.

8. Following student's work

Attending lecture	0,5	Activity in lecture		Seminar work	0,4	Experimental work	
Final exam	0,5	Oral exam	0,6	Essay		Research	
Project		Continuous knowledge control		Report		Practical work	
Portfolio							

9. Appraisal and evaluation of student's work during lectures and at the final examination

Appraisal is performed according to the Regulation of studies of the University in Rijeka in force (authorized by the University of Rijeka Senate).

10. Obligatory literature (at the moment of the registration of the Study Program proposal)

S. Terry Canale, James H. Beaty, Campbell's operative orthopaedics, Mosby Elsevier,2017

11. Additional literature (at the moment of registration of the Study Program proposal)

Selected original scientific, clinical and review articles from recent literature.

12. Number of copies of the obligatory literature related to the number of students that are at the moment frequenting lecture on the subject

Title	Number of copies	Number of students
S. Terry Canale, James H. Beaty, Campbell's operative orthopaedics, Mosby Elsevier,2017	2	10

13. Ways of following the quality that are assuring the acquisition of exiting knowledge, skills and competences

Conduct a survey among students and data evaluation, quality monitoring system at the Faculty of Medicine.

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COURSE DESCRIPTION		
Course instructor	Prof. Josip Španjol, MD, PhD	
Lecturers		
Name of the course	Molecular biology in urology- practical aplication and modern research	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+6

1. Course objectives

Acquiring knowledge's necessaries for usage of molecular markers in diagnosing, monitoring and healing urological malignancies

2. Course enrolment requirements

Enrollment in doctoral program

3. Expected learning outcomes

1. Knowing how to use biochemical markers (PSA, PCA-3) in diagnostics and follow up of patients with prostate cancer,
2. Knowing molecular basis of immunotherapy and oncological treatment uf renal cell cancer
3. Knowing how to use biochemical markers (beta HCG, alfa-fetoprotein, LDH) in diagnostics and follow up of patients with testicular malignancies
4. Knowing molecular markers of tumor differentiation
5. Knowing molecular basis of chemotherapeutics used in treatment of urologic malignancies
6. Knowing molecular mechanism of hormonal treatment of prostate cancer
7. Knowing the role of bone morphogenetic proteins in pathogenesis of prostate cancer and renal diseases
8. Knowing the effects of radiation on malignant cells at the molecular level

4. Course content

Lectures (1h each)

1. The implementation of PSA in prostate cancer diagnostics and follow up
2. The implementation of PCA-3 in prostate cancer diagnostics and follow up
3. The implementation of beta HCG, alpha-fetoprotein and LDH, in malignant testicular tumors diagnostics and follow up
4 Markers of tumor differentiation
5. Pharmacokinetics and dynamics of chemotherapeutic agents
6. Physiology of prostate cancer hormonal tratment
7. The molecular effects of radiation on malignant cells
8. BMPs in prostate cancer bone metastases pathogenesis
9. Implementation of BMPs in treatment of renal insuff.
10. Nano technology in treatment of malignant tumors

Seminars (1h each)

1. Molecular basis of early detection and treatment of prostate cancer
2. Molecular basis of oncological treatment of renal cell cancer
3. Malignant testicular tumors: Treatment and diagnostics
4. Immunotherapy of bladder cancer
5. Molecular basis of kidney damage and recovery
6. Antitumoral vaccine and new generation of antiandrogens in treatment of prostate cancer

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

1. REGULAR ATTENDANCE
2. PREPARATION FOR SEMINARS
3. WRITTEN AND VERBAL EXAME

8. Monitoring of student work[37]

Class attendance	0,5	Class participation		Seminar paper	0,2	Experimental work	
Written exam	0,6	Oral exam		Essay		Research	
Project		Continuous assessment	0,7	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The overall assessment o class attendance has a share of 4%, student activitiy 8%, seminar paper 8%, written exam 30%, continuous testing 50%

10. Mandatory literature (at the time of submission of study programme proposal)

Manual of urology-in print
J.Smith: General Urology. Lipincott and Williams, London, 2007
Campbell et al. Urology. Lipincott and Williams, London, 2009

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. http://www.uroweb.org/nc/professional-resources/guidelines/online/
2. Bobinac D, Maric I, Zoricic S, **Spanjol J**, Djordjevic G, Mustac E, Fuckar Z. Expression of bone morphogenetic proteins in human metastatic prostate and breast cancer. Croat Med J 2005;46(3):389-96.
3. **Španjol J**, Đorđević G, Markić D, Klarić M, Fučkar D, Bobinac D. Role of Bone Morphogenetic Proteins in Human Prostate Cancer Pathogenesis and Development of Bone Metastases: Immunohistochemical Study. Collegium Antropologicum 2010; 34 (Suppl 2): 119–25.

[37] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

4. Markić D, Čelić T, **Španjol J**, Gršković A, Bobinac D, Fučkar Ž. Expression of Bone Morphogenetic Protein-7, It´s Receptors and Smad1/5/8 in Normal Human Kidney and Renal Cell Cancer. Collegium Antropologicum 2010; 34 (Suppl 2): 149–53.
5. Matušan-Ilijaš K, Damante G, Fabbro D, Dorđević G, Hadžisejdić I, Grahovac M, Marić I, **Spanjol J**, Grahovac B, Jonjić N, Lučin K. Osteopontin expression correlates with nuclear factor-κB activation and apoptosis downregulation in clear cell renal cell carcinoma. Pathol Res Pract 2011; 207(2):104-10. doi: 10.1016/j.prp.2010.11.004.
6. Markić D, Ćelić T, Gršković A, **Španjol J**, Fučkar Ž, Grahovac B, Dorđević G, Bobinac D. mRNA expression of bone morphogenetic proteins and their receptors in human renal cell carcinoma. Urol Int 2011;87(3):353-8. doi: 10.1159/000330797.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
Ž.Fučkar, J.Španjol:Urologija I i II, Medicinski fakultet Sveučilišta u Rijeci, Rijeka, 2013..	10	10
B.Alberts, A.Johnson, J.Lewis: Molecular Biology of tehe cell (Sixth edition). Garland Science, New York, 2015.	2	10

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

Student questionnaire and evaluation of learning goals.

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COURSE DESCRIPTION		
Course instructor	Prof. Sandra Peternel, MD, PhD	
Lecturers	Prof. Ines Brajac, MD, PhD, Prof. Hrvoje Jakovac, MD, PhD, Prof. Marija Kaštelan, MD, PhD, Prof. Larisa Prpić Massari, MD, PhD	
Name of the course	Inflammatory skin diseases - from immunopathogenesis to targeted therapy	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+0

1. Course objectives

The principal aim of the course is to introduce students to the current concepts on the immunopathogenesis and targeted therapy of chronic inflammatory skin diseases.
Many of the chronic inflammatory skin diseases are characterized by limited efficacy of traditional therapeutic agents. However, studies performed over the past decade have significantly increased our understanding of how the immune system influences the development of inflammatory skin conditions. These recent findings have led to novel, specifically targeted, highly effective therapies that have revolutionized the management of dermatologic patients. This “translational revolution” initially started with psoriasis and is now extending to many other immune-mediated skin diseases, such as atopic dermatitis, alopecia areata, vitiligo, chronic idiopathic urticaria and others. The aim of the course is to provide the students with an overview of the novel, targeted, pathogenesis-based therapies that are being developed to provide higher efficacy and safer long-term disease control.
Since the immunopathogenesis of inflammatory skin diseases significantly overlaps with that of the inflammatory diseases of other organ systems, many of the described targeted therapeutic agents are concomittantly used for indications other then dermatologic (particularly in rheumatology, clinical immunology, gastroenterology). For that reason, the course may be attractive to students of different professional orientations and interests.

2. Course enrolment requirements

Enrolment in the doctoral study programme

3. Expected learning outcomes

By completing this course, students will be able to:
- summarize the fundamental concepts in innate and adaptive immunity and explain how they relate to the inflammatory skin diseases
- identify key immunological pathways in common inflammatory skin diseases that can be therapeutically targeted (psoriasis, atopic dermatitis, chronic idiopathic urticaria, lupus erythematosus, pemphigus and pemphigoid, lichen planus, vitiligo, alopecia areata, acne/hidradenitis suppurativa, pyoderma gangrenosum)
- discuss the emerging concept of inflammatory dermatoses as cutaneous manifestations of systemic inflammation with recognized comorbidities
- define current and emerging treatments in the context of disease pathogenesis

- select treatments based on new understanding of disease pathogenesis (TNF-alpha inhibitors, anti-cytokines, B cell depleting agents, Janus kinase inhibitors)
- summarize potential adverse effects of targeted therapeutic agents

4. Course content

The course will cover the following topics:

- Overview of basic concepts of innate and adaptive immunity in the context of inflammatory skin diseases
- Psoriasis - current concepts of pathogenesis and recent therapeutic advances: antagonists of TNF alpha
- Psoriasis - current concepts of pathogenesis and recent therapeutic advances: agents acting on IL-17 and IL-23
- Atopic dermatitis pathogenesis: the epidermal barrier, the immune system and the microbiome
- The translational revolution in atopic dermatitis: targeted therapeutics (agents acting on IL-4, IL-13, IL-31)
- Pathogenesis and management of chronic idiopathic urticaria: from antihistamines to omalizumab
- Pemphigus and pemphigoid: the role of B-cell depleting agents and IVIG
- Hidradenitis suppurativa, PAPA, PASH: the role of anti-TNF and anti-IL-1 agents
- Janus kinase inhibitors in the treatment of alopecia areata, vitiligo and atopic dermatitis
- Immunopathogenesis of lichen planus and psoriasis: overview of the group's own research

Lectures will be based on the relevant literature data covering both basic research of the immunopathogenesis as well as results of the most important clinical trials in the field. In addition, to better showcase the clinical presentation of each disease and the efficacy of a given drug, lectures will be complemented by presentations of real clinical cases, wherever possible. Finally, a short overview of the research activities performed at the Department will be presented at the end of the course.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Regular class attendance.

8. Monitoring of student work[38]

Class attendance	0,5	Class participation		Seminar paper		Experimental work	
Written exam	1,6	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

[38] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Learning outcomes will be evaluated by means of a written multiple choice test.

10. Mandatory literature (at the time of submission of study programme proposal)

A. Lectures (in ppt or pdf format)

B. Selected scientific publications:

1. Hawkes JE, Chan TC, Krueger JG. Psoriasis pathogenesis and the development of novel targeted immune therapies. *J Allergy Clin Immunol* 2017;140(3):645-653.
2. Brunner PM, Guttman-Yassky EG, Leung DY. The immunology of atopic dermatitis and its reversibility with broad-spectrum and targeted therapies. *J Allergy Clin Immunol* 2017;139:S65-S76.
3. Hawkes JE, Yan BY, Chan TC, Krueger JG. Discovery of the IL-23/IL-17 Signaling Pathway and the Treatment of Psoriasis. *J Immunol* 2018;201:1605-13.
4. Giménez-Arnau AM, Toubi E, Marsland AM, Maurer M. Clinical management of urticaria using omalizumab: the first licensed biological therapy available for chronic spontaneous urticaria. J Eur Acad Dermatol Venereol 2016;30 Suppl 5:25-32.
5. Damsky W, King BA. JAK inhibitors in dermatology: The promise of a new drug class. *J Am Acad Dermatol* 2017; 76:736-44.
6. Pollmann R, Schmidt T, Eming R, Hertl M. Pemphigus: a Comprehensive Review on Pathogenesis, Clinical Presentation and Novel Therapeutic Approaches. Clin Rev Allergy Immunol 2018;54:1-25.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Saint-Georges V, Peternel S, Kastelan M, Brajac I. Tumor Necrosis Factor Antagonists in the Treatment of Pyoderma Gangrenosum, Acne, and Suppurative Hidradenitis (PASH) Syndrome. *Acta Dermatovenerol Croat* 2018;26:173-8.
2. Vičić M, Peternel S, Simonić E, Sotošek-Tokmadžić V, Massari D, Brajac I, Kaštelan M, Prpić-Massari L. Cytotoxic T lymphocytes as a potential brake of keratinocyte proliferation in psoriasis. *Medical hypotheses* 2016;87:66-8.
3. Peternel S, Prpic-Massari L, Manestar-Blazic T, Brajac I, Kastelan M. Increased expression of TRAIL and its death receptors DR4 and DR5 in plaque psoriasis. *Arch Dermatol Res* 2011;303:389-97.
4. Peternel S, Kaštelan M. Immunopathogenesis of psoriasis: focus on natural killer T cells. *J Eur Acad Dermatol Venereol* 2009;23:1123-7.
5. Peternel S, Prpić-Massari L, Guina T, Novak S, Brajac I, Kaštelan M. Treatment of severe psoriasis with infliximab: report of two cases. Acta Dermatovenerol Croat 2009;17:204-8.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Selected scientific publications	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Results of the final written exam will provide information on potential flaws in the delivery of lectures or difficulties in understanding of the course content. Students' feedback will be evaluated by means of regular end-of-course anonymous questionnaires. Results of the students' assessments will be used with the aim of future improvement of teaching and learning in this course.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Vladimira Vuletić, MD, PhD	
Lecturers		
Name of the course	Neurostimuation and neuromodulation from bench to bedside	
Study programme	Doctoral school Biomedicine and health – course of study Clinical medicine	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	6+4+6

1. Course objectives

This course will provide PhD students with a basic and new scientific understanding of neuromodulation variation in neurodegenerative disease from bench to bedside, what is nowadays a revolution in neuroscience. PhD students will be familiarized with Transcranial magnet stimulation, Transcranial current stimulation, Deep brain stimulation and focus magnet ultrasound in neurodegenerative diseases, mechanism of action, following up of results by scales and special neurological exams for movement disorders and psychological evaluation. They will be familiarized with the newest achievements, researches and experimental and therapeutic possibilities from this the most contemporary neuroscience field in neurodegenerative disease. With such knowledge and skills, PhD student will be more competitive on job market and future research.

2. Course enrolment requirements

None

3. Expected learning outcomes

-to explain which cerebral structures targets are used for neuromodulation and neurostimulation in neurodegenerative diseases.
- to differentiate diseases suitable for these methods and those that are under investigation
- to know predictors of good and bed outcome and their biomarkers
- to understand application of neurostimulation and neuromodulation in the research of neurodegenerative diseases in animals and humans
-to describe neurophysiology, pathophysiology and mechanism of neurostimulation acting
-to understand Transcranial magnet stimulation, its results and future research
- to understand Transcranial current stimulation, its results and future research
- to understand Deep brain stimulation, its results and future research
- to understand Focus ultrasound stimulation – MR guided, its results and future research

4. Course content

- Which cerebral structures are target pleases for neuromodulation and neurostimulation in neurodegenerative diseases.
- Diseases suitable for this methods and also those under investigation
- Application of neurostimulation and neuromodulation in the research of neurodegenerative diseases in animals and humans
- Neurophysiology, pathophysiology and mechanism of neurostimulation acting

- Transcranial magnet stimulation
- Transcranial current stimulation
- Deep brain stimulation
- Focus ultrasound stimulation – MR guided
- Neurodegenerative disease- mostly Alzheimer disease, Parkinson's disease, dystonia, essential tremor, multiple sclerosis

5. Manner of instruction	X ☐ lectures X ☐ seminars and workshops X ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Teaching is done in the form of lectures and seminars. Active participation of students in the curriculum where students through seminars, exercises, together with their teachers, actively discuss subjects of course.	

7. Student responsibilities

Lesson attendance and active participation in education (seminar tasks, searching and read ing of literature)

8. Monitoring of student work[39]

Class attendance	0,5	Class participation		Seminar paper	0,3	Experimental work	
Written exam	0,6	Oral exam		Essay		Research	
Project		Continuous assessment	0,6	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluating of the students is according to regulations of Rijeka Medical faculty and University. The total success rate of students during class accounts for 70% and final exam 30% of the grade. The final oral exam of some part of materials will be mandatory part of the final exam.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Perestelo-Perez L, Rivero-Santana A, Perez-Ramos J, et al. Deep brain stimulation in Parkinson's disease: meta-analysis of randomized controlledtrials. J Neurol 2014; 261:2051–2060.
2. Kleiner-Fisman G, Herzog J, Fisman DN, et al. Subthalamic nucleus deepbrain stimulation: summary and meta-analysis of outcomes. Mov Disord 2006; 21 (Suppl 14):S290–S304.
3. Follett KA, Weaver FM, Stern M, et al. Pallidal versus subthalamic deep-brain stimulation for Parkinson's disease. N Engl J Med 2010; 362:2077–2091.
4. Rizzone MG, Fasano A, Daniele A, et al. Long-term outcome of subthalamic nucleus DBS in Parkinson's disease: from the advanced phase towards the late stage of the disease? Parkinsonism Relat Disord 2014; 20:376–381.
5. Vidailhet M, Vercueil L, Houeto JL, et al. Bilateral, pallidal, deep-brain stimulation in primary generalised dystonia: a prospective 3 year follow-up study. Lancet Neurol 2007; 6:223–229.
6. FitzGerald JJ, Rosendal F, de Pennington N, et al. Long-term outcome of deep brain stimulation in generalised dystonia: a series of 60 cases. J Neurol Neurosurg Psychiatry 2014; 85:1371–1376.

[39] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

7. Bruggemann N, Kuhn A, Schneider SA, et al. Short- and long-term outcome of chronic pallidal neurostimulation in monogenic isolated dystonia. Neurology 2015; 84:895–903.
8. Schrock LE, Mink JW, Woods DW, et al. Tourette syndrome deep brain stimulation: a review and updated recommendations. Mov Disord 2015;30:448–471.
9. Fasano A and Lozano AM. Deep brain stimulation for movement disorders: 2015 and beyond. Curr Opin Neurol 2015, 28:423–436
10. Rabey JM, Dobronevsky E. Repetitive transcranial magnetic stimulation (rTMS) combined with cognitive training is a safe and effective modality for the treatment of Alzheimer's disease: clinical experience. J Neural Transm (2016) 123:1449–1455.
11. Vosskuhl, J., Huster, R. J., & Herrmann, C. S. (2015). Increase in short-term memory capacity induced by down-regulating individual theta frequency via transcranial alternating current stimulation. *Frontiers in Human Neuroscience*, *9*, 257. http://doi.org/10.3389/fnhum.2015.00257
12. Brittain, J.-S., Probert-Smith, P., Aziz, T. Z., & Brown, P. (2013). Report Tremor Suppression by Rhythmic Transcranial Current Stimulation. http://doi.org/10.1016/j.cub.2013.01.068
13. Chou YH et al. Effects of repetitive transcranial magnetic stimulation on motor symptoms in Parkinson disease: a systematic review and meta-analysis. JAMA Neurol. 2015 Apr;72(4):432-40.
14. Krishna V, et al. A Review of the Current Therapies, Challenges, and Future Directions of Transcranial Focused Ultrasound TechnologyAdvances in Diagnosis and Treatment *JAMA Neurol.* 2018;75(2):246-254.
15. Almahariq F, Raguz M, Vuletic V, Oreskovic D, Franciskovic I, et al. Bilateral Deep Brain Stimulation of the Subthalamic Nuclei in Parkinson's disease Patients with Camptocormic Posture. Scientifi c Journal of Neurology & Neurosurgery. 2017;3(2): 037-040.
16. Vuletic V, Chudy D, Almahariq F, Dobricic V, Kostic V, Bogdanovic N Excellent outcome of pallidal deep brain stimulation in DYT6 dystonia: A case report. J Neurol Sci. 2016 Jul 15;366:18-9. doi: 10.1016/j.jns.2016.04.032. Epub 2016 Apr 19.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- A.M. Lozano and M. Hallett. Handbook of Clinical Neurology, Vol. 116 (3rd series) Brain Stimulation Elsevier 2013
- All available journals in neurodegenerative diseases on PubMed, Ovid etc.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Selected scientific publications	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Anonymous questionnaire

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COURSE DESCRIPTION		
Course instructor	Prof. Ivone Uhač, DMD, PhD Assoc. Prof. Sunčana Simonić-Kocijan, DMD, PhD	
Lecturers	Assoc. Prof. Vlatka Lajnert, DMD, PhD, Asst. Prof. Petra Tariba Knežević, DMD, PhD	
Name of the course	Pathophysiology of orofacial pain	
Study programme	Doctoral school Biomedicine and health – course of study Dentistry	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8
1. Course objectives		
The goal of the course is to gain knowledge in the field of orofacial pain with special focus on the definition, classification, diagnostics tools and differential diagnosis of orofacial pain. Lectures will point out the importance of team approach in analysis of intraoral, intracranial and extracranial systemic disorders which can lead to orofacial pain development. Students will be introduced to peripheral and central pain perception and modulation mechanisms with focus on the neurobiology of temporomandibular disorders onset.		
2. Course enrolment requirements		
None		
3. Expected learning outcomes		
After the course students will be able to: Describe the neurobiological aspect of orofacial pain development Analyse systemic causes in orofacial pain development Explain the mechanisms of orofacial pain perception and modulation Perform orofacial pain measurements		
4. Course content		
Neurobiological aspect of orofacial pain development Systemic causes in orofacial pain development Mechanisms of orofacial pain perception and modulation Measurements of pain		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		

Participation in all aspects of education process.							
8. Monitoring of student work[40]							
Class attendance		Class participation	0,2	Seminar paper	0,4	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment	0,4	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Seminar paper and written exam.

10. Mandatory literature (at the time of submission of study programme proposal)

- De Leeuw R, Klasser GD. Orofacial pain: Guidelines for assessment, diagnosis, and management, Fifth Edition. Quintessence Pubblishing, 2013.
- Goulet JP, Velly AM. Orofacial pain biomarkers. Springer-Verlag GmbH Germany, 2017.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Manfredini D, Arboretti R, Guarda Nardini L, Carrozzo E, Salmaso L. statistical approaches to orofacial pain and temporomandibular disorders research. Springer 2014.
- Tariba Knežević P, Vukman R, Antonić R, Kovač Z, Uhač I, Simonić-Kocijan S. The role of $P2X_3$ receptors in bilateral masseter muscle allodynia in rats. Croat Med J 2016;57:530-9.
- Simonić-Kocijan S, Liu W, Wu Y, Uhac I, Wang KW. TRPV1 channel mediated bilateral allodynia induced by unilateral masseter muscle inflammation in rats. Mol Pain. 2013;9:68.
- Simonić-Kocijan S, Uhač I, Tariba P, Fugošić V, Kovačević Pavičić D, Lajnert V, Braut V. Alterations in the masseter muscle and plasma il-6 level following experimentally induced occlusal interference and chronic stress – a study in rats. Coll Antropol. 2012;36: 651-5.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

1. The proportion of students present at the lecture in relation to the total number of applicants
2. Share of present students in seminar / practical work compared to the total number of applicants

[40] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

3. Assessment of the set up learning outcomes (knowledge of the written part of the exam, skills and attitudes from seminar)
4. Evaluation of the course questionnaire survey - grade of lecturer and total subject (average grade)
5. Apply defined instruments for quality testing

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COURSE DESCRIPTION		
Course instructor	Prof. Tomislav Ćabov, DMD, PhD Asst. Prof. Romana Peršić Bukmir, DMD, PhD	
Lecturers	Prof. Nataša Ivančić-Jokić, DMD, PhD, Assoc. Prof. Danko Bakarčić, DMD, PhD, Prof. Miranda Muhvić-Urek, DMD, PhD, Ivana Vidović Zdrilić, DMD, PhD, Maja Kinkela Devčić, DMD, PhD, Ana Zulijani, DMD, PhD	
Name of the course	Regeneration of the orofacial region	
Study programme	Doctoral school Biomedicine and health – course of study Dentistry	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8

1. Course objectives

The course regeneration of the orofacial region has the purpose to familiarize the course takers with the latest scientific findings in the field of odontogenic complex in the case of trauma, chain of reactions in the periapical tissue in the transition from pulpitis to apical periodontitis, immunological and inflammatory reaction of soft tissues and molecular diagnostic protocols for detection of precancerous lesions of the oral soft tissues, and molecular mechanism during injury and regeneration of the salivary glands after irradiation and tissue regeneration in orofacial region with the latest biomaterials.
The course participants will get the insight, trough authors own research and literature overview, into the mechanism of orofacial regeneration. The biological aspects of apexifications will be explained. They will get familiarized with the histomorphometric method for apical lesion measurement, cell culture, and the latest data on field bone stem cells will be presented. The purpose and rationale of inflammation mediator levels measurement in the orofacial tissues and body fluids during inflammatory and allergic reactions will be explained. The process of carcinogenesis will be described as a complex genetic disorder that includes changes in the function of the oncogens and tumor suppressor genes, together with the molecular mechanisms during damage and regeneration of salivary gland tissues after irradiation

2. Course enrolment requirements

No special requirements

3. Expected learning outcomes

The participants will be trained to interpret the mechanisms that are included in the onset and course of the orofacial regeneration. They will get familiarized with the stages of healing and cell interaction of the odontogenic complex, as well as the mechanism of the medicaments used after dental trauma, recognize the stages of the apical parodontitis development, describe the immunological and inflammatory processes in the apical tissue, and implementation of the stem cells in the oral tissue regeneration. The course attendees will master the methods of studying the onset of inflammatory and immunological processes in the oral soft tissues, as well as molecular mechanisms of salivary glands injury and regeneration after irradiation. The information about molecular biology and biochemistry methods gathered from cytological swabs and biopsies will be discussed and the expression of certain bimolecules depending on the lesions malignant potential pointed out.

4. Course content

The elective course Regeneration of the Orofacial Region consists of four thematic lecture blocks: Chronical atrophy and osteolytic processes on the alveolar ridge., Apexogenesis and apexification after dental trauma, Onset and healing of the apical periodontitis, and imunology and molecular pathology of the oral cavity soft tissues.
During the course the basis of the pathophisiological mechanisms of the onset and development of the chronical atrophy and osteolytic processes on the alveolar ridge will be explained, together with the newest findings in the molecular and ion levels with the aim of clarifying the complex etiology of the disorder. The mechanisms and cellular interaction in apical odontogenic complex during the phases of root development after dental trauma will be compared to the processes after application of the certain therapeutical medicaments.
The changes in the transition phases from pulpitis to periodontitis will be explained with the aid of foreign body reaction in the cell culture. The term embryonic and tissue stem cells together with their differentiation potential will be explained. The tissue response like: adherence, phagocytosis, microbial macrophage activity, will be described and explained. Various molecular and biochemical methods will be demonstrated in the cytological swab analyses and biopsies of leucoplaquie, erithroplaque and oral lihen, as well as the mechanisms of the salivary gland tissue damage during and after irradiation, and regeneration facilitated with stem cells application.

5. Manner of instruction	x☐ lectures x☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	x☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

The student is obliged to be present on the lectures, write and a present a seminar, and pass the final exam.

8. Monitoring of student work[41]

Class attendance	0,2	Class participation	0,2	Seminar paper	0,6	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The grading and evaluation of the student work will be conducted trough student presence, grading seminar work and presentation and final exam grading. The final grade will be a summarized grade of all student activities and accomplishments during the course.

10. Mandatory literature (at the time of submission of study programme proposal)

- Simunović-Soskić M, Pezelj-Ribarić S, Brumini G, Glazar I, Grzić R, Miletić I. Salivary levels of TNF-alpha and IL-6 in patients with denture stomatitis before and after laser phototherapy. Photomed Laser Surg. 2010;28:189-93.

[41] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

- Wu RQ, Zhao XF, Wang ZY, Zhou M, Chen QM. Novel molecular events in oral carcinogenesis via integrative approaches.J Dent Res 2011;90:561-72.
- Grundmann O, Mitchell GC, Limesand KH. Sensitivity of salivary glands to radiation: from animal models to therapies. J Dent Res. 2009;88:894-903.
- Camberlain TM, Kirkpatric TC, Rutledge RE. pH changes in external root surface cavities after calcium hydroxide placed 1,3 and 5 mm short of the radiographic apex. Dent Traumatol 2009;25:470-4.
- Moore A, Howley MF, O Connell AC. Treatment of open apex teeth using two types of white mineral trioxide aggregate after initial dressing with calcium hydroxide in children. Dent Traumatol 2011;27:166-73.
- Bakland LK, Andreasen JO. Will mineral trioxide aggregate replace calcium hydroxide in treating pulpal and periodontal healing complicationa subsequent to dental trauma? A review. Dent Traumatol 2012;28:25-32.

Buser D. 20 Years of Guided bone regeneration. Quintessence Publishing.2009.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Pezelj-Ribarić S, Magasić K, Prpić J, Miletić I, Karlović Z. Tumor necrosis factor-alpha in peripical tissue exudates of teeth with apical periodontitis. Mediators Inflamm. 2007;:69416.
- Corderiro MM., et al. Dental pulp tissue engineering with stem cells from exfoliated deciduous teeth. J Endod. 2008;34:962-9.
- Graunaite I, Lodiene G, Maciulskiene V. Pathogenesis of apical periodontitis: a literature review. J Oral Maxillofacial Res. 2011;2:4.
- JOE Editorial Board. Immunologic reactions and endodontics: an online study guide. J Endod. 2008 May;34(5Suppl):e181-6.
- Brekalo I, Pezelj-Ribarić S, Abram M, Ahel V. Effect of root canal sealers on mouse peritoneal macrophage functions. Folia Microbiol (Praha). 2007;52:95-8.
- Prso IB, Kocjan W, Simić H, Brumini G, Pezelj-Ribarić S, Borcić J, Ferreri S, Karlović IM. Tumor necrosis factor-alpha and interleukin 6 in human periapical lesions. Mediators Inflamm. 2007;2007:38210.
- Choi S, Myers JN. Molecular pathogenesis of oral squamous cell carcinoma: implications for therapy. J Dent Res 2008; 87:14-32.
- Vissink A, Mitchell JB, Baum BJ, Limesand KH, Jensen SB, Fox PC, Elting LS, Langendijk JA, Coppes RP, Reyland ME. Clinical management of salivary gland hypofunction and xerostomia in head-and-neck cancer patients: successes and barriers. Int J Radiat Oncol Biol Phys. 2010;78:983-91.
- Škrinjarić I. Traume zuba u djece. Globus Zagreb 1988.
- Ivančić N. Ozljede zuba u djece. Medicinski fakultet Sveučilišta u Rijeci, 2000.(Magistarski rad)
- Rafter M. Apexification: a review. Dent Traumatol 2005;21:1-8.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Above suggested literature	*1*	*30*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Analysis of the survey on students' attitudes on quality of lectures and teachers' preformance
Evaluation of set learning outcomes (knowledge through written part of exams, skills and attitudes through seminar work).

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Davor Kuiš, DMD, PhD	
Lecturers	Prof. Daniela Kovačević Pavičić, DMD, PhD, Assoc. Professor, Jelena Prpić, DMD, PhD, Asst. Prof. Višnja Katić, DMD, PhD, Vjera Perković, DMD, PhD	
Name of the course	Efficacy and efficiency of dental treatments	
Study programme	Doctoral school Biomedicine and health – course of study Dentistry	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	9+0+7

1. Course objectives

The students will be presented with theoretical basics of clinical research in dental medicine – organization and set-up of the clinical investigation and its hierarchy. Special emphasis will be put on randomized clinical trials.
Students will be taught on the importance of clinical trial registration in accordance with the increasing requests form CC journals.
To teach the students about international multicenter clinical trials (the course of drafting and setting the trial protocol, drafting of the informed consent in accordance with the local regulations, forms for data entry and their tranfer to Excel tables, patient „drop out“ and reporting of side-effects, insurance policy, conflict of interest statements, necessary certificates for application of various products in particular countries, and ethics committee approvals).
Familiarize the students with comparison between the orthodontic appliance effects and average changes caused by skeletal, dental and soft tissue growth, as well the use of different sources to floow the growth and treatment effect parameters.
Teach the students about measurements of the tooth extraction forces, modifications of the existing instruments and design of the new and more efficient ones.

2. Course enrolment requirements

Official enrollment into the postgraduate PhD program.

3. Expected learning outcomes

Students will learn to discern between different types of clinical research, recognize the qualities of randomized clinical trial and critically discuss the quality of the aforementioned.
Students will learn that the investigation may be registered prospectively or retrospectively, and in cases when the investigation concerns people or biological material, an Ethics committee (university and/or health institution)
Students will get acquainted with the problems related to multicenter clinical investigations.
Students will be able to list the methods for observing the growth and the efficiency of orthodontic treatmnt; recognize the adequate comparable groups; ddesrcibe the methods for superimposing the referent marks; list the common mistakes during the superimposing of referent marks and finally get relevant information on data bases used to monitor growth.

Students will become familiar with the recent developments in the field of tooth extraction instruments and application of new techniques applied in tooth extraction procedures.		
4. Course content		
Organization, set-up and hierarchy of the scientific factors in clinical research. Randomized clinical trials (RCT's). Analysis of the randomized clinical trial in the case of surgical treatment for gingival recession deffects. Registration of the clinical investigation (prerequisites and protocols). International multicenter trials – performance and challenges. Methods for evaluation of orthodontics treatment efficiency. Measurements of the tooth extraction forces.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		
Choose one clinical investigation upon agreement with the course instructor or his associates and critically appraise its components. Draft a presentation of the chosen investigation and present the critique before the other students.		
8. Monitoring of student work[42]		

Class attendance	0,5	Class participation		Seminar paper	0,75	Experimental work	
Written exam	0,75	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio		Presentation of seminar					

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students are encouraged to participate actively. Seminar work are used as a basis for evaluation.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Špalj S. Oralna epidemiologija. Rijeka: Sveučilište u Rijeci; 2015.
2. Kuis D, Sciran I, Lajnert V, Snjaric D, Prpic J, Pezelj-Ribaric S, Bosnjak A. Coronally advanced flap alone with connective tissue graft in the treatment of single gingival recession: a long-term randomized clinical trial. J Periodontol 2013; 84: 1576-85.
3. Saltovic E, Lajnert V, Saltovic S, Kovacevic Pavicic D, Pavlic A, Spalj S. Development and validation of a new condition-specific instrument for evaluation of smile esthetics-related quality of life. Esthet Restor Dent. 2017 doi: 10.1111/jerd.12362. [Epub ahead of print]

[42] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

4. Kovacevic Pavicic D, Kolceg M, Lajnert V, Pavlic A, Brumini M, Spalj S. Changes in quality of life induced by tooth whitening are moderated by perfectionism: a randomized double-blinded placebo-controlled trial. Int J Prosthodont. 2018 [Epub ahead of print]
5. Spalj S, Mroz Tranesen K, Birkeland K, Katic V, Pavlic A, Vandevska-Radunovic V. comparison of activator-headgear and twin block treatment approaches in class ii division 1 malocclusion. Biomed Res Int. 2017;2017:4861924.
6. Eliades T, Brantley W. Orthodontic applications of biomaterials. Woodhead Publishing. 2016.
7. Ahel V, Ćabov T, Špalj S, Perić B, Jelušić D, Dmitrašinović M. Forces that fracture teeth during extraction with mandibular premolar and maxillary incisor forceps. Br J Oral Maxillofac Surg. 2015;53:982-7
8.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Ahel V, Brekalo I, Ahel J, Brumini G. Measurement of tooth extraction forces in upper incisors. Coll Antropol. 2006;30:31-5.
Kovacevic Pavicic D, Spalj S, Uhac I, Lajnert V. A cross-sectional study of the influence of tooth color elements on satisfaction with smile esthetics. Int J Prosthodont. 2017;30:156-15.
Kovacevic Pavicic D, Pavlic A, Kinkela Devcic M, Lajnert V, Spalj S. Tooth color as a predictor of oral health-related quality of life in young adults. J Prosthodont. 2017 doi: 10.1111/jopr.12666. [Epub ahead of print]
European Journal of Clinical Orthodontics
Angle Orthodontics
Korean Journal of Orthodontics

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Špalj S. Oralna epidemiologija. Rijeka: Sveučilište u Rijeci; 2015. e-knjiga	1	30
Above suggested literature	1	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Final test and seminar presentation of every student will be used to assess learning outcomes.
An anonymous structured survey on the quality of the teaching process and the teachers will be also used.

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COURSE DESCRIPTION		
Course instructor	Prof. Sonja Pezelj Ribarić, DMD, PhD	
Lecturers	Prof. Ivana Brekalo Pršo, DMD, PhD, Assoc. Prof. Jelena Prpić, DMD, PhD, Asst. Prof. Višnja Katić, DMD, PhD, Assoc. Prof. Mirna Didović Petković, Ph	
Name of the course	Properties and effects of dental biomaterials	
Study programme	Doctoral school Biomedicine and health – course of study Dentistry	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8

1. Course objectives

Dental therapy includes the use of composite materials, metals and alloys, pharmaceutical substances and various products which may act as toxic and/or allergological factors. Students will become familiar with definition and properties of polymer composite substances in general, description of specific composite materials frequently used in dental medicine, as well as correlation between their properties and applications. The aim of this course is to teach the students basics of tissue response to novel dental biometrials in *in vitro* and *in vivo* conditions. Furthermore, the aim is to demonstrate and familiarize the students with the possibilities of testing the dental biomaterials for biocompatibility and mechanical stability. The course will include decriptions of standards, methods for testing and definitions of mechnical properties such as strength and rigidity, tests of friction, surface roughness and material adhesion properties. Types of corrosion and electrochemical tests will also be explained. Students will be able to gain insight into the methods for application of hyaluronic acid in the oral cavity. Students will become familiar with application of biomaterials in endodontics, properties of endodontic materials and their effects on living tissues, role of biomaterials in regenerative endodontics and the future of bioactive materials as well as their effects on the growth of dental pulp stem cells.

2. Course enrolment requirements

3. Expected learning outcomes

Students will gain knowledge on possibilities for testing biocompatibility and mechanical stability of dental biomaterials.
Students will become trained to interpret the study results and draft a methodology for specific testing of the tissue response to novel biomaterials in in vitro and in vivo conditions.
Students will master the methods for analysis of tissue response to dental materials exhibited by the living tissues.
Students will learn the methods to analyze the effects of hyaluronic acide application in the oral cavity.
Finally, students will become familiar with the methods for biomaterial applications in endodontics.
One of the expected learning outcomes is also a critical appraisal of scientific results and clinical applications of dental materials.

4. Course content

Definition, properties and applications of polymer composite materials. Tissue response to novel dental biomaterials in *in vivo* and *in vitro* conditions. Possibilities for biocompatibility and mechanical stability

testing for dental biomaterials. Biocompatibility and mechanical stability of dental biomaterials. Standards, methods for testing and definitions of mechanical properties such as strength and rigidity; friction, surface roughness and material adhesion tests. Types of corrosion and electrochemical tests for biomaterials. Methods applied in research of hyaluronic acid application in the oral cavity. Application of biomaterials in endodontics, properties of endodontic materials and their effects on the living tissues, role of biomaterials in regenerative endodontics and the future of biomaterials and their effects as stimulants for dental pulp stem cell growth.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

The students must attend lectures, draft and present the seminary work and pass the final exam.

8. Monitoring of student work[43]

Class attendance	0,1	Class participation		Seminar paper	0,5	Experimental work	*0,9*
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Grading and evaluation of the student work will be performed through assessment of their presence in classes, grades of the seminary works and the exam, while the final grade will be the sum of all of the student evaluation elements.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Brekalo Pršo I, Kocjan W, Šimić H, Brumini G, Pezelj-Ribarić S, Borčić J, Ferreri S, Miletić Karlović I. Tumor necrosios factor–alpha and interleuikin 6 in human periapical lesions. Mediators Inflamm, 2007;2007:38210.
2. Brekalo Pršo I, Pezelj-Ribarić S, Abram M, Ahel V. effect of rot canal sealers on mouse peritoneal macrophage fuctions. Folia Microbiol (Praha). 2007;52:95-8.
3. Pezelj-Ribarić S, Magašić K, Prpić J, Miletić I, Karlović Z. Tumor necrosis factor-alpha in peripical tissue exudates of teeth with apical periodontitis. Mediators Inflamm. 2007;2007:69416.
4. Pezelj-Ribarić S, Prpić J, Miletić I, Brumini G, Simunović Šoškić M, Anić I. Association between oral lichenoid reactions and amalgam restorations. J Eur Acad Dermatol Venereol. 2008;22:1163-7.
5. Anić I, Miletić I, Krmek S, Borčić J, Pezelj-Ribarić. Vibrations produced during erbium:yttrium-aluminum-garnet laser irradiation. Lasers Med Sci. 2009;5:697-701.

[43] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

6. Šimunović Šoškić M, Pezelj-Ribarić S, Brumini G, Glažar Irena, Gržić R, Miletić I. Salivary levels of TNF-alpha and IL-6 in patents with denture stomatitis before and after low-level laser therapy. Photomed Laser Surg. 28 2010, 2; 189-93
7. Katić V, Curković HO, Semenski D, Baršić G, Marušić K, Spalj S. Influence of surface layer on mechanical and corrosion properties of nickel-titanium orthodontic wires. Angle Orthod. 2014;84:1041-8.
8. Katić V, Mandić V, Ježek D, Baršić G, Špalj S. Influence of various fluoride agents on working properties and surface characteristics of uncoated, rhodium coated and nitrified nickel-titanium orthodontic wires. Acta Odontol Scand. 2015;73:241-9.
9. Katic V, Curkovic L, Bosnjak MU, Peros K, Mandic D, Spalj S. Effect of pH, fluoride and hydrofluoric acid concentration on ion release from NiTi wires with various coatings. Dent Mater J. 2017;36:149-56.
10. Mueller A, Fujioka-Kobayashi M, Mueller H-D, Lussi A, Sculean A, Schmidlin PR, Miron RJ. Effect of hyaluronic acide on morphological changes to dentin surfaces and subsequent effect on periodontal ligament cell survival, attachment and spreading. Clin Oral Investig. 2017;21:1013-9.
11. Bertl K, Bruckmann C, Isberg PE, Klinge B, Gotfredsen K, Stavropoulos A. Hyaluronan in non-surgical and surgical periodontal therapy: a systematic review. J Clin Periodontol. 2015;42:236-46.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Katić V, Špalj S. Ispitivanje svojstava materijala za uporabu u dentalnoj medicini. Medicina Fluminensis 2014;50:268–78.
2. Ivanković Buljan Z, Pezelj Ribarić S, Abram M, Ivanković A, Špalj S. In vitro oxidative stress induced by conventional and self-ligating brackets. Angle Orthod. 2012;82:340-5.
3. Kuiš D, Prpić J, Mišković I, Bošnjak A, Pezelj-Ribarić S. Connective tissue graft versus acellular dermal matrix – 1 year follow-up, a case report. J Clin Periodontol 2015;42: 214.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Above suggested literature	*1*	*30*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Analysis of the results of the final exam and seminar work to assess set out learning outcomes (knowledge, skills and attitudes) and an anonymous survey on organisation of educational process.

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COURSE DESCRIPTION		
Course instructor	Prof. Stjepan Špalj, DMD, PhD	
Lecturers	Prof. Irena Glažar, DMD, PhD, Prof. Renata Gržić, DMD, PhD, Asst. Prof. Romana Peršić Bukmir, DMD, PhD, Magda Trinajstić Zrinski, DMD, PhD, Martina Žigante, DMD, PhD, Martina Brumini, DMD, PhD, Mia Uhač, DMD, PhD	
Name of the course	Public health aspect of dentistry	
Study programme	Doctoral school Biomedicine and health – course of study Dentistry	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	12+0+4

1. Course objectives

Through their own experience and scientific activity lecturers will present students epidemiological methods for monitoring oral health, disease and quality of life. Student will be informed on the ways of determining risk indicators for the development and progress of oral diseases. Importance of studying socioeconomic factors, general health and habits in the process of onset and development of oral diseases will be pointed out. An outline of analysis of predictors of seeking therapy and predictors of therapy success in order to create guidelines for directing limited resources of the public health system to the selection of patients who will most benefit. Getting acquainted with health system analysis and developing strategies for oral health promotion and prevention of oral diseases. Methods of planning oral health interventions in the community will be outlined.

2. Course enrolment requirements

Enrolment into PhD programme.

3. Expected learning outcomes

To differentiate epidemiological methods and types of research. To know how to approach critically the selection of the index for monitoring oral health, disease and quality of life. To understand methods of analysis and planning in health care. To create public health interventions based on the analysis of health needs and the health care system. To analyse conducted epidemiological research.

4. Course content

Biopsychosocial model of oral health.
Epidemiological methods and structure of research.
Psychosocial aspect of altered oral health and dentofacial aesthetics.
Recognizing and analyzing oral health needs in specific populations, predictors of therapy seeking, and factors that influence the success of therapy.
Public health aspect of caries and apical periodontitis
Public health aspect of oral mucosa and periodontal disease
Public health aspect of malocclusions
Public health aspect of aging - analysis of oral health needs of elderly people.
Interventions and strategies for oral health promotion and disease prevention in specific populations.

Oral health policy, financing and management.		
5. Manner of instruction	☐ lectures ■ seminars and workshops ☐ exercises ■ distance learning ☐ fieldwork	■ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Part of lectures will be on e-course on platform Merlin	
7. Student responsibilities		
Regular attendance, preparation of seminar work and final exam. Using eLearning content on the Merlin platform		

8. Monitoring of student work[44]

Class attendance		Class participation		Seminar paper	1	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students are encouraged to participate actively in group work and seminars. Exam and the seminar work are used as a basis for evaluation.

10. Mandatory literature (at the time of submission of study programme proposal)

Špalj S. Oralna epidemiologija. Rijeka: Medicinski fakultet; 2015.
Glažar I, Urek MM, Brumini G, Pezelj-Ribaric S. Oral sensorial complaints, salivary flow rate and mucosal lesions in the institutionalized elderly. J Oral Rehabil. 2010;37:93-9.
Glažar I, Muhvić Urek M, Kuiš D, Prpić J, Mišković I, Kovačević Pavičić D, Pezelj-Ribarić S. Salivary flow rate, oral yeast colonization and dental status in institutionalized and non-institutionalized elderly. Acta Clin Croat. 2016;55:390-5.
Špalj S, Katić V, Vidaković R, Šlaj M, Šlaj M. History of orthodontic treatment, treatment needs and influencing factors in adolescents in Croatia.Cent Eur J Public Health. 2016;24:123-7.
Spalj S, Slaj M, Varga S, Strujic M, Slaj M. Perception of orthodontic treatment need in children and adolescents. Eur J Orthod. 2010;32:387-94.
Persić R, Kqiku L, Brumini G, Husetić M, Pezelj-Ribarić S, Brekalo Prso I, Städtler P. Difference in the periapical status of endodontically treated teeth between the samples of Croatian and Austrian adult patients. Croat Med J. 2011;52:672-8.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Peršić Bukmir R, Jurčević Grgić M, Brumini G, Spalj S, Pezelj-Ribaric S, Brekalo Pršo I. Influence of tobacco smoking on dental periapical condition in a sample of Croatian adults. Wien Klin Wochenschr. 2016;128:260-5.

[44] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Spalj S, Novsak A, Bilobrk P, Katic V, Trinajstic Zrinski M, Pavlic A. Mediation and moderation effect of the big five personality traits on the relationship between self-perceived malocclusion and psychosocial impact of dental esthetics. Angle Orthod. 2016;86:413-20.
Špalj S, Lajnert V, Ivanković L. The psychosocial impact of dental aesthetics questionnaire-translation and cross-cultural validation in Croatia. Qual Life Res. 2014;23:1267-71.
Pine C, Harris R. Community oral health. Berlin: Quintessenz; 2007.
Burt BA, Eklund SA. Dentistry, dental practice, and the community. 6th ed. Philadeplphia: Saunders; 2005.
Chattopadhyay A. Oral health epidemiology: principles and practice. Sudburry: Jones and Barlett Publishers; 2011.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
Špalj S. Oralna epidemiologija. Rijeka: Medicinski fakultet; 2015.	*1*	*30*
Above suggested literature	*1*	*30*

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

An anonymous structured survey aiming to evaluate students' satisfaction with the work of teachers and the quality of the educational process.
The learning outcomes (knowledge, skills and competencies) will be evaluated by analyzing final test

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COURSE DESCRIPTION		
Course instructor	Prof. Alen Braut, DMD, PhD	
Lecturers	Assoc. prof. Zoran Kovač, DMD, PhD, Asst. Prof. Barbara Mady Maričić, DMD, PhD, Assoc. Prof. Sven Maričić, PhD, Asst. Prof. Damir Šnjarić, DMD, PhD, Jelena Vidas Hrstić, DMD, PhD	
Name of the course	Experimental models in dentistry	
Study programme	Doctoral school Biomedicine and health – course of study Dentistry	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS	2
	No of hours (P+V+S)	8+0+8

1. Course objective

Couse Experimental models in dental medicine has the aim of introducing the attendees with the latest scientific models in dental medicine that cross borders between dental medicine and technical achievements in technical fields. The medical questions posed in the dental field sometimes cannot be answered on *in vivo* models, and therefore an artificial model is required. In order of the model to be useful in clinical application it has to be adjusted as close as possible to the real clinical cases. In order to adjust the required models a extensive knowledge is needed of the pathological processes that we want to represent and the technical possibilities of the current technological model fabricating devices and software. The pathological and physiological processes that occur inside and outside the teeth, in the surrounding tissues, have established methods of detection by classical x-rays, RVG, CT, CBCT and electrical impedance measuring devices (apex locators, caries detectors, ect.). The interpretation of the gathered diagnostics results is important to extrapolate correctly into the model in order to achieve life-mimicking models. The modern materials have properties similar to live tissue but have to be implemented properly in order to achieve desired results. The proper implementation is essential for the long-term success.

2. Course enrolment requirements

Basic computer and statistical analysis skills

3. Expected learning outcomes

Gathering knowledge and skils of analysing various softwares on the market, variouse scanners, printers, planning devices and handling. Performing the basic tasks, evaluating the fabricated models by measure comparison and reverse engineering. Theoretical application of the models to clinical cases.

4. Course content

Analyzing and reverse engineering live cases and processes, getting familiar with the software of operation scanners, 3D printers, Preparation of the digital models for scanning, formats of scanned models for communication on distance, fabrication of 3D models on 3D printers, photometric analysis pre and post model fabrication and calculating the accuracy and usefulness of the models.

5. Manner of instruction	x☐ lectures x☐ seminars and workshops x☐ exercises	x☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship

	☐ distance learning ☐ fieldwork	☐ other
6. Comments		

7. Student responsibilities

The students are obliged to be present on the lectures, write and a present a seminar, and pass the final exam.

8. Monitoring of student work[45]

Class attendance	0,2	Class participation	0,2	Seminar paper	0,6	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The grading and evaluation of the student work will be conducted through student presence, grading seminar work and presentation and final exam grading. The final grade will be a summarized grade of all student activities and accomplishments during the course

10. Mandatory literature (at the time of submission of study programme proposal)

1. Šnjarić D, Čarija Z, Braut A, Halaji A, Kovačević M, Kuiš D. Irrigation of human prepared root canal–ex vivo based computational fluid dynamic analysis. Croat Med J. 2012;53:470-9.
2. Swenen GRJ. 3D Virtual treatment planning of orthognathic surgery. Berlin: Springer-Verlag; 2017.
3. Hsu SSP, Gateno J, Bell RB, Hirsch DL, Markiewicz MR, et al. Accuracy of a computer-aided surgical simulation protocol for orthognathic surgery: a prospective multicenter study. J Oral Maxillofac Surg. 2013;71:128-42.
4. Glavičić S, Anić I, Braut A, Miletić I, Borčić J. Vertical force and torque analysis during mechanical preparation of extracted teeth using hand ProTaper instruments. Aust Endod J. 2011;37:51-5.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Graber. Orthodontics: current principles and techniques, sixth edition. St. Louis: Elsevier; 2016.
2. Aboul-Hosn Centenero S, Hernández-Alfaro F. 3D planning in orthognathic surgery: CAD/CAM surgical splints and prediction of the soft and hard tissues results. Our experience in 16 cases. J Craniomaxillofac Surg. 2012;50:162-8.
3. Borcić J, Antonić R, Urek MM, Petricević N, Nola-Fuchs P, Catić A, Smojver I. 3-D stress analysis in first maxillary premolar. Coll Antropol. 2007;31:1025-9.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

[45] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Above suggested literature	1	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Analysis of anonymous polls that the students fill out after completing the course indicatating their satisfaction with the organization of lectures, content of the course and the activities.The set learning outcomes will be assessed by written exam and seminar work.

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COURSE DESCRIPTION		
Course instructor	Prof. Branko Kolarić, MD, PhD	
Lecturers	Asst. Prof. Morana Tomljenović, MD, PhD, Assoc. Prof. Lovorka Bilajac, PhD	
Name of the course	Epidemiological Research	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	3
	Number of class hours (L+E+S)	12+4+8
1. Course objectives		
- education in research methodology in terms of preparing and conducting students' research - discussion on what is a contribution to science - preparing students for making doctoral thesis (defining hypothesis and goals of research, defining scientific contribution)		
2. Course enrolment requirements		
none		
3. Expected learning outcomes		
- the clasification of epidemiological study design - describe the public health research - discussion and critical reading of scientific papers - to be able to calculate sample size for different study designs - knowledge on different sampling methods - to make a design and plan of their own research (if possible, doctoral thesis) - describe and understand the categories of errors in extrapolating the observations of a sample to the entire population (chance and bias errors)		
4. Course content		
1. Types of epidemiological research L 2. Causal relationship L 3. Sample size calculation L+E 4. Errors in research L+S 5. Developing research plan E+S 6. Types of public health research L+E		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☒ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments		
7. Student responsibilities		

Course attendance of min 70%. Writing essay and preparing portfolio.

8. Monitoring of student work[46]

Class attendance	0,3	Class participation	0,5	Seminar paper	1	Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	0,2	Report		Practical work	
Portfolio	1						

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student's work will be assessed during the course (attendance and activity), including continuous knowledge development assessment. For final exam student will prepare a portfolio of their own research.

10. Mandatory literature (at the time of submission of study programme proposal)

Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Gordis L. Epidemiology. Elsevier.
Rothman JK, Greenland S, Lash TL. Modern Epidemiology. Lippincott, Williams and Wilkins.
Doricic R, Coric T, Tomljenovic M, Lakoseljac D, Muzur A, Kolaric B. Mortality Characteristics of Two Populations in the Northern Mediterranean (Croatia) in the Period 1960–2012: An Ecological Study. Int J Environ Res Public Health. 15, 2591, 2018.
Kolarić.B. Izvori pogrešaka u populacijskim istraživanjima. U Statistička analiza medicinskih podataka. Medicinski fakultet Sveučilišta u Zagrebu 2004

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.	5	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Continuous analysis of the performance of tests on issues and areas in accordance with the learning outcomes.

[46] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Vanja Tešić, MD, PhD	
Lecturers		
Name of the course	Epidemiology of malignant diseases	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8

1. Course objectives

The aim is to familiarize students with current knowledge in the field of epidemiology of malignant diseases and planning of preventive measures.

2. Course enrolment requirements

/

3. Expected learning outcomes

Indicate of epidemiological features of major malignant diseases, widespreadness, frequency and mortality.
describe of the malignant disease monitoring system.
differentiate sources of the information.
Identification and analysis of risk factors and protective factors.
Describe the principles of organization, implementation and evaluation of the screening program.
Interpretation of the risk assessment models for cancer.

4. Course content

Epidemiological characteristics of malignant diseases. Specific aspects of epidemiology of malignant diseases: classification, cancer register, long-term monitoring methods. Sources of information and use of indicators. Analytical epidemiology of malignant diseases. Interpretation of research results. Genetic epidemiology. Risk factors and protective factors. Prevention options. Theory of screening programs: criteria, goals, evaluation. Epidemiological bases of the models for assessing the risk of cancer.

5. Manner of instruction		
	☒ lectures	☐ individual assignments
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratories
	☐ distance learning	☐ mentorship
	☐ fieldwork	☐ other

6. Comments

7. Student responsibilities

Attendance of the lectures and the writing of seminar papers based on internet search of available literature in the field of malignant diseases.

8. Monitoring of student work[47]

Class attendance	0,5	Class participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay	1	Research	
Project		Continuous assessment	0,5	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student activity will be monitored during classes (the presence and activity), will continuously monitor the knowledge, and for final exam students will prepare an essay with the default theme.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Puntarić D, Ropac D, Jurčev-Savičević A (urednici) i sur. Javno zdravstvo. Medicinska naklada, Zagreb, 2014.
2. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray, F. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11. Lyon, France: International Agency for Research on Cancer; 2013.
3. Torre, L. A., Bray, F., Siegel, R. L., Ferlay, J., Lortet-Tieulent, J. and Jemal, A. Global cancer statistics, 2012. CA: A Cancer Journal for Clinicians, 2015. 65: 87–108. doi:10.3322/caac.21262
4. WHO. Cancer control: knowledge into action: WHO guide for effective programmes. WHO Geneva 2007.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Tešić V, Kolaric B, Znaor A, Kusacic Kuna S, Brkljacic B. Mammographic Density and Estimation of Breast Cancer Risk in Intermediate Risk Population. The Breast Journal 2013; 19:71-78.
2. Kusačić Kuna S, Samardžić T, Tešić V, Medvedec M, Kuna K, Bračić I, Dodig D.: Thyroid remnant ablation in patients with papillary cancer: a comparison of low, moderate, and high activities of radioiodine. Nucl Med Commun. 2009; 30:263-9.
3. *Brkljačić B, Divjak E, Tomasović- Lončarić Č, Tešić V, Ivanac G.* Shear-wave sonoelastographic features of invasive lobular breast cancers. CMJ 2016; 57: 42-50.
4. Hashim D, Boffetta P, La Vecchia C, Rota M, Bertuccio P, Malvezzi M, Negri E. The global decrease in cancer mortality: trends and disparities. Ann Oncol. 2016.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Selected chapters	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

[47] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Performance analysis of written tests by topic area and in accordance with the specified learning outcomes

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COURSE DESCRIPTION		
Course instructor	Prof. Tomislav Rukavina, MD, PhD	
Lecturers	Prof. Vanja Vasiljev, PhD, Assoc. Prof. Lovorka Bilajac, PhD, Asst. Prof. Morana Tomljenović, MD, PhD	
Name of the course	Infectious diseases as a modern public health challenge	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	5+0+10

1. Course objectives

- education of students on changed relationships between humans, microorganisms and the environment in the modern world
- introducing students to factors of modern lifestyle that influence epidemiology of infectious diseases
- introducing students to innovative solutions and new opportunities for combating infectious diseases

2. Course enrolment requirements

none

3. Expected learning outcomes

- Interconnect changes of interactions between humans, microorganisms and environmental interactions in the modern world
- Link the changed characteristics of the above-mentioned factors with influence to epidemiology of infectious diseases
- Introduction of students to relevant sources with the aim of monitoring the current epidemiological situation of infectious diseases
- clasification of the examples of emerging and re-emergent infectious diseases during the past decades
- explain the research of emerging and re-emergent causes of infectious diseases
- describe to diagnostic, therapeutic and anti-epidemic strategies for suppressing emerging and re-emergent infectious diseases
- Critical analysis of scientific papers

4. Course content

1. Demographic changes of significance for the epidemiology of infectious diseases L + S
2. Modified properties of microorganisms L + S
3. Influence of the development of modern civilization on the global change of physical, chemical, social and climatic determinants with influence on interrelation between humans and microorganisms L + S
4. Emerging and re-emergent microorganisms L + S
5. Evolution of infectious diseases in the 21st century and the development of new diagnostic, therapeutic and anti-epidemic strategies for suppressing emerging and re-emergent infectious diseases L + S

6. Relevant sources for monitoring the current global epidemiological situation of infectious diseases L + S							
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☒ distance learning ☐ fieldwork			☒ individual assignments ☒ multimedia and network ☐ laboratories ☒ mentorship ☐ other			
6. Comments							
7. Student responsibilities							
Students are obliged to attend at least 70% of the organized group lessons and prepare the seminar work and the research project on the given topic.							
8. Monitoring of student work[48]							
Class attendance	0,2	Class participation	0,3	Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	1	Continuous assessment	0,5	Report		Practical work	
Portfolio							
9. Assessment of learning outcomes in class and at the final exam (procedure and examples)							
Student activity will be monitored during the course (presence and activity at the seminars), progress will be continuously followed-up, and for the final exam the students will prepare a draft of their own research.							
10. Mandatory literature (at the time of submission of study programme proposal)							
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.							
11. Optional/additional literature (at the time of submission of the study programme proposal)							
Gordis L. Epidemiology. Elsevier. Rothman JK, Greenland S, Lash TL. Modern Epidemiology. Lippincott, Williams and Wilkins. Communicable Disease Investigation Reference Manual, World Health Organization. International Health Regulations. 2005.; http://www.who.int/ihr/en/ WHO Recommended Strategies for the Prevention and Control of Communicable Diseases							

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.	5	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

[48] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Performance analysis of written tests by topic area and in accordance with the specified learning outcomes

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COURSE DESCRIPTION		
Course instructor	Prof. Vanja Vasiljev, PhD	
Lecturers	Assoc. Prof. Lovorka Bilajac, PhD, Asst. Prof. Darko Roviš, PhD	
Name of the course	Public health interventions	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+4+6
1. Course objectives		
- education in research methodology in terms of preparing and conducting public health interventions - discussion on importance of public health interventions - preparing students for critical thinking regarding public health interventions in the community		
2. Course enrolment requirements		
None		
3. Expected learning outcomes		
- describe of public health interventions design - disscuss and critical analysis of common public health interventions - conducting public health needs - design and independently plan public health interventions - understanding of influence of public health interventions in the community		
4. Course content		
Definitions and aspects of public health interventions in the community (L) Examples of good practice (L) Developing public health interventions (S+E) Selection of appropriate public health intervention (S) Development and conduction of public health intervention in the community		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☒ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments		
7. Student responsibilities		
Course attendance of min 70%. Writing essay and preparing portfolio.		

8. Monitoring of student work[49]

Class attendance	0,2	Class participation	0,3	Seminar paper	0,5	Experimental work	
Written exam	0,3	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	0,7
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student's work will be assessed during the course (attendance and activity), including continuous knowledge development assessment. For final exam student will prepare a portfolio of their own research.

10. Mandatory literature (at the time of submission of study programme proposal)

Puntarić, Dinko ; Ropac, Darko ; Jurčev-Savičević, Anamarija. Naslov: Javno zdravstvo. Izdavač: Medicinska naklada.
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Franse, CB.; Grieken, A; Alhambra-Borrás, T; Valía-Cotanda, E; Staveren, R van; Rentoumis, T; Markaki, A; Bilajac, L; Vasiljev Marchesi, V; Rukavina, T; Verma, A; Williams, G; Koppelaar, E; Martijn, R; Voorham, AJ.J.; Mattac, F; Garcés-Ferrerb, RJ; Raat, H. The effectiveness of a coordinated preventive care approach for healthy ageing (UHCE) among older persons in five European cities: A pre-post controlled trial. International journal of nursing studies. 88 (2018) ; 153-162.
2. Roviš, D; Černelič Bizjak, M; Vasiljev Marchesi, V; Petelin, A; Jenuš, T; Vidic, S; Drevenšek, G; Jenko Pražnikar, Z. Increased Risk-Taking Behaviour and Brain-Derived Neurotrophic Factor Val66Met Polymorphism Correlates to Decreased Serum Brain-Derived Neurotrophic Factor Level in Heroin Users. European addiction research. 24 (2018) , 4; 189-200.
3. Bilajac, L; Vasiljev Marchesi, V; Tešić, V; Rukavina, T.Life satisfaction, optimism and social capital as predictors of mental health of the recipients of financial welfare from the state. Psychiatria Danubina. 26 (2014) ; 435-441.
4. Franse, CB.; Voorham, A J.J.; van Staveren, R; Koppelaar, E; Martijn, R; Valía-Cotanda, E; Alhambra-Borrás, T; Rentoumis, T; Bilajac, L; Vasiljev Marchesi, V; Rukavina, T; Verma, A; Williams, G; Clough, G; Garcés-Ferrer, J; Mattace Raso, F; Raat, H. Evaluation design of Urban Health Centres Europe (UHCE): preventive integrated health and social care for community dwelling older persons in five European cities. BMC Geriatrics. 17 (2017) ; 209-1-209-8...

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Puntarić, Dinko ; Ropac, Darko ; Jurčev-Savičević, Anamarija. Naslov: Javno zdravstvo. Izdavač: Medicinska naklada.	5	10
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada	5	10

[49] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Performance analysis of written tests by area and topic in accordance with given learning outcomes as well as exit knowledge and skills of students.

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COURSE DESCRIPTION		
Course instructor	Asst. Prof. Morana Tomljenović, MD, PhD	
Lecturers	Prof. Branko Kolarić, MD, PhD	
Name of the course	Vaccination	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8

1. *Course objectives*

- presentation of mass vaccination program criteria
- analysis of „anti vaccination movement“
- development of critical appraisal and attitudes towards vaccination

2. *Course enrolment requirements*

none

3. Expected learning outcomes

- disscuss and interpretation of vaccine hesitancy background
- provide the basis for discussion of participants in public communication in the field of vaccination (both with parents and public)

4. Course content

1. History and success of vaccination L
2. Mass vaccination program L
3. Anti vaccination movement and vaccine hesitancy S
4. Communication about vaccination (with parents and interested public) S

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other

6. Comments

7. Student responsibilities

Course attendance of min 70%. Active participation during communication seminar. Writing essay.

8. *Monitoring of student work*[51]

Class attendance	0.2	Class participation	0,3	Seminar paper	0,5	Experimental work	

[51] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Written exam		Oral exam		Essay	1	Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student's work will be assessed during the course (attendance and activity), including continuous knowledge development assessment. For final exam student will prepare an essay.

10. Mandatory literature (at the time of submission of study programme proposal)

Plotkin S, Orenstein W, Offit P, Edwards KM. Vaccines. Elsevier.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Lovric Makaric Z, Kolaric B, Tomljenovic M, Posavec M. Attitudes and beliefs related to childhood vaccinations among parents of 6 years old children in Zagreb, Croatia. Vaccine. 36:7530–5, 2018.
Kaic B, Gjenero-Margan I, Brzovic M, Lakoseljac D, Aleraj B, Nemeth-Blazic T, Kolaric B, Macolic-Sarinic V, Simunovic A, Pavlic J. Vaccine regulations in Croatia. Coll Antropol. 31(Suppl 2):117–20, 2007.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Plotkin S, Orenstein W, Offit P, Edwards KM. Vaccines. Elsevier.	10	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Performance analysis of written tests by area in accordance with learning outcomes.

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COURSE DESCRIPTION		
Course instructor	Prof. Gordana Blagojević Zagorac, MD, PhD	
Lecturers		
Name of the course	Health economics	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	3
	Number of class hours (L+E+S)	16+8+0

1. *Course objectives*

Healthcare system is a complex public system which constantly changes with the changes in technology, types of prevalent diseases, social and economic circumstance. To ensure the quality of governance, one needs to understand the workings of the healthcare system and ways in which it adapts to the challenges of the 21st century. The aim of the course is threefold. First, it will introduce students to the basic economic principles of the healthcare system as well as its organizational and other specificities. Second, students will gain insight into the implications of different financial and organizational forms on the behaviour and motivations of key stakeholders in healthcare. Finally, students will be acquainted with various tools that other European countries utilize in order to achieve goals of efficiency and equity, including management skills and new technology.

The course will initially provide an overview of the Croatian healthcare system and a comparison with the main European systems. The focus will be on the organization and financing of healthcare providers. Since the system can be "designed" in many different ways, it is crucial to understand other organizational and financial schemes, used in other systems and hence expand on students' toolbox. The healthcare system distinguishes itself from other public systems and the specificities thereof need to be understood (e.g., moral hazard, solidarity, asymmetrical information) since these dictate the dynamics of healthcare. Although the healthcare system is a public system, it functions on the basis of supply and demand but under strong government regulation. Students will understand the issues related to the supply and demand for healthcare services as well as the basic concepts such as its cost (and how to determine it). Different financial arrangements have different impact on the level of cost as well as on the supply and demand. The question of which financial arrangements bring the supply and demand at the desired equilibrium is one of the fundamental questions in healthcare organization.

The success of the healthcare system in terms of desired levels of efficiency and equity, as well as quality can be measured. Health outcomes of different healthcare services can also be measured and included in the economic evaluations of health technologies, a key tool for healthcare governance. Students will be provided with an overview of the methods used to measure health outcomes as well as the levels of equity and efficiency.

Healthcare system needs to change with the changes in the available technology and the changes in demands of patients and well as rising costs and demographic changes. Students will understand the new trends in healthcare, primarily the concept of patient-centred care, integrated care, as well as tools such as telemedicine and personalized medicine.

2. *Course enrolment requirements*

No special requirement.

3. Expected learning outcomes

It is expected that students will understand the organization and financing of the Croatian healthcare system and compare it to other European healthcare systems. Students will be acquainted with the concepts of asymmetrical information, moral hazard, solidarity, equity, and other basic concepts in Health economics. Financing options and arrangements, including insurance, will be understood. Students will be able to describe how supply and demand for healthcare services is created and balanced. Students will be able to critically appraise, based on the reading materials (empirical literature) and on theoretical grounds, the level of efficiency as well as the equity-related issues in the Croatian healthcare system. Students will be able to measure health outcomes using standardized instruments. Health outcomes will be used in exercises so that students can understand the concept and the working of economic evaluations of health technologies as well as how it can be used to increase the cost-effectiveness of budget allocation. Basic management principles will be understood as well as evidence-based policy-making. Finally, students will understand how personalized medicine and integrated care, as well as new communications technologies can increase the level of efficiency and the quality of health outcomes.

4. Course content

1. Introduction to Health economics. Healthcare organization in Croatia and selected European countries. The impact of socio-economic circumstances on healthcare. Specificities of the healthcare system.
2. Healthcare financing: insurance, supply and demand, payment models and their implications.
3. Efficiency and equity in healthcare. Measurement, empirical research. Distributional justice.
4. Healthcare decision-making. Economic evaluations and cost-effectiveness. Health outcomes measurement and quality of life research. Tools and practical work.
5. Healthcare system governance. Productivity measurement. Healthcare management. Effective teams. Effective communication. Evidence-based policy-making.
6. Changing paradigm: patient-centred care and patient self-management. Telemedicine. Personalized care. Integrated care.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	None.	

7. Student responsibilities

Students are required to attend classes and write a paper on the basis of desk research – literature review. Students will be required to present their paper in class while another student group will comment on their work. Discussion and participation will be noted.

8. Monitoring of student work[52]

Class attendance	0,3	Class participation	0,5	Seminar paper	0,7	Experimental work	
Written exam	1,5	Oral exam		Essay		Research	

[52] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Written test – 60%
Class participation – 10%
Seminar paper and presentation – 30%

10. Mandatory literature (at the time of submission of study programme proposal)

Vehovec, M,. Ur. «O zdravstvu iz ekonomske perspektive. Zagreb: Ekonomski Institut Zagreb, 2014 (the book is freely available in PDF (http://www.eizg.hr/hr-HR/O-zdravstvu-iz-ekonomske-perspektive-1417.aspx).

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Bobinac A, van Exel NJA, Rutten FFH, Brouwer WBF (2012) Get more, pay more? An elaborate test of construct validity of willingness to pay per QALY estimates obtained through contingent valuation. Journal of Health Economics 31: 158-168.
2. Bobinac A, van Exel NJA, Rutten FFH, Brouwer WBF (2012) Inquiry into the relationship between equity weights and the value of the QALY. Value in Health 15: 1119–1126
3. Bobinac A, van Exel NJA, Rutten FFH, Brouwer WBF (2013) Valuing QALY gains by applying a societal perspective. Health Economics, 22: 1272-1281
4. van de Wetering, L., van Exel, J., Bobinac, A., Brouwer, W. B. (2015). Valuing QALYs in Relation to Equity Considerations Using a Discrete Choice Experiment. PharmacoEconomics, 1-12.
5. Bobinac, A., Vehovec, M. (2016). Economic Evaluations of Personalized Health Technologies: An Overview of Emerging Issues in Personalized Medicine (pp. 107-135). Springer International Publishing

Recent research and scientific papers will be made available to students (in English)

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Performance analysis of written tests by area in accordance with learning outcomes.

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COURSE DESCRIPTION		
Lecturer	Assoc. Prof. Aleksandar Racz, MD, PhD	
Associates	Prof. Tomislav Rukavina, MD, PhD, Prof. Vanja Vasiljev, PhD	
Course title	Public healthcare and the sustainable development concept in the first half of the 21st century: from global towards local	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Course status	elective course	
Year	I., II., III.	
ECTS credits awarded and the teaching method	ECTS coefficient of student load	2
	Number of classes (L+E+S)	10+0+6

1. Course objective

-to define and describe sustainable development in numerous ways
-to define and describe each of the 17 individual goals of sustainable development
-to highlight and analyse public health topics which are part of particular goals
-to analyse different perspectives within a multiperspectivist approach to the analysis of sustainable development goals with an emphasis on the public health perspective
-to discuss and analyse in detail the factors of achievement and obstacles to the achievement of public health goals at the global and national level
-to examine, analyse and synthesize available data on individual measuring indicators for achieving individual goals of sustainable development
-to compare the significance of each problem at the global and national level and compare the national parameters in relation to the rest of the world
-to develop a plan and programme for solving particular public health issues at the global and local level through a paradigm of sustainable development such as poverty, hunger, unemployment, child labour, undermining the right to dignified labour, gender inequality, human trafficking, drinking water availability, sustainable urbanization, etc.

2. Requirements for enrolment

none

3. Expected learning outcomes

After completing the course, students will be able to:
define sustainable development;
collect, analyse, classify and synthesize relevant information and knowledge on the goals of sustainable development contained in Programme 2030;
properly interpret basic concepts related to public health topics within the concept of sustainable development;
explain and interpret various public health aspects related to each of the 17 individual public health topics within the concept of sustainable development;
identify the restraining global and national factors for achieving public health goals within the concept of sustainable development;
analyse the processes of sustainable development concept implementation at the global and national level;
understand different legislative standards related to public health issues arising from the concept of sustainable development;

<table>
<tr><td colspan="3">assess acquired knowledge, skills and competencies in order to apply the concept of sustainable development;
interpret research related to the public health perspective of the concept of sustainability of development;
make a proposal for a solution to one of the 17 particular issues.</td></tr>
<tr><td colspan="3">4. Course content</td></tr>
<tr><td colspan="3">Public health challenges in the 21st century are closely related to the concept of sustainable development, which implies a process of achieving a balance between economic, social and environmental demands, to "meet the needs of the present generation without compromising the ability of future generations to meet their needs". Operationalisation of the concept and its application in practice are the result of both theoretical and political aspirations aimed at ensuring long-term development of human society in a preserved environment. Programme 2030 is a global agreement establishing a universal, comprehensive course of action for all countries, including national policies. Each of the 17 goals of sustainable development is aimed at overcoming a certain public health problem at both the global and the local level. By analysing the secondary data of each of the goals, didactically grouped according to the topic, they will be examined by using a multiperspectivist paradigm with emphasis on public health and ecological health approach.
1st topic – The world in the second decade of the 21st century: critical review of millennium development goals – what has (not) been accomplished
2nd topic - Healthy life and promoting welfare for all
3rd topic - Inclusive and quality education, gender equality and empowerment of women's rights
4th topic – Sustainable drinking water management as a foodstuff and as
5th topic - Employment and dignity of work, work and trade hidden from the public
6th topic – Inclusive and sustainable industrialization and innovation, sustainable consumption and production
7th topic – Sustainable management of marine, coastal and land ecosystems and response to climate changes
8th topic - Rule of law at the national and international level
9th topic - Global partnership for sustainable development
10th topic – Humanitarian organisations and missions – success and controversy</td></tr>
<tr><td colspan="3">Global development programme for 2030 (2030 Agenda).</td></tr>
<tr><td rowspan="5">5. Teaching method</td><td>X lectures</td><td>X independent tasks</td></tr>
<tr><td>☐ seminars and workshops</td><td>X multimedia and network</td></tr>
<tr><td>☐ exercises</td><td>☐ laboratory</td></tr>
<tr><td>☐ distance education</td><td>☐ mentorship</td></tr>
<tr><td>☐ field work</td><td>☐ other
_____</td></tr>
<tr><td>6. Comments</td><td colspan="2"></td></tr>
<tr><td colspan="3">7. Student obligations:</td></tr>
<tr><td colspan="3">Regular attendance, active participation during the topic presentations; independent analysis of at least one of the available national indicators and contextualization of the collected secondary data, writing essays on one of the three offered topics based on own literature research and the analysis of at least 5 different scientific articles published in indexed journals, a problem-solving task as part of the oral exam preparation</td></tr>
</table>

8. Student[54] monitoring							
Attendance	0,2	Activity in classes	0,3	Seminar paper	0,5	Experiments	
Written exam	0,5	Oral exam		Essay	0,5	Research	
Project		Continuous testing		Paper		Practical work	
Portfolio							

9. Procedure and examples of evaluating individual learning outcomes during the course and at the final exam

Students' activity will be monitored during the course (attendance and activity in class), students will prepare an essay on the given topic and the final exam will be held as an oral exam.

10. Compulsory literature (at the time of application of the study programme proposal)

1. UN (2015) Sustainable development goals (available at:http://www.un.org/sustainabledevelopment/sustainable-development-goals/
2. UN (2017) The Sustainable Development Goals Report 2017 (dostupno na: https://unstats.un.org/sdgs/files/report/2017/TheSustainableDevelopmentGoalsReport2017.pdf
3. Un (2015) Transforming our world: the 2030 Agenda for Sustainable Development (available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

11. Additional literature (at the time of application of the study programme proposal)

1. Racz, A., Vasiljev Marchiesi, V., Crnković, I. Economical, environmental and ethical impact of food wastage in hospitality and other global industries" JAHR 2018, 2:25-42. http://www.jahr-bioethics-journal.com/index.php/JAHR/article/view/420
2. Živčić, D., Racz, A., Naletilić, D. (2014). Differences in attitudes towards/beliefs on complementary and alternative medicine witnessed between physiotherapists, nurses/paramedics and physicians. African Journal of Traditional, Complementary and Alternative Medicines, 11(6), 57-65. http://journals.sfu.ca/africanem/index.php/ajtcam/article/view/2439/2031
3. Kalambura, S., Racz, A., Jovičić, N., Toth, M. (2017). Perceptions of issues, possibilities and habits of separate waste collection. Socijalna ekologija: časopis za ekološku misao i sociologijska istraživanja okoline, 25(3), 271-287. https://doi.org/10.17234/SocEkol.25.3.3::

12. Number of copies of compulsory literature in relation to the number of students who are currently attending classes

Title	Number of copies	Number of students
All publications - free availability on the public internet	30	30

13. Methods of quality monitoring which ensure the acquisition of knowledge, skills and competencies

Performance analysis of written tests by area and topic in accordance with learning outcomes

[54] IMPORTANT: In addition to each of the student monitoring methods, enter the corresponding percentage in the ECTS credits for each activity so that the total number of ECTS credits corresponds to the total number of credits for this course. Use blank fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Ozren Polašek, MD, PhD	
Lecturers		
Name of the course	Global Health	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	4+4+8

1. Course objectives		
Familiarize students with the global health concept, institutions and organisations involved in it; empower the students for priorities assessment, development of a simple burden of disease model, and critical appraisal in global health		
2. Course enrolment requirements		
Research methodology and statistics course completion		
3. Expected learning outcomes		
describe the basic determinants in global health, enumerate the measures and indicators to assess global health, outline the basic model of burden of disease, interpret the results of the Global Burden of Disease project, propose priorities for improving global health, critically evaluate the results of selected research papers		
4. Course content		
Global and public health, international organisations, systematic reviews and meta-analysis in global health, burden of disease, Global biobank, Economic worth of global health, methods: PLANET, CHERG and EQUIST		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☒ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		
Develop a model of the burden of disease or a similar global health assignment		
8. Monitoring of student work[55]		

[55] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Class attendance	0,2	Class participation	0,3	Seminar paper	0,5	Experimental work	
Written exam		Oral exam		Essay		Research	1
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Exam/individual work

10. Mandatory literature (at the time of submission of study programme proposal)

o Rehberg J, Stipčić A, Ćorić T, Kolčić I, Polašek O. Mortality patterns in Southern Adriatic islands of Croatia: a registry-based study. Croat Med J. 2018;59:118-123.
o GBD 2017 Mortality Collaborators. Global, regional, and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018;392:1684–735.
o GBD 2017 Causes of Death Collaborators Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018; 392: 1736–88.
o GBD 2017 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392:1859-1922.
o GBD 2017 Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392:1923-1994.
o AMANHI (Alliance for Maternal and Newborn Health Improvement) Bio–banking Study group), Baqui AH, Khanam R, Rahman MS, Ahmed A, Rahman HH, et al. Understanding biological mechanisms underlying adverse birth outcomes in developing countries: protocol for a prospective cohort (AMANHI bio-banking) study. J Glob Health. 2017;7:021202.
o Polasek O. Future of biobanks - bigger, longer, and more dimensional. Croat Med J. 2013;54:496-500.
o Kolčić I. Achieving millennium development goals 4 and 5: do every mother and child really count? Croat Med J. 2013;54:107-9.
o Kolčić I. Double burden of malnutrition: A silent driver of double burden of disease in low- and middle-income countries. J Glob Health. 2012;2:020303.
• Budimir D, Polasek O, Marusić A, Kolcić I, Zemunik T, Boraska V, et al. Ethical aspects of human biobanks: a systematic review. Croat Med J. 2011;52:262-79.Odabrani članci koje će studenti dobiti na početku nastave

11. Optional/additional literature (at the time of submission of the study programme proposal)

o WHO. World Health Statistics 2018: Monitoring health for the SDGs (Dostupno na: https://apps.who.int/iris/bitstream/handle/10665/272596/9789241565585-eng.pdf?ua=1)
o https://www.who.int/gho/mortality_burden_disease/en/
o http://www.un.org/millenniumgoals/
• https://sustainabledevelopment.un.org/?menu=1300

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12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Performance analysis of written tests by area and topic in accordance with learning outcomes.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Lovorka Bilajac, PhD	
Lecturers	Prof. Vanja Vasiljev, PhD	
Name of the course	Health inequalities	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	6+4+6

1. Course objectives

The core objective of the course is to encourage students to think critically about the determinants of health and their impact on the health of individuals and communities and how much they contribute to existing inequalities in health between residents within a single country and among the different countries.

2. Course enrolment requirements

none

3. Expected learning outcomes

Identify the reasons for existing inequalities in health
Discuss and critically comment on the impact of health determinants on the health of the population
Recognize differences between terms of equity and equality;
Explain the difference between the terms iquity and inequality;
Classify the methods of measurement of inequality;
Develop independent ideas for reducing inequalities in health

4. Course content

Determinants of health, Research inequalities in health, Measurements of inequality,
Projects to reduce inequalities in health, evaluation of activities

5. Manner of instruction		
	☒ lectures	☒ individual assignments
	☐ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratories
	☐ distance learning	☐ mentorship
	☐ fieldwork	☐ other

6. Comments

7. Student responsibilities

Students are required to attend classes (at least 70%) and prepare a final task

8. Monitoring of student work[56]

[56] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Class attendance	0,2	Class participation	0,3	Seminar paper	1	Experimental work	
Written exam		Oral exam		Essay	0,5	Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students' activity will be monitored during the course (presence and activity in lectures and seminars), and for the final exam they will prepare the seminar work on the given topic and present it in front of the group.

10. Mandatory literature (at the time of submission of study programme proposal)

Handbook on health inequality monitoring: with a special focus on low- and middle-income countries., WHO , Geneva,2013.
National health inequality monitoring: a step-by-step manual, WHO 2017.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Bilajac, L; Vasiljev Marchesi, V; Rukavina, T.Inequalities as a consequence of living Health for all?! Evidence-based healthy ageing in Europe!
Franse, CB.; Grieken, A; Alhambra-Borrás, T; Valía-Cotanda, E; Staveren, R van; Rentoumis, T; Markaki, A; Bilajac, L; Vasiljev Marchesi, V; Rukavina, T; Verma, A; Williams, G; Koppelaar, E; Martijn, R; Voorham, AJ.J.; Mattac, F; Garcés-Ferrerb, RJ; Raat, H. The effectiveness of a coordinated preventive care approach for healthy ageing (UHCE) among older persons in five European cities: A pre-post controlled trial. International journal of nursing studies. 88 (2018) ; 153-162.
Franse, CB.; Voorham, A J.J.; van Staveren, R; Koppelaar, E; Martijn, R; Valía-Cotanda, E; Alhambra-Borrás, T; Rentoumis, T; Bilajac, L; Vasiljev Marchesi, V; Rukavina, T; Verma, A; Williams, G; Clough, G; Garcés-Ferrer, J; Mattace Raso, F; Raat, H. Evaluation design of Urban Health Centres Europe (UHCE): preventive integrated health and social care for community dwelling older persons in five European cities. BMC Geriatrics. 17 (2017) ; 209-1-209-8..
Bilajac, L; Vasiljev Marchesi, V; Tešić, V; Rukavina, T.Life satisfaction, optimism and social capital as predictors of mental health of the recipients of financial welfare from the state. Psychiatria Danubina. 26 (2014) ; 435-441.
Bilajac, L; Rukavina, T; Vasiljev Marchesi, V; Mastilica, M; Benkovic, V; Stavanović, R.Health and health care use in unemployed population of the Republic of Croatia, ICUH Manchester, 2014

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	30	30

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Performance analysis of written tests by area and topic in accordance with learning outcomes

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COURSE DESCRIPTION		
Course instructor	Prof. Nada Starčević Čizmarević, PhD	
Lecturers	Prof. Smiljana Ristić, PhD	
Name of the course	Genetic Epidemiology	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	1
	Number of class hours (L+E+S)	6+2+2

1. *Course objectives*

The course will provide a scientific understanding of general concepts and methods related to genetic epidemiology with focus on family-related linkage analysis and especially population-based association studies. The course will also provide a background in basic genetics, genetic technology and the human genome project as well as a background in the use of genetics in medicine and health services. The purpose is to explain principles in genetic epidemiology relevant to the study of complex human diseases. Further learning objective of this course is to be able to think critically about the impact of genetics on public health.

2. *Course enrolment requirements*

/

3. *Expected learning outcomes*

After completed program the students will be capable to:
- define genetic epidemiology and describe the fundamental concepts critical to genetic epidemiology
- describe the major study designs used in genetic epidemiology
- describe molecular-genetic methods and recent developments in genomics
- explain contribution of GWAS studies research of complex diseases in populations
- use genetic databases
- search literature and carry out meta-analysis
- describe the relationship and impacts of genetic epidemiology on public health
- explain how genetic epidemiologic findings can be applied in public health

4. *Course content*

This course will cover principles of human/population genetics and molecular biology relevant to understanding approaches in molecular and genetic epidemiology. Basic concepts of genetic epidemiology (Hardy-Weinberg equilibrium, haplotypes, linkage disequilibrium), study design, genetic risk studies, family-based, twin/adoption studies, linkage analysis and in particular population-based association studies with analysis of qualitative/quantitative traits and multifactorial analysis of SNPs will be included. The latest designs and methods for genome-wide association studies and other approaches to identify genetic variants and environmental risk factors important to disease and health will be presented. Use of Genetic Variation Databases and studies of meta-analysis will be demonstrated. Students will participate in critical review of articles relevant to molecular and genetic epidemiology.

5. *Manner of instruction*		
	☒ lectures	☐ individual assignments
	☒ seminars and workshops	☐ multimedia and network

	☒ exercises ☐ distance learning ☐ fieldwork	☐ laboratories ☐ mentorship ☐ other
6. *Comments*		
7. *Student responsibilities*		
Lesson attendance and active participation in education.		
8. *Monitoring of student work*[57]		

Class attendance	0,1	Class participation	0,2	Seminar paper		Experimental work	
Written exam	0,4	Oral exam	0,3	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. *Assessment of learning outcomes in class and at the final exam (procedure and examples)*
Evaluating in the ECTS system is made by absolute distribution. The total success consists of performance during class and final exam. Student can collect 0.2 ECTS by engagement in seminar. Additional 0.7 ECTS the student can get during final examination (written exam 0.5 ECTS and oral exam 0.3 ECTS). To achieve ECTS on final exam, student student must fulfill more than 50% of the written test.
10. *Mandatory literature (at the time of submission of study programme proposal)*
- Turnpenny PD, Ellard S (2018): Emery's Elements of Medical Genetics, 15th Edition, Elsevier. - Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard (2016): Genetics in Medicine, 8th edition, Saunders Elsevier. - Tizaoui K et al. Association between vitamin D receptor polymorphisms and multiple sclerosis: systematic review and meta-analysis of case-control studies. Cell Mol Immunol. 2015;12:243-52.
11. *Optional/additional literature (at the time of submission of the study programme proposal)*
- Teare, M. Dawn (2011): Genetic Epidemiology, Springer. - Ristić S, Čizmarević NS et al. Angiotensin-converting enzyme insertion/deletion gene polymorphism in multiple sclerosis: a meta-analysis. Neurol Sci. 2016;37:1955-59. - Paternoster L et al. Genetic epidemiology and Mendelian randomization for informing disease therapeutics: Conceptual and methodological challenges. PLoS Genet. 2017;13(10):e1006944. -Eline Slagboom P et al. Phenome and genome based studies into human ageing and longevity: An overview. Biochim Biophys Acta. 2017 pii: S0925-4439(17)30332-0. - Haslam DE et al. Interactions between Genetics and Sugar-Sweetened Beverage Consumption on Health Outcomes: A Review of Gene–Diet Interaction Studies. Front Endocrinol. 2018;8:368. - Other original and review articles
12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	30	30

[57] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Performance analysis of written tests by area and topic in accordance with learning outcomes

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Jadranka Vraneković, PhD	
Lecturers	Prof. Nada Starčević Čizmarević, PhD	
Name of the course	Noninvasive and invasive prenatal testing of chromosomal aneuploidies	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	1
	Number of class hours (L+E+S)	8+0+2

1. *Course objectives*

The main objective of this course is to gain knowledge of the latest achievements and guidelines in the area of prenatal screening and diagnosis of chromosomal abnormalities.

2. *Course enrolment requirements*

3. *Expected learning outcomes*

Upon completion of this course students will be able:
to describe first and second trimester screening tests
to describe diagnostic methods
to compare indications for noninvasive and invasive prenatal testing of chromosomal aneuploidies
to explain the principles of genetic counseling in prenatal diagnosis

4. *Course content*

During the course, students will be introduced to a noninvasive and invasive prenatal testing of chromosomal aneuploidies. The newest methods of screening and diagnostics as well as new guidelines and indications for prenatal test will be presented. Also, the guidelines and principles of genetic counseling in prenatal diagnosis will be covering by this course.

5. *Manner of instruction*	☐ **lectures** ☐ **seminars and workshops** ☐ exercises ☐ distance learning ☐ fieldwork	☐ **individual assignments** ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. *Comments*		

7. *Student responsibilities*

Lesson attendance and active participation in education (seminar tasks)

8. *Monitoring of student work*[58]

[58] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Class attendance	0,1	Class participation	0,2	Seminar paper	0,2	Experimental work	
Written exam	0,3	Oral exam	0,2	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluating in the ECTS system is made by absolute distribution. The total success rate of students during the course accounts for 70% and final exam 30% of the grade. Student can collect 0,5 ECTS by solving seminar task and with active participating during the lectures. Additional 0,5 ECTS the student can get during written final exam (0.3ECTS) and oral exam (0.2ECTS). To achieve ECTS on final exam, student must fulfill more than 50% of test.

10. Mandatory literature (at the time of submission of study programme proposal)

Prenatalno testiranje i genetika reprodukcije. u: Turnpenny P, Ellard S. Emeryeve osnove medicinske genetike (14. izdanje). Zagreb, Medicinska naklada; 2011; 325-38.
Brajenović-Milić B, Stipoljev F. Prenatalna dijagnostika.u: Čulić V, Pavelić J, Radman M i sur. Genetičko informiranje u praksi. Zagreb, Medicinska naklada; 2016; 277-83.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Titles are available in electronic version provided by course coordinator

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Prenatalno testiranje i genetika reprodukcije. u: Turnpenny P, Ellard S. Emeryeve osnove medicinske genetike (14. izdanje). Zagreb, Medicinska naklada; 2011; 325-38. Brajenović-Milić B, Stipoljev F. Prenatalna dijagnostika.u: Čulić V, Pavelić J, Radman M i sur. Genetičko informiranje u praksi. Zagreb, Medicinska naklada; 2016; 277-83.	3	15

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Sven Maričić, PhD	
Lecturers		
Name of the course	New technologies in public health	
Study programme	Doctoral school Biomedicine and health – course of study Public Health	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	6+4+6

1. *Course objectives*

- Methodological education of students in the field of application of new technologies in public health
- Analysis and discussion of the importance and relevance of new technologies
- Analysis of new trends
- Preparation of students for the PhD thesis activities

2. *Course enrolment requirements*

none

3. Expected learning outcomes

- Getting acquainted with the historical development of technology in the public health service
- Explain the function of the importance of applying new technologies
- Critical analysis of scientific papers
- Getting acquainted with the basic principles and the way of applying new technologies
- Ability to independently develop own research
- Identify current trends and possible future directions of developing new technologies in public health

4. Course content

1. Historical Development of Public Health Technology
2. Importance and quality of implementation in everyday practice
3. Classification by type and mode of use of new technologies
4. Directions for future development with an emphasis on local implementation

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other

6. Comments

7. Student responsibilities

8. *Monitoring of student work*[60]

Class attendance	0,2	Class participation	0,3	Seminar paper	0,6	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	0,3
Project		Continuous assessment	0,1	Report		Practical work	
Portfolio							

9. *Assessment of learning outcomes in class and at the final exam (procedure and examples)*

Student activity will be monitored during the course (presence and activity on exercises and seminars), progress will be monitored.

10. *Mandatory literature (at the time of submission of study programme proposal)*

J.P. Narain, R. Ofrin: Role of modern technology in public health: opportunities and challenges, WHO South-East Asia Journal of Public Health 2012
W.H.Curioso: New technologies and public health in developing countries: The Cell Preven Project, Universidad Peruana Cayetano Heredia, Peru

11. *Optional/additional literature (at the time of submission of the study programme proposal)*

S.Maričić, M.Perinić, D. Kovačević Pavičić: Uvod u biotehnološko CAD/CAM modeliranje, Sveučilište u Rijeci 2013

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	30	30

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

Performance analysis of written tests by area nad topic in accordance with given learning outcomes

[60] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Dalibor Broznić, PhD	
Lecturers		
Name of the course	Mathematical modelling and computer simulations of environmental systems	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	5+10+5

1. Course objectives

The course is aimed to provide knowledge, skills and practical experience in methodology of open chemical and biological systems mathematical modeling with aid of computer simulation.

2. Course enrolment requirements

Students are expected to possess fundamentally systematized knowledge gained from the different Chemistry Courses and Mathematics.
PC computing (writing, sketching, MS Excel).
Statistical analysis of numerical data and their graphical presentation.

3. Expected learning outcomes

After course and exam completion students will be able to:

- describe the environmental system with mathematical formulas and perform expressions of homogeneous and distributed substance, energy and momentum balances
- identify the characteristics of the environmental system important for the mathematical model development
- apply models of chemometric analysis, neural networks, "fuzzy logic" and genetic algorithm
- apply simulation with modeling software such as, Berkeley Madonna, Statistica and Wolfram Research Mathematica in environmental systems
- calculate and graphically present the behavior of certain dynamic model variables of the environmental system and apply the theoretical knowledge in the results interpretation

4. Course content

Systems view on modeling of open chemical and biological systems. Fundamentals of deterministic and stochastic models. Nonstationary balances for mass, momentum and energy. Modeling of chemical and biological kinetics. A chemometric approach in analysis of multivariate systems. Fundamentals on modeling by neural networks and fuzzy logic. Systems adaptation by genetic algorithm. Development of models for system monitoring and process control.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☒ multimedia and network ☐ laboratories ☐ mentorship ☒ other consultation

6. Comments	

7. Student responsibilities

Lectures attendance, active participation in seminars, practical work with computer modeling systems.

8. Monitoring of student work[61]

Class attendance	0,6	Class participation	0,1	Seminar paper	0,6	Experimental work	
Written exam	0,4	Oral exam		Essay		Research	
Project	0,3	Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the project assignment, the seminar paper and the final written exam on which the issues will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

1. J. Thibodeaux: Environmental Chemodynamics, J. Wiley, 1996; J.L. Schnoor, Environmental Modeling; J. Wiley, 1999.
2. A.L. Koch: Mathematical Modeling in Microbial Ecology, Springer, 1998;
3. N.Hritonenko, Y.Yatsenko, Mathematical Modeling in Economics, Ecology and the Environment, Springer, 2013

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. The scientific papers in consultation with the student according to the seminar topic
2. Broznić, Dalibor; Milin, Čedomila. *Mathematical prediction of imidacloprid persistence in two Croatian soils with different texture, organic matter content and acidity under laboratory conditions*. Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes. 48 (2013); 906-918.
3. Broznić, Dalibor; Marinić, Jelena; Tota, Marin; Čanadi Jurešić, Gordana; Petković, Orjen; Milin, Čedomila. *Hysteretic Behavior of Imidacloprid Sorption-Desorption in Soils of Croatian Coastal Regions*. Soil & sediment contamination. 21 (2012); 850-871.
4. Broznić, Dalibor; Milin, Čedomila. *Effects of Temperature on Sorption-Desorption Processes of Imidacloprid in Soils of Croatian Coastal Regions*. Journal of Environmental Science and Health, Part B. 47(2012), 8; 779-794.
5. Broznić, Dalibor; Marinić, Jelena; Tota, Marin; Čanadi Jurešić, Gordana; Milin, Čedomila. *Kinetic Evaluation of Imidacloprid Degradation in Mice Organs Treated with Olive Oil Polyphenols Extract*. Chemica Croatica Acta. 81 (2008), 1; 203-209.
6. Broznić, Dalibor; Marinić, Jelena; Tota, Marin; Čanadi Jurešić, Gordana; Milin, Čedomila. *Soil sorption characteristics of imidacloprid in different Croatian regions*. International Journal of Environmental Engineering. 4 (2012) , 3/4; 324-336.

[61] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
J. Thibodeaux: Environmental Chemodynamics, J. Wiley, 1996; J.L. Schnoor, Environmental Modeling; J. Wiley, 1999.	1	5
A.L. Koch: Mathematical Modeling in Microbial Ecology, Springer, 1998;	1	5
N.Hritonenko, Y.Yatsenko, Mathematical Modeling in Economics, Ecology and the Environment, Springer, 2013	1	5

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Jadranka Pečar-Ilić, PhD	
Lecturers	-	
Name of the course	Environmental Information Systems	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	15+5+0

1. Course objectives

The Course enables the understanding of the basic concepts in the interdisciplinary field of Environmental Informatics and explains the role of Information and Communications Technology (ICT) for the timely and efficient exchange of information on environment and health. Students receive basic knowledge within the three thematic frameworks (Environmental protection, Environmental management, ICT) with the presentation of case studies for information management systems. Students will be able to apply the adopted knowledge for the purpose of their scientific researches, in such a way that they will be able to identify the appropriate legislations in the legislative framework for environmental and health management and to identify relevant geo-information and ICT.

2. Course enrolment requirements

-

3. Expected learning outcomes

After successfully mastering a course, students will be able to:

- Compare and analyze the European and Croatian legislative framework for environmental protection and health
- Analyze roles and hierarchical structures of actors in environmental and health management
- Define the interdisciplinary Environmental Informatics field and the term Enviromatics
- Explain what the concept of "eEnviroment" means and indicate the benefits of its introduction
- Identify the importance of standardization and application of the INSPIRE directive for environmental management systems
- Classify system components for creation, exchange and dissemination of geo-information on the environment
- Distinguish concepts: database, geographic information system (GIS), web technology
- Connect and apply acquired knowledge and provide a solution for example of own research (selection of corresponding legislation, relevant geo-information and ICT)

4. Course content

Within the framework of this course will be analyzed examples of how the achievements (knowledge) in the field of telecommunications, informatics and computing are applied in the interdisciplinary field of Environmental Informatics (Enviromatics) for various issues within environmental protection and environmental management in order to minimize risks and negative effects on health.

Scientific and professional profile of this course can be represented by a hierarchical division of topics in the form of different levels of the pyramid (i.e., hierarchical pyramid). Top of the pyramid consists of laws and regulations on the environment (policy) and the applicable standards for environmental management according to which development of complex information and communication systems should be conducted. In the middle of the pyramid is the interdisciplinary Environmental Informatics, which enables the successful implementation of R&D projects in accordance with the laws and standards, and it is based on modern approaches, techniques and ICT concepts, which are classified in the base of the pyramid. The whole concept of the hierarchical pyramid can be applied on an international and European levels (e.g., European environmental law and related legislation), the national level (e.g., Croatian legislative framework), the local government level (e.g., Environmental Protection Programme of the City of Zagreb), and the level of organization (e.g., its environmental policy).

Development of efficient information and communication technological (ICT) solutions that enable greater speed, capacity and level of integration in the management of information resources will depend on: the observed problems of environmental protection and management at international, national/local levels, the prescribed statutory legislation/ standards, the responsible authorities, and technical capabilities.

This course addresses the areas that are associated with information management systems inside three thematic frameworks as follows: environmental protection, environmental management and environmental informatics & ICT.

- Environmental protection framework provides a comparative overview of EU legislation and Croatian legislative framework for the protection and management of the environment and explains the roles of participants (public administration, agencies and research institutions).
- Environmental management framework includes:

– Introduction to standardization in the field of environmental management (ISO 14001; EMAS) and presentation of different architectures for environmental information management systems,
– Introduction to Environmental Informatics (boundaries of the interdisciplinary field, definition of terms and scientific curriculum, international projects, conferences and journals) and definition of Enviromatics (application of telematics and environmental informatics),
– Introduction to the concept of "eEnvironment" which includes the application of ICT solutions (information, services and knowledge) for a more active participation of public in the governmental decision-making process concerning environmental protection and sustainable development in the EU.

- ICT thematic framework provides an introduction to basic definitions and concepts:

– Databases, Geographic Information Systems (GIS), geospatial and web technologies,
– Architectures for web-based temporal and spatial presentations used for various issues within environmental protection, EU directive INSPIRE.

Finally, a case study of development of complex information system for temporal and spatial presentations of environmental information will be analyzed:

– Development of Information system for management of water quality data in the Danube river basin will be explained (e.g., development method, user requirements, components of the system architecture, the selected programming tools and technologies, build-in functionalities, possibilities of dynamic temporal and spatial reporting through interactive Web-GIS application for authorized users);
– Data from the international Environmental Programme for the Danube River Basin (EPRDB) will be used in examples.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☒ multimedia, Internet network, Web ☐ laboratories ☐ mentorship ☒ other ___Consultations___

6. Comments							
7. Student responsibilities							
Attending lectures (with the possibility of coming to the consultations)							
8. Monitoring of student work[62]							
Class attendance	0,5	Class participation	0,2	Seminar paper		Experimental work	0,3
Written exam	1	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

- Monitoring of active participation in class during lectures, exercises and discussion of case studies
- In the case of a justified absence from the regular term for the written exam, attendants may request additional consultations before the new written exam period
- Assessment of learning outcomes through a written exam makes the overall grade for the course

10.Mandatory literature (at the time of submission of study programme proposal)

1. J. Hrebicek, G. Schimak, M. Kubasek, A.E. Rizzoli (Eds.), "Environmental Software Systems. Fostering Information Sharing", 10th IFIP WG 5.11 International Symposium, ISESS 2013, Neusiedl am See, Austria, October 2013, Proceedings; Series: IFIP Advances in Information and Communication Technology 413; ebook, Springer, 2013.
2. Oliver Gunther: "Environmnetal Information Systems", ebook, Springer Berlin Heidelberg, 2014.
3. T.M. Connolly, C.E. Begg: "Database Systems: A practical Approach to Design, Implementation, and Management", 6th edition, Global edition, Publisher: Pearson Education Limited, 2015.

11.Optional/additional literature (at the time of submission of the study programme proposal)

ICT-BASED SYSTEMS FOR ENVIRONMENTAL AND HEALTH MANAGEMENT

1. *Pečar-Ilić, J.*, Ružić, I. Application of GIS and Web technologies for Danube waterway data management in Croatia, Environmental Modelling & Software, Special issue Environmental Informatics, 21 (2006), 11, 1562-1571.
2. I. Ružić, *J. Pečar-Ilić*,"Review of Croatian ICT Research Activities on Sharing Environmental Information", Opportunities of SEIS and SISE: Integrating Environmental Knowledge in Europe, Proc. of European conf. TOWARDS eENVIRONMENT (Eds. J. Hrebicek et. al.), Brno, (2009) 494-501. (ISBN 978-80-210-4824-9). Referred in FP7 ICT-ENSURE Information System on Literature in the Field of ICT for Environmental Sustainability [http://iai-uiserv1.iai.fzk.de/ictensure/site?mod=litdb]
3. S. Davila, I. Bešlić, *J. Pečar-Ilić*, K. Šega. 2012. ICT activities for Air Quality Monitoring: An example of Network Stations of the City of Zagreb. Proc. of 26th Inter. Conf. Informatics for Environmental Protection-EnviroInfo. Sustainable Development and Risk Management. H.-K. Arndt, G. Knetsch, W.

[62] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Pillmann (Eds.), Dessau, Germany, 111-118 (ISBN 978-3-8440-1248-4, ISSN 1616-0886). Referred in FP7 ICT-ENSURE Literature Information System in the Field of ICT for Environmental Sustainability.

4. S. Davila, *J. Pečar Ilić*, I. Bešlić. 2015. Real-time dissemination of air quality information using data streams and Web technologies: linking air quality to health risks in urban areas. Archives of Industrial Hygiene and Toxicology 66 2:171-180.

MODELING OF ENVIRONMENTAL PROCESSES (data analysis, processing and visualization)

5. I. Ružić, *J. Pečar-Ilić*, N. Ivošević DeNardis, Mathematical model for kinetics of organic particle adhesion at an electrified interface, J. Electroanal. Chem., 642 (2010), 2, 120-126.
6. N. Ivošević DeNardis, I. Ružić, *J. Pečar-Ilić*, S. El Shawish, P. Ziherl. 2012. Reaction kinetics and mechanical models of liposome adhesion at charged interface. Bioelectrochemistry 88:48-56.
7. N. Ivošević DeNardis, *J. Pečar Ilić*, I. Ružić, G. Pletikapić. 2015. Cell Adhesion and Spreading at a Charged Interface: Insight into the Mechanism using Surface Techniques and Mathematical Modelling. Electrochim. Acta 176:743-754.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
J. Hrebicek, G. Schimak, M. Kubasek, A.E. Rizzoli (Eds.), "Environmental Software Systems. Fostering Information Sharing", 10th IFIP WG 5.11 International Symposium, ISESS 2013, Neusiedl am See, Austria, October 2013, Proceedings; Series: IFIP Advances in Information and Communication Technology 413; ebook, Springer, 2013.	5	5
Oliver Gunther: "Environmnetal Information Systems", ebook, Springer Berlin Heidelberg, 2014.	5	5
T.M. Connolly, C.E. Begg: "Database Systems: A practical Approach to Design, Implementation, and Management", 6th edition, Global edition, Publisher: Pearson Education Limited, 2015.	5	5

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Assess defined learning outcomes.
The learning process of students will continuously be evaluated based on their activity during lectures, exercises, discussions and analysis and of case studies.
After completion of the course students will through anonymous survey express their attitude towards the organization of teaching and course content.

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COURSE DESCRIPTION		
Course instructor	Prof. Jasenka Mršić-Pelčić, MD, PhD	
Lecturers	Prof. Siniša Tomić, PhD, Assoc. Prof. Goran Pelčić, MD, PhD	
Name of the course	Drug toxicology	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	1
	Number of class hours (L+E+S)	4+0+6
1. Course objectives		
To introduce the students with basic principles of drug toxicity; the latest directives in the treatment of acute/chronic poisoning; procedures for evaluation of drug toxicity from preclinical studies to clinical use; to develop critical approach towards toxicity of particular drug or drug groups; to learn basic legal regulative and acts related to drug toxicity.		
2. Course enrolment requirements		
3. Expected learning outcomes		
To describe and explain symptoms of poisoning with particular drugs or groups of drugs on target organs (toxicology of respiratory system, liver, kidneys, skin, eyes, central nervous system, reproductive and cardiovascular system, immunotoxicology) from preclinical to clinical perspectives; To analyse processes of pre-clinical testing and development of the drug; To explain and interpret the basic legal principles in the field of regulatory toxicology.		
4. Course content		
Drug toxicity; Immunotoxicology; Toxicology of respiratory system, liver, kidneys, skin, eyes, central nervous system, cardiovascular and reproductive system; Urgent situations in toxicology; Evaluation of drug toxicity (acute/chronic toxicity, carcinogenesis, mutagenesis, reproductive toxicity and teratogenesis, local irritability, ecotoxicity); Law regulations and regulative related to drug toxicity.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		
Regular attendance and active participation at the seminars/workshops.		

8. Monitoring of student work[63]							
Class attendance	0,3	Class participation		Seminar paper	0,3	Experimental work	
Written exam	0,4	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The knowledge and active participation of the students will be continuously monitored during classes and it will account for 70% of the final mark. The acquired knowledge will be evaluated on the final written exam (30% of the final mark). Evaluation of individual learning outcomes will be ensured through discussion and presentation during the course and on the final written exam where the questions will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

Francetić I, Vitezić D. Klinička farmakologija. Drugo, promijenjeno i dopunjeno izdanje, Medicinska naklada, 2014.
Faqi. A.S. (Editor) A Comprehensive Guide to Toxicology in Preclinical Drug Development Hardcover, Elesvier, 2012
Mršić-Pelčić J. Temelji toksikologije. U: Francetić I, Vitezić D. Klinička farmakologija. Drugo, promijenjeno i dopunjeno izdanje, Medicinska naklada, 2014.
Bradamante V, Mršić-Pelčić J. Pretkliničko ispitivanje lijekova. U: U: Francetić I, Vitezić D. Klinička farmakologija. Drugo, promijenjeno i dopunjeno izdanje, Medicinska naklada, 2014.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Timbrell JA. Principles of Biochemical Toxicology, Fourth Edition, Informa Healthcare, New York, 2009.
Dart RC i sur., Medical Toxicology, Third Edition, Lippincott, Williams & Wilkins, Philadelphia, 2004.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Francetić I, Vitezić D. Klinička farmakologija. Drugo, promijenjeno i dopunjeno izdanje, Medicinska naklada, 2014.	10	10
Mršić-Pelčić J. Temelji toksikologije. U: Francetić I, Vitezić D. Klinička farmakologija. Drugo, promijenjeno i dopunjeno izdanje, Medicinska naklada, 2014.	10	10
Faqi. A.S. (Editor) A Comprehensive Guide to Toxicology in Preclinical Drug Development Hardcover, Elesvier, 2012	2	10
Bradamante V, Mršić-Pelčić J. Pretkliničko ispitivanje lijekova. U: U: Francetić I, Vitezić D. Klinička farmakologija. Drugo, promijenjeno i dopunjeno izdanje, Medicinska naklada, 2014.	10	10

[63] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences
At the end of the lectures an anonymous poll will be provided among students regarding the Course (content and quality of lectures such as lecturers involved in the Course). The learning outcomes evaluation will be additionally based on the analysis of the successful response to specific issues.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Aleksandar Bulog, PhD	
Lecturers		
Name of the course	Ecotoxicology	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+10

1. Course objectives

Understanding and learning about relationships in ecotoxicology, getting to know the most important sources of anthropogenic pollution in the environment and linking scientific facts about sustainable development and management of health risks.

2. Course enrolment requirements

Inscribed the Doctoral Study: "Health and Environmental Engineering" on the Medical study of Rijeka.

3. Expected learning outcomes

- Define ecotoxicological concepts and distinguish between the main principles of interdependence of environmental pollutants and the maintenance of health of individuals and populations in an integrated environmental context.
- Classify and apply knowledge about the properties of environmental pollution, the principles of pollution and the interdependence of various environmental factors, and understand and evaluate the interrelationships with increased health risk in humans.
- Describe and explain the biological and physiological effects of environmental pollutants on the structure and function of molecules, cells, organs and organic systems in humans.
- Adopt and integrate scientific findings on the erosion of sustainable development and its use in planning and managing health risks.
- Assess the use of modern biomarkers to detect reversible and/or irreversible molecular changes in the negative impacts of environmental pollutants on human health and assess the viability of their use in modern scientific and professional biomedical research.

4. Course content

Principles and elaboration of concepts in ecotoxicology. Pollutants and their behavior in the ecosystem. The major classes of pollutants (organic pollutants: PCBs, PAHs, BTEX, carbamate and pyrethroid insecticides, phenoxy herbicides, detergents, organometallic compounds radioactive isotopes, gaseous pollutants-DEP). Roads which contaminants entering the ecosystem. Complex paths and modes of movement of contaminants in the environment. The behavior of metals and radioactive isotopes in contaminated ecosystems. The behavior of organic pollutants separately in species and ecosystem. Tests to determine the toxicity and biochemical effects of contaminants. Physiological effects of contaminants at the level of molecules on the cell level, at the level of organs and at the level of the whole organism, the behavior of aquatic animals-aquatic toxicity tests. Interactive effects of contaminants. Biomarkers in ecotoxicology: classification, specificity, relationship to various adverse effects, action at various levels of biological

integration, different number of examples. Biological monitoring in terrestrial, aquatic and marine ecosystems. Evaluation of resistance to contaminants. Risk assessment in ecotoxicology. Basic principles of ecogenetics and ecotoxicological examples. GM organisms and the risks to the environment. Changes in communities and in the ecosystem. Using modern biomarkers in human population studies and practical examples.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☒ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments	/	

7. Student responsibilities

Participation in lectures and seminars, independent study work, written examination.

8. Monitoring of student work[64]

Class attendance	0,4	Class participation	0,3	Seminar paper	0,6	Experimental work	
Written exam	0,7	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

It is evaluated and recorded attending and participation of each student on classes and seminars. The definition of ecotoxicological concepts, classification of environmental pollutants, quality of description and explanation of biological and physiological effects has been assessed at different levels of biological integration and the application of the student's knowledge based on the final evaluation of the seminar, the quality of writing and presentation presented to the course manager and other colleagues. The knowledge gained, the integration of the acquired knowledge on practical examples, the adoption and use of knowledge on the processed course material will be evaluated on the final written exam that will be held after lectures and seminars. Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the seminar presentation and the final written exam on which the issues will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

- C.H.Walker, S.P.Hopkin, R.M.Sibly, D.B.Peakall : Principles of Ecotoxicology, Second Edition, Taylor and Francis, London (2001).
- Tahir Sofilić: Ecotoxicology, University of Zagreb, Faculty of Metallurgy, Sisak 2014.
- C.H.Walker, S.P.Hopkin, R.M.Sibly, D.B.Peakall: Principles of Ecotoxicology, Taylor and Francis, London (1997).

[64] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

- G.H.Degen, J.P.Seiler, P.Bentley (eds.): Toxicology in Transition, Arhives of Toxicology, Suppl.17, Springer-Verlag, New York-Berlin (1995).
- M.A.Levin, H.S.Strauss: Risk Assessment in Genetic Engineering, Mc Graw Hill Inc., New York (1991).
- S.A.Levin, M.A.Harwell, J.B.Kelly, K.D.Kimball : Ecotoxicology-Problems and Approaches. Springer Verlag, New York-Berlin (1989).

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Kraljević Pavelić, Sandra; Micek, Vedran; Filošević, Ana; Gumbarević, Darko; Žurga, Paula; Bulog, Aleksandar; Orct, Tatjana; Yamamoto, Yasuaki; Preočanin, Tajana; Plavec, Janez; Peter, Robert; Petravić, Mladen; Vikić-Topić, Dražen; Pavelić, Krešimir.
  Novel, oxygenated clinoptilolite material efficiently removes aluminium from aluminium chloride-intoxicated rats in vivo. // Microporous and mesoporous materials. 249 (2017) ; 146-156. URL link to work
- Lekić, Andrica; Brekalo, Zdrinko; Kvesić, Ante; Kovačević, Miljanko; Baričev Novaković, Zdenka; Šutić, Ivana; Bulog, Aleksandar; Šutić, Ingrid; Pavišić, Valentino; Mrakovčić-Šutić, Ines.
  Crosstalk Between Enzyme Matrix Metalloproteinases 2 and 9 and Regulatory T Cell Immunity in the Global Burden of Atherosclerosis. // Scandinavian journal of immunology. 86 (2017) , 1; 65-71. URL link to work
- Brajenović, Nataša; Brčić Karačonji, Irena; Bulog, Aleksandar.
  Evaluation of urinary BTEX, nicotine and cotinine as biomarkers of airborne pollutants in non-smokers and smokers. // Journal of toxicology and environmental health. Part A. 78 (2015) , 17; 1133-1136. URL link to work
- Bulog, Aleksandar; Brčić Karačonji, Irena; Šutić, Ivana; Mićović, Vladimir.
  Immunomodulation of cell-mediated cytotoxicity after chronic exposure to vapors.// Collegium antropologicum. 35 (2011) , S2; 61-64. URL link to work
- Bulog, Aleksandar; Mićović, Vladimir; Šuljić, Petra; Mrakovčić-Šutić, Ines.
  Determination of enzyme matrix metalloproteinases-9 and immune status as indicators of development of the environmental diseases. // Collegium antropologicum. 35 (2011) , S2; 153-156. URL link to work
- Mićović, Vladimir; Bulog, Aleksandar; Kučić, Natalia; Jakovac, Hrvoje; Radošević-Stašić, Biserka.
  Metallothioneins and heat shock proteins in marine mussels as sensors of environmental pollution in Northern Adriatic Sea. // Environmental Toxicology and Pharmacology. 28 (2009) , 3; 439-447. URL link to work
- Mićović, Vladimir; Vojniković, Božidar; Bulog, Aleksandar; Čoklo, Miran; Malatestinić, Đulija; Mrakovčić-Šutić, Ines.
  Regulatory T cells (Tregs) Monitoring in Environmental Diseases. // Collegium Antropologicum. 33 (2009) , 3; 743-746.
- Grebić, Damir; Jakovac, Hrvoje; Mrakovčić-Šutić, Ines; Tomac, Jelena; Bulog, Aleksandar; Mićović, Vladimir; Radošević-Stašić, Biserka.
  Short-term exposure of mice to gasoline vapor increases the metallothionein expression in the brain, lungs and kidney. // Histology and Histopathology. 22 (2007) , 6; 593-601.
- Heinrich-Ramm R, Jakubowki M, Heinzow B, Molin Christensen J, Olsen E, Hertel O. Biological monitoring for exposure to volatile organic compounds (VOCs). Pure Appl Chem 2000;72:385-436.
- Crebelli R, Tomei F, Zijno A i sur. Exposure to benzene in urban workers: environmental and biological monitoring of traffic police in Rome. Occup Environ Med 2001;58:165-171.
- Ines Mrakovčić-Šutić, Vladimir Mićović, Aleksandar Bulog, Đulija Malatestinić, Zdenka Baričev-Novaković. The role of regulatory t cells (tregs) in environmental diseases // Advances in Research

& Management of Asthma and COPD - Proceedings of the World Asthma and COPD Forum / Sepiashvili R. (ur.). Bologna Italy : Medimond S. r.I. 2008. Str. 82-87.

- Kouniali A, Cicolella A, Gonzalez-Flesca N, Dujardin R, Gehanno JF, Bois F. Environmental benzene exposure assessment for parent-child pairs in Rouen, France. Sci Total Environ 2003;308:73-82.
- Vladimir Mićović, Aleksandar Bulog, Ines Mrakovčić-Šutić. The role of chronic exposure to gasoline and diesel on cell mediated immunity of people situated near gasoline industry // 13th International Congress of Immunology, Rio de Janeiro (Brazil), August 21-25, 2007. / Jorge Kalil, Edecio Cunha-Neto, Luiz Vicente-Rizzo (ur.). Bologna, Italy : Medimond S.r.I. 2007. Str. 313-316.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
C.H.Walker, S.P.Hopkin, R.M.Sibly, D.B.Peakall: Principles of Ecotoxicology, Taylor and Francis, London (1997).	1	10
Tahir Sofilić: Ecotoxicology, University of Zagreb, Faculty of Metallurgy, Sisak, 2014.	1	10
C.H. Walker, S.P.Hopkin, R.M. Sibly, D.B. Peakall : Principles of Ecotoxicology, Second Edition, Taylor and Francis, London (2001).	1	10
G.H.Degen, J.P.Seiler, P.Bentley (eds.): Toxicology in Transition, Arhives of Toxicology, Suppl.17, Springer-Verlag, New York-Berlin (1995).	1	10
M.A.Levin, H.S.Strauss: Risk Assessment in Genetic Engineering, Mc Graw Hill Inc., New York (1991).	1	10
S.A.Levin, M.A.Harwell, J.B.Kelly, K.D.Kimball (eds.): Ecotoxicology: Problems and Approaches. Springer Verlag, New York-Berlin (1989).	1	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

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COURSE DESCRIPTION		
Course instructor	Prof. Olivera Koprivnjak, PhD	
Associate instructor	Asst. Prof. Valerija Majetić Germek, PhD	
Lecturers	Food safety	
Name of the course	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Study programme	elective course	
Status of the course	I., II., III.	
Year of study	ECTS student 's workload coefficient	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+10

1. Course objectives

To enable students for the application of principles, standards and regulations referred to the food safety insurance and management.

2. Course enrolment requirements

-

3. Expected learning outcomes

After passing the exam, students will be able to:

- ✓ explain the criteria for classifying food as harmful to health or unfit for human consumption
- ✓ provide examples of biological, chemical or physical hazards with relevant preventive measures from the domain of good manufacturing and good hygienic practice
- ✓ use regulations when defining food safety criteria
- ✓ use regulations when defining obligation of food business operators regarding prerequisite programs
- ✓ define the terms traceability, recall and withdrawal of unsafe food
- ✓ describe the purpose and organization of the Rapid Alert System for Food and Feed (RASFF)
- ✓ explain the risk assessment principle of physical, chemical or biological hazards in a production plant or process
- ✓ explain using an example the characteristics and purpose of setting operational prerequisite programs (oPRP)
- ✓ explain using an example the target limits and procedures for removing inefficiency or non-conformance at control points
- ✓ explain using an example the critical limits and corrective actions at critical control points
- ✓ list the main characteristics of certification schemes or standards related to food safety management systems

4. Course content

Food safety (definition of food safety, categories of unsafe food, types of hazards in food – physical, biological and chemical; regulations defining the criteria of food safety – allowed levels and forms of particular hazards)

Legislation and food safety policy in EU (features of traditional and contemporary approaches; general food law in EU, EU regulations related to food business operators, regulations related to the national

competent authorities, obligation to establish a comprehensive system of traceability, Rapid Alert System for Food and Feed (RASFF).
Good manufacturing and hygienic practice (prerequisite programs – PrP, standard operating procedures – SOP, guidebooks for good manufacturing practice – GMP and good hygienic practice – GHP).
Food safety management systems (HACCP system, risk assessment in a production plant or process; operational prerequisite programs (oPRP), control points – CP, critical control points – CCP, standards / certification schemes related to food safety and quality management).
Specificities of certain types of food industry in the domain of food safety (specific hazards associated with raw materials and procedures of processing, product storage and distribution; actions aimed to monitoring and control of specific hazards; specific standards, regulations and guidelines; case reports of crisis situations).

5. Manner of instruction	✓ lectures ✓ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Attending courses; collecting data and making presentations on a selected topic; exam.

8. Monitoring of student work[65]

Class attendance	0,7	Class participation		Seminar paper	0,6	Experimental work	
Written exam	0,7	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Presentation of the seminar will be evaluated based on the performance evaluation of independent finding and use of literature and materials for presentation, coverage of all aspects of the topic as well as comprehensibility and logic sequence of presentation. Evaluation of the written exam will be based on the percentage of correct answers.

10. Mandatory literature (at the time of submission of study programme proposal)

✓ Power Point lectures
✓ Olivera Koprivnjak: Kvaliteta, sigurnost i konzerviranje hrane (*e-textbook*), Medicinski fakultet Sveučilišta u Rijeci, Rijeka, 2014.

11. Optional/additional literature (at the time of submission of the study programme proposal)

✓ Laws, regulations, standards and guidelines in the field of food safety
✓ Ivona Babić, Jelena Đugum i sur.: Uvod u sigurnost hrane, Inštitut za sanitarno inženirstvo, Ljubljana 2014.

[65] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

✓ Jasmina Havranek, Milna Tudor Kalit i sur.: Sigurnost hrane od polja do stola, MEP, Zagreb 2014. ✓ https://www.foodsafetymagazine.com/magazine-archive1/

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Olivera Koprivnjak: Kvaliteta, sigurnost i konzerviranje hrane (*e-textbook*), Medicinski fakultet Sveučilišta u Rijeci, Rijeka, 2014.	10	*10*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

The survey participants on: the organization of teaching, the usefulness of educational content, the availability of information on the course, the degree to which learning outcomes are achieved.

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COURSE DESCRIPTION		
Course instructor	Prof. Dražen Lušić, PhD	
Lecturers		
Name of the course	Food risk analysis	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	20+0+10

1. Course objectives

The aim of this course Is to instigate a student to apply the principles and norms in the framework of food risk analysis as a complex process that, in addition to risk assessment of food-borne diseases, includes risk management and reporting of risk assessment results.

2. Course enrolment requirements

Standard requirements regarding the entering to the elective courses from Module 10 - "Food Safety"

3. Expected learning outcomes

After passing the exam the “Food Safety Analysis”, the student should be able to:

- To independently use terminology of risk analysis,
- To assess the adequacy of the selected process in the process of risk assessment of food-borne diseases.
- To describe the basic procedures and tools used for risk analysis and food safety assurance.
- To Identify and explain tools and procedures of risk analysis in food
- To participate in decision making and information transfer process toward interested parties in the food chain.

4. Course content

Basic principles of risk assessment, risk management and risk communication. Terminology. Concepts. Tools and Techniques. Different models.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments	Teaching is carried out according to the curriculum publicly available on the faculty's web pages (http://www.medri.uniri.hr) and in the Archives of the Student Office Coordinator as well as the Vice-Dean responsible for the study of Sanitary Engineering. The offered framework of the course may be changed to a lesser extent during the course, depending on the student's	

	expressed interest in specific content, their suggestions and expressed willingness to access individual topics. Teaching is carried out according to the curriculum that is publicly available on the faculty's web pages (http://www.medri.uniri.hr) and in the Archives of the Study Guide and the Prodekan responsible for the study of sanitary engineering. Academic integrity Teaching will be carried out in accordance with academic business ethics, based on the provisions of the Code of Ethics of the University of Rijeka. During the course, students' academic behavior is expected in accordance with the provisions of the Code of Ethics for Students at the University of Rijeka. Any form of violation of the normal teaching process will not be tolerated. In such situations, the provisions of the Ordinance on Studies at the University of Rijeka and the Statute of the Faculty of Medicine of the University of Rijeka shall apply. Contacting the teacher Contacting the teacher will take place as follows: – During classes – In the anticipated term for consultations – By electronic means. To accomplish this form of communication, students will be asked for an electronic contact address at the beginning of their classes. When contacting teachers, students must comply with the terms for consultation and take into account the reasonable time to answer in case of contact of the teacher through electronic mail. In the event of a inability (leave, leave, leave, sick leave, etc.), the teacher will communicate with the students again after returning to the workplace. Information about the subject – Students will receive all information about the subject, the teaching procedure, the obligations and the rights, the schedule of classes and the forms of instruction during the introductory lecture. Possible explanations are also possible during the course of the course. – All official information to be transmitted during the above introductory lecture as well as additional official notices during the semester will be available on the web pages of the Postgraduate Study (http://www.medri.uniri.hr/en/studenti/poslijediplomski-sveucilisni- PhD-studies / health-and-ecological-inzenjerstvo.html) – The student's obligation is to regularly inform themselves about the current contents of the Course, by contacting the official Web

	site of the Postgraduate Study and the teachers in the terms provided. Informing the students about all relevant content will also be carried out through a common electronic e-mailing list, based on the obtained contact data from the students themselves (ie faculty student services, if available)

7. Student responsibilities

To respect the hour schedule according to the published curriculum plan; Regular attendance to all forms of teaching; Successfully make thematic seminars, which includes: review of the default literature; preparation of the presentation of the reading text; active participation in the discussion within the seminar group. Successful completion of a practical seminar including the completion of a self-assigned assignment by the course leader where the student must be able to interpret the information gathered during the analysis of the given process as well as to actively participate in the discussion within the seminar group.

8. Monitoring of student work[66]

Class attendance	0,5	Class participation	0,5	Seminar paper	0,5	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the seminar paper and the final written exam on which the issues will be in line with the expected learning outcome. Passing threshold for each activity is reaching the 50% of assessment points. The exam can be accessed by a student who attended at least 50% of the classes during the course, who collected at least 50 points of grade and fulfilled the conditions prescribed by the Rules of the University of Rijeka.

10. Mandatory literature (at the time of submission of study programme proposal)

- Teaching materials with lectures
- Ivona Babić i Jelena Đugum at al. "Introductory to Food Safety", Ljubljana, 2014 (Book, Croatian version)
- Food Law (Official Gazette, No. 81/13, 14/14, 30/15, 115/18) - Internet access

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Vasić, Vesna; Gašić, Uroš; Stanković, Dalibor; Lušić, Dražen; Vukić Lušić, Darija; Milojković-Opsenica, Dušanka; Tešić, Živoslav; Trifković, Jelena. Towards better quality criteria of European honeydew honey: Phenolic profile and antioxidant capacity. // Food Chemistry. 274 (2019) , February; 629-641
- Tariba Lovaković, Blanka; Lazarus, Maja; Brčić Karačonji, Irena; Jurica, Karlo; Živković Semren, Tanja; Lušić, Dražen; Brajenović, Nataša; Pelaić, Zdenka; Pizent, Alica. Multi-elemental composition and

[66] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

antioxidant properties of strawberry tree (*Arbutus unedo* L.) honey from the coastal region of Croatia: Risk-benefit analysis. // Journal of trace elements in medicine and biology. 45 (2018) ; 85-92

- Gobin, Ivana; Crnković, Goranka; Magdalenić, Maja; Begić, Gabrijela; Babić, Ana; Lušić, Dražen; Vučković, Darinka. Antibacterial potential of Croatian honey against antibiotic resistant pathogenic bacteria. // Medicinski glasnik Ljekarske komore Zeničko-dobojskog kantona. 15 (2018) , 2; 139-144
- Vukić Lušić; Darija, Đandara, Andrea; Piškur Vanda; Linšak, Željko; Bilajac, Lovorka; Lušić, Dražen. Zdravstvena ispravnost vode za piće u Gorskom kotaru u petogodišnjem razdoblju od 2011. do 2015.. // Medicina Fluminensis (0025-7729). 53 (2017) , 2; 216-224
- Jurica, Karlo; Brčić Karačonji, Irena; Lasić, Dario; Vukić Lušić, Darija; Anić Jurica, Sonja; Lušić, Dražen. Determination of phthalates in plum spirit and their occurrence during plum spirit production. // Acta alimentaria. 45 (2016) , 1; 141-148
- Milojković Opsenica, Dušanka; Ristivojević, Petar; Trifković, Jelena; Vovk, Irena; Lušić, Dražen; Živoslav, Tešić. TLC Fingerprinting and Pattern Recognition Methods in the Assessment of Authenticity of Poplar-Type Propolis. // Journal of chromatographic science. 54 (2016) , 7; 1077-1083
- Gašić, Uroš M.; Natić, Maja M.; Mišić, Danijel M.; Lušić, Darija V.; Milojković-Opsenica, Dušanka M.; Tešić, Živoslav Lj.; Lušić, Dražen. Chemical markers for the authentication of unifloral *Salvia officinalis* L. honey. // Journal of food composition and analysis. 44 (2015) ; 128-133
- Milojković Opsenica, Dušanka; Lušić, Dražen; Tešić, Živoslav. Modern analytical techniques in the assessment of the authenticity of Serbian honey. // Arhiv za higijenu rada i toksikologiju. 66 (2015) , 4; 233-241
- Gobin, Ivana; Vučković, Darinka; Lušić, Dražen. Antibakterijska svojstva meda. // Medicina : glasilo Hrvatskoga liječničkoga zbora, Podružnica Rijeka. 50 (2014) , 2; 150-157
- Jurica, Karlo; Uršulin-Trstenjak, Natalija; Vukić Lušić, Darija; Lušić, Dražen; Šmit, Zdenko. Izloženost ftalatima i njihova pojavnost u alkoholnim pićima. // Archives of Industrial Hygiene and Toxicology. 64 (2013) , 2; 317-325
- Smerdel, Bojana; Pollak, Lea; Novotni, Dubravka; Čukelj, Nikolina; Benković, Maja; Lušić, Dražen; Ćurić, Duška.
  Improvement of gluten-free bread quality using transglutaminase, various extruded flours and protein isolates. // Journal of food and nutrition research. 51 (2012) , 4; 242-253
- Jerković, Igor; Marijanović, Zvonimir; Malenica Staver, Mladenka; Lušić, Dražen. Volatiles from a Rare *Acer* spp. Honey Sample from Croatia. // Molecules. 15 (2010) , 7; 4572-4582
- Lušić, Dražen; Koprivnjak, Olivera; Ćurić, Duška; Sabatini, Anna G.; Conte, Lanfranco S. Volatile Profile of Croatian Lime (Tilia sp.) Tree, Fir (Abies alba) Honeydew and Sage (Salvia officinalis) Honeys. // Food Technology and Biotechnology. 45 (2007) , 2; 156-165

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
Ivona Babić i Jelena Đugum sa suradnicima: „Uvod u sigurnost hrane“, Ljubljana, 2014 (knjiga, hrvatsko izdanje)	*5*	*5*
Zakon o hrani (Narodne novine, broj 81/2013, 14/2014) – internet pristup	*5*	*5*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

A detailed breakdown of the elements that are evaluated in accordance with the aforementioned Student Evaluation System. Continuous modification of teaching material, and thus knowledge transfer, with the latest achievements, processes and legal acts in the Food Risk Analysis Sector. Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

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COURSE DESCRIPTION		
Course instructor	Prof. Sandra Pavičić Žeželj, PhD	
Lecturers	Asst. Prof. Igor Dubrović, PhD	
Name of the course	Recent advances of nutrition application in health	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	5+5+10
1. Course objectives		
To introduce students nutrients that have a potential protective role in the human body for diseases, especially chronic non-communicable diseases (obesity, diabetes, cardiovascular diseases, inflammatory diseases, cancers). Students are introduced to dietary sources of protective nutrients, with classification and mechanisms of action on human health.		
2. Course enrolment requirements		
Standard conditions for enrollment of elective courses.		
3. Expected learning outcomes		
- Define and explain nutrients that have a protective role in the body - Describe and define mechanisms of action of protective nutrients - Identify and isolate nutrient sources that play a protective role in food - Explain the application of protective nutrition to the prevention and treatment of chronic non-communicable diseases - Use and evaluate scientific and professional literature for lifelong learning and career advancement - Present and explain the results of their work - Follow of new cognitions about nutrition to improve health		
4. Course content		
Classification of protective nutrients and their protective effect on health; Application of protective nutrients in functional foods; Mechanisms of action and application of protective nutrients in the prevention and treatment of chronic non-communicable diseases; Applying protective nutrients with recent dietary trends (Mediterranean Diet, Paleo Diet, Anti-Inflammation Diet) and personalized nutrition.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		
7. Student responsibilities		

Students are required to regularly attend and actively participate in all forms of teaching.

8. Monitoring of student work[67]

Class attendance	0,7	Class participation		Seminar paper	0,5	Experimental work	0,3
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the seminar paper and the final written exam on which the issues will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

1. Lectures prepared for the course
2. Minihane AM et al. Low-grade inflammation, diet composition and health: current research evidence and its translation. Br J Nutr. 2015; 14;114(7):999-1012.
3. Varadharaj S, Kelly OJ, Khayat RN, Kumar PS, Ahmed N, Zweier JL. Role of Dietary Antioxidants in the Preservation of Vascular Function and the Modulation of Health and Disease. Front Cardiovasc Med. 2017 :1;4:64.
4. Verma M, Hontecillas R, Abedi V, et al. Modeling-Enabled Systems Nutritional Immunology. Frontiers in Nutrition. 2016;3:5.
5. Shlisky J, Bloom DE, Beaudreault AR, et al. Nutritional Considerations for Healthy Aging and Reduction in Age-Related Chronic Disease. Advances in Nutrition. 2017;8(1):17-26.
6. Weaver CM. Bioactive Foods and Ingredients for Health. Advances in Nutrition. 2014;5(3):306S-311S.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1.Sandra Pavičić Žeželj, Ana Tomljanović, Gordana Kenđel Jovanović, Greta Krešić, Olga Cvijanović Peloza, Nataša Dragaš Zubalj and Iva Pavlinić Prokurica. Prevalence, Knowledge and Attitudes Concerning Dietary Supplements among a Student Population in Croatia. Int. J. Environ. Res. Public Health 2018, 15(6), 1058.
2.Sandra Pavičić Žeželj, Gordana Kenđel Jovanović, Nataša Dragaš Zubalj, Vladimir Mićović and Željko Sesar. Associations between Adherence to the Mediterranean Diet and Lifestyle Assessed with the MEDLIFE Index among the Working Population. Int. J. Environ. Res. Public Health 2018, 15(10), 2126.
3.Žeželj SP, Cvijanović O, Mićović V, Orlić ZC, Malatestinić G. Effect of Menopause, Anthropometry, Nutrition and Lifestyile on bone status of Women in the Northern Mediterranenan. West Indian Med J. 2010;59(5):494-502.
4.Kenđel Jovanović G, Pavičić Žeželj S, Malatestinić Đ, Mrakovčić Šutić I, Nadarević Štefanec I, Dorčić F. Diet Quality of Midlle Age and Older Women from Primorsko-Goranska County Evaluated by Healthy Eating Index and Association with Body Mass Index. Coll Antropol. 2010; 34: Suppl 2. 155-160.
5.Kenđel Jovanović G, Krešić G, Pavičić Žeželj S, Mićović V, Štefanac Nadarević V. Cancer and Cardiovascular Diseases Nutrition. Knowledge and Dietary Intake of Medical Students. Coll Antropol. 2011; 35:765-74.

[67] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

6.Cvijanović O, Pavičić Žeželj S, Lukanović S, Bićanić N, Domitrović R, Bobinac D, Crnčević Orlić Ž. Osteoporosis and Nutrition-Nutrition, Anthropometry and Bone Mineral Density in Women. In book Topics in Osteoporosis. Published by INTECH 2013;179-192.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
All publications - free availability on the public internet	*10*	*10*

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

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COURSE DESCRIPTION		
Course instructor	Prof. Nada Starčević Čizmarević, PhD	
Lecturers	Assoc. Prof. Jadranka Vraneković, PhDAsst. prof. Gordana Kenđel Jovanović, PhD	
Name of the course	Genetic Diseases and Environmental Factors	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	(12+0+2)

1. Course objectives

This course will provide a scientific understanding of heredity in genetic diseases and of importance of environmental factors in the development of complex polygenic diseases. The purpose is to understand the interaction between genes and environmental factors (viruses, toxins, nutrition). Explanation of that interaction and epigenetic processes which integrate influences from the genes and the environment enable us to act preventively on environmental factors that contribute to the development of diseases in genetically susceptible persons.

2. Course enrolment requirements

/

3. Expected learning outcomes

After completed program the students will be capable to:

- explain the association of mutagenic environmental factors with the formation of mutations and their consequences in the development of disease
- distinguish types of inheritance in monogenic diseases and recognize non-Mendelian inheritance
- define epigenetic modification
- explain principles of polygenic inheritance and understand how multifactorial influences lead to the development of a complex diseases
- explain the interaction of nutrients and / or their metabolites with the human genome and their impact on development but also on the prevention of disease
- recognize approaches in the study of genes and environmental factors involved in development of complex diseases
- Through these students will acquire knowledge, skills and attitudes about genetic principles, epigenetic mechanisms and the interaction of genes and the environment in the development of complex diseases.

4. Course content

This course will cover principles of human genetics, molecular basis and patterns of inheritance, polygenic and multifactorial inheritance, human gene disorders and application of DNA technology in diagnosis and population screening; environmental and genetic factors in common diseases, interpretation of new knowledge about the effect of diet on human genome as well as on development and prevention of chronic

diseases (cardiovascular disease, diabetes mellitus, obesity…); genetics of celiac disease and the role of HLA genes; genetics of multiple sclerosis and role of the viruses, microbiome and iron accumulation; genetics of schizophrenia and deficit of membrane polyunsaturated fatty acids in the etiology of the metabolic syndrome; the influence of MTHFR genes and folic acid during periconception period in the prevention of neural tube defect.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments		

7. Student responsibilities

Lesson attendance and active participation in education.

8. Monitoring of student work[70]

Class attendance	0,5	Class participation		Seminar paper	0,5	Experimental work	
Written exam	0,5	Oral exam	0,5	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluating in the ECTS system is made by absolute distribution. The total success consists of performance during class and final exam. Student can collect 0,5 ECTS by engagement in seminar. Additional 1,5 ECTS the student can get during final examination (written exam 1,0 ECTS and oral exam 0,5 ECTS). To achieve ECTS on final exam, student student must fulfill more than 50% of the written test.

10. Mandatory literature (at the time of submission of study programme proposal)

- Turnpenny PD, Ellard S (2018): Emery's Elements of Medical Genetikcs, 15th Edition, Elsevier.
- Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard (2016): Genetics in Medicine, 8th edition, Saunders Elsevier.
- Nadalin S et al. Etiopathogenesis of metabolic syndrome in schizophrenia – recent findings. Medicina Fluminensis. 2017; 53:27-42.
- Starčević Čizmarević N et al. Genes and celiac disease. Paediatr Croat. 2015;59(2):88-94.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Fallaize R et al. APOE genotype influences insulin resistance, apolipoprotein CII and CIII according to plasma fatty acid profile in the Metabolic Syndrome. Scientific Reports, 2017; 7:6274.
- Didonna A and Jorge R. Oksenberg. The Genetics of Multiple Sclerosis. In: Zagon IS, McLaughlin PJ. Multiple Sclerosis: Perspectives in Treatment and Pathogenesis. Brisbane (AU): Codon Publications; 2017.
- Ristić S, Starčević Čizmarević N et al. Angiotensin-converting enzyme insertion/deletion gene polymorphism in multiple sclerosis: a meta-analysis. Neurological Sciences 2016;37:1955-9

[70] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

- Wekerle H. Nature plus nurture: the triggering of multiple sclerosis. Swiss Med Wkly. 2015; 145:14189.
- Matzaraki V et al. The MHC locus and genetic susceptibility to autoimmune and infectious diseases. Genome Biol. 2017;18(1):76.
- Heianza Y, Qi L. Gene-Diet Interaction and Precision Nutrition in Obesity. Int J Mol Sci. 2017 7;18(4): E787
- Corella D, Ordovás JM. Aging and cardiovascular diseases: the role of gene-diet interactions. Ageing Res Rev. 2014;18:53-73.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Turnpenny PD, Ellard S (2018): Emery's Elements of Medical Genetikcs, 15th Edition, Elsevier.	3	15
Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard (2016): Genetics in Medicine, 8th edition, Saunders Elsevier.	3	15
all titles are available in electronic version provided by course coordinator		

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

An anonymous survey about the performance of the course through a questionnaire for evaluating learning outcomes, evaluation of knowledge and the quality of teaching.

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COURSE DESCRIPTION		
Course instructor	Prof. Darija Vukić Lušić, PhD	
Lecturers	Prof. Luka Traven, PhD	
Name of the course	Water air pollution	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	7+0+8

1. Course objectives

The aim of this course is to encourage students critically to evaluate the problems related to water pollution. The course focuses on improving the understanding of the water pollution process and selecting ways of remedial measures of water pollution from different sources.
In addition, the student will distinguish basic physical characteristics of the atmosphere, meteorology, the major sources and categories of air pollutants, ways of their distribution in the atmosphere, and will be familiar and up to date on the most current air pollution abatement measures and technologies. Students will compare ways of estimating population level exposure to certain levels of air pollution as well as air pollution risk characterization and management.

2. Course enrolment requirements

Completed graduate degree program. Courses related to chemical and microbiological pollution of the environment (hydrosphere, biosphere).
Knowledge of elementary physics and general chemistry. General knowledge of descriptive and inferential statistics.

3. Expected learning outcomes

1) Identify the potential sources and ways of water pollution
2) Specify the type of contaminants in water
3) Analyse possible impact of pollutants on the quality of drinking water and recreational water
4) Interpret existing legislation
5) Differentiate analytical methods used in water quality testing
6) Describe and analyse actual examples of water pollution
7) Distinguish the types and characteristics of air pollutants
8) Describe ways meteorology influences air quality
9) Propose air quality monitoring measures and air pollution abatement measures
10) Evaluate potential health air pollution risks.

4. Course content

Natural water quality. Sources of inorganic and organic pollutants and their specific characteristic. Possible risks. Analytical methods in testing of water quality. Regulations concerning quality and categorization of water.
Atmosphere: structure and composition. Temperature inversions. Major categories and sources of air pollutants. Physical and chemical characteristics of pollutants in the atmosphere. Photochemical smog.

Stationary sources of air pollution. Motor vehicle emissions. Air quality limit and target values. Averaging times. Air pollution control and abatement measures and technologies. Exposure to air pollutants and characterization and management of health and environmental risks.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Students are required to realize the Seminar paper about the approved topic. Lectures precede to the writing of the essay. Students receive detailed instructions about the structure of the essay and the elements that are taken into consideration for the evaluation.

8. Monitoring of student work[71]

Class attendance	0,3	Class participation	0,2	Seminar paper	0,8	Experimental work	
Written exam	0,7	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Students will be evaluated based on the attendance and activity during the lectures, seminars and final written exam. Passing threshold for each activity is reaching the 50% of assessment points.

10. Mandatory literature (at the time of submission of study programme proposal)

Sullivan P., Agardy F., Clark J., (2005) The Environmental Science of Drinkig Water, Elsevier (Butherworth Heinemann).
Masters, G. M. & Ela, W. P. 2007. Introduction to Environmental Engineering and Science (3rd Edition). Prentice Hall.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Luna GM, Manini E, Turk V, Tinta T, D'Errico G, Baldrighi E, Baljak V, Buda D, Cabrini M, Campanelli A, Cenov A, Del Negro P, Drakulović D, Fabbro C, Glad M, Grilec D, Grilli F, Jokanović S, Jozić S, Kauzlarić V, Kraus V, Marini M, Mikuš J, Milandri S, Pećarević M, Perini L, Quero GM, Šolić M, **Vukić Lušić D**, Zoffoli S (IN Press) Status of faecal pollution in ports: A basin-wide investigation in the Adriatic Sea, Marine Pollution Bulletin
- Mance D, Mance D, **Vukić Lušić D** (2018). Marine Pollution Differentiation with Stable Isotopes of Groundwater. Scientific Journal of Maritime Research. 32(1),80-87.
- Mance D, Mance D, **Vukić Lušić D** (2018) Environmental isotope 18O in coastal karst spring waters as a possible predictor of marine microbial pollution. Acta Adriatica. 59(1),3-16
- Cenov, A; Perić, L; Glad, M; Žurga, P; **Vukić Lušić, D**; Traven, L; Tomić Linšak, D; Linšak, Ž; Devescovi, M; Bihari, N (2018) A baseline study of the metallothioneins content in digestive gland of the Norway

[71] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

lobster Nephrops norvegicus from Northern Adriatic Sea: Body size, season, gender and metal specific variability, Marine Pollution Bulletin. 131, 95-105

- Jozić S; **Vukić Lušić D**; Ordulj M; Frlan E; Cenov A; Diković S; Kauzlarić V; Fiorido Đurković L; Stilinović Totić J; Ivšinović D; Eleršek N; Vucić A; Peroš-Pucar D; Unić Klarin B; Bujas L; Puljak T; Mamić M; Grilec D; Jadrušić M; Šolić M (2018) Performance characteristics of the temperature-modified ISO 9308-1 method for the enumeration of Escherichia coli in marine and inland bathing waters, Marine Pollution Bulletin. 135, 150-158
- **Vukić Lušić D**, Kranjčević L, Mačešić S, Lušić D, Jozić S, Linšak Ž, Bilajac L, Grbčić L, Bilajac N (2017) Temporal variations analyses and predictive modeling of microbiological seawater quality, Water Research 119, 160-170
- **Vukić Lušić D**, Đandara A, Piškur V, Linšak Ž, Bilajac, L Lušić, D (2017) Zdravstvena ispravnost vode za piće u Gorskom kotaru u petogodišnjem razdoblju od 2011. do 2015., Medicina Fluminensis, 2, 216-224
- **Vukić Lušić D**, Jozić S, Cenov A, Glad M, Bulić M, Lušić D (2016) Escherichia coli in marine water: comparison of methods for the assessment of recreational bathing water samples, Marine Pollution Bulletin, 13, 1-2; 438-443.
- Bakarčić D, Ivančić Jokić N, Negovetić Vranić D, Majstorović M, **Vukić Lušić D**, Blečić E, Gržić R (2014) Guidelines for teeth fluoridation with respect to fluoride concentration in Primorsko-goranska county, Paediatria Croatica 58, 25-30.
- **Vukić Lušić D**; Peršić V, Djakovac T, Traven L, Horvatić J, Glad M, Jurica K, Lušić, D (2013) Trophic state assessment of NE Adriatic Sea coastal waters based on water quality parameters, Fresenius Environmental Bulletin 22, 1021-1030.
- Jurica K, Uršulin-Trstenjak N, **Vukić Lušić D**, Lušić D, Šmit Z (2013) Exposure to Phtalates and Their Presence in Alcoholic Beverages, Archives of Industrial Hygiene and Toxicology 64, 317-324.
- **Vukić Lušić D**, Lušić D, Pešut D, Mićović V, Glad M, Bilajac L, Peršić V (2013) Evaluation of equivalence between different methods for enumeration of fecal indicator bacteria before and after adoption of the new Bathing Water Directive and risk assessment of pollution, Marine Pollution Bulletin 73, 252-257.
- Traven L, Mićović V, **Vukić Lušić D**, Smital T (2013) The responses of the hepatosomatic index (HSI), 7-ethoxyresorufin-O-deethylase (EROD) activity and glutathione-S-transferase (GST) activity in sea bass (Dicentrarchus labrax, Linnaeus 1758) caged at a polluted site: implications for their use in environmental risk assessment, Environmental monitoring and assessment 185, 9009-18.
- Bilajac L, **Vukić Lušić D**, Jelinic Doko J, Rukavina T (2012) Microbiological and chemical indicators of water quality in indoor hotel swimming pools before and after training of swimming pool operators, Journal of Water and Health 10, 108-115.
- **Vukić Lušić D**, Peršić V, Horvatić J, Viličić D, Traven L, Đakovac T, Mićović V (2008) Assessment of nutrient limitation in Rijeka Bay, NE Adriatic Sea, using miniaturized bioassay Journal of Experimental Marine Biology and Ecology 358, 46-56.
- **Traven L,** Fijan Parlov S, Galovic L, Sverdrup H (2005) Prospects for a regional assessment of forest soil chemistry dynamics in Croatia: Application of the SAFE model to a forested site in the region of Mt. Medvednica. Periodicum Biologorum 107, 17-26.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
Masters, G. M. & Ela, W. P. 2007. Introduction to Environmental Engineering and Science (3rd Edition). Prentice Hall.	1	5

Sullivan P., Agardy F., Clark J., (2005) The Environmental Science of Drinkig Water, Elsevier (Butherworth Heinemann)	1	
Assessment of students' learning outcomes. Evaluation of the course by the course attendees.		
13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences		
Assessment of students' learning outcomes. Evaluation of the course by the course attendees.		

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COURSE DESCRIPTION		
Course instructor	Prof. Nevenka Ožanić, PhD	
Lecturers	-	
Name of the course	Water resources in karst areas and their protection	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	14+0+6

1. Course objectives

Assure that students acquire knowledge and skills needed for understanding the characteristic rules and methodological settings for analyzing hydrological processes, and to present students basics of statistic procedures and their application as well as the application of probability theory. Enabling students for independent performance of elementary hydrologic calculations.
Getting acquainted with the specific legalities and methodological settings of the study of the process of flow, water supplies and their protection in the karst environments,
Ensuring that students learn the knowledge needed to understand the problem of studying and protecting water resources in the karst.

2. Course enrolment requirements

There is no course enrolment requirements.

3. Expected learning outcomes

- Develop the knowledge needed to understand the specific legality and methodological settings of the process of flow, water supplies and their protection in karst environments.
- Analyze and solve complex problems and mechanisms of hydrological processes (the relationship of precipitation and runoff in karst, hydrological legality of flow through and across different media, multivariate time series analysis, etc.) Using recent scientific methodology of modern methods and approaches (regionalization, multi-criteria optimization, mathematical and physical modeling, etc.)
- Give critical feedback to the results of your analysis and present them to a scientific, professional and general audience in a clear and effective way.
- Analyze and compare the results obtained with the results of similar research.

4. Course content

- Systems theory – Elements, classification, structure and importance of systems
- Systems and environment, biosphere, aquatic systems
- Natural water resources systems, anthropogenic impacts, ecohydrological interactions with the environment
- Karst as a morphological and geological phenomenon, the typology of karst, karst formations and appearances
- Hydro geologic basics of water appearances in karst, principles of water movement in karst aquifers, dynamics of flows and pollution dispersion

- Surface flows
- Natural lakes
- Ground water, karst springs and aquifers
- Changed water systems (reservoirs, drainage, sewage and other urban water systems)
- Water supply catchment structures – characteristics, principles and protection of water resources
- Systems for waste water disposal – characteristics, principles and protection of water resources
- Waste management, waste disposal in karst areas and interaction with water resources
- Mathematic modelling of processes related to water resources
- Specific protected water systems – national parks, nature parks, sanitary areas for drinking water protection
- Specifics of planning and water management in karst and coastal areas

5. Manner of instruction	X lectures X seminars and workshops ☐ exercises ☐ distance learning X fieldwork	X individual assignments ☐ multimedia and network X laboratories X mentorship ☐ other
6. Comments	The course is similar with aims and objectives of the courses at other university studies in the Republic of Croatia, the European Union and in the world.	

7. Student responsibilities

Class attendance, writing and presentation of the seminar, attendance to the demonstrational field exercise.

8. Monitoring of student work[72]

Class attendance	0,5	Class participation	0,2	Seminar paper	0,3	Experimental work	0,2
Written exam	0,3	Oral exam	0,3	Essay		Research	0,2
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The total grade of the course consists of: 50% of the seminar score (seminar preparation and presentation of the seminar within which research and / or experimental work will be conducted), 40% of the examination (the exam consists of the written and oral part) and 10% teaching activities.
The exam consists of making, presenting and verifying the seminar work and the written-oral part of the exam.

10. Mandatory literature (at the time of submission of study programme proposal)

Bonacci, O.: Karst hydrology. Springer Verlag, 1987.
Ford, D. Karst hydrogeology and geomorphology. Wiley, 2007.

11. Optional/additional literature (at the time of submission of the study programme proposal)

- Bögli, A.: Karst Hydrology and Physical Speleology, Berlin - Heidelberg - New York, 1980.

[72] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

- Ožanić, N. (2003): **Hidrogrami velikih voda.** Priručnik za hidrotehničke melioracije – III kolo/knjiga 1 (ur. Ožanić, N.). Građevinski fakultet Sveučilišta u Rijeci, Rijeka, 197-237.
- Ožanić, N. (2005): **Statističke obrade velikih voda hidromelioracijskih sustava**. Priručnik za hidrotehničke melioracije – III kolo/knjiga 2 (ur. Ožanić, N.). Građevinski fakultet Sveučilišta u Rijeci, Rijeka, 33-75.
- Dingman, L.S., : **Physical Hydrology.** Macmillan Publising Company, New York, 1994.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Bögli, A.: Karst Hydrology and Physical Speleology, Berlin - Heidelberg - New York, 1980.	1	5
Ožanić, N. (2003): Hidrogrami velikih voda. U: Priručnik za hidrotehničke melioracije – III kolo/knjiga 1 (ur. Ožanić, N.). Građevinski fakultet Sveučilišta u Rijeci, Rijeka, 197-237.	5	5
Ožanić, N. (2005): Statističke obrade velikih voda hidromelioracijskih sustava. U: Priručnik za hidrotehničke melioracije – III kolo/knjiga 2 (ur. Ožanić, N.). Građevinski fakultet Sveučilišta u Rijeci, Rijeka, 33-75.	5	5
Dingman, L.S., : Physical Hydrology. Macmillan Publising Company, New York, 1994.	1	5

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

According to the regulations of the University of Rijeka.
Evaluation of the acquired knowledge and skills in the development of hydrological analyzes and critical review on them through presentation to the scientific, professional and general public in a clear and effective way.
Evaluating skills and attitudes by comparing own results with the results of similar scientific research.

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COURSE DESCRIPTION		
Course instructor	Prof. Jasna Hrenović, PhD	
Lecturers	Prof. Marina Šantić, PhD	
Name of the course	Bioremediation	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+5
1. Course objectives		
To enable students to apply bioremediation in the remediation of degraded environment.		
2. Course enrolment requirements		
Basic knowledge of microbiology.		
3. Expected learning outcomes		
1. To recognize and to define pollutants in the environment which are suitable for removal by technology of bioremediation. 2. Be able to choose the conditions necessary for the bioremediation of a particular type of contaminants. 3. To know independently design the laboratory studies on suitability of bioremediation. 4. Summarize the basic knowledge and be able to apply the technology of bioremediation in the field. 5. To conclude about the importance of the application of microbes in order to degrade the harmful compounds in the environment.		
4. Course content		
1. The concepts and principles of bioremediation 2. Bioaugmentation 3. Bioremediation of oil 4. Bioremediation of phenolic substances 5. Bioremediation of nitrosamines 6. Bioremediation of drugs 7. Bioremediation of colours 8. Bioremediation of selenium 9. Bioremediation of arsenic 10. Bioremediation of landfill leachate.		
5. Manner of instruction	x☐ lectures x☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments x☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other

6. Comments							
7. Student responsibilities							
Regular attendance of lectures, preparation and presentation of the seminar.							
8. Monitoring of student work[73]							
Class attendance	*0,3*	Class participation	0,2	Seminar paper	0,6	Experimental work	
Written exam	0,9	Oral exam	1	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Seminar paper 10%, written exam 40%, oral exam 50% share in the final mark.

10. Mandatory literature (at the time of submission of study programme proposal)

Das S. (2014): Microbial Biodegradation and Bioremediation. Elsevier.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Aleksander M. (1999): Biodegradation and Bioremediation. Academic Press.
Rawlings D.E., Johnson B.D. (2007): Biomining. Springer.
Selected scientific papers.
Ivanković T., Mejdandzić M., Postić S., Malešević N., Hrenović J. (2015): Practical bioremediation course – laboratory exercises on biodegradation of cationic surfactant. Journal of Microbiology and Biology Education, 16 (1), 69-71.
Hrenović J., Durn G., Šeruga Musić M., Dekić S., Troskot-Čorbić T., Škorić D. (2017): Extensively and multi drug-resistant Acinetobacter baumannii recovered from technosol at a dump site in Croatia. Science of the Total Environment, 607-608, 1049-1055.
Vukoje M., Miljanić S., Hrenović J., Rožić M. (2018): Thermochromic ink–paper interactions and their role in biodegradation of UV curable prints. Cellulose, 25, 6121-6138.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Das S. (2014): Microbial Biodegradation and Bioremediation. Elsevier.	10	*10*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Internal and external anonymous student surveys.

[73] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Luka Traven, PhD	
Lecturers		
Name of the course	Waste management	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	7+0+3

1. Course objectives

The objective of the course is to acquaint the student with (a) waste characterization and classification methods, (b) waste collection methods, (c) treatment and disposal methods, (d) health and environmental risk during involved in waste management, (e) risk minimisation methods.

2. Course enrolment requirements

Knowledge of elementary physics and general chemistry. General knowledge of descriptive and inferential statistics.

3. Expected learning outcomes

Upon successful completion of the course the student will be able to (a) understand the concept of waste and be able to classify waste according to its physiochemical characteristics, (b) understand health and environmental risks related to waste management, (c) implement risk mitigation measures, (d) understand the concept of waste management hierarchy, (c) devise strategies for minimising waste quantities and toxicity, (d) understand the methods for mechanical and biological treatment of waste including waste to energy processes, (e) understand the proper landfilling of waste, (f) consult and interpret waste management legislation.

4. Course content

Definition of waste. Hazardous and non-hazardous waste. Municipal solid waste (MSW) and industrial waste. Waste management hierarchy. Environmental and health risks of waste management activities. Risk mitigation approaches. Waste collection. Waste prevention and minimisation. Reuse. Recycling. Biological treatment. Composting. Anaerobic digestion. Waste to energy. Landfilling. Waste management planning.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Attendance at lectures.

8. Monitoring of student work[74]

Class attendance	0,2	Class participation	0,1	Seminar paper	0,6	Experimental work	
Written exam	0,8	Oral exam		Essay		Research	
Project		Continuous assessment	0,3	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

The students will be graded based on the attendance and activity during the lectures, a mid-term exam and a written final exam.

10. Mandatory literature (at the time of submission of study programme proposal)

William A. Worrell, P. Aarne Vesilind. Solid Waste Engineering. CL Engineering; 2 edition.

11. Optional/additional literature (at the time of submission of the study programme proposal)

L Traven. Circular economy and the waste management hierarchy: Friends or foes of sustainable economic growth? A critical appraisal illustrated by the case of the Republic of Croatia. Waste Management & Research 37 (1), 1-2.
L Traven, I Kegalj, I Šebelja. Management of municipal solid waste in Croatia: Analysis of current practices with performance benchmarking against other European Union member states. Waste Management & Research 36 (8), 663-669)
Peer-reviewed papers on waste management. Legislative documents on waste management.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
William A. Worrell, P. Aarne Vesilind. Solid Waste Engineering. CL Engineering; 2 edition.	1	5

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

End-of-course student survey.

[74] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Ivana Gobin, PhD	
Lecturers	Prof. Marina Šantić, PhD	
Name of the course	Microbial resistance in the environment	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	5+0+15
1. Course objectives		
Awareness of the presence of antibiotics in the environment in recent years is of increasing concern. Numerous studies have shown their harmful effect on the environment, in particular flora and fauna. The problem of development of resistant bacterial strains not only applies to the widespread use of antibiotics in the treatment of humans, but also on the use of antibiotics in veterinary medicine, agriculture and aquaculture, thereby contributing to the spread of resistance. The course is designed for students who wish to learn about different ways of antibiotics entering in the environment, the impact of the presence of antibiotics and resistant bacteria in the environment to further spread of resistance.		
2. Course enrolment requirements		
Knowledge of the mechanisms of action of antibiotics as well as human pathogens.		
3. Expected learning outcomes		
Upon completion of the course, students will be able to: list and describe the mechanisms of antibiotic resistance and ways of spreading resistance in the environment; critically describe and analyse the impact of wastewater from various sources on the spread of resistance in the environment. Students will be able to critically process and present scientific paper in the selected topics. In addition, students will develop teamwork, solve problems and make logical conclusions.		
4. Course content		
Mechanisms of antibiotic resistance; interactions between environmental and resistant bacterial strains; Sources of antibiotics and resistance in the environment: waste water from hospitals, urban waste water and waste water from the farm; The impact of agriculture on water pollution antimicrobials; Resistance in freshwater and marine environments; Residues of antibiotics in food; Methods for determining residues of antibiotics in food; Law regulations.		
5. Manner of instruction	X lectures X seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☐ individual assignments ☐ multimedia and network ☐ laboratories X mentorship ☐ other
6. Comments		
7. Student responsibilities		

Students are expected to regularly attend classes, actively participate in all forms of instruction, and ask questions. Supporting literature related to a particular teaching unit, as well as copies of the lectures will be available on the Department of Microbiology. Students are advised for theoretical preparation, reading and reviewing the learning material before coming to class. Final written test will consist of questions with multiple choice answers. Feedback will be obtained based on the percentage of correct answers.

8. Monitoring of student work[75]

Class attendance	0,3	Class participation	0,4	Seminar paper	0,7	Experimental work	
Written exam	0,6	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Assessment and evaluation of students will be carried out according to the Code of evaluation of students at the Medical Faculty in Rijeka, which is based on the current Regulations of University of Rijeka and the applicable regulations of the Medical Faculty in Rijeka.
The written test will evaluate antibiotic resistance mechanisms and ways of expanding environmental resistance. The application of acquired knowledge will be evaluated by presenting a potential route of transmission of resistant bacteria in a particular situation or in a specific environment (hospital environment, food factory) or in the environment. A presentation of a scientific article will be evaluated from a selected topic that the student should analyze, evaluate or critically process.

10. Mandatory literature (at the time of submission of study programme proposal)

Jawetz, Malnick and Adelberg. Medicinska mikrobiologija. 2015.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Prepared copies of the latest articles from various publications at the primary processing of each of the lessons.

- Broznić D, Ratkaj I, Malenica Staver M, Kraljević Pavelić S, Žurga P, Bubalo D, Gobin I. Evaluation of the Antioxidant Capacity, Antimicrobial and Antiproliferative Potential of Fir (Abies alba Mill.) Honeydew Honey Collected from Gorski kotar (Croatia). // Food technology and biotechnology. 56 (2018) , 4; 533-545.
- Klančnik A, Gobin I, Vučković D, Smole Možina S, Abram M, Jeršek B.Reduced contamination and infection via inhibition of adhesion of foodborne bacteria to abiotic polystyrene and biotic amoeba surfaces. // International journal of food science & technology. 53 (2018) ; 1013-1020.
- Matešić M, Vučković D, Gobin I.Preživljavanje bakterija na suhim površinama u bolničkoj sredini. // Medicina Fluminensis. 50 (2014) , 1; 39-46
- O'Toole DK. The Natural Environment May Be the Most Important Source of Antibiotic Resistance Genes. 2014. mBio 5(4):e01285-14.
- Kummerer K. (2004) Resistance in the environment. Journal of Antimicrobial Chemotherapy 54, 311–320
- Martinez JL. (2009) The role of natural environments in the evolution of resistance traits in pathogenic bacteria. Proc. R. Soc. B 276, 2521–2530

[75] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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Web sites are an important source of information related to specific educational topics.

12. *Number of assigned reading copies in relation to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
	10	*10*

13. *Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences*

The study program will be monitored and evaluated according to the prescribed regulations of the Faculty, University of Rijeka and the Ministry of Science, Education and Sports. Anonymous survey, students will evaluate their teachers and their classes. It will also evaluate the weight and validity of written test.

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COURSE DESCRIPTION		
Course instructor	Prof. Branko Kolarić, MD, PhD	
Lecturers	Asst. Prof. Morana Tomljenović, MD, PhD	
Name of the course	Outbreak control	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+10
1. Course objectives		
Understanding outbreak control interventions as well as techniques used in early signal detection and aoutbreak control. Understanding scientific epidemiological methods in terms of causative agent, source and routes of transmission. Understanding of the Epidemiology service organization and its role of in outbreak control, including the early warning system, international communication and intervention. Understanding scientific methods of evaluation of outbreak control measures.		
2. Course enrolment requirements		
Requirements for II year of postgraduate study. Intervention Epidemiology module participation.		
3. Expected learning outcomes		
Describe the information system of Surveillance of infectious diseases and epidemics List the elements of the Early warning system Define the basics of medical counter-epidemic interventions Demonstrate the techniques of cooperation during a counter-epidemic intervention Differentiate the sampling techniques Analyse the counter-epidemic DDD		
4. Course content		
Epidemiology information system Organization of the Epidemiology Service International intervention epidemiology Examples of outbreak control interventions Examples of interventions in the field of massive chronic diseases		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☒ distance learning ☐ fieldwork	☒ individual assignments ☒ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments	Assistants: Morana Tomljenović	
7. Student responsibilities		
Course attendance. Writing essay.		

8. Monitoring of student work[76]

Class attendance	0,5	Class participation	0,2	Seminar paper	0,2	Experimental work	
Written exam	0,6	Oral exam		Essay	0,3	Research	
Project		Continuous assessment	0,2	Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Student's work will be assessed during the course (attendance and activity), including continuous knowledge development assessment. For final exam student will write an essay (written exam).

10. Mandatory literature (at the time of submission of study programme proposal)

European Centre for disease Prevention and Control. Rapid Risk Assesment. (http://ecdc.europa.eu/en/publications/risk_assessment/Pages/default.aspx)
Center for Disease Control. Environmental Health Emergency Response Guide. Advanced practice centres. (http://www.cdc.gov/nceh/ehs/Docs/EH_Emergency_Response_Guide.pdf)
Valić F. i sur. Zdravstvena ekologija. Medicinska Naklada, Zagreb

11. Optional/additional literature (at the time of submission of the study programme proposal)

Lovrić Z, Kolarić B, Kosanović Ličina ML, Tomljenović M, Đaković Rode O, Danis K, Kaić B, Tešić V. An outbreak of haemorrhagic fever with renal syndrome linked with mountain recreational activities in Zagreb, Croatia, 2017. Epidemiol Infect. 46(10):1236-9, 2018
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.
David L. Heymann. Control of Communicable Diseases Manual 20th Edition. Apha Press.
Kenrad E. Nelson, Carolyn Williams. Infectious Disease Epidemiology: Theory and Practice 3rd Edition. Jones & Barklett Learning

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
European Centre for disease Prevention and Control. Rapid Risk Assesment. (http://ecdc.europa.eu/en/publications/risk_assessment/Pages/default.aspx)	1	10
Kolčić I, Vorko-Jović A. Epidemiologija. Medicinska naklada.	1	10
David L. Heymann. Control of Communicable Diseases Manual 20th Edition. Apha Press	1	10
Kenrad E. Nelson, Carolyn Williams. Infectious Disease Epidemiology: Theory and Practice 3rd Edition. Jones & Barklett Learning.	1	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Questionnaire for assessment of knowledge, learning outcomes and course quality.

[76] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

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COURSE DESCRIPTION		
Course instructor	Prof. Vanja Tešić, MD, PhD	
Lecturers	Asst. Prof. Morana Tomljenović, MD, PhD	
Name of the course	Bioterrorism	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	8+0+8
1. Course objectives		
The main objective of the course is to introduce the knowledge about the possible use of biological weapons, types, method of application and the development of biological weapons, as well as early detection of the use of biological weapons and prevention measures.		
2. Course enrolment requirements		
Enrolment requirements for II. year of study		
3. Expected learning outcomes		
List the biological agents that can be used in bioterrorism. Explain the molecular and biological principles of the development of biological agents and their ways of application. Interpret the importance of an information system for monitoring infectious diseases in the context of bioterrorism. Define measures for the prevention and suppression of infectious diseases for the patient and the environment. Describe the role of public health in the event of an attack on a biological weapon.		
4. Course content		
The programme corresponds with that in the fields of microbiology, immunology, infectology and vaccinology as well as that in which there is word in the application of DDD measures in the prevention of infectious diseases. Early Alert System. Information systems in emergency situations. Examples of intervention in emergency situations. History of bioterrorism Classification of biological agents that can be used in bioterrorism Clinical symptoms and detection of the most important cause Epidemiological indications for possible attack on biological weapons Prevention and epidemic control interventions of agents that can be used in bioterrorism Biosafety		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ distance learning	☐ individual assignments ☒ multimedia and network ☐ laboratories mentorship

	☐ fieldwork			☐ other			
6. Comments							
7. Student responsibilities							
Attendance of the lectures and the writing of seminar papers based on internet search of available literature in the field of bioterrorism.							
8. Monitoring of student work[77]							
Class attendance	0,3	Class participation	0,2	Seminar paper		Experimental work	
Written exam	0,7	Oral exam		Essay	0,8	Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							
9. Assessment of learning outcomes in class and at the final exam (procedure and examples)							
Student activity will be monitored during classes (the presence and activity), will continuously monitor the knowledge, and for final exam students will prepare an essay with the default theme.							
10. Mandatory literature (at the time of submission of study programme proposal)							
Centers for Disease Control and Prevention, Emergency Preparedness and Response (http://emergency.cdc.gov/bioterrorism). Ropac D. i sur. Epidemiologija zaraznih bolesti. Medicinska naklada, Zagreb, 2004. World Health Organization. Public Health Response to Biological and Chemical Weapons – WHO Guidance. 2nd edition of Health Aspects of Chemical and Biological Weapons: Report of a WHO Group of Consultuants.Geneva, Switzerland, 2004. Available at: http://www.who.int/csr/delibepidemics/introduction.pdf							
11. Optional/additional literature (at the time of submission of the study programme proposal)							
Lovrić Z, Kolarić B, Kosanović Ličina ML, Tomljenović M, Đaković Rode O, Danis K, Kaić B, Tešić V. An outbreak of haemorrhagic fever with renal syndrome linked with mountain recreational activities in Zagreb, Croatia, 2017. Epidemiol Infect. 46(10):1236-9, 2018. Milton Leitenberg. Assessing the biological weapons and bioterrorism threath. United States Government. 2005. (http://www.strategicstudiesinstitute.army.mil/pdffiles/pub639.pdf).							
12. Number of assigned reading copies in relation to the number of students currently attending the course							

Title	*Number of copies*	*Number of students*
Centers for Disease Control and Prevention, Emergency Preparedness and Response (http://emergency.cdc.gov/bioterrorism).	10	10
Ropac D. i sur. Epidemiologija zaraznih bolesti. Medicinska naklada, Zagreb, 2004.	2	10

[77] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

2nd edition of Health Aspects of Chemical and Biological Weapons: Report of a WHO Group of Consultuants.Geneva, Switzerland, 2004. Available at: http://www.who.int/csr/delibepidemics/introduction.pdf	10	10

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Internal control, external evaluation, control from the side of the Committee for education quality control.

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COURSE DESCRIPTION		
Course instructor	Prof. Marina Šantić, PhD	
Lecturers	Asst. Prof. Mirna Mihelčić, PhD, Prof. Ivana Gobin, PhD	
Name of the course	Emerging zoonosis	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	10+0+10

1. Course objectives

The aim of the course is to learn about selected zoonosis with special focus on zoonosis caused by bacteria and viruses. The course will cover foodborne zoonosis, zoonotic diseases of humans, occupational zoonosis, emergence of new zoonotic diseases, prevention and control of zoonosis: from Science to practice. The microbiological features of zoonosis will be introduced to students as well as their clinical manifestation. The course will also cover public health problem in regarding the concept from farm to table in food processing. Student seminars work will emphasize emerging diseases associated with climate change, including those with an impact on global health. During the course the doctoral students will be encourage on critical assessment and thinking.

2. Course enrolment requirements

Microbiology course

3. Expected learning outcomes

After the course the doctoral students will be able to understand the major principles, concepts about zoonosis. Research a zoonotic disease topic, organize supporting details, and produce a scientific fact sheet. Understand the types of laboratory tests and their limitations for confirmation of zoonotic diseases. Preparation of an oral presentation will be good training for students in public health careers.

4. Course content

- Introduction to zoonosis, Overview and definitions of zoonosis
- Routes of infection and transmission to humans
- Foodborne and Occupational Zoonotic Diseases
- The microbiological features of zoonosis including clinical manifestation and pathogenesis of selected zoonotic disease: plague, small pox, tularaemia, anthrax, brucellosis, leptospirosis, listeriosis, salmonellosis, influenza, viruses transmitted by arthropods and rodents
- Prevention and Control of Zoonosis
- Emergence of New Zoonotic Diseases

5. Manner of instruction	x lectures x seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	x individual assignments ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other

6. Comments							
7. Student responsibilities							
Presence and active participation during the course, preparation of seminar papers on a given subject.							
8. Monitoring of student work[78]							
Class attendance	0,4	Class participation	0,3	Seminar paper	0,8	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Evaluation of student work at the course will be carried out in accordance with the Rules of the University of Rijeka (approved by the Senate of the University of Rijeka). Validation of learning outcomes includes the results achieved during the class activities, the project assignment, the seminar paper and the final written exam on which the issues will be in line with the expected learning outcomes.

10. Mandatory literature (at the time of submission of study programme proposal)

H. Kraus et. Al. Zoonoses, ASM press, Washington DC, 2009.
Ropac D. i sur. Epidemiologija zaraznih bolesti. Medicinska naklada, Zagreb, 2003.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1.Mihelčić, Mirna; Habuš, Josipa; Vucelja, Marko; Svodoba, Petra; Kurolt Ivan-Christian; Markotić, Alemka; Turk, Nenad; Margaletić, Josip; Šantić, Marina. Prevelence of Francisella tularensis in the population of small mammals species in conttinental forests of Croatia. Šumarski list:9 (2018), 10; 481-486.
2.Ozanic M, Marecic V, Abu Kwaik Y, Santic M. The Divergent Intracellular Lifestyle of Francisella tularensis in Evolutionarily Distinct Host Cells. PLoS Pathog. 2015 Dec 3;11(12). IF:7.562.
3. Santic, Marina; Al-Khodor, Souhaila; Abu Kwaik, Yousef. Cell biology and molecular ecology of Francisella tularensis. Cellular Microbiology.12 (2010),2;129-139.IF: 5.625.

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
H. Krauss i sur. Zoonoses, ASM press, Washington DC, 2009	1	5
Ropac D. i sur. Epidemiologija zaraznih bolesti. Medicinska naklada, Zagreb, 2003.	1	5

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

[78] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Survey for the course - A final evaluation of the course will be conducted in order to receive feedback from the students about the course content, the ability to teaching skills and success of interaction with the students. Exiting knowledge will be checked on the final written exam. The learning outcomes score will be additionally based on the analysis of the success of the answer to specific questions of a written exam.

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COURSE DESCRIPTION		
Course instructor	Assoc. Prof. Dijana Tomić Linšak, PhD	
Lecturers		
Name of the course	Rodents and the human health	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	6+7+7

1. Course objectives

By listening to this course students will be able to recognize the basic biological, ethological and physiological characteristics of rodents (pests). Prepare and rank and classify the most important examples of rodents important for human health. Get knowledge and will be able to identify, identify, and group ways to convey diseases from these animals to humans and name, differentiate and show ways to protect from them. Furthermore, the principles and disadvantages of disinfection, disinfection and deratization in public buildings, businesses and households will be recalled. At seminary, students will be able to select and choose a personal presentation on the topic of the semiannual presentation of the chapter, which will show acquired skills to show how to plan, evaluate and differentiate the hazards that rodents can cause. After the presentation, all students will be able to participate in the discussion and the comments and individually evaluate and evaluate the approaches to the analyzed problem of the individual student. In the exercises, the student will be able to extract, sketch, and use all systemic rodent protection options. Plan measures and prepare operational plans for the implementation of field measures.

2. Course enrolment requirements

The program is in correlation with several other modules and particularly with other subjects within this module.

3. Expected learning outcomes

Count the Sistema of the Empire of the Animalia and order of *Rodentia*.
Indicate, express and differentiate etiology and control over the rodent population (emphasis on mice and rats).
Identify and evaluate the extent of damage that can cause the presence of rodent population in public health and economic terms.
Predict the possible size of the population in time projection as well as predict the impact of implemented deratization measures.
Argue and categorize systematic measures to decrease these pests to a biologically acceptable minimum.
Identify the dangers that may cause chemical agents used to control this pest. Calculate the active substances and evaluate the effects of the planned action of suppression.
Identify the dangers and risks associated with the use of chemical agents and their impact on man and the environment.

4. Course content

By listening to the course, students will be able to identify, name and group anatomy, physiology, ethology and other characteristics of some rodents such as rats (*Rattus norvegicus, Rattus rattus, Mus musculus domesticus, Apodemus agrarius, Microtus arvalis*).
Describe and distinguish the diseases that are transmitted from the rodent to man. Predict the damage that rodents can cause to food and furniture and create a picture of the risk to human health or the impact on the human environment. Students will also learn to evaluate planning and conduct rodenticide application action and what methods to use for that.
Show and apply the provisions of the national and European legislation and regulations the pesticides in communal hygiene.
Learn to connect the dangers that a reservoir and vector of infectious diseases may have.

5. Manner of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ distance learning ☒ fieldwork	☒ individual assignments ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
6. Comments		

7. Student responsibilities

Students are required to regularly attend and actively participate in all forms of teaching and consulting. Students during the classes/consultations can take some random quick assessment. Upon completion of the classes / consultations students have to take the final exam in a written form.

8. Monitoring of student work[79]

Class attendance	0,4	Class participation	0,3	Seminar paper	0,4	Experimental work	
Written exam	0,4	Oral exam	0,5	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Course attendance
Written exam
Activity/Participation
Seminar paper
Experimental work

Finally be able to evaluate and conclude the scope and impact of these pests of humans and the environment.

10. Mandatory literature (at the time of submission of study programme proposal)

Asaj A.: Zdravstvena dezinsekcija u nastambama i okolišu, Med. naklada, Zagreb 1999.
Asaj A.: Dezinfekcija, Med. naklada, Zagreb 2000.
Asaj A.: Deratizacija u praksi, Med. naklada, Zagreb 1999.
Krajcar S.: dezinfekcija, dezinsekcija, deratizacija, 2001.
Mallis A.: Handbook of pest control, 1997.

[79] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

11. Optional/additional literature (at the time of submission of the study programme proposal)

Gary Mullen & Lance Durden: Medical and Veterinary Entomology, Academic Press, Amsterdam 2002.
Mike W. Service: Medical Entomology for Students, Cambridge univ. press, 2002.
Bruce F. Eldridge and John D. Edman: Medical Entomology A Textbook on Public Health and Veterinary Problems Caused by Artropods, Kluwer academic publishers, 2004.
William S. Romoser and John G. Stoffolano, Jr: Entomology, McGraw-Hill, Boston 1998.
Milan Maceljski: Poljoprivrena entomologija, Zrinski, Čakovec 2002.
Linsak DT1, Kresic K, Coklo M, Majanaric K, Susnic V, Lakoseljac D and Linsak Z -The Impact of the Natural Hazard Flooding in East Part of Croatia-Reducing Possible Consequences, J Remote Sensing & GIS 2016, 5:1 DOI: 10.4172/2469-4134.1000153

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Prepared copies of selected chapters/articles from the mentioned literature	*5*	*5*
Asaj A.: Zdravstvena dezinsekcija u nastambama i okolišu, Med. naklada, Zagreb 1999.	*1*	*5*
Asaj A.: Dezinfekcija, Med. naklada, Zagreb 2000.	*1*	*5*
Asaj A.: Deratizacija u praksi, Med. naklada, Zagreb 1999.	*1*	*5*
Krajcar S.: dezinfekcija, dezinsekcija, deratizacija, 2001.	*1*	*5*
Mallis A.: Handbook of pest control, 1997.	*1*	*5*

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

Through anonymous student questionnaire, official and unofficial.

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COURSE DESCRIPTION		
Course instructor	Prof. Srećko Valić, PhD	
Lecturers	Assoc. Prof. Damir Klepac, PhD	
Name of the course	Characterization and Degradation of Polymeric Materials	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	3
	Number of class hours (L+E+S)	20+5+5
1. Course objectives		
Understanding the basics of synthesis, nomenclature and polymerization methods, types of polymeric materials for widespread use, polymer aging problems, storage and decomposition of waste polymers. A1, A3, A4, A5, A6, A7, C1, C2, C3, C4.		
2. Course enrolment requirements		
No requirements		
3. Expected learning outcomes		
4. Course content		
Basic concepts of synthesis and nomenclature of polymers. Basic structure of the polymer chain: linear, branched and crosslinked chains; configuration and chain conformation. Statistical coil, radius of rotation. Methods for determining the molecular mass of the polymer and the distribution of molecular masses. Significance of the molecular mass for the material properties. Polymer viscosity and the ways of determining it. The structure of the polymer chain and its identification by spectroscopic techniques. Polymers in solution: swelling, polymer dissolving, polymer solution properties. Conformation of macromolecules in solution. "Theta" conditions. Polymers in solid state: glassy, crystalline and viscoelastic. Thermal behavior and phase transitions, free volume. Structure and crystal morphology. Segmental orientation in space. Natural polymers: natural rubber, cellulose, proteins. Copolymers - statistically, alternating and block copolymers. Polymer mixtures. Hybrid and composite polymer materials. Polymeric liquid crystals. Conductive polymers. Disintegration of polymers and stabilization. Natural and synthetic polymers in pharmacology and medicine. Durability, thermal aging, and polymer degradation under the influence of external factors. Problem of flammability. Problems of degradation and their environmental echo. Polymer waste, storage and proper processing of polymer waste. Recycling and biodegradability of polymer materials.		
5. Manner of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☒ multimedia and network ☐ laboratories ☐ mentorship ☒ other

		consultation
6. Comments		
7. Student responsibilities		
Attending lectures, exercises and seminars, seminar work and the final exam. During the course, students are obliged to prepare a seminar on the chosen topic and present it.		
8. Monitoring of student work[80]		

Class attendance	0.5	Class participation	0.5	Seminar paper	1.0	Experimental work	
Written exam		Oral exam	1.0	Essay		Research	
Project							
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)
10. Mandatory literature (at the time of submission of study programme proposal)
1. Z. Janović, Polimeri i polimerizacije, HKDI - Kemija u industriji, Zagreb, 1999. 2. S. Halim Halid, Handbook of Polymer Degradation, Second Edition, (Environmental Science & Pollution) 2nd Ed., Marcel Dekker Inc., New York, 2000. 3. D. Campbell, R.A. Pethrick, J.R. White, Polymer Characterization: Physical Techniques, 2nd Edition, Taylor and Francis, 2000.
11. Optional/additional literature (at the time of submission of the study programme proposal)
12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Z. Janović, Polimeri i polimerizacije, HKDI - Kemija u industriji, Zagreb, 1999.	1	3
S. Halim Halid, Handbook of Polymer Degradation, Second Edition, (Environmental Science & Pollution) 2nd Ed., Marcel Dekker Inc., New York, 2000.	1	3
D. Campbell, R.A. Pethrick, J.R. White, Polymer Characterization: Physical Techniques, 2nd Edition, Taylor and Francis, 2000.	1	3

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

[80] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

Activity during the lectures and seminars, seminar work and final exam.

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COURSE DESCRIPTION		
Course instructor	Prof. Gordana Čanadi Jurešić, PhD	
Lecturers		
Name of the course	Proteomics in the research of environmental agents toxicity	
Study programme	Doctoral school Biomedicine and health – course of study Health and Environmental Engineering	
Status of the course	elective course	
Year of study	I., II., III.	
ECTS credits and manner of instruction	ECTS credits	2
	Number of class hours (L+E+S)	6+2+2

1. Course objectives

Recently, lots of attention was paid to the application of proteomic methods in the research of biological mechanisms of different diseases. Etiology of many diseases is based, among many other factors, on the toxic environmental agents (pesticide residues, organic solvents, toxic metals, anaesthetic gases...) and in their interactions with genetic inheritance. Functional characterization of proteins expressed in some disease is the main goal in many researches. In neurodegenerative disease researches, in order to prevent and heal, etiological identification and linkage of protein aggregation with consequences at the molecular level is making. Proteomic methods can be used for identification of protein expression in different type of cells or tissues and for establishment an oxidative stress provoked protein modification. There are several steps in proteomic research, with a few methods that can be used in every step. For protein separation 2D-electrophoresis can be used, while for protein identification mass-spectrometry. In this course the students can learn about theoretical and practical possibilities of 2D-electrophoresis and gain knowledge for independent proteomic research with different biological samples.

2. Course enrolment requirements

None

3. Expected learning outcomes

Students will be able to:

- define and describe 2D-electrophoresis (IEF and SDS-PAGE)
- interpret hove to choose correctly sample preparation method and/or analyze different methods for sample preparation
- describe protein visualisation/detection methods
- intepret protein identification methods
- design and conduct experiments with critical evaluation of the obtained results
- prepare protein samples, quantify them, prepare the strips, run IEF, prepare the gels, run electrophoresis, visualize and evaluate results

4. Course content

1. Basic principles of electrophoresis - types of electrophoresis, 2D-electrophoresis.
2. Sample preparation – general strategy. Methods of cell disruption. Protection against proteolysis. Precipitation procedures and removal of contaminants. Composition of sample solution.
3. First dimension – Isoelectric focusing (overview and background of this method, sample application, strip rehydration, IEF device system, protocol running).

4. Second dimension – SDS-PAGE (overview and background of this method, IPG strip equilibration and applying, gel preparation, electrophoresis devices, running the method)
5. Visualization and evaluation of results – visualization methods, evaluation of results, standardization of results, further
analysis of protein spots, picking the spots, digestion of proteins.
6. Mass spectrometry - MALDI-ToF mass spectrometry.

5. Manner of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ distance learning ☐ fieldwork	☒ individual assignments ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
6. Comments		

7. Student responsibilities

Course attendance and lab reports are mandatory.

8. Monitoring of student work[81]

Class attendance	0,3	Class participation		Seminar paper	0,8	Experimental work	
Written exam	0,5	Oral exam		Essay		Research	
Project		Continuous assessment		Report	0,4	Practical work	
Portfolio							

9. Assessment of learning outcomes in class and at the final exam (procedure and examples)

Seminar paper using scientific publication is mandatory. Experimental parts of the course require each student to turn in a written report. Final mark is based on seminar paper, experimental work report and written exam.

10. Mandatory literature (at the time of submission of study programme proposal)

1. 2-D Electrophoresis Principles and methods, GE Healthcare, Handbook, 2004
2. Selected scientific and review papers.

11. Optional/additional literature (at the time of submission of the study programme proposal)

1. Imaging Principles and Methods, GE Healthcare, Handbook

Papers in review or preparation:

1) Gordana Čanadi Jurešić, Martina Barbarić, Nermina Mumiši, Božena Ćurko-Cofek, Branka Blagović, Polona Jamnik: Do lead and iron share a similar pattern in their toxicity?
2) Gordana Čanadi Jurešić, Ana Katić, Iva Justinić, Deni Uršičić and Branka Blagović: Combining Proteomics and Lipid Analysis to Unravel Confidor stress response in Saccharomyces cerevisiae

12. Number of assigned reading copies in relation to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Principles and methods	*5*	*5*

[81] IMPORTANT: Enter the appropriate proportion of ECTS credits for each activity so that the total number of credits equals the ECTS value of the course. Use empty fields for additional activities.

http://www.gelifesciences.com/webapp/wcs/stores/servlet/catalog/en/GELifeSciences-at/service-and-support/handbooks		

13. Quality monitoring methods that ensure the acquisition of exit knowledge, skills and competences

The quality of the lectures and lecturers will be monitored using official and unofficial surveys.
Assessment of learning outcomes will be tested additionally based on written exam.