Lecturers

Name: Matjaž Ravnikar
Academic Background: PhD, Biological and biotechnical sciences – field of Biotechnology at the Biotechnical Faculty, University of Ljubljana
Field of Specialization: Assistant at the Department of Pharmaceutical Biology
Employer: Faculty of Pharmacy, University of Ljubljana
Previous positions: Post-doc researcher at the University of natural resources and Life Sciences in Vienna
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Name: Borut Bohanec
Academic Background: PhD, Biotechnical Faculty
Field of Specialization: Professor and Head of the Chair of genetics, biotechnology, statistics and plant breeding at the Biotechnical Faculty, University of Ljubljana
Plant biotechnology, Agronomy, Biotechnology
Employer: Biotechnical Faculty, University of Ljubljana
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Name: Maša Vodovnik
Academic Background: BSc Microbiology, Biotechnical Faculty; PhD Biochemistry and Molecular Biology, Medical Faculty
Field of Specialization: Assistant Professor and Researcher, Chair for Microbiology and Microbial Biotechnology, Biotechnical Faculty, University of Ljubljana
Employer: Biotechnical Faculty, University of Ljubljana
Previous positions: Teaching assistant and Researcher, Chair for Microbiology and Microbial Biotechnology, Biotechnical Faculty, University of Ljubljana
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Name: Marko Dolinar
Academic Background: PhD in natural sciences (dr. rer. nat., Technische Universität München, Germany), BSc Biology, Biotechnical Faculty
Field of Specialization: Associate professor of biochemistry and molecular biology, University of Ljubljana
Employer: Faculty of Chemistry and Chemical Technology, University of Ljubljana
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Name: Mark Zver
Academic Background: MSc in Biotechnology, Biotechnical faculty
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Employer: Acies Bio
Previous positions: -
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Name: Duško Lainšček
Academic Background: PhD in Biomedicine-Biochemistry and Molecular biology, Medical faculty
Field of Specialization: Assistant with doctoral degree
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Name: Marjanca Starčič Erjavec
Academic Background: PhD in field Molecular biology and Microbiology, Utrecht University; Interfaculty graduate studies of Biochemistry and Molecular Biology, University of Ljubljana
Field of Specialization: Full Professor and Research Counsellor for Molecular Biology
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Previous positions: -
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Name: Andrej Senegačnik
Academic Background: PhD, Faculty of Mechanical Engineering, power and process engineering, field of work: Reliability of power plants
Field of Specialization: Associated professor, University of Ljubljana, Faculty of Mechanical Engineering
Employer: University of Ljubljana, Faculty of Mechanical Engineering
Previous positions: Assistant professor, University of Ljubljana, Faculty of Mechanical Engineering
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Name: Darja Keše
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Employer: Institute of microbiology and immunology, Faculty of medicine, University of Ljubljana
Previous positions: -
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Name: Suvad Bajrić
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Previous positions: -
CV: Link to Suvad Bajrić's CV

Course Description

Title: Change me baby one more time

Fields of activity: Biological/Biotechnical/Gene Engineering, Biology, Biomedical Engineering, Biofuels

Examination type: Oral exam

Number of ECTS credits issued: 1 ECTS

Learning Goals and Objective: The aim is for students to get to know the basics of genetic mechanisms and possibilities new technologies bring in modifying organisms. The focus of genetic modification will be on several organisms in relevance to some of the modern methods. With the knowledge provided, students will have a better understanding of what the future of genome editing could look like.

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Syllabus

Name of activity	**Recombinant DNA technology in medicine (50 years of recombinant drugs)**
Number of working hours	2
Type of activity	Lecture
Lecturer	Matjaž Ravnikar
Short summary of content	The introduction of recombinant DNA technology in medicine (almost 50 years ago) transformed the field and introduced many new possibilities for the treatment of various diseases to diagnostics and gene therapies. The lecture will describe the progress and different applications of recombinant DNA in medicine, from the first drug (Insulin) to modern vaccines, antibodies, cytokines, antibiotics and gene therapies.
Bibliography	Everything needed can be found down below.
Expected effect	Students will acquire an insight in the use of recombinant DNA technology in medicine and pharmacy.

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Name of activity	**EU is rejecting modern GMO and GE plant varieties: what are we missing and why your opinion matters**
Number of working hours	2
Type of activity	Lecture
Lecturer	Borut Bohanec
Short summary of content	Genetically modified food has gained major acceptance around the world, in just 20 years, despite regions like EU rejecting it, GMO varieties are grown on area far larger that all European fields together. Farmers are benefiting most since they can apply much less insecticides and protect soil drift. Several examples will be shown and discussed. Lately, new varieties have been released that target consumers exhibiting direct benefits to them. On top of this, new breeding techniques were developed, most exposed being genome editing (GE). Methods differ but they have in common, that no novel genetic elements are inserted but rather existing genes are deleted or slightly modified. Again, EU rejects also this novel form of plant breeding through complicated political manipulations. The main focus of the lecture will be showing various examples existing in scientific literature that resulted as GMO or GE varieties, but are not all produced because of overregulation.
Bibliography	Everything needed can be found down below.
Expected effect	Students will have the opportunity to discuss the consequences of long-term non-formal ban on modern biotechnological methods.

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Name of activity	**Exploring and fine-tuning microbial enzyme systems for sustainable production of biofuels**
Number of working hours	1
Type of activity	Lecture
Lecturer	Maša Vodovnik
Short summary of content	The global energy consumption continues to increase in keeping up with industrialization and improving quality of life. On the other hand, heavy use of fossil fuels is recognized as one of the main contributors to climate change. Thus, there is much interest in producing biofuels (and other chemicals) by microbial cell factories and enzymes from renewable non-food biomass, instead of relying on petrochemical routes. To meet the need to develop industrially competitive microorganisms (enzymes), different strategies are being applied: from exploring (meta)genomes for novel biocatalysts, genome-wide identification of metabolic engineering targets, fine-tuning and control of gene expression, genome and protein engineering to creation of synthetic circuits. The lecture will cover some general approaches used to identify and develop improved biocatalysts for transformation of waste biomass to biofuels and value-added chemicals.
Bibliography	Everything needed can be found down below.
Expected effect	Students will acquire knowledge about the production of biofuels by microbial cell factories and enzymes from renewable non-food biomass, that could possibly provide a more sustainable future.

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Name of activity	**Genome editing: braking and re-building DNA the old way**
Number of working hours	2
Type of activity	Lecture
Lecturer	Marko Dolinar
Short summary of content	Genome editing is a method that enables introduction of desired changes into the genetic blueprint of living cells. To introduce changes at specific positions in the genome, most of the current approaches rely on initial precise genome cleavage. This can be achieved by several approaches which all rely on an endonuclease enzyme. It has to be as specific as possible and there are a range of options available. This lecture will focus on the basics of genome editing, problems that can occur in the process and on older techniques, that are now considered to be old-fashioned since the introduction of CRISPR/Cas9.
Bibliography	Everything needed can be found down below.
Expected effect	Students will be introduced to the basic principles of genome editing and will learn about the techniques that are now considered to be old-fashioned.

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Name of activity	**Company visit – Acies Bio**
Number of working hours	1.5
Type of activity	Company visit
Lecturer	Mark Zver
Short summary of content	ACIES BIO is a biotechnology contract research organization offering state-of-the-art R&D services to pharmaceutical, chemical, biotech and food industries. We provide full support from idea conceptualization through research to product development. Combining biotechnology and synthetic organic chemistry expertise, we offer a comprehensive service, covering all key development steps for efficient production of biosynthetic natural products or their semi-synthetic derivatives, as well as entirely synthetic compounds. The visit of the company will include microbiology laboratories, reactors and other workspaces of the company. The company will explain what they do, how they do it and what kind of products do they make.
Bibliography	Everything needed can be found down below.
Expected effect	Students will be introduced with the laboratories and reactors the company uses. They will get to know more about the work the company does and the aspects behind it.

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Name of activity	**CRISPR/Cas9 as the foundation of the revolution in the research and therapeutic genome editing**
Number of working hours	2
Type of activity	Lecture
Lecturer	Duško Lainšček
Short summary of content	CRISPR/Cas9 has emerged as an important versatile tool for genome editing and gene expression control. Although the genome-wide specific CRISPR/Cas9 system has some possible disadvantages regarding off-target effects, the wide range of applicability offers tremendous progress in time and efficiency in the development of various cell lines, animal models for human illnesses and gives a possible treatment choice for human genetic-derived diseases and that represents a revolution in personalized medicine.
Bibliography	Everything needed can be found down below.
Expected effect	In this lecture, students will get to know the basics of genome engineering and transcription regulation using CRISPR/Cas system, its properties and functionality and key steps in making CRISPR/Cas system as a potent tool in various fields of research.

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Name of activity	**Introducing changes into the bacterial genome**
Number of working hours	3
Type of activity	Lecture
Lecturer	Marjanca Starčič Erjavec
Short summary of content	As bacteria are fast growing and usually easy to handle, they are often used for genetic manipulations. Several methods and techniques for introduction of changes into the bacterial genome are known. The choice, which method to be employed depends on the type of required change(s). In this lecture, some of the most widely used methods and techniques will be presented.
Bibliography	Everything needed can be found down below.
Expected effect	Students will be introduced with the methods of changing bacterial genome and mutagenesis. They will learn which methods to apply based on the desired changes.

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Name of activity	**CRISPR/Cas9 as the foundation of the revolution in the research and therapeutic genome editing**
Number of working hours	2
Type of activity	Lecture
Lecturer	Andrej Senegačnik
Short summary of content	What is fuel and what are its main properties? This lecture will focus on the basics of fuels and main world and EU statistic of fuels. It will be discussed what are the basic principles of heat engines, including how you manage to transform heat to power and the Carnot cycle. Later on, a connection between biofuels, their production, use, emissions and environment indicators will be established. The lecture will serve as an introduction to the theme of biofuels.
Bibliography	Everything needed can be found down below.
Expected effect	In this lecture, students will get a better view of world energy use, basics of heat conversion to work and see what can be expected from biofuels in general.

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Name of activity	**Company visit – Institute of Microbiology and Immunology**
Number of working hours	1.5
Type of activity	Company visit
Lecturer	Darja Keše
Short summary of content	Institute of Microbiology and Immunology is the principal and the largest institution in Slovenia, highly qualified for microbiology and immunology activities in healthcare, research and education. In cooperation with the University Medical Centre Ljubljana, Institute of Oncology Ljubljana and several other healthcare institutions in Slovenia, the Institute is responsible for developing and linking the basic and clinical microbiology and immunology. In this visit students will get to see what the institute is working on, followed by a tour of the automatic bacterial line TLA Kiestra, laboratory for electronic microscopy and molecular laboratory.
Bibliography	Everything needed can be found down below.
Expected effect	Participants will get an inside look into the microbiology laboratories and get to see the mechanized process of applying microorganisms on agar plates.

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Name of activity	**Innovative ways of producing energy**
Number of working hours	3
Type of activity	Project work
Lecturer	Suvad Bajrić
Short summary of content	Seeing the future, even before it happens, is the quality of all that want to build it. A clear vision is the most responsible for Petrol becoming the largest Slovenian company in terms of revenue and the largest Slovenian energy company. After the presentation of the company Petrol d.d. and their plan for the future in producing fuels, they will present a problem, concerning biofuels, genome editing and the future of producing energy. The participants will have to solve the problem inside a group and present their solution.
Bibliography	Everything needed can be found down below.
Expected effect	The purpose of the project work is to explore the possibilities of producing energy in a more environmentally friendly way, employing the use of genome editing.

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Name of activity	**The power of CRISPR/Cas9: Rewriting the code of life**
Number of working hours	2
Type of activity	Group seminars
Lecturer	Duško Lainšček
Short summary of content	In this activity, the students will be presented with a theoretical laboratory exercise. They will get familiar with target design for targeted genome modification, vector preparation and will acquire a more detailed overview of delivery systems for CRISPR/Cas9. The preparation of animal organisms to study diseases with CRISPR/Cas9 will also be presented. After, we will have a discussion on the technology, its perks, disadvantages and other aspects of it.
Bibliography	Everything needed can be found down below.
Expected effect	Students will get a better perspective on laboratory exercises in genome editing. They will also have the opportunity to express their opinions about the CRISPR/Cas9 technology and discuss it with the expert on it.

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Name of activity	**Final exam**
Number of working hours	1
Type of activity	Oral exam
Lecturer	Suvad Bajrić
Short summary of content	The students will have an oral presentation of their solutions for the given problem and will then be asked questions about it by professionals.
Expected effect	The purpose of this activity is to test the knowledge, the students have acquired during the course and to give students an overview of the whole academic part of the course.

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Pre-materials

Pre-materials are prepared by professors that will take part in our course. They contain basic knowledge that has to be ingested before the event. Thanks to pre-materials we will be able to skip really basic information and provide more advanced knowledge.

You can find them by clicking on the name in each table.

Name	Recombinant DNA Technology in Medicine
Topic/field	Biotechnology, Pharmacy
Author/ Professor	Agisha Raaje P (Provided by professor Matjaž Ravnikar.)
Short description	It is desired from students to be familiar with the basic pharmaceutical substances and drugs that are used in medicine (antibiotics, vaccines,...).

Name	What is Gene Editing and How Does it Work?
Topic/field	Gene editing
Author/ Professor	Provided by professor Marjanca Starčič Erjavec.
Short description	It is desired from students to be familiar with what gene editing is and it's basic principles.

Name	How CRISPR works
Topic/field	CRISPR technology
Author/ Professor	Provided by lecturer Duško Lainšček.
Short description	It is desired from students to be familiar with the CRISPR technology and it's basics that the course will build on.

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Name	Development and applications of CRISPR-Cas9
Topic/field	CRISPR technology
Author/ Professor	Patrick D. Hsu, Eric S. Lander and Feng Zhang (Provided by lecturer Duško Lainšček.)
Short description	It is intended for students that want to acquire more advanced knowledge of CRISPR-Cas9 technique and its development before the course.

Name	Economic feasibility and long-term sustainability criteria on the path to enable a transition from fossil fuels to biofuels
Topic/field	Biofuels, sustainability
Author/ Professor	Giorgio Perin and Patrik R. Jones (Provided by professor Andrej Senegačnik.)
Short description	It is desired from students to be familiar long-term sustainability criteria, that is applied in a transition from fossil fuels to biofuels.

Name	The evolution of the biofuel science
Topic/field	Biofuels
Author/ Professor	Pooya Azadi, Robert Malina, Steven R.H.Barrett and Markus Craft (Provided by professor Andrej Senegačnik.)
Short description	It is desired from students to be familiar with the basics of biofuels science and its evolution.

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