

COURSE TITLE: Experimental Immunology		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURER: Prof. Mariastefania Antica, PhD - Institute for Medical Research and Occupational Health, Zagreb Prof. Maja Matulić, PhD - University of Zagreb, Faculty of Science, Department of Biology Prof. Petra Korać, PhD - University of Zagreb, Faculty of Science, Department of Biology Krešo Bendelja, PhD - Institute of Immunology, Zagreb Prof. Tomislav Vladušić, PhD - University of Zagreb, Faculty of Food Technology and Biotechnology		
COURSE CONTENT	HOURS:	ECTS
Lectures	12	3
Practical	5	
Tutorial	3	
COURSE OBJECTIVES: The aim of this course is to introduce the students to experimental approaches that led to the general principles of immunology in humans and animals, some key models and concepts of biotherapy in infectious, autoimmune and malignant diseases, development of new vaccine candidates, chemotherapy and immunotherapy and regenerative immunology.		
COURSE CONTENT: The course will cover fundamentals of the immune system. Applicability of diverse mechanisms and principles taught us by immunology. Lymphocyte and thymus development from stem cells, and regenerative immunology, including the identification and development of adult stem cells, 3D cultures and organoid systems, hematopoietic stem cells and bone marrow transplantation, the use of flow cytometry in stem cell analysis, and applications in regenerative medicine and immune modulation. It will explore immune disorders and mucosal immunity, focusing on food allergies, autoimmune diseases, mucosal immune regulation, and the role of tumor-infiltrating immune cells in cancer. The course also addresses immune cell engineering and experimental therapies, such as novel approaches in leukemia treatment, immune cell manipulation, experimental infection models, vaccine development, and mucosal vaccine strategies. Additionally, it will examine the development and function of innate immune cells, particularly macrophages and Natural Killer (NK) cells, as well as cytokines and immune-modulating factors, including their signaling mechanisms, functional assays, and therapeutic applications. Practical course: Immunofluorescence and flow cytometry		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attending the lectures, practical and seminars		
MODES OF EXAMINATION: seminars and final exams		
COURSE QUALITY EVALUATION: evaluation of students (final exam grades), evaluation of lecturer (students written opinions)		
RECOMMENDED LITERATURE: Janeway's Immunobiology/ K. Murphy, C. Weaver, with acknowledgment to Charles A. Janeway, Paul Travers, Mark Walport, (eds.), 9 th ed., Garland Science Publishing, 2017. https://immunologos.wordpress.com/wp-content/uploads/2020/08/janeways-immunobiology-9th-ed_booksmedicos.org_.pdf Original scientific papers		

COURSE TITLE: Cell Culture Bioengineering		
YEAR: 2 nd		TERM (SEMESTER): 3 rd
LECTURERS: Prof. Igor Slivac, PhD - University of Zagreb, Faculty of Food Technology and Biotechnology Prof. Kristina Radošević, PhD – University of Zagreb, Faculty of Food Technology and Biotechnology Prof. Višnja Gaurina Srček, PhD – University of Zagreb, Faculty of Food Technology and Biotechnology Guest lecturers: Tanja Košutić Gulija, PhD – University of Zagreb, Centre for Research and Knowledge Transfer in Biotechnology Maja Jagušić, PhD – University of Zagreb, Centre for Research and Knowledge Transfer in Biotechnology		
COURSE CONTENT	HOURS	ECTS
Lectures	30	4
Practical	15	
Tutorial		
COURSE OBJECTIVES: Identifying and addressing problems that can be resolved through the application of cell culture techniques. Metods and principles of tissue engineering, <i>in vitro</i> drug evaluation, and viral vaccine production.		
COURSE CONTENT: Definition of cellular bioengineering Certain aspects of cellular engineering: - Fundamentals of Tissue engineering - Cell migration in drug discovery - Viral vector and viral vaccine production - Application and cultivation of spheroids Practical course: Cell viability assessment, monitoring morphological changes, cellular migration		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Attending lectures and practical classes. Basic knowledge in animal cell cultivation.		
MODES OF EXAMINATION: written lab report, written exam		
COURSE QUALITY EVALUATION: anonymous survey after the course completion		
RECOMMENDED LITERATURE: review articles, references inside the teaching materials (updated regularly)		

COURSE TITLE: Professional Project		
YEAR: 2 nd		TERM (SEMESTER): 3 rd
LECTURER: Prof. Igor Stuparević, PhD - University of Zagreb, Faculty of Food Technology and Biotechnology		
COURSE CONTENT	HOURS	ECTS
Lectures		2
Practical		
Tutorial	20	
COURSE OBJECTIVES: Development of student competences 1. how to build up your personal professional project 2. to prepare the students to find a traineeship (stay) or a job		
COURSE CONTENT: Bibliography report on the topic chosen by student for his professional practice. Preparation of a personal professional project. Independent research and planning of a professional project. Building a professional project based on personal life experience. Defining (determining) whether “what you want” is really “what you can do”. Preparing for a job interview. Presenting and defending the central professional project in front of an audience. Understanding the organisation of a company. Several lectures and interviews will enable the students to gather a deeper knowledge in the various careers in the "biotechnology" world, the experience real economic situation in Croatia and benefit from several professionals’ experience.		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Writing a report of the meetings attended by representatives of biotech companies, job application, CV and letter of motivation for job application.		
MODES OF EXAMINATION: report		
COURSE QUALITY EVALUATION: anonymous course evaluation form filled by students		
RECOMMENDED LITERATURE: the support given during lessons (including references inside)		

COURSE TITLE: Plant Engineering		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURER: Prof. Nataša Bauer, PhD - University of Zagreb, Faculty of Science, Department of Biology		
COURSE CONTENT	HOURS	ECTS
Lectures	10	4
Practical	20	
Tutorial		
COURSE OBJECTIVES: To acquire basic knowledge in plant engineering techniques		
COURSE CONTENT: Lectures: 1. Plant micropropagation methods and conventional breeding 2. Methodology of plant genetic modification 3. Engineering plants to overcome biotic and abiotic stress 4. Engineering plant performances and quality 5. Genome editing in plants and regulative of GMO and crops derived by new genomic techniques application Practical work: 1. Floral dip transformation of <i>Arabidopsis thaliana</i> 2. Agroinfiltration of <i>Nicotiana benthamiana</i> leaves and detection of subcellular localization of transgenic protein(s) in the epidermal cells by fluorescent microscopy 3. Biolistic transformation of the onion epidermal cells		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attendance of all classes (lectures and practical)		
MODES OF EXAMINATION: written exam		
COURSE QUALITY EVALUATION: student evaluation and communication with students throughout the lectures and practicum		
RECOMMENDED LITERATURE: Glick, Bernard R. Molecular biotechnology: principles and applications of recombinant DNA / Bernard R. Glick, Jack J. Pasternak, and Cheryl L. Patten. - 4 th ed. Selected original scientific papers and reviews		

COURSE TITLE: Bioimaging		
YEAR: 2 nd		TERM (SEMESTER): 3 rd
LECTURERS: Prof. Josef Hamacek, PhD – University of Orléans Asst. Prof. Anthony Delalande, PhD – University of Orléans Sara Lacerda, PhD – CNRS Orleans Campus Asst. Prof. Stéphane Pallu, PhD – University of Orléans		
COURSE CONTENT	HOURS	ECTS
Lectures	18	2
Practical	0	
Tutorial	0	
COURSE OBJECTIVES: 1. Master imaging technologies in cellulo and in-vivo. Understanding the techniques of analysis for the qualitative and quantitative evaluation of cellular and living mechanisms; 2. Introduction to in vivo imaging (scope and limits); 3. Acquiring theoretical bases of data processing and applications of digital image analysis in biology. The aim is to enable insertion into technological platforms for fundamental research or medical diagnosis.		
COURSE CONTENT: Microscopy and biological applications. Fluorescence microscopy in basic and biomedical research; F-techniques (FRAP, FRET, FLIM and FCS); real-time imaging, spectral imaging, TIRF. Modern biomedical imaging: principles and applications. Optical imaging (bioluminescence, fluorescence in the visible and near infrared, optical tomography). X-ray-based imaging (radiography, computed tomography). Nuclear imaging (scintigraphy, positron emission tomography). Magnetic resonance imaging. Ultrasound imaging and hybrid methods. Molecular imaging agents combined to generate or enhance the signal.		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: basic knowledge of spectroscopic techniques, bases of chemistry and biochemistry		
MODES OF EXAMINATION: written exam		
COURSE QUALITY EVALUATION: anonymous quiz		
RECOMMENDED LITERATURE: support given during lessons (including references inside)		

COURSE TITLE: Experimental Approach in Genetics		
YEAR: 2 nd		TERM (SEMESTER): 3 rd
LECTURER: Assoc. Prof. Marina Svetec Miklenić, PhD (responsible) and Prof. Ivan Krešimir Svetec, PhD, University of Zagreb Faculty of Food Technology and Biotechnology, Croatia		
COURSE CONTENT	HOURS	ECTS
Lectures	20	4
Practical	4	
Tutorial	6	
COURSE OBJECTIVES: Present to students the entire process of conducting experimental research in the field of molecular genetics, including the formulation of a scientific question or hypothesis, the selection or design and construction of the experimental system, the execution of the experiment and the prediction of possible results, as well as the critical analysis of results and the drawing of conclusions that lead to new insights in molecular genetics. Encourage students to engage in critical thinking and critical evaluation of research results, and develop problem-solving skills, teamwork, and creativity in order to enhance their employability in the fields of development, science, and innovation.		
COURSE CONTENT: Students will be presented with three scientific research projects in the field of molecular genetics, or molecular biosciences, with potential applications in molecular biotechnology. Prior to that, they will be provided with all the necessary information to understand these projects. LECTURES Introduction to the course. Comprehensive overview of all types and models of genetic recombination (from the broadest to the most specific), considering the type of organism (prokaryotes, eukaryotes), the phase of the cell and life cycle (mitosis, meiosis, conjugation...), and other parameters. Applications of genetic recombination in biotechnology and scientific research. Presentations of scientific research projects: Investigation of the mechanism of double-strand DNA break repair (a potentially lethal type of damage), Palindromes and quasi-palindromes in genomes – their biological role and risk to genome stability, Investigation of essential genes – from genetic to phenotypic lethality. TUTORIAL (SEMINAR) Students present an original scientific paper from the field of molecular biosciences, with emphasis on the scientific question (hypothesis), interpretation of the experimental system and results obtained, and scientific contribution. Students also participate in a group discussion. PRACTICAL COURSE Students will analyse a range of genetic events based on the Southern blot method (DNA hybridization method according to Southern) and, using the colour of yeast colonies in a specific experimental system, independently draw conclusions about the stability of palindromic sequences in the eukaryotic genome.		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attending the lectures, practical and seminar		
MODES OF EXAMINATION: seminar work + written final exam		
COURSE QUALITY EVALUATION: Anonymous course evaluation form filled by students		
RECOMMENDED LITERATURE: original scientific papers		

COURSE TITLE: Chemical Analysis Techniques		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURERS: Prof. Ivone Jakaša , PhD - University of Zagreb, Faculty of Food Technology and Biotechnology Prof. Caroline West, PhD - University of Orléans		
COURSE CONTENT	HOURS:	ECTS
Lectures	15	2
Practical	0	
Tutorial	0	
COURSE OBJECTIVES: Acquiring the basic knowledge of the theoretical principles of separation methods and the modern experimental approach to compound analysis in various matrices; developing the competencies necessary for scientific research and professional work		
COURSE CONTENT: The course provides an introduction to chromatography, focusing on fundamental concepts and theoretical principles underlying separation processes. Emphasis is placed on gas, liquid and thin-layer chromatography including discussions of instrumentation, operational parameters, and different detection modes. The course includes practical applications of chromatographic methods for the analysis of real samples from various matrices. Extraction methods and bioactivity testing will also be briefly addressed. Students will be introduced to the critical steps in method development, including the selection of chromatographic conditions, sample preparation strategies, and optimization of separation parameters. A portion of the course is dedicated to method validation, covering key validation parameters as defined by international regulatory guidelines.		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attendance of classes.		
MODES OF EXAMINATION: Written evaluation test.		
COURSE QUALITY EVALUATION: anonymous evaluation of the course, communication with students throughout the lectures		
RECOMMENDED LITERATURE: D. A. Skoog, F. J. Holler, S. R. Crouch: Principles of Instrumental Analysis, Brooks/Cole Pub, 6th edition, 2006.		

COURSE TITLE: Innovative Therapy		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURER: Prof. Chantal Pichon, PhD - University of Orléans and Inserm Andreja Ambriović Ristov, PhD - Ruđer Bošković Institute		
COURSE CONTENT	HOURS	ECTS
Lectures	18	3
Practical	0	
Tutorial	0	
COURSE OBJECTIVES: To present an overview of the different ways to modulate gene expression, especially by using nucleic acids delivery systems. Several therapeutic applications will be given. By this module we want to summarize the basic principles of gene therapy. Various gene strategies will be discussed: gene replacement, destruction of unwanted tissues, immune stimulation and tissue engineering. All stages of gene therapy will be covered: vector design, preclinical and clinical testing.		
COURSE CONTENT: The first part of the course will cover structure of viruses from which vectors are derived adenoviruses, retroviruses, adeno-associated viruses and herpes viruses. The modifications to the wild type viruses needed for a production of gene therapy vectors will be described. Special attention will be given to tumour gene therapy and vaccination. Finally, several examples of clinical trials will be given to illustrate how preclinical research is transferred into clinical testing. The second part comprises non-viral system for nucleic acids delivery. Applications: Cancer gene therapy and Gene therapy for monogenic diseases and regenerative medicine		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attendance of classes (theoretical and practical)		
MODES OF EXAMINATION: written evaluation test		
COURSE QUALITY EVALUATION: anonymous evaluation of the course		
RECOMMENDED LITERATURE: support given during lessons (including references inside)		

COURSE TITLE: Nanomedicine		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURER: Asst. Prof. Varvara Gribova, PhD - University of Orléans		
COURSE CONTENT	HOURS	ECTS
Lectures	14	2
Practical	0	
Tutorial	0	
COURSE OBJECTIVES: The goal of this course is to familiarize the students with innovative therapeutic approaches that make use of nanomedicine, from their emergence in a research laboratory, through preclinical evaluation and up to the marketing phase.		
COURSE CONTENT: Nanomedicine encompasses several marketed products, ranging from the delivery of therapeutic molecules to medical imaging, diagnostics, and biomaterials. This course will cover different types of therapeutic approaches that utilize nanomedicine: gene therapy, targeted drug delivery, nanosystems for tissue regeneration, and more. In addition, we will present the various stages involved in the development of a therapeutic approach, such as scientific research, preclinical characterization, and the associated regulations. New technologies like molecular modelling and artificial intelligence will also be presented. By the end of this course, you will understand the "life cycle" of an innovative therapeutic approach in the field of nanomedicine, starting from its invention in the research laboratory and going through the various perilous phases of preclinical and clinical trials, before being made available to patients. The theoretical part will be concluded by a 3-hour group work on a project, which will allow to synthesize the acquired knowledge and apply the theory.		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: The students are expected to attend all the lectures and participate in the final group project.		
MODES OF EXAMINATION: written exam		
COURSE QUALITY EVALUATION: anonymous poll		
RECOMMENDED LITERATURE: will be provided during the lectures		

COURSE TITLE: Chemical Analysis Techniques - practical training		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURERS: Prof. Caroline West, PhD - University of Orléans Prof. Ivone Jakaša, PhD - University of Zagreb, Faculty of Food Technology and Biotechnology		
COURSE CONTENT	HOURS:	ECTS
Lectures	0	2
Practical	12	
Tutorial	0	
COURSE OBJECTIVES: Understand the basics of instrumental analysis with particular focus on chromatographic and electrophoretic separation methods. Learn how to prepare samples of natural products prior to introduction in the separation systems.		
COURSE CONTENT: This laboratory-based course provides hands-on experience with modern instrumental methods of chemical analysis, with a primary focus on chromatographic techniques. Students will learn the principles, operation, and applications of gas chromatography (GC), high-performance liquid chromatography (HPLC), and related separation methods. Through practical exercises, they will develop skills on method development for the analysis of natural products from sample preparation, instrument calibration and method optimization to data interpretation.		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attendance of classes.		
MODES OF EXAMINATION: Evaluation of written reports submitted after practical works.		
COURSE QUALITY EVALUATION: anonymous evaluation of the course, communication with students throughout the lectures		
RECOMMENDED LITERATURE: D. A. Skoog, F. J. Holler, S. R. Crouch: Principles of Instrumental Analysis, Brooks/Cole Pub, 6th edition, 2006.		

COURSE TITLE: Gene Therapies Practical Training		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURERS: Prof. Maryvonne Ardourel, PhD – University of Orléans Asst. Prof. Anthony Delalande, PhD – University of Orléans		
COURSE CONTENT	HOURS	ECTS
Lectures	0	2
Practical	20	
Tutorial	6	
COURSE OBJECTIVES: The objectives of the course are to provide students with a practical understanding of gene therapy strategies, tools, and experimental techniques. The course aims to illustrate how gene therapy can be used to correct genetic disorders or modulate gene expression, through hands-on sessions involving nucleic acid manipulation, transfection, and analysis of gene expression. Students will be expected to progressively acquire autonomy and critical thinking by simulating conditions encountered in a real research laboratory environment.		
COURSE CONTENT: Introduction to gene therapy: principles, vectors, and delivery systems; RNA extraction and quantification techniques; Use of plasmids vectors; Transfection methods in mammalian cells (lipofection, electroporation); Assessment of gene expression by RT-qPCR and reporter gene assays; Microscopy techniques for cell imaging and transfection analysis; Flow cytometry for quantitative analysis of transgene expression and cell populations; Safety procedures in a lab; Applications in neurology, oncology or rare diseases (depending on the project); Applications of the "Innovative Therapies" course (C. Pichon) in practical settings		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: Regular attendance of classes (theoretical and practical) Regular attendance of both theoretical and practical sessions is mandatory. Students are expected to actively participate in all laboratory activities, comply with safety and hygiene regulations, and demonstrate responsible conduct in a research environment. During the week of practical training, students will work in groups to design and carry out a coherent series of experiments under semi-autonomous conditions, simulating the workflow of an academic research project. Each group will be required to compile all data and analyses into a final report written in the format of a scientific article, which will be assessed for scientific rigor, clarity, and collaboration quality.		
MODES OF EXAMINATION: Scientific report: a structured manuscript in the format of a scientific article compiling the results of the practical week. The report will be evaluated for scientific accuracy, methodological clarity, data analysis, and group collaboration. Participation grade: individual evaluation based on active engagement, autonomy, teamwork, and respect of laboratory safety and hygiene rules during the practical sessions.		
COURSE QUALITY EVALUATION: anonymous evaluation of the course		
RECOMMENDED LITERATURE: will be provided during the practical work		

COURSE TITLE: Scientific Communication in English and in French		
YEAR: 2nd		TERM (SEMESTER): 3rd
LECTURERS: Prof. Ana Kovačić - University of Zagreb Faculty of Food Technology and Biotechnology Prof. Marie Delmet - Embassy of France in Croatia		
COURSE CONTENT	HOURS	ECTS
Lectures	30	
Practical		
Tutorial		
COURSE OBJECTIVES: The aim of this course is to provide French and Croatian students with a knowledge of scientific English and Croatian students with a basic knowledge of French and to introduce specific terminology, both colloquial and scientific.		
COURSE CONTENT:		
STUDENT REQUIREMENTS IN THE COURSE AND THE WAY OF ACCOMPLISHMENT: none		
MODES OF EXAMINATION: written exam		
COURSE QUALITY EVALUATION: anonymous evaluation of the course		
RECOMMENDED LITERATURE: will be provided during the lectures		