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**COURSE TITLE:** Experimental Immunology

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd

**LECTURER:** Dr. Mariastefania Antica, Ruder Bošković Institute, Zagreb, Croatia  
Dr. Dubravko Forčić, Dr. Krešo Bendelja, Immunology Institute, Zagreb, Croatia  
Professor Nada Oršolić, Faculty of Science, University of Zagreb, Croatia  
Assistant Professor Lidija Šver, Faculty of Food Technology and Biotechnology, University of Zagreb, Croatia

**COURSE CONTENT**  
<table>
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**COURSE OBJECTIVES:** The aim of this course is to introduce 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.

**COURSE CONTENT:**  
- Mechanisms, design and application of vaccines; novel approaches in the development of vaccines; Regulatory expectations and requirements for safety testing of vaccine candidates  
- Biological therapy; development of next generation vaccines; monoclonal antibodies, cytokine therapy; DNA/RNA therapy  
- Mechanism of chemoprevention - anti-mutagenesis/anti-carcinogenesis, anti-proliferation/anti-progression; antioxidants and chemotherapy, antioxidants and radiotherapy, chemoimmunotherapy and hyperthermy, immunotherapy; General mechanisms of resistance to chemotherapeutic drugs; Propolis and related polyphenolic compounds; their relevance to host resistance and interaction with chemotherapy  
- Immune systems and immune responses of domesticated animals - Immunity of domesticated animals. Immunological assays and methods to examine immunity and disease in domesticated animals; Immunology and inflammation in the gastrointestinal tract - Mucosal immunity. Oral tolerance. Immunomodulation. Mucosal Immunization  
- Critical analysis of original research articles in a discussion format. Special attention is given to the experimental approaches in immunological disorders and immunotherapy.  

**Practical work:** Immunofluorescence and flow cytometry

**STUDENT REQUIREMENTS IN THE COURSE AND MEANS OF ACCOMPLISHMENT:** Regular attendance of lectures, practical exercises and seminar

**MODES OF EXAMINATION:** seminars and final exam

**COURSE QUALITY EVALUATION:** evaluation of students (final exam grades), evaluation of lecturer (written student opinions)

Original scientific papers
**COURSE TITLE:** Experimental approaches in genetics

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd

**LECTURER:**  
Associate Professor Ivan Krešimir Svetec, Faculty of Food Technology and Biotechnology, University of Zagreb, Croatia  
Professor Višnja Besendorfer, Faculty of Science, University of Zagreb, Croatia

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**COURSE OBJECTIVES:** Understanding the principles of the application of genetic methods

**COURSE CONTENT:**  
**Lectures:**  
1. Genetic markers in molecular ecology  
2. Plant genome organization - coding and noncoding (satellite DNA, retrotransposons) DNA.  
3. Molecular and chromosome markers in the determination of varieties, cultivars, hybrids etc., population diversity (genetic polymorphism).  
4. Genetic modifications in commercial GMOs  
5. Genetic diversity based on case studies (seminars).

**Practical work:** Fluorescence in situ hybridization (FISH); Pulsed-field gel electrophoresis; Southern blotting

**STUDENT REQUIREMENTS IN THE COURSE AND MEANS OF ACCOMPLISHMENT:** Regular attendance of lectures, practical exercises and seminar

**MODES OF EXAMINATION:** seminar work + final exam

**COURSE QUALITY EVALUATION:** evaluation of students (final exam grade) , evaluation of lecturer (written student opinions)

**RECOMMENDED LITERATURE:** original scientific papers
### COURSE TITLE: Cell Culture Bioengineering

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd

**LECTURER:**

- **Assistant Professor Višnja Gaurina Srček**, Laboratory for Cell Culture Technology and Biotransformation, Faculty of Food Technology and Biotechnology, University of Zagreb, Croatia
- **Professor Chantal Pichon**, University of Orleans, Center for Molecular Biophysics, CNRS Orleans, France
- **Dr. Patrick Midoux**, INSERM, Center for Molecular Biophysics, CNRS Orleans, France
- **Dr. Igor Slivac**, Research Assistant, Laboratory for Cell Culture Technology and Biotransformation, Faculty of Food Technology and Biotechnology, University of Zagreb, Croatia

**COURSE CONTENT**

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**COURSE OBJECTIVES:**
Introduction to animal cell culture application and laboratory techniques

**COURSE CONTENT:**

- **Lectures:**
  - laboratory organization and equipment
  - types, origin and development of cell lines
  - cell culture media and growth conditions
  - special laboratory techniques: flow cytometry, cell cycle analysis, cloning
  - application of animal cell culture technology: medicine, biopharmaceutics, cosmetology

- **Practical work:**
  - cell types and characterisation
  - cell synchronisation
  - confocal microscopy
  - flow cytometry

**STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS OF ACCOMPLISHMENT:**
Regular attendance of classes and practical exercises

**MODES OF EXAMINATION:**
Written examination

**COURSE QUALITY EVALUATION:**
Student evaluation and communication with students throughout the lectures

**RECOMMENDED LITERATURE:**
**COURSE TITLE:** Chemical Analysis Techniques

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd

**LECTURER:**
Dr. Emilie Destandau, Maître de Conférence, Institut de Chimie Organique et Analytique, Université d’Orléans, France  
Assistant Professor Damir Iveković, Laboratory for General and Inorganic Chemistry and Electroanalysis, Department of Chemistry and Biochemistry, Faculty of Food Technology and Biotechnology, University of Zagreb, Croatia  
Assistant Professor Ivone Jakaša, Laboratory for Analytical Chemistry, Department of Chemistry and Biochemistry, Faculty of Food Technology and Biotechnology, University of Zagreb, Croatia

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**COURSE OBJECTIVES:** Introduction to the basic theoretical principles of instrumental analytical methods

**COURSE CONTENT:**

**Lectures:**
- Introduction to instrumental analytical methods (theoretical background and definition of key concepts)
- Short introduction to spectroscopic methods (AAS, ICP, IR, UV/VIS and NMR)
- Gas chromatography (theoretical background, instrumentation, applications)
- Liquid and thin-layer chromatography (theoretical background, instrumentation, applications)
- Mass spectrometry for gas and liquid chromatography
- Electrophoresis (capillary electrophoresis and gel electrophoresis, theoretical background, applications)

**Practical exercises:**
- Determination of sugars in honey (HPLC-light scattering)
- Determination of parabens in creams (HPLC-UV/VIS)
- Determination of eugenols in food (TLC)
- Determination of essential oils in plant material (SPE-GC-MS)
- Determination of fatty acids in oils (GC-FID)
- Determination of benzoic acid and its derivatives (Electrophoresis)

**STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS OF ACCOMPLISHMENT:**
- Regular attendance of classes, seminar papers

**MODES OF EXAMINATION:**
- Written examination, written and oral examination

**COURSE QUALITY EVALUATION:**
- Student evaluation and communication with students throughout the lectures

**RECOMMENDED LITERATURE:**
COURSE TITLE:  Plant engineering

YEAR:  2nd  
TERM (SEMESTER):  3rd

LECTURERS:
Assistant Professor Nataša Bauer, Division of Molecular Biology, Faculty of Science, University of Zagreb
Associate Professor Biljana Balen, Division of Molecular Biology, Faculty of Science, University of Zagreb

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COURSE OBJECTIVES: Techniques used in plant breeding, application to industrial productions

COURSE CONTENT:
Plant improvement: traditional hybridization, in vitro culture, plant transformation, mutations and transgenic techniques, primary and secondary metabolite production, recombinant proteins

STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS OF ACCOMPLISHMENT:
Regular attendance of lectures and practical exercises

MODES OF EXAMINATION: Final exam

COURSE QUALITY EVALUATION: evaluation of students (final exam grades), evaluation of lecturer (written students opinions)

RECOMMENDED LITERATURE: Transgenic Plants (Methods and Protocols), L. Pena, 2005, Humana Press
Biotechnology for Beginners, R. Renneberg, 2008, Academic Press
**COURSE TITLE:** Gene Therapy – Gene Transfer

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd and 4th

**LECTURERS:**  
Professor Chantal PICHON, University of Orleans, Center for Molecular Biophysics, CNRS Orleans, France  
Dr. Patrick Midoux, INSERM, Center for Molecular Biophysics, CNRS Orleans, France  
Dr. Andreja Ambriovic Ristov, Ruđer Bošković Institute, Zagreb

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**COURSE OBJECTIVES:** To present an overview of the different ways to modulate gene expression, especially using nucleic acid delivery systems. Several therapeutic applications will be given. This module aims 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.

**LECTURE 1 (2 hours): ADENOVIRUSES**

**LECTURE 2 (2 hours): RETROVIRUSES**

**LECTURE 3 (2 hours): ADENO-ASSOCIATED VIRUSES AND HERPES VIRUSES**

**LECTURE 4 (2 hours): VIRAL VECTORS IN TUMOUR GENE THERAPY AND VACCINATION**

**LECTURE 5 (2 hours): CLINICAL TRIALS WITH VIRAL VECTORS**

The second part comprises non-viral systems for nucleic acid delivery.

**LECTURE 1 (4 hours):** Non viral gene delivery systems: basic knowledge of targets and intracellular routing  
**LECTURE 2 (4 hours):** Physical methods for gene delivery  
**LECTURE 3 (4 hours):** Chemical vectors  
Applications:  
**LECTURE 4 (4 hours):** Cancer gene therapy  
**LECTURE 5 (4 hours):** Gene therapy for monogenic diseases and regenerative medicine

**STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS 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:**
COURSE TITLE: Bio-imaging

YEAR: 2nd TERM (SEMESTER): 4th

LECTURER: Prof. Chantal PICHON, University of Orleans, Center for Molecular Biophysics, CNRS Orleans, France

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COURSE OBJECTIVES: To gain knowledge of: 1) fluorescence based-imaging and non-invasive bioimaging of small animal models; 2) applications of fluorescence microscopy in biomedical research and 3) new fluorescence-based techniques for biomedical research and biotechnology.

COURSE CONTENT:
1. Introduction to the basics of fluorescence;
2. Epifluorescence and confocal laser scanning microscopy mono and multi-photons
3. Microspectrofluorimetry, videomicroscopy
4. F-techniques: FISH, FRAP, FRET and FLIM
5. *In vivo* bioimaging: optical imaging (luminescence, fluorescence) and X-ray imaging

STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS OF ACCOMPLISHMENT:
Regular attendance of classes and practical exercises

MODES OF EXAMINATION: Written evaluation test

COURSE QUALITY EVALUATION: Anonymous evaluation of the course

RECOMMENDED LITERATURE:
**COURSE TITLE:** Professional Project - Knowledge about firms

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd

**LECTURER:** Professor Daniel Hagège, Plant Physiology, International Liaison Officer, Faculty of Sciences, Orléans, France

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**COURSE OBJECTIVES:** DEVELOPMENT OF STUDENT COMPETENCES  
- how to build up your personal professional project  
- to prepare the students to find a traineeship (stay) or a job

**COURSE CONTENT:**
Professional project  
Development of personal and professional projects.  
Personal study on how to draw up a professional project  
Build professional project from personal experience throughout life  
Define if "what you wish" is really "what you can do".  
Lay out a CV and a cover letter in response to job offer  
Preparation for job interviews  
Report and defence of the personal project in front an audience.  
Knowledge about firms  
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 MEANS OF ACCOMPLISHMENT:** none

**MODES OF EXAMINATION:** oral presentation of the personal professional project

**COURSE QUALITY EVALUATION:**

**RECOMMENDED LITERATURE:**
**COURSE TITLE:** Scientific Communication in English and in French

**YEAR:** 2nd  
**TERM (SEMESTER):** 3rd

**LECTURER:** Lecturer from the French Embassy

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**COURSE OBJECTIVES:** to give to the student basic knowledge of French terminology in current language and in scientific terminology

**COURSE CONTENT:**

**STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS OF ACCOMPLISHMENT:** none

**MODES OF EXAMINATION:**

**COURSE QUALITY EVALUATION:**

**RECOMMENDED LITERATURE:**
## COURSE TITLE: Industrial Training

### YEAR: 2nd
### TERM (SEMESTER): 3rd

### LECTURER: Lecturer from the French Embassy

### COURSE CONTENT

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### COURSE OBJECTIVES:

The 4-to-6-month industrial training period in a firm (Orléans-Zagreb) is a course requirement. 3 to 5 students may be given the opportunity to carry it out in a French firm, or in Croatia in a firm or in the university research laboratory at the University of Zagreb.

### STUDENT REQUIREMENTS IN THE COURSE AND THE MEANS OF ACCOMPLISHMENT: none

### MODES OF EXAMINATION:

### COURSE QUALITY EVALUATION:

### RECOMMENDED LITERATURE: