

Semestral lectures and courses in 2013/2014

Fundamentals of Molecular Biology - 17AMBZMB, winter term (WT), 2+2 hours per week. Faculty of Biomedical Engineering, Czech Technical University in Prague. For students of the international programme ERASMUS MUNDUS. Synopsis: Structure and function of nucleic acids DNA and RNA. Replication, transcription, translation. Protein synthesis, prokaryotic and eukaryotic gene expression. Structure and function of proteins. Enzymes. Cell reproduction, cell cycle, cell division. Biotechnology, hybridoma technology. Recombinant DNA vectors, restriction enzymes. Changes in genetic information, mutations. Methods of molecular biology – DNA isolation, centrifugation, electrophoresis, PCR. Flow cytometry. Genetic manipulations – gene engineering, gene modification, gene splicing. In English. [[Marie Lipoldová](#), Taťána Jarošíková (CTU Prague)]

Advances in Immunology of Infectious Diseases - CCOC5874, Molecular Mechanisms of Defence against Infection - CVOLPI1, summer term (ST), 15 hours, 3rd Faculty of Medicine. Introduction to the mechanisms of defence against viral, bacterial and parasitic infections with focus on new knowledge. [[Marie Lipoldová](#)]

Advances in Molecular Immunology - CVOL209, CCOC5935, WT, 15 hours, 3rd Faculty of Medicine, Charles University in Prague. Introduction to an integrated view on the basic molecular mechanisms and elements of the immune response with focus on new knowledge. [[Marie Lipoldová](#)]

Innate Immunity - MB150P90E, Faculty of Science, Charles University, WT, 2 hours per week. Basic questions of the evolution, functions and significance of the innate immunity system. In English. [[Dominik Filipp](#)]

Immunology - MB150P14B, Faculty of Science, Charles University, WT, 2 hours per week. The course provides extensive fundamentals of modern immunology, with focus on the molecular and cellular principles of immune system functions. The second part of the course is oriented to the role of particular immune mechanisms in the defence against various pathogens, to anti-tumour immunity and to immune mechanism defects (autoimmunity, allergies, immunodeficiency). [[Tomáš Brdička](#), [Václav Hořejší](#)]

Advances in Immunology I - MB150P78, Faculty of Science, Charles University, WT, ST, 2 hours per week. The course is intended for advanced Magister and PhD students, developing the knowledge of immunology in the context of new publications in relevant journals. Unique lectures present advances in many various areas of immunology (from receptor signalling to anti-tumour mechanisms) and detailed discussion of relevant recent papers (with impact on the methods). The

topics are not repeated and the lecturers select them according to the advances in the field. The course thus represents tutorial combination of lectures on particular topics (first two hours) with presentation of a relevant paper (second two hours). [Tomáš Brdička, Karel Drbal, Dominik Filipp, Václav Hořejší, Pavel Otáhal]

Molecular Immunology - MB150P15A, Faculty of Science, Charles University, WT, ST, 2 hours per week. Advanced two-term lecture series aimed at thorough deepening of knowledge of the molecular mechanisms of selected immune phenomena, the bases of which were explained in the fundamental immunology course. Topics in winter term: 1/ introduction to methodology: basic principles of recent methods applied in molecular immunology; 2/ building blocks of the immune system: molecular mechanisms of the generation and function of innate immunity receptors, immune receptors and MHC proteins, NK receptors. More complex systems in summer term: 3/ co-receptors, cytokines/chemokines and their corresponding receptors and other ligand/receptor pairs; significant signalling pathways and associated transcription programmes, their interplay at the cellular level; 4/ systemic view on the molecular level of immune phenomena and their causative relationships with human diseases: functional genomics, interactome, metabolome, domain and motif arrangement of interacting partners. [Karel Drbal]

Bioinformatics - MC250P30, Faculty of Science, Charles University, WT, ST, 2 hours per week. Combination of biochemistry, molecular biology, structural biology and computing methods applied to computer processing of data. These disciplines serve for acquisition, preservation, organization and analysis of biologic, genetic and structural information with following understanding of the significance and role of the studied system in living organisms. The main aim is to transform the complex data into a paradigm allowing study of the system in its complexity. Data preserved and utilized in bioinformatics include gene and protein sequences, cDNA, nucleotide sequences, and structure of both proteins and DNA. Data are obtained by experimental techniques such as sequencing, combinatorial chemical synthesis, gene expression, pharmacological and proteomic studies, X-ray crystallography and other methods. By using these data we can establish synthetic and predictive models allowing better understanding of the living systems as a whole. Bioinformatics is extensively used in biology, chemistry, pharmacy, medicine and agriculture. [Jan Pačes, Jiří Vondrášek]

Epigenetics - MB150P85, Faculty of Science, Charles University, WT, 2 hours per week. Course intended for students in the second year of Magister studies and PhD students considering a scientific career in the field of cell and molecular biology and biomedicine. The course modelled on the lectures of the Magister and PhD programme at the University of Pennsylvania is interactive and uses original epigenetic data. Essential impact is laid on the synthesis of knowledge and problem solving. In the first half the course covers three topics: histone modifications, DNA methylation and small RNA molecules. In the second half these mechanisms are integrated into lectures on such significant biologic processes and models as imprinting, dosage compensation (including X-inactivation), epigenetic reprogramming in mammalian life cycle and stem cell biology. Detailed explanation of the methods of epigenetic studies such as chromatin immunoprecipitation, bisulfite sequencing and RNAi is provided. In English. [Petr Svoboda]

Genome Integrity in Carcinogenesis and Ageing - MB150P62, Faculty of Science, Charles University, WT, 2 hours per week. The selected course provides Magister and PhD students with the present views on the fundamental mechanisms of the maintenance of integrity of the cell genome, cell response to DNA damage including cell senescence and apoptosis, cell cycle control during DNA damage and the role of DNA damage in the initiation and progression of tumour growth and cell and organism ageing. In addition, students will be introduced to a review of hereditary disorders originating from the defects in DNA repair mechanisms. The course will also explain the basic methods of DNA damage analysis with laboratory demonstration. [[Ladislav Anděra](#), [Kamila Burdová](#), [Libor Macůrek](#), [Václav Urban](#)]

Model Organisms in Developmental Biology - MB150P83, Faculty of Science, Charles University, ST, 2 hours per week. The course provides a review of different animal models used in developmental biology. Any model organism presents both advantages and disadvantages. The course is therefore presented as a comparison of particular models with the aim to teach students to select a suitable model for a particular scientific problem or for their scientific interests. The lectures will include both vertebrates and invertebrates, but major attention will be paid to the mouse model as a key organism in biomedicine. Focus will be placed on explanation of the available experimental approaches (methodology) and existing sources (databases, collections of mutants, etc.). Nearly every model organism may provide a unique and irreplaceable benefit to biology. In English. [[Zbyněk Kozmik](#)]

Molecular Biology of Cancer - MB150P89, Faculty of Science, Charles University, ST, 2 hours per week. Lectures are focused on the molecular and cell biology of healthy and tumour tissues and on the molecular mechanisms of initiation and progression of some “model” cancer diseases. Most lectures include information on modern methodology approaches to the study of gene functions, namely on the techniques exploiting experimental mice (knockout and knock-in, transgenesis, etc.) and on the methods of RNA interference (RNAi) and microarrays. The course, intended namely for Magister students, consists of 12 fundamental lectures on the syllabus topics. [[Vladimír Kořínek](#)]

Molecular Genetics of the Mammalian Organism - MB140P57, Faculty of Science, Charles University, ST, 2 hours per week. Students will be introduced to the field of present genetics and genomics of the mammalian organism on a model of laboratory mouse (*Mus musculus*). Focus is laid on the methodology principles determining the future development of genetics and genomics and on biomedicine aspects. Particular attention is paid to positional cloning and epigenetic regulations. The prerequisite for attending is basic knowledge in classical as well as molecular genetics. [[Jiří Forejt](#)]

Molecular Mechanisms of Apoptosis - MB150P79E, MB150P79, Faculty of Science, Charles University, ST, 2 hours per week. Cycle of lectures dealing with the questions of “life and death”, but at the cellular level only. Apoptosis, or directed/programmed cell death, is the most natural as well as most frequent manner of demise of a eukaryotic cell. The lectures are devoted to the significance of apoptosis or, more generally, cell death for the development and life of a multicellular organism, as well as to the initiation and regulation of this essential cellular process in various model organisms

and during some human diseases and pathological conditions. In total 9 ca 1.5-2-hour lectures. In English in case of attendance by foreigners. [[Ladislav Anděra](#)]

RNA Structure and Function - MB150P91E, Faculty of Science, Charles University, ST, 2 hours per week. Course for Magister and PhD students extending the basic knowledge of molecular and cell biology. The course is focused on the regulation of gene expression and constantly growing RNA field. Lectures are devoted to the mRNA synthesis and processing, and function and processing of non-coding RNA. They are based on most recent publications with explanation of key experiments. In English. [[David Staněk](#)]

Strategy of Grant Application - MPGS0054, Faculty of Science, Charles University, WT, ST, 40 hours Course intended for PhD students focused on learning the fundamental principles of preparing a high-quality grant application. During the course each student should prepare a draft project according to the requirements of the Czech Science Foundation (part C). During the following revision students are individually provided feedback on their draft grant application and they make corrections (both factual and formal) to be able to achieve success in a real CSF competition. [[Petr Dráber](#)]

Structure a Function of the Cytoskeleton - MB150P67, Faculty of Science, Charles University, WT, 2 hours per week. Lecture series aimed at introducing students to the present topic of the animal cell cytoskeleton. Building proteins of cytoskeletal structures will be described along with their organization into polymers and other structural units. Mechanisms regulating the dynamics of cytoskeletal structures and their interactions with other cell components will be explained. In addition, the structure and function of molecular cell motors interacting with the cytoskeleton will be described. The role of the cytoskeleton in particular cell cycle phases, intercellular signalling and pathological cell conditions will be elucidated. Lectures will include demonstration of experimental results of the Laboratory of Biology of the Cytoskeleton at IMG. [[Pavel Dráber](#)]

Three-Dimensional Structure Solution of Macromolecules - MC250P17, Faculty of Science, Charles University, WT, 2 hours per week. Lectures introducing students of Magister and PhD studies to the fundamentals of 3D structure of proteins and nucleic acids and providing more detailed explanation of two most widely used methods of 3D structure determination: X-ray crystallography and nuclear magnetic resonance (NMR). Lectures will be complemented with practical demonstration at the institutions exploiting these methods. [[Pavlína Maloy Řezáčová](#), [Jiří Brynda](#), Richard Hrabal]

Gene Engineering, Institute of Chemical Technology Prague, WT, 2 hours per week. Course focused namely on the methodology of molecular biology. T. Ruml, M. Rumlová, V. Pačes: Gene Engineering, manual. [[Václav Pačes](#), [Tomáš Ruml](#), [Jan Pačes](#)]

Molecular Genetics, Institute of Chemical Technology Prague, ST, 3 hours per week. The course is focused on the fundamentals of molecular genetics, following the courses Biochemistry I and II. The course is accompanied by a seminar. [[Tomáš Ruml](#), [Václav Pačes](#)]

Molecular Modelling and Bioinformatics - N320019, Institute of Chemical Technology Prague, WT, 2 hours per week. The lectures aim at introducing students to the fundamentals of modern instrumental analytical techniques and their applications in such fields as biochemistry, microbiology and bioengineering. The topics include mass spectrometry, nuclear magnetic resonance spectroscopy, X-ray crystallography and electron microscopy. The introductory lecture block is devoted to the methods of visualization of molecules, computing methods, and database applications. [Richard Hrabal, [Jiří Brynda](#), Jiří Šantrůček, Vojtěch Spiwok, Pavel Ulbrich]

Mouse Models of Human Diseases for Experimental Toxicology. 2x 3 hours. The course is devoted to utilization of mouse models in toxicology studies and intended for students in biomedicine. Palacký University, Olomouc [[Radislav Sedláček](#)]

Pharmacology, 10 hours, selected chapters in pharmacology for fourth-year students, 2nd Faculty of Medicine, Charles University and Faculty of Medicine, Charles University Hradec Králové [[Jaroslav Blahoš](#)]

Microscopy Methods in Biomedicine, Czechoslovak Microscopy Society, 5-day theoretical course with demonstrations and practical training covering the modern methodology of light and electron microscopy (including principles of preparation of biological samples), acquisition and processing of digital images and stereology. Part of the course also introduces atomic force microscopy and its demonstration. The course is intended namely for PhD students and young scientists in biomedical fields. After attending the course the participants will be able to determine which microscopy technique should be used to answer the particular investigated question. [[Pavel Hozák](#), Lucie Kubínová, Jana Nebesářová]

Transmission Electron Microscopy in Life Sciences – Faculty of Science, Charles University + Czechoslovak Microscopy Society, 5-day course aimed at beginners and intermediate users of transmission electron microscopes in biomedicine. It will devote about equal time to the theory and to practical use of microscopes. The course is limited to 15 participants and during practical sessions the participants will be divided into three groups. The techniques discussed in theoretical sessions will be demonstrated on three transmission electron microscopes of varying complexity – the simplest Morgagni, more complex Philips CM 100 and the most powerful Tecnai T20. In English. [[Pavel Hozák](#)]

Advances in Molecular Biology and Genetics, annual lecture series organized by the Institute of Molecular Genetics and Centre for Doctoral Study Programmes in Biomedicine at Charles University and Academy of Sciences. The course is intended for PhD students in biomedicine, starting scientists and newly also for Magister students. The course aims at providing information on scientific progress in the multidisciplinary field of molecular biology, genetics and biomedicine, with some biotechnology insights. In English. [[Petr Svoboda](#), [Jiří Jonák](#)]