Faculty of Science and Informatics

University of Szeged

Szeged, Hungary

Biology courses for

Visiting Students

2014

Did you know?

The University of Szeged traces its origins back to 1581, and the predecessor to the modern university was founded in 1872.

The Nobel Prize in Physiology or Medicine in 1937 was awarded to Albert Szent-Györgyi, then at the University of Szeged, *"for his discoveries in connection with the biological combustion processes, with special reference to vitamin C and the catalysis of fumaric acid"*.

The University of Szeged has been named among the top ranked 501-550 universities worldwide by QS World University Rankings.

The city of Szeged, on average, has about 2029 hours of sunshine per year.

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Course codes will be provided before the semester starts.

Department of Biochemistry and Molecular Biology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Prof. Dr. Imre Miklós Boros
Web: http://biokemia.bio.u-szeged.hu/index_e.html

Course code#

Biochemistry 1: structure and function of macromolecules

For BSc students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. Monika Kiricsi and Ildikó Huliak

Tel.: +36 (62) 546-377, Fax: +36 (62) 544-887
E-mail: kiricsim@gmail.com , huliakildiko@gmail.com

Aims
The course describes the major macromolecules and their monomers, gives an overview of their structures, chemical and physical properties and functions in the living organisms, characterizes carbohydrates, lipids, proteins and nucleic acids, and explains the general concepts of enzymology.

Course description
Carbohydrate characteristics, classifications of sugars (aldose-ketose, number of carbon atoms, reducing/non-reducing, mono-di-oligo- and polysaccharides). Major mono/di/oligo- and polysaccharides. Lipid classes and their properties. Storage lipids and membrane lipids: correlations between structure and function. Building blocks of phospholipids, sphingolipids, triacylglycerols. Structure of cholesterol and various steroids. Nucleic acids and their monomers: bases, sugar units and nucleotides. Types of RNA molecules and their various functions. Structure of the double stranded DNA, DNA denaturation and melting. Techniques for DNA analysis. Classification of amino acids, formation of peptide bonds, primary, secondary, tertiary and quaternary structure of proteins and the interactions stabilizing protein structure, definition of domains, prosthetic groups. Correlation between protein structure and function. Methods for protein purification, protein synthesis, sequencing and structure analysis. Thermodynamics of living systems, thermodynamical parameters and their role. General enzymology: enzyme classes, coenzymes, characterization of enzymes, isoenzymes, multienzyme systems, general models of substrate-enzyme connection, molecular mechanism of catalysis (acid-base, covalent, metal ion catalysis). Enzyme kinetics: Michaelis-Menten model and its linearization (Lineweaver-Burk and direct method), modulation and regulation of enzyme activity: competitive, non-competitive, uncompetitive inhibition, allosteric effectors, covalent modification of enzymes: phosphorylation and limited proteolysis. The effect of pH and temperature on enzyme activity.

Learning outcomes
The course provides a thorough introduction to the structure-function relationship of macromolecules. The level is suitable for advanced BSc students majoring in life sciences. The lectures give a general overview followed by a detailed examination of the chemical basis, classifications and basic functions of macromolecules from carbohydrates to nucleic acids. The course gives a particularly detailed review of enzyme structure and kinetcs. By completion, students will have a comprehensive understanding of the architecture and function of macromolecules of the living cells.

Skills and attributes
The students will become familiar with the various structures and related functions of different macromolecules of pro- and eukaryotic cells. They will possess an overall knowledge of chemical structure, physical properties and multiple roles of the carbohydrates, lipids, proteins and nucleic acids in living cells. Participants of the course will be acquainted with the basic methods used in DNA analysis, techniques of protein synthesis and purification, procedures of protein sequence and structure analysis. They will gain profound understanding about enzymatic biocatalysis in living systems.

Suggested reading
JM Berg, J Tymoczko, L Stryer: Biochemistry, 7th edition, W.H. Freeman, 2012, New York
D Voet, JG Voet: Fundamentals of Biochemistry, 4 th Edition, Wiley Publishing 2011.

Exam Written

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Course code#

Research project in molecular biology: macromolecule design and manipulation – a practical course

For MSc students *Fall semester, 4 hours/week, 4 credits*

Lecturer: Dr. Orsolya Buzás-Bereczki

Tel.: +36 (62) 546-377, Fax: +36 (62) 544-887
E-mail: opszin@gmail.com

Aims
This advanced laboratory practical course will deepen the experience of the students with experimental procedures. First, the production and purification of Pfu thermostable DNA polymerase is performed, and its enzymatic activities are characterized. Next, the regulation and function of the lac operon is analyzed. In the last section of the course SNP analysis (genotyping) by allele specific PCR is performed. During the course the students will work in pairs on given project assignments and document their findings in detailed project notebooks. They will present their findings in a final report.

Course description
Preparation of DH5α E. coli competent cells and transformation of pET-Pfu plasmid into these cells. Preparation of pET-Pfu plasmid DNA from DH5 α E. coli cells. Preparation of Rosetta (DE3) competent cells. Transformation of pET-Pfu plasmid into Rosetta (DE3) cells. Induction of Pfu protein expression by lactose or IPTG in Rosetta cells. Isolation of Pfu protein from induced Rosetta cells using sonication method. Testing the enzyme activity of Pfu polymerase in PCR reaction. Examination of Pfu protein expression by PAGE assay. Further purification of Pfu protein by salting out assay. Isolation of proteins from PAGE gels and examination by mass spectrometry. Purification of GST-tagged proteins by affinity chromatography. Applications of PCR technology. Isolation of genomic DNA. Genotyping the ABO(H) blood groups by SNP analysis. Determination of ABO alleles by allele-specific PCR, product analysis by agarose gelelectrophoresis. Analysis of the regulation of the E coli lac operon.

Learning outcomes
The course is designed to provide a thorough introduction to basic techinques in molecular biology: isolation of genomic and plasmid DNA, PCR techniques and two application areas of PCR technology. Assays for protein expression after induction by IPTG or lactose and protein purification and gene regulation in prokaryotic cells by lac operon. The course is suitable for advanced MSc students majoring in molecular biology. During the course various techniques for expression and purification of recombinant proteins in prokaryotic cells are applied. By its completion, students will have a comprehensive understanding of the macromolecule design and manipulation.

Skills and attributes
The students will become familiar with the various molecular biology methods. They will understand the ways of protein expression using pET-system and two purification techniques (salting out and affinity chromatography) for recombinant proteins. They will create a complete project notebook by the end of the semester, which will help them to prepare their thesis. They will acquire the ability of self-working from syllabus. During the course the students will gain practice in manual skills, such as sterile work, pipetting and solution handling and various gel electrophoresis (agarose, PAGE) techniques.

Suggested reading
D Voet, JG Voet: Fundamentals of Biochemistry, 4 th Edition, Wiley Publishing 2011.
Lodish, Berk, Krieger, Kaiser, Scott, Bretscher, Ploegh, Matsudaira: Molecular cell biology, 6 th Edition, Scientific American Books, 2007.

Exam Written, in the form of a final report

Department of Biochemistry and Molecular Biology
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Web: http://biokemia.bio.u-szeged.hu/index_e.html

Course code#

Molecular biology 1 - from genes to genomes

For MSc students *Fall semester, 2 hours/week, 3 credits*

Lecturer: Dr. Orsolya Buzás-Bereczki and Prof. Dr. Imre Miklós Boros

Tel.: +36 (62) 546-377, Fax: +36 (62) 544-887
E-mail: opszin@gmail.com , borosi@bio.u-szeged.hu

Aims
The primary aim is to provide an up-to-date overview and develop a solid understanding in the student on the organization and functional characteristics of pro- and eukaryotic genes and genomes. Structural characteristics of replication and transcription units, organization of pro- and eukaryotic nuclear genomes and extra-chromosomal DNA elements will be discussed. The mechanism of DNA replication, transcription, their regulation and mechanisms of RNA processing in pro- and eukaryotes will be covered. The students will also learn about the most fundamental experimental methods and model organisms used in genomic studies.

Course description
Nucleic acids structure, discovery. Tools for its study. The genomes of prokaryotes and their viruses. The eukaryotic genome, unique sequences and repeats. Genome size and complexity. The chromatin. Extra-chromosomal genomes, genomes of organelles, plasmids. DNA synthesis in vivo and in vitro. Errors and their repairs. Transcription units of prokaryotes. Coding and regulatory regions. Operons. The transcription process. Gene organization in eukaryotes. The primary transcript and mature RNA. Cis-regulatory elements of transcription. Eukaryotic RNA synthesizing enzymes. The basal transcription machinery. Trans-acting transcription regulators. DNA-binding proteins. Enhancers. The role of chromatin in transcription control. Epigenetics. The organization of the nucleus, long range interactions. Transcription and cell fate determination, stem cells, differentiation, tumorigenesis.

Learning outcomes
Knowledge and Understanding:
The course is designed to provide a thorough introduction to the organisation and function of the genome. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. The course is concerned both with pro-and eukaryotic cells in order to provide an evolutionary view on gene function. Emphasis is placed on animal cells and human implications where appropriate, to highlight direct practical consequences. The lectures are structured to correlate structure and function at all levels of macromolecular organization, and are equally devoted to structural details and molecular functions. By completion of the course, students will have a comprehensive understanding on the architecture and function of genetic material.

Suggested reading
Alberts, Johnson, Julian, Raff, Roberts, Walter: Molecular Biology of the Cell, 4th edition, Garland Science, 2002, New York
Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh, Matsudaria: Molecular Cell Biology, 6th edition, W.H. Freeman, 2007, New York

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Course code#

Advanced molecular biology: qualitative and quantitative analysis of macromolecules

For MSc students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. László Bodai and Dr. Zsuzsanna Újfaludi

Tel.: +36 (62) 343-951, Fax: +36 (62) 544-887
E-mail: bodai@bio.u-szeged.hu , odianya@bio.u-szeged.hu

Aims
The course aims to familiarize students with the main tools and techniques of molecular biology research. The students will learn modern methods suitable for the isolation, labelling and analysis of the structure and function of biological macromolecules and macromolecular complexes; and develop a strong experimental viewpoint.

Course description
Molecular cloning, cloning vectors, enzymes used in molecular biology. Generation and use of genomic DNA and cDNA libraries. Hybridization techniques (colony, Southern, Northern). Labelling and detection of nucleic acids and proteins. Immunohistochemistry, labelling and detection using antibodies. Detection of macromolecules by fluorescent and confocal microscopy. Methods for the quantitative and qualitative analysis of RNA. Gel based and chromatographic methods of protein purification and analysis. In vitro and in vivo methods of analysis of protein-protein interactions. In vitro and in vivo methods of analysis of interactions of proteins and nucleic acids. Mass-spectrometry and proteomics. Polymerase chain reaction and its applications. DNA sequencing, applications of deep sequencing methods. The tools of genomics and functional genomics.

Learning outcomes
The course will familiarize students with recombinant DNA technology, the methods of isolation and qualitative and quantitative analysis of macromolecules, and the experimental systems, tools and techniques used in the characterization of the organization and function of macromolecular systems. The main tools and methods the students will understand after completion are molecular cloning, labelling and detection of macromolecules, immunochemical methods and microscopy; techniques of RNA and protein purification, separation and analysis; methods of protein-protein and protein-DNA interaction studies; PCR; DNA sequencing; and methods of genomics and proteomics.

Skills and attributes
The course is designed to help students to develop competencies required in the field of molecular biological research. They will gain detailed knowledge about the practical application of modern experimental methodologies, their advantages and disadvantages in answering specific research questions. They will learn to break down problems into basic units that can be answered using experimental approaches. They will acquire skills in designing experimental procedures, and using the experimental approach to answer complex biological problems.

Suggested reading
Wilson, Walker: Principles and Techniques of Biochemistry and Molecular Biology, Cambridge Univ. Press; 7th ed.

Exam Written

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Course code#

Tumorbiology

For MSc students *Fall semester, 2 hours/week, 3 credits*

Lecturer: Prof. Dr. Imre Miklós Boros and Ildikó Huliak

Tel.: +36 (62) 544-686, Fax: +36 (62) 544-887
E-mail: borosi@bio.u-szeged.hu , huliakildiko@gmail.com

Aims
The course describes the process of tumorigenesis and metastases. Detailed description of tumor cell characteristics, the molecular background of tumorigenesis and metastasis are presented. The last part of the course discusses strategies of different general cancer therapies and also the possibility of personalized cancer treatment.

Course description
Cells in the body and in culture. Basics of cell-to-cell communications, cell cycle, cell division. Cells in culture, growth characteristics of primary cells and cancer cells. Tumors: types, morphological characteristics, occurrence, tumor and tumor environment, development of tumors, familial and sporadic occurrence of tumors. Brief overview of cancer epidemiology. The role and involvement of RNA and DNA viruses in cancer (biology and research). Cancer causing retroviruses and DNA viruses: RSV, ALV, HTLV, HPV. Non-biological cancer causing agents: radiations, chemical mutagenesis, mechanisms guarding genome maintenance and integrity. Tumor promoters. Oncogenes and oncogene activation. Types of oncogenes. The role of proto-oncogenes in normal cells, mechanisms of oncogene activation. Tumor suppressor genes, gatekeepers and caretakers. Rb and p53. Genome integrity, genome alterations, telomere, telomerase. Metabolic features of cancer cells, energy production, metastasis, angiogenesis. The cancer genome, tumor driver and passenger mutations, evolution of cancer cells. Cancer and the immune system. Cancer stem cells. Cancer and epigenetics. Cancer prevention and cancer therapy approaches: surgery, radiation, chemotherapy: Anticancer drugs, drug targets, drug resistance. Targeted (rational) and personalized cancer treatment. Present and future.

Learning outcomes
The course will provide a thorough introduction to the molecular background of tumor formation including very recent data of the field of tumorbiology research. The material is presented at a level suitable for advanced MSc students majoring in molecular biology. The lectures are directed to introduce the characteristics of tumor cells. They give a particularly detailed review of intrinsic and extrinsic causes of tumor formation, the progression of metastases and also the available and future cancer treatments. By its completion, students will have a comprehensive understanding of the background of tumorigenesis, metastases and cancer treatments.

Skills and attributes
The students will become familiar with the basics of characteristics of normal and cancer cells. They will possess the basic knowledge of tumor types, of cancer epidemiology and the importance of tumor microenvironment. They will have detailed acquaintance about molecular basis of tumorigenesis, including: the role of DNA and RNA viruses, of non-biological cancer causing agents, of oncogenes and tumor suppressors, of the alterations of genome integrations in tumor formation and progression. They will become familiar with the crucial steps of metastases and the molecular basis of traditional and next generation cancer treatments.

Suggested reading
RA Weinberg: The Biology of Cancer, 2nd edition, Garland Science, 2013, New York.

Exam Written

Department of Biological Anthropology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. György Pálfi

Course code#

Biological anthropology

For MSc and MSc students *Spring semester, 2 hours/week, 3 credits*

Lecturers: Dr. György Pálfi, Dr. Erika Molnár, Dr. Zsolt Bereczki

Tel./Fax: +36 (62) 544-314
E-mail: palfigy@bio.u-szeged.hu, balinte@bio.u-szeged.hu, bereczki.zsolt@bio.u-szeged.hu

Aims
The one-semester-long course provides an introduction to the field of biological anthropology or human biology and gives profound overall knowledge on the variation of physical characteristics of the human species considered as an extraordinary member of the animal kingdom. The topics of the course cover the most important fields of human biology and will introduce both historical and modern research directions of the discipline.

Course description
The topics of the course cover: Human biology/biological anthropology as a scientific field. Introduction to human anatomy. Metrical traits. Morphological traits. Biodiversity of the human species. Ontogeny, growth and development, aging. Sexual dimorphism. Reproduction and contraception. Physiological traits in anthropology. Dermatoglyphics. Body composition. Human evolution. Paleopathology. Field anthropology.

Learning outcomes
Students will become familiar with the most important fields and research directions of contemporary human biology. Along with information provided on historical issues, students will get a thorough overview of problems in the discipline from macromorphology through physiology and molecular investigations to cultural aspects of human variation. The course serves as a suggested preparation for the courses titled “Human paleopathology and paleoepidemiology”.

Skills and attributes

Suggested reading
Stein P, Rowe B: Physical Anthropology. McGraw-Hill Humanities/Social Sciences/Languages; 10th ed., 2010

Exam Written

Department of Biological Anthropology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. György Pálfi

Course code#

Human paleopathology and paleoepidemiology

For MSc and MSc students *Fall semester, 2 hours/week, 3 credits*

Lecturers: Dr. György Pálfi, Dr. Erika Molnár, Dr. Zsolt Bereczki

Tel./Fax: +36 (62) 544-314
E-mail: palfigy@bio.u-szeged.hu, balinte@bio.u-szeged.hu, bereczki.zsolt@bio.u-szeged.hu

Aims
The course is intended to introduce the wide range of possibilities of assessing a skeletal population's health status based on bone lesions and aided by histological and molecular analysis. The topics of the course will provide students with general knowledge on the main categories of bone lesions, classical macromorphological diagnostics, state-of-the-art examination techniques, epidemiological and evolutionary trends of health history.

Course description
The topics of the course cover: Introduction to paleopathology. From bone lesions to health status. Joint diseases. Trauma. Metabolic diseases. Hematological disorders. Developmental defects. Specific infections. Non-specific infections. Stress markers. Neoplasms and other diseases. The epidemiological approach.

Learning outcomes
The course provides on overall, basic knowledge on the current state of paleopathological studies. Students will get to know all major categories of osteological disorders and the principles of health status assessment that can provide a basis for further paleopathological studies both theoretical and practical.

Skills and attributes

Suggested reading
Donald J. Ortner: Identification of Pathological Conditions in Human Skeletal Remains. Academic Press, 2003.

Exam Written

Department of Biotechnology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. Gábor Rákhely
Web: http://biotech.szbk.u-szeged.hu/index_eng.html

Course code#

Biotechnology 1

For BSc students *Fall semester, 2 hours/week, 3 credits*

Lecturer: Prof. Dr. Kornél Kovács

Tel.: +36 (62) 544-930, Fax: +36 (62) 544-352
E-mail: kovacs.kornel@brc.mta.hu

Aims
The course provides strong knowledge in processes in biotechnology with emphasis on the current practice as well as the most promising developments in technologies as well as molecular level enhancement of the applied organisms. During the semester the major topics include the introduction of the main organisms used in biotechnology, the basic techniques and complex technologies currently applied in the industry.

Course description
Methanogens and their application in biotechnology. Methylotrophs and their application in biotechnology. Clostridia and their application in biotechnology. Lactic acid bacteria and their application in biotechnology. Bacilli and their application in biotechnology. Pseudomonas strains and their application in biotechnology. Photorophic microorganisms and their application in biotechnology. Streptomycetes and their application in biotechnology. Yeasts and their application in biotechnology. Filamentous fungi and mushrooms and their application in biotechnology. General and specific aspects of cultivating microbes. Industrial substrates. Characteristics of eukaryotic cell culture maintenance. Sterilizing techniques. Oxygen supply and special features of anaerobic fermentation. Recovery of biomass from fermented slurry. Cell disruption techniques. Extraction of low molecular weight compounds. Size separation and purification techniques. Charge-based separation methods. Separation techniques based on hydrophobic interactions. Separation techniques using affinity chromatography. Proteomics. Formulation technologies. Measurement of biomass. Measurement t of fermentation parameters. Measurement of substrates and products. General characteristics of biosensors. Enzyme based biosensors. Principles of immunological biosensors. Detection methods in immunological biosensors. Characteristics of anaerobic biotechnological processes. Maintenance of anaerobic conditions. Immobilization techniques. Immobilization using encapsulation. Immobilization via surface adsorption. Elimination of nitrogen content in water. Bio-hydrogen production procedures. Technical considerations of biogas production. Biotechnology of biogas production. Biotechnology of bioethanol production. Technology of starch based bioethanol production. Utilization of the end products of bioethanol production. Technology of biodiesel production. Utilization of the end products of biodiesel production. Biotechnological production of glycerol. Biotechnological production of acetone and butanol. Biotechnological production of 2,3-butanediol. Biotechnological production of citric acid. Biotechnological production of gluconic acid. Biotechnological production of acetic acid. Biotechnological production of polyhydroxyalkanoates. The main properties of milk with respect to biotechnology. Dairy products: whey, milk permeate, lactose-free milk, milk powder, sour cream. Dairy products: butter, ice cream, cottage cheese, yogurt, kefir, kumis. Dairy products: cheeses. Biotechnology of sour cabbage and pickles production. Biotechnology of beer production. Biotechnology of whiskey production. Biotechnology of the production of bread, cocoa butter, soy sauce and nattō.

Learning outcomes
The Biotechnology course is designed to provide a thorough introduction to biotechnological methods and applications. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. The course is concerned primarily with prokaryotic cells, and emphasis is placed on the practical aspects of fermentation technologies. The lectures are compiled to introduce the basic biochemistry, molecular biology and microbiology behind the various applications. By its completion, students will have a comprehensive understanding of the frequently practiced biotechnological techniques.

Skills and attributes
The students will become familiar with the various strategies exploited for biotechnological utilization. They will get acquainted with the most important properties of the microbes and eukaryotes employed in biotechnological processes. The rational and design strategy of biotechnological processes will be thoroughly discussed. A number of selected applications and biotechnological technologies to convert the substrates into various products will be explained.

Suggested reading
Biotechnology, 2nd Completely Revised Edition, H.-J- Rehm, G. Reed (eds.) VCH GmbH. (1994).

Exam Written

The Life Sciences Building of the Faculty of Science and Informatics, University of Szeged, is located on the left bank of the river Tisza near the beautiful Elisabeth Grove. The building houses all but one Biology Departments.

Department of Cell Biology and Molecular Medicine
Faculty of Medicine – Faculty of Science and Informatics
University of Szeged
6720 Szeged, Somogyi u. 4.
Head: Prof. Dr. Karoly Gulya
Web: http://www2.sci.u-szeged.hu/zoolcell/

XSE031-celbio1

Cell biology 1

For BSc and medical students *Fall semester, 2 hours/semester, 3 credits*

Lecturer: Prof. Dr. Karoly Gulya

Tel.: +36 (62) 544-570, Fax: +36 (62) 544-569
E-mail: gulyak@bio.u-szeged.hu; gulya.karoly@med.u-szeged.hu

Aims
The first part of this two-semester-long Cell Biology course provides a core knowledge with strong emphasis on the interrelationship between the structural, molecular and functional aspects of the cell. During the fall semester the major topics include the structural and molecular basis of cellular compartmentalization, protein trafficking, cytoskeleton, molecular motors, cell cyle and proliferation, cell death/survival, and cell-cell and cell-matrix interactions.

Course description
Research methods in cell biology. Evolution of the cell. General characteristics of pro- and eukaryotic cells. Compartmentarization. Membrane dynamics. Structure of the cell membrane. Membrane models. Structure and function of membrane proteins. Membrane specializations (tight junction, gap junction, desmosome, etc.). The extracellular matrix. Structure and function of the cytoskeleton. The cell nucleus/nucleolus. Chromatin structure. The chromosomes. The cell cycle. Mitotic and meiotic cell division. The endoplasmic reticular system. The signal hypothesis. The Golgi complex. Secretory proteins. Membrane trafficking. Transport vesicles. Internalization of macromolecules and particles. Receptor-mediated endocytosis. The lysosomes. Secretory and lysosomal proteins. The mitochondria.

Learning outcomes
The Cell Biology course is designed to provide a thorough introduction to cell biology. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. The course is concerned primarily with eukaryotic cells, and emphasis is placed on animal cells and human implications where appropriate. The lectures are directed to correlate structure and function at all levels of cellular organization, and are equally devoted to structural details and molecular functions of the different parts of the cell. By its completion, students will have a comprehensive understanding of the architecture and function of living cells.

Skills and attributes
The students will become familiar with the various subcellular structures and organelles of the eukaryotic cells. They will understand the membrane structure, and the structural and functional relationships of the different compartments. They will be familiar with the diverse molecular structures and behaviors of the cytoskeleton, the importance of the vesicular trafficking, the endocytotic and exocytotic processes. They will be acquainted with cell adhesion and the components of the extracellular matrix. They will understand the chromatin structure, and the basic events of the cell cycle, including mitotic ans meiotic cell divisions.

Suggested reading
Alberts, Johnson, Julian, Raff, Roberts, Walter: Molecular Biology of the Cell, 4th edition, Garland Science, 2002, New York
Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh, Matsudaria: Molecular Cell Biology, 6th edition, W.H. Freeman, 2007, New York

Exam Written

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Web: http://www2.sci.u-szeged.hu/zoolcell/

YSE_TTIK-18

Cell biology 2

For BSc and medical students *Spring semester, 2 hours/semester, 3 credits*

Lecturer: Prof. Dr. Karoly Gulya

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Aims
The second part of this the two-semester-long Cell Biology curriculum provides a strong core knowledge with emphasis on the interrelationship between the structural, molecular and functional aspects of the cell. The second semester will deal with the inter- and intracellular signalization phenomena, e.g. the cell-cell signalization processes, characterization of the different intracellular signalization pathways, and target cell adaptation. A series of lectures will deal with the regulation of gene expression, the embryonic and adult stem cells, cell differentiation and tissue repair.

Course description
General characteristics of cell signalization. Intracellular signalization pathways. Characteristics of neuronal signal transduction. Mechanisms of neuronal signal transduction. The role of glial cells in neuronal signalization processes. Regulation of gene expression. Regulationof neuronal gene expression. Target cell adaptation. Fast and slow adaptations. General characteristics of stem cells. Cell differentiation and tissue maintenance. Embryonic and adult stem cells. Neuronal stem cells. Induced pluripotent stem cells. Cell therapies. Apoptotic and necrotic processes.

Learning outcomes
The Cell Biology course is designed to provide a thorough introduction to cell biology. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. The students will be introduced to the principles of cell-cell signaling processes. The different intracellular signaling pathways and signal integration will be explained. A series of lectures will deal with cell differentiation and tissue maintenance. Embryonic and adult stem cell and their derivatives will be introduced.

Skills and attributes
They will understand the characteristics of intracellular signalization processes with special reference to neuronal signal transduction. They will be familiar with basic events of the cell cycle and the importance of apoptosis. They will understand the basics of stem cell biology and the medical use of cell therapy. The students should be able to apply and understand the theoretical basis for key technologies utilized in stem cell research.

Suggested reading
Alberts, Johnson, Julian, Raff, Roberts, Walter: Molecular Biology of the Cell, 4th edition, Garland Science, 2002, New York
Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh, Matsudaria: Molecular Cell Biology, 6th edition, W.H. Freeman, 2007, New York
Selected review articles from PubMed.

Exam Written

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Course code#

Cell and tissue cultures: theory and practice

For BSc, MSc and medical students *Spring semester, 52 hours/semester, 6 credits*

Lecturer: Prof. Dr. Karoly Gulya

Tel.: +36 (62) 544-570, Fax: +36 (62) 544-569
E-mail: gulyak@bio.u-szeged.hu; gulya.karoly@med.u-szeged.hu

Aims
The course introduces the students to various cell and tissue culturing methods widely used in vertebrate neurosciences. After a thorough theoretical introduction, the students will be trained in basic aseptic techniques and cell culture practical skills, and study cell differentiation in various in vitro systems (e.g., cultures from adult rat bone marrow, and embryonic chicken and rat cerebral cortices).

Course description
Theoretical background: cell and tissue culture techniques (4 x 4 hours, 4 hours / week / 4 weeks)
In vitro maintenance of embryonal and adult cells and tissues. Isolation of cells, maintaining subcultures, cell passaging. Manipulation and differentiation of cultured cells. Cell transfection, transduction. Cell viability. Utilization of in vitro systems in molecular medicine. Tissue engineering. Major cell lines. Culturing media. Mitogens. Minimal/essential culturing media, supplements. Maintenance of sterile environment. Major equipments of the cell culturing lab (thermostat, laminar flow, microscopes, centrifuge, etc.). Preparation and culture of adult bone marrow cells and its derivatives. Primary cortical and hippocampal cell cultures (chick and rat). Preparation and maintenance of mixed (neuronal and glial) cultures. Organotypic cell and tissue cultures. Preparation and in vitro maintenance of explant cultures. In vitro phenotyping. Immunocytochemistry, Western blot analysis. Neuronal and glial markers.

Introductory practicals, practicing sterile work (2 x 4 hours, 4 hours / week, 2 weeks): The sterile laborator environment. Maintaining aseptic working environment, working with culturing media, without cells. Preparation of bone marrow cells from young adult rats. Removal of bone marrow, purification, centrifugation. Cell counting techniques. Preparation of cell smears. May-Grünwald/Giemsa staining.

Practicals with rat bone marrow cell cultures (2 x 4 hours, 4 hours / week, 2 weeks): Preparation of bone marrow cells from young adult rats. Removal of bone marrow, purification, centrifugation, plating. Treatment with mitogens. Collection of mitogen-treated bone marrow-derived cells (neurospheres, DIV7) for Western blot analysis. Determination of protein content.

Practicals with primary cultures from embryonal chicken forebrain (2 x 4 hours, 4 hours / week, 2 weeks): Preparation of primary cultures from embryonal chicken forebrain (E16-E18). Tissue removal, purification, centrifugation. Cell counting. Plating to petri dishes. AChE histochemistry on chicken forebrain cultures. Digital imaging in light microscopy, making of microphotographs. Trypsin treatment, passage of cultured cells for further culturing.

Practicals with primary cultures from embryonic rats (3 x 4 hours, 4 hours / week, 3 weeks): Isolation of cerebral cortical tissue samples from E18 rat embryos. Tissue preparation, purification, centrifugation. Cell counting. Plating to petri dishes. Fluorescent immunocytochemical detection of GFAP in astrocytes in primary cortical cultures (DIV7). Digital microphotography on GFAP positive astrocytes (2 days).

Learning outcomes
The course is designed to provide a thorough introduction to the theory and practice of various in vitro techniques used in vertebrate neurosciences. The material is presented at a level suitable for advanced

B.Sc. students majoring in life sciences. The practicals will use adult bone marrow cells to differentiate neurospheres, and chicken and rat mixed primary neuronal cultures. Histological staining procedures and fluorescent immunohostochemistry will be used to demonstrate the presence of different cell types and astrocytes, respectively.

Skills and attributes
During this one-semester course, the students will not only learn and practice basic laboratory skills (basic cell handling and cell counting methods, the use of automatic pipettes, microscopes, etc.; they will be guided to use a medium-sized centrifuge and different types of light microscopes), but to be able to work in a sterile environment (laminar flow) and capable to handle sterile media and plated cultured cells. The students will also learn basic histological/immunohistochemical methods (May-Grünwald/Giemsa staining, GFAP fluorescent immunohistochemistry).

Suggested reading
Selected reviews from PubMed.

Exam Written

The Department of Cell Biology and Molecular Medicine is housed on the 3rd and 4th floors of the building which is located in the city centre, on the right bank of the river Tisza.

Department of Cell Biology and Molecular Medicine
Faculty of Medicine – Faculty of Science and Informatics
University of Szeged
6720 Szeged, Somogyi u. 4.
Head: Prof. Dr. Karoly Gulya
Web: http://www2.sci.u-szeged.hu/zoolcell/

Course code#

Research project in cell biology: microglial cell phenotyping in vitro

For BSc and medical students *Fall semester, 10 hours/week, 12 credits*

Lecturer: Prof. Dr. Karoly Gulya, Dr. Adam Legradi

Tel.: +36 (62) 544-570, Fax: +36 (62) 544-569
E-mail: gulyak@bio.u-szeged.hu; gulya.karoly@med.u-szeged.hu; legradam@bio.u-szeged.hu

Aims
The students will design and carry out a research project related to one of the major research interests of the Department of Cell Biology and Molecular Medicine. The major fields of interest are 1) regulation of neuronal and glial gene expression in physiological, pathophysiological and experimental conditions in vivo and in vitro; 2) in vitro neuronal and glial cell phenotyping; 3) roles of microglial cells in neurodegenerative processes in vivo and in vitro.

The course is offered only to those students who completed the Cell and tissue culture: theory and practice course in the Spring semester.

Learning outcomes
The students will be able to look/search for relevant literature in databases; they will understand how to design and carry out scientific experiments, how to collect data, and how to present their data in a scientific publication. Benchwork includes establishing and maintaining mixed primary and pure cell cultures, immunocytochemistry and image analysis.

Skills and attributes
Searching Medline and other databases. Concepts in designing experiments and organizing data. Presenting data and preparing research reports. Learning and practicing cell culturing techniques, immunocytochemisry and image analysis.

Suggested reading
Current literatue will be given to the students who are also encouraged to search databases for information.

Exam Written, by the submission of a 15-20 page-long thesis about the experimental work

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Web: http://www2.sci.u-szeged.hu/zoolcell/

Course code#

Molecular medicine

For BSc, MSc and medical students *Fall semester, 2 hours/week, 3 credits*

Lecturer: Prof. Dr. Karoly Gulya

Tel.: +36 (62) 544-570, Fax: +36 (62) 544-569
E-mail: gulyak@bio.u-szeged.hu; gulya.karoly@med.u-szeged.hu

Aims
The course will introduce the students to selected up-to-date diagnostic and therapeutic techniques and methods in molecular medicine. Major topics include molecular genetic and cell biology methods in the clinical practice, genomic and proteomic techniques, cell and tissue culture methods. Diagnostic methods based on immunologic and nucleic acid hybridization will be discussed. A series of lectures will deal with cell signalization processes and the regulation of gene expression. Gene expresion profiling and its diagnostic value will be discussed. Embryonal and adult stem cells and their possible therapeutic use, as well as telomerase-directed molecular therapy, immunotherapy and antitumour immune responses will be discussed in detail.

Course description
Introduction to molecular genetic and cell biology methods in the clinical practice. Diagnostic methods based on immunological techniques (RIA, ELISA, Western blot analysis, immunocytology, etc.). Diagnostic methods based nucleic acid hybridization (Northern blot analysis, in situ hybridization, DNA chip technology, etc.). Gene sequencing and analysis, genomic and proteomic techniques, cell and tissue culture methods. Molecular markers in human disorders. Diagnostic methods based on specific endonuclease activity (fragment length polymorphism, pedigree analysis, etc.). Molecular biological methods in clinical practice. Intracellular signalization in pathophysiological processes. Regulation of gene expression. Regulation of neuronal gene expression. Molecular biological aspects of neurologic and psychiatric disorders. Gene therapy, viral vectors, DNA-liposome complexes. Antisense pharmacology. Small interfering RNA. Molecular chaperons. Embryonal and adult stem cells. Neuronal stem cells. The feasibility of stem cell therapies. Cell replacement therapies. In vitro differentiation of stem cells to the desired phenotype. Transfection of stem cells. Regulation of cell cycle and cell differentiation, translation control of gene expression. Telomerase-directed molecular therapy. Immunotherapy. Antitumour immune responses. Introduction to bioinformatic and computer-assisted methods in diagnosis and therapy: functional genomics and proteomics.

Learning outcomes
This one-semester-long course is designed to provide an introduction to a number of emerging topics that are related to molecular biology-based diagnostic and therapeutic approaches. The lectures will summarize recent advances in selected fields such as intracellular signalization, regulation of gene expression, (stem) cell replacement technologies, telomerase-based therapies, gene therapies, etc. Recent advances in antitumor therapies, immunotherapies will also be discussed.

Skills and attributes
The students will become familiar with various immunological and nucleid acid-based diagnostic technologies. They will be introduced to cutting-edge diagnostic and therapeutic methodologies based on molecular biological approaches. They will understand how genetic profiling could help diagnosis, and how stem cell-based approaches could be used for therapeutic purposes.

Suggested reading
Selected reviews from PubMed.

Exam Written

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6720 Szeged, Somogyi u. 4.
Head: Prof. Dr. Karoly Gulya
Web: http://www2.sci.u-szeged.hu/zoolcell/

Course code#

Molecular neurobiology

For BSc and MSc students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. Adam Legradi

Tel.: +36 (62) 544-000 ext. 2296, Fax: +36 (62) 544-569
E-mail: legradam@bio.u-szeged.hu

Aims
This course provides a a broad survey of modern molecular biological aspects of neurobiology.

Course description
Neurocytology, molecular architecture of neurons. Micro RNAs in the neuronal tissue. Alternative splicing in neurons. Mechanisms of local protein synthesis in different neuronal compartments: dendritic and axonal protein synthesis. Axonal transport. Molecular mechanism of axon guidance. Neocortex development. Cell death in the neurons. Roles of astrocytes. Extra- and intraneuronal protein aggregation and neurodegeneration. Neuroimmunology. Neuroactive steroids.

Learning outcomes
The course is designed to present the molecular background of selected neuronal functions. The course will provide information about several newly discovered biomolecules such as micro RNAs, intracellular signaling pathways, characteristics of local protein synthesis in neuronal subdomains, and the molecular background of different neurodegenerative disorders (Alzheimer's disease, Parkinson's disease). The course will provide a concise knowledge about the molecular aspects of the embryonal development of the neocortex.

Skills and attributes
The students will have an introduction to some of the molecular mechanisms undelying neuronal functions, and help them to find their own research interest in the field of molecular neurobiology.

Suggested reading
Relevant review articles from Pubmed.

Exam Written

Department of Ecology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. László Körmöczi
Web: http://expbio.bio.u-szeged.hu/ecology/english.htm

Course code#

Conservation biology

For BSc students *Spring semester, 2 hours/week, 3 credits*

Lecturers: Dr. Katalin Margóczi, Dr. Zoltán Bátori

Tel.: +36 (62) 546-950, Fax: +36 (62) 546-949
E-mail: margoczi@bio.u-szeged.hu, zbatory@gmail.com

Aims
To give an introduction of conservation biology, a multidisciplinary, mission oriented science, and to emphasize the importance of a necessary conceptual shift in order to stop biodiversity crisis.

Course description
Conservation biology: past and present. Historical foundation. Mission-oriented, interdisciplinary science. New challenges. Biodiversity. Forms of biodiversity. Large scale temporal dynamic of biodiversity changes. Large scale spatial dynamic of biodiversity. Inventorying and monitoring of biodiversity. Climate change. Effects on the physical environment. Effects on species and biodiversity. Effects on biotic interactions. Mitigation. In situ and ex situ conservation of species. Rarity and commonness. Causes of rarity. Ex situ conservation practices: advantages and disadvantages. In situ conservation practices: advantages and disadvantages. Habitat fragmentation and landscape change. Fragmentation, isolation and edge effect. Oceanic and habitat islands. Species and area. Island biogeography and nature conservation. The roles of people in conservation. A brief history of humanity's influence on ecosystems. Factors mediating human-environment relations. Biodiversity conservation and local resource use. Equity, resource rights, and conservation. Social research and conservation.

Learning outcomes
A certain awareness of conservation ideas and efforts from all over the world.

Skills and attributes
Better understanding of the nature of biodiversity crisis, getting to know some possible solution, or mitigation of it.

Suggested reading
NS Sodhi, PR Ehrlich (eds.): Conservation Biology for All. Oxford University Press, 2010.

Exam Oral

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6726 Szeged, Középfasor 52.
Head: Dr. László Körmöczi
Web: http://expbio.bio.u-szeged.hu/ecology/english.htm

Course code#

Basic ecology

For BSc students *Fall semester, 2 hours/week, 3 credits*

Lecturers: Dr. László Körmöczi, Dr. Róbert Gallé

Tel.: +36 (62) 546-950, Fax: +36 (62) 546-949
E-mail: kormoczi@bio.u-szeged.hu, galle.robert@gmail.com

Aims
The course introduces the history and present state of main hypotheses and basic rules in population and community ecology.

Course description
The topics of the course include the history and development of ecology, hierarchy of biological organization, ecological environment and niche theory, spatial properties of a single population, fundamentals of population dynamics, models of population growth, theories of population regulation, structured populations, life-history strategies, metapopulation theories, and interactions within a single population. Students will be provided with some ecological applications at population level relevant from the nature conservation point of view.

Learning outcomes
The Basic ecology course is designed to provide an overview on the wide range of ecology. It attempts to synthesise taxonomic, behavioural and physiological knowledges completed with the properties of supra-individual organization level. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences.

Skills and attributes
The students will get familiar with wide range of ecological patterns, processes, and with the most recent and theories of ecology. They will also understand the practical use and application of ecological knowledges.

Suggested reading
Michael Begon, Colin R. Townsend, John L. Harper (2006) Ecology: From Individuals to Ecosystems. Blackwell
Gary G. Mittelbach (2012) Community Ecology. Sinauer Associates
Peter J. Morin (2011) Community Ecology. Wiley-Blackwell
Robert E. Ricklefs, Rick Relyea (2008) The Economy of Nature. Palgrave Macmillan
Larry Rockwood (2006) Introduction to Population Ecology. Blackwell
Colin R. Townsend (2008) Ecological Applications: toward a sustainable world. Blackwell

Exam Oral

Students are offered a number of laboratory/practical and field courses.

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Course code#

Ecology field course

For BSc students *Spring semester, 30 hours/semester, 4 credits*

Lecturers: Dr. Róbert Gallé, Dr. László Körmöczi

Tel.: +36 (62) 546-950, Fax: +36 (62) 546-949
E-mail: galle.robert@gmail.com, kormoczi@bio.u-szeged.hu

Aims
The course gives an overview on the main habitats as well as on the fauna and flora of the Pannon Biogeographical Region. Students also gain insight to the experimental design and methodologies of ecological field studies.

Course description
The course will be held at various natural, semi-natural habitat complexes of the Pannon Biogeographical Region. The participants will acquire knowledge on the sampling methods of plant and invertebrate populations, communities, and environmental measurements. Main tasks: Estimating population density and dispersion. Estimating age distribution of populations. Assessment of population interactions: competition measurements on bait. Estimating plant community composition: quadrat method, line intercept method, local frequency method. Estimating invertebrate community traits: pitfall trapping, suction sampling (D-vac), sweep netting. Habitat description and habitat mapping. Statistical evaluation.

Learning outcomes
The Ecology field course is designed to provide the comprehensive research methods in field ecology, and the most recent statistical procedures. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences.

Skills and attributes
The students will get familiar with wide range of field sampling techniques, from population size estimation to comprehensive evaluation of biogeocenoses. Students will become familiar with equipments used in field surveys. They will also observe some ecological and nature conservation consequences of local land use practices.

Suggested reading
TRE Southwood, PA Henderson (2000): Ecological Methods. Blackwell Science Ltd. Oxford.
M Kent, P Cooker (1992): Vegetation description and analysis. A practical approach. Belhaven Press, London.

Exam Written (course report)

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Web: http://expbio.bio.u-szeged.hu/ecology/english.htm

Course code#

Zootaxonomy and systematics

For BSc students *Fall semester, 2 hours/semester, 4 credits*

Lecturers: Dr. Attila Torma, Gábor Lőrinczi

Tel.: +36 (62) 546-952 Fax: +36 (62) 546-949
E-mail: torma_a@yahoo.com , lorinczig@gmail.com

Aims
This course surveys the major taxonomic groups of animals, their evolutionary origins and phylogenetic relationships. Special focus will be given to some invertebrate phyla (e.g., Arthropoda) and to vertebrates.

Course description
History of taxonomy. Principles of zootaxonomy and zoosystematics, their relationship and methodologies. Phenetic and phylogenic classifications. Taxonomic ranks, species concepts. Theories on the development of multicellular organisms. Parazoa. Eumetazoa. Cnidaria, Ctenophora. Division of Bilateria, the evolution of body cavities. Division of Lophotrochozoa. Platyzoa. Bryozoa, Phoronozoa. Mollusca, Annelida. Division of Ecdysozoa. Introverta (Scalidophora, Nematoida). Lobopoda. Classification of arthropods (Arthropoda), Myriochelata (Myriapoda, Chelicherata), Pancrustacea (Crustacea, Insecta). Division of Deuterostomia. Hemichordata, Echinodermata. The origin and evolution of chordates. Cephalochordata, Urochordata. Hyperotreti. The evolution of vertebrates (Vertebrata). Petromyzontimorphi. Gnathostomata, the evolution of jawed fishes. Chondrichthyes, Actinopterygii. Evolutionary trends in Tetrapoda. Amphibia: Lissamphibia. Major reptilian lineages, Anapsida, Diapsida. The origin and classification of birds (Neornithes). The evolution of mammals (Mammalia), Prototheria, Theria (Metatheria, Eutheria). The course relies on knowledge in animal anatomy, physiology and ontogeny, but also draw on other disciplines such as palaeontology and biogeography.

Learning outcomes
The students will have basic knowledge of the evolutionary origins of and phylogenetic relationships among the major taxonomic groups of animals.

Skills and attributes
Understanding of the breadth of animal diversity and major trends in animal evolution.

Suggested reading
David Grimaldi, Michael S. Engel: Evolution of the Insects. Cambridge University Press. 2005.
Claus Nielsen: Animal Evolution. Oxford University Press. 1995.
Jack R. Holt, Carlos A. Iudica: Systematic Biology

Exam Oral

Department of Ecology
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Head: Dr. László Körmöczi
Web: http://expbio.bio.u-szeged.hu/ecology/english.htm

Course code#

Ornithology

For BSc and MSc students *Spring and fall semesters, 2 hours/week, 3 credits*

Lecturer: Csaba Tölgyesi

Tel.: +36 (62) 546-951
E-mail: festuca7@yahoo.com

Aims
The course provides students with a thorough understanding of the biology of birds, with an emphasis on avian behavior, ecology and conservation.

Course description
Topics include the anatomical and physiological properties of birds, avian evolution and systematics, feeding habits, social behavior and vocalization, migration and navigation, reproduction, and bird conservation. Classroom seminars are integrated with a field excursion, providing an opportunity for students to study birds in their natural environment. All students are required to prepare an assignment about a bird-related conservation issue. Assignments will be discussed on the last seminar.

Learning outcomes
The course provides a comprehensive knowledge of ornithology.

Skills and attributes
The students will get familiar with the most up to date concepts of ornithology and the state of the art methods used for studying birds, ranging from molecular techniques to advanced satellite trackings of birds. Students will also receive a firsthand understanding of current bird conservation issues by participating in the field excursion. Furthermore, the preparation of the assignment improves the skills to digest and critically evaluate scientific literature.

Suggested reading
Frank B. Gill (2007): Ornithology. *W. H. Freeman & Co. Ltd.*, USA
Lars Svensson, Killian Mullarney, Dan Zetterström, Peter J. Grant (2009): Collins Bird Guide. *Harper Collins Publ.*, UK

Exam Oral

Department of Ecology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. László Körmöczi
Web: http://expbio.bio.u-szeged.hu/ecology/english.htm

Course code#

Biogeography

For BSc students *Fall semester, 2 hours/week, 3 credits*

Lecturers: Dr. László Körmöczi, Dr. Márta Zalatnai

Tel.: +36 (62) 546-942, Fax: +36 (62) 546-949
E-mail: kormoczi@bio.u-szeged.hu, zalatnai@bio.u-szeged.hu

Aims
The course introduces the history of biogeography and the most recent knowledge about pattern and evolution of the Earth biosphere.

Course description
The topics of the course include following topics: A brief history of Biogeography. Patterns of biodiversity. Diversity in space and time. The distribution of species. Dispersal and distribution. Barriers of distribution. Speciation and extinction. The theory of Plate Tectonics. The land life from the Devonian to the Pleistocene. Glaciation and biogeographic dynamics of the Pleistocene. Island biogeography. Patterns in species richness. Evolution of insular biotas. The main terrestrial floristic and faunistic realms. The distribution of communities. From communities to biomes. The geographic template of biogeography patterns. The major terrestrial biomes of the Earth. Marine and freshwater communities. Conservation biogeography: the Human impact.

Learning outcomes
The Biogeography course is designed to introduce the development of the biosphere from the early land life up till now. The patterns and processes are explained on ecological and evolutionary bases. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences.

Skills and attributes
The students will get familiar with the development of Earth biosphere, evolution and distribution of species, and the background factors influencing the biogeographic patterns over geological times.

Suggested reading
Christopher Barry Cox, Peter D. Moore (2000) Biogeography: An Ecological and Evolutionary Approach. Blackwell
Mark V. Lomolino, Brett R. Riddle, Robert Whittaker, James H. Brown (2010) Biogeography. Sinauer Associates

Exam Oral

Department of Ecology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. László Körmöczi
Web: http://expbio.bio.u-szeged.hu/ecology/english.htm

Course code#

Evolutionary biology

For BSc students *Spring semester, 2 hours/week, 3 credits*

Lecturers: Dr. Zsolt Pénzes

Tel.: +36 (62) 546-947
E-mail: penzes@bio.u-szeged.hu

Aims
This course provides the core concept of evolutionary biology, divided into four parts. First, knowledge of the development of the modern concept is a key to understand recent debates about evolution. Second, diversification of the tree of life describes the pattern to be explained in large scale, both for taxa and for their properties. Third, this diversification can be deduced to the combination of a few elementary processes on the microevolutionary scale. Finally, moving to larger scale (macroevolution) the most important general patterns are explained.

Course description
Basic concepts, the history of evolutionary biology. Evidence of evolution. Origin of life, early diversification. Diversification of eukaryotes, major transitions. Origin and patterns of variation. Genetic drift. Natural selection. Phenotypic evolution. Conflict and cooperation. Species and speciation. Molecular evolution, genome evolution. Character evolution, evolutionary novelties. Evolution of interactions among species. Evolutionary biogeography.

Learning outcomes
The course is designed to survey fundamental topics of evolutionary biology across different levels of biological organisation. Students will learn main events in the evolutionary history of life and understand basic processes resulting in the huge variety of spatial and temporal patterns.

Skills and attributes
Evolution integrates different fields of biology. Besides the traditional interests, understanding the basic concept provides logic to link different disciplines of biology.

Suggested reading
Barton N.H., Briggs D.E.G., Eisen J.A., Goldstein D.B., Patel N.H. Evolution. CSHL Press, 2007 (http://evolution-textbook.org)
Futuyma D.J. Evolution, 3rd edition, Sinauer Associates, Inc., 2013

Exam Written

Department of Genetics
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. Péter Deák
Web: http://genetika.bio.u-szeged.hu/web/en

Course code#

Introduction to genetics

For BSc students *Fall semester, 2 hours/week, 3 credits*

Lecturers: Dr. Péter Deák, Dr. Rita Sinka, Dr. Tibor Török

Tel.: +36 (62) 544-025, Fax: +36 (62) 544-651
E-mail: deakp@bio.u-szeged.hu, rsinka@bio.u-szeged.hu, torokt@bio.u-szeged.hu

Aims
The course will give an introduction to principles and concepts of heredity, including classic Mendelian genetics and molecular genetics with application to the study of biological function at the level of molecules, cells, and multicellular organisms. The topics include general aspects of inheritance and the famous experiments of Mendel, sex linked inheritance, chromosomal basis of heredity and human genetics. Chromosome movements and segregation will be emphasized during cell proliferation. Students will be introduced to gene interactions, basic eukaryotic chromosome mapping techniques and the enzymatic mechanism and models of recombination. Finally the course will provide information how mutations can generate genetic variations and what is the mechanism of gene mutations.

Course description
Introduction and general aspects of genetics. DNA structure and replication. Mendelian inheritance. Applications of Mendelian inheritance and medical genetics. Patterns of inheritance and gene interactions. The chromosomal basis of heredity. Mitosis and meiosis. Gene linkage and genetic mapping. The genetics of bacteria and their viruses. Mechanism of recombination. Molecular mechanism of mutation and DNA repair. Transposable genetic elements.

Learning outcomes
The Introduction to Genetics course is designed to provide a comprehensive introduction to heredity. The material is presented at a level suitable for advanced BSc students majoring in life sciences. The knowledge gained from this course will help the student to achieve scientific competency. It is integrative over a broad range of fields, ranging from cytology and cell biology, through physiology and molecular biology to evolution. It is also quantitative, using concepts from probability, statistics and in silico biology.

Skills and attributes
The topics of the Introduction to Genetics Seminars together with the Introduction to Genetics course will help the students to master the following skills and competences: Understand the fundamental processes of gene transmission, variation, expression and regulation; Interpret genetic experimental data and make implications about the underlying causes; Analyze genetic processes using numerical relationships; Learn to formulate genetic hypotheses in a statistical framework; Develop basic skills in problem solving that require the application of basic genetic concepts.

Suggested reading
Griffiths, Wessler, Lewontin and Carroll: Introduction to Genetic Analysis, 9th edition, Freeman, 2008, New York, USA
Hartl: Essential Genetics: A Genomics Perspective, 6th edition, Jones & Bartlett Learning, 2013, Burlington, MA, USA

Exam Written

Department of Genetics
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. Péter Deák
Web: http://genetika.bio.u-szeged.hu/web/en

Course code#

Introduction to genetics: seminar

For BSc students *Fall semester, 1 hour/week, 1 credit*

Lecturers: Dr. Péter Deák, Dr. Rita Sinka, Dr. Tibor Török

Tel.: +36 (62) 544-025, Fax: +36 (62) 544-651
E-mail: deakp@bio.u-szeged.hu, rsinka@bio.u-szeged.hu, torokt@bio.u-szeged.hu

Aims
The Introduction to Genetics Seminars will follow the topics of the Introduction to Genetics course and focus on specific human genetic conditions, using case-study formats with primary research papers as a main resource. Individual sessions will explore the methods, by which genes for certain genetic condition were identified and the biology at the organism, tissue, cell, and molecular level. The aim of this seminar is to refine and extend your verbal and written fluency in genetic concepts and techniques.

Course description
Introduction and general aspects of genetics. DNA structure and replication. Mendelian inheritance. Applications of Mendelian inheritance and medical genetics. Patterns of inheritance and gene interactions. The chromosomal basis of heredity. Mitosis and meiosis. Gene linkage and genetic mapping. The genetics of bacteria and their viruses. Mechanism of recombination. Molecular mechanism of mutation and DNA repair. Transposable genetic elements.

Learning outcomes
The Introduction to Genetics Seminars, together with the Introduction to Genetics course, is designed to provide a comprehensive introduction to heredity. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. The knowledge gained from this course will help the student to achieve scientific competency. It is integrative over a broad range of fields, ranging from cytology and cell biology, through physiology and molecular biology to evolution. It is also quantitative, using concepts from probability, statistics and in silico biology.

Skills and attributes
The topics of the Introduction to Genetics Seminars together with the Introduction to Genetics course will help the students to master the following skills and competences: Understand the fundamental processes of gene transmission, variation, expression and regulation; Interpret genetic experimental data and make implications about the underlying causes; Analyze genetic processes using numerical relationships; Learn to formulate genetic hypotheses in a statistical framework; Develop basic skills in problem solving that require the application of basic genetic concepts.

Suggested reading
Griffiths, Wessler, Lewontin and Carroll: Introduction to Genetic Analysis, 9th edition, Freeman, 2008, New York, USA
Hartl: Essential Genetics: A Genomics Perspective, 6th edition, Jones & Bartlett Learning, 2013, Burlington, MA, USA

Exam Written

Department of Genetics
Faculty of Science and Informatics
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Course code#

Genetics laboratory practical

For BSc students *Fall semester, 4 hours/week, 6 credits*

Lecturers: Dr. Rita Sinka, Dr. Barbara Laurinyecz, Dr. Margit Pál

Tel.: +36 (62) 544-025, Fax: +36 (62) 544-651
E-mail: rsinka@bio.u-szeged.hu, barbara@bio.u-szeged.hu, palm@brc.hu

Aims
The Genetics Laboratory Practical will give firsthand experience in basic genetic techniques and manipulations. The topics of the practical include classical genetics, molecular genetics and behavioral genetics. Students learn to work with the fruit fly, *Drosophila melanogaster*, one of the most important model organisms of genetics and developmental biology.

Course description
Blood groups. Drosophila as a model system in genetics, Drosophila life cycle. Introduction to Drosophila genetics. Flybase, fly informatics. Balancer chromosomes and genetic markers. Sex linkage. Complementation analysis and deletion mapping. Transposable elements and P element as a genetic tool. P-element remobilization and insertional mutagenesis. Fluorescent proteins as cellular markers. Gametogenesis. Courtship behavior.

Learning outcomes
The Genetics Laboratory Practical is designed to provide experimental insight into principles of heredity. The material is presented at a level suitable for advanced B.Sc. students, who completed the Introduction to Genetics course and seminar. Students gain practical experience in classical and molecular genetics.

Skills and attributes
The topics of the Genetics laboratory practical will help the students to develop skills to do classical and molecular genetics, including: determine blood groups, handling Drosophila, sex linkage, mapping of lethal genes in Drosophila, using transposable elements to induce mutations and to use them as a genetic tool; and observe the behavior of fruit fly. Students can learn to use and get information out of the publicly available databases.

Suggested reading
Sullivan Ashburner Hawley: Drosophila protocols
Greenspan: Fly Pushing

Exam Written

Department of Microbiology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Prof. Dr. Csaba Vágvölgyi
Web: http://www2.sci.u-szeged.hu/microbiology/english.html

Course code#

Frontiers in applied microbiology

For BSc students *Spring semester, 2 hours/week, 3 credits*

Lecturers: Prof. Dr. Csaba Vágvölgyi, Dr. Attila Gácser, Dr. Zsuzsanna Hamari

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: csaba@bio.u-szeged.hu, gacsera@bio.u-szeged.hu, hamari@bio.u-szeged.hu

Aims
The course provides a strong knowledge on the different fields of applied microbiology. During the course the major topics include the basics of clinical microbiology and parasitology, antimicrobial chemotherapy, identification and diagnostics of microbes, microbial biopesticides, methods for strain improvement and genetic engineering of microbes, diversity and practical significance of microbial secondary metabolites and their analysis.

Course description
Basics of clinical microbiology (pathogenicity, obligate and opportunistic pathogens, virulence and virulence factors, transmission and manifestations of microbial infections, spreading of infections and epidemiology, prevention, vaccination schedules). Parasite protists: overview of lyfe cycle, pathomechanism, epidemiology and diagnostics. Basics of antimicrobial chemotherapy (basic concepts, antibacterial, antifungal, antiviral and anti-protozoan chemotherapy). Identification of microorganism and diagnostic methods. Microbial biopesticides. Strain improvement by mutagenesis and protoplast fusion. Methods of genetic and metabolic engineering in microbiology. Microbial secondary metabolites. Purification of secondary metabolites using separation methods. Analytical measurement of microbial secondary metabolites.

Learning outcomes
The course will provide a thorough introduction to some currently highly studied and dynamically developing fields of applied microbiology. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. Through selected titles, the course emphases the clinical, environmental and biotechnological importance of microorganisms and focuses on the different methods used in the laboratory practice.

Skills and attributes
The students will understand the basics of microbial pathogenicity, virulence, epidemiology and diagnostics. They will get an overview of certain fields of microbiology, such as identification of microorganisms, biopesticides, genetic manipulation of the microbial genome and metabolism and secondary metabolite production, with special emphasis on practical importance and currently used methods.

Suggested reading

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Course code#

Infection and immunity

For BSc students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. Attila Gácser

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: gacsera@bio.u-szeged.hu

Aims
The course will provide a comprehensive knowledge about the basic immunology with strong emphasis on the interactions between the pathogens and the immune system. The course will cover the major topics of the immunobiological process during infection including recognition, inflammation and elimination.

Course description
The structure of the immune system, basics and general terms. Innate immunity, humoral and cellular components of the innate immune system, immune cell development. PAMPs, MAMPs, DAMPs, patogen recognition receptors. Microbial elimination strategies, phagocytosis and intracellular killing. Complement system, activation, function and regulation. Accute inflammation, leukocyte rolling and function. Adaptive immunity and immunoglobulins, B Cell Receptors. Immunoglobulin genetics, structure and function (izotypes, allotypes, idiotypes). MHC molecules, antigen presentation and antigen processing. T cell development, T Cell Receptors. T cell populations and their role in the infection control (Th1, Th2, Th17, T regs, Tc).

Learning outcomes
The Infection and Immunity course will provide detailed knowledge regarding the interaction between pathogens and the immune system. The topics are designed at a level suitable for advanced B.Sc. students majoring in life sciences. The lectures will cover various areas of immunology including basic information about the immune system, general properties of the innate immunity, mechanisms of molecular pathogenesis, virulence factors, cellular microbiology, host resistance or susceptibility, and the generation of innate and adaptive immune responses. By its completion, students will have a comprehensive understanding of the immune defense mechanisms during different kind of infections.

Skills and attributes
The students will gain solid knowledge regarding the basic mechanisms during immune response upon infections. They will become familiar with the structural and functional components of the immune system. They will understand the pathogen recognition and elimination mechanisms in both the innate immune system as well as the adaptive immune system. The students will learn the pathogen elimination strategies of the immune system, will understand the role of recognition receptors, complement system, antigen presentation, immunoglobulins and the adaptive T cell response in the defense against pathogens.

Suggested reading
Janeway C and Travers P: Immunobiology, Garland Publishing Inc. London, NY

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Course code#

Industrial applications of microscopic fungi

For BSc students *Spring semester and Fall semester, 2 hours/week, 3 credits*

Lecturer: Dr. Tamás Papp

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: pappt@bio.u-szeged.hu

Aims
The course reviews the industrial applications of fungi in a seminary form. Through the survey and discussion of the recent literature, the course offers an insight in various fields of applied microbiology, Screening for new bioactive features, strain improvement techniques, production of different fungal metabolites and proteins and the theme of the fungal cell factories will be discussed in detail.

Course description
Students will read and treat scientific papers connected with one of the following titles: Biotechnologically relevant fungal species. Methods for fungal strain isolation. Culture and maintenance. Screening for biological activities. Production of different primer and seconder metabolites by fungi. Classical and recombinant techniques for strain improvement. Metabolic engineering. Fungi as cell factories. Fungi in the food industry. Environmental applications of fungi.

Papers relevant to the different subjects will be read, discussed and detailed during the consultations. Students should prepare a short presentation and outline based on the treated subject.

Learning outcomes
The seminary provides an overview of the applied mycology including industrial applications and methodologies used to discover, improve and exploit the biotechnological potential of fungi. It gives an introduction to the most relevant fungal groups and fields of applications. Students read and interpret selected scientific papers in a consultative form. They prepare a short presentation based on the assayed paper. Biological and/or methodical background of the subject will be discussed in detail during the consultations.

Skills and attributes
Student will understand the significance of fungal biology. They get an introduction into the learning and interpretation of scientific results and articles. They also have opportunity to practise the preparation, presentation and discussion of their contributions.

Suggested reading
Wainwright (1992) An Introduction to Fungal Biotechnology. Wiley Biotechnology Series, Wiley and Sons Inc.
Arora DK (2003) Handbook of Fungal Biotechnology. Marcel Dekker
Anke T (1998) Fungal Biotechnology. Chapman & Hall
Tkacz JS, Lange L (2004) Advances in Fungal Biotechnology for Industry, Agriculture, and Medicine. Kluwer Academic/Plenum Publishers

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Course code#

Microbiology practices 1

For BSc students *Spring semester, 4 hours/week, 6 credits*

Lecturers: Prof. Dr. Csaba Vágvölgyi, Dr. Tamás Papp, Dr. Ilona Pfeiffer

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: csaba@bio.u-szeged.hu, pappt@bio.u-szeged.hu, pfeiffer@bio.u-szeged.hu

Aims
The course will provide the attainment of the most important techniques used in a microbiological laboratory. The first semester of the course covers the basic and generally used methods of microscopy, inoculation and isolation of microorganisms, preparation of pure cultures and characterization of bacterial, yeast and fungal strains.

Course description
I. Examination of microbial cultures
Preparation and sterilization of basic and selective media. Inoculation of microbes onto solid and into liquid media. Isolation of microorganisms from the environment. Effect of environmental factors (such as nutrients, growth temperature and pH) on the microbial growth. Testing of carbon source assimilation under aerobic and anaerobic growth conditions (assimilation and fermentation of sugars). Examples of antibiotic sensitivity testing methods. Determination of living germ number of microbial populations. Methods for isolation of pure microbial cultures.

II. Microscopy
Measuring methods for microscopic organisms and determination of the whole cell number. Examination of the microbial morphology using simple staining methods. Complex and differential staining methods: Gram, Dorner and Schaeffer-Fulton methods. Microscopic studies on sexual and asexual reproductive structures of microorgansism.

Learning outcomes
The Microbiology Practices 1 is a practical course, which will provide a comprehensive introduction to the most frequently used microbiological laboratory techniques. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. By the completion of the first semester, students will acquire the basic laboratory methodology indispensable in the common microbiological practice.

Skills and attributes
The students will understand the basics and the requirements of the sterile laboratory work. They will acquire the basic techniques of strain isolation and preparation of pure microbial cultures as well as culturing of bacterial and fungal strains. The student will have possibility to carry out various microbiological experiments including the study of the effect of different environmental factors, carbon source assimilation assays or antibiotic sensitivity tests. They will learn the usage of a laboratory microscope, the basic microscopy measurements and the most important staining methods.

Suggested reading

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Course code#

Microbiology practices 2

For BSc students *Fall semester, 4 hours/week, 6 credits*

Lecturers: Prof. Dr. Csaba Vágvölgyi, Dr. Tamás Papp, Dr. Ilona Pfeiffer, Dr. Zsuzsanna Hamari

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: csaba@bio.u-szeged.hu, pappt@bio.u-szeged.hu, pfeiffer@bio.u-szeged.hu, hamari@bio.u-szeged.hu

Aims
The two-semester-long Microbiology Practices provides the attainment of the most important techniques used in a microbiological laboratory. The second semester of the course provide the attainment of various advanced microbiological techniques or demonstrate representative biological features of bacteria, yeast and fungi.

Course description
Experiments with bacteriophages: phage infection, quantification of bacteriophages. Demonstration of dimorphism on zygomycetes fungi. Molecular background of the killer activity of yeasts. Study of DNA repair mechanisms in bacteria. Genetic transformation of bacterial and yeast cells. Examination of the parasexual cycle of filamentous fungi (heterokaryon formation by anastomoses and protoplast fusion, isolation of diploids, induced haploidization). Examination of the sexual cycle of yeasts. Extracellular enzyme systems in microorganisms (enzymes catalyzing oxidation and reduction reactions and degrading macromolecules and amino acids). Electrophoretic karyotyping analysis of the genome organization in yeasts and fungi

Learning outcomes

Skills and attributes

Suggested reading

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Web: http://www2.sci.u-szeged.hu/microbiology/english.html

Course code#

Microbe hunters 1

For BSc students *Spring semester, 1 hour/week, 1 credit*

Lecturer: Dr. László Kredics

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: kredics@bio.u-szeged.hu

Aims
The course introduces the students to the history of the discipline Microbiology from the discovery of bacteria till the discovery of the causal agents of tuberculosis. The personalities of famous microbiology researchers is brought closer and their most important discoveries are discussed in details.

Course description
ANTONIE VAN LEEUWENHOEK: The discovery of bacteria. LAZZARO SPALLANZANI: First experimental evidence against the abiogenesis theory. LOUIS PASTEUR: Disprooving abiogenesis, studies in the silk and fermentation industries, introduction of vaccines against chicken cholera, anthrax and rabies. ROBERT KOCH: Postulates to prove connection between microbes and diseases. Discovery of the causal agents of anthrax and tuberculosis.

Learning outcomes
Information about the discovery of bacteria. Principles and results of experiments providing evidence against the abiogenesis theory. Scientific background of fermentation processes. The germ theory of diseases. Introduction of vaccination against infectious diseases. Koch's postulates to prove connection between microbes and diseases and their application in discovering the causal agents of diseases.

Skills and attributes

Suggested reading
Paul de Kruif: Microbe Hunters (1926) - Chapters 1-5

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Course code#

Microbe hunters 2

For BSc students *Fall semester, 1 hour/week, 1 credit*

Lecturer: Dr. László Kredics

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: kredics@bio.u-szeged.hu

Aims
The course introduces the students to the history of the discipline Microbiology from the development of serum therapy till the discovery of penicillin. The personalities of famous microbiology researchers is brought closer and their most important discoveries are discussed in details.

Course description
EMILE ROUX and EMILE BEHRING: Development of the serum therapy against diphteria and tetanus. ELIE METCHNIKOFF: Discovery of cellular immunity, father of probiotics. PAUL EHRLICH: Discovery of the first chemotherapeutic agent. ALEXANDER FLEMING: Discovery of the first antibiotic. The history of bioterrorism.

Learning outcomes
Principles and development of serum therapy. First research efforts in the fields of cellular immunity and probiotics. Principles of chemotherapy, Salvarsan, the first chemotherapeutic agent. Principles of antibiotic therapy, the first introduced antibiotic. History of biological warfare and bioterrorism.

Skills and attributes

Suggested reading
Paul de Kruif: Microbe Hunters (1926) Chapters 6, 7, 12
André Maurois: The life of Sir Alexander Fleming.

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Course code#

Laboratory projects in microbiology

For BSc students *Spring semester and Fall semester, 10 hours/week, 12 credits*

Lecturers: Dr. László Kredics, Dr. Tamás Papp, Dr. András Szekeres

Tel.: +36 (62) 544-516, Fax: +36 (62) 544-516
E-mail: kredics@bio.u-szeged.hu, pappt@bio.u-szeged.hu, szandras@bio.u-szeged.hu

Aims
The course offers individual laboratory practice in general microbiology. Students carry out a mini project under the guidance of a supervisor and write a short project report on their achievements. Mini projects will be offer opportunity to the students to gain expertise in various techniques used in microbiological laboratories, such as screening for enzyme activities, carbon source assimilation studies, antimicrobial susceptibility tests, selection of biocontrol agents or analysis of secondary metabolite production.

Course description
Students have the opportunity to carry out a mini research project in one of the following fields: Screening for extracellular enzyme activities. Carbon source assimilation studies with fungi. Antimicrobial susceptibility tests. Selection of microbial biocontrol agents. Purification of selected secondary metabolites using separation methods. Analytical measurement of microbial secondary metabolites.

Students perform a mini project during the semester working under the guidance of a supervisor. They should write a short project report on their activity and results achieved during the semester. Acceptance of the project report by the supervisor is required to the completion of the course.

Learning outcomes
The practical course Laboratory Projects in Microbiology will provide opportunity to carry out a short individual project. By the completion of practical course, students gain experience in performing a complete research including experimental work, recording and evaluation of the results and preparation of project report.

Skills and attributes
Students participate in an intensive laboratory practice. Performing their on mini project, they learn the principal laboratory techniques, and various methods used in the different fields of microbiological research. They learn basics of experimental planning and evaluation and presentation of their results.

Suggested reading

Exam Written (project report)

Department of Physiology, Anatomy and Neuroscience
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Prof. Dr. József Toldi
Web: http://phys.bio.u-szeged.hu/index_eng.html

Course code#

Recent results in exerimental neuroprotection

For BSc and MSc students *Spring semester, 2 hours/week, 3 credits*

Lecturers: Prof. Dr. József Toldi, Dr. Tamás Farkas

Tel./Fax: +36 (62) 544-381
E-mail: toldi@bio.u-szeged.hu, tfarkas@bio.u-szeged.hu

Aims
The course is to review the most recent advancements in experimental neuroprotection.

Course description
In the frame of the course the students will acquire insight into the experimentally induced brain ischemia and its underlying mechanisms. Selected chapters covered during the course: forms of ischemic models, exitotoxicity, glutamate scavenging, role of neurosteroids, ischemic postconditioning, second pathophysiological stress, modulation of NMDA and AMPA receptors.

Learning outcomes

Skills and attributes

Suggested reading
Selected, recent reviews published in leading international scientific journals (Nature, Science, Neuron, Nature Neuroscience, Nature Reviews Neuroscience)

Exam Written

Department of Plant Biology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. Irma Tari
Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Environmental plant physiology

For BSc and MSc students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. Barnabás Wodala

Tel.: +36 (62) 544-307, Fax: +36 (62) 544-307
E-mail: wodalab@bio.u-szeged.hu

Aims
The responses of plants to their environment is at the core of this one-semester course. The course walks the students through the key anatomical-morphological and physiological acclimation and adaptation processes of plants in response to (often stressful and often combined) abiotic and biotic environmental factors, and discusses these processes at the molecular, cellular, whole-plant and community level. The course builds on a basic knowledge of plant physiology and introduces the key concepts in the interaction of plants and their environment by examples from scientific research, which provide insight into the research methods of environmental plant physiology.

Course description
Environmental stress factors. General stress physiology. Stress detection and signalling. Abiotic stress: Light. Abiotic stress: Temperature. Abiotic stress: Oxygen deficiency. Abiotic stress: Water deficiency. Abiotic stress: Salt. Thermal and water balance of plants. Nutrient and carbon relations: Whole-plant mechanisms, interactions. Abiotic stress: (Heavy) metals. Abiotic stress: Xenobiotica. Phytoremediation: heavy metals, organic pollutants. Biotic stress. Bioindication, biomonitoring. Measuring photosynthetic activity in the laboratory and the field. Chlorophyll fluorescence and PAM measuring principle. P700 absorbance. IRGA.

Learning outcomes
The Environmental Plant Physiology course is designed to provide a thorough introduction to plant physiology in an environmental context. The material is presented at a level suitable for advanced B.Sc. students majoring in life sciences. The course is concerned primarily with higher plants, and emphasis is placed on photosynthesis, which is a core process affected by all environmental stress factors. The lectures discuss environmental factors and key plant responses through examples of actual research, which provoke active thinking and provide insight into research methods in the field. Students who complete the course will have a comprehensive understanding of plant responses to environmental stress factors and some insight into how the interaction between plants and their environment is studied.

Skills and attributes
The students will become familiar with a number of biotic and abiotic environmental factors that affect plant life, including extreme illumination, temperature water and mineral availability. They will understand the key aspects and common processes underlying plant responses to environmental stresses from molecular to whole-plant and community level. They will be introduced to some major non-invasive diagnosic tools used in ecophysiological research, such as chlorophyll fluorescence, P700 absorbance and infrared gas analysis.

Suggested reading
Gurevitch, Scheiner, Fox: The ecology of plants, Sinauer Associates, 2002, Sunderland.
Lambers, Chapin, Pons: Plant physiological ecology, Springer, 2008, New York.
Schulze, Beck, Müller-Hohenstein: Plant ecology, Springer, 2005, New York.

Exam Oral

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6726 Szeged, Középfasor 52.
Head: Dr. Irma Tari
Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Environmental plant physiology – laboratory practicals

For BSc and MScstudents *Spring semester, 2 hours/week, 4 credits*

Lecturer: Dr. Barnabás Wodala

Tel.: +36 (62) 544-307, Fax: +36 (62) 544-307
E-mail: wodalab@bio.u-szeged.hu

Aims
The responses of plants to their environment is at the core of this one-semester course. The course offers a collection of simple, but informative experiements addressing key concepts in the field of environmental plant physiology with the aim to complement and embasize the topics discussed in the Environmental plant physiology lecture.

Course description
Measuring water potential in plant tissues. Studying nutrient deficiencies with hydroponics. The effect of light intensity on photosynthetic pigment contents in leaves. In vitro Hill-reaction: the effect of the herbicide atrazine on photosynthesis. Stomatal responses to drought (abscisic acid). The effect of temperature and organic pollutants on membrane function. Photosynthetic responses to light. Photosynthetic responses to temperature. Photosynthetic responses to osmotic stress. Photosynthetic responses to salt stress. Photosynthetic responses to the herbicide diuron. Photosynthetic performance of plants under different concentrations of CO_2.

Learning outcomes
The Environmental Plant Physiology course provides a basic collection of key experiments, and familiarizes students with some important research tools and areas of environmental plant physiology research. The experiments are presented and carried out at a level suitable for advanced B.Sc. students majoring in life sciences. The course uses higher plants, and emphasis is placed on photosynthesis, which is a core process affected by all environmental stress factors. Students will familiarize with a collection of simple, but insightful experiments each addressing the impact of an environmental factors on the physiology of the plant. Students who complete the course will have a comprehensive understanding of research methods employed in plant ecophysiology and will familiarize and learn to operate a number of non invasive measuring instruments currently used in plant physiology.

Skills and attributes
The students will become familiar with a number of biotic and abiotic environmental factors that affect plant life including extreme illumination, temperature water and mineral availability. They will understand the key aspects and common processes underlying plant responses to environmental stresses and learn to understand and design experiments that study such processes. They will be introduced to and learn to operate some major non-invasive instruments used in ecophysiological research, such as chlorophyll fluorescence, P700 absorbance and infrared gas analysis devices.

Suggested reading
Schulze, Beck, Müller-Hohenstein: Plant ecology, Springer, 2005, New York.

Exam Oral

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Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Cell communication

For BSc, MSc and PhD students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. Gábor Laskay

Tel.: +36 (62) 544-307, Fax: +36 (62) 544-307
E-mail: glaskay@bio.u-szeged.hu

Aims
The aim of the module is to give a comprehensive treatise on the various ways the cells communicate with each other. It will focus on the cell communication networks in multicellular organisms, but the evolution of communication and signaling pathways will also be discussed. Special emphasis will be given to cancer cells and they can avert the commands arriving from other parts of the body. The course will finish with introduction of the students to the various techniques that are used to study cell communication.

Course description
The module will comprise the following topics: General introduction into communication in biology. Quorum sensing as the prototype of communication between bacteria. Communication between Dictyostelium discoideum cells as a prototype of communication between unicellular eukaryotic cells. Evolution of signaling networks: from the bacterial two-component system to G-proteins. Cell communication in yeasts during mating. Evolution of signaling nwetworks: from G proteins to MAP-kinase cascade. General principles of cell communication in multicellular organism. Cell communication between adjacent cells of the epithelium. Special aspects of cell communication in tumours and lack of communication between normal and cancer cells. A specific example of three-way communication: the signaling networks triggered by IL-3. Signaling networks in cell communication (e.g. JAK/STAT, Notch, etc.). How to study the signaling pathways involved in cell communication.

Learning outcomes
The students will listen to lectures on the basics of communication networks between various kinds of cells in the body. A comprehensive treatise will be given on the basic principles of cell communication, why it is essential for the cells to communicate and what kind of channels they can use to do that. Both intercellular and intracellular communication networks and pathways will be discussed. The students will be provided with strong theoretical background of the various communication pathways as well as the similarities and differences between the various pathways employed by animals and plants and their different kind of cells.

Skills and attributes
The students will be familiar with the most important signaling pathways with which the cells can send messages to each other. Special emphasis will be given to cancer cells and how they can avert the signaling network of normal cells around them. In addition, the students will also receive training in the basic methodology of how to study the various communcation pathways in different kinds of cells. This includes relevant techniques of genomics and proteomics.

Suggested reading
Selected reviews from PubMed.

Exam Oral

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Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Fluorescent probes

For BSc, MSc and PhD students *Spring semester, 2 hours/week, 3 credits*

Lecturer: Dr. Gábor Laskay

Tel.: +36 (62) 544-307, Fax: +36 (62) 544-307
E-mail: glaskay@bio.u-szeged.hu

Aims
The aim of this module is to give a comprehensive treatise to the interested students on the theoretical and practical aspects of using fluorescent probes in biology. These dyes have become indispensable means in nearly every area of modern biology and they have literally revolutionised this science. The module will explain the importance of fluorescent dyes, it will give a historical background, a bit of chemistry and it will be finished with a practical demonstration.

Course description
The module will comprise the following topics: General introduction into fluorescence, physical basics, spectra and how to record them. The advantages of fluorescent dyes over alternative methods in cell biology. General introduction into how to measure intracellular ion concentrations. Ca-sensitive dyes. How to measure intracellular pH. How to measure resting membrane potential. How to detect apoptosis. How to measure cell viability. How to use fluorescent dyes in genomics and proteomics. How to study signal transduction with fluorescent probes. Instruments that are used for fluorescence studies (with practical demonstration).

Learning outcomes
The students will listen to lectures on the development and applicability of various fluorescent probes that can be used in molecular biology, cell biology, and molecular genetics. A comprehensive treatise will be given on the basic principles of fluorescence and a short introduction into spectroscopy and various methods used in spectroscopy. We will discuss the different kinds of spectra, including absorption, emission and excitation spectra, how to obtain them and how to make use of them. Then we will discuss the various types of fluorescent dyes and what aspects need to be taken into account when we want to select to use one specific dye.

Skills and attributes
The students will be familiar with calibration of the dyes, various aspects of dye sensitivity and other technical problems. At the end of the course demonstrations will be given to the students where they can obtain hand-on experience in using fluorimeters, fluorescence and confocal microscopes, flow cytometers and fluorescence-activated cell sorters as well. Different aspects of the various methods will be discussed and practical advice will be given along with reinforcing the theoretical basics.

Suggested reading
Selected reviews from PubMed.

Exam Oral

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Head: Dr. Irma Tari
Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Fluorescent probes – laboratory practicals

For BSc, MSc and PhD students *Spring semester, 2 hours/week, 4 credits*

Lecturer: Dr. Gábor Laskay

Tel.: +36 (62) 544-307, Fax: +36 (62) 544-307
E-mail: glaskay@bio.u-szeged.hu

Aims
The aim of this module is to give a comprehensive treatise to the interested students on the theoretical and practical aspects of using fluorescent probes in biology. These dyes have become indispensable means in nearly every area of modern biology and they have literally revolutionised this science. The module will explain the importance of fluorescent dyes, it will give a historical background, a bit of chemistry and it will be finished with a practical demonstration.

This practical course is offered only to those students who enrolled in Fluorescent probes course.

Course description
The course will comprise the following topics: General introduction into fluorescence, physical basics, spectra and how to record them. The advantages of fluorescent dyes over alternative methods in cell biology. General introduction into how to measure intracellular ion concentrations. Ca-sensitive dyes. How to measure intracellular pH. How to measure resting membrane potential. How to detect apoptosis. How to measure cell viability. How to use fluorescent dyes in genomics and proteomics. How to study signal transduction with fluorescent probes. Instruments that are used for fluorescence studies (with practical demonstration).

Learning outcomes
The students will listen to lectures on the development and applicability of various fluorescent probes that can be used in molecular biology, cell biology, and molecular genetics. A comprehensive treatise will be given on the basic principles of fluorescence and a short introduction into spectroscopy and various methods used in spectroscopy. We will discuss the different kinds of spectra, including absorption, emission and excitation spectra, how to obtain them and how to make use of them. Then we will discuss the various types of fluorescent dyes and what aspects need to be taken into account when we want to select to use one specific dye.

Skills and attributes
The students will be familiar with calibration of the dyes, various aspects of dye sensitivity and other technical problems. At the end of the course demonstrations will be given to the students where they can obtain hand-on experience in using fluorimeters, fluorescence and confocal microscopes, flow cytometers and fluorescence-activated cell sorters as well. Different aspects of the various methods will be discussed and practical advice will be given along with reinforcing the theoretical basics.

Suggested reading
Selected reviews from PubMed.

Exam Oral

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Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Functional plant anatomy – laboratory practicals

For BSc students *Fall semester, 2 hours/week, 4 credits*

Lecturer: Dr. Gábor Laskay

Tel.: +36 (62) 544-307, Fax: +36 (62) 544-307
E-mail: glaskay@bio.u-szeged.hu

Aims
The course will give a comprehensive treatise on the basic and contemporary knowledge of the structure and morphology of higher plants, with special reference to Pteridophytes, Gymnosperms and Angiosperms at the level of cells, tissues and organs. Microscopic preparations will be used to distingush between the main tissue types. Primary and secondary tissues will be made clear. Different types of secondary growth in the rott and stem will be discussed and studied. The anatomy of leaves and genarative structures (sporangia and flowers) will bhe shown. Plants are essential components of the biosphere and contribute significantly to human health and welfare through their agricultural use and medicinal and energy-producing potential. Therefore, knowledge and understanding of the structural complexity of terrestrial plants and their organs are indispensable for all students studying biology.

Course description
Basics of the organization of plant body. Plant tissues, primary and secondary tissues. The root: structure, zones, tissues and functions. The shoot: structures, stele-types, herbaceous and woody stems, primary and secondary growth. Leaves: anatomy and morphology. Reproductive structures, spores, gametes, alternation of generations. The flower: structure, development, sporogenesis and gametogenesis. Fruits and seeds, structure, types. Germination, types of shoots, buds. The importance of plants in the development of the present vegetation of the Earth.

Learning outcomes
Cell wall components, plasmodesms, symplast, apoplast, plant pigments, chloroplast structure, tissues, primary and secondary meristems, differentiation and dedifferentiation, parenchymas, dermal tissues, vascular tissues, mechanical tissues, xylem and phloem, primary and secondary growth, periderm, root system, shoot system, foliage, reproductive structures, alternation of generations, spores, flowers, seeds.

Skills and attributes
Understanding the organization of the plant body, characterization of plant cells, basic differences between animal and plant cells, understanding the role and development of tissues, the basic differences between tissue development in animals and plants, understanding the structure and role of the plant organs: roots, shoots, leaves and reproductive structures, understanding the basics of the alternation of generation and the role of flowers in higher plants.

Suggested reading
Dickinson WC, Integrative Plant Anatomy, Academic Press, New York, 2000.
Raven PH, Evert RF, Eichhorn SE (eds.): Biology of Plants, 6th Edition, W.H. Freeman and Co., New York, 1999.
Romberger JA, Hejnovicz Z, Hill JF, Plant Structure: Function and Development. Springer-Verlag, Berlin, 1993.

Exam Oral and written

Department of Plant Biology
Faculty of Science and Informatics
University of Szeged
6726 Szeged, Középfasor 52.
Head: Dr. Irma Tari
Web: http://www2.sci.u-szeged.hu/plantphys/indexen.html

Course code#

Functional plant anatomy

For BSc students *Fall semester, 2 hours/week, 3 credits*

Lecturer: Dr. Gábor Laskay

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E-mail: glaskay@bio.u-szeged.hu

Aims
The course will give a comprehensive treatise on the basic and contemporary knowledge of the structure and morphology of higher plants, with special reference to Pteridophytes, Gymnosperms and Angiosperms. Plants are essential components of the biosphere and contribute significantly to human health and welfare through their agricultural use and medicinal and energy-producing potential. Therefore, knowledge and understanding of the structural complexity of terrestrial plants and their organs are indispensable for all students studying biology.

Course description
Basics of the organization of plant body. Characterization of plant cells, differences between plant and animal cells. Cell walls, vacuoles, plastids. Plant tissues, development of primary and secondary tissues. The root: structure, zones, tissues and functions. The shoot: structures, stele-types, herbaceous and woody stems, primary and secondary growth. Leaves: anatomy and morphology. Reproductive structures, alternation of generations. The flower: structure, development, sporogenesis and gametogenesis. Fruits and seeds, structure, types. Germination, types of shoots, buds. The importance of plants in the development of the present vegetation of the Earth.

Learning outcomes
Cell wall components, plasmodesms, symplast, apoplast, plant pigments, chloroplast structure, tissues, primary and secondary meristems, differentiation and dedifferentiation, parenchymas, dermal tissues, vascular tissues, mechanical tissues, xylem and phloem, primary and secondary growth, periderm, root system, shoot system, foliage, reproductive structures, alternation of generations, spores, flowers, seeds.

Skills and attributes
Understanding the organization of the plant body, characterization of plant cells, basic differences between animal and plant cells, understanding the role and development of tissues, the basic differences between tissue development in animals and plants, understanding the structure and role of the plant organs: roots, shoots, leaves and reproductive structures, understanding the basics of the alternation of generation and the role of flowers in higher plants.

Suggested reading
Dickinson WC, Integrative Plant Anatomy, Academic Press, New York, 2000.
Raven PH, Evert RF, Eichhorn SE (eds.): Biology of Plants, 6th Edition, W.H. Freeman and Co., New York, 1999.
Romberger JA, Hejnovicz Z, Hill JF, Plant Structure: Function and Development. Springer-Verlag, Berlin, 1993.

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Course code#

Plant cell biology – laboratory practicals

For BSc students, MSc and PhD students *Fall semester, 2 hours/week, 4 credits*

Lecturer: Dr. Gábor Laskay

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Aims
The course will give a practical treatise on the basic and contemporary knowledge of the structure and function of plant cells. Special attention will be given to the cell wall, vacuoles, plastids, plant pigments, cell size determination, cell counting, cell membranes and effects of detergents of plant cell membranes, spectroscopy of plant pigments, fluorescence studies of plant mitochondria. Plants are essential components of the biosphere and contribute significantly to human health and welfare through their agricultural use and medicinal and energy-producing potential. Therefore, knowledge and understanding of the structural and functional aspects of plant cells are indispensable for all students studying biology.

Course description
General characterization plant cells. Plasmolysis. Structure and function of plant cell walls. Vacuoles and cell sap. Pigments present in the vacuoles. Plastids and their pigments. Spectroscopy of plant pigments. Plant cell membranes and the effects of detergents on them. Measuring the size of plant cells. Measuring cell numbers in suspension cultures of unicellular algae. Fluorescent dyes in plant cell physiology.

Learning outcomes
Plant cell structure, cell wall components, pectins, hemicelluloses, cellulose, extensin, lignin, pits and plasmodesms, symplast, apoplast, vacuolar pigments, flavonoids, chloroplast structure, chloroplastic pigments, chlorophylls, carotenoids, vacuole, turgor pressure, plasmolysis, osmotic relations, ionic homeostasis, transport ATPases, mitosis, meiosis, inequal cell division, polarity, totipotency, differentiation, dedifferentiation, polyploidy, extension growth, membrane transport, self-incompatibility.

Skills and attributes
Understanding the mechanisms which stick together the various components of plant cell walls, understanding the importance of ionic and osmotic relations in plant cells, overview of plant pigments, genetic manipulation of plants having different colours, understanding the importance of mitosis, meiosis and inequal cell division in the formation of the plant body, understanding the importance and basiscs of energy production in plant cells, understanding the mechanisms of self-incompatibility in plants, understanding the cellular mechanisms of plant movements.

Suggested reading
Raven PH, Evert RF, Eichhorn SE (eds.): Biology of Plants, 6th Edition, W.H. Freeman and Co., New York, 1999.

Exam Oral and written

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Course code#

Plant cell biology

For BSc students, MSc and PhD students *Fall semester, 2 hours/week, 3 credits*

Lecturer: Dr. Gábor Laskay

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E-mail: glaskay@bio.u-szeged.hu

Aims
The course will give a comprehensive treatise on the basic and contemporary knowledge of the structure and function of plant cells, emphasizing the main differences between animal and plant cells. Special attention will be given to the peculiarities of cell division in plants (both in terms of mitosis and meiosis), the phenomenon and consequences of polyploidy and the special abilities to plant cells (totipotency and dedifferentiation. Plants are essential components of the biosphere and contribute significantly to human health and welfare through their agricultural use and medicinal and energy-producing potential. Therefore, knowledge and understanding of the structural and functional aspects of plant cells are indispensable for all students studying biology.

Course description
General characterization plant cells, the fundamental differences between animal and plant cells. Special properties of plant cells: turgor pressure, plasmolysis, plasmodesms, symplast, apoplast. Structure and function of plant cell walls. Vacuoles and cell sap. Osmotic relations in plant cells. Ionic homeostasis of plant cells. Transport ATPases. Cell division in plants: mitosis and meiosis. Inequal cell division, polarity, totipotency, differentiation and dedifferentiation. Polyploidy and its consequences. Extension growth of plant cells. Membranes of plant cells: special features and transport characteristics of plasmalemma, tonoplast and chloroplast membranes. Bioenergetics of plants cells: photosynthesis and respiration. Self-incompatibility in plants. Pathogen recognition and the hypersensitive reaction. Cellular basics of plant movements.

Learning outcomes
Plant cell structure, cell wall components, pectins, hemicelluloses, cellulose, extensin, lignin, pits and plasmodesms, symplast, apoplast, vacuolar pigments, flavonoids, chloroplast structure, chloroplastic pigments, chlorophylls, carotenoids, vacuole, turgor pressure, plasmolysis, osmotic relations, ionic homeostasis, transport ATPases, mitosis, meiosis, inequal cell division, polarity, totipotency, differentiation, dedifferentiation, polyploidy, extension growth, membrane transport, self-incompatibility.

Skills and attributes
Understanding the mechanisms which stick together the various components of plant cell walls, understanding the importance of ionic and osmotic relations in plant cells, overview of plant pigments, genetic manipulation of plants having different colours, understanding the importance of mitosis, meiosis and inequal cell division in the formation of the plant body, understanding the importance and basiscs of energy production in plant cells, understanding the mechanisms of self-incompatibility in plants, understanding the cellular mechanisms of plant movements.

Suggested reading
Raven PH, Evert RF, Eichhorn SE (eds.): Biology of Plants, 6th Edition, W.H. Freeman and Co., New York, 1999.

Exam Oral and written