The University of Pécs
Medical School

MEDICAL BIOTECHNOLOGY
Major

STUDY PROGRAM
2010/2011

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BIOCHEMISTRY

Course director: **DR. BALÁZS SÜMEGI**, professo
Department of Biochemistry and Medical Chemistry

4 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **28 lectures +14 practices + 14 seminars = total of 56 hours**
Headcount limitations (min-max.): **min. 1 – max. 0**
Prerequisites: **none**

Topic

The subject covers the principles of chemical/biochemical processes occuring in living organisms. It deals with the fundamental metabolic processes and with the function, structure and regulation of the enzymes, transporters and other proteins which participate in the abovementioned processes. The subject uncovers the physical, chemical, thermodynamical and reaction-kinetical laws and rules of the essential metabolic processes and describes the structural characteristics of participating small molecules. It gives a deeper view into the fundamentals of structure-function relationships of small- and macromolecules, especially focusing on the structure, function and regulation of the molecules that are involved in the storage and transmission of genetic information, and dealing with basic molecular biology techniques. Furthermore, the regulation mechanisms of metabolic, hormonal and signal transduction pathways on the levels of the cell as well as of the organism are covered. The special biochemical characteristics of the different organs are also discussed.

Conditions for acceptance of the semester
According to the code of studies.

Making up for missed classes
None.

Reading material
Albert L. Lehninger-David L.Nelson-Michael M.Cox: Principles of Biochemistry 2nd edition, 1993 Worth Publishers, Inc.
Biochemistry. Syllabus for Medical Students Edited by the Biochemical Departments of DOTE-POTE-SZOTE.
Experimental Biochemistry Edited by Dénes Szabó, 1990
Recommended literature:
Lubert Stryer: Biochemistry 4th edition, 1995 E.H.Freeman & Company, New York.
Thomas M. Devlin: Textbook of Biochemistry. With Clinical Correlations 2nd edition John Wiley & Sons, New York

Lectures

1. Regulation and disorders of carbohydrate metabolism
2. Regulation and disorders of lipid metabolism
3. Mitochondrial transport
4. Water soluble vitamins
5. Lipid soluble vitamins
6. Proteins in blood, blood clotting
7. Serum lipoproteins
8. Special functions of the liver
9. Hormonal regulation of metabolism I (epinephrine, insuline, glucagon)
10. Hormonal regulation of metabolism II (steroid hormones, peptide hormones)
11. Changes accompanying the switch from fed to fasting state
12. Cell signalling and kinases I
13. Cell signalling and kinases II
14. Cell signalling, CO and NO as signals, transcription factors
15. Oxidative stress induced signalling pathways
16. Hypoxia-induced signalling.
17. Oncogenes and oncogenesis
18. Tumor suppressors and cancer
19. Genetic disorders of hemoglobin

20. Biochemistry of digestion: macronutrients
21. Biochemistry of digestion: micronutrients
22. Iron metabolism and related disorders
23. Biochemistry of inflammation and septic shock
24. Mitochondrial permeability transition
25. Biochemistry of the senses
26. Biochemistry of the nervous system I (ion-channels, receptors)
27. Nervous system II (survival, differentiation, learning and memory)
28. CNS Pathobiochemistry

Practices

1. Buffer solutions
2. Enzyme kinetics, enzyme inhibitions
3. Determination of cholesterol
4. Isolation of membrane proteins
5. Activity of membrane proteins
6. Detection of a Gene Deletion using PCR
7. Gene expression in Yeast
8. Bioinformatics, Systems Biology
9. Noninvasive bioanalytical methods
10. Cell culture studies
11. Heart perfusion studies
12. DNA array. Genomics
13. Proteomics
14. Pre-exam discussion

Seminars

Exam topics/questions

Participants

Dr. Pap Marianna (PAMFAAO.PTE); Dr. Gallyas Ferenc

INTRODUCTION TO MOLECULAR AND CELL BIOLOGY

Course director: **DR. JÓZSEF SZEBERÉNYI,** professo
Department of Medical Biology

4 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **28 lectures +14 practices + 14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The subject covers the structure, functions and regulation of eukaryotic cells. The functional morphology of cell organelles (cell nucleus, endoplasmic reticulum, Golgi complex, mitochondria, lysosome, cytoskeleton, cell membrane) are discussed, together with the most important methods. Basic processes of molecular biology (the structure of genome and genes, DNA replication and repair, RNA transcription and processing, translation) and their regulation are also included in the curriculum**.**

Conditions for acceptance of the semester

According to the code of studies.

Making up for missed classes

None.

Reading material

Szeberényi J., Komáromy L.: Molecular Cell Biology Syllabus (handout)

G.M. Cooper: The Cell. A Molecular Approach, Essential Cell Biology: An Introduction to the Molecular Biology of the Cell by Bruce Alberts, Ed: illustrated, Taylor & Francis, 1998, Molecular Cell Biology by Harvey Lodish, Arnold Berk, S. Lawrence Zipursky Ed: 4, W.H. Freeman, 2001, Molecular Biology of the Cell: [media DVD-ROM Inside] by: Bruce Alberts, John Wilson, Ed: 5, Garland Science, 2008

Lectures

1. The functional morphology of the cell
2. The structure and composition of chromatin
3. The cell cycle
4. DNA replication
5. DNA repair
6. Transcription
7. RNA processing
8. Translation
9. Gene regulation
10. Vesicular transport
11. The cytoskeleton
12. Mitochondria
13. The cell membrane and the extracellular matrix
14. Closing lecture

Practices

1. Orientation sessions (3)
2. Pathology of the nucleus (1)
   Cycle I: Light microscopy (2)
3. Chromatin (1)
   Confocal microscopy (2, demonstration)
4. Cell division (1)
   Electron microscopy (2, demonstration)

5. The cell cycle (1)
   Cycle I.: Immunocytochemistry (2)
6. DNA replication and repair (1)
   Cycle I: Separation techniques - centrifugation /chromatography (2)
7. Transcription and RNA processing (1)
   Cycle 1: Protein electrophoresis and Western blotting (2)
8. Midterm test (1)
   Cycle 2: Plasmid isolation, restriction analysis, electrophoresis (2)
9. Translation (1)
   Cycle 2: Isolation of DNA (2)
10. Gene regulation (1)
    Cycle 2: Isolation of RNA, electrophoresis (2)
11. Vesicular transport (1)
    Cycle 2: Histochemistry of macromolecules (2)
12. The cytoskeleton (1)
    Mitochondria (2)
13. The cell membrane and the extracellular matrix (1)
    Pre-exam discussion (2)
14. Pre-exam discussion (1)

Semester test (2)

Seminars

Exam topics/questions

Participants

HUMAN PSICHOLOGY

Course director: **DR. KARÁDI ZOLTÁN,** professo
Department of Physiology

4 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **28 lectures +14 practices + 14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The goal of the course is to disclose human physilogical processes to the students. By means of the knowledge of complex human physiological processes the biotechnology students will also learn the interconnections and mutual influences of physiological systems and they will utilize their knowledge in planning and executing related animal model experiments and pharmaceutical tests.

Conditions for acceptance of the semester

According to the code of studies.

Making up for missed classes

None.

Reading material

W.F. Ganong: Review of Medical Physiology, Appleton and Lange, Lange Medical Publications, 1990-2006
A.C. Guyton: Textbook of Medical Physiology, W.B. Saunders Company, 1996-2006
J.B. West (ed.): Best and Taylor's Physiological Basis of Medical Practice, Williams and Wilkins, 1990-1998
Fonyó: Principles of Medical Physiology, Medicina Kiadó 2002, Physiology exercises
Laboratory exercises in physiology 1st Semester

Lectures

1. Concept of homeostasis. Body fluid compartments and blood components.
2. Functions of cellular elements. Blood clotting. Blood groups.
3. Characteristics of the circulation in the human body.
4. Heart physiology: pacemaker activity, conductive system, electrical activity.
5. Control of circulation.
6. Respiration. Interaction between circulation and respiration.
7. Structure and function of the gastrointestinal tract: digestion and absorption.
8. Hormonal regulation of the gastrointestinal tract.
9. Kidney circulation, glomerular filtration, clearance.
10. Kidney: tubular transport mechanisms. Volume, osmotic and pH regulation.
11. Energy balance, metabolic rate and heat regulation.
12. Mechanism of hormone action. Hypothalamo-hypophyseal control of hormonal secretion.
13. Structure, function and hormonal control of reproductive organs.
14. Hormonal regulation of carbohydrate and intermediary metabolism.
15. Endocrinology of stress and adaptation.
16. Endocrinology of thyroid gland. Regulation of calcium and phosphate homeostasis.
17. General properties of neurons and their functions.
18. Interaction and communication between neurons. Neuronal networks.
19. Proprioception, somatosensory mechanisms, pain and temperature sensation.
20. Physiology of muscles. Spinal cord reflexes and locomotion.
21. Coordination of body movements and balance. Extrapyramidal, cerebellar and cortical control of motion.
22. Structure of the eye, primary sensory processes in the retina and central visual information processing.

23. Hearing. Taste and smell.
24. Autonomic nervous system.
25. Electrical activity of the brain, Electroencephalography, evoked potentials. Sleep-wakefullness.
26. Plasticity and regeneration in the nervous system. Learning and memory.
27. Control of emotion and mood. Drive and motivation.
28. Cerebral dominance. Speech and higher order cortical functions.

Practices

1. Blood. Red blood cell and differential leukocyte count, blood groups, osmotic resistance of red blood cells.

2. Heart. In situ and isolated frog's heart. Stannius ligatures. Cardiac cycle. Extrasystole.

3. Electrocardiography and phonocardiography.

4. Circulation. Arterial blood pressure and pulse. Microcirculation. Effects of adrenaline and acetylcholine.

5. Respiration Spirometry: lung volumes, capacities and dynamic parameters. Compliance.

6. Measurement of metabolic rate. Basal and actual metabolic rate.

7. Reproductive physiology: Estrous cycle, menstrual cycle. Pregnancy tests. Mid-term student report.

8. Carbohydrate metabolism: detection of blood glucose, glucose tolerance test, diabetes mellitus.

9. Electrical stimulation of peripheral nerve. Electrotonic potentials, action potentials. Cathode make and anode break excitations.

10. Compound and single fiber action potential, conduction velocity, chronaxy and rheobase.

11. Muscle physiology: Summation, superposition, incomplete and complete tetanus. Fatigue. Electromyography.

12. Central nervous system physiology I.: Reflexes. Stereotaxic technique.

13. Central nervous system physiology II.: Sensory systems.

14. Central nervous system physiology III.: Electroencephalography.

Seminars

Exam topics/questions

Participants
Dr. Karádi Zoltán

GENETICS

Course director: **DR. BÉLA MELEGH**, professo
Department of Medical Genetics

4 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **28 lectures +14 practices + 14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The aim of human genetic studies to explain the human genome and inherited and aquired mutations and consequent genetic diseases. The course material involves classical elements of general genetics and specifics of human genetics. The course also discusses results from the Human Genome Project that was completed in 2003. The primary aim of the course is to highlight general characteristics of the human genome, modern diagnostic techniques, ways of prevention and treatment of diseases. The causes of genomic disorders, their pathomechanism, early identification of involved families, and human genetic methods are also covered. The curriculum follows the general principles of similar European and US courses, beginning at the foundation and finally reaching the most up-to-date results.

Conditions for acceptance of the semester

According to the code of studies.

Making up for missed classes

None.

Reading material

- Nelson Textbook of Paediatrics
- Emery and Mueller: Elements of Medical Genetics

- High-Yield Genetics, by Ronald W Dudek, John E Wiley, Lippincott Williams & Wilkins, 2008

Lectures

1. The history of genetics: the development of modern human genetics and human molecular genetics. 1953-2003: Half a century in the development of genomics and the future. The Human Genome Project.
2. Basics of inheritance in human genetics. Mendels laws in clinical genetics. Consanguinity and incestus. Basics of pedigree documentation and analysis.
3. Structure and characteristics of the human genome. Gene identification methods. The Hardy-Weinberg distribution and its importance in human genetics.
4. Online genetic databases. Utilization of the scientific literature. OMIM.
5. Chromosomes and their mutations, the basics of cytogenetic methods. X and Y chromosomes. Dysmorphology, and identification of the syndrome. Syndrome search engines in clinical genetics.
6. Genome mutations, the possible consequences of the mutation types: variability and diseases. DNA methylation. Genomic instability. Basics of epigenetics in human genetics.
7. Variability of the human genome, single nucleotide polymorphism (SNP), copy number variations (CNP). HapMap project. Definition of linkage disequilibrium, linkage analysis, LOD score.
8. Deviations from Mendelian Laws: mitochondrial medicine, trinucleotide extension diseases, uniparental disomy, genomic imprinting.
9. Basic molecular biology techniques in human genetics (PCR and variants, use of RFLP, blotting, sequencing and fragment analysis, array techniques, FISH and its extensions, CGH and array CGH, genome association studies, mass spectrometry, and next generation sequencing).
10. Basics of molecular medicine. Population genetics and susceptibility genes. The human genetic aspects of tumor genetics. Basics of teratology.
11. Diseases in today's genetics: possible approaches to classical and classically not genetic diseases. The differences between "rare diseases" and diseases affecting large populations.
12. Pharmacogenetics, basics of personalized medicine. System biology in human genetics.
13. The patient and the patient suffering from a genetic disorder. Predictive medicine, possible disease risks of healthy people. General traits and presentation symptoms of genetic diseases. Genetic counseling institutions and major components of its practice.
14. Genetic dilemmas, ethical concerns, laws. ELSI, GINA, 23/2002 EüM regulation and 2008. XXI. Law.

Practices

Seminars

Exam topics/questions

Participants
Dr. Bene Judit

BYOPHISICS

Course director: **DR. MIKLÓS NYITRAI**, professo
Department of Biophysics

4 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **28 lectures +10 practices + 18 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The aim of the Biophysics curses is to introduce the students to the theoretical and experimental bases of the methods and applications commonly used in medical biotechnology. To achieve these aims we will provide detailed information in the lectures regarding the principals underlying these applications. The seminars and practicals will serve the aims of the manifestation of this knowledge in practical situations, during manual applications. An example for the subjects covered in biophysics.

Making up for missed classes

None.

Reading material

1. Medical Biophysics, (Ed.:Sándor Damjanovich, Judit Fidy, János Szöllősi); 2008, Medicina. 2. Biophysics practicals, PTE ÁOK; 3. Integrated Molecular and Cellular Biophysics by Valerica

Lectures

1. Structure of the atom
2. The electromagnetic spectrum. Light
3. The laser
4. Radioactivty. Interaction of radioactive radiations with matter
5. Dosimetry. Detection of radioactive radiations
6. Biological effect of radioactive radiations
7. Foundations of thermodynamics
8. Laws of thermodynamics
9. Diffusion. Osmosis
10. Laws of fluid flow
11. Structure of macromolecules. Protein folding
12. Resting membrane potential. Action potential
13. The cytoskeletal system, motor proteins
14. Absorption photometry
15. Infrared, Raman and CD spectroscopy
16. Fluorescence spectroscopy
17. Fluorescence polarization. FRAP
18. FRET. Fluorescence quenching
19. X-ray diffraction
20. Rapid kinetic methods
21. Principles of optical microscopy
22. Fluorescence and confocal microscopy
23. Sedimentation, electrophoresis
24. Flow cytometry
25. 3Mass spectrometry
26. EPR, NMR
27. MRI
28. CT, PET

Practices

1. Fluorescence spectroscopy (anisotropy, FRET, quenching)
2. Fluorescence and confocal microscopy
3. EPR/NMR spectroscopy
4. Rapid kinetics measurements
5. Absorption photometry

6. Polarimetry
7. Centrifugation
8. The Geiger-Müller counter. Radioactive half-life I
9. Gamma-absorption and spectrometry. Radioactive half-life II
10. Optics

Seminars

Exam topics/questions

Participants

INFORMATICS

Course director: **DR. GÁBOR PAULER, ASSOCIATE PROFESSOR**
Faculty of Engineering Institute of Electrical and Computer Engineering Department of Computer

4 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **14 lectures +28 practices + 14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

This course introduces students in the joint use of MS Access and MS Excel, with the pupose of enabling them to perform data processing and basic statistical analysis task in routine biotech research job. We stress on describing differences in purpose and capacities of spreadsheet and database software to avoid common misuses resulting data loss and redundant workload. We introduce students of very basics of programming in SQL, procedural VB, and cell functions coding.

Making up for missed classes

None.

Reading material

PTE-PMMK Databases/Spreadheets, Data Mining 2 Electronic Course Material, Introduction to Bioinformatics by Arthur Lesk, Ed: 2nd, 2005, Oxford University Press, New York, Understanding Bioinformatics by Marketa Zvelebil and Jeremy O. Baum; R Programming for Bioinformatics (Chapman & Hall/CRC Computer Science & Data Analysis) by Robert Gentleman

Lectures

1. What is bioinformatics? What units of information do we deal with in bioinformatics?
2. More than biology: Evolutionary algorithms
3. Distinct components in complex genomes. The three genomic paradoxes.
4. What are that nasty little settings in bioinformatics software: basics of sequence searching algorithms
5. Transcriptional regulator sites and transcription factors.
6. What to do if your bioinformatics software cannot handle things: Survive with database processing 1
7. Genomics databases: comparative genomics.
8. What to do if your bioinformatics software cannot handle things: Survive with database processing 2
9. Protein sequence databases.
10. Setting up hypotesis: Explorative statistics 1
11. Sequencing genome: next-generation sequencing technologies.
12. Setting up hypotesis: Explorative statistics 2
13. Measuring gene expression: SAGE, DDRT-PCR, SSH, Microarray.
14. Testing hypotesis: Parametric and non-parametring tests

Practices

1. Examples of biological data used in bioinformatics. Supported data format: FASTA, EMBL, GeneBank, PDB, PIR, Pfam, SCF, ClustalW, BLAST etc.
2. What are that nasty little settings in bioinformatics software: basics of sequence searching algorithms, Case study: ClustalW
3. Coding and non-coding DNA. International Nucleotide Sequence Database Collaboration Case studies: DDBJ-DNA Data Bank of Japan, European Nucleotide Archive, GenBank®
4. What to do if your bioinformatics software cannot handle things: Survive with database processing, Case study: Special joining data, MS Access
5. Flat-file Databases. Case studies: simple sequence analysis, coding and non-coding, gene structure, introns and exons, splice sites.
6. Setting up hypotesis: Explorative statistics 1, Case study: Poligene factors of child obesty, SPSS, Excel
7. Protein sequence motifs and active sites. Case studies: protein domain databases; protein classification, databases of individual protein families.
8. Mid-term exam. Practice mid-term exam.
9. Relational Databases. Case studies: protein properties, protein localization and targeting.
10. Setting up hypotesis: Explorative statistics 2, Case study: Poligene factors of child obesty, SPSS, Excel
    Genome annotation terms, ontologies and nomenclature. Case studies: GO-Gene Ontology.

11. Testing hypotesis: Parametric and non-parametring tests, Case study: Poligene factors of child obesty, SPSS
12. Measuring gene expression. Case studies: microarrays data and other gene expression databases.
13. Semester test. Practice final-exam.

Seminars

Exam topics/questions

Participants

INTRODUCTION TO ECONOMICS

Course director: **DR. ATTILA VARGA**, university professo
Faculty of Economics

2 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **14 lectures +14 practices + 0 seminars = total of 28 hours**
Headcount limitations (min-max.): **min. 1 – max. 0**
Prerequisites: **none**

Topic

The objective of the course is to introduce the scope of investigation, basic definitions, methodology as well as the main paradigms of economics. The aim is to provide students with fundamental knowledge needed to understand how modern economies function. Further objective is to give strong fundamental theoretical base for students who might wish to take a job in the business sphere.

Key definitions, methods to get known:

Models, induction, deduction, marginal analysis. Needs, goods, social-economic coordination. Redistribution, reciprocity, market. Division of labor, technical versus economical effectiveness. Production factors, market structure, demand, supply, price mechanisms. Production and consumption, employment, inflation, income. State, economic policy, fiscal and monetary policy. Money, securities. International division of labor.

Making up for missed classes
None.

Reading material

Paul Samuelson and William Nordhaus, The McGraw-Hill Companies

Lectures

1. Definition, aim and methodology of economics. Evolution and fields of economics
2. Theoretical history and basic streams of economics
3. Economy and society. Three basic questions of management. Coordination forms, societal systems and economy
4. Basic definitions of economics I: needs, goods, basic principles of economic acting
5. Basic definitions of economics II: definition of production factors, actors and sectors of economy
6. Basic definitions of economics III: market definition and forms, competition and market mechanism
7. Price mechanism in the “competitive market”: demand, supply and equilibrium price
8. Price setting in “non-competitive” markets, price influencing role of the state
9. Market equilibrium and market failures
10. Economic role of the state in dealing with market failures and management of economic processes
11. Measuring national output, employment and inflation
12. Evolution of money and its role in modern national economies
13. Financial transferring system: financial markets and institutions
14. Economy and society policy: aims, tools and institutions

Practices

Seminars

Exam topics/questions

Participants
Erdős Katalin

MANAGEMENT

Course director: **DR. ÁKOS JARJABKA**, associate professo
Faculty of Economics

2 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **14 lectures +14 practices + 0 seminars = total of 28 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The goal of this course: Gives a brief summary of themes and different methods of management science. In possession of management knowledge on basic level the students can define, analyse and solve the management and leading process and problems The course is included the most famous management theories, methods, processes and solutions.

Making up for missed classes

None.

Reading material

1. David Buchanan – Andrzej Huczynski: Organizational Behavior – An Introductory Text - , Prentice Hall – Financial Times, 5. edition, 2004., ISBN: 0 273 68222 9 2. Managing Small Business: An Entrepreneurial Emphasis by Carlos W. Moore, Justin Gooderl 1917- Longenecker, Ed: 14, Cengage Learning EMEA, 2008; The Management of Technological Innovation: Strategy and Practice by Mark Dodgson, David Gann, Ammon Salter, Ed: 2, Oxford University Press, 2008

Lectures

1. Introduction
   - Introduction to Management
     (Organization, environment, challenges)
   - What is Managent?
     (Definition, the main management functions)
2. Managemet functions I.
   - Planning,
   - organizing,
   - leading,
   - controlling
3. Managemet functions II.
   - The source of power
   - Managerial levels
   - Managerial skills
4. The business strategy
   - The evolution of business strategy
   - Level of strategy
   - Strategy goals and plans
   - The planning process
5. Corporate cultures and values
6. Fundamentals of organizing
7. Management methods and techniques I.
   - Porter's five forces
   - Porter's value chain (Value net)
   - McKinsey 7-S framework
   - Internal – external issues
   - SWOT analysis
8. Management methods and techniques II.
   - STEP
   - STEEPLE
   - 3-C's model
   - 4-P's model
   - Corporate life-cycle
9. Management methods and techniques III.
   - Product life-cycle
   - Decision tree
   - Stakeholder analysis
10. Functional areas and major concerns
    - Productive functions
    - supportive functions

11. Organizational structures I.
    - division of labour
    - Authortiy and responsibility
    - Coordination
12. Organizational structures II.
    - Functional app roach
    - Divisional approach
    - Matrix approach
    - Syndicate, holding approach
    - network approach

Practices

Seminars

Exam topics/questions

Participants

Dr. Vajkay András

BUSINESS LAW

Course director: **DR. TIBOR NOCHTA**, associate professo
Faculty of Law

1 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **14 lectures +0 practices + 0 seminars = total of 14 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The course will deal with the main issues of regulation of economy,businesse law, company law, contracts law, leas,-franchise factor - managemant consulting contracts, trade law. It will also give a general overview of insolvensy.

Making up for missed classes

None.

Reading material

1. Nochta Tibor: Company Law, 2. Nochta-Juhasz-Szécsényi: Law Regulation of Economy I-II. 2008 Budapest, 3. Nochta T. , Paths of Civil Law Laibility in Company Law; 4. K. Clarkson: Business law (West's Business Law) Ed: 11th

Lectures

1. The legal conditions of the management of undertakings in Hungary – The forms of undertakings
2. Private undertaking – its special forms in Hungary
3. Joint enterprises
4. The funding of companies, taking part in companies
5. The establishment and operation of companies
6. Characteristics of certain companies
7. Hungarian Company Law-European Company Law
8. Corporate Governance
9. Fundamental questions of Contract Law
10. The conclusion, modification and termination of contracts
11. Typical and atypical contracts
12. The basic features of Commercial Protection Law
13. Consumer Protection Law in the Eu
14. Hungarian Competition Law, limitations of business competition
15. Competition Law in the Eu
16. International Commercial Law

Practices

Seminars

Exam topics/questions

Participants

ETHICS IN BIOTECHNOLOGY

Course director: **DR. JÁNOS KÁLLAI,** professo
Department of Behavioural Sciences

1 credit ▪ midsemester grade ▪ Elective module ▪ autumn semester ▪ recommended semester: 1

Number of hours/semester: **14 lectures +0 practices + 0 seminars = total of 14 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **none**

Topic

The main aim of the course is to present the ethical considerations and dilemmas, which are related to the biotechnological researches and to the applications of biotechnology. Beyond that, during the course students will get acquainted with the social debates that are involved by the development of medical biotechnology, and also with the main elements of the European legal regulations in this area. During the semester the following subjects will be discussed: the ethics and the legal regulations of animal experiments, the ethical questions concerning organ and tissue transplantation, the ethical issues of cloning and genetic interventions, the future prospects of biotechnology and their social implications.

Making up for missed classes

None.

Reading material

A Companion to Genethics, edited by Justin Burley and John Harris, Balckwell Publishers Ltd., Massachussets/Oxford, 2002.

- Gehring, Verna V., Genetic Prospects: Essays On Biotechnology, Ethics, and Public Policy, Rowman & Littlefield Publishers, Inc., 2004.

- Andrew Johnson, Alan Holland, *Animal Biotechnology and Ethics*, Springer, 1997.

- Peter Singer, *Practical Ethics*, Cambridge University Press, 1979, 48-72.

- Hoeyer, K., Koch, L. *The ethics of functional genetics: same, same, but different?,* Trends in Biotechnology, 24(9), 387-3789, 2006.

- H. Verhoog, Naturalness and the genetic modification of animals, Trends in Biotechnology,

21(7), 294-297, 2003.

- F. S. Collins, E. D. Green, et al., *A vision for the future of genomic research*, Nature, 422,

835-847, 2003

- Peter Singer, *Practical Ethics*, Cambridge University Press, 1979, 48-72.

- Hoeyer, K., Koch, L. *The ethics of functional genetics: same, same, but different?,* Trends in Biotechnology, 24(9), 387-3789, 2006.

- H. Verhoog, Naturalness and the genetic modification of animals, Trends in Biotechnology,

21(7), 294-297, 2003.

- F. S. Collins, E. D. Green, et al., *A vision for the future of genomic research*, Nature, 422,

835-847, 2003.

- *A Companion to Genethics*, edited by Justin Burley and John Harris, Balckwell Publishers Ltd., Massachussets/Oxford, 2002.

- Gehring, Verna V., Genetic Prospects: Essays On Biotechnology, Ethics, and Public Policy, Rowman & Littlefield Publishers, Inc., 2004.

- Andrew Johnson, Alan Holland, *Animal Biotechnology and Ethics*, Springer, 1997.

Lectures

1. Introduction: biotechnology in the risk society
2. General ethical viewpoints
3. Fundamental ethical questions about biotechnology and genetic engineering
4. Some ethical dilemmas relating to agricultural biotechnology
5. The ethics of animal experiments
6. Ethical dilemmas concerning the genetic modification and cloning of animals
7. Ethics and research on human beings

8. The ethics of organ and tissue transplantation
9. Human genetics: the ethical implications of genetic testing, and of somatic cell gene therapy
10. Human genetics: the problem of germ-line genetic intervention
11. The ethical implications of stem cell research and therapy
12. Sci-fi bioethics: the future of medical biotechnology and the emerging new challenges
13. Post-academic science and the ethics of scientific publication
14. Written test

Practices

Seminars

Exam topics/questions

Participants

Dr. Szolcsányi T ibor (SZTAAJ.B.JPTE)

NUCLEIC ACID MANIPULATION AND VECTOR DESIGN

Course director: **DR. JUDIT E. PPONGRACZ**, associate professo
Institute of Immunology and Biotechnology

4 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **14 lectures +28practices +14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The aim of the course is to present the theoretical and practical background of nucleic acid manipulation and vector-design. The course discusses in detail the methods and aims of nucleic acid manipulation and also the establishment of recombinant viral vectors. Participants will become familiar with the practical utilization of vectors, the genetic manipulation of cells and laboratory animals, and how e.g. a gene-therapeutic intervention is designed in the case of a monogenic recessive hematological disorder.

Making up for missed classes

None.

Reading material

1. Principles of Gene Manipulation and Genomics, 7th Edition. S. B. Primrose & R. M. Twyman. Blackwell Publishing. 2006. 626 pages. ISBN 1 405 13544 1

2. Medical Biotechnology, editors: Pongracz J, Keen M, Elsevier (2009), 3. Human Molecular Genetics by Tom Strachan, Garland Publishing, (2004)

Lectures

1. Revision of basic molecular biology: DNA and gene structure, flow of genetic information
2. Invited speaker: analysis of genome, transcriptome, genetic polymorphisms (Life T.)
3. Basic DNA manipulation toolkit I:
4. restriction endonuclease digestion, ligation
5. Basic DNA manipulation toolkit II:
6. DNA modification, labeling, hybridization
7. What is gene cloning and how is it performed?
8. Verification and characterization of cloned genes and their products (DNA, RNA, protein level)
9. Genomic and cDNA libraries
10. (random, arrayed and ordered libraries)
11. Conventional gene knock-out technologies, applications and limitations
12. Invited speaker: RNAi or mRNA-specific knock-down, applications and limitations (Life T.)
13. Temporal and spatial orchestration of gene expression / tissue and developmental stage specific promoters
14. Non-viral vectors and gene delivery techniques
15. Viral vectors, *in vitro* and *in vivo* applications
16. Invited speakers:
17. Lentiviral transgenesis (Dr. Patrick Salmon)
18. Artificial chromosomes (Prof. Gyula Hadlaczky)

Practices

Seminars

Exam topics/questions

Participants

Dr. Kvell Krisztián

PROTEINS AND PROTEIN NETWORK

Course director: **DR. FERENC KILÁR**, professor
Institute of Bioanalysis

4 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **28 lectures +14 practices + 14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The purpose of this subject is to describe the protein networks that coordinates the cell-functions. Analysis of the proteome („phosphoproteome", „immunoproteome", „inflammaproteome") with molecular biology, bioinformatics and biostatistical methods. Structure-function relationships in proteins. Protein associates.

Making up for missed classes

None.

Reading material

D. Liu and F-Y. Wan, editors, *Advances in Computational Intelligence: Theory & Applications*, World Scientific, Hackensack, 2006.

Panchenko, Anna; Przytycka, Teresa (Eds.), *Protein-protein Interactions and Networks,* Identification, Computer Analysis, and Prediction, Series: Computational Biology , Vol. 9, 2008, Springer,

Petsko, Gregory A./ Ringe, Dagmar, Protein Structure and Function, Sinauer Associates Inc., 2004

Buxbaum, Engelbert, Fundamentals of Protein Structure and Function, 2007, Springer

Lectures

1. Amino acid networks and interactomes
2. Dynamics of amino acid networks
3. Protein-protein interactions (the game-theory approach 'protein-games')
4. Interactome-dynamics
5. Percolation analysis of protein-protein interaction networks
6. Serum proteins
7. Protein networks in blood (blood clotting, complement system)
8. The phosphoproteome
9. The immunoproteome
10. The inflammaproteome
11. Structure-function relationships in proteins
12. Domain-multidomain setups and functions
13. Protein associates
14. Signal transduction of proteins

Practices

1. Buffer solutions
2. Isolation of proteins
3. Immunoprecipitation
4. Affinity electrophoresis
5. Bioinformatics of proteins
6. Noninvasive bioanalytical methods
7. Scattering techniques for protein studies

8. Affinity purification
9. Selective gels for protein recognition
10. Surface plasmon resonance theory
11. Theoretical modelling
12. Protein-protein docking
13. Protein crystallization
14. Pre-exam discussion

Seminars

Exam topics/questions

Participants

SIGNAL TRANSDUCTION

Course director: **DR. TÍMEA BERKI**, associate professor
Institute of Immunology and Biotechnology

4 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **28 lectures +14 practices + 14 seminars = total of 56 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

Novel antibodies against receptors, protein kinase inhibitors, and antisense oligonucleotides targeting both signal transduction and gene expression will predominate the therapeutic approaches in the coming decades. The course focus on the therapeutic potential for targeting cell signaling mechanisms with particular attention to cancer therapies and inflammatory signaling pathways as well as immunomodulation. General concepts of inter-and intracellular signal transduction: receptor-mediated signal transduction, cell surface receptors, steroid hormone and nuclear receptors and their cytoplasmic signal transduction and nuclear responses, apoptotic cell signaling will be discussed together with the novel approaches to drug discovery in signal transduction. Internationally known experts of the field guest lecturers from Hungarian universities are contributing in the course.

Making up for missed classes

None.

Reading material

1.Gerhard Krauss: Biochemistry of Signal Transduction and Regulation (Wiley)

Finkel, Toren(ed.) ; 2. Gutkind, J. Silvio(ed.): Signal Transduction and Human Disease

(John Wiley & Sons, Inc.), 3. Bioinformatics and Systems Biology: Collaborative Research and Resources, Frederick Marcus, Springer, 2008

Lectures

1. Introduction, overlap with other disciplines
2. Overview of extracellular signaling
3. Families of extracellular receptors
4. Second messengers (cAMP)
5. Receptor tyrosine kinases
6. The Ca++ signal
7. Transcription factors
8. Signaling in the specific immune system: B cell signaling. [Dr. Sármay Gabriella]
9. T cell activation and signaling [Hannes Stockinger]
10. FcγReceptor signaling
11. FcεReceptor signaling [Israel Pecht]
12. Signaling in the innate immune system: CR and TLR signaling [Dr. Mócsai Attila]
13. Tyrosine kinase-linked receptors I.: cytokine/chemokine signaling
14. Tyrosine kinase-linked receptors II.: growth factors
15. Signaling in tumor cells (EGF-R, Her-2R etc) [Dr. Tímár József]
16. Apotosis signaling [Dr. Szondy Zsuzsa]
17. Receptors with intrinsic enzymatic activity (insulin, growth factors)
18. G-protein-linked receptors (epinephrine, serotonin, glucagon)
19. Ion-channel receptors (acetilcholine receptor) [Dr. Panyi György]
20. Cell-surface hormone receptors
21. Intracellular/nuclear receptor signaling (steroid hormones and thyroxin)

22. Non-genomic steroid hormone signaling pathways
23. Receptor interactions, signaling cross-talk
24. Wnt receptor signaling
25. Signaling in the nervous system
26. Pharmacological influence of the signaling 1.
27. Pharmacological influence of the signaling 2.
28. Summary, preparation for the exam

Practices

1. Measurement of intracellular **Ca^{++}** level using flow cytometry. T cell activation with anti-CD3; mast cell activation through FcεR.

2-3. Analysis of the **phosphorylation** status of the key signaling molecules in the TcR signaling pathway. Detection of tyrosine-phosphorylation in T cells after anti-CD3 activation with Western-blot or with phospho-flow technique using phospho-specific antibodies.

4. Detection of **transcription factor** activation.

5. **FcεR signaling** elicited biological responses *in vivo* (mouse model) and *in vitro* (mast cell model). Passive cutaneous anaphylaxis, degranulation test.

6. Signaling pathways of **apoptosis** (intrinsic and extrinsic). AnnexinV/propidium-iodode staining; detection of activated Caspase-8, -9, -3; analysis of the Bcl-2 protein family; changes of the mitochondrial membrane potential.

7. Analysis of the genomic and non-genomic **glucocorticoid** (GC) signaling pathways. Translocation of the glucocorticoid-receptor into the nucleus and the mitochondrium (confocal microscopy) in different cell lines. Gene-expression changes induced by the GC signaling (PCR).

Seminars

Exam topics/questions

Participants

Dr. Boldizsár Ferenc

IMMUNOLOGY

Course director: **DR. PÉTER NÉMETH**, professor
Institute of Immunology and Biotechnology

3 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **14 lectures +14 practices + 14 seminars = total of 42 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The subject comprises major immunological processes, their cellular and molecular components, discusses the regulation of a physiological immune response. The course also briefly summarizes basic processes of immune-pathologies (i.e. autoimmunity, tumor-immunity, etc). The practices allow for the participants to become familiar with standard and modern immunological techniques.

Making up for missed classes

None.

Reading material

IMMUNOBIOLOGY 7 PB (Janeway's Immunobiology) (Immunobiology: The Immune System (Janeway)) by Kenneth M. Murphy, Paul Travers, and Mark Walport; Kuby Immunology (Kindt, Kuby Immunology) by Thomas J. Kindt, Barbara A. Osborne, and Richard A. Goldsby; Essentials of Clinical Immunology by H.Chapel, Ed:5, Blackwell Publishing, 2008

Lectures

Practices

Seminars

Exam topics/questions

Participants

MICROBIOLOGY

Course director: **DR. JÚLIA SZEKERES-BARTHÓ**, professor
Department of Medical Microbiology and Immunology

3 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **14 lectures +14 practices +14 seminars = total of 42 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The subject explains the course of setting the diagnosis and performing an efficient antimicrobial treatment in the case or suspicion of an infectious disease. The course follows current trends based on modern biotechnological knowledge (i.e. increase in the significance of opportunistic pathogens, recognition of new pathogens, changes in the roles of conventional pathogens etc).

Making up for missed classes

None.

Reading material

1. Medical Microbiology and Immunology by Warren Levinson;

2. Microbial Biotechnology: Fundamentals of Applied Microbiology by Alexander N. Glazer and Hiroshi Nikaido; 3. Advances in Applied Microbiology by Wayne William Umbreit, Academic Press, 2005

Lectures

1. Orientation, bacterial cell structure
2. Physiology of bacteria
3. Bacterial genetics
4. Pathogenicity and virulence, endo- and exotoxins
5. Desinfection and antimicrobial therapy I.
6. Antimicrobial therapy II.
7. Virology I.
8. Virology II.
9. Immunology in microbiology: defence mechanisms against microbial pathogens
10. Immunology in microbiology: vaccines
11. Bacterial pathogens and diseases of humans I.
12. Bacterial pathogens and diseases of humans II.
13. Bacterial pathogens and diseases of humans III.
14. Fungal and parasitic infections of humans, closing of semester

Practices

1. Orientation, microscopy in microbiology, staining methods
2. Culture of bacteria
3. Biochemical test in the identification of bacteria
4. Serological tests in medical microbiology
5. Molecular biological methods in medical microbiology
6. Antibiotic resistance testing
7. Diagnostic of viral infections
8. Bacterial diagnostic of wound secrete, haemoculture
9. Bacterial diagnostic of urinary tract infections

10. Bacterial diagnostic of respiratory tract infections
11. Bacterial diagnostic of gastrointestinal diseases
12. Diagnostic of anaerobic bacteria
13. Diagnostic of mycologic and parasitic infections
14. Pre-exam discussion

Seminars

Exam topics/questions

Participants

Dr. Palkovics Tamás (PATHAAO.PTE)

MOLECULAR BASIS OF MICROBAL PATHOGENESIS

Course director: **DR. CSABA FEKETE**, associate professor Faculty of Sciences

3 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **14 lectures +14 practices + 14 seminars = total of 42 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The course is concerned with modern aspects of molecular microbiology including examination of the regulation of the growth of bacteria and fungi, and the molecular determination of virulence in pathogenic microorganisms. The lectures will focus on current molecular and biochemical techniques that are the most frequently used in medical and clinical research. Theoretical and practical aspects of molecular techniques used in the prevention, diagnosis and treatment of major pathogens will also be discussed. We will talk about how these methods work, their pitfalls, and strengths. The lecture component covers the molecular features of the interactions between pathogens and the host, including the role of the immune system and the use of antimicrobial drugs in combating infection.

Making up for missed classes

None.

Reading material

Diagnostic Molecular Microbiology: Principles and Applications by David H. Persing, T. F. Smith, F. C. Tenover. Published by ASM Press, 1993. Medical Biomethods Handbook by John M. Walker, Ralph Rapley Contributor John M. Walker, Ralph Rapley Published by Humana Press, 2005. Fundamentals of Molecular Diagnostics. By David E. Bruns, Edward R. Ashwood, Carl A. Burtis, Barbara G. Sawyer, Published by Saunders Elsevier, 2007. Principles of Gene Manipulation and Genomics by S. Primrose and R. Twyman, Blackwell Publishing,

Lectures

1. The Microbe World: a comprehensive directory of micro-organisms and their activities.
2. Classification of Microbes: roles, difficulties and benefits.
3. Host-Pathogen Interactions: basic concepts of microbial commensalism, colonization, infection, and disease.
4. General Aspects of Microbial Pathogenesis: transmission, adhesion, penetration, spread and survival in the host.
5. Microbial Pathogenomics: molecular version of Koch postulates, the attributes of virulence.
6. Genome Organization and Plasticity in Pathogenic Bacteria: correlation between genome rearrangements and lifestyle.
7. Fungal Pathogenicity: virulence factors that promote colonization and damage the host.
8. Interplay Between Host Immune Components and Microbial Virulence Factors.
9. Manipulation of Host-Cell Pathways by Microbial Pathogens: functional genomics to understand defense responses.
10. The Human Microbiome Project: relationship between human health and changes in the human microbiome.
11. The Evolution of Antibiotic Resistance: molecular basis of resistance to antimicrobials.
12. Microbial Secondary Metabolism: when and why are they produced?
13. Microbe-Microbe Interaction: how and why microbes communicate with each other?
14. Future Trends and Challenges in Pathogenomics: whole genome sequences, new screening technologies, proteomics, comparative genomics and bioinformatics.

Practices

1. Orientation.
2. Polyphasic Taxonomy: morphological, physiological, and biochemical characterization. **Safe handling of microbes: aseptic techniques.**
3. Microbial model systems. Growth and culturing of microbes.
4. Basics for handling food safely. **Counting microbes.**

5. Germ theory of disease: historical overview. *Caenorhabditis elegans* model system for study of host pathogen interactions.
6. Cellular and molecular biology of filamentous fungi. Fluorescent staining of fungi in clinical specimens.
7. Inspection of transcript profiles in pathogens: why measure gene expression? **Isolation of high quality RNA.**
8. Mid-term exam. Assessment of RNA integrity using Agilent 2100 Bioanalyzer.
9. Approaches to look for differentially expressed genes: the principles of real-time PCR and cDNA AFLP. T**he two-steps RT-reaction and cDNA-AFLP profiling.**
10. Primer and probe design. **StepOne™ System.**
11. Methods for the quantitative assays: fluorescence chemistry. P**late setup and running qPCR experiments.**
12. Absolute, relative and comparative quantitation. **Data evaluation.**
13. Pre-exam discussion. Pre-exam discussion.
14. Semester test. Practice final-exam.

Seminars

Exam topics/questions

Participants

MOLECULAR PATHOLOGY

Course director: **DR. LÁSZLÓ PAJOR,** professor
Department of Pathology

2 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **28 lectures +0practices + 0 seminars = total of 28 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

Molecular aberrations of tumours best characterised at the molecular level, will be presented at oncopathology lectures. The main emphasis will be on – apart from chronic myeloproliferative disorders, acute myeloid and lymphoid leukaemias, B- and T-cell malignant lymphomas – breast cancer, brain tumours (gliomas), HPV associated cervical carcinoma, colorectal and pulmonary epithelial tumours, and childhood soft tissue cancers. The lecture will also address existing and potential target therapies, their molecular basis, and system of criteria for predictive pathological diagnostics. The practical part of the course involves laboratory presentations, and experiments with active student participation. The experiments involve convential and molecular cytogenetics, automated interphase cytogenetic, multiparametric flow cytometry and cell sorting, DNA and RNA PCR, quantitative PCR, allele discrimination quantitative PCR and mutation analysis.

Making up for missed classes

None.

Reading material

Margaret A. Knowles and Peter J. Selby. Introduction to the Cellular and Molecular Biology of Cancer. Oxford University Press, USA; 4 edition. 2005.

Michael Khan, Stella Pelengaris. The Molecular Biology of Cancer. Wiley-Blackwell; 1 edition. 2006., DeVita, Hellman, and Rosenberg's Cancer: Principles & Practice of Oncology by Vincent T. DeVita, Theodore S Lawrence, Steven A. Rosenberg, Robert A Weinberg, Ronald A DePinho, Ed: 8, Lippincott Williams & Wilkins, 2008

Lectures

1. Basic pathology. The role of morphological-, immunophenotypical and genotypical investigations in diagnostic pathology
2. Conventional cytogenetics and interphase fluorescence in situ hybridization (FISH)
3. Multicolour FISH based karyotyping
4. Array-based karyotyping/aka digital karyotyping. Molecular karyotyping in practice
5. One stop shop: next generation sequencing in research and pathology
6. Applications of PCR techniques in research and diagnostic pathology
7. Advanced imaging. FRET, FLIM, 3D and 4D imaging of live cells
8. Predictive molecular pathology of chronic myeloproliferative neoplasms and myelodysplastic syndromes
9. Predictive molecular pathology of acute leukaemias.
10. Predictive molecular pathology of mature B-, T- and NK-cell neoplasms and Hodgkin lymphoma
11. Predictive molecular pathology of breast cancer and cervical carcinomas associated with HPV
12. Predictive molecular pathology of colorectal carcinomas and pulmonal epithelial tumours
13. Predictive molecular pathology of pediatric soft tissue malignancies. Brain tumours
14. Molecular medicine: From diagnostics to treatment and back

Seminars

Exam topics/questions

Participants

Dr. Alpár Donát

DEVELOPMENTAL BIOLOGY

Course director: **DR. PÉTER BALOGH,** associate professor
Department of Immunology and Biotechnology

2 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **28 lectures +0 practices + 0 seminars = total of 28 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

This course covers the molecular and cellular bases of development in a variety of experimental organisms with special emphasis on mammalian and human models. With the observation of differential gene-activity and geneexpression patterns it explains the development of various tissues and organs. The course considers the possible pharmacological and pharmacotherapical applications in the biological development.

Making up for missed classes

None.

Reading material

1. Scott F. Gilbert: Developmental Biology 2006. Sinauer Associates, 2. Principles of Development by Lewis Wolpert, Jim Smith, Tom Jessell, and Peter Lawrence, Oxford University Press, Ed: 3rd, 3. Essential Developmental Biology by Jonathan M. W. Slack, Blackwell, 2006; 4. Evolutionary Developmental Biology by B.K. Hall, Kluwer, Ed 2nd

Lectures

1. Developmental biology: The anatomical tradition
2. Comparative and Evolutionary Embryology
3. Medical Embryology and Teratology
4. Genes and development: Techniques and ethical issues.
5. The genetic core of development: Differential gene expression and RNA Localization Techniques
6. Cell-cell communication in development
7. Germ line and gametogenesis
8. Early embryonic development: Structure of the Gametes, Recognition of Egg and Sperm
9. Gamete Fusion and synchronization
10. Early Mammalian Development
11. Formation and differentiation of the Neural Tube
12. Tissue Architecture of the Central Nervous System and Neuronal Types
13. Development of the Vertebrate Eye
14. The Epidermis and the Origin of Cutaneous Structures
15. Neural crest cells and axonal specificity
16. Paraxial and intermediate mesoderm
17. Development of haematopoiesis
18. Development of primary and secondary lymphoid organs
19. The Development of Muscle
20. The Development of Bones
21. Lateral plate mesoderm and endoderm
22. Limb development: generation of three axes and their coordination
23. Cell Death and the Formation of Digits and Joints
24. Sex determination in Mammals: Chromosomal and environmental
25. Metamorphosis and regeneration

26. Environmental regulation of animal development
27. Evolution and development
28. Therapeutic developmental biology

Practices

Seminars

Exam topics/questions

Participants

Engelmann Péter

IN VIVO TEST SYSTEMS AND TRANSGENIC ANIMALS

Course director: **DR. PÉTER BALOGH,** associate professor
Department of Immunology and Biotechnology

2 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **14 lectures +14 practices + 0 seminars = total of 28 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The aim of this course is the presentation of current in vivo experimental approaches for the development and application of various genetically modified animals (mainly mice) in biomedical research.

Making up for missed classes

None.

Reading material

Transgenic Animals: Generation and Use. Louis-Marie Houdebine CRC Press, 1997, Transgenic Animal Technology: A Laboratory Handbook by Carl A. Pinkert, Academic Press, Ed:2nd, 2002, What's Wrong with My Mouse?: Behavioral Phenotyping of Transgenic and Knockout Mice by J.N. Crawley, Ed:2nd, 2007; Mouse Genetics and Transgenics: A Practical Approach by Ian J. Jackson and Cathy Abbott, Oxford University Press, 2001

Lectures

1. Introduction to transgenic animals
2. Ethics of in vivo animal experimentation
3. Molecular biology and analyses
4. Enabling technologies
5. Transgenic animal production focusing on the mouse model.
6. Transgenic animal production using DNA microinjection.
7. Factors affecting transgenic animal production.
8. Gene targeting in embryonic stem cells I: History and methodology.
9. Gene targeting in embryonic stem cells II. Conditional technologies.
10. Retrovirus-mediated gene transfer.
11. Nuclear transfer technologies.
12. Production of transgenic domestic animal species
13. Surgical models in animal experimentation
14. Non-transgenic cell knock-in or knock-out technologies: cellular depletion and regeneration

Practices

1. Mouse care and husbandry
2. Cryopreservation and rederivation of embryos and gametes
3. Spatial analysis of gene expression
4. Mapping phenotypic trait loci
5. Mapping genomes
6. Mouse cytogenetics and FISH
7. Electronic tools for accessing the mouse genome
8. Mutagenesis of the mouse germline
9. Generation of transgenic mice from plasmids, BACs and YACs
10. Directed mutagenesis in embryonic stem cells

11. Immunological testing: cellular and serological procedures
12. Behavioral phenotyping and assessment
13. Humanization of the mouse
14. Consultation

Seminars

Exam topics/questions

Participants

Engelmann Péter

TISSUE CULTURE TECHNIQUES

Course director: **DR. JUDIT E. PONGRACZ** associate professor
Department of Immunology and Biotechnology

3 credit ▪ midsemester grade ▪ Elective module ▪ spring semester ▪ recommended semester: 2

Number of hours/semester: **14 lectures +28 practices + 0 seminars = total of 42 hours**

Headcount limitations (min-max.): **min. 1 – max. 0**

Prerequisites: **Basic science core material**

Topic

The course material discusses the basic principles of cell culture techniques both for cell lines and primary tissues. Fundamental techniques for stem cell purification and stem cell culture will also be detailed. The course will provide both theoretical and practical background for the use of tissue cultures in complex pharmaceutical testing and biotechnological modification of cells and tissues.

Making up for missed classes

None.

Reading material

Fundamental techniques in cell culture – a laboratory handbook (ECACC&Sigma), Tissue Culture Techniques: An Introduction by Bernice M. Martin (Paperback - Aug 1, 1994); Clinical Bone Marrow and Blood Stem Cell Transplantation by Kerry Atkinson Ed: 3, Cambridge University Press, 2004, Animal Cell Technology: From Biopharmaceuticals to Gene Therapy by Leda dos Reis Castilho, Routledge, 2008

Encyclopedia of Stem Cell Research by Clive Svendsen, Svendsen, Allison D. Ebert, Sage eReference, SAGE Publications, 2008 by Ian J. Jackson and Cathy Abbott, Oxford University Press, 2001

Lectures

1. History of cell cultures and introduction to a cell culture facility
2. Cell and tissue types in culture. Origins of cell types, tissue banks
3. Regulations on using cell cultures
4. Cell culture protocols, risk assessment and microbial screening
5. Preparatory techniques used in creating cell lines from complex tissues
6. Differentiation and redifferentiation of cell lines. Testing spontaneous transformation. Regular “fingerprinting”
7. Arteficially immortalized cell types
8. Experimental designs using cell cultures
9. Main characteristics of stem cells and origin of stem cell types
10. Stem cell markers and stem cell cultures
11. Keeping stem cells in culture
12. Directed differentiation of stem cells
13. Complex stem cell cultures
14. Experimental designs using stem cells

Practices

1. Practicing sterile work in a tissue culture laboratory, thawing up adhesive and non-adhesive cell lines
2. Keeping cell lines in culture, passage of cell cultures, counting and pelletting cells, setting up cell cultures at set cell numbers
3. Storage and freezing down cell lines.
4. Practicing microbial screening I.
5. Practicing microbial screening II.
6. Testing cell lines for transdifferentiation, apoptosis, etc.. General fingerprinting of cell lines
7. Designing immortalization of primary cells
8. Purification of primary cells using tissue characteristic markers
9. Culturing primary cells and testing survival and apoptotic death
10. Purification of adult stem cells based on predicted markers
11. Culturing stem cells
12. Testing for differentiation markers and cellular proliferation
13. 13-14 Presentation and discussion:
14. Individual experiments designed by students

Seminars

Exam topics/questions

Participants

Dr. Kvell Krisztián