

Degree level learning objectives of Master's Programme in Molecular Medicine, Double Degree

Oulu:

744620S Protein chemistry II

After the course, the students are able to describe professional literature dealing with advanced techniques of protein analysis. He can plan and implement the purification of a given protein on a large scale. The student is able to present and explain work related to protein purification and analysis.

744621S Molecular biology II

After the course student is able to discuss the general features of DNA manipulating/amplifying enzymes. He can design (on paper or in silico) oligonucleotides for PCR amplification, set up restriction digests and ligation reactions in order to carry out basic and advanced cloning procedures. The student is also familiar with the basic tools used in the genetic manipulation of mice.

743657S Tumor cell biology

Upon successful completion student is able to name, list and discuss the major aspects including formation of a tumor cell. He can present, describe and discuss characteristic aspects of oncogenes and tumor suppressor genes. He is able to use methods to study, examine and to analyze tumor genesis and tumor progression.

747608S Biochemical methodologies II

Upon successful completion student is able to describe the theoretical basis of the main biochemical analysis methods for proteins, to identify and use the different instruments. He can describe the potential of the different analytical techniques and develop strategies for addressing specific questions in protein & proteome-analysis. The student is also able to integrate data from multiple sources and evaluate it critically.

743664S Hypoxia response pathway – molecular mechanisms and medical applications

Upon completion the student should be able to present and discuss the basic mechanisms involved in regulation of oxygen homeostasis on cellular, tissue, organ/organism level. The student can integrate/adapt regulation of oxygen homeostasis under normal physiological conditions to pathological situations. He/she is able to display an understanding on how the basic biochemical knowledge translates from the bench to the bedside. The student can also understand the meaning of translational research.

743665S Molecular, cell biological and genetic aspects of diseases

Upon completion of the course the student should be able to:

Based on biogenesis, structure and function of the key cell organelles discuss their role in pathology and understand organelle-specific disease mechanisms; understand typical inherited diseases in terms of their occurrence, biochemistry behind their origin, and their analysis and treatment possibilities; present and defend a scientific presentation on a theme related to inherited diseases.

747613S In silico methodologies in biochemistry and molecular medicine

After a successful completion of this course, student will have obtained an appreciation of the quantitative aspects of analyzing scientific (big) data either stored in large data databases or generated by sophisticated modeling and simulation tools. The student has gained a basic understanding of applying various bioinformatics methods to large biological data sets. He has also realized the potential of scientific computing for the study of the behavior of biological systems, in particular large biological macromolecules.

747614S Macromolecular X-ray crystallography

After completion of this course student is able to discuss the key aspects of protein crystallization methods and interpret the results. He can describe the diffraction of X-rays and the importance of crystal symmetry. The student is also able to describe the importance of the Fourier transform method in the structure determination and to describe the phase problem and tell the methods to solve it. He can apply knowledge on protein chemistry to refinement of a crystal structure as well as judge the quality of a protein structure.

743662S Extracellular matrix

Upon successful completion student is able to describe the structure and key components of the mammalian ECM and to describe the main significance of the ECM for cell and tissue function. He can outline the roles of ECM in inherited connective tissue disorders and in common other diseases. He is also able to identify connective tissue and some of its components in tissue samples using various staining protocols (laboratory work). The student can summarize background knowledge of ECM sufficiently to feel comfortable in undertaking a postgraduate research project in the ECM field.

743655S Systems biology

After the course student is able to define the cell as an ensemble of structural and functional parts. He is also able to connect and describe their current knowledge on cellular, molecular and structural biology into a general view. The student is also able to assess scientific information critically on novel research findings and the problems associated with massive amounts of novel scientific information.

902101Y Scientific communication

The course aims to help the student to acquire understanding of the conventions and expectations of the academic community of biochemists for scientific reporting, and to develop presentation and writing skills for the future professional life. By the end of the course, the student is expected to be able to write a research article that follows the main discourse conventions of biochemistry and to apply the rules of referencing. He can prepare and deliver an oral scientific presentation supported by an effective slideshow. The student is able to use a sufficient range of appropriate academic vocabulary relevant to your discipline

and to write with a good level of linguistic accuracy and correct punctuation. The student can also structure his work for optimal clarity and impact as well as make good use of feedback from peers and teachers to improve his own scientific production.

747611S Biochemistry and biotechnology of protein folding

After the course the student is able to present and discuss issues presented in the primary literature on a variety of aspects of protein folding. The student can display an understanding of the theoretical and practical implications of in vivo, in vitro and in silico studies on protein folding and the integration of results. He is able to demonstrate the ability to interpret a wide range of data from multiple sources, to critically evaluate and contextualize this data and to solve problems relating to interpretation.

743663S Developmental biology, stem cells and tissue engineering

Upon completion of the course the student has obtained an overview of how the development of tissues and organs is regulated and executed via developmental gene regulation and developmental programs behind morphogenesis. Student will become familiar with the classical and modern experimental embryological techniques during lectures and also with hands-on laboratory work.

744623S Yeast genetics

Upon successful completion students are able to tell a basic knowledge of yeast genetics and physiology and to tell the basic principles of using the yeast model organism to address fundamental genetic and cell biological problems. After the practical course the student can describe variety of genetic and molecular biology techniques commonly used to manipulate baker's yeast in the pursuit of biological questions.

747615S Introduction to structure-based drug discovery

After completion of this course student is able to find and analyze a protein structure of interest from databases from the point of view of drug discovery. The student can critically assess a quality of an experimental protein-small molecule complex structure. He is also able to discuss the process of creating a virtual small molecule library. He can describe the commonly used computational methods for screening of small molecule libraries against a protein target and critically judge the results of the computational screening.

743660S Introduction to immunology

After the course students will be able to identify, analyze and apply essential cellular molecules, components and mechanisms related to immunology, and complete their previous knowledge of molecular and cellular biology and protein chemistry with immunobiochemistry issues.

743661S Virology

Upon successful completion students are able to discuss the major groups of viruses and their infection and replication mechanisms. He can present and discuss characteristic features of specific viruses and their relation to pathogenesis and immunity and to describe diagnostic methods and antiviral therapy.

744617S Orientation to research work

744624S Orientation to biochemical work

After these courses the student has gained experience of practical work done in research groups. Student is able to demonstrate goal-oriented teamwork, to apply methods used in proper environment. The student is able to discuss the practical work done and reflect his knowledge.

744618S Dissertation

Student is able to apply information in the right context, integrate information from a wide range of sources and evaluate it critically. He can communicate science in extensive written format and discuss and defend scientific arguments. The student is also able to demonstrate independent work including self motivation, planning, organizational skills and time management.

747695S Pro gradu thesis in molecular medicine

After the experimental work students is able to undertake scientific research with supervision using typical methods in biochemistry. He is able to plan and perform experiments in laboratory, perform efficient time management, consider his motivation and how to improve that, work independently and as part of a team. The student is able to identify and solve practical problems, record and critically evaluate data. On successful completion of this course, the student is able to retrieve and appraise information critically and integrate information to new entity. He is also able to communicate in science and make and defend scientific arguments.

740672S Maturity test (M.Sc. degree)

Maturity test will be written in context to Pro gradu thesis. In the test student must show a good command of both language skills and their field of Pro gradu thesis. If student's native language is not Finnish or Swedish Faculty of Science will define language in the test.

Ulm:

8810772137 Current concepts in stem cell biology and regenerative medicine

Student is able to describe the most important concepts in stem cell biology and regenerative medicine with respect to basic science as well as potential therapeutic use. Student is able to present, discuss and access current research in the field of stem cell biology and regenerative medicine. Students is also able to discuss current concepts of stem cell biology with respect to ethical aspects.

8810772138 Bioinformatics and systems biology

Student can describe the most important concepts in bioinformatics and systems biology. He is able to apply, discuss and interpret state-of-the-art techniques out the field of bioinformatics and systems biology. The student can also interpret basic mathematical networks and models.

8810772139 New drug discovery, development and evaluation

The student understands the academic aspects of the discovery, development, and evaluation of new drugs (as opposed to understanding of the pharmacology and toxicology of known drugs). He can present and discuss about important new findings and principles in the field. Knowledge in this field prepares the student for the future jobs in and outside of academia.

8810772140 Practical training in laboratory methods and correlative imaging

Student learns basic and advanced laboratory methods to be able to take part in the 4-weeks practical internships of the blocks in the 2nd and 3rd semester, and to be able to work independently on own projects.

The student learns different imaging application methods from molecular to macroscopic level including the theoretical knowledge. After the course the student is able to use the instructed methods.

8810772133 Molecular oncology

After lectures the student has deepened knowledge in the topics of cancer research and oncology and has theoretical skills for the practical part of the course.

In the practical training the student works on a specific project and learns to present the data obtained in a seminar. The student is able to have critical discussions with fellow students based on given problems.

8810772141 GLP/GSP and bioethics

After completion of the course student will have basic knowledge of how to present scientific results in form of a paper. Student will be able to know the basics about presentation formats and scientific publishing. He knows how to prepare tables and figures. He can write scientifically and knows how to organize the different parts of papers. He can efficiently read papers and interpret scientific results. The student learns how to present data and how to scientifically discuss results. He has knowledge of the fundamental issues concerning scientific practice in methodological (working techniques) and historical-systematic point of view; logic of scientific discovery and the practice of research. The student has elementary insight in contents and methods of modern empirical sciences, in scientific techniques dealing with scientific literature. He has critical awareness concerning the possibilities and limitations of scientific practice (ethic of sciences).

Student will also learn the basics in philosophy of science, e.g. scientific truth and facts as well as the norms and values of science. He will have improved analytic abilities and critical thinking, he can understand, analyze and present scholarly texts. The student also has the ability to critically reflect upon and discuss

current biomedical research, including its historical, social, and ethical dimension, test coherence and consistency of ethical arguments. He can apply basic types of ethical reasoning and is able to understand and analyze historical and philosophical articles in scientific journals.

8810772134 Trauma research and regenerative medicine

The student has obtained an overview of pathophysiology of trauma and principals of trauma-care, of pathophysiology of shock and principals of shock management. He understands the role of barrier dysfunction for multiple organ failure and modelling of trauma-shock-sepsis. In practical training student learns to work in a research group on a specific project related to "Trauma Research and Regenerative Medicine". He can present data generated in the 4-weeks practical. Student is also able to present data, which was generated in a critical discussion with fellow students based on given problems.

8810772135 Signaling pathways in stem cells, development and aging

Student is able to describe the most important concepts in stem cell biology, developmental biology and aging processes. He can identify and discuss current methods in developmental biology, stem cell biology, and biology of aging. In practical training student learns to work in a group on a project related to "Signaling pathways in stem cells, development and aging". Student is able to present the data generated in the 4-weeks practical in a seminar.

8810772142 Clinical trials and project management and funding

Clinical Trials:

Student knows the general outline of clinical drug development and to sum up the main steps in planning, conducting, analyzing and reporting clinical trials. He learns the rationale and importance of randomization and blinding as well as distinguishing between different analysis collectives. Furthermore, the student is familiar with the cornerstones of evidence based medicine.

Project Management and Funding:

Student is able to explain different phases of project management, knows the different types of research projects and understands the different levels of complexity in their management. Student can estimate the budget of a research project. Student has an idea of proper communication and conflict management. Student also improves their writing skills and understands the crucial aspects of writing a winning grant proposal.

8810772136 Infectious diseases and immune defense

Students knows the mechanisms of pathogen (bacteria and viruses) and host interactions, e.g. how pathogen are sensed by the immune system and reactions of the immune system, mechanisms of pathogenicity of selected infectious diseases. The student is able to name important human pathogens and their characteristics. He is able to use the knowledge from text books, scientific literature or other sources to develop ideas and hypothesis to answer unsolved questions connected to infectious diseases.

8810780000 Master Thesis and Disputation including Journal Club and Progress Report

Student learns to work on a specific scientific topic, to write a thesis and to defend his data in an oral exam.