

Module Number 2b	Title: High-Throughput Analysis: Genomics and Proteomics		
Module type: compulsory elective	Language: English	Group Size: 5 students	
Study semester: 1	Availability: Each winter semester	Duration: 1 semester	
Workload: 180 hrs	Credits: 6 CP	Contact time: 55 hrs	Independent Study: 125 hrs
1	Courses a) Lecture: 1 PPW b) Practical course: 3 PPW c) Seminar: 1 PPW		
2	Intended Learning Outcomes This module consists of a genomics and a proteomics part. Upon completion of the genomics part, the students will be able to describe the various gene regulation mechanisms on the DNA and RNA level and all necessary analytical tools to analyse genes, genomes, and gene expression. The students will be able to perform basic DNA and RNA analyses and they will be capable to describe and explain genome-wide, high-throughput DNA and RNA analyses in order to detect genomic variations and changes in gene expression. After completion of the proteomics part, the students will be able to describe and to apply state-of-the-art proteomic approach facilitating protein mass spectrometry (MS) and will be capable to describe the function of MS. They will be able to describe and apply data analysis for protein identification and quantification. The students will be able to discuss critically the obtained results and present basic aspects of genomics and proteomics in an oral presentation. Furthermore, they will be able to discuss the advantages and disadvantages of <i>C. elegans</i> as a model for neurodegenerative diseases.		
3	Content The lecture about genomics will cover basic aspects of eukaryotic gene expression and regulation. The theoretical background of PCR, classical Sanger sequencing, DNA microarray analysis, and next generation DNA and RNA Seq analyses will be described. The students will discuss the obtained results in a seminar. The practical course will include: <ul style="list-style-type: none"> - Isolation and purification of DNA and RNA - Quantitative and qualitative nucleic acid measurements - PCR - DNA Sanger sequencing (detection of genetic variations) - DNA microarray / NGS sequencing analyses (changes in gene expression) In the practical course about proteomics the students will perform all steps for protein identification and quantification comprising: <ul style="list-style-type: none"> - Sample preparation (lysis, homogenisation, digestion etc.) - Peptide separation by UPLC - Peptide analysis using LC-ESI-MS/MS - Protein identification using data base searches - Protein quantification In the theoretical part the students will get insight into the set-up and function of mass spectrometers and the analysis of quantitative mass spectrometric data. Furthermore, the students will get insights into a neurotoxic <i>C. elegans</i> model and will learn how to prepare worm samples for downstream analysis.		

4	Teaching methods Combination of lecture, hands-on practical course and seminar
5	Prerequisites Formal: Proficiency in English level B2 of Common European Framework of Reference for Languages (CEFR) With regards to content: Basic knowledge of cell biology and biochemistry and Practical laboratory experience
6	Examination types Oral presentation (20 minutes)
7	Requirements for award of credit points Regular and active participation in the practical course; written summary of the practical course; passing the final examination.
8	Module applicability (in other study courses) Modul 2b is more technically/analytically oriented. The focus is on state of the methods in genome/transcriptome sequencing and protein analysis as well as transcriptomics/proteomics quantitative approaches. Knowledge about these methods are helpful for several other modules dealing with cellular/animal systems and might also be relevant for the pilot projects/master's thesis. Parts of the module can also be used in other programs as currently in Master Molecular Medicine.
9	Assessment The mark given will contribute to the final grade in proper relation to its credits.
10	Module convenor and main lecturers Prof. Dr. Karl Köhrer, Prof. Dr. Kai Stühler, Dr. Gereon Poschmann, Dr. Patrick Petzsch, Prof. Dr. Anna von Mikecz, Thorsten Wachtmeister
11	Further information The regular participation in the lecture is strongly recommended. The content of the lectures is a prerequisite for the practical.