

Module Name Molecular concepts of human diseases (Brachvogel)					
Identification Number	Workload	Credit Points	Term	Offered Every	Duration
MN-BC-BSM02	360 h	12 CP	1 st or 2 nd term	Winter, 1 st half	7 weeks
1	Type of lessons a) Lectures b) Practical/Lab c) Seminar	Contact Times 8 h 140 h 8 h	Self-Study Times 40 h 120 h 44 h	Group Size* max. 10 max. 2 max. 10	
2	Module Objectives and Skills to be Acquired Students who successfully completed this module ... <ul style="list-style-type: none"> • have acquired detailed knowledge on the molecular concepts of diseases related to mutated proteins in e.g. intracellular organelles, immune system, mitochondria or extracellular matrix. • have learned how to use experimental model systems to analyze molecular disease mechanism. • can apply flow cytometry to quantify protein levels on the cell surface and phenotype immune cell populations. • are able to use label-free surface plasmon resonance (SPR) based technology for studying dysfunctional biomolecular interactions in real time. • can analyze altered gene expression profiles by quantitative PCR approaches. • can define mitochondrial dysfunction using bioenergetic measurements • have learned how to present research results in oral and written form and to critically discuss scientific content related to the topic of the module on a professional level. • are able to transfer skills acquired in this module to other fields of biochemistry. 				
3	Module Content <ul style="list-style-type: none"> • Molecular cloning, recombinant protein expression protein purification • Flow cytometry • Analysis of protein-protein interactions • Gene expression analysis (sequencing, array, quantitative PCR) • Oxygen consumption measurements, mutation and copy number analysis of mtDNA (long-range and qPCR) • Fluorescent tagged protein expression and imaging (GFP, HIS) • Experimental gene regulation (siRNA, miRNA) • Bioinformatics analysis of gene interaction networks • Immunofluorescence, laser confocal scanning microscopy • mass spectrometry <p><i>Explanatory note:</i> The exact content for each student will depend on the individual research project.</p>				
4	Teaching Methods Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form				
5	Prerequisites Enrolment in the Master's degree course "Biochemistry and Molecular Medicine" or in the Master's degree course "Biological Sciences"				
6	Type of module examinations The final examination consists of three parts: 20 min oral examination about the practical/lab part (50 % of the total module mark), 10 min oral presentation (25 % of the total module mark) and written report (25 % of the total module mark)				

7	<p>Credits Awarded Regular and active participation; Each examination part at least “sufficient” (see appendix of the examination regulations for details)</p>
8	<p>Compatibility with other Curricula Subject module in the Master’s degree course “Biological Sciences”</p>
9	<p>Proportion of Final Grade 10%</p>
10	<p>Module Coordinator Prof. Dr. Bent Brachvogel, phone 478-6996, e-mail: bent.brachvogel@uni-koeln.de</p>
11	<p>Further Information Biochemical Subject Module of the Master’s degree course “Biochemistry and Molecular Medicine” Literature:</p> <ul style="list-style-type: none"> • Flow cytometry: principles and clinical applications in hematology. Brown M1, Wittwer C. Clin Chem. 2000 Aug;46(8 Pt 2):1221-9. • https://www.ed.ac.uk/files/atoms/files/igmm_flow-cytometry-basics-guide.pdf • Surface plasmon resonance as a high throughput method to evaluate specific and non-specific binding of nanotherapeutics. Schneider CS, Bhargav AG, Perez JG, Wadajkar AS, Winkles JA, Woodworth GF, Kim AJ. J Control Release. 2015 Dec 10;219:331-44. doi: 10.1016/j.jconrel.2015.09.048. Epub 2015 Sep 28 • The real-time polymerase chain reaction. Kubista M1, Andrade JM, Bengtsson M, Forootan A, Jonák J, Lind K, Sindelka R, Sjöback R, Sjögreen B, Strömbom L, Ståhlberg A, Zoric N .Mol Aspects Med. 2006 Apr-Jun;27(2-3):95-125. Epub 2006 Feb 3. • A beginner’s guide to RT-PCR, qPCR and RT-qPCR, Grace Adams, Biochem (Lond) (2020) 42 (3): 48–53. • Beginner’s guide to next-generation sequencing. Louise Aigrain, Biochem (Lond) (2021) 43 (6): 58–64. • Mitochondrial DNA maintenance: an appraisal. Akhmedov AT, Marin-García J. Mol Cell Biochem. 2015 Nov;409(1-2):283-305. doi: 10.1007/s11010-015-2532-x. Epub 2015 Aug 19. • A beginner’s guide to mass spectrometry–based proteomics. Ankit Sinha; Matthias Mann Biochem (Lond) (2020) 42 (5): 64–69. https://doi.org/10.1042/BIO20200057 <p>General time schedule: Week 1-4 (Mon.-Fri.): Lectures, practical/lab; Week 5-6 (Mon.-Fri.): Preparation of the written report and the oral presentation Week 7 (Mon.-Fri.): Preparation for the oral examination</p> <p>Note: The module contains hand-on laboratory work conducted by small groups of students and individually and is taught in course rooms and research laboratories. The module does not contain computer-based practicals/research as a main component.</p>

* 8 students from the Master’s degree course “Biochemistry and Molecular Medicine” and 2 students from the Master’s degree course “Biological Sciences”.