

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, CRISPR/CAS etc.) • Bioinformatics analysis of gene interaction networks • Immunofluorescence, laser confocal scanning microscopy • mass spectrometry • clinical genomics/transcriptomics <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 (Typ BC 7): 20 min oral examination about the practical/lab part (50 % of the total module mark), 20 min seminar talk (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</p> <p>Participating Faculty: Prof. Dr. Mats Paulsson, Prof. Dr. Gerhard Sengle, Prof. Dr. Bent Brachvogel</p> <p>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, Marín-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>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> <p>General time schedule: Week 1-5 (Mon.-Fri.): Lectures, practical/lab; Week 6 (Mon.-Fri.): Preparation of the written report and the oral presentation Week 7 (Mon.-Fri.): Preparation for the oral examination</p> <p>Introduction to the module: 14.10.24, 9:15h Kleiner Seminarraum, 2.OG, CMMC Forschungsgebäude 66, Robert-Koch-Str. 21, 50931 Köln</p> <p>Examination: 1st oral examination: 29.11.24; 2nd oral examination: 23.12.24</p>

* 10 students from the Master's degree course “Biochemistry and Molecular Medicine”