Molecular Medicine – Molecular and Cellular Mechanisms in the Pathogenesis of Human Diseases						
Identification number	Workload	Credit points	Term of studying		Frequency of occurrence	Duration
MN-B-SM (B 2)	360 h	12 CP	1st or 2nd term of studying		Winter term, 1st half	7 weeks
1	Type of lessons		Contact times	Self-study times		Intended group size*
	a) Lectures		8 h	40 h		max. 10
	b) Practical/Lab		140 h	120 h		max. 2
	c) Seminar		8 h	44 h		max. 10
2	Aims of the module and acquired skills Students who successfully completed this module… • can produce and validate therapeutic antibodies. • can apply flow cytometry to quantify protein levels on the cell surface and phenotype immune cell populations. • have learned 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. • are able to study autophagy processes. • can define mitochondrial dysfunction using bioenergetic measurements. • are able to characterize the proteome of patient material. • 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 present research results in oral and written form and to critically discuss scientific publications 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	Contents of the module • Therapeutic antibodies • Flow cytometry • Protein-protein interactions (surface plasmon resonance spectroscopy, ELISA) • Gene expression analysis (quantitative PCR) • Oxygen consumption measurements, mutation and copy number analysis of mtDNA • Autophagy regulation and detection • Intracellular protein fluorescenttagged protein expression and imaging (GFP, HIS) • Immunofluorescence, laser confocal scanning microscopy • High-resolution mass spectrometry *Explanatory note:*The exact content for each student will depend on the individual research project.						
4	Teaching/Learning methods Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form						
5	Requirements for participation Enrollment in the Master´s degree course “Biological Sciences” or in the Master’s degree course “Biochemistry”						

6	Type of module examinations The final examination consists of three parts: 30 min oral examination about the practical/lab part (50 % of the total module mark), oral presentation (25 % of the total module mark) and seminar paper (= protocol, 25 % of the total module mark)
7	Requisites for the allocation of credits Regular and active participation; Passed seminar paper; Each examination part at least "sufficient" (see appendix of the examination regulations for details)
8	Compatibility with other Curricula Biological subject module in the Master´s degree course "Biochemistry"
9	Significance of the module mark for the overall grade In the Master´s degree course "Biological Sciences": 15 % of the overall grade (see also appendix of the examination regulations)
10	Module coordinator Prof. Dr. Bent Brachvogel, phone 478-6996, e-mail: bent.brachvogel@uni-koeln.de
11	Additional information Subject Module of the Master´s degree course "Biological Sciences" Focus of research: (B) Biochemistry, Biotechnology and Biophysics Participating faculty:Prof. Dr. B. Brachvogel, Prof. Dr. S. Höning, Prof. Dr. M. Koch, Prof. Dr. M. Krüger, Prof. Dr. M. Paulsson, PD Dr. M. Plomann, PD Dr. G. Sengle, Prof. Dr. R. Wiesner Literature: • Flow cytometry: principles and clinical applications in hematology. Brown M1, Wittwer C. Clin Chem. 2000 Aug; 46(8 Pt 2):1221-9. • 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. • 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. • Evolution and emergence of therapeutic monoclonal antibodies: what cardiologists need to know.Foltz IN, Karow M, Wasserman SM.Circulation. 2013 Jun 4;127(22):2222-30. General time schedule: Week 1-6 (Mon.-Fri.): Lectures, practical/lab, preparation of the oral presentation and the protocol (= seminar paper); Week 7 (Mon.-Fri.): Preparation for the oral examination 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. Introduction to the module: October 07, 2019 at 10 a.m., Institute for Biochemistry (MTI Complex, Joseph-Stelzmann-Str. 52), lecture room (ground floor, next to the lecture theatre) Oral examination: November 22, 2019, second/supplementary examination February 14, 2020; the latter date may vary. More details will be given at the beginning of the module.

*2 students from the Master´s degree course "Biological Sciences" and 8 students from the Master´s degree course "Biochemistry".