

| Module Name 3D Cryo Electron Microscopy | | | | | | |
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| Identification Number | Workload | Credit Points | Term | Offered Every | Start | Duration |
| MN-BC-BSM07 | 360h | 12 CP | 1 st or 2 nd term of studying | Summer term | Summer term only | 7 weeks |
| 1 | Course Types a) Lecture b) Practical/lab c) Seminar | | Contact Time 24 h 150 h 8 h | Private Study 48 h 106 h 24 h | | Group Size* max. 12 max. 12 max. 12 |
| 2 | Module Objectives and Skills to be Acquired Students who successfully completed this module... <ul style="list-style-type: none"> • have acquired fundamental knowledge about the principles of electron microscopy (EM) as a tool in structural biology, including the physical background of electron optics, and about the computational methods required to reconstruct 3D objects from 2D images. • are able to prepare sample grids for negative-stain EM, operate a transmission electron microscope, assess protein quality by EM, and use computational tools to process EM datasets to determine the 3D structures of proteins. • are familiar with the use of high-performance computing resources for advanced computational tasks, and are able to write simple computer scripts to automate repetitive tasks. • 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 | Module Content <ul style="list-style-type: none"> • Imaging with electrons: theory and practical aspects • Sample preparation for EM: negative-staining and vitrification of biological macromolecules • Data collection using electron microscopes, routine operations on electron microscopes, and strategies for automated data collection and quality assessment • Basic introduction into using high-performance computing resources in structural biology • Reconstruction of 3D structures from 2D EM images using single-particle refinement strategies | | | | | |
| 4 | Teaching Methods Lectures; Practical/Lab; Seminar; Computer exercises; Guidance to independent research; Training on presentation techniques in oral and written form | | | | | |
| 5 | Prerequisites Enrollment in the Master's degree course "Genetics and Biology of Aging and Regeneration", in the Master's degree course "Biochemistry and Molecular Medicine" or in the Master's degree course "Chemistry". | | | | | |
| 6 | Type of Examination M.Sc. Biochemistry and Molecular Medicine (Type BC4): The final examination consists of two parts: 20-30 min oral examination about topics of the lectures and seminar presentations (50% of the total module mark), and written report on the experimental results (50% of the total module mark). | | | | | |
| 7 | Credits Awarded Regular and active participation; completed homework Each examination part at least "sufficient" (see appendix of the examination regulations for details) | | | | | |

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| 8 | <p>Compatibility with other Curricula</p> <p>Biochemical subject module in the master's degree course "Genetics and Biology of Aging and Regeneration" and in the master's degree course "Chemistry"</p> |
| 9 | <p>Proportion of Final Grade</p> <p>10%</p> |
| 10 | <p>Module Coordinator</p> <p>Prof. Dr. Elmar Behrmann, phone 470 76300, e-mail: elmar.behrmann@uni-koeln.de</p> |
| 11 | <p>Further Information</p> <p>Participating faculty: Prof. Dr. E. Behrmann, Dr. M. Gunkel, Dr. S. Pöpsel</p> <p>Literature</p> <ul style="list-style-type: none"> • Frank, J. (2006) Three-Dimensional Electron Microscopy of Macromolecular Assemblies: Visualization of Biological Molecules in Their Native State. Oxford University Press • Jensen, G. Getting Started in Cryo-EM. Online course https://em-learning.com/ • Additional material and subject specific literature will be provided <i>ad hoc</i> via Ilias <p>Note: the module contains hand-on laboratory work conducted by small groups of students and is taught in course rooms and research laboratories. The module also contains computer-based research/practicals as an important component.</p> <p>Location: The course will take place at the Institute of Biochemistry, Zülpicher Str. 47, 50674 Cologne.</p> <p>General time schedule: Week 1-5 (Mon.-Fri.): mixed lectures experimental/computational work 9:00 to 17:00 (Mon: 13:00 to 17:00) including a lunch break five times a week. Exact times can vary according to the laboratory needs; Week 6 (Mon.-Fri.): Preparation and presentation of the seminar talk and the poster, respective of the written report; Week 7 (Mon.-Fri.): Preparation for the oral examination</p> |

* 4 students from the Master's degree course "Genetics and Biology of Ageing and Regeneration", 7 students from Master's degree course "Biochemistry and Molecular Medicine", and 1 from the Master's degree course "Chemistry".