Module name	**Active Matter Hydrodynamics**
Module number	CMS-TRK-AMH
Senior Lecturer	Prof. Dr. Stephan Grill grill@mpi-cbg.de
Qualification objectives	Students have in-depth knowledge of theoretical biological physics. They are familiar with concepts and methods for mathematical description of spatial and temporal dynamics, as well as key modelling concepts of active biological matter. Students can use the theoretical knowledge they have acquired to independently develop mathematical models to describe biological processes.
Contents	The module includes the hydrodynamics of active matter, non-balancing physics and their application to describe selected biological systems, including regulatory parameters, generalised thermodynamic forces and currents, onsager ratios, entropy production, dynamics of active liquids, and the theory of liquid crystals and active gel theory.
Forms of teaching and learning	The module includes lectures of 2 SWS, exercises of 2 SWS and self-study. The language of the lectures and exercises will be English.
Eligibility for participation	Mathematical knowledge such as integral and differential accounting, ordinary and partial differential equations, basic knowledge of statistical physics and basic knowledge of basic polymer models at bachelor's level are required. The following literature is suitable for preparation: 1. Biological Physics. Philip Nelson. Chiliagon Science, 2020, 2. Mechanics of Motor Proteins and the Cytoskeleton. Jonathon Howard. Sinauer, 2005, 3. Soft Condensed Matter Physics in Molecular and Cell Biology. W.C.K. Poon, David Andelman. CRC Press, 2006. 4. Priciples of Condensed Matter Physics. Chaikin, P.M., Lubensky, T.C. Cambridge Univerity Press, 2000, 5. Non-Equilibrium Thermodynamics. S.R. de Groot, P. Mazur. Dover Publications Inc, 1984.

Usability	In the Computational Modeling and Simulation Masters Course, the module is an optional module in the Track Computational Life Science and in the Track Computational Mathematics, to be selected in accordance with Annex 2 to the Specific Examination Regulations. The module cannot be chosen in the Master's Course Computational Modeling and Simulation if this or a module with substantially the same content from a Course with which the entry conditions under § 3 of the Studienordnung have been met has already been completed. The module provides the pre-requisites for the modules it designates under the pre-requisites for participation.
Conditions for the award of credits	Credits are awarded when the module test is passed. The module test consists of a non-public oral test performance as an individual test lasting 30 minutes. The language of the test will be English.
Credits and marks	The module allows 5 credit points to be obtained. The module score corresponds to the test performance score.
Frequency of the module	The module is offered every winter semester.
Workload	The total workload is 150 hours.
Duration of the module	The module covers 1 semester.