Primary Area of Specialization: Statistical and Biological Physics						
Identification number MN-P-SP-StatBio		Workload (540 + 90) h	Credits 21 CP	Term of studying 1st to 3rd semester	Frequency of occurrence Details are provided online in the table "Course Offerings".	Duration 3 semesters
1	Type of lessons a) Lecture b) Problem class c) Advanced Seminar d) Exam	Contact times depending on the individual choice 10 h 1 h	Self-study times depending on the individual choice 80 h 24 h	Intended group size 15–20 Students per problem class individual counseling for the seminar		
2	Aims of the module and acquired skills Bring students to the forefront of current research in statistical and biological physics, application of concepts from physics to biological systems, understanding of complex phenomena emerging from simple systems, learn to construct models and infer model parameters from empirical observations, train interdisciplinary skills and interaction between experiment and theory, train presentation skills in advanced seminars					
3	Contents of the module The module is subdivided into core courses, specialized courses and the advanced seminar: 1. Core courses • Biological Physics I: Molecules and cells (3+1 HPW, 6 CP; or 4+1, 7.5 CP): Introduction to molecular cell biology, random walks in biology, mechanical forces in molecular and cellular biology, rate equations and cellular dynamics, photophysics, electrical signals in nerve cells, biophysical methods • Biological Physics II: Systems (3+1 HPW, 6 CP; or 4+1, 7.5 CP): Dynamical systems, dynamics of small gene regulatory networks, noise in gene expression, statistical analysis of large biological networks, biological pattern formation, reaction-diffusion systems, empirical laws in biology • Evolutionary Biology and Genomics for Physicists (3+1 HPW, 6 CP; or 4+1, 7.5 CP): Basic concepts of evolutionary theory, introduction to molecular evolution and genomics, theory of bio-molecular networks, concepts and methods of data analysis • Selected Topics in Statistical Physics (3+1 HPW, 6 CP; or 4+1, 7.5 CP), including Soft and biological matter, Non-equilibrium statistical physics, Statistical physics of disordered systems, information, and inference as specified annually in the "kommentiertes Vorlesungsverzeichnis" 2. Specialized courses • Computational soft matter physics (2+1 HPW, 4.5 CP) • Experiment and simulation on biological systems (3 HPW, 4.5 CP) • Introduction to network science (2+1 HPW, 4.5 CP) • Probability theory and stochastic processes (3+1 HPW, 6 CP) • Statistical optics (2 HPW, 3 CP) • and others					

	3. Advanced Seminar in Statistical and Biological Physics (2 HPW, 3 CP) The contents of the specialized courses can be found in the “kommentiertes Vorlesungsverzeichnis” and in the lecture descriptions online.
4	Teaching/Learning methods Besides the teaching in lectures, the self-study based on books and lecture notes plays an important role. The students work individually on problem sets. In discussions with others and in the problem classes, they learn to solve challenging problems in a team and to present their approaches and results. By preparing an advanced seminar, they become acquainted with a current topic of research, scientific methods and literature. They also learn to communicate in a pedagogical way on an advanced topic. In the additional lab course the students also gain insight into state-of-the-art instrumentation by conducting experiments independently.
5	Requirements for participation Experimental and theoretical physics at the level of the bachelor courses in physics.
6	Type of module examinations The module examination is by oral exam covering the topics of all attended courses. To be admitted to the exam, students must actively participate in the problem sessions (as defined in the individual courses). The grade given for the module is equal to the grade of the oral examination.
7	Requisites for the allocation of credits The Primary AoS StatBio is composed of: 1. At least two core course (lectures and exercises) 2. Specialized courses (lectures and exercises) 3. Advanced Seminar in Statistical and Biological Physics
8	Compatibility with other Curricula and Soft Skills As elective subject in other M.Sc. programs. Scientific reading and presentation skills, in particular oral presentations. Interdisciplinary approach. This module prepares for topics of current research in statistical and biological physics and provides the basis for the preparation of the master thesis.
9	Significance of the module mark for the overall grade The weight of the module is 21/111 ≈ 18.9 %.
10	Module coordinator B. Maier
11	Additional information Detailed information on the occurrence and the course contents are provided online and in the “kommentiertes Vorlesungsverzeichnis”. Version: 08.03.2019 BM