

Program of Studies:	Master Program Bioinformatics
Name of the module:	Special Lecture Bioinformatics: Single-Cell Bioinformatics
Abbreviation:	BI-BM-1
Subtitle:	-
Modules:	Lecture and tutorial
Semester:	Winter semester
Responsible lecturer:	Jun.-Prof. Dr. Fabian Müller
Lecturer:	Jun.-Prof. Dr. Fabian Müller
Language:	English
Level of the unit/ Mandatory or not:	Graduate course / mandatory elective
Course type/weekly hours:	V4 Ü2
Total workload:	270 h = 56 h of classes, 28 h of tutorials, 186 h private study and assignments
Credits:	9
Entrance requirements:	To enroll, students should have a basic knowledge in Next Generation Sequencing (NGS), modern genomics and epigenomics, sequence analysis, linear algebra and machine learning. They should have basic skills for script-based programming using the R language.
Aims/Competences to be developed:	The course reviews current technologies, laboratory techniques and bioinformatics methods for single-cell analysis. The lecture provides the theoretical background on single-cell *omics. Three programming projects will apply the learned bioinformatics methods to real-world single-cell datasets and will ensure that students have a working knowledge with practical experience on the material.
Content:	<p>Current technologies, laboratory techniques and bioinformatics methods for:</p> <ul style="list-style-type: none"> • Single-cell transcriptomics • Single-cell epigenomics, including chromatin accessibility, DNA methylation and regulatory protein profiling • Spatial transcriptomics • Single-cell DNA sequencing • Single-cell proteomics • Single-cell multiomics • Single-molecule sequencing • Perturbation experiments with single-cell readout • Emerging technologies <p>Bioinformatics focus:</p>

	<ul style="list-style-type: none"> • Processing of single-cell sequencing data • Data quality control • Exploratory data analysis • Differential data analysis • Single-cell trajectory inference • Data integration (multi-dataset and multi-omics) • Inference of gene-regulation and gene regulatory networks
Assessment/Exams:	Final exam: written or oral, depending on participant numbers Participants need to score 50% on the three programming assignments to be admitted to the exam. The final grade will be based on the exam
Literature:	Lecture slides, current research papers on single-cell technology and bioinformatics methods