Please note that this English version of the study and examination regulations is nothing more than an aid to orientation. Solely the German version is legally binding.

Study Regulations for the Master's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics at the Free University of Berlin and the Faculty of Charité University Medicine Berlin

Preamble

On the basis of § 14 Par. 1 No. 2 of the Partial Basic Regulations (Trial Model) of the Free University of Berlin of 27 October 1998 (FU Announcements No. 24/1998) and § 9 Par. 1 No. 1 of the Berlin University Medicine Law of 5 December 2005 (GVBl. [Law and Ordinance Gazette] p. 739) in conjunction with § 74 of the Berlin Higher Education Act in the version of 26 July 2011 (GVBl. p. 378), the Joint Commission on Bioinformatics established by the Faculty of Mathematics and Informatics of the Free University of Berlin, the Faculty of Biology, Chemistry and Pharmaceutics of the Free University of Berlin and the Faculty of Charité University Medicine Berlin (Charité) issued, on 6 June 2012, the following Study Regulations for the Master's Program in Bioinformatics:[1]

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[1] The Senate Administration responsible for higher education took cognizance of the Study Regulations on 9 August 2012. The term of validity for the regulations ends on 30 September 2013.

§ 1 Scope of application

(1) These regulations stipulate the objective, contents and structure of the Master's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics of the Free University of Berlin and Faculty of Charité University Medicine Berlin (Master's Program) based on the Examination Regulations for the Master's Program of 6 June 2012. The Joint Commission on Bioinformatics established by the Faculty of Mathematics and Informatics of the Free University of Berlin, the Faculty of Biology, Chemistry and Pharmaceutics of the Free University of Berlin and the Faculty of Charité are responsible for the organization of teaching and studies.

(2) This is a consecutive master's program acc. to § 23 Par. 3 No. 1 a) BerlHG (Berlin Higher Education Act).

§ 2 Qualification objectives

(1) Graduates have mastered the essential aspects of modern bioinformatics as well as the relevant principles of mathematics, informatics (computer science) and biomedical science. They are capable of independent analysis of problems in bioinformatics, comparison of different approach methodologies and assessment of the advantages and drawbacks of these methodologies. Graduates are capable of selecting a fitting approach from among different possibilities, working out a solution independently and representing the results within an interdisciplinary context. They are capable of independent research and development in the field of bioinformatics.

(2) In addition to their specialist qualification, graduates possess teamwork, communication and transference skills and are familiar with gender and diversity aspects.

(3) Graduates have been prepared for qualified leadership functions in various fields of activity. These include for example the fields of pharmaceutics, medicine, bioengineering and corresponding facilities and bodies in industry, research and administration. A further academic qualification can be acquired within the framework of a doctorate.

§ 3 Study contents

(1) The Master's Program is a direct response to an ongoing paradigm shift in medicine and the biological sciences. Further research in these fields will in future be based to an increasing degree on evaluation of biological mass data. Use of computers, in combination with accurate mathematical models and efficient algorithms will be indispensable for this work. With in-depth education in the corresponding branches of mathematics, informatics, biology and medicine, the course of studies imparts the skills needed to recognize the relevant biological problems, develop appropriate mathematical or informatic solutions and arrive at correct interpretations of the results within the biological context.

(2) The students are familiarized with the content and methods of fields of study related to ongoing research. In addition to specialist competence in bioinformatics, they acquire interdisciplinary competence and key qualifications with a view to future research work or managerial functions.

§ 4 Structure and outline

(1) The Master's Program, encompassing 120 credit points (CP) is comprised of a mandatory part comprising 40 CP, an elective part comprising 50 CP and the Master's Thesis with presentation of results comprising 30 CP.

(2) The mandatory part comprising 40 CP includes the following modules:

1. Algorithms (6 CP)
2. Genomics (6 CP)
3. Numerics (6 CP)
4. Optimization (6 CP)
5. Statistics (6 CP)
6. Research internship (10 CP)

(3) The elective part comprising 50 CP is divided between core modules and practical modules as follows:

1. The following core modules are offered, two of which must be selected and completed:
    1. Biodiversity and Evolution (10 CP)
    2. Medical Bioinformatics (10 CP)
    3. Network Analysis (10 CP)
    4. Physiology (10 CP)
    5. Sequence Analysis (10 CP)
    6. Structural Bioinformatics (10 CP)

2. The following practical modules are offered, two of which must be selected and completed:
    1. Current Cytophysiological Problems (5 CP)
    2. Applied Sequence Analysis (5 CP)
    3. Measurement and Analysis of Physiological Processes (5 CP)
    4. Computer-Based Systems Biology (5 CP)
    5. Environmental Metagenomics (5 CP)
    6. Current Problems from Medical Genomics (5 CP)
    7. Current Problems from Structural Bioinformatics (5 CP)

3. The following research modules are offered, one of which must be selected and completed:
    1. Research Module A (20 CP)
    2. Research Module B (20 CP)

The modules of the elective part are offered in variable sequence. At least three core modules are offered in each summer semester along with, at the same time or in the winter semester, at least three practical modules. The research modules are offered in each semester.

(4) The module descriptions in Annex 1 provide information on content, qualification objectives, forms of teaching and learning, time requirements, forms of active participation, normal duration and frequency of offering for each module.

(5) The examples of courses of study in Annex 2 course provide information on the recommended study sequence.

§ 5 Forms of teaching and learning

The Master's Program offers the following forms of teaching and learning:

1. The contents of each course are presented and explained by the instructor in lectures. The instructors impart teaching content accompanied by references to specialist literature and encourage students to work independently and think critically.

2. Exercises in small workgroups normally accompany the lectures. In the workgroups, the lecture contents are repeated in outline and practical application of the materials learned is realized based on assigned exercises.

3. Seminars serve the purpose of exemplary familiarization with contents, theories and methods

of areas of specialization within bioinformatics based on clearly defined thematic areas. In the seminars, students formulate, present and discuss teaching content under the guidance of an instructor and based on specialist literature and empirical knowledge.

4. In practical seminars, students work under supervision, alone or in small groups, on substantial practical or scientific problems. The focus of project work is on the process of finding a solution, that is practical application of suitable techniques and processes in application of scientific knowledge and methods. Interdisciplinary qualifications such as teamwork, communication and transference skills are acquired and responsible and gender-sensitive procedures are practiced.

§ 6 Studies abroad

(1) it is recommended that students participate in studies abroad. Within the framework of study abroad, study and examination performances (credit points) are acquired that count towards this course of studies.

(2) Study abroad be preceded by conclusion of an agreement between the student, the Chairman of the Examination Committee and the competent office of the relevant foreign scientific institution regarding the duration of the period of studies abroad, the scope of performances expected during the studies abroad, which are to be equivalent to the performance items in the Master's Program, and the credit points to be assigned to these performance items. Performance items completed as per the agreement are then credited accordingly.

(3) The second or third advanced semester in the Master's Programs is recommended as a suitable time for a period of study abroad.

§ 7 Entry into force and transitional regulation

(1) These regulations come into form on the day following their publication in the Official Gazette of the Free University of Berlin (FU Announcements) and in the Gazette of the Faculty of Charité - University Medicine Berlin (Charité).

(2) At the same time, the Study Regulations for the Master's Program of 20 June 2007 (FU Announcements No. 53/2007, p. 1182) become invalid.

(3) These regulations apply to students who matriculate following their entry into force for the Master's Program at the Free University of Berlin. Students who matriculated for the Master's Program at the Free University of Berlin before entry into force of these regulations continue their course of studies based on the Study Regulations for the Master's Program as per Par. 2 unless they apply to the Examination Committee to continue based on the present regulations. In the latter case, on the occasion of the transcription resulting from said application, the Examination Committee shall make a decision regarding the scope of modules begun or completed when the application was made or regarding crediting of these performance items within the framework of these regulations, whereby the principles of legitimate expectation and equal opportunity are respected. The transcription cannot be revised.

(4) The opportunity to complete the course of studies according to the Study Regulations as per Par. 2 is to be upheld until the end of the 2014 summer semester.

Annex 1: Module descriptions

Explanations:

The following module descriptions designate the following each Master's Program module:

- Designation of module
- Content and qualification objectives of module
- Teaching and learning forms of module
- Estimated student effort requirement to complete the module
- Forms of active participation
- Normal duration of module

The information on time requirements refer in particular to

- Active participation in on-campus study period
- Time required for completion of minor tasks related to on-campus study period
- Time for independent preparation and follow-up
- Processing of study units in online study phases
- Preparation time immediately prior to examinations
- Examination time.

The information on time requirements for self-study (including preparation and follow-up, examination preparations, etc.) are guideline values to help students organize the time required for module-related work.

The information on work effort requirements corresponds to the number of credit points assigned to each module as the unit of measure for student work effort as an approximation of the work required to complete the module successfully.

Active participation, as well as regular participation in the teaching and learning forms and successful completion of the examination requirements of each module, are the preconditions for acquiring the credit points assigned to each module. In modules with no module examination, active participation as well as regular participation in the teaching and learning forms are the preconditions for acquiring the credit points assigned to each module

Annex 1 to the Study Regulations of the Master's Program lists the number of credit points and other examination-related information for each module.

1. Mandatory part

Module: Algorithms			
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Informatics			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have acquired a deeper understanding of mathematical concepts and methods in advanced algorithmics against the background of current bioinformatic research. They have been familiarized with advanced tools for development and analysis of deterministic and randomized algorithms. They are capable of independent recognition of the concepts and and apply the analytical methods independently to solve related problems.			
Contents: Introduction of various types of algorithms and analytical methods, advanced graphic algorithms, analysis of randomized data structures and algorithms as well as hashing algorithms			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Preparation and follow-up 60
Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 40 Examination preparation and examination 20
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise: yes	
Total working time requirement		180 hours	6 CP
Duration of module		one semester	
Frequency of course offering		each winter semester	
Applicability		Master's Program Bioinformatics	

Module: Genomics			
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have acquired a deeper understanding of basic mathematical concepts in the field of genomic sequence analyses against the background of current bioinformatic and bioengineering research. They are able to recognize which data structures and algorithms are adequate in specific cases and to apply this knowledge independently to similar situations.			
Contents: Themes from the following areas are considered in depth: - Paradigms for approximative, semiglobal alignments (read mapping) - Methods of genome assembly and metagenome assembly - Methods of determining genetic variations (SNVs, SNPs, CNVs) - Algorithmic quantification using NGS data			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	Taking tests	On-campus lecture 30 Preparation and follow-up 50
Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 50 Examination preparation and examination 20
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise: yes	
Total working time requirement		180 hours	6 CP
Duration of module		one semester	
Frequency of course offering		each winter semester	
Applicability		Master's Program Bioinformatics	

Module: Numerics			
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have acquired a deeper understanding of advanced mathematical concepts and methods in the field of numerical solutions of differential equations against the background of current research in bioinformatics and system biology. Students are able to select problem-specific numerical methods, apply them in practice and assess the quality of the results.			
Contents: Modeling methods; chemical reaction kinetics, stiff initial value problems in normal differential equations (asymptotic behavior of solutions, stability, test equations), differential-algebraic equations (basic terminology, index) and parametric identification			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Preparation and follow-up 60
Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 40 Examination preparation and examination 20
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise: yes	
Total working time requirement		180 hours	6 CP
Duration of module		one semester	
Frequency of course offering		each winter semester	
Applicability		Master's Program Bioinformatics	

Module: Optimization			
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have acquired a deeper understanding of advanced mathematical concepts and methods in discrete mathematics and applied optimization methods. The are able to develop discrete mathematical models for problems in the fields of bioinformatics and system biology, to use suitable algorithms to solve them and to analyze the results.			
Contents: Linear programming, simplex algorithm, duality, integer linear programming, branch-and-bound, cut levels, branch-and-cut, constraint programming, local search and metaheuristics			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Preparation and follow-up 60
Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 40 Examination preparation and examination 20
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise: yes	
Total working time requirement		180 hours	6 CP
Duration of module		one semester	
Frequency of course offering		each winter semester	
Applicability		Master's Program Bioinformatics	

Module: Statistics				
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students have acquired a deeper understanding of advanced mathematical concepts and methods in the field of statistical analysis against the background of current research in bioinformatics and system biology. They are familiar with statistical approaches, in particular the theoretical background of MCMC (Markov chain Monte Carlo) methods and can apply them.				
Contents: Introduction to Markov chain theory, important MCMC methods (Gibbs Sampler, Metropolis Hastings algorithm, Barker algorithm), introduction to the EM algorithm, theory and application of false discovery rate				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2	-	On-campus lecture Preparation and follow-up	30 60
Exercise	2	Work on assigned exercises	On-campus exercise Work on assigned exercises Examination preparation and examination	30 40 20
Course language		English or German		
Mandatory regular participation		Lecture: Participation recommended, exercise: yes		
Total working time requirement		180 hours		6 CP
Duration of module		one semester		
Frequency of course offering		each winter semester		
Applicability		Master's Program Bioinformatics		

Module: Research internship				
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students have gained practical research experience in the area of bioinformatics or in adjacent fields and can apply the learning contents of the course of studies in research practice. They have experience in project coordination and implementation and have teamwork skills.				
Contents: Current research themes in bioinformatics.				
Forms of teaching and learning	**On-campus studies** (hours)	**Forms of active participation**	**Work effort** (hours)	
Internship	270	Internship report and final presentation	Implementation of internship Preparation and follow-up	270 30
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		300 hours		10 CP
Duration of module		one semester		
Frequency of course offering		each semester		
Applicability		Master's Program Bioinformatics		

2. Elective part

a) Core Modules

Module: Biodiversity and evolution			
University/Faculty/Institute: Free University of Berlin/ Biology, Chemistry, Pharmaceutics/ Biology			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have an overview of use of next-generation sequencing (NGS) in modern biodiversity research. They are familiar with the processes of gene and genome evolution and the basic principles of analysis of metagenomes and metatranscriptomes the their practical applications. The students know which informatics methods are used in current biodiversity research and can assess which methods to use for which applications in these fields.			
Contents: - Genome evolution , *tree of life*, evolution of populations - Evolution models, phylogenetics, *coalescent* theory - Current applications of NGS in biodiversity research (e.g. SNPs, epigenetics, marker genes, *ancient* DNA, DNA taxonomy) - Metagenomics: Structure and function of natural communities			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Lecture preparation and follow-up 45
Exercise	1	Work on assigned exercises	On-campus exercise 15 Exercise preparation and follow-up 60
Seminar	2	Seminar presentation	On-campus seminar 30 Seminar preparation and follow-up 60 Examination preparation and examination 60
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	
Total working time requirement		300 hours	10 CP
Duration of module		one semester	
Frequency of course offering		irregular	
Applicability		Master's Program Bioinformatics	

Module: Medical bioinformatics			
University/Faculty/Institute: Free University of Berlin and Faculty of Charité - University Medicine Berlin			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have acquired a deeper understanding of basic concepts in the field of medical bioinformatics and genomics against the background of current bioinformatic and bioengineering research. They grasp the various problems and objectives of biomedical genome analysis. They know which results can be derived from which clinical data and are capable of adequately assessing computer-based predictions in the clinical and scientific context.			
Contents: Themes from the following areas are considered in depth: - Coupling imbalance (LD), coupling analysis, association analyses - Ontologies, semantic analysis, integrative analysis of biomedical data - Analysis of medically relevant high-throughput sequencing data - Exome and genome sequencing, interpretation and assessment of sequence variants. Analysis of RNA expression data and epigenomic data in a biomedical context			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	Taking tests	On-campus lecture 30 Lecture preparation and follow-up 70

Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 30 On-campus seminar Seminar preparation and follow-up 30 80 Examination preparation and Examination 30
Seminar	2	Seminar presentation	
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	
Total working time requirement		300 hours	10 CP
Duration of module		one semester	
Frequency of course offering		irregular	
Applicability		Master's Program Bioinformatics	

Module: Network analysis			
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students have acquired a deeper understanding of basic mathematical and algorithmic concepts in the field of modeling, simulation and analysis of molecular networks against the background of current system biology and bioengineering research. Students are familiar with the basic methods of modeling molecular networks. They are capable of analyzing a given biological or medical problem, selecting a suitable modeling approach, independently developing a solution and assessment and communication of the results.			
Contents: Themes from the following areas are considered in depth: - Modeling of biochemical networks with normal differential equations - Discrete modeling of regulatory networks - Constraint-based modeling - Stochastic and hybrid modeling			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	Taking tests	On-campus lecture 30 Lecture preparation and follow-up 70 On-campus exercise 30 Work on assigned exercises 30 On-campus seminar Seminar preparation and follow-up 30 80 Examination preparation and examination 30
Exercise	2	Work on assigned exercises	
Seminar	2	Seminar presentation	
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	
Total working time requirement		300 hours	10 CP
Duration of module		one semester	
Frequency of course offering		irregular	
Applicability		Master's Program Bioinformatics	

Module: Physiology
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin
Persons responsible for module: Module Instructors
Admission requirements: none
Qualification objectives: Students are capable of essentially independent scientific work on the current research themes at Charité in the fields of physiology and system biology. They are capable of properly implementing physiological and biological experiments in these areas in a technically qualified manner and interpreting and evaluating the results. Students are capable of applying, comparing, modifying and adequately evaluating different methods and models for

recording and analysis of physiological signals. The can present their results, and discussions of their results, in an appropriate form.

Contents: Themes from the following areas are considered in depth:
- Biomedical and key technologies in physiology and pathophysiology: Theoretical and practical knowledge Central methods are developed and applied to problems in physiology and pathophysiology.
- Analysis of biological adaptation processes: The significance of molecular mechanisms of biological adaptation is analyzed experimentally with the help of mathematical simulation methods.
- Biometrics and analysis of physiological signals: Complex physiological signals are recorded, analyzed using linear, non-linear and non-stationary methods, then interpreted and evaluated as to biological significance.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Lecture preparation and follow-up 60
Exercise	2	Work on exercise and internship assignments	On-campus exercise 30 Work on assigned exercises 60
Seminar	2	Seminar presentation	On-campus seminar Seminar preparation and follow-up 30 60 Examination preparation and examination 30
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	
Total working time requirement		300 hours	10 CP
Duration of module		one semester	
Frequency of course offering		irregular	
Applicability		Master's Program Bioinformatics	

Module: Sequence analysis

University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Informatics

Persons responsible for module: Module Instructors

Admission requirements: none

Qualification objectives: Students have acquired a deeper understanding of basic algorithmic concepts in the field of genomic sequences against the background of current bioinformatic and bioengineering research. They grasp various paradigms for approximative searches, they known when certain algorithms are to be preferred and are capable of assessing scientific publications in the field accordingly.

Contents: Themes from the following areas are considered in depth:
- Paradigms for approximative, semiglobal alignments (read mapping)
- Methods of genome assembly and metagenome assembly
- Methods of determining genetic variations (SNVs, SNPs, CNVs)
- Algorithmic quantification using NGS data

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	Taking tests	On-campus lecture 30 Lecture preparation and follow-up 70
Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 30
Seminar	2	Seminar presentation	On-campus seminar Seminar preparation and follow-up 30 80 Examination preparation and examination 30
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	

Total working time requirement	300 hours	10 CP
Duration of module	one semester	
Frequency of course offering	irregular	
Applicability	Master's Program Bioinformatics	

Module: Structural bioinformatics			
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students are familiar with the current, research-relevant algorithms for analysis of biological structures. They are capable of assessing the strengths and weaknesses of different approaches and can discern which algorithms are adequate for handling specific analytical problems.			
Contents: Themes from the following areas are considered in depth: - Structure, function and dynamics of proteins - Algorithms of molecular similarity and their application - Methods for calculation of (multiple) local and global structural alignments - Docking of organic microstructures to proteins as well as protein-protein docking			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Preparation and follow-up 70
Exercise	2	Work on assigned exercises	On-campus exercise 30 Work on assigned exercises 30
Seminar	2	Seminar presentation	On-campus seminar Preparation and follow-up 30 80 Examination preparation and examination 30
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	
Total working time requirement		300 hours	10 CP
Duration of module		two semesters	
Frequency of course offering		irregular	
Applicability		Master's Program Bioinformatics	

b) Practical Modules

Module: Current cytophysiological problems			
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students are familiar with different electrophysiological, molecular biological and optical measuring methods and can apply them to solve a physiological problem from current research. They are capable of evaluating the results and comparing and evaluating them using computer models they develop. Students are capable of weighing advantages and limitations of different methods against one another and arriving at a critical assessment of the transferability of the computer models used to cellular systems.			
Contents: Starting with a cytophysiological problem, experimental approaches to solving it are developed, using e.g. computer models. The following techniques may be used in the experimental segment: - Impedance spectroscopy - Polymerase chain reaction (PCR) - Sequencing - Transformation - Transfection - Western Blot - Confocal laser scanning microscopy			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)

Practical seminar	4	Work on assigned tasks Presentation of results	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		150 hours		5 CP
Duration of module		one semester		
Frequency of course offering		each semester		
Applicability		Master's Program Bioinformatics		

Module: Applied sequence analysis				
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Informatics				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students can use standard sequence analysis programs independently. The are familiar with the different concepts and can operate and program selected systems. Students can design new workflows and present the results in graphic form.				
Contents: Themes from the following areas are considered in depth: - Implementations of distributed computing - Integration of standard programs in workflows - Generation and use of bioinformatics workflows in existing systems				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Practical seminar	4	Work on assigned tasks, Presentation of results	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		150 hours		5 CP
Duration of module		one semester		
Frequency of course offering		each summer semester		
Applicability		Master's Program Bioinformatics		

Module: Measurement and analysis of physiological processes			
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students are familiar with different electrophysiological, biometric, mechanical and optical measuring methods and problems of telemetric and non-invasive data collection in field and laboratory. They are also familiar with methods of signal processing and can use them to analyze physiological processes. Students are capable of carrying out physiological and biological experiments from the above-mentioned thematic areas in a qualified manner and of evaluating the results. They can properly select, apply and assess analytical methods for time and frequency, as well as in-depth biostatistical methods, to address different questions and problems.			
Contents: Themes from the following areas are considered in depth: - Biosignals and sources of interference - Analysis of time and frequency - Variance analyses, linear and non-linear (multiple) regression analyses, artificial neuronal networks - Body composition (impedance spectroscopy, whole body plethysmography and whole body scanning, stereophotogrammetry) - Sleep and circadian rhythms - Variability of cardiac frequency and blood pressure under physical and mental stress - Electrooculography and electroencephalography			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)

Practical seminar	4	Work on assigned tasks Presentation of results	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		150 hours		5 CP
Duration of module		one semester		
Frequency of course offering		each winter semester		
Applicability		Master's Program Bioinformatics		

Module: Computer-based system biology				
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students have practical experience in modeling and analysis of molecular networks. They are familiar with different methods and software tools for network analysis and can apply them to concrete problems in system biology,interpret the results and communicate them in an interdisciplinary context.				
Contents: Themes from the following areas are considered in depth: - Simulation of biochemical reaction networks - Structure and dynamics of regulatory networks - Metabolic engineering				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Practical seminar	4	Work on assigned tasks, presentation of results	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		150 hours		5 CP
Duration of module		one semester		
Frequency of course offering		each summer semester		
Applicability		Master's Program Bioinformatics		

Module: Environmental metagenomics				
University/Faculty/Institute: Free University of Berlin/ Biology, Chemistry, Pharmaceutics/ Biology				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students can generate and analyze a metagenome. They know how to take and store samples. They can prepare the samples for analysis independently and interpret the data obtained.				
Contents: Themes from the following areas are considered: - Environmental sampling (e.g. lake) - Lab processing of samples (e.g. DNA extraction, sequencing) - Analysis of metagenomic data				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Practical seminar	4	Sampling, lab work, data analysis	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		

Mandatory regular participation	yes	
Total working time requirement	150 hours	5 CP
Duration of module	one semester	
Frequency of course offering	each summer semester	
Applicability	Master's Program Bioinformatics	

Module: Current problems in medical genomics				
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students are familiar with different informatic and statistical methods in the field of medical genomics and can apply them to solve a problem in integrative genomics from current research. They are capable of evaluating the results and comparing and evaluating them using computer models and scripts they develop. Students can compare and assess the advantages and limitations of different methods and provide a critical estimation of the relevance of the results generated by the computer programs to an understanding of biological systems in a medical context.				
Contents: Based on a genomic problem, informatic approaches to a solution are formulated using computer programs and scripts developed by the students to address research questions from current literature or derivative questions. The objective is to learn how integrative data analysis can be used to understand high-throughput data. Students are to derive themes from current literature and develop scripts / programs to test and expand on partial aspects.				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Practical seminar	4	Work on assigned tasks Presentation of results	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		150 hours		5 CP
Duration of module		one semester		
Frequency of course offering		once per academic year		
Applicability		Master's Program Bioinformatics		

Module: Current Problems from Structural Bioinformatics				
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students have gained practical experience in application of current algorithms for analysis of biological structures. They recognize the strengths and drawbacks of different approaches and apply suitable algorithms to given analytical problems independently.				
Contents: Themes from the following areas are considered in depth: - Homology modeling of proteins - In silico screening with subsequent substance evaluation and filtering (ADMETox) - 3D superpositions, 3D QSAR, pharmacophore searches - Use of GOLD and Accelrys in structure-based ligand design				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Practical seminar	4	Work on assigned tasks Presentation of results	On-campus time Preparation and follow-up Examination preparation and examination	60 70 20
Course language		English or German		
Mandatory regular participation		yes		
Total working time requirement		150 hours		5 CP

Duration of module	one semester
Frequency of course offering	once per academic year
Applicability	Master's Program Bioinformatics

c) Research Modules

Module: Research Module A			
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students are familiar with current themes and research issues in bioinformatics and have mastered the relevant analytical techniques. They are prepared for future work as independent researchers. In supervised work on a project paper, they define common themes from their courses, then formulate and delimit the shared factors. They are capable of interrelating different concepts and methods of bioinformatics and drawing evaluative comparisons between them.			
Contents: Current research themes in bioinformatics			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lectures 60 Lecture preparation and follow-up 120
Lecture	2		
Exercise	1	Work on assigned exercises, seminar presentation, project paper	On-campus exercises 30 Work on assigned exercises 90
Exercise	1		On-campus seminar Seminar preparation and follow-up 30 120
Seminar	2		Project paper 150
Course language		English or German	
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes	
Total working time requirement		600 hours	20 CP
Duration of module		one or two semesters	
Frequency of course offering		each semester	
Applicability		Master's Program Bioinformatics	

Module: Research Module B			
University/Faculty/Institute: Free University of Berlin/ Mathematics and Informatics/ Mathematics			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students are familiar with current themes and research issues in bioinformatics and have mastered the relevant analytical techniques. They are prepared for future work as independent researchers. In supervised work on a project paper, they define common themes from their courses, then formulate and delimit the shared factors. They are capable of interrelating different concepts and methods of bioinformatics and drawing evaluative comparisons between them.			
Contents: Current research themes in bioinformatics.			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2	-	On-campus lecture 30 Lecture preparation and follow-up 60
Exercise	1	Work on assigned exercises Seminar presentations Project paper	On-campus exercise 15 Work on assigned exercises 45
Seminar	2		On-campus seminars Seminar preparation and follow-up 60 240
Seminar	2		

			Project paper	150
Course language		English or German		
Mandatory regular participation		Lecture: Participation recommended, exercise and seminar: yes		
Total working time requirement		600 hours		20 CP
Duration of module		one or two semesters		
Frequency of course offering		each semester		
Applicability		Master's Program Bioinformatics		

Annex 2: Examples of courses of study:

- Example with Research Module A:

Semester					
1. 30 CP	Algorithms 6 CP	Genomics 6 CP	Numerics 6 CP	Optimization 6 CP	Statistics 6 CP
2. 30 CP	Core Module 1 (e.g. sequence analysis) 10 CP	Core Module 2 (e.g. medical bioinformatics) 10 CP	Practical Module 1 (e.g. applied sequence analysis) 5 CP	Practical Module 2 (e.g. environmental metagenomics) 5 CP	
3. 30 CP	Research internship 10 CP	Research Module A 20 CP			
4. 30 CP	Master's Thesis including presentation 30 CP				

- Example with Research Module B:

<table>
<tr><td>Semester</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1.
30 CP</td><td>Algorithms
6 CP</td><td>Genomics
6 CP</td><td>Numerics
6 CP</td><td>Optimization
6 CP</td><td>Statistics
6 CP</td></tr>
<tr><td>2.
30 CP</td><td>Core Module 1
(e.g. sequence analysis)
10 CP</td><td>Core Module 2
(e.g. Physiology)
10 CP</td><td rowspan="2">Research Module B
20 CP</td><td>Practical Module 1
(e.g. applied sequence analysis)
5 CP</td><td></td></tr>
<tr><td>3.
30 CP</td><td>Research internship
10 CP</td><td>Practical Module 2
(e.g. Measurement and analysis of physiological processes)
5 CP</td><td></td><td></td></tr>
<tr><td>4.
30 CP</td><td colspan="5">Master's Thesis including presentation 30 CP</td></tr>
</table>

Examination Regulations for the Master's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics at the Free University of Berlin and the Faculty of Charité University Medicine Berlin

Preamble

On the basis of § 14 Par. 1 No. 2 of the Partial Basic Regulations (Trial Model) of the Free University of Berlin of 27 October 1998 (FU Announcements No. 24/1998) and § 9 Par. 1 No. 1 of the Berlin University Medicine Law of 5 December 2005 (GVBl. [Law and Ordinance Gazette] p. 739) in conjunction with § 74 of the Berlin Higher Education Act in the version of 26 July 2011 (GVBl. p. 378), the Joint Commission on Bioinformatics established by the Faculty of Mathematics and Informatics of the Free University of Berlin, the Faculty of Biology, Chemistry and Pharmaceutics of the Free University of Berlin and the Faculty of Charité University Medicine Berlin (Charité) issued, on 6 June 2012, the following Examination Regulations for the Master's Program in Bioinformatics:[*]

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Annexes

[*] The Senate Administration responsible for higher education confirmed the Examination Regulations on 9 August 2012. The term of validity for the regulations ends on 30 September 2013.

§ 1 Scope of application

These Examination Regulations regulate, in supplementation of the Statute on General Matters Regarding Examinations of the Free University of Berlin (SfAP), requirements and procedures for performance of study work in the Master's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics of the Free University of Berlin and the Faculty of Charité – University Medicine Berlin (Master's Program).

§ 2
Examination Committee

The Examination Committee established by the Joint Commission on Bioinformatics for the Master's Program is responsible for organization of the examinations and other tasks listed in the SfAP.

§ 3
Standard study period

The standard study period is four semesters.

§ 4 Scope of performance

(1) A total of 120 credit points (CP) must be earned, including

(a) 40 CP in the mandatory part as per § 4 Par. 2 Study Regulations,

(b) 50 CP in the elective part as per § 4 Par. 3 Study Regulations,

(c) 30 CP for die Master's Thesis as per § 5 of these regulations.

(2) Annex 1 provides information on the examination work required parallel to the individual modules, obligations regarding regular participation in the forms of teaching and learning and the credit points accorded to the individual modules.

(3) Students may choose to do examination work in either German or English.

§ 5
Master's Thesis

(1) The purpose of the Master's Thesis is to demonstrate that the student is capable of working independently on a task of an advanced nature from the field of bioinformatics and presenting and assessing the results obtained from this work competently in written and oral form.

(2) Students are admitted to work on a Master's Thesis upon application if they

1. were most recently matriculated in the Master's Program of the Free University of Berlin and

2. have successfully completed modules as per § 4 of these regulations in conjunction with § 4 Study Regulations amounting to at least 60 CP.

(3) The application for admission to the Master's Thesis must be accompanied by proof of fulfillment of the conditions as per Par. 2 as well as confirmation by an instructor entitled to administer examinations of intent to supervise the Master's Thesis. The Examination Committee issues a decision on whether the application is accepted. If no confirmation of intent to supervise the Master's Thesis as per Phrase 1 is submitted, the Examination Committee will appoint a supervisor accordingly. Students are given the opportunity to

propose thesis themes, which may or may not be accepted.

(4) The Master's Thesis, including footnotes, and references, is to be up to 80 pages long with a maximum word count of 24,000.

(5) The Examination Committee assigns the theme of the Master's Thesis in consultation with the supervisor. The theme and set tasks must be of such a nature that the work can be completed within the assigned period. The assignment and submission of the Master's Thesis are to be recorded and the information kept on file. When the thesis is submitted, the student must affirm in writing that he or she has written the paper independently, using only the sources and aids listed. A copy of the Master's Thesis may be retained for the Institute Library with the permission of the student upon graduation.

(6) The assigned period for the thesis work is 23 weeks. The assigned period begins on the date on which the theme is assigned by the Examination Committee. The theme can be returned once within the first three weeks and is then considered unassigned. The Examination Committee makes a decision on the application in consultation with the supervisor of the Master's Thesis.

(7) The Master's Thesis must be evaluated by two instructors entitled to administer examinations as assigned by the Examination Committee. One of the two entitled instructors should be the supervisor of the Master's Thesis. At least one of the two entitled instructors must be an active instructor in the Master's Program and also a University Instructor on the Faculty of Mathematics and Informatics of the Free University of Berlin, on the Faculty of Biology, Chemistry, Pharmaceutics of the Free University of Berlin or on the Faculty of Charité - University Medicine Berlin.

(8) If approved by the Examination Committee, the work on the Master's Thesis can also be done externally in a suitable operation or scientific facility as long as scientific supervision by an examiner is ensured.

(9) The results of the Master's Thesis are presented and discussed in an oral presentation. The oral presentation lasts about 15 minutes and is followed by a discussion period that lasts about 15 minutes and is not graded. The oral presentation is mandatory and follows submission of the Master's Thesis.

(10) If the Master's Thesis does not receive a grade of at least "sufficient" (4.0), it may be repeated once.

§ 6
Master's Thesis, special procedure

(1) Students who have successfully concluded the Qualification Examination for Phase II of the International Max Planck Research School for Computational Biology and Scientific Computing (IMPRS) may apply to the Examination Committee for admission to the Master's Thesis, special procedure, enclosing the relevant confirmations.

(2) Preconditions for admission to the Master's Thesis, special procedure are performance levels as per § 5 Par. 2 or equivalent that have received the grade "good" (2.0) or better as per § 13 Par. 6 SfAP as well as a reasoned written statement of intent to supervise a future doctoral thesis project by a university instructor. Otherwise, the relevant Doctoral Degree Regulations apply to admission to the doctorate procedure.

(3) In cases of admission to the special procedure, the Master's Thesis work is realized independently using current scientific methods in the form of a concept for which a scientific rationale is provided in conjunction with a presentation and subsequent discussion. In the concept as per Phrase 1, the theme of the dissertation is described and established within the context of current research.

(4) § 5 Par. 6 Phrase 1 applies regarding the assigned period for completion of the Master's Thesis. The Master's Thesis must be written in either German or English.

(5) When the thesis is submitted, the student must affirm in writing that he or she has written the paper independently, using only the sources and aids listed.

(6) Following submission, the Master's Thesis must be evaluated by the appointed supervisor and an additional examiner appointed by the Examination Committee. At least one of the two entitled instructors must be an active instructor in the Master's Program and also a University Instructor on the Faculty of Mathematics and Informatics of the Free University of Berlin, on the Faculty of Biology, Chemistry, Pharmaceutics of the Free University of Berlin or on the Faculty of Charité - University Medicine Berlin. The evaluations must be submitted to the Examination Committee no later than four weeks after submission of the thesis.

(7) The results of the Master's Thesis are presented and discussed in an oral presentation. The oral presentation lasting about 15 minutes is followed by a discussion period lasting about 15 minutes and is not graded. The oral presentation is mandatory and follows submission of the Master's Thesis.

(8) If the Master's Thesis does not receive a grade of at least "sufficient" (4.0), it may be repeated once.

§ 7 Graduation

(1) The graduation requirement is provision of proof that the scope of study performance as required by § 4 Par. 1 of these regulations, in conjunction with § 4 Study Regulations, has been completed.

(2) Graduation is not permitted if the student has conclusively failed to complete a required scope of performance or conclusively failed to pass required examinations or is involved in a pending examination procedure at another university in the same course of studies, in the same subject or in a module that is identical or comparable to a module completion of which is required for the Master's Program and the grade for which counts towards the overall grade.

(3) The application for recognition of graduation must be accompanied by proof of satisfaction of the requirements as per Par. 1 and a statement confirming that none of the cases under Par. 2 applies to the person of the applicant. The competent Examination Committee decides on the application.

(4) On the basis of the passed examination, students receive a Report of Grades and a Diploma (Annexes 2 and 3) as well as a Diploma Supplement (in English and German). A further supplement to the Report of Grades is also issued that contains information on the individual modules and their content (Transcript). An English translation of the Report of Grades and Diploma are issued on request.

§ 8 Entry into force and transitional regulation

(1) These regulations come into form on the day following their publication in the Official Gazette of the Free University of Berlin (FU Announcements) and in the Gazette of the Faculty of Charité - University Medicine Berlin (Charité).

(2) At the same time, the Examination Regulations for the Master's Program of 20 June 2007 (FU Announcements No. 53/2007, p. 1217) become invalid.

(3) These regulations apply to students who matriculate following their entry into force for the Master's Program at the Free University of Berlin. Students who matriculated for the Master's Program at the Free University of Berlin before entry into force of these regulations complete their course work based on the Examination Regulations for the Master's Program as per Par. 2 unless they apply to the Examination Committee to complete their course work based on the present regulations. In the latter case, on the occasion of the transcription resulting from said application, the Examination Committee shall make a decision regarding the scope of modules begun or completed when the application was made or regarding crediting of these performance items within the framework of these regulations, whereby the principles of legitimate expectation and equal opportunity are respected. The transcription cannot be revised.

(4) The opportunity to complete the course of studies according to the Examination Regulations as per Par. 2 is to be upheld until the end of the 2014 summer semester.

Annex 1: Scope of performance, admission requirements, mandatory participation and credit points

Explanations:

Information is provided below for each module in the Master's Program regarding

- the examination forms
- mandatory regular participation
- the credit points assigned to the modules.

To the extent the required study performance includes regular participation, this is established, as well as active participation in the teaching and learning forms and successful completion of the examination requirements of each module, as a precondition for acquiring the credit points assigned to the respective module. Regular participation compliance is when at least 85% of the on-campus study time scheduled in the teaching and learning forms of a module were attended, assuming no higher presence quota is prescribed below.

The credit points assigned to a module reflect the hours of student study effort presumably required to complete the module successfully. These work time estimates include both on-campus courses and phases of self-study (preparation and follow-up, examination preparation, etc.). A credit point is equivalent to about 30 hours.

Module exams - if assigned - must be taken for each module. Modules are completed with only one examination (module exam). The module exam must reflect the qualification objectives of the module. It tests whether the objectives of the module have been reached based on an exemplary sampling. The scope of the examination is limited to what is required to achieve this. In modules for which alternative examination forms are planned, the examination form for each semester must be determined by the responsible instructor by the first course date at the latest.

Credit points are awarded following successful completion of the entire module – that is following regular and active participation in the teaching and learning forms and successful completion of the module exam. In modules with no module exam, active participation as well as regular participation in the teaching and learning forms are the preconditions for acquiring the credit points assigned to each module

Annex 1 of the Study Regulations for the Master's Program describes the contents and qualification objectives, teaching and learning forms of the module, the estimated student work effort requirement to complete a module, forms of active participation, the normal duration of the module and how frequently the module is offered.

1. Mandatory part

Module: Algorithms		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Genomics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Numerics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Optimization		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Statistics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Research internship		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Internship	none	yes
Credit points: 10		

2. Elective part

a) Core Modules

Module: Biodiversity and evolution		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Oral exam (approx. 20 minutes)	Participation recommended
Exercise		yes
Seminar		yes
Credit points: 10		

Module: Medical bioinformatics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Oral exam (approx. 20 minutes)	Participation recommended
Exercise		yes
Seminar		yes
Credit points: 10		

Module: Network analysis		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Oral exam (approx. 20 minutes)	Participation recommended
Exercise		yes
Seminar		yes
Credit points: 10		

Module: Physiology		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Oral exam (approx. 20 minutes)	Participation recommended
Exercise		yes
Seminar		yes
Credit points: 10		

Module: Sequence analysis		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Oral exam (approx. 20 minutes)	Participation recommended
Exercise		yes
Seminar		yes
Credit points: 10		

Module: Structural bioinformatics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Oral exam (approx. 20 minutes)	Participation recommended
Exercise		yes
Seminar		yes
Credit points: 10		

b) Practical Modules

Module: Current cytophysiological problems		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

Module: Applied sequence analysis		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

Module: Measurement and analysis of physiological processes		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

Module: Computer-based system biology		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

Module: Environmental metagenomics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

Module: Current problems in medical genomics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

Module: Current Problems from Structural Bioinformatics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Written presentation (approx. 5 pages) or oral presentation (approx. 15 minutes)	yes
Credit points: 5		

c) Research Modules

Module: Research Module A		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	none	Participation recommended
Lecture		Participation recommended
Exercise		yes
Exercise		yes
Seminar		yes
Credit points: 20		

Module: Research Module B		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	none	Participation recommended
Exercise		yes
Seminar		yes
Seminar		yes
Credit points: 20		

Annex 2: Report of Grades (sample)

FREE UNIVERSITY OF BERLIN
CHARITÉ – UNIVERSITY MEDICINE BERLIN

REPORT OF GRADES

Ms./Mr. [first name/last name]

Date of birth [day/month/year] in [place of birth]

has successfully completed the Master's Program in

Bioinformatics

on the basis of the Examination Regulations of 6 June 2012 (FU Announcements No. [XX]/year) with the overall grade

[grade as number and text]

and earned the required number of 120 credits.

Evaluation of examination results:

Field(s) of study	Credit points	Grade
Study phase	90 (60)	
Master's Thesis	30 (30)	

The them of the Master's Thesis was: [XX]

Berlin, this day of [day/month/year] (seal)

Dean Chairman of the Examination Committee

Grading scale: 1.0 – 1.5 very good; 1.6 – 2.5 good; 2.6 – 3.5 satisfactory; 3.6 – 4.0 sufficient; 4.1 – 5.0 insufficient
The credit points are in accordance with the European Credit Transfer and Accumulation System (ECTS)
Some study work is not graded; the credit points in parentheses reflect the scope of graded performance levels that impact the overall grade.

Annex 3: Diploma (sample)

FREE UNIVERSITY OF BERLIN
CHARITÉ – UNIVERSITY MEDICINE BERLIN

DIPLOMA

Ms./Mr. [first name/last name]

Date of birth [day/month/year] in [place of birth]

has successfully completed the Master's Program in

Bioinformatics

.

Based on the Examination Regulations of 6 June 2012 (FU Announcements No. [XX]/year)

the university degree

Master of Science (M.Sc.)

is awarded.

Berlin, this day of [day/month/year] (seal)

Dean

Chairman of the
Examination Committee