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M-BS1-MAT - Fundamental Calculus and Statistics						**1st sem.**	**6 CP**
Module description		**Fundamental Calculus and Statistics**					
Module code		M-BS1-MAT					
Faculty/Subject/Department		06 (THM)					
Associated degree course/Semester taken		M.Sc. Bioinformatics and Systems Biology/1					
Module coordinator		Cf. German Version					
Lecturers		Cf. German Version					
Prerequisites		See individually agreed syllabi					
Learning outcomes		Module core for two parallel courses; division based on an ungraded admission test.					
Module content							
Form(s) of instruction		Seminars (40%), tutorials (60%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits					
	Course type and title	A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**	
	S Seminars	18	46			**160**	
	P Tutorials	27	69				
	E Written examination				20	**20**	
	Total	**45**	**115**		**20**	**180**	
Module examination	Examination requirements	Submission of exercise sheets					
	Method(s) of assessment (duration)	Written examination (120 min.)					
	Contribution to the final mark	Written examination (100%)					
	Module retake examination	Written examination (120 min.)					
Frequency		Annual	Duration 1 semester	Winter semester			
Intake capacity		30					
Language of instruction		German					

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M-BS1-MATA - Fundamental Calculus and Statistics A		**1st sem.**	**6 CP**
Module description	Fundamental Calculus and Statistics A		
Module code	M-BS1-MATA		
Faculty/Subject/Department	06 (THM)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	See individually agreed syllabi		

Learning outcomes

The students will know the basic concepts in the following areas and will acquire advanced theoretical and methodological knowledge in at least two of the topic areas listed below depending on the specific pre-qualification in a subject area A

- Discrete mathematics
- Real analysis
- Linear algebra
- Simple ordinary differential equations
- Descriptive statistics
- Inferential statistics

Module content

- Differentiation, and integration of real functions
- Simple ordinary differential equations
- Inferential statistics, hypothesis testing, ANOVA, LM, GLM

Additional options

- Graphs, especially trees
- Matrices, determinants, linear equation systems, eigenvalues and eigenvectors
- General and descriptive statistics, probability calculation, conditional probability, random variables, specific distributions

Form(s) of instruction	Seminars (40%), tutorials (60%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
S	Seminars	18	46			**160**
P	Tutorials	27	69			
E	Written examination				20	**20**
	Total	**45**	**115**		**20**	**180**

Module examination

Examination requirements	Submission of exercise sheets
Method(s) of assessment (duration)	Written examination (120 min.)
Contribution to the final mark	Written examination (100%)
Module retake examination	Written examination (120 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German		

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M-BS1-MATB - Fundamental Calculus and Statistics B		**1st sem.**	**6 CP**
Module description	Fundamental Calculus and Statistics B		
Module code	M-BS1-MATB		
Fault/Subject/Department	06 (THM)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1		
Module co-ordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	See individually agreed syllabi		

Learning outcomes

The students will know the basic concepts in the following areas and acquire advanced theoretical and methodological knowledge in at least two of the areas listed below depending on the specific pre-qualification in a subject area B

- Discrete mathematics
- Real analysis
- Linear algebra
- Simple ordinary differential equations
- Descriptive statistics
- Inferential statistics

Module content

- Differentiation, and integration of real functions
- Simple ordinary differential equations
- Inferential statistics, hypothesis testing, ANOVA, LM, GLM

Additional options

- Graphs, especially trees
- Matrices, determinants, linear equation systems, eigenvalues and eigenvectors
- General and descriptive statistics, probability calculation, conditional probability, random variables, specific distributions

Form(s) of instruction	Seminars (40%), tutorials (60%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
S	Seminars	18	46			**160**
P	Tutorials	27	69			
E	Written examination				20	**20**
	Total	**45**	**115**		**20**	**180**

Module examination

Examination requirements	Submission of exercise sheets
Method(s) of assessment (duration)	Written examination (120 min.)
Contribution to the final mark	Written examination (100%)
Module retake examination	Written examination (120 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German		

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M-BS1-INF - Introduction to Computer Science						**1st sem.**	**6 CP**
Module description		Introduction to Computer Science					
Module code		M-BS1-INF					
Faculty/Subject/Department		06 (THM)/07 (JLU)					
Associated degree course/Semester taken		M.Sc. Bioinformatics and Systems Biology/1					
Module coordinator		Cf. German Version					
Lecturers		Cf. German Version					
Prerequisites		See individually agreed syllabi					
Learning outcomes		The students will understand algorithms and structures of computer science. They will be be able to • meaningfully select and implement basic data structures and algorithms • estimate and optimise performance parameters of algorithms The students will understand the concepts of database management systems, will be able to develop simple data models and will have a mastery of the basics of the standard database language SQL.					
Module content		• Efficiency of algorithms (runtime, memory usage) • Searching and sorting: concepts and applications in frameworks • Introduction to databases, simple data models • Introduction to SQL • Programming of database access (JDBC)					
Form(s) of instruction		Seminars (50%)/tutorials (50%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits					
	Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
	L	Lecture	20	60			**80**
	P	Tutorial	20	60			**80**
	O	Oral examination				20	**20**
		Total	**40**	**120**		**20**	**180**
Module examination	Examination requirements	Submission of exercise sheets					
	Method(s) of assessment (duration)	Oral examination (30 - 45 min.)					
	Contribution to the final mark	Oral examination (100%)					
	Module retake examination	Oral examination (30 - 45 min.)					
Frequency		Annual	Duration 1 semester		Winter semester		
Intake capacity		30					
Language of instruction		German					

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M-BS1-BIO- Fundamentals in Biology		**1st sem.**	**6 CP**
Module description	Fundamentals in Biology		
Module code	M-BS1-BIO		
Faculty/Subject/Department	08 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	See individually agreed syllabi		

Learning outcomes

The students should become familiar with the basic biological principles of Bioinformatics and Systems Biology

- they will gain insight into the different levels of organisation in biology
- they will develop a deeper understanding of structure-function relationships
- they will become familiar with the basic principles of (molecular) evolution
- they will discuss new scientific interrelationships in an interdisciplinary context
- they will learn the scientifically correct description and interpretation of basic biological processes
- they will have a mastery of the "hypothetical-deductive approach" and will be able to interpret results truthfully

Module content

- Structure and function of DNA, RNA and proteins
- Genomes and genomic analyses, mutations
- Gene expression
- Cell, macromolecular machines, intracellular transport, cell-cell communication
- Development processes in vertebrates
- Evolution, molecular systematics and diversity, tree of life
- Biological networks, host-parasite interactions

Form(s) of instruction	Lectures (36%), tutorials (55%), colloquia (9%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction		B Auto-nomous work	C Final examination incl. pre-paration	**Total**
		a Contact hours	b Pre-paration/ revision			
L	Lecture	20	30			**50**
P	Tutorial	30	60			**90**
C	Colloquium	5	15			**20**
O	Oral examination				20	**20**
	Total	**55**	**105**		**20**	**180**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Presentation, oral examination (30 - 45 min.)
Contribution to the final mark	Presentation (20%), oral examination (80%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German		

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M-BS1-ES - Introduction to Core Areas of the Master's Degree Course	**1st sem.**	**12 CP**

Module description	Introduction to Core Areas of the Master's Degree Course
Module code	M-BS1-ES
Faculty/Subject/Department	06 (THM), 07 – 11 (JLU)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	See individually agreed syllabi

Learning outcomes

The students should
- understand simple algorithms in bioinformatics and be able to apply them in practical examples
- be able to deal efficiently with the most important platforms for the development of bioinformatics software, and be able to use bioinformatics tools in the public domain and programme software tools
- get an overview of the basic procedures and terminology of molecular systems biology
- using selected examples from various fields, gain insight into various issues of proteomics, transcriptomics, metabolomics and metagenomics
- get an overview of the basic procedures and terminology in modelling, and the mathematical foundations of modelling
- using selected examples from various fields, gain insight into various issues of modelling, and be able to implement simple models in R and SimuLink.
- possess a basic knowledge of high-throughput technologies and their applications in scientific problems and be familiar with the technical basics
- have basic knowledge of accruing data, its statistical analysis and evaluation

Module content

- Overview of simple algorithms in bioinformatics and their applications (e.g. pairwise local and global sequence alignment, FASTA, BLAST, simple algorithms for phylogeny, and scouting)
- Overview of platforms for software development in bioinformatics (scripting languages, special development environments for bioinformatics)
- Basic concepts of molecular systems biology, overview of the primary methods of protein analysis, metabolome analysis, transcriptome analysis, genomic analysis and metagenome analyse
- Basic concepts of modelling in systems biology, provision of examples for modelling from different subject areas (e.g. cellular, population genetic, ecological, interaction models, models for structure prediction, population models)
- Implementation of simple modelling/simulations in modelling software (R/Simulink)
- Introduction to the technology and biology of high-throughput methods
- Introduction to biological systems analysed with high-throughput methods
- Analysis of high-throughput data based on selected examples - data collection, statistical methods and introduction to modelling of accruing data

Form(s) of instruction	Seminars (50%)/tutorials (50%)
Workload total	360 hours = 12 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Preparation/ revision	B Autonomous work	C Final examination incl. preparation	**Total**
L	Lecture	75	85			**160**
P	Tutorial	75	85			**160**
E	Written examination				40	**40**
	Total	**150**	**170**		**40**	**360**

Module examination

Examination requirements	50% of practical assignments successfully completed
Method(s) of assessment (duration)	Written examination (180 min.)
Contribution to the final mark	Written examination (100%)
Module retake examination	Written examination (180 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German		

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M-BS1-ZQ1 - Additional Qualification 1			**1st sem.**	**3 CP**
Module description		Additional Qualification 1		
Module code		M-BS1-ZQ1		
Faculty/Subject/Department		07 – 11 (JLU), 06 (THM)		
Associated degree course/Semester taken		M.Sc. Bioinformatics and Systems Biology/1		
Module coordinator		Cf. German Version		
Lecturers		Cf. German Version		
Prerequisites		See individually agreed syllabi		
Learning outcomes		See module descriptions of the specific courses on offer		
Module content		See module descriptions of the specific courses on offer		
Form(s) of instruction		See module descriptions of the specific courses on offer		
Workload in hours	Workload total	90 hours = 3 ECTS credits		
	See module descriptions of the specific courses on offer			
Module examination	Examination requirements	See module descriptions of the specific courses on offer		
	Method(s) of assessment (duration)	See module descriptions of the specific courses on offer		
	Contribution to the final mark	See module descriptions of the specific courses on offer		
	Module retake examination	See module descriptions of the specific courses on offer		
Frequency		Annual Duration 1 semester Winter semester		
Intake capacity		30		
Language of instruction		German/English		

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M-BS1-ZQ1A - Statistical Models for Bioinformatics and Systems Biology	**1st sem.**	**3 CP**

Module description	Statistical Models for Bioinformatics and Systems Biology
Module code	M-BS1-ZQ1A
Faculty/Subject/Department	09 (JLU)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	See individually agreed syllabi

Learning outcomes

The students will be able to apply statistical methods to systems biology questions using a software package

Module content

- Foundations of Probability Calculation
- Statistical tests
- Stochastic processes
- Markov chains/hidden Markov models
- Models of sequence evolution
- Sequence analyses
- Tree reconstruction

Form(s) of instruction	Seminars (50%)/tutorials (50%)
Workload total	90 hours = 3 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
L	Lecture	20	20			**40**
P	Tutorial	20	20			**40**
E	Written examination				10	**10**
	Total	**40**	**40**		**10**	**90**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Written examination (90 min.), tutorial assignments
Contribution to the final mark	Written examination (50%), tutorial assignments (50%)
Module retake examination	Written examination (90 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German/English		

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M-BS1-ZQ1u2B - Object-Oriented Programming					**1st sem.**	**6 CP**
Module description	Object-Oriented Programming					
Module code	M-BS1-ZQ1u2B					
Faculty/Subject/Department	FB 06 (THM), 07 (JLU)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	See individually agreed syllabi					
Learning outcomes	The students should: • be able to develop small to medium sized object-based programs in a modern object-oriented programming language with a simple graphical user interface and in compliance with software engineering principles • verify the correctness of their solution in systematic tests					
Module content	• Data types, data structures, abstract data types, generic data types • Loops, recursion, functions, methods • Input/output: Console, file access, GUIs • Classes, class design: static classes (modules), • stateless and stateful classes • Information hiding, encapsulation • Object-based programming, interface inheritance • Functional tests • Class library: Collection types					
Form(s) of instruction	Seminars (50%)/tutorials (50%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits				
	Course type and title	A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
	L Lecture	20	60			**80**
	P Tutorial	20	60			**80**
	E Written examination				20	**20**
	Total	**40**	**120**		**20**	**180**
Module examination	Examination requirements	Submission of exercise sheets to be graded				
	Method(s) of assessment (duration)	Written examination (90 min.)				
	Contribution to the final mark	Written examination (80%), tutorial assignments (20%)				
	Module retake examination	Oral examination (30 - 45 min.)				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS1-ZQ1u2C - Special Course on Computer Science		**1st sem.**	**6 CP**
Module description	Special Course on Computer Science		
Module code	M-BS1-ZQ1u2C		
Faculty/Subject/Department	06 (THM)/07 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1 M.Sc. Mathematics/1 – 4 L3 Computer science/5 – 8		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	See individually agreed syllab		

Learning outcomes

Students should expand the knowledge acquired in the basic modules through an advanced special topic, e.g. computability, complexity theory, algorithms, etc. The following learning outcomes should be taught:

- deeper understanding of an (algorithmic) problem and its solution methods
- ability to classify problems regarding different cost dimensions
- knowledge of the relationships between machine models and cost dimensions
- understanding of the basic concepts and methods of computability, complexity and/or algorithm analysis

providing the basis for the preparation of a Master's dissertation

Module content

Selected topics in computer science, e.g. computability, complexity theory, algorithms, etc. These include (partial list):

- basic models of computation (Turing machine, circuits, etc.) and cost dimensions (time, space, depth, number of gates, etc.) Non-decidability and rec. enumerability
- Completeness and fundamental structural relationships between computability and complexity classes, P vs. NP problem.

Potential in-depth studies and applications (not complete): computability theory, arithmetic hierarchy, structural complexity theory, polynomial hierarchy, lower and upper bounds, functional problems, optimisation problems and their approximation, Kolmogorov complexity, complexity-theoretic foundations of cryptography, algorithmic problems, basic algorithms (searching, sorting , etc.), algorithm analysis

Form(s) of instruction	Seminars (75%)/tutorials (25%)

Workload in hours

Workload total: 180 hours = 6 ECTS credits

Course type and title		A Formal instruction		B Auto-nomous work	C Final examination incl. pre-paration	**Total**
		a Contact hours	b Pre-paration/ revision			
L	Lecture	45	45			**90**
P	Tutorial	15	45			**60**
O	Oral examination				30	**30**
	Total	**60**	**90**		**30**	**180**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Oral examination (30 - 45 min.)
Contribution to the final mark	Oral examination (100%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German		

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M-BS1-ZQ1D - Design of Small Molecule Drugs					**1st sem.**	**3 CP**
Module description	Design of Small Molecule Drugs					
Module code	M-BS1-ZQ1D					
Faculty/Subject/Department	06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1					
Module co-ordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	See individually agreed syllabi					
Learning outcomes	After successful completion of the module, the students should have an overview of the modern methods of drug design. They will be familiar with the important algorithms and methods and can apply them in drug design.					
Module content	• 3-dimensional structure of drugs • Simulation of the interaction of drugs with their target • Prediction of therapeutic efficacy • Computer-assisted design of biologically active chemical substances (structure-based design, ligand-based design) • Use of software in the public domain and programming of own tools					
Form(s) of instruction	Seminars (50%)/tutorials (50%)					
Workload in hours	Workload total	90 hours = 3 ECTS credits				
	Course type and title	A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
	L Lecture	20	20			**40**
	P Tutorial	20	20			**40**
	E Written examination				10	**10**
	Total	**40**	**40**		**10**	**90**
Module examination	Examination requirements	Submission of exercise sheets				
	Method(s) of assessment (duration)	Oral examination (30 - 45 min.)				
	Contribution to the final mark	Written examination (100%)				
	Module retake examination	Oral examination (30 - 45 min.)				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS1-ZQ2 - Additional Qualification 2			**1st sem.**	**3 CP**
Module description		Additional Qualification 2		
Module code		M-BS1-ZQ2		
Faculty/Subject/Department		07 – 11 (JLU), 06 (THM)		
Associated degree course/Semester taken		M.Sc. Bioinformatics and Systems Biology/1		
Module coordinator		Cf. German Version		
Lecturers		Cf. German Version		
Prerequisites		See individually agreed syllabi		
Learning outcomes		See module descriptions of the specific courses on offer		
Module content		See module descriptions of the specific courses on offer		
Form(s) of instruction		See module descriptions of the specific courses on offer		
Workload in hours	Workload total	90 hours = 3 ECTS credits		
	See module descriptions of the specific courses on offer			
Module examination	Examination requirements	See module descriptions of the specific courses on offer		
	Method(s) of assessment (duration)	See module descriptions of the specific courses on offer		
	Contribution to the final mark	See module descriptions of the specific courses on offer		
	Module retake examination	See module descriptions of the specific courses on offer		
Frequency		Annual Duration 1 semester Winter semester		
Intake capacity		30		
Language of instruction		German/English		

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M-BS1-ZQ2A - Methods in Biology		**1st sem.**	**3 CP**
Module description	Methods in Biology		
Module code	M-BS1-ZQ2A		
Faculty/Subject/Department	08 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	See individually agreed syllabi		

Learning outcomes

The students will

- be familar with the important working techniques for the generation of systems biology data in molecular biology and analytical biochemistry
- for a pending analytical problem, be able to choose the right technique and justify the selection
- be familiar with the advantages and disadvantages of each method
- be able to assess the quality of the data generated

Module content

Students learn about important working techniques in the life sciences, e.g.

- real-time PCR
- 2D gel electrophoresis
- immunoassays
- sequencing techniques
- chip technologies
- gene knockout/overexpression, reporter gene cloning
- mass spectrometry
- NMR spectrometry
- chromatography
- cell sorting
- fluorescence microscopy and spectroscopy
- live cell imaging
- spectrometric procedures
- fluorescence markers

Form(s) of instruction	Lectures (100%)

Workload in hours

Workload total	90 hours = 3 ECTS credits

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
L	Lecture	40	40			**80**
O	Oral examination				10	**10**
	Total	**40**	**40**		**10**	**90**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Oral examination (30 - 45 min.)
Contribution to the final mark	Oral examination (100%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German/English		

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M-BS1-ZQ2D - Design of Biologic Drugs					**1st sem.**	**3 CP**
Module description	**Design of Biologic Drugs – Biologics**					
Module code	M-BS1-ZQ2D					
Faculty/Subject/Department	06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/1					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	See individually agreed syllabi					
Learning outcomes	After successful completion of the module, the students should have an overview of the modern methods of biomolecule design. They will be familiar with the important algorithms and methods and can apply them in drug design.					
Module content	• 3-dimensional structure of biomolecules • Simulation of the interaction of drugs with their target • Computer-assisted design of biologically active chemical substances (use of software in the public domain and programming of own tools)					
Form(s) of instruction	Lectures (50%)/tutorials (50%)					
Workload in hours	Workload total	90 hours = 3 ECTS credits				
	Course type and title	A Formal instruction		B Auto-nomous work	C Final examination incl. pre-paration	**Total**
		a Contact hours	b Pre-paration/ revision			
	L Lecture	20	20			**40**
	P Tutorial	20	20			**40**
	E Written examination				10	**10**
	Total	**40**	**40**		**10**	**90**
Module examination	Examination requirements	Submission of exercise sheets				
	Method(s) of assessment (duration)	Oral examination (30 - 45 min.)				
	Contribution to the final mark	Written examination (100%)				
	Module retake examination	Oral examination (30 - 45 min.)				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

M-BS2-S1A - Bioinformatics Algorithms Part 1					**2nd sem.**	**6 CP**
Module description	Bioinformatics Algorithms Part 1					
Module code	M-BS2-S1A					
Faculty/Subject/Department	06 (THM), 07 (JLU)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	M-BS1-ES					
Learning outcomes	The students will • be familiar with the algorithmic foundations of bioinformatics, • understand the key algorithms and public domain bioinformatics tools from the fields of structure prediction and computer-aided drug design and be able to apply them to problems in practice • be able to develop, analyse and implement suitable algorithms for solving bioinformatics problems in these areas					
Module content	• Algorithmic foundations of bioinformatics (e.g. dynamic programming, HMM, neural networks, SVPs, optimisation methods) • Application of these algorithms to the fields of bioinformatics and systems biology (e.g. structure prediction of biological macromolecules and computer-aided drug design) • New algorithms and applications based on current research					
Form(s) of instruction	Seminars (50%)/tutorials (50%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits				

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
L	Lecture	20	60			**80**
P	Tutorial	20	60			**80**
E	Written examination				20	**20**
	Total	**40**	**120**		**20**	**180**

Module examination		
	Examination requirements	Submission of exercise sheets
	Method(s) of assessment (duration)	Written examination (90 min.)
	Contribution to the final mark	Written examination (100%)
	Module retake examination	Written examination (90 min.)
Frequency	Annual	Duration 1 semester Summer semester
Intake capacity	20	
Language of instruction	German/English	

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-S1B - Bioinformatics Algorithms Part 2	**2nd sem.**	**6 CP**

Module description	Bioinformatics Algorithms Part 2
Module code	M-BS2-S1B
Faculty/Subject/Department	06 (THM), 07(JLU)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	M-BS1-ES, M-BS2-S1A
Learning outcomes	The students will • understand the key algorithms and public domain bioinformatics tools from the fields of efficient sequence alignment, high-throughput methods of phylogeny, as well as genome assembly and analysis, and be able to apply them to practical problems • be able to develop, analyse and implement suitable algorithms for solving bioinformatics problems in these areas
Module content	• Efficient algorithms for sequence alignment and genome assembly • Phylogenetic algorithms • Genome analysis algorithms • Algorithmic and statistical aspects of high-throughput methods • New algorithms and applications based on current research
Form(s) of instruction	Lectures, tutorials
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
L	Lecture	20	50			**70**
P	Tutorial	20	50			**70**
P	Presentation	10			10	**20**
E	Written examination				20	**20**
	Total	**50**	**100**		**30**	**180**

Module examination

Examination requirements	Submission of exercise sheets
Method(s) of assessment (duration)	Written examination (90 min.), presentation
Contribution to the final mark	Written examination (70%), presentation (30%)
Module retake examination	Oral examination (30 - 45 min.)
Frequency	Annual Duration 1 semester Summer semester
Intake capacity	20
Language of instruction	German/English

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-S2A - Molecular Systems Biology Part 1		**2nd sem.**	**6 CP**
Module description	Molecular Systems Biology Part 1		
Module code	M-BS2-S2A		
Faculty/Subject/Department	08 (JLU), 11 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2		
Module coordinator	Cf. German		
Lecturers	Cf. German Version		
Prerequisites	M-BS1-ES		

Learning outcomes

The students should become familiar with the theoretical basis of transcriptomeanalysis and also of genome and metagenome analysis in pro/eukaryotes and their practical implementation and will

- be familiar with the most important methods of transcriptomeanalysis and of genome or metagenome analysis
- be able to prepare and present methofs of transcriptomeanalysis and also of genome and metagenome analysis
- be able, for given questions, to select the appropriate methods of transcriptomeanalysis and also of genome and metagenome analysis and prepare an optimised concept for the practical implementation
- be able to apply methods of transcriptomeanalysis and also of genome and metagenome analysis in practice
- have the knowledge to be able to evaluate critically and question results of transcriptomeanalysis and also of genome and metagenome analysis

Module content

- Overview of the main methods of transcriptome analysisand of genome and metagenome analysis
- Development of a transcriptome analysis method or a genome or metagenome analysis through study of the literature based on primary literature
- Presentation of a transcriptome analysis or a genome or metagenome analysis
- Isolation of chromosomal DNA from e.g. bacteria and bacterial populations, cloning of chromosomal DNA into plasmid, fosmid and BAC vectors
- Preparation of cloning and sequencing libraries, quality control of cloning and sequencing libraries, storage of cloning and sequencing libraries
- Isolation of plasmids, fosmids and BAC-DANN
- DNA sequencing, operational work using DNA sequencing equipment
- Bioinformatic analysis of primary DNA sequencing data, generation and assembly of contig data
- Isolation of total RNA from bacteria
- Manufacturing and quality control of cDNA sequencing libraries
- cDNA sequencing, operational work using DNA sequencing equipment
- Bioinformatic analysis and mapping of primary cDNA sequencing data

Form(s) of instruction	Lectures (26%)/seminars (17%)/work placement (57%)

Workload in hours

Workload total	180 hours = 6 ECTS credits

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
P	Lecture	18	36			**54**
S	Seminars	12	24			**36**
I	Work placement	40	40			**80**
P	Presentation				10	**10**
	Total	**70**	**100**		**10**	**180**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Work placement report, presentation
Contribution to the final mark	Work placement report (70%), presentation (30%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Annual	Annual
Intake capacity	20		
Language of instruction	German/English		

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-S2B - Molecular Systems Biology Part 2	**2nd sem.**	**6 CP**

Module description	Molecular Systems Biology Part 2
Module code	M-BS2-S2B
English module description	Molecular Systems Biology Part 2
Faculty/Subject/Department	08 (JLU), 11 (JLU)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	M-BS1-ES

Learning outcomes

The students should become familiar with the theoretical foundations of protein analysis methods and of metabolome analysis and their practical implementation. i.e. they will

- become familiar with the basic methods of protein analysis and mass spectrometry metabolome analysis
- be able to prepare and present protein analysis methods and mass spectrometry methods for metabolome analysis from the primary literature
- be able, for given questions, to select the appropriate methods of protein analysis or mass spectrometry methods of metabolome analysis, and prepare an optimised concept for the practical procedure
- be able to apply protein analysis methods and mass spectrometry methods for metabolome analysis in practice
- have the knowledge to be able to evaluate critically and question the results of scientific work involving protein analysis and metabolome analysis

Module content

- Overview of the main methods of protein analysis and mass spectrometric metabolome analysis, and of substance-specific extraction techniques and different derivatizations
- Development of a protein analysis method and a mass spectrometry method of metabolome analysis by study of the literature based on primary literature
- Presentation of a protein analysis method or a mass spectrometry method of metabolome analysis as part of a seminar presentation
- Extraction of proteins from a model organism, protein quantification
- Implementation of substance-specific extractions from a model organism
- Separation of a proteome and metabolome by e.g. 2D gel electrophoresis, GC-MS or LC-MS
- Identification of proteins after in-gel digestion by mass spectrometry
- Identification of different substances (e.g. steroid hormones, amino acids, acylcarnitines, organic acids, sugars) by mass spectrometry

Form(s) of instruction	Lectures (26%)/seminars (17%) /work placement (57%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Preparation/ revision	B Autonomous work	C Final examination incl. preparation	**Total**
P	Lecture	18	36			**54**
S	Seminars	12	24			**36**
I	Work placement	40	40			**80**
P	Presentation				10	**10**
	Total	**70**	**100**		**10**	**180**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Work placement report, presentation
Contribution to the final mark	Work placement report (70%), presentation (30%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-S3A - Theoretical Basics of Modelling		**2nd sem.**	**6 CP**
Module description	Theoretical Basics of Modelling		
Module code	M-BS2-S3A		
Faculty/Subject/Department	09 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	M-BS1-ES		

Learning outcomes

The students should
- expand their knowledge of the statistical and mathematical foundations of modelling
- be familiar with the different methods of modelling and have a deep understanding of interdependencies in dynamic systems
- describe simple models/simulations and be able to implement them in R/Simulink
- be familiar with the characteristics and advantages and disadvantages of different modelling methods, and be able to evaluate them critically

Module content

- Introduction to systems analysis
- Exercises in systems analysis
- Statistical and mathematical algorithms in modelling
- Explanation of different types of models in biological systems
  - Qualitative models
  - Stochastic models
  - Deterministic models
- Methods for modelling interdependencies in dynamic systems
  e.g. differential equations, Petri nets, cellular automata, agent-based models
- Implementation of mathematical models in modelling software, e.g. R (incl. C/Fortran/C++), SimuLink, NetLogo
- Evaluation and validation of models
- Data standard/quality

Form(s) of instruction	Seminars (50%)/tutorials (50%)

Workload in hours

Workload total	180 hours = 6 ECTS credits

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
P	Lecture	35	45			**80**
P	Tutorial	35	45			**80**
E	Written examination				20	**20**
	Total	**70**	**90**		**20**	**180**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Written examination (90 min.), tutorial assignments
Contribution to the final mark	Written examination (50%), tutorial assignments (50%)
Module retake examination	Written examination (90 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-S3B - Applied Modelling of Complex Biological Processes and Systems	**2nd sem.**	**6 CP**

Module description	Applied Modelling of Complex Biological Processes and Systems
Module code	M-BS2-S3B
English module description	Applied Modelling of Complex Biological Processes and Systems
Faculty/Subject/Department	09 (JLU)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	M-BS2-S3A

Learning outcomes

The students should

- be able to model data from various complex biological systems independently
- be able to start working quickly on different problems
- be able to present the results of the models coherently

Module content

- Project work in small groups to apply the knowledge acquired in module M-BS-S3A
- Modelling of experimentally recorded or simulated data from various biological systems, e.g. metabolic networks, cellular transport processes, intra- and intercellular signal transduction, phylogenetic trees
  - Systems analysis
  - Description of the interactions in biological systems using mathematical models
  - Implementation of mathematical models in corresponding modelling software, e.g. R (incl. C/Fortran/C++), SimuLink, NetLogo
  - Evaluation and validation of models
- Graphical display and presentation of modelling results

Form(s) of instruction	Seminars (46%)/tutorials (54%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
P	Lecture	30	40			**70**
P	Tutorial	30	60			**90**
P	Presentation				20	**20**
	Total	**60**	**100**		**20**	**180**

Module ...

Examination requirements	None
Method(s) of assessment (duration)	Implementation and presentation of an independently conducted project
Contribution to the final mark	Presentation (20%), project (80%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		

M-BS2-S4A - Analysis of High-Throughput Data Part 1		**2nd sem.**	**6 CP**
Module description	Analysis of High-Throughput Data Part 1		
Module code	**M-BS2-S4A**		
English module description	Analysis of High-Throughput Data Part 1		
Faculty/Subject/Department	08 (JLU), 09 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	M-BS1-ES		

Learning outcomes

The students should

- have a working knowledge of the use of biomaterials and their processing for further use in high-throughput methods
- understand and be able to apply the principles of statistical and bioinformatic methods used in high-throughput technologies
- have knowledge of efficient data structures in high-throughput technologies
- be able to handle high-throughput data critically and model and analyse it then efficiently

Module content

- Practical processing and elaboration of biomaterials for subsequent high-throughput analysis
- Establishing and preparation of analysis pipelines and the use of published analysis pipelines for the collection, quality control and processing of high-throughput data
- Modelling and interpretation of the functional relationships based on the results of the high-throughput data analyses
- Public databases for storage of high-throughput data and its interfaces/data mining

Form(s) of instruction	Seminars (50%)/tutorials (50%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction		B Autonomous work	C Final examination incl. preparation	**Total**
		a Contact hours	b Preparation/ revision			
P	Lecture	35	45			**80**
P	Tutorial	35	45			**80**
E	Written examination				20	**20**
	Total	**70**	**90**		**20**	**180**

Module examination

Examination requirements	None
Method(s) of assessment (duration)	Written examination (90 min.), practical tasks
Contribution to the final mark	Written examination (50%), tutorial assignments (50%)
Module retake examination	Written examination (90 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		

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M-BS2-S4B - Analysis of High-Throughput Data Part 2	**2nd sem.**	**6 CP**
Module description	Analysis of High-Throughput Data Part 2	
Module code	**M-BS2-S4B**	
Faculty/Subject/Department	08 (JLU), 09 (JLU)	
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2	
Module coordinator	Cf. German Version	
Lecturers	Cf. German Version	
Prerequisites	M-BS2-S4A	

Learning outcomes

The students should

- be able to analyse complex datasets originating from different high-throughput technologies integratively
- be able to interpret data derived from high-throughput technologies in a systems biology approach
- be able to interpret complex high-throughput data functionally
- be able to derive experimentally testable hypotheses from high-throughput data
- be able to communicate bioinformatic analyses effectively to multidisciplinary teams

Module content

- Analysis of complex data sets from high-throughput experiments
- Integration of data from international consortia that generate systems biology-relevant high-throughput data in high throughput (e.g. ENCODE, 1000 Genomes Project, HapMap, etc.)
- Presentation of the results obtained
- Presentation of current literature

Form(s) of instruction	Seminars (50%)/tutorials (50%)

Workload in hours

Workload total	180 hours = 6 ECTS credits

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
P	Lecture	30	30			**600**
P	Tutorial	40	60			**100**
P	Presentation				20	**20**
	Total	**70**	**90**		**20**	**180**

Module

Examination requirements	None
Method(s) of assessment (duration)	Implementation and presentation of an independently conducted project
Contribution to the final mark	Presentation (20%), project (80%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		

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M-BS2-MTS - Methods Seminar			**2nd sem.**	**3 CP**
Module description		Methods Seminar		
Module code		M-BS2-MTS		
Faculty/Subject/Department		06 (THM), 07-11 (JLU)		
Associated degree course/Semester taken		M.Sc. Bioinformatics and Systems Biology/2		
Module coordinator		Cf. German Version		
Lecturers		Cf. German Version		
Prerequisites		See specific module descriptions		
Learning outcomes	Module core for M-BS-MTS(1-n)			
Module content	See specific module descriptions			
Form(s) of instruction		See specific module descriptions		
Workload in hours	Workload total	90 hours = 3 ECTS credits		
	See specific module descriptions			
Module examination	Examination requirements	See specific module descriptions		
	Method(s) of assessment (duration)	See specific module descriptions		
	Contribution to the final mark	See specific module descriptions		
	Module retake examination	See specific module descriptions		
Frequency		Annual Duration 1 semester Winter semester		
Intake capacity		30		
Language of instruction		German/English		

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M-BS2-MTS1 - Methods Seminar - Computer Science		**2nd Sem.**	**3 CP**
Module description	Methods Seminar – Computer Science		
Module code	M-BS2-MTS1		
Faculty/Subject/Department	06 (THM), 07 (JLU)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	M-BS1-MAT		
Learning outcomes	The students should complement the knowledge acquired in the basic modules with an advanced special topic from the fields of mathematics, computer science and bioinformatics. Recent research findings from the above-mentioned fields are developed by the participants and presented and discussed in the plenary. They should prepare the basis for the preparation of a Master's dissertation.		
Module content	Selected topics in computer science, e.g. discrete mathematics, basic algorithms, bioinformatics algorithms, algorithm analysis, automata and formal languages, complexity theory, description complexity, computability, etc. Recent research findings (from relevant technical seminars and/or technical journals) from the above-mentioned fields are developed by the participants and presented and discussed in the plenary. Development of the selected subject area through literature review and preparation of a report.		
Form(s) of instruction	Seminars		
Workload in hours	Workload total: 90 hours = 3 ECTS credits		

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
S	Seminars	30	50			**70**
E	Written examination				10	**20**
	Total	**30**	**50**		**10**	**90**

Module examination		
	Examination requirements	Regular and successful participation in the seminar (80%)
	Method(s) of assessment (duration)	Presentation (60 min.), written report
	Contribution to the final mark	Presentation (80%), written report (20%)
	Module retake examination	Presentation (60 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	30		
Language of instruction	German/English		

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M-BS2-MTS2 - Metabolome Analysis			**2nd sem.**	**3 CP**
Module description	Metabolome Analysis			
Module code	M-BS2-MTS1			
Faculty/Subject/Department	08 (JLU), 11 (JLU)			
Associated degree course/Semester taken	MSc Bioinformatics and Systems Biology/2			
Module coordinator	Cf. German Version			
Lecturers	Cf. German Version			
Prerequisites	M-BS1-ES			
Learning outcomes	The students should become familiar with the theoretical foundations of metabolome analysis in cells and organisms and its practical implementation, i.e. they will • become familiar with the most important mass spectrometry methods of metabolome analysis • be able to able to prepare and present mass spectrometry methods of metabolome analysis from the primary literature • be able, for given questions, to select the appropriate mass spectrometry methods of metabolome analysis, and prepare an optimised concept for the practical procedure of metabolome analysis • be able to apply mass spectrometry methods of metabolome analysis in practice • have the knowledge to be able to evaluate critically and question the results of scientific work involving metabolome analysis			
Module content	• Overview of the most important methods of mass spectrometry metabolome analysis • Overview of substance-specific extraction techniques and different derivatisations • Development of a mass spectrometry method of metabolome analysis by study of the literature based on primary literature • Presentation of a mass spectrometry method of metabolome analysis as part of a seminar presentation • Implementation of substance-specific extractions from a model organism • Separation of a metabolome by e.g. GC-MS or LC-MS • Identification of different substances (e.g. steroid hormones, amino acids, acylcarnitines, organic acids, sugars) by mass spectrometry			
Form(s) of instruction	Lectures (26%)/seminars (17%)/work placement (57%)			
Workload total	90 hours = 3 ECTS credits			

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
P	Lecture	9	18			**27**
S	Seminars	6	12			**18**
I	Work placement	20	20			**40**
P	Presentation				5	**5**
	Total	**35**	**50**		**5**	**90**

Module

Examination requirements	None
Method(s) of assessment (duration)	Work placement report, presentation
Contribution to the final mark	Work placement report (70%), presentation (30%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		
Additional information	Module advice and literature: see semester notice board/Dates: see course catalogue		

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-MTS3 - Methods in Protein Analysis				**2nd sem.**	**3 CP**
Module description	**Methods in Protein Analysis**				
Module code	M-BS2-MTS3				
Faculty/Subject/Department	08 (JLU), 11 (JLU)				
Associated degree course/Semester taken	MSc Bioinformatics and Systems Biology/2				
Module co-ordinator	Cf. German Version				
Lecturers	Cf. German Version				
Prerequisites	M-BS1-ES				
Learning outcomes	The students should become familiar with the theoretical foundations of protein analysis methods and their practical implementation, i.e. they will • become familiar with the most important methods of protein analysis • be able to prepare and present methods of protein analysis from the primary literature • be able, for given questions, to select the appropriate methods of protein analysis, and prepare an optimised concept for the practical procedure • be able to apply the methods of protein analysis in practice • have the knowledge to be able to evaluate critically and question the results of protein analyses				
Module content	• Overview of the most important methods of protein analysis • Development of a method of protein analysis by lstudy of the literature based on primary literature • Presentation of a method of protein analysis as part of a seminar presentation • Extraction of proteins from a model organism, protein quantification • Separation of a proteome by e.g. 2D gel electrophoresis • Identification of proteins after in-gel digestion by mass spectrometry • Preparation of a work placement report				
Form(s) of instruction	Lectures (26%)/seminars (17%)/work placement (57%)				
Workload in hours	Workload total	90 hours = 3 ECTS credits			

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
P	Lecture	9	18			**27**
S	Seminars	6	12			**18**
I	Work placement	20	20			**40**
P	Presentation				5	**5**
	Total	**35**	**50**		**5**	**90**

Module				
	Examination requirements	None		
	Method(s) of assessment (duration)	Work placement report, presentation		
	Contribution to the final mark	Work placement report (70%), presentation (30%)		
	Module retake examination	Oral examination (30 - 45 min.)		
Frequency		Annual	Duration 1 semester	Summer semester
Intake capacity		20		
Language of instruction		German/English		
Additional information		Module advice and literature: see semester notice board/Dates: see course catalogue		

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-MTS4 - Transcriptomic Analysis	**2nd sem.**	**3 CP**

Module description	**Transcriptomic Analysis**
Module code	M-BS2-MTS4
Faculty/Subject/Department	08 (JLU), 11 (JLU)
Associated degree course/Semester taken	MSc Bioinformatics and Systems Biology/2
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	M-BS1-ES

Learning outcomes

The students should be familiar with the theoretical basis of transcriptome analysis in pro-/eukaryotes and their practical implementation, i.e. they will

- become familiar with the most important methods of transcriptome analysis
- be able to prepare and present methods of transcriptome analysis from the primary literature
- be able, for given questions, to select the appropriate methods of transcriptome analysis, and prepare an optimised concept for the practical procedure
- be able to apply methods of transcriptome analysis in practice
- have the knowledge to evaluate critically and question the results of transcriptomeanalysis

Module content

- Overview of the most important methods of transcriptome analysis
- Development of a method of transcriptome analysis by study of the literature based on primary literature
- Presentation of a method of transcriptome analysis as part of a seminar presentation
- Isolation of total RNA from bacteria
- Preparation of cDNA sequencing libraries
- Quality control of cDNA sequencing libraries
- cDNA sequencing, operational work using DNA sequencing equipment
- Bioinformatic analysis of primary cDNA sequencing data
- Mapping of cDNA sequencing data

Form(s) of instruction	Lectures (26%)/seminars (17%)/work placement (57%)
Workload total	90 hours = 3 ECTS credits

Workload in hours

Course type and title		A Formal instruction		B Autonomous work	C Final examination incl. preparation	**Total**
		a Contact hours	b Preparation/ revision			
P	Lecture	9	18			**27**
S	Seminars	6	12			**18**
I	Work placement	20	20			**40**
P	Presentation				5	**5**
	Total	**35**	**50**		**5**	**90**

Module

Examination requirements	None
Method(s) of assessment (duration)	Work placement report, presentation
Contribution to the final mark	Work placement report (70%), presentation (30%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		
Additional information	Module advice and literature: see semester notice board/Dates: see course catalogue		

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

M-BS2-MTS5 - Genome and Metagenome Analysis	**2nd sem.**	**3 CP**

Module description	**Genome and Metagenome Analysis**
Module code	M-BS2-MTS5
Faculty/Subject/Department	08 (JLU), 11 (JLU)
Associated degree course/Semester taken	MSc Bioinformatics and Systems Biology/2
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	M-BS1-ES

Learning outcomes

The students should be familiar with the theoretical basis of genome and metagenome analysis in pro-/eukaryotes and their practical implementation, i.e. they will

- become familiar with the most important methods of genome and metagenome analysis
- be able to prepare and present methods of genome and metagenome analysis from the primary literature
- be able, for given questions, to select the appropriate methods of genome and metagenome analysis, and prepare an optimised concept for the practical procedure
- be able to apply methods of genome and metagenome analysis in practice
- have the knowledge to be able to evaluate critically and question the results of genome and metagenome analyses

Module content

- Overview of the most important methods of genome and metagenome analysis
- Elaboration of a genome and metagenome analysis method through study of the literature based on primary literature
- Presentation of a genome and metagenome analysis in a seminar presentation
- Isolation of chromosomal DNA from e.g. bacteria and bacterial populations from different ecological niches
- Cloning of chromosomal DNA into plasmid, fosmid and BAC vectors
- Preparation of cloning and sequencing libraries, quality control of cloning and sequencing libraries, storage of cloning and sequencing libraries
- Isolation of plasmids, fosmids and BAC-DANN
- DNA sequencing, operational work using DNA sequencing equipment
- Bioinformatic analysis of primary DNA sequencing data, generation and assembly of contig data

Form(s) of instruction	Lectures (26%)/seminars (17%)/work placement (57%)
Workload total	90 hours = 3 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Preparation/ revision	B Autonomous work	C Final examination incl. preparation	**Total**
P	Lecture	9	18			**27**
S	Seminars	6	12			**18**
I	Work placement	20	20			**40**
P	Presentation				5	**5**
	Total	**35**	**50**		**5**	**90**

Module

Examination requirements	None
Method(s) of assessment (duration)	Work placement report, presentation
Contribution to the final mark	Work placement report (70%), presentation (30%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	20		
Language of instruction	German/English		
Additional information	Module advice and literature: see semester notice board/Dates: see course catalogue		

M-BS2-MTS6 - Methods Seminar – Drug Research		**2nd sem.**	**3 CP**
Module description	Methods Seminar – Drug Research		
Module code	M-BS2-MTS6		
Faculty/Subject/Department	06 (THM)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	See individually agreed syllabi		

Learning outcomes

Students will have an overview of the modern methods of drug research and development. They will be familiar with the applications of bioinformatics and will be able to develop and apply bioinformatics methods for drug research and development.

Module content

- The phases of drug research and clinical development
- Applications of bioinformatics in the development of new therapies
- Applications of bioinformatics in the profiling of new drugs
- Bioinformatics applications in clinical research
- Current topics in research and development
- Use of bioinformatics tools in the public domain and programming of own tools

Form(s) of instruction	Seminars

Workload in hours

Workload total: 90 hours = 3 ECTS credits

Course type and title		A Formal instruction		B Autonomous work	C Final examination incl. preparation	**Total**
		a Contact hours	b Preparation/ revision			
S	Seminars	30	50			**70**
E	Written examination				10	**20**
	Total	**30**	**50**		**10**	**90**

Module examination

Examination requirements	Regular and successful participation in the seminar (80%)
Method(s) of assessment (duration)	Written examination (90 min.)
Contribution to the final mark	Written examination (100%)
Module retake examination	Written examination (90 min.)

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	30		
Language of instruction	German/English		

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M-BS2-MTS7 - Object-Oriented Programming of Interactive Systems	**2nd sem.**	**3 CP**

Module code		M-BS2-MTS7
Faculty/Subject/Department		06 (THM)
Associated degree course/Semester taken		MSc Bioinformatics and Systems Biology/2
Module coordinator		Cf. German Version
Lecturers		Cf. German Version
Prerequisites		M-BS1-ZQ1u2B
Learning outcomes		The students should: • be able to develop small- to medium-sized object-based programmes in a modern object-oriented programming language with simple to complex graphical user interfaces and in compliance with software engineering principles, and • be able to verify the correctness of their solution in systematic tests.
Module content		• Development of graphical user interfaces • Programming of simple web-based systems • Threads • Database connectivity
Form(s) of instruction		Lectures (67%), tutorials (33%)
Workload in hours	Workload total	90 hours = 3 ECTS credits

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Preparation/revision	B Autonomous work	C Final examination incl. preparation	**Total**
L	Lecture	20	20			**40**
T	Tutorial	10	40			**50**
	Total	**30**	**60**			**90**

Module examination	Prerequisite(s)	90% of exercise sheets have to be submitted
	Method(s) of assessment (duration)	Assessment of exercise sheets
	Formation of the module mark	Average grade of exercise sheets (100%)
	Retake examination	Oral examination (30 min.)
Frequency		Annual Duration 1 semester Summer semester
Intake capacity		30
Language of instruction		German / English

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M-BS2-MAS - Modern Aspects of Bioinformatics and Systems Biology					**2nd sem.**	**3 CP**
Module description	Modern Aspects of Bioinformatics and Systems Biology					
Module code	M-BS2-MAS					
Faculty/Subject/Department	07 – 11 (JLU), 06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/2					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites						
Learning outcomes	The students should • acquire an initial overview of the research areas of the relevant working groups • identify possible areas of interest for semesters 3 and 4 • establish contacts with the respective working group leaders • develop a profile of their 2nd year of study • select a supervisor for the 2nd year of study					
Module content	• Working groups of JLU and THM present their current research in the fields of bioinformatics and systems biology • Possible topics for the research preparation semester (3rd semester) and the master thesis are presented with examples from previous semesters • New research topics are introduced.					
Form(s) of instruction	Lectures (100%)					
Workload in hours	Workload total	90 hours = 3 ECTS credits				
	Course type and title	A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
	P Lecture	40	40	10		**90**
	Total	**40**	**40**	**10**		**90**
Module examination	Examination requirements	None				
	Method(s) of assessment (duration)	Supervisor for the 2nd year of study must be selected				
	Contribution to the final mark	The module is graded				
	Module retake examination	Supervisor for the 2nd year of study must be selected				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS3-LP1 - Laboratory Rotation 1					**3rd Sem.**	**6 CP**
Module description	Laboratory Rotation 1					
Module code	M-BS3-LP1					
Faculty/Subject/Department	07-11 (JLU), 06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	M-BS2-MAS					
Learning outcomes	The students will • acquire specific, research-oriented laboratory skills • learn to establish co-operation contacts • be able to quickly start working with new concepts and approaches in bioinformatics/systems biology • be able to plan and implement a project • become familiar with new, interdisciplinary working methods • acquire communication and presentation skills					
Module content	Practical work in a new laboratory environment • Training in modern laboratory techniques • Collaboration in work processes and specific technologies • Quality assurance and workplace safety • Demonstration training to third parties					
Form(s) of instruction	All-day scientific work (100%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits				
	Course type and title	A Formal instruction		B Auto-nomous work	C Final examination incl. pre-paration	**Total**
		a Contact hours	b Pre-paration/ revision			
	I Laboratory work placement	120	40			**160**
	Presentation				20	**20**
	Total	**120**	**40**		**20**	**180**
Module examination	Examination requirements	Regular participation (120 h), submission of lab notebook/specifications				
	Method(s) of assessment (duration)	Presentation				
	Contribution to the final mark	Presentation (100%)				
	Module retake examination	Presentation				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS3-LP2 - Laboratory Rotation 2					**3rd sem.**	**6 CP**
Module description	Laboratory Rotation 2					
Module code	M-BS3-LP2					
Faculty/Subject/Department	07-11 (JLU), 06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	M-BS2-MAS					
Learning outcomes	The students will • acquire specific, research-oriented laboratory skills • learn to establish co-operation contacts • be able to quickly start working with new concepts and approaches in bioinformatics/systems biology • be able to plan and implement a project • become familiar with new, interdisciplinary working methods • acquire communication and presentation skills					
Module content	Practical work in a new laboratory environment • Training in modern laboratory techniques • Collaboration in work processes and specific technologies • Quality assurance and workplace safety • Demonstration training to third parties					
Form(s) of instruction	All-day scientific work (100%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits				
	Course type and title	A Formal instruction		B Auto-nomous work	C Final examination incl. pre-paration	**Total**
		a Contact hours	b Pre-paration/ revision			
	I Laboratory work placement	120	40			**160**
	Presentation				20	**20**
	Total	**120**	**40**		**20**	**180**
Module examination	Examination requirements	Regular participation (120 h), submission of lab notebook/specifications				
	Method(s) of assessment (duration)	Presentation				
	Contribution to the final mark	Presentation (100%)				
	Module retake examination	Presentation				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS3-BP - Work Placement					**3rd sem.**	**6 CP**
Module description	Work Placement					
Module code	M-BS3-BP					
Faculty/Subject/Department	07-11 (JLU), 06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	Approval of the Board of Examiners has been given (replaces M-BS-LP2)					
Learning outcomes	The students will • have a sound knowledge of the job descriptions and requirements • be able to apply for a career field placement (in writing and orally) • have in-depth knowledge of the application of the technical knowledge acquired in the different operating processes • do practical work experience in a typical field of activity • be able to collaborate in the practical processes of the company/authority/institution • experience the specific conditions of the career fields • be familiar with the professional, organizational, and social structures of the different levels of the company/authority/institution • acquire teamwork skills • establish contacts with potential activity fields • be able to evaluate, document and then present their experiences with confidence • be able to answer and discuss questions about the operating procedures adequately • be able inform other students about the activities in the visited professional field						
Module content	• Career research/career fields in research and education, industry, government and media • Requirements of the labour market for academics • "How do I apply?" • Effective planning of work-flows • Participation in work-flows and special technologies of the company, authority or institution • Quality assurance and marketing of biological, biomedical or pharmacological products • Data protection and patent law • Training for interviews • Evaluation of the survey					
Form(s) of instruction	Laboratory work placement (100%)					
Workload in hours	Workload total	180 hours = 6 ECTS credits				
	Course type and title	A Formal instruction		B Autonomous work	C Final examination incl. preparation	**Total**
		a Contact hours	b Preparation/ revision			
	I Laboratory work placement	150	20			**160**
	R Report				10	**20**
	Total	**150**	**20**		**10**	**180**
Module	Examination requirements	Regular participation (150 h)				
	Method(s) of assessment (duration)	Report				
	Contribution to the final mark	The module is evaluated				
	Module retake examination	Report				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS3-BP1 - Extended Work Placement	**3rd sem.**	**12 CP**

Module description	Extended Work Placement
Module code	M-BS3-BP1
Faculty/Subject/Department	07-11 (JLU), 06 (THM)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3
Module co-ordinator	Chairperson of Examinations Board
Lecturers	Cf. German Version
Prerequisites	Cf. German Version

Learning outcomes

The students will

- have a sound knowledge of the job descriptions and requirements
- be able to apply for a career field placement (in writing and orally)
- have in-depth knowledge of the application of the technical knowledge acquired in the different operating processes
- do practical work experience in a typical field of activity
- be able to collaborate in the practical processes of the company/authority/institution
- experience the specific conditions of the career fields
- be familiar with the professional, organizational, and social structures of the different levels of the company/authority/institution
- acquire teamwork skills
- establish contacts with potential activity fields
- be able to evaluate, document and then present their experiences with confidence
- be able to answer and discuss questions about the operating procedures adequately
- be able to inform other students about the activities in the professional field visited

Module content

- Career research/career fields in research and education, industry, government and media
- Requirements of the labour market for academics
- "How do I apply?"
- Effective planning of work-flows
- Participation in work-flows and special technologies of the company, authority or institution
- Quality assurance and marketing of biological, biomedical or pharmacological products
- Data protection and patent law
- Training for interviews
- Evaluation of the survey

Form(s) of instruction	Laboratory work placement (100%)
Workload total	360 hours = 12 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
I	Laboratory work placement	320	20			**340**
R	Report			10		**10**
P	Presentation			10		**10**
	Total	**320**	**20**	**20**		**360**

Module

Examination requirements	Regular participation (300 h)
Method(s) of assessment (duration)	Presentation
Contribution to the final mark	Presentation (100%)
Module retake examination	Presentation

Frequency	Annual	Duration 1 semester	Winter semester
Intake capacity	30		
Language of instruction	German/English		

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M-BS3-PP - Scientific Project Work						**3rd sem.**	**6 CP**
Module description	Scientific Project Work						
Module code	M-BS3-PP						
Faculty/Subject/Department	07-11 (JLU), 06 (THM)						
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3						
Module coordinator	Cf. German Version						
Lecturers	Cf. German Version						
Prerequisites	M-BS2-MAS						
Learning outcomes	The students will • be able, when involved in a research project under guidance, to perform complex experiments independently • be able to summarise, classify and discuss results in writing in the form of a scientific publication • be familiar with the concept of troubleshooting • acquire team skills						
Module content	Introduction to the literature • Preparation of a work plan • Development of measurement and evaluation methods • Implementation and evaluation of experiments • Written and oral presentation of the project work						
Form(s) of instruction	Full-day instruction in scientific work in a scientific team						
Workload in hours	Workload total	180 hours = 6 ECTS credits					
	Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
	I	Laboratory work placement	120	40			**160**
	R	Report				20	**20**
		Total	**120**	**40**		**20**	**180**
Module	Examination requirements	Regular participation (120 h)					
	Method(s) of assessment (duration)	Final report					
	Contribution to the final mark	The module is evaluated					
	Module retake examination	Final report					
Frequency	Annual	Duration 1 semester	Winter semester				
Intake capacity	30						
Language of instruction	German/English						

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M-BS3-ISW - Introduction to Scientific Work and Thesis Preparation	**3rd sem.**	**6 CP**

Module description	Introduction to Scientific Work and Thesis Preparation
Module code	M-BS3-ISW
Faculty/Subject/Department	06 (THM), 07-11 (JLU)
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3
Module coordinator	Cf. German Version
Lecturers	Cf. German Version
Prerequisites	M-BS3-PP

Learning outcomes

The students should become familiar with the practical and conceptual components of planning scientific projects and writing project proposals and scientific papers, i.e. they will

- be familiar with hypothesis-driven scientific work
- be able to plan research projects conceptually
- be able to communicate concepts, methods and results of research in bioinformatics and systems biology in an interdisciplinary framework
- possess routines for the targeted development of co-operations
- develop an ability to judge their own and others' work critically
- be experienced in dealing with literature in English and will be able to communicate scientific aspects in English
- possess a high cognitive competence (contextual thinking, logical and abstract thinking, conceptual thinking),
- develop an ethical judgement relative to scientific work

Module content

- Overview of scientific writing, structure of scientific publications
- Conducting searches in relevant literature and databases
- Selection of target journals for publication, *impact factors*, *peer review*
- Planning of an individual Master's thesis dissertation
- Writing and defending of a fictitious research proposal to the German Research Foundation
- Scientific ethics

Form(s) of instruction	Lectures (23%), tutorials (54%), colloquia (23%)
Workload total	180 hours = 6 ECTS credits

Workload in hours

Course type and title		A Formal instruction: a Contact hours	A Formal instruction: b Preparation/ revision	B Autonomous work	C Final examination incl. preparation	**Total**
P	Lecture	15	15			**30**
P	Tutorial	35	75			**110**
E	Colloquium	15	15			**30**
P	Presentation				10	**10**
	Total	**65**	**105**		**10**	**180**

Module

Examination requirements	None
Method(s) of assessment (duration)	Written research application, presentation
Contribution to the final mark	Written research application (50%), presentation (50%)
Module retake examination	Oral examination (30 - 45 min.)

Frequency	Annual	Duration 4 weeks	Winter semester
Intake capacity	30		
Language of instruction	German/English		
Additional information	Module advice and literature: see semester notice board/Dates: see course catalogue		

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M-BS3-SS1 - Special Seminar 1					**3rd sem.**	**3 CP**
Module description	Special Seminar 1					
Module code	M-BS3-SS1					
Faculty/Subject/Department	07-11 (JLU), 06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3					
Module coordinator	'Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	See individually agreed syllabi					
Learning outcomes	The students will • gain insight into researching and developing current research topics • be able to search for and understand scientific publications on a topic (literature search) • be able to reproduce a scientific paper in a presentation.					
Module content	• Current topics from a research area of bioinformatics or systems biology • Preparation of a presentation on a current topic (e.g. literature presentation)					
Form(s) of instruction	Seminar (100%)					
Workload in hours	Workload total	90 hours = 3 ECTS credits				
	Course type and title	A Formal instruction: a Contact hours	A Formal instruction: b Preparation/ revision	B Autonomous work	C Final examination incl. preparation	**Total**
	S Seminars	30	30			**60**
	P Presentation				30	**30**
	Total	**30**	**30**		**30**	**90**
Module	Examination requirements	Regular participation (80%)				
	Method(s) of assessment (duration)	Presentation				
	Contribution to the final mark	Presentation (100%)				
	Module retake examination	Presentation				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

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M-BS3-SS2 - Special Seminar 2					**3rd sem.**	**3 CP**
Module description	Special Seminar 2					
Module code	M-BS3-SS2					
Faculty/Subject/Department	07-11 (JLU), 06 (THM)					
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/3					
Module coordinator	Cf. German Version					
Lecturers	Cf. German Version					
Prerequisites	See individually agreed syllabi					
Learning outcomes	The students will • gain insight into researching and developing current research topics • be able to search for and understand scientific publications on a topic (literature search) • be able to reproduce a scientific paper in a presentation.					
Module content	• Current topics from a research area of bioinformatics or systems biology • Preparation of a presentation on a current topic (e.g. literature presentation)					
Form(s) of instruction	Seminars					
Workload in hours	Workload total	180 hours = 3 ECTS credits				
	Course type and title	A Formal instruction		B Autonomous work	C Final examination incl. preparation	**Total**
		a Contact hours	b Preparation/ revision			
	S Seminars	30	30			**60**
	P Presentation				30	**30**
	Total	**30**	**30**		**30**	**90**
Module	Examination requirements	Regular participation (80%)				
	Method(s) of assessment (duration)	Presentation				
	Contribution to the final mark	Presentation (100%)				
	Module retake examination	Presentation				
Frequency	Annual	Duration 1 semester	Winter semester			
Intake capacity	30					
Language of instruction	German/English					

M-BS4-THE - Master Thesis		**4th sem.**	**30 CP**
Module description	Master Thesis		
Module code	M-BS4-THE		
Faculty/Subject/Department	07-11 (JLU), 06 (THM)		
Associated degree course/Semester taken	M.Sc. Bioinformatics and Systems Biology/4		
Module coordinator	Cf. German Version		
Lecturers	Cf. German Version		
Prerequisites	All modules of semesters 1-3 successfully completed (see SpeZo §5)		

Learning outcomes

The students will
- be able to process and present scientific questions independently
- be able to plan and implement projects independently
- be familiar with the most important theoretical background information and publications in their subject area
- know the rules of good scientific work

Module content

For the Master thesis, a current bioinformatics topic is processed within a working group of a university/applied science university teacher.
This includes
- the planning of the master thesis
- the learning of subject-specific methods
- the interpretation of the results
- search of the literature
- critical discussion of the results in the context of current research results
- documentation and presentation of the results
- preparation of the Master Thesis

Form(s) of instruction	All-day scientific work/seminar
Workload total	900 hours = 30 ECTS credits

Workload in hours

Course type and title	A Formal instruction: a Contact hours	A Formal instruction: b Pre-paration/ revision	B Auto-nomous work	C Final examination incl. pre-paration	**Total**
Scientific work	380	160	280		**820**
Seminars	20	20			**40**
Presentation				20	**20**
Defence				20	**20**
Total	**400**	**180**	**280**	**40**	**900**

Module testing

Examination requirements	Seminar presentation
Method(s) of assessment (duration)	Master thesis/defence
Contribution to the final mark	Master thesis (70%), defence (30%)
Module retake examination	See the general provisions of JLU §34 para. 2

Frequency	Annual	Duration 1 semester	Summer semester
Intake capacity	30		
Language of instruction	German/English		