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M-BS1-MATB - Fundamental Calculus and Statistics B.		
M-BS1-INF - Introduction to Computer Science		
M-BS1-BIO- Fundamentals in Biology		
M-BS1-ES - Introduction to Core Areas of the Master's Degree Course		
M-BS1-ZQ1 - Additional Qualification 1		ð
M-BS1-ZQTA - Statistical Models for Bioinformatics and Systems Biology		
M-BS1-ZQ1u2B - Object-Oriented Programming		
M-BS1-ZQ102C - Special Course on Computer Science.		
M-BS1-ZQ1D - Design of Small Molecule Drugs		
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M-BS1-ZQZA - Methods in Biology		
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M-BS2-SIA - Bioinformatics Algorithms Part 1		
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M-BS2-S2A - Molecular Systems Biology Part 1	,	
M-BS2-S2B - Molecular Systems Biology Part 2		
M-BS2-S3A - Theoretical Basics of Modelling.		
M-BS2-S3B - Applied Modelling of Complex Biological Processes and Systems		
M-BS2-S4A - Analysis of High-Throughput Data Part 1	,	
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M-B	S1-MAT - Fundamental Calculus	and Statistics	1 st s	em.	6 CP			
Mod	ule description	Fundamental	Calculus and Statist	tics				
Mod	ule code	M-BS1-MAT						
Facu	lty/Subject/Department	06 (THM)						
Asso	ciated degree	M.Sc. Bioinform	matics and Systems	Biology/1				
cour	se/Semester taken							
Mod	ule coordinator	Cf. German Ve	rsion					
Lecti	urers	Cf. German Ve	rsion					
Prer	equisites	See individual	y agreed syllabi					
Learning	Module core for two parallel	courses; division	based on an ungra	ded admissi	on test.			
Module								
Form	n(s) of instruction	Seminars (40%	eminars (40%), tutorials (60%)					
ad in hours	Workload total	180 hours = 6 ECTS credits						
	Course type and title	A Formal in a Contact hours	A Formal instruction B b Pre-n a Contact paration/ W		C Final examination incl. pre- paration	Total		
kloa	S Seminars	18	46			160		
Vor	P Tutorials	27	69					
	E Written examination	27	00		20	20		
	Total	45	115		20	100		
		45 Submission of			20	100		
ninatio	Method(s) of assessment (duration)	Written exami	nation (120 min.)					
lle exai	Contribution to the final mark	Written exami	nation (100%)					
Modu	Module retake examination	Written exami	nation (120 min.)					
Freq	uency	Annual	Duration 1	semester	Winter semes	ter		
Intal	ke capacity	30						
Lang	uage of instruction	German						

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M-B	S1-MATA - Fundamental Calcul	us and Statistics	A		1 st se	em.	6 CP			
Mod	ule description	Fundamental Calculus and Statistics A								
Mod	ule code	M-BS1-MATA								
Facu	lty/Subject/Department	06 (THM)	06 (THM)							
Asso	ciated degree	M.Sc. Bioinform	M.Sc. Bioinformatics and Systems Biology/1							
cour	se/Semester taken									
Mod	ule coordinator	Cf. German Ve	rsion							
Lect	urers	Cf. German Ve	Cf. German Version							
Prer	equisites	See individuall	See individually agreed syllabi							
	The students will know the bas	sic concepts in th	e following areas a	nd will acqui	ire advanced th	eoretic	al and			
es	methodological knowledge in a	at least two of th	e topic areas listed	below depe	nding on the sp	ecific p	ore-			
ш	qualification in a subject area	4								
utc	 Discrete mathematics 	5								
08	Real analysis									
nin	 Linear algebra 									
ear	 Simple ordinary differ 	ential equations								
	Descriptive statistics									
	Inferential statistics									
	Differentiation, and integration of real functions									
Ţ	Simple ordinary differential equations									
ten	Interential statistics, hypothesis testing, ANOVA, LM, GLM									
con										
le	Additional options									
lodu	 Graphs, especially tre 	es								
Σ	 Wiatrices, determinan Concernational deservations 	ts, linear equation	on systems, eigenva	liues and eig	envectors	-l				
	variables, specific distributions									
Forn	(s) of instruction	Seminars (40%) tutorials (60%)							
	Workload total	180 hours = 6	ECTS credits							
S		A Formal in	struction	B Auto-	C Final					
no			h Dro-	nomous	examination					
h	Course type and title	a Contact	naration/	work	incl. pre-					
i p		hours	revision		paration	Tota	1			
kloa	S Seminars	19	16			160				
Vorl		27	40 60			100				
5	F Tutorials	21	09		20	20				
		45	445		20	20				
		45	115		20	180				
tiol	Examination requirements	Submission of	exercise sheets							
ina	(duration)	whiten exami	nation (120 min.)							
άm	Contribution to the final mark	Written evami	nation (100%)							
e e)		WITCEIT EXAIIII								
npc	Module retake examination	Written exami	nation (120 min.)							
й										
Freq	uency	Annual	Duration 1	semester	Winter semest	er				
Intal	ke capacity	30								
Lang	uage of instruction	German								

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M-B	S1-MATB - Fundamental Calculu	s and Statistics	В		1 st se	em.	6 CP		
Mod	ule description	Fundamental Calculus and Statistics B							
Mod	ule code	M-BS1-MATB							
Fault	:/Subject/Department	06 (THM)							
Asso	ciated degree	M.Sc. Bioinformatics and Systems Biology/1							
cour	se/Semester taken								
Mod	ule co-ordinator	Cf. German Version							
Lectu	urers	Cf. German Version							
Prere	equisites	See individually agreed syllabi							
Module content Learning outcomes	 The students will know the basic concepts in the following aleas and acquire advant methodological knowledge in at least two of the areas listed below depending on the qualification in a subject area B Discrete mathematics Real analysis Linear algebra Simple ordinary differential equations Descriptive statistics Inferential statistics 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 eigenve General and descriptive statistics, probability calculation, conditional prob variables, specific distributions 						nd		
Form	(s) of instruction	Seminars (40%), tutorials (60%)						
	Workload total	180 hours = 6 l	CTS credits						
ad in hours	Course type and title	A Formal ir a Contact hours	struction b Pre- paration/ revision	B Auto- nomous work	C Final examination incl. pre- paration	Tota			
klo	S Seminars	18	46			160			
Nor	P Tutorials	27	69			-			
	E Written examination				20	20			
	Total	45	115		20	180			
Ę	Examination requirements	Submission of	evercise sheets		20	100			
minatic	Method(s) of assessment (duration)	Written exami	nation (120 min.)						
ule exa	Contribution to the final mark	Written exami	nation (100%)						
Modi	Module retake examination	Written exami	nation (120 min.)						
Freq	uency	Annual	Duration 1	semester	Winter semest	ter			
Intak	e capacity	30 Correct							
Inpo W Frea	Module retake examination	Written exami	nation (120 min.) Duration 1	semester	Winter semest	er			
Intak	e capacity	30							
Lang	uage of instruction	German							

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M-B	S1-INF - Introduction to Computer	Science			1 st ser	n.	6 CP				
Mod	dule description	Introduction to Computer Science									
Mod	dule code	M-BS1-INF	•								
Facu	ulty/Subject/Department	06 (THM)/07 (JLU)									
Asso	ociated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/1									
take	n										
Mod	dule coordinator	Cf. German V	Cf. German Version								
Lect	urers	Cf. German Version									
Prer	equisites	See individua	ally agreed syllabi								
Learning outcomes	 The students will understand algo meaningfully select and im estimate and optimise per The students will understand the simple data models and will have 	prithms and str aplement basic formance para concepts of da a mastery of t	ructures of comput c data structures an ameters of algorith atabase manageme the basics of the sta	er science. They wil d algorithms ms ent systems, will be andard database lar	l be be ab able to de nguage SQ	evelo L.	р				
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) 										
Forr	n(s) of instruction	Seminars (50)%)/tutorials (50%)								
	Workload total180 hours = 6 ECTS credits										
ours		A Formal in	struction b Pre-	B Auto- C Fina nomous exam	al ination						
ad in h	Course type and title	a Contact hours	paration/ revision	work incl. parat	ore- ion	Tota	al				
klo	L Lecture	20	60			80					
Nor	P Tutorial	20	60			80					
-	O Oral examination	-		20		20					
	Total	40	120	20		180					
Ľ	Examination requirements	Submission	of exercise sheets	20		100					
ninatio	Method(s) of assessment (duration)	Oral examina	ation (30 - 45 min.)								
ile exai	Contribution to the final mark	Oral examina	ation (100%)								
Modu	Module retake examination	Oral examina	ation (30 - 45 min.)								
Frec	quency	Annual	Duratio	n 1 semester Wi	nter seme	ester					
Inta	ke capacity	30									
Lang	guage of instruction	German									

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M-B	S1-BIO- Fundamentals in Biology					1 st sem.	6 CP	
Мос	lule description	Fundamentals in Biology						
Мос	lule code	M-BS1-BI	0					
Facu	Ilty/Subject/Department	08 (JLU)						
Asso	ciated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/1						
take	n							
Mod	lule coordinator	Cf. German Version						
Lect	urers	Ct. Germa	an Version	L :				
Prer	equisites	See indivi	dually agreed sylla					
Learning outcomes	 The students should become familia Biology they will gain insight into the they will develop a deeper they will become familiar was they will discuss new scient they will learn the scientific they will have a mastery of results truthfully 	ne different understand vith the bas tific interrel cally correct the "hypot	levels of organisat ling of structure-fu ic principles of (mo ationships in an inf description and in hetical-deductive a	iciples of Biom ion in biology nction relation plecular) evolut terdisciplinary iterpretation o approach" and	ships ion context f basic k will be a	cs and Syste biological pr able to inte	ems rocesses rpret	
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 Dialogical patworks, best pageits interactions 							
Forr	n(s) of instruction	Lectures	36%), tutorials (55	%), colloguia (9	9%)			
	Workload total	180 hours	s = 6 ECTS credits	<i>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</i>				
in hours	Course type and title	A Formal in a Contact hours	struction b Pre- paration/	B Auto- nomous work	C Final examin incl. pre paratio	ation 2- n Tot		
ad		20	20		1	50	Lai	
rklo		20	50			50		
No		50 F	15			90		
	C Colloquium	5	15		20	20		
					20	20		
		55	105		20	180)	
odule examinatior	Examination requirements Method(s) of assessment (duration) Contribution to the final mark Module retake examination	None Presentat Presentat Oral exan	ion, oral examinati ion (20%), oral exa nination (30 - 45 m	ion (30 - 45 mir mination (80% in.)	n.))			
Ĕ								
Frec	uency	Annual	Duratio	on 1 semester	Wint	er semeste	r	
Inta	ke capacity	30						
Lang	guage of instruction	German						

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Module description Introduction to Core Areas of the Master's Degree Course Module code M-BS1-ES Faculty/Subject/Department 06 (THM), 07 – 11 (ILU) Associated degree M.S. Bioinformatics and Systems Biology/1 Course/Semester taken C. German Version Lecturers C. German Version Prerequisites See individually agreed syllabi The students should • onderstand simple algorithms in bioinformatics and be able to apply them in practical examples • be able to use bioinformatics tools in the ubulic domain and programme software tools • ear overview of the basic procedures and terminology of molecular systems biology • using selected examples from various fields, gain insight into various issues of 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 a and simuluk. • posses a basic knowledge of accruing data, its statistical analysis and evaluation • overview of simple algorithms in bioinformatics and the applications in scientific problems and be familiar with the technical basic • have basic knowledge of accruing data, its statistical analysis and evaluation • overview of simple algorithms in bioinformatics of proceed and global sequence alignment, FASTA, BLAST, simple algorithms to inoinformatics (S	M-B	S1-ES - Introduction to Core	Areas of the Master's Degree Course		1 st sem.	12 CP					
Module code M-B31-E5 Faculty/Subject/Department 06 (THMI), 07 – 11 (LU) Associated degree M.Sc. Bioinformatics and Systems Biology/1 Course/Stemester taken M.Sc. Bioinformatics and Systems Biology/1 Module coordinator Cf. German Version Prerequisites See individually agreed syllabi The students should • understand simple algorithms in bioinformatics and be able to apply them in practical examples • understand simple algorithms in bioinformatics and be able to apply them in practical examples • understand simple algorithms in bioinformatics and be able to apply them in practical examples. • 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 modelling, and the mathematical foundations of modeling. • using selected examples from various fields, gain insight into various issues of modelling, and be able to implement single models in R and Simulan. • using selected examples from various fields, gain insight into various issues of modelling, and be able to implement single algorithms in bioinformatics and their applications in scientific problems and be able to implement single from various fields, gain insight into various issues of modelling, and be able to implement single algorithms for philogeny, and socium; • posses a basic knowledge of accruing data, its statistical analysis, and evaluation • Overview of fisherbory, a	Mod	lule description	Introduction to Core Areas of the Master's Degree	Course	•	•					
Faculty/Subject/Department 06 (THM), 07 – 11 (LU) Associated degre M.Sc. Bioinformatics and Systems Biology/1 Course/Semester taken Module coordinator Cf. German Version Ecturers Cf. German Version Ecturers Prerequisites See individually agreed syllabi 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 • usig selected examples from various fields, gain insight into various issues of modelling, and be able to implement simple models in R and Simulan. • posses 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 • Overview of simple algorithms in bioinformatics (scripting languages, special development environments for bioinformatics) • Overview of simple algorithms in biology, overview of the primary methods of protein analysis, transcriptome analysis, genomic analysis and metagenome analyse • Bave basic knowledge of accruing data.	Mod	lule code	M-BS1-ES								
Associated degree course/Semester taken M.Sc. Bioinformatics and Systems Biology/1 Module coordinator Cf. German Version Prerequisites See individually agreed syllabi The students should • inderstand simple algorithms in bioinformatics and be able to apply them in practical examples • be able to duel 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 • et 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 model of acruing data, its statistical analysis and evaluation • Diverview of simple algorithms in bioinformatics and their applications in scientific problems and be familiar with the technical basics • have basic knowledge of acruing data, its statistical analysis and evaluation • Overview of simple algorithms in bioinformatics and their applications (e.g. pairwise local and global sequence alignment, FASTA, BLAST, simple algorithms in biology, orviview of the primary methods of protein analysis, metabolome analysis, transcriptome analysis, genomic analysis and metagenome analyse • Basic concepts of modelling in systems biology	Facu	Ity/Subject/Department	06 (THM), 07 – 11 (JLU)								
Course/Semester taken Module coordinator Cf. German Version Intervent Cf. German Version Cf. German Version Prerequisites See individually agreed syllabi See individually agreed syllabi • 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 Set to deal efficiently with the most important platforms for the development of bioinformatics, metabolomics, and metagenomics. • 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 modelling, and the mathematical foundations of modelling and the mathematical foundations of modelling in with the technical basics • pet an overview of the basic procedures and terminology in modelling, and the mathematical foundations of modelling in sight into various issues of modelling, and be able to implement simple models in a and simuluk. • posses a basic knowledge of factruing data, its statistical analysis and evaluation • have basic knowledge of factruing data, its statistical analysis and evaluation • lower were of simple aignithms in bioinformatics and the mategenome analyse • Devrive of platforms tor software development in bioinformatics (scripting languages, special development envirous invites of modelling in systems biology, overview of the primary methods of protein analysis, metabolome analysis, stranscriptome analysis, anomation models, models for structure prediction, population m	Asso	ciated degree	M.Sc. Bioinformatics and Systems Biology/1								
Module coordinator Cf. German Version Lecturers Cf. German Version Prerequisites See individually agreed syllabi The students should • orderstand 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 • egt an overview of the basic procedures and terminology in modelling, and the mathematical foundations of modelling • egt an overview of the basic procedures and terminology in modelling, and the mathematical foundations of modelling • sing selected examples from various fields, gain insight into various issues of proteomics, materscriptomics, metabolomics and be familiar with the technical basics • lawe basic knowledge of high-throughput technologies and their applications in scientific problems and be familiar with the technical basics • lawe basic knowledge of nacruing data, its statistical analysis and evaluation • Overview of platforms for software development in bioinformatics (scripting languages, special development environments for bioinformatics • Overview of platforms for software development in bioinformatics (scripting languages, special development environments for bioinformatics • Overview of modelling in systems biology, orevision of examples for modelling from different subject areas (e.g. cellular, population genetic, ecological, interaction models of str	cour	se/Semester taken									
Lecturers Cf. German Version Prerequisites See individually agreed syllabi 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 agree bioinformatics tools in the public domain and programme software tools • get an overview of the basic procedures and terminology of molecular systems biology • e able to use bioinformatics tools in the public domain and programme software tools • get an overview of the basic procedures and terminology in modelling, and the mathematical foundations of modelling • get an overview of the basic procedures and terminology in modelling, and the able to implement simple models in R and Simuluk. • possess a basic knowledge of faigh-throughput technologies and their applications is scientific problems and be familiar with the technical basics • have basic knowledge of accruing data, its statistical analysis and evaluation • Overview of simple algorithms in bioinformatics of their applications (e.g. pairwise local and global sequence alignment, FATA, BLAT, simple algorithms for biology, overview of the primary methods of protein analysis, metabolome analysis, transcriptome analysis, genomic analysis and metagenome analyse • Basic concepts of modelling, systems biology, provision of examples for working in production to the technology and biology of high-throughput methods • Introduction to the technology a	Mod	lule coordinator	Cf. German Version								
Prerequisites See individually agreed syllabi The students should • understand simple algorithms in bioinformatics and be able to apply them in practical examples • be able to deal elficiently 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 • Overview of platforms for software development in bioinformatics (e.g. pairwise local and global sequence analysis, transcriptome analysis, genomic analysis and metagenome analyse. • Basic concepts of molecular systems biology, overview of the primary methods of protein analysis, metabolome analysis, orhigh eling in ystems biology, provision of examples for modelling from different subject areas (e.g. cellular, population genetic, ecological, interaction models, models for structure prediction, population models)	Lect	urers	Cf. German Version	German Version							
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 • sign selected examples from various fields, gain insight into various issues of modelling, and be able to implement simple models in R and Simuluk. • posses 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 • Overview of simple algorithms in bioinformatics and their applications (e.g. pairwise local and global sequence alignment, FASTA, BLAST, simple algorithms in public of modelling from different subject areas (e.g. cellular, population genetic, ecological, interaction models, models for structure prediction, population models, development in bioinformatics (scripting languages, special development environments for bioinformatics) • Basic concepts of modelling systems biology, provision of examples for modelling from different subject areas (e.g., cellular, population genetic, ecological, interaction models, models for stru	Prer	equisites	See individually agreed syllabi	ndividually agreed syllabi							
understand simple algorithms in bioinformatics and be able to apply them in practical examples understand simple algorithms in bioinformatics and metagenomics egt 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, metagenomics e or 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 fa dismutink. possess a basic knowledge of high-throughput technologies and their applications in scientific problems and be familiar with the technical basics overview of platforms for software development in bioinformatics (scripting languages, special development environments for bioinformatics) overview of platforms for software development in bioinformatics (scripting languages, special development environments for bioinformatics) e. 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 molecular systems biology of high-throughput methods introduction to biological systems analysed with high-throughput methods introduction to biological systems analysed with high-throughput methods introduction to biological systems analysed with high-throughput methods intro		The students should									
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. eget 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. overview of simple algorithms in bioinformatics and their applications in scientific problems and be familiar with the technical basics have basic knowledge of accruing data, its statistical analysis and evaluation Overview of simple algorithms for phylogeny, and scouting) Overview of platforms for software development in bioinformatics (scripting languages, special development ewironments for bioinformatics) Basic concepts of modelling in 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, cological, 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 the dendlarg analysed with high-throughput methods Introduction to the dendlarg analysed with high-throughput methods Introduction to the final 150 170 40 360 P Tutorial 75 85 1600 E written examination tequirements 50% of		 understand simple algorith 	ns in bioinformatics and be able to apply them in practic	al examples	5						
be able to use bioinformatics tools in the public domain and programme software tools equipment be able to use bioinformatics tools in the public domain and programme software tools using selected examples from various fields, gain insight into various issues of proteomics, transcriptomics, metabolomics and metagenomics equipment 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 Overview of platforms for software development in bioinformatics and their applications (e.g. pairwise local and global sequence alignment, FATA, BLAST, simple algorithms for phylogeny, and scouting) Overview of platforms for software development in bioinformatics and metagenome analyse. Basic concepts of modelling in 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) 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 dat formal soft high-throughput data based on selected examples - data collection, statistical methods and introduction to modelling of accruing dat formal soft high-throughput data based on selected examples - data collection, statistical methods and introduction to modelling of accruing dat formal soft high-thr		 be able to deal efficiently w 	ith the most important platforms for the development o	fbioinform	atics software	e, and					
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Intake capacity 30	Freq	uency	Annual Duration 1 semest	er Wint	er semester						
Language of instruction	Intal	ke capacity	30								
	Lang	uage of instruction	German								
	Lang	uage of instruction	German	German							

 Special Regulation for the Master Degree Programme Bioinformatics and Systems Biology
 7.36.08 No. 5

 Attachment 2: Module Descriptions
 Yes in 12, 2002

Version 1 of December 12, 2012

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes onl	у.
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M-BS	1-ZQ1 - Additional Qualifi	catio	1		1 st sem.	3 CP	
Modu	le description	Add	tional Qualification 1				
Modu	ile code	M-B	\$1-ZQ1				
Facult	ty/Subject/Department	07 –	11 (JLU), 06 (THM)				
Assoc	iated degree	M.S	. Bioinformatics and Systems Biology/1				
cours	e/Semester taken						
Modu	lle coordinator	Cf. G	erman Version				
Lectu	rers	Cf. C	erman Version				
Prere	quisites	See	ndividually 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 co	urses on off	fer		
.⊆	Workload total		90 hours = 3 ECTS credits				
Workload hours	See module descriptions	of th	e specific courses on offer				
ition	Examination requirements		See module descriptions of the specific co	urses on off	fer		
xamina	Method(s) of assessmen (duration)	t	See module descriptions of the specific co	urses on off	fer		
ule e	Contribution to the final m	ark	See module descriptions of the specific co	urses on off	fer		
Mod	Module retake examinati	on	See module descriptions of the specific co	urses on off	fer		
Frequ	ency		Annual Duration 1 semest	er Winter	r semester		
Intake	e capacity		30				
Language of instruction			German/English				

 Special Regulation for the Master Degree Programme Bioinformatics and Systems Biology
 7.36

 Attachment 2: Module Descriptions
 7.36

Version 1 of December 12, 2012

M-B	S1-ZQ1A - Statistical Models	for Bioinforma	atics and	Systems Bio	logy	1 st ser	n. 3 CP			
Mod	dule description	Statistical Mode	els for B	oinformatics	and Systems Bio	logy				
Mod	dule code	M-BS1-ZQ1A								
Facu	Ilty/Subject/Department (09 (JLU)								
Asso	ciated degree	M.Sc. Bioinform	natics an	d Systems Bio	ology/1					
cou	rse/Semester taken									
Mod	dule coordinator 0	Cf. German Ver	sion							
Lect	urers (Cf. German Version								
Prer	equisites S	See individually agreed syllabi								
Learning outcomes	The students will be able to package	apply statistica	il metho	ds to systems	s biology questio	ns using a softw	are			
	Foundations of Probabi	lity Calculation								
t	 Statistical tests 	tical tests								
Itel	Stochastic processes									
CO	Markov chains/hidden I	Markov models								
lule	 Models of sequence ev 									
100		Jution								
2	• Sequence analyses									
-	Ifee reconstruction		(500() /)							
Forr	n(s) of instruction									
		90 110013	- 5 ECT3	creats						
(0		A Forr	nal instr	uction	B Auto-	C Final				
Sinc					nomous	examination				
р Ч	Course type and title	a Cont	tact r	paration/	work	incl. pre-				
i be		hours	r	evision		paration	Total			
klo	L Lecture	20	2	20			40			
Vor	P Tutorial	20	2	20			40			
_	E Written examination			-		10	10			
	Total	40	4	10		10	90			
L	Examination requirements	None		-		-				
atic	Method(s) of assessment	Written e	xaminat	ion (90 min.),	tutorial assignm	nents				
min	(duration)			<i>、 "</i>	0					
le exai	Contribution to the final mark	Written e	xaminat	ion (50%), tut	orial assignmen	ts (50%)				
Modu	Module retake examination	Written e	xaminat	ion (90 min.)						
Frec	Juency	Annual		Durat	tion 1 semester	Winter seme	ster			
Inta	ke capacity	30								
Lang	guage of instruction	German/E	nglish							

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M-B	S1-ZQ1u2B - Object-Oriented Progra	mming			1 st sem	. 6 CP			
Mod	lule description	Object-Oriented Programming							
Мос	lule code	M-BS1-ZQ	1u2B						
Facu	<pre>ilty/Subject/Department</pre>	FB 06 (THN	/I), 07 (JLU)						
Asso	ciated degree course/Semester	M.Sc. Bioir	nformatics and Syste	ms Biology/1					
take	'n	-							
Mod	lule coordinator	Cf. Germar	n Version						
Lect	urers	Ct. German Version							
Prer	equisites	See individually agreed syllabi							
Learning outcomes	 The students should: be able to develop small to programming language wit engineering principles verify the correctness of the statement of the state	e medium size h a simple gr eir solution i	ed object-based prog raphical user interfac n systematic tests	grams in a mo ce and in com	odern object-or pliance with sc	iented ftware			
 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 									
Forr	n(s) of instruction	Seminars (50%)/tutorials (50%))					
	Workload total	180 hours	= 6 ECTS credits						
S		A Formal in	struction	B Auto-	C Final				
ad in hour	Course type and title	a Contact hours	b Pre- paration/ revision	nomous work	examination incl. pre- paration	Total			
rklo	L Lecture	20	60			80			
٨٥	P Tutorial	20	60			80			
	E Written examination				20	20			
	Total	40	120		20	180			
	Examination requirements	Submission	of exercise sheets t	o he graded					
	Method(s) of assessment	Written ex	amination (90 min.)						
lule	(duration)		, , , , , , , , , , , , , , , , , , ,						
Moc	Contribution to the final mark	Written ex	amination (80%), tut	torial assignm	ents (20%)				
	Module retake examination	Oral exami	ination (30 - 45 min.))					
Frec	uency	Annual	Duration	1 semester	Winter semes	ster			
Inta	ke capacity	30							
Lang	guage of instruction	German/E	nglish						

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Pleas	e note that only the German version of the	modules is official and legally b	inding. The English version is	for informative purpo	ses only.	
M-B	S1-ZQ1u2C - Special Course on C	omputer Science		1 st se	em. 6 CP	,
Mod	ule description	Special Course on Com	puter Science		•	
Mod	ule code	M-BS1-ZQ1u2C				
Facu	lty/Subject/Department	06 (THM)/07 (JLU)				
Asso	ciated degree	M.Sc. Bioinformatics an	nd Systems Biology/1			
cour	se/Semester taken	M.Sc. Mathematics/1 -	- 4			
		L3 Computer science/5	-8			
Mod	ule coordinator	Cf. German Version				
Lectu	urers	Cf. German Version				
Prere	equisites	See individually agreed	syllab			
Module content Learning outcome	 Students should expand the knowledge of the relative value ability to classify problem knowledge of the relation understanding of the analysis providing the basis for the preproviding the basis for t	ty theory, algorithms, etc. The following learning outcomes should be taught: ing of an (algorithmic) problem and its solution methods oblems regarding different cost dimensions elationships between machine models and cost dimensions he basic concepts and methods of computability, complexity and/or algorithm reparation of a Master's dissertation science, e.g. computability, complexity theory, algorithms, etc. These include hputation (Turing machine, circuits, etc.) and cost dimensions (time, space, ates, etc.) Non-decidability and rec. enumerability fundamental structural relationships between computability and complexity oblem. ad applications (not complete): computability theory, arithmetic hierarchy, , polynomial hierarchy, lower and upper bounds, functional problems, heir approximation, Kolmogorov complexity, complexity-theoretic r, algorithmic problems, basic algorithms (searching, sorting , etc.), algorithm Seminars (75%)/tutorials (25%)				
Form	allarysis	Sominars (7E%)/tutoria	lc (25%)			_
2 1011	Workload total	180 hours - 6 ECTS creater	dite			_
ηοι		100 110013 - 0 2013 010				—
examination Workload in hours of the seamination workload in hours of the seaminatin workload in hours of the seamination		A Formal instruction	n BAuto-	C Final		-
Workload	Course type and title	a Contact hours revisio	nomous non/ work	examination incl. pre- paration	Total	_
	L Lecture	45 45			90	
	P Tutorial	15 45			60	
	O Oral examination			30	30	
	Total	60 90		30	180	
ion	Examination requirements	None				_
minati	Method(s) of assessment (duration)	Oral examination (30 -	45 min.)			
lle exa	Contribution to the final mark	Oral examination (1009	%)			
Modu	Module retake examination	Oral examination (30 -	45 min.)			-
Freq	uency	Annual	Duration 1 semester	Winter semest	er	
Intak	ke capacity	30				
Lang	uage of instruction	German				

M-B	S1-ZQ1D - Design of Small Molecule	Drugs				1 ^s	sem.	3 CP	
Mod	lule description	Design of	f Small Mole	cule Dru	ıgs			1	
Mod	lule code	M-BS1-Z	Q1D						
Facu	Ilty/Subject/Department	06 (THM))						
Asso	ciated degree course/Semester	M.Sc. Bio	M.Sc. Bioinformatics and Systems Biology/1						
take	n			_					
Mod	lule co-ordinator	Cf. Germ	an Version						
Lect	urers	Cf. Germ	an Version						
Prer	equisites	See individually agreed syllabi							
Learning outcomes	After successful completion of the of drug design. They will be familian drug design.	module, the	e students si nportant alg	hould ha	ave an overv and metho	/iew of the m ds and can ap	odern n oply thei	nethods m in	
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 								
Forn	n(s) of instruction	Seminars	s (50%)/tuto	rials (50	%)				
	Workload total	90 hours	= 3 ECTS cre	edits					
		A Formal in	A Formal instruction B A		B Auto-	C Final			
d in hours	Course type and title	a Contact hours	b Pre- paration/ revision		nomous work	examinatic incl. pre- paration	n [–] Tot	al	
cload	L Lecture	20	20				40		
Vork	P Tutorial	20	20				40		
>	E Written examination					10	10		
	Total	40	40			10	90		
_	Examination requirements	Submissi	on of exercis	se sheet	S				
ninatior	Method(s) of assessment (duration)	Oral exar	nination (30	- 45 mii	n.)				
ule exar	Contribution to the final mark	Written e	examination	(100%)					
Modu	Module retake examination	Oral exar	nination (30	- 45 mii	n.)				
Freq	uency	Annual		Duratio	n 1 semeste	er Winters	emeste	r	
Intal	ke capacity	30							
Lang	guage 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.

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M-B	S1-ZQ2 - Additional Qualificatio	n 2 1 st sem. 3 CP								
Mod	ule description	Additional Qualification 2								
Mod	ule code	M-BS1-ZQ2								
Facu	lty/Subject/Department	07 – 11 (JLU), 06 (THM)								
Asso	ciated degree	M.Sc. Bioinformatics and Systems Biology/1								
cour	se/Semester taken									
Mod	ule coordinator	Cf. German Version								
Lect	urers	Cf. German Version								
Prer	equisites	See individually agreed syllabi								
Learning outcomes	See module o	descriptions of the specific courses on offer								
Module content	See module descriptions of the specific courses on offer									
Forn	n(s) of instruction	See module descriptions of the specific courses on offer								
L	Workload total	90 hours = 3 ECTS credits								
Workload i	See module descriptions of the	e specific courses on offer								
	Examination requirements	See module descriptions of the specific courses on offer								
dule	Method(s) of assessment (duration)	See module descriptions of the specific courses on offer								
Mo	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								
Freq	uency	Annual Duration 1 semester Winter semester								
Intal	ke capacity	30								
Lang	uage of instruction	German/English								

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M-B	S1-ZQ2A - Methods in Biology				1 st sem.	3 CP		
Mod	lule description	Methods	in Biology		·	•		
Mod	lule code	M-BS1-ZC	2A					
Facu	<pre>ilty/Subject/Department</pre>	08 (JLU)						
Asso	ciated degree course/Semester	M.Sc. Bioi	informatics and Syst	tems Biology/1				
take	n							
Mod	lule coordinator	Cf. Germa	in Version					
Lect	urers	Cf. German Version						
Prer	equisites	See indivi	dually agreed syllab	i				
Learning outcomes	 The students will be familar with the importa molecular biology and anal for a pending analytical probe familiar with the advant be familiar with the advant be able to assess the qualit 	ant working ytical bioch oblem, be al ages and di y of the dat	techniques for the emistry ole to choose the rig sadvantages of each a generated	generation of syste ght technique and _ n method	ems biology justify the se	data in election		
Module content	 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 							
Forr	n(s) of instruction	Lectures (100%)					
	Workload total	90 hours	= 3 ECTS credits					
load in hours	Course type and title	A Formal in a Contact hours	struction b Pre- paration/ revision	B Auto- C Fin nomous exam work incl. para	al nination pre- tion T	otal		
ork	L Lecture	40	40		8	0		
3	O Oral examination			10	10	0		
	Total	40	40	10	9	0		
ç	Examination requirements	None	-	-*				
atio	Mathod(s) of assessment	Oral evan	vination (30 - 15 mir					
examin	(duration)		1111 CH - 45 1111	,				
ule (Contribution to the final mark	Oral exam	nination (100%)					
Mod	Module retake examination	Oral exam	nination (30 - 45 mir	ı.)				
Freq	uency	Annual Duration 1 semester Winter semester						
Inta	ke capacity	30						
Lang	guage of instruction	German/I	English					

M-B	S1-ZQ2D - Design of Biologic Drugs				1 st se	m.	3 CP		
Mod	ule description	Design o	f Biologic Drugs – E	Biologics					
Mod	ule code	M-BS1-ZC	Q2D						
Facu	lty/Subject/Department	06 (THM)	06 (THM)						
Asso	ciated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/1							
take	n	_							
Mod	ule coordinator	Cf. German Version							
Lect	urers	Cf. German Version							
Prer	equisites	See indiv	idually agreed sylla	bi					
nes	After successful completion of the i	module, the	e students should h	ave an overview o	of the mode	ern m	ethods		
con	of biomolecule design. They will be familiar with the important algorithms and methods and can apply								
out	them in drug design.								
ling									
earr									
IT L	 2 dimensional structure of bio 	moloculos							
nter	 Simulation of the interaction of drugs with their target 								
I O	Computer-assisted design of h	iologically a	ctive chemical subs	stances luse of sol	twara in th	no nut	alic		
• Computer-assisted design of biologically active chemical substances (use of software in the domain and programming of own tools)						ie pur	ЛС		
Moí		Wir tooloj							
Forn	n(s) of instruction	Lectures	(50%)/tutorials (50	%)					
	Workload total	90 hours = 3 ECTS credits							
		A Formal in	struction	B Auto- C F	nal				
nrs	Course type and title	a Contact	b Pre-	nomous exa	mination				
o ho		hours	paration/	WORK Inc. par	. pre- ation	T			
ad ir		lioure	revision		ation	Tota	3l		
klo	L Lecture	20	20			40			
Wor	P Tutorial	20	20			40			
-	E Written examination			10		10			
	Total	40	40	10		90			
u	Examination requirements	Submissio	on of exercise shee	ts					
nati	Method(s) of assessment	Oral exan	nination (30 - 45 m	in.)					
exami	(duration)								
dule	Contribution to the final mark	Written e	examination (100%)						
Moc	Module retake examination	Oral examination (30 - 45 min.)							
Freq	uency	Annual	Duratio	on 1 semester	Vinter sem	nester			
Intal	ke capacity	30							
Lang	uage of instruction	German/	English		-				

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M-B	S2-S1A - Bioinformatics Algorithms Pa	art 1			2 nd ser	n. 6 CP			
Mod	lule description	Bioinforr	natics Algorithms P	art 1					
Mod	lule code	M-BS2-S	1A						
Facu	Ilty/Subject/Department	06 (THM). 07 (JLU)						
Asso	pciated degree course/Semester	M.Sc. Bio	M.Sc. Bioinformatics and Systems Biology/2						
take	n								
Mod	lule coordinator	Cf. Germ	Cf. German Version						
Lect	urers	Cf. German Version							
Prer	equisites	M-BS1-E	5						
content Learning outcomes	 The students will be familiar with the algor understand the key algor structure prediction and in practice be able to develop, analy problems in these areas Algorithmic foundations SVPs, optimisation method 	rithmic fou ithms and computer- yse and imp of bioinfor ods)	ndations of bioinfor public domain bioir aided drug design a plement suitable alg matics (e.g. dynami	rmatics, nformatics tools f and be able to ap gorithms for solvi c programming, I	from the fiel ply them to ng bioinforr HMM, neura	lds of problems natics al networks,			
le	• Application of these a	of biologi	al macromolecules	and computer-a	ided drug di	esign)			
 New algorithms and applications based on current research 									
Σ	n(s) of instruction	Cominar	$(\Gamma O 0/)$ /tutorials (ΓO	20/1					
FULL	Workload total	180 hour	(50%)/(0.01) (50%)	170)					
		100 11001							
	Α	Formal in	struction	B Auto- C Fi	inal				
n hours	Course type and title a	Contact	b Pre- paration/ revision	nomous exa work incl par	mination . pre- ation	Total			
i pe	l lecture 2	0	60			80			
klo	P Tutorial 2	0	60			00			
Vor	F Tutonal 2	.0	00	20		20			
_		_		20		20			
	Total 4	0	120	20		180			
		1							
ion	Examination requirements	Submissi	on of exercise shee	ts					
inat	Method(s) of assessment	Written e	examination (90 mir	n.)					
exam	(duration)								
dule	Contribution to the final mark	Written e	examination (100%)	1					
Mo	Module retake examination	Written e	examination (90 min	n.)					
Freq	uency	Annual	Durat	ion 1 semester	Summer s	emester			
Inta	ke capacity	20							
Lang	guage of instruction	German/	English						

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M-B	S2-S1B - Bioinformatics Algorithms P	art 2			2 nd	sem.	6 CP		
Mod	lule description	Bioinform	natics Algorithms P	art 2					
Mod	lule code	M-BS2-S1	.В						
Facu	lty/Subject/Department	06 (THM)	, 07(JLU)						
Asso	ciated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/2							
take	n								
Mod	lule coordinator	Cf. Germa	an Version						
Lect	urers	Cf. German Version							
Prer	equisites	M-BS1-ES, M-BS2-S1A							
Learning outcomes	 The students will understand the key algo efficient sequence align assembly and analysis, a be able to develop, anal problems in these areas 	orithms and ment, high- and be able yse and im	public domain bio throughput metho to apply them to p plement suitable a	informatics to ods of phyloge practical proble Igorithms for s	ols from the ny, as well as ems solving bioinf	fields o genom ormatic	f ie cs		
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 								
Forr	n(s) of instruction	Lectures,	tutorials						
	Workload total	180 hours	s = 6 ECTS credits						
		A Formal ir	struction	B Auto-	C Final				
in hours	Course type and title	a Contact hours	b Pre- paration/ revision	nomous work	examination incl. pre- paration	Tota	al		
oad	L Lecture	20	50			70			
orkl	P Tutorial	20	50			70			
Š	P Presentation	10			10	20			
	E Written examination	10			20	20			
	Total	50	100		30	180			
ion	Examination requirements	Submissio	on of exercise shee	ts	50	100			
inat	Method(s) of assessment	Written e	examination (90 mi	n.), presentati	on				
xam	(duration)		·	<i>"</i> 1					
dule e	Contribution to the final mark	Written e	examination (70%),	presentation	(30%)				
Moc	Module retake examination	Oral exan	nination (30 - 45 m	in.)					
Freq	uency	Annual	Duratio	on 1 semester	Summer	semeste	er		
Inta	, ke capacity	20							
Lang	uage of instruction	German/	English						

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

M-B	M-BS2-S2A - Molecular Systems Biology Part 1					sem.	6 CP
Mod	dule description	Molecular Sy	/stems Biology Par	rt 1			
Mod	dule code	M-BS2-S2A					
Facu	ulty/Subject/Department	08 (JLU), 11	(JLU)				
Asso	ociated degree course/Semester	M.Sc. Bioinfo	ormatics and Syste	ems Biology/2			
take	n						
Mod	dule coordinator	Cf. German					
Lect	urers	Cf. German Ve	ersion				
Prer	equisites	M-BS1-ES					
 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 and 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 Overview of the main methods of transcriptome analysis and 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						nd alysis alysis ne and ce of he into e of	
Forr	n(s) of instruction	Lectures (26	%)/seminars (17%)/work placer	ment (57%)		
	Workload total	180 hours =	6 ECTS credits	,, ,			
		•					
		A Formal in	struction	B Auto-	C Final		
urs	Course type and title	a Cantact	b Pre-	nomous	examinatio	n	
o h o	course type and the	a Contact	paration/	work	incl. pre-		
d ir		nours	revision		paration	Tota	al
kloa	P Lecture	18	36			54	
/or	S Seminars	12	24			36	
5	I Work placement	40	40			80	
	P Presentation				10	10	
	Total	70	100		10	180	
ation	Examination requirements	None					
mina	Method(s) of assessment	Work placen	nent report, prese	ntation			
еха	(duration)	Work place	2001 roport (70%)	procontation	(200/)		
dule				, presentation	1 (30%)		
Мо	Nidule retake examination	Ural examina	ation (30 - 45 min.)			
Freq	luency	Annual Annual Annual					
Intake capacity 20							

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M-B	M-BS2-S2B - Molecular Systems Biology Part 2				2 nd s	em.	6 CP		
Mod	dule description	Molecula	r Systems Biology P	art 2	I				
Mod	dule code	M-BS2-S2	B						
Eng	lish module description	Molecula	r Systems Biology P	art 2					
Facu	ulty/Subject/Department	08 (JLU), 1	11 (JLU)						
Asso	ociated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/2							
take	en								
Mod	dule coordinator	Cf. Germa	an Version						
Lect	urers	Ct. German Version							
Prer	requisites	M-BS1-ES							
 The students should become familiar with the theoretical foundations of protein analysis methods and of metabolic 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 metabolome analysis from the primary literature be able, for given questions, to select the appropriate methods of protein analysis or mass spectrometry method for metabolome analysis in practical procedure be able to apply protein analysis methods and mass spectrometry methods for metabolome analysis in practical have the knowledge to be able to evaluate critically and question the results of scientific work involving protein analysis and metabolome analysis and metabolome analysis, and of substance-specific extraction techniques and different derivatizations Overview of the main methods of protein analysis method and a mass spectrometry method of metabolome analysis by study the literature based on primary literature Presentation of a protein analysis method and a mass spectrometry method of metabolome analysis as part of a seminar presentation Extraction of proteins from a model organism, protein quantification Implementation 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 						ethods ctice itein udy of of a			
	mass spectrometry		a normones, annio a		ines, organic dei	us, sug	ur5) 6y		
Forr	n(s) of instruction	Lectures	26%)/seminars (17	%) /work plac	ement (57%)				
	Workload total	180 hours = 6 ECTS credits							
							<u> </u>		
ş		A Formal In	struction	B AUTO-	C FINAI				
ino	Course type and title	a Contact	b Pre-	work	incl pre-				
in h		hours	paration/	WORK	paration	Tota			
ad	D Locture	10	26		•	T010			
rklo		10	30			54			
Wo	S Seminars	12	24			36			
	I Work placement	40	40		10	80			
		70	100		10	10			
_		70 	100		10	180			
atior	Examination requirements	None							
kamina	Method(s) of assessment (duration)	Work place	cement report, pres	sentation					
Jle e	Contribution to the final mark	Work place	cement report (70%	5), presentatio	on (30%)				
Modu	Module retake examination	Oral exan	nination (30 - 45 mi	n.)					
Frec	Juency	Annual	Duratio	n 1 semester	Summer se	meste	r		
Inta	ke capacity	20							
Lang	guage of instruction	German/	English						

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M-B	S2-S3A - Theoretical Basics of Model	ling			2 nd sem.	6 CP		
Moc	lule description	Theoretic	al Basics of Modellir	ng				
Moc	lule code	M-BS2-S3	A	0				
Facu	Ilty/Subject/Department	09 (JLU)						
Asso	ociated degree course/Semester	M.Sc. Bio	informatics and Syst	ems Biology/	2			
take	n							
Mod	lule coordinator	Cf. Germa	an Version					
Lect	urers	Cf. Germa	an Version					
Prer	equisites	M-BS1-ES	1					
S	The students should							
me	 expand their knowledge of the s 	statistical a	nd mathematical for	undations of I	modelling			
utco	• be familiar with the different me	ethods of m	nodelling and have a	deep unders	standing of			
3 OL	interdependencies in dynamic s	ystems						
nin	 describe simple models/simulations and be able to implement them in R/Simulink 							
ear	• be familiar with the characteristics and advantages and disadvantages of different modelling methods,							
	and be able to evaluate them cr	and be able to evaluate them critically						
	Introduction to systems analysis							
	Exercises in systems analysis							
	Statistical and mathematical algorithms in modelling							
	Explanation of different types of models in biological systems							
t	- Qualitative models							
<u>e</u>	- Stochastic models							
	Stochastic models							
cont	 Deterministic models 							
ule cont	 Deterministic models Methods for modelling interdent 	andancias	in dynamic systems					
Aodule cont	 Deterministic models Methods for modelling interdep a g differential equations. Petri 	endencies	in dynamic systems	based model	c			
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematics 	endencies nets, cellul	in dynamic systems ar automata, agent- amadelling software	-based model	s C/Fortran/Cu) Cimuliak		
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica National 	endencies nets, cellul al models ir	in dynamic systems ar automata, agent n modelling software	based model e, e.g. R (incl.	s C/Fortran/C++	-), SimuLink,		
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo 	endencies nets, cellul al models ir	in dynamic systems ar automata, agent- n modelling software	·based model e, e.g. R (incl.	s C/Fortran/C++	-), SimuLink,		
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo 	endencies nets, cellul al models ir dels	in dynamic systems ar automata, agent n modelling software	-based model e, e.g. R (incl.	s C/Fortran/C++	-), SimuLink,		
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality 	endencies nets, cellul al models ir dels	in dynamic systems ar automata, agent modelling software	based model e, e.g. R (incl.	s C/Fortran/C++	-), SimuLink,		
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction 	endencies nets, cellul al models ir dels Seminars	in dynamic systems ar automata, agent modelling software (50%)/tutorials (50%	·based model e, e.g. R (incl. %)	s C/Fortran/C++	-), SimuLink,		
Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total 	endencies nets, cellul al models ir dels Seminars 180 hours	in dynamic systems ar automata, agent modelling software (50%)/tutorials (50%	-based model e, e.g. R (incl. %)	s C/Fortran/C++	-), SimuLink,		
Form Form	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total 	endencies nets, cellul al models ir dels Seminars 180 hours	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (509 s = 6 ECTS credits	based model e, e.g. R (incl. %)	S C/Fortran/C++	-), SimuLink,		
urs 34 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in	in dynamic systems ar automata, agent modelling software (50%)/tutorials (50% 5 = 6 ECTS credits struction	based model e, e.g. R (incl. %) B Auto-	s C/Fortran/C++ C Final	-), SimuLink,		
hours 31 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact	in dynamic systems ar automata, agent modelling software (50%)/tutorials (50% s = 6 ECTS credits struction b Pre-	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl_pre-	-), SimuLink,		
d in hours 3	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) s = 6 ECTS credits struction b Pre- paration/ ravision	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration	-), SimuLink,		
load in hours 3	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours	in dynamic systems ar automata, agent- modelling software (50%)/tutorials (50%) 5 = 6 ECTS credits struction b Pre- paration/ revision	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration	-), SimuLink,		
forkload in hours 걸 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours	in dynamic systems ar automata, agent modelling software (50%)/tutorials (50% s = 6 ECTS credits struction b Pre- paration/ revision 45	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration	-), SimuLink, Total		
Workload in hours 정 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) s = 6 ECTS credits struction b Pre- paration/ revision 45 45	-based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration	-), SimuLink, 		
Workload in hours	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35	in dynamic systems ar automata, agent modelling software (50%)/tutorials (50%) = 6 ECTS credits struction b Pre- paration/ revision 45 45	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration 20	-), SimuLink, Total 80 80 20		
Workload in hours 정 정 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) s = 6 ECTS credits struction b Pre- paration/ revision 45 45 90	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20	-), SimuLink, Total 80 80 20 180		
tion Workload in hours 3	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) 5 = 6 ECTS credits struction b Pre- paration/ revision 45 45 90	-based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20	-), SimuLink, Total 80 80 20 180		
nination Workload in hours 3	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements Method(s) of assessment 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None Written e	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) s = 6 ECTS credits struction b Pre- paration/ revision 45 45 90 xamination (90 min	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20 20 30	-), SimuLink, Total 80 80 20 180		
xamination Workload in hours 정	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements Method(s) of assessment (duration) Method(s) of assessment	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None Written e	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) (50%)/tutorials (50%)/tutori	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20 20 30	-), SimuLink, Total 80 80 20 180		
ile examination Workload in hours 정	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements Method(s) of assessment (duration) Contribution to the final mark 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None Written e Written e	in dynamic systems ar automata, agent- n modelling softward (50%)/tutorials (50%) 5 = 6 ECTS credits struction b Pre- paration/ revision 45 45 90 xamination (90 min xamination (50%), t	based model e, e.g. R (incl. %) B Auto- nomous work .), tutorial assign	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20 20 20 20 20 20 20 20 20 20 20	-), SimuLink, Total 80 20 180		
lodule examination Workload in hours 걸 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements Method(s) of assessment (duration) Contribution to the final mark Module retake examination 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None Written e Written e	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) s = 6 ECTS credits struction b Pre- paration/ revision 45 45 90 xamination (90 min xamination (50%), t xamination (90 min	based model e, e.g. R (incl. %) B Auto- nomous work	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20 20 20 30 30 30 30 30 30 30 30 30 30 30 30 30	-), SimuLink, Total 80 80 20 180		
Module examination Workload in hours	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements Method(s) of assessment (duration) Contribution to the final mark Module retake examination 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None Written e Written e	in dynamic systems ar automata, agent- n modelling softward (50%)/tutorials (50% s = 6 ECTS credits struction b Pre- paration/ revision 45 45 90 xamination (90 min xamination (50%), t xamination (90 min	based model e, e.g. R (incl. %) B Auto- nomous work .), tutorial assign .)	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20 20 20 20 20 20 20 20 20 20 20	-), SimuLink, Total 80 20 180		
전 권 Module examination Workload in hours 전 전 Module cont	 Deterministic models Methods for modelling interdep e.g. differential equations, Petri Implementation of mathematica NetLogo Evaluation and validation of mo Data standard/quality n(s) of instruction Workload total Course type and title P Lecture P Tutorial E Written examination Total Examination requirements Method(s) of assessment (duration) Contribution to the final mark Module retake examination 	endencies nets, cellul al models ir dels Seminars 180 hours A Formal in a Contact hours 35 35 70 None Written e Written e Written e Annual	in dynamic systems ar automata, agent- n modelling software (50%)/tutorials (50%) 5 = 6 ECTS credits struction b Pre- paration/ revision 45 45 90 xamination (90 min xamination (90 min Duration	based model e, e.g. R (incl. %) B Auto- nomous work .), tutorial assign .) n 1 semester	s C/Fortran/C++ C Final examination incl. pre- paration 20 20 20 20 20 30 5ignments ments (50%)	-), SimuLink, Total 80 80 20 180 mester		

Version 1 of December 12, 2012

M-B	S2-S3B - Applied Modelling of Cor	nplex Biologic	al Processes and Sy	stems	2 nd sen	n. 6 CP		
Mod	dule description	Applied Mod	elling of Complex B	iological Proce	esses and Syst	ems		
Mod	dule code	M-BS2-S3B						
Engl	ish module description	Applied Mod	elling of Complex B	iological Proce	esses and Syst	ems		
Facu	ulty/Subject/Department	09 (JLU)						
Asso	ciated degree course/Semester	M.Sc. Bioinfo	ormatics and System	ns Biology/2				
take	n							
Mod	dule coordinator	Cf. German \	/ersion					
Lect	urers	Ct. German Version						
Prer	equisites	M-BS2-S3A						
ome	 be able to model data from various complex biological systems independently 							
outo	• be able to start working quic	kly on differen	t problems					
лg с	be able to present the results of the models coherently							
rnir	so all to provent the round of the models concretify							
	• Project work in small groups	to apply the k	nowledge acquired i	in module M-I	BS-S3A			
	 Modelling of experimentally recorded or simulated data from various biological systems, e.g. 							
	metabolic networks, cellular	transport prod	esses. intra- and int	ercellular sign	nal transductio	on.		
ent	phylogenetic trees							
ont	- Systems analysis							
с е	 Description of the interactions in biological systems using mathematical models 							
qul	 Description of the interactions in biological systems using mathematical models Implementation of mathematical models in corresponding modelling software, e.g. P. (inclusion) 							
δ	- Implementation of mathematical models in corresponding modelling software, e.g. R (incl.							
	C/Fortran/C++), SimuLink, NetLogo							
	- Evaluation and validation	ition and validation of models						
	 Graphical display and presen 	tation of mode	elling results					
Forr	n(s) of instruction	Seminars (46	%)/tutorials (54%)					
	Workload total	180 hours = 6 ECTS credits						
rs		A Formal in	struction	B Auto-	C Final			
nou	Course type and title	a Contact	b Pre-	nomous	examination			
	course type and title	bours	paration/	work i	incl. pre-			
bad		nours	revision		paration	Total		
rklo	P Lecture	30	40			70		
۸o	P Tutorial	30	60			90		
	P Presentation				20	20		
	Total	60	100	:	20	180		
	Examination requirements	None						
	Method(s) of assessment	Implementatio	on and presentation	of an indeper	ndently condu	cted project		
dule	(duration)							
Moc	Contribution to the final mark	Presentation (20%), project (80%)					
	Module retake examination	Oral examination (30 - 45 min.)						
Freq	luency	Annual	Duration	n 1 semester	Summer se	mester		
Inta	ke capacity	20						
Lang	guage of instruction	German/Englis	sh					

M-B	1-BS2-S4A - Analysis of High-Throughput Data Part 1					2 nd sem.	6 CP		
Mod	dule description	Analysis of H	ligh-Throughput Da	ata Part 1					
Mod	dule code	M-BS2-S4A	0 01						
Engl	lish module description	Analysis of High-Throughput Data Part 1							
Facu	ulty/Subject/Department	, 08 (JLU), 09	(JLU)						
Asso	ociated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/2							
Mod	dule coordinator	Cf. German Version							
Lect		Cf. German Version							
Prer		M-BS1-ES							
odule content Learning outcomes	 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 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 								
Mo	 throughput data analyses Public databases for storage or 	f high-through	nput data and its in	terfaces/da	ta mining				
Forr	n(s) of instruction	Seminars (50	0%)/tutorials (50%)						
	Workload total	180 hours =	6 ECTS credits						
in hours	Course type and title	A Formal in a Contact hours	struction b Pre- paration/ revision	B Auto- nomous work	C Final examinatio incl. pre- paration	on	 		
ad	P Lecture	35	45			80			
rklo	P Tutorial	35	45			80			
۸o	E Written examination				20	20			
	Total	70	90		20	180			
		70	30		20	180			
tion	Examination requirements	None							
examinat	Method(s) of assessment (duration)	Written exa	mination (90 min.),	practical ta	sks				
Jule (Contribution to the final mark	Written exa	mination (50%), tut	orial assign	ments (50%))			
Moc	Module retake examination	Written exa	mination (90 min.)						
Freq	luency	Annual	Duratio	n 1 semeste	er Summ	ner semest	ter		
Inta	ke capacity	20							
Lang	guage of instruction	German/Eng	glish						

Intake capacity

Language of instruction

Version 1 of December 12, 2012 Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only. 2nd sem. 6 CP M-BS2-S4B - Analysis of High-Throughput Data Part 2 Module description Analysis of High-Throughput Data Part 2 Module code M-BS2-S4B Faculty/Subject/Department 08 (JLU), 09 (JLU) Associated degree M.Sc. Bioinformatics and Systems Biology/2 course/Semester taken Module coordinator Cf. German Version Lecturers Cf. German Version Prerequisites M-BS2-S4A The students should Learning outcomes 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 highthroughput 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 total 180 hours = 6 ECTS credits A Formal instruction B Auto-C Final **Workload in hours** nomous examination b Pre-Course type and title a Contact work incl. preparation/ hours paration revision Total 30 600 Ρ Lecture 30 Ρ Tutorial 40 60 100 Ρ Presentation 20 20 Total 70 20 180 90 **Examination requirements** None Method(s) of assessment Implementation and presentation of an independently conducted project Module (duration) Contribution to the final mark Presentation (20%), project (80%) Module retake examination Oral examination (30 - 45 min.) Frequency Annual Duration 1 semester Summer semester 20

German/English

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M-BS2	2-MTS - Methods Seminar		2 nd sem.	3 CP						
Modu	le description	Methods Seminar		1						
Modu	le code	M-BS2-MTS								
Facult	y/Subject/Department	06 (THM), 07-11 (JLU)								
Associ	ated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/2								
taken										
Modu	le coordinator	Cf. German Version								
Lectur	ers	Cf. German Version	Cf. German Version							
Prerec	quisites	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								
rs	Workload total	90 hours = 3 ECTS credits								
Workload in hou	See specific module descriptio	ns								
ſ	Examination requirements	See specific module descriptions								
odule inatior	Method(s) of assessment (duration)	See specific module descriptions								
Mo xam	Contribution to the final mark	See specific module descriptions								
e e	Module retake examination	See specific module descriptions								
Frequ	ency	Annual Duration 1 semester Winte	r semester							
Intake	capacity	30								
Langu	age of instruction	German/English								

M-B	52-MTS1 - Methods Seminar - C	omputer Scien	ce			2 nd Sem.	3 CP		
Mod	ule description	Methods Sen	ninar – Computer	Science					
Mod	ule code	M-BS2-MTS1							
Facu	lty/Subject/Department	06 (THM), 07	(JLU)						
Asso	ciated degree	M.Sc. Bioinfo	rmatics and Syste	ms Biology/2					
cour	se/Semester taken								
Mod	ule coordinator	Cf. German V	'ersion						
Lectu	urers	Cf. German V	'ersion						
Prere	equisites	M-BS1-MAT							
Learning outcome	The students should complement topic from the fields of mather the above-mentioned fields ar They should prepare the basis	ent the knowle matics, comput e developed by for the prepara	dge acquired in the ser science and bion the participants a tion of a Master's	ne basic modul binformatics. R and presented s dissertation.	es with an a ecent resea and discuss	dvanced sp rch finding: ed in the p	ecial s from lenary.		
algorithms, algorithm analysis, automata and formal languages, complexity theory, descriptio complexity, computability, etc. Recent research findings (from relevant technical seminars an technical journals) from the above-mentioned fields are developed by the participants and pr discussed in the plenary. Development of the selected subject area through literature review preparation of a report.									
Form	n(s) of instruction	Seminars							
nrs	Workload total	90 hours = 3 ECTS credits							
o ho									
dir		A Formal	instruction	B Auto-	C Final				
Workloa	Course type and title	a Contact hours	b Pre- paration/ revision	nomous work	examinat incl. pre- paration	ion Tota	I		
	S Seminars	30	50			70			
	E Written examination				10	20			
	Total	30	50		10	90			
tion	Examination requirements	Regular and s	successful particip	ation in the se	minar (80%)				
amina	Method(s) of assessment (duration)	Presentation	(60 min.), written	report					
e e)	Contribution to the final mark	Presentation	(80%), written re	port (20%)					
Modu	Module retake examination	Presentation (60 min.)							
Freq	uency	Annual	Duratio	n 1 semester	Summer s	emester			
Intak	e capacity	30							
Language of instruction German/English									

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M-B	S2-MTS2 - Metabolome Analysi	s			2 nd sem.	3 CP			
Mod	dule description	Metabolome A	nalysis						
Мос	dule code	M-BS2-MTS1							
Facu	ulty/Subject/Department	08 (JLU), 11 (JL	U)						
Asso	ociated degree	MSc Bioinform	atics and Systems B	iology/2					
coui	rse/Semester taken								
Mod	dule coordinator	Cf. German Ve	rsion						
Lect	urers	Cf. German Ve	rsion						
Prer	equisites	M-BS1-ES							
Learning outcomes	 and its practical implementation, i become familiar with the be able to able to prepar primary literature be able, for given question and prepare an optimise be able to apply mass sp have the knowledge to be metabolome analysis 	e. they will e most important i re and present ma ons, to select the a d concept for the ectrometry metho ie able to evaluate	mass spectrometry me ss spectrometry meth appropriate mass spec practical procedure of ods of metabolome an e critically and question	ethods of metal ods of metabol trometry meth metabolome a alysis in practic n the results of	bolome analysis ome analysis fro ods of metabolo inalysis e scientific work i	om the ome analysis, involving			
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 								
Forr	n(s) of instruction	Lectures (26%)/seminars (17%)/work placement (57%)							
	Workload total	90 hours = 3 E0	CTS credits						
n hours	Course type and title	A Formal in a Contact hours	struction b Pre- paration/ revision	B Auto- nomous work	C Final examination incl. pre- paration	Total			
bad	P Lecture	9	18			27			
orklo	S Seminars	6	12			18			
Ň	I Work placement	20	20			40			
	P Presentation				5	5			
	Total	35	50		5	90			
	Examination requirements	None							
odule	Method(s) of assessment (duration)	Work placeme	nt report, presentat	ion					
Ĕ	Contribution to the final mark	Work placeme	nt report (70%), pre	sentation (30	%)				
	Module retake examination	Oral examination (30 - 45 min.)							
Frec	quency	Annual Duration 1 semester Summer semester							
Inta	Ke capacity	20 Cormon/English							
Add	itional information	Module advice course catalog	and literature: see	semester noti	ice board/Date	es: see			

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M-B	S2-MTS3 - Methods in Protein A	Analysis			2 nd sem		3 CP		
Мос	Jule description	Methods in Pi	rotein Analysis						
Мос	Jule code	M-BS2-MTS3							
Facı	ulty/Subject/Department	08 (JLU), 11 (J	LU)						
Asso	ociated degree	MSc Bioinforn	natics and Systems E	Biology/2					
cour	rse/Semester taken								
Мос	dule co-ordinator	Cf. German Ve	ersion						
Lect	urers	Cf. German Ve	ersion						
Prer	equisites	M-BS1-ES							
g outcomes	The students should become ra their practical implementation, become familiar with t be able to prepare and	miliar with the i.e. they will the most import present metho	theoretical foundati	ons of prote tein analysis is from the I	in analysis metr primary literatu	re	nd		
Learning	 be able, for given quest an optimised concept be able to apply the m have the knowledge to 	for the practical ethods of prote be able to eval	the appropriate me I procedure in analysis in practic luate critically and q	thods of pro ce uestion the	results of protei	id pre in ana	pare lyses		
Module content	 Overview of the most important methods of protein analysis Development of a method of protein analysis by Istudy 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 								
Forr	Preparation of a work finite struction	placement repo	rt	ark placomo	+ (E70/)				
FUIT	Workload total	90 hours = 3 E	CTS credits		lit (57 %)				
		A Formal ir	istruction	B Auto-	C Final				
in hours	Course type and title	a Contact hours	b Pre- paration/ revision	nomous work	examination incl. pre- paration	Tota	al		
bad	P Lecture	9	18			27			
orklo	S Seminars	6	12			18			
Ň	I Work placement	20	20			40			
	P Presentation				5	5			
	Total	35	50		5	90			
	Examination requirements	None							
odule	Method(s) of assessment (duration)	Work placeme	ent report, presenta	tion					
Š	Contribution to the final mark	Work placeme	ent report (70%), pre	esentation (3	30%)				
	Module retake examination	Oral examinat	ion (30 - 45 min.)						
Fred	luency	Annual Duration 1 semester Summer semester							
Inta	ke capacity								
Lang	juage of instruction	German/English							
Auu			and interature. see	semester no	blice board/bat	es. set	2		

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M-B	S2-MTS4 - Transcriptomic Analy	ysis			2 nd s	em.	3 CP			
Мос	dule description Tran	nscriptomic Anal	ysis							
Мос	dule code M-B	S2-MTS4								
Facu	Ilty/Subject/Department 08 (JLU), 11 (JLU)								
Asso	ociated degree MSc	Bioinformatics	and Systems Biolog	v/2						
cour	rse/Semester taken		, .							
Mod	dule coordinator Cf. C	German Version								
Lect	urers Cf. C	German Version								
Prer	equisites M-B	BS1-ES								
	The students should be familiar	with the theoretic	cal basis of transcript	ome analysis i	in pro-/eukaryot	es anc	l their			
nes	practical implementation, i.e. the	ney will								
tcor	become familiar with	the most importa	nt methods of transci	riptome analy	sis					
out	be able to prepare an	d present method	s of transcriptome an	alysis from th	e primary literat	ure				
ing	 be able, for given questions, to select the appropriate methods of transcriptome analysis, and prepare an antimical consent for the practical procedure. 									
earr	opumised concept for the practical procedure be able to apply methods of transcriptome analysis in practice									
Ľ	 have the knowledge to evaluate critically and question the results of transcriptomeanalysis 									
	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									
ent	Presentation of a met	Presentation of a method of transcriptome analysis as part of a seminar presentation								
onti	Isolation of total RNA	olation of total RNA from bacteria								
e Ci	Preparation of cDNA	sequencing librarie	25							
npc	Quality control of cDN	IA sequencing libra	aries							
ž	cDNA sequencing, op	erational work usin	ng DNA sequencing e	quipment						
	Bioinformatic analysis	s of primary cDNA	sequencing data							
Form	Mapping of CDNA sec	Locturos (26%)	/cominars (17%)/w	ork placame	(E79/)					
FULL	Workload total	90 hours = 3 ECTS credits								
		A Formal in	struction	B Auto-	C Final					
s			h Pre-	nomous	examination					
uno	Course type and title	a Contact	paration/	work	incl. pre-					
in h		hours	revision		paration	То	tal			
bad	P Lecture	9	18			27				
orklo	S Seminars	6	12			18				
Mo	I Work placement	20	20			40				
	P Presentation				5	5				
	Total	35	50		5	90				
	Examination requirements	None								
a) ·	Method(s) of assessment	Work placeme	nt report, presenta	tion						
dule	(duration)									
Mo	Contribution to the final mark	Work placeme	nt report (70%), pr	esentation (3	30%)					
	Module retake examination	le retake examination Oral examination (30 - 45 min.)								
Freq	juency	Annual	Duration 2	1 semester	Summer ser	neste	r			
Inta	ke capacity	20								
Lang	guage of instruction	German/English								
Add	itional information	Module advice and literature: see semester notice board/Dates: see								
		course catalog	ue							

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M-B	S2-MTS5 - Genome and Met	agenome Analysis	genome Analysis 2 nd sem.									
Mod	lule description	Genome and Metag	genome Analysis									
Mod	lule code	M-BS2-MTS5										
Facu	lty/Subject/Department	08 (JLU), 11 (JLU)										
Asso	ciated degree	MSc Bioinformatics	and Systems Bio	logy/2								
cour	se/Semester taken			0,7								
Мос	lule coordinator	Cf. German Version										
Lect	urers	Cf. German Version	German Version									
Prer	equisites	M-BS1-ES										
Module content Learning outcomes	The students should be fam and their practical impleme become familiar v be able to prepare literature be able, for given prepare an optim be able to apply n have the knowled analyses Overview of the n Elaboration of a g primary literature Presentation of a Isolation of chrom niches Cloning of chromo Preparation of clo storage of cloning Isolation of plasm DNA sequencing,	iliar with the theoreti ntation, i.e. they will with the most importa e and present method questions, to select the ised concept for the p methods of genome ar ge to be able to evalu most important method enome and metagend genome and metagend sosomal DNA from e.g posomal DNA from e.g and sequencing libra ids, fosmids and BAC- operational work usin	ation, i.e. they will h the most important methods of genome and metagenome analysis nd present methods of genome and metagenome analysis from the primary lestions, to select the appropriate methods of genome and metagenome analysis, and d concept for the practical procedure thods of genome and metagenome analysis in practice to be able to evaluate critically and question the results of genome and metagenome st important methods of genome and metagenome analysis ome and metagenome analysis method through study of the literature based on nome and metagenome analysis in a seminar presentation somal DNA from e.g. bacteria and bacterial populations from different ecological omal DNA into plasmid, fosmid and BAC vectors ng and sequencing libraries, quality control of cloning and sequencing libraries, nd sequencing libraries s, fosmids and BAC-DANN									
Form	Bioinformatic ana	lysis of primary DNAs	equencing data, g	eneration and as	sembly of contig (data						
FOIT	Workload total	90 hours = 3 F	CTS credits	//work placeme	(57%)							
in hours	Course type and title	A Formal ir a Contact hours	b Pre- paration/ revision	B Auto- nomous work	C Final examination incl. pre- paration	Total						
oad	P Lecture	9	18			27						
/ork	S Seminars	6	12			18						
5	P Presentation	20	20		5	<u>40</u> 5						
	Total	35	50		5	90						
	Examination requirements	None										
dule	Method(s) of assessment (duration)	Work placeme	ent report, presei	ntation								
Mc	Contribution to the final mark	Work placeme	ent report (70%),	presentation (3	30%)							
	Module retake examination	n Oral examination (30 - 45 min.)										
Freq	uency	Annual Duration 1 semester Summer semester										
Inta	ke capacity	20 Correct (English										
Add	tional information	Module advice course catalog	and literature: s ue	see semester no	otice board/Dat	German/English Module advice and literature: see semester notice board/Dates: see						

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

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M-BS2	-MTS6 - Methods Seminar – Dru	ug Research			2 nd	sem.	3 CP	
Modul	e description	Methods Semi	inar – Drug Resear	ch	I			
Modul	e code	M-BS2-MTS6						
Faculty	//Subject/Department	06 (THM)						
Associa	ated degree course/Semester	M.Sc. Bioinfor	matics and System	ns Biology/2				
taken								
Modul	e coordinator	Cf. German Ve	ersion					
Lecture	ers	Cf. German Ve	rsion					
Prereq	uisites	See individual	ly agreed syllabi					
Learning outcomes	Students will have an overview familiar with the applications o methods for drug research and	 of the modern of bioinformatics development. 	methods of drug r and will be able t	research and to develop ar	developmen nd apply bioir	t. They Iformat	will be ics	
Module content	 The phases of drug resear Applications of bioinformations Applications of bioinformatics Bioinformatics application Current topics in research Use of bioinformatics topication 	ch and clinical d atics in the deve atics in the profi is in clinical rese and developme is in the public c	levelopment lopment of new th ling of new drugs earch ent lomain and progra	herapies	vn tools			
Form(s	s) of instruction	Seminars						
ST ST	Workload total	90 hours = 3 E	CTS credits					
hot								
d in		A Formal in	struction	B Auto-	C Final			
Workloa	Course type and title	a Contact hours	b Pre- paration/ revision	nomous work	examinatio incl. pre- paration	n Tot	tal	
	S Seminars	30	50			70		
	E Written examination				10	20		
	Total	30	50		10	90		
atior	Examination requirements	Regular and su	accessful participa	tion in the se	eminar (80%)			
amina	Method(s) of assessment (duration)	Written exami	nation (90 min.)					
e e)	Contribution to the final mark	Written exami	nation (100%)					
Modu	Module retake examination	Written examination (90 min.)						
Freque	ency	Annual	Duration	1 semester	Summer se	emester	r	
Intake	capacity	30						
Langua	age of instruction	German/English						

Special Regulation for the Master Degree Programme Bioinformatics and Systems Biology7.36.08 No. 5p. 31Attachment 2: Module DescriptionsVersion 1 of December 12, 2012Image: Construction of the second secon

M-I	BS2-MTS7 - Object-Oriented Pro	ogramming of Inte	eractive Systems		2nd sem		3 CP		
Mod	ule code	M-BS2-MTS7			1				
Facu	lty/Subject/Department	06 (THM)							
Asso	ciated degree	MSc Bioinformat	tics and Systems Bio	logy/2					
cour	se/Semester taken								
Mod	ule coordinator	Cf. German Vers	ion						
Lectu	urers	Cf. German Vers	ion						
Prere	equisites	M-BS1-ZQ1u2B							
Learning outcomes	 The students should: be able to develop sm programming languag software engineering be able to verify the c 	nall- to medium-siz ge with simple to c principles, and orrectness of thei	zed object-based pro complex graphical us r solution in systema	ogrammes in er interfaces atic tests.	a modern objec and in complia	ct-orie nce w	ented ith		
Module content	Development of graphical user interfaces Programming of simple web-based systems Threads Database connectivity Form(s) of instruction								
Form	n(s) of instruction	Lectures (67%),	tutorials (33%)						
nrs	Workload total	90 hours = 3 ECT	S credits						
ho									
din		A Formal in	struction	tion B					
cloa	Course type and title	a Contact	b	Autonom	examination				
ork	course type and three	a Contact	Preparation/revi	ous work	s work incl.				
3		nours	sion		preparation	Tot	al		
	L Lecture	20	20			40			
	T Tutorial	10	40			50			
	Total	30	60			90			
ion	Prerequisite(s)	90% of exercise	sheets have to be su	ubmitted					
nat	Method(s) of assessment	Assessment of e	xercise sheets						
ami	(duration)		-						
exe	Formation of the module mark	Average grade o	f exercise sheets (10	0%)					
Module	Retake examination	Oral examination	n (30 min.)						
Freq	uency	Annual	Duration 1 se	emester Su	ummer semeste	r			
Intak	ke capacity	30							
Language of instruction German / English									

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M-B	S2-MAS - Modern Aspects of Bio	oinformatics and	d Systems Biology	y		2 nd sem.	3 CP		
Mod	dule description	Modern Aspec	cts of Bioinformat	ics and System	s Biology				
Mod	dule code	M-BS2-MAS							
Facu	ulty/Subject/Department	07 – 11 (JLU),	06 (THM)						
Asso	ociated degree	M.Sc. Bioinfor	matics and Syster	ms Biology/2					
coui	rse/Semester taken								
Mod	dule coordinator	Cf. German Ve	ersion						
Lect	urers	Cf. German Ve	ersion						
Prer	equisites								
Learning outcomes	The students should acquire an initial overv identify possible areas establish contacts with develop a profile of th select a supervisor for 	view of the resea of interest for s the respective eir 2nd year of s the 2nd year of	arch areas of the i emesters 3 and 4 working group lea tudy study	relevant workin aders	ng groups				
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 total	90 hours = 3 E	CTS credits						
		A Formal instruction		B Auto-	C Final				
rs	Course type and title	- Comboot	b Pre-	nomous	examina	ation			
ηοι	course type and title	a Contact	paration/	work	incl. pre	-			
i.		nours	revision		paratio	י Tot a	al		
bad	P Lecture	40	40	10		90			
rklo									
Ν									
-	Total	40	40	10		00			
	Total	40	40	10		90			
	Examination requirements	None							
0	Method(s) of assessment	Supervisor for	the 2 nd year of st	udv must be se	elected				
gule	(duration)		,						
Moo	Contribution to the final mark	The module is	graded						
	Module retake examination	Supervisor for the 2 nd year of study must be selected							
Frec	luency	Annual	Durat	ion 1 semester	· Winte	er semester			
Inta	ke capacity	30							
Language of instruction German/English									

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M-B	S3-LP1 - Laboratory Rotation 1				3 rd Sem	n. 6 CP			
Mod	dule description	Laboratory	Rotation 1		I				
Мос	dule code	M-BS3-LP1							
Facu	ulty/Subject/Department	07-11 (JLU), 06 (THM)						
Asso	ociated degree course/Semester	M.Sc. Bioir	nformatics and Sy	/stems Biology/	3				
take	n								
Moc	dule coordinator	Cf. German	n Version						
Lect	urers	Cf. German	n Version						
Prer	equisites	M-BS2-MA	S						
nt Learning outcomes	 The students will acquire specific, research-o learn to establish co-opera be able to quickly start wo biology be able to plan and implen become familiar with new, acquire communication an 	priented labo ition contacts rking with ne nent a projec interdisciplin d presentatio environment	oratory skills s w concepts and a t nary working met on skills	approaches in b thods	bioinformatics/s	systems			
ntei	Training in modern laborate	orv techniqu	es						
Ö	Collaboration in work proc	esses and sp	ecific technologie	25					
ule	 Quality assurance and wor 	kplace safety	/						
lod	• Demonstration training to third parties								
\geq Earm(s) of instruction All day scientific work (100%)									
1011	Workload total	180 hours	= 6 FCTS credits	,0)					
F									
		A Formal in	mal instruction B Auto-		C Final				
hours	Course type and title	a Contact	b Pre- paration/	nomous work	examination incl. pre-				
in		nours	revision		paration	Total			
orkload	Laboratory work I placement	120	40			160			
Ň	Presentation				20	20			
	Total	120	40		20	180			
	Eveningtion requirements	Degular pa	rtisination (120 k) cubmission a	of lob				
ion	Examination requirements	Regular pa	111111111111111111111111111111111111111	i), submission d					
ninati		notebook/	specifications						
e exan	Method(s) of assessment (duration)	Presentati	on						
dule	Contribution to the final mark	Presentati	on (100%)						
Mo	Module retake examination	Presentation							
Frec	Juency	Annual	Durati	on 1 semester	Winter seme	ester			
Inta	ke capacity	30							
Lang	guage of instruction	German/F	nglish						

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M-B	S3-LP2 - Laboratory Rotation 2				3 rd se	m.	6 CP		
Мос	dule description	Laboratory	Rotation 2						
Мос	dule code	M-BS3-LP2							
Facı	Ilty/Subject/Department	07-11 (JLU), 06 (THM)						
Asso	ociated degree course/Semester	M.Sc. Bioir	nformatics and Syst	ems Biology/3	3				
take	n								
Mod	dule coordinator	Cf. German	n Version						
Lect	urers	Cf. German	n Version						
Prer	equisites	M-BS2-MA	.S						
ontent Learning outcomes	 The students will acquire specific, research-o learn to establish co-opera be able to quickly start wo biology be able to plan and implen become familiar with new, acquire communication an Practical work in a new laboratory e Training in modern laborate 	priented labo tion contacts rking with ne nent a projec interdiscipli d presentatio environment cory techniqu	oratory skills w concepts and ap t nary working metho on skills	proaches in bi ods	ioinformatics/	syste	ms		
S	Collaboration in work proc	esses and sp	ecific technologies						
dule	Quality assurance and wor	kplace safety	1						
VIOC	Demonstration training to	third parties							
Form(s) of instruction All-day scientific work (100%)									
	Workload total	180 hours	= 6 ECTS credits						
		A Formal in	ormal instruction B Auto-		C Final				
l in hours	Course type and title	a Contact hours	b Pre- paration/ revision	nomous work	examination incl. pre- paration	Тс	otal		
orkload	Laboratory work I placement	120	40			16	50		
Ň	Presentation				20	20)		
	Total	120	40		20	18	30		
	Examination requirements	Regular na	rticination (120 h)	submission of	flah				
ion		negulai pa		500111551011 01					
nat		notebook/	specifications						
e exami	Method(s) of assessment (duration)	Presentati	on						
dule	Contribution to the final mark	Presentati	on (100%)						
Moe	Module retake examination	Presentation							
Frec	luency	Annual	Duration	n 1 semester	Winter sem	ester			
Inta	ke capacity	30							
Lang	guage of instruction	German/F	nglish						

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M-B	S3-BP - Work Placement				3 rd sem.	6 CP
Mod	lule description	Work Place	ment		•	
Mod	lule code	M-BS3-BP				
Facu	Ilty/Subject/Department	07-11 (JLU)	, 06 (THM)			
Asso	ciated degree course/Semester	M.Sc. Bioin	formatics and Syste	ms Biology/3		
take	n					
Mod	lule coordinator	Cf. Germar	Version			
Lect	urers	Cf. Germar	Version			
Prer	equisites	Approval o LP2)	f the Board of Exam	iners has been giv	en (replaces	M-BS-
Module content Learning outcomes	The students will have a sound knowledge of the job de be able to apply for a career field place have in-depth knowledge of the applie do practical work experience in a typie be able to collaborate in the practical experience the specific conditions of t be familiar with the professional, orgation company/authority/institution acquire teamwork skills establish contacts with potential active be able to evaluate, document and th be able to answer and discuss question be able inform other students about Career research/career fields in resea Requirements of the labour market for "How do I apply?" Effective planning of work-flows Participation in work-flows and specia Quality assurance and marketing of bit Data protection and patent law Training for interviews Evaluation of the survey 	escriptions and ement (in wri cation of the t cal field of act processes of t the career field anizational, an vity fields en present the che activities i rch and educa or academics al technologies iological, biom	I requirements ting and orally) echnical knowledge ac ivity the company/authority ds d social structures of t eir experiences with co operating procedures a n the visited professio tion, industry, govern s of the company, auth redical or pharmacolog	equired in the different y/institution the different levels of onfidence adequately <u>nal field</u> ment and media nority or institution gical products	ent operating f the	processes
Forr	n(s) of instruction	Laboratory	work placement (10	00%)		
	Workload total	180 hours :	= 6 ECTS credits			
n hours	Course type and title	A Formal in a Contact	struction b Pre-	B Auto- C Fi nomous exa work incl	nal mination . pre-	
ad i		hours	revision	para	ation	Total
Worklo	Laboratory work I placement	150	20			160
	R Report			10		20
	Total	150	20	10		180
	Examination requirements	Regular pa	rticipation (150 h)			
dule	Method(s) of assessment (duration)	Report				
Σ	Contribution to the final mark	The modul	e is evaluated			
	Module retake examination	Report				
Freq	uency	Annual	Duration	1 semester Wi	nter semest	er
Inta	ke capacity	30				
Lang	guage of instruction	German/Er	nglish			

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M-B	S3-BP1 - Extended Work Placement				3 rd sem.	12 CP			
Mod	dule description	Extende	d Work Place	ement					
Мос	dule code	M-BS3-I	3P1						
Facu	Ilty/Subject/Department	07-11 (J	LU), 06 (THM)					
Asso take	ociated degree course/Semester	M.Sc. Bi	oinformatics	and Systems Biology/3					
Мос	dule co-ordinator	Chairpe	rson of Exam	inations Board					
Lect	urers	Cf. Gern	nan Version						
Prer	equisites	Cf. Gern	nan Version						
	The students will								
	have a sound knowledge of the sound know	ne job desc	riptions and re	equirements					
	 be able to apply for a career f 	ield placen	nent (in writing	g and orally)					
S	 have in-depth knowledge of t processes 	ne applicat	tion of the tech	nnical knowledge acquired in t	he different op	erating			
me	 do practical work experience 	in a typical	field of activit	v					
tco	 be able to collaborate in the r 	practical pr	ocesses of the	., company/authority/institutio	า				
no	 experience the specific condit 	tions of the	e career fields						
ing	be familiar with the professio	nal, organi	zational, and s	ocial structures of the differen	t levels of the				
arn	company/authority/institutio	n							
Le	acquire teamwork skills								
	 establish contacts with poten 	tial activity	fields	·····					
	 be able to evaluate, document be able to approve and discuss 	it and then	present their	experiences with confidence					
	 be able to answer and discuss be able to inform other stude 	nts about i	the activities in	the professional field visited					
	Career research/career fields	in research	n and educatio	n. industry, government and n	nedia				
	 Requirements of the labour m 	narket for a	academics	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
eni	 "How do I apply?" 								
ont	Effective planning of work-flows								
le co	 Participation in work-flows ar 	nd special t	echnologies of	the company, authority or ins	titution				
npo	Quality assurance and marketing of biological, biomedical or pharmacological products								
Ĕ	Data protection and patent law								
	 Fraining for interviews Evaluation of the survey 								
Forr	n(s) of instruction	Laborat	orv work plac	cement (100%)					
	Workload total	360 hou	irs = 12 ECTS	credits					
	A	A Formal i	nstruction	B Auto- C Fi	nal				
rs		а	b Pre-	nomous exa	mination				
nou	course type and title	Contact	paration/	work incl	pre-				
in t		hours	revision	para	ation 1	Гotal			
rkload	Laboratory work J placement	320	20		3	340			
٧٥	R Report			10	1	0			
	P Presentation			10	1	0			
	Total 3	320	20	20	3	60			
	Examination requirements	Regular	participation	(300 h)					
dule	Method(s) of assessment (duration)	Present	ation						
δ	Contribution to the final mark	Presentation (100%)							
	Module retake examination	on Presentation							
Frec	luency	Annual		Duration 1 semester W	inter semeste	er			
Inta	ke capacity	30							
Lang	guage of instruction	German/English							

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	-					-						
M-B	S3-PP - Scientific Project Work	c			3 rd sem.	6 CP						
Mod	dule description	Scientific Project	Scientific Project Work									
Mod	dule code	M-BS3-PP	M-BS3-PP									
Facu	ulty/Subject/Department	07-11 (JLU), 06	07-11 (JLU), 06 (THM)									
Asso	ociated degree	M.Sc. Bioinform	M.Sc. Bioinformatics and Systems Biology/3									
cour	rse/Semester taken											
Mod	dule coordinator	Cf. German Ver	Cf. German Version									
Lect	urers	Cf. German Ver	Cf. German Version									
Prer	equisites	M-BS2-MAS	M-BS2-MAS									
 The students will be able, when involved in a research project under guidance, to perform complex experimin independently be able to summarise, classify and discuss results in writing in the form of a scientific public be familiar with the concept of troubleshooting acquire team skills 												
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												
Forr	Form(s) of instruction Full-day instruction in scientific work in a scientific team											
	Workload total	al 180 hours = 6 ECTS credits										
LS		A Formal instruction B Auto-			Final							
ad in hou	Course type and title	a Contact hours	b Pre- nomous ex Contact paration/ work in ours revision paration/ paration/		amination cl. pre- aration	Total						
Worklo	Laboratory work I placement	120	40			160						
	R Report			20)	20						
	Total	120	40	20)	180						
	Examination requirements	Regular particip	oation (120 h	n)								
odule	Method(s) of assessment (duration)	Final report	Final report									
Σ	Contribution to the final mark	The module is e	The module is evaluated									
	Module retake examination	Final report										
Freq	luency	Annual	D	uration 1 semester V	Vinter semest	er						
Inta	ke capacity	30										
Lang	guage of instruction	German/Englis	<u></u> ו									

	Attac	hment 2: Module Descriptions							
	Versi	on 1 of December 12, 2012							
	Pleas	se note that only the German version of the	modules is official and legally binding. The English version	is for informativ	ve purposes on	ly.			
	M-B	S3-ISW - Introduction to Scienti	fic Work and Thesis Preparation		3 rd sem.	6 CP			
	Mod	dule description	Introduction to Scientific Work and Thesis Pr	eparation					
	Mod	dule code	M-BS3-ISW						
Faculty/Subject/Department			06 (THM), 07-11 (JLU)						
	Asso cour	ociated degree rse/Semester taken	M.Sc. Bioinformatics and Systems Biology/3						
	Mod	dule coordinator	Cf. German Version						
	Lect	urers	Cf. German Version						
	Prer	requisites	M-BS3-PP						
	Learning outcomes	 writing project proposals and scier be familiar with hypothe be able to plan research be able to communicate an interdisciplinary frame possess routines for the develop an ability to judg be experienced in dealing English possess a high cognitive develop an ethical judge 	itific papers, i.e. they will sis-driven scientific work projects conceptually concepts, methods and results of research in bioinf ework targeted development of co-operations ge their own and others' work critically g with literature in English and will be able to comm competence (contextual thinking, logical and abstra- ment relative to scientific work	formatics and nunicate scie act thinking,	d systems bio entific aspect conceptual t	ology in s in hinking),			
	A Module content	 Overview of scientific wr Conducting searches in r Selection of target journa Planning of an individual Writing and defending of Scientific ethics n(s) of instruction 	iting, structure of scientific publications elevant literature and databases als for publication, <i>impact factors, peer review</i> Master's thesis dissertation a fictitious research proposal to the German Resea Lectures (23%), tutorials (54%), colloquia (23 180 hours = 6 ECTS credits	arch Foundat %)	tion				
			A Formal instruction B Auto-	C Fina	il				
			h Pro- nomou:	s exami	ination				

in hours			A Formal instruction		B Auto-	C Final		
	Course type and title		a Contact hours	b Pre- paration/ revision	nomous work	examination incl. pre- paration	Total	
bad	P Lecture		15	15			30	
orklo	Р	Tutorial	35	75			110	
Ň	E	Colloquium	15	15			30	
	Р	Presentation				10	10	
		Total	65	105		10	180	
	Exam	ination requirements	None					
dule	Meth (dura	nod(s) of assessment ation)	Written research application, presentation					
Мо	Contr	ibution to the final mark	Written research application (50%), presentation (50%)					
	Module retake examinationOral examination (30 - 45 min.)							
Freq	uency		Annual	Durat	Duration 4 weeks		Winter semester	
Intake capacity		30						
Lang	guage (of instruction	German/Englis	h				
Additional information		Module advice and literature: see semester notice board/Dates: see course catalogue						

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M-B	S3-SS1 - Special Seminar 1					3	3 rd sem.	3 CP			
Mod	lule description	Special Seminar 1									
Mod	lule code	M-BS3-SS1									
Facu	Ilty/Subject/Department	07-11 (JLU), 06 (THM)									
Asso	ciated degree course/Semester	M.Sc. Bioinformatics and Systems Biology/3									
Таке	n Iule econdinator	(Cf. Commo									
IVIOC		Ct. German Version									
Lect		Cr. German Version									
s Prer	The students will	See maivid	iually agre	eu syllabi							
ne:	I ne students will										
tco	• gain insight into research	understand		nublication		(1:+=====	o coorch'	۱			
out	be able to search for and	understand		publication	is on a topic ((literatur	e search)			
rning	be able to reproduce a sci	ientific pape	r in a pres	sentation.							
Leai											
ent	Current topics from a rese	earch area o	f bioinforı	matics or s	ystems biolog	gy					
onto	Preparation of a presenta	tion on a cu	rrent topi	c (e.g. liter	ature presen	tation)					
с е											
qu											
Мо											
Forr	n(s) of instruction	Seminar (1	LOO%)								
	Workload total	90 hours = 3 ECTS credits									
ours		A Formal instruction			B Auto-	C Final	–				
ч и	Course type and title	a Contact	b Pre-		nomous	examin	ation				
i pe		hours	paration	า/	WORK	inci. pre	2-				
klo			revision			paratio	n ·	Total			
Vor	S Seminars	30	30					60			
_	P Presentation					30		30			
	Total	30	30			30	9	90			
	Examination requirements	Regular pa	rticipatio	n (80%)							
<u>e</u> :	Method(s) of assessment	Presentati	on								
npc .	(duration)										
ž	Contribution to the final mark	Presentation (100%)									
	Module retake examination	Presentation									
Freq	uency	Annual		Duration	1 semester	Winter	semeste	er			
Inta	ke capacity	30									
Lang	guage of instruction	German/English									

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M-B	S3-SS2 - Special Seminar 2						3 rd sem.	3	3 CP	
Mod	dule description	Special Seminar 2								
Mod	dule code	M-BS3-SS2								
Facu	ulty/Subject/Department	07-11 (JLU), 06 (THM)								
Asso	ociated degree course/Semester	M.Sc. Bioi	M.Sc. Bioinformatics and Systems Biology/3							
take	en									
Mod	dule coordinator	Cf. German Version								
Lect	urers	Ct. German Version								
Prer		See individ	dually agre	eed syllabi						
nes	The students will									
COL	gain insight into researchin	g and develo	oping curr	ent resear	ch topics					
out	be able to search for and u	nderstand so	cientific p	ublications	on a topic (li	iteratur	e search)			
ng	 be able to reproduce a scie 	entific paper	in a prese	ntation.						
arni										
Le:										
ent	Current topics from a research	arch area of	bioinform	atics or sys	stems biology	y				
onte	 Preparation of a presentati 	ion on a curr	ent topic	(e.g. literat	ure presenta	ation)				
00			·		·					
qule										
No										
Forr	n(s) of instruction	Seminars								
	Workload total 180 hours = 3 ECTS credits									
ours		A Formal instruction			B Auto-	C Fina				
р Ч	Course type and title	a Contact	b Pre-		nomous	exami	nation			
i p		a Contact	paratio	า/	work	incl. p	re-			
kloa		nours	revision		par		on	Tota	I	
Vor	S Seminars	30	30					60		
_	P Presentation					30		30		
	Total	30	30			30		90		
	Examination requirements	Regular pa	rticipatio	n (80%)						
ف	Method(s) of assessment	Presentati	on							
np	(duration)									
δ	Contribution to the final mark	Presentation (100%)								
	Module retake examination	Presentation								
Frec	Juency	Annual		Duration	1 semester	Winte	er semest	er		
Inta	ke capacity	30								
Lang	guage of instruction	German/English								

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M-BS	4-THE - Master Thesis				4 th sem.	30 CP					
Mod	ule description	Master	Master Thesis								
Mod	ule code	M-BS4-1	M-BS4-THE								
Facu	ty/Subject/Department	07-11 (J	07-11 (JLU), 06 (THM)								
Asso	ciated degree course/Semester	M.Sc. Bi	M.Sc. Bioinformatics and Systems Biology/4								
taker	1										
Mod	ule coordinator	Cf. Gern	Cf. German Version								
Lectu	irers	Cf. Gern	nan Version								
Prere	equisites	All mod	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 										
Form	• preparation of the Master 1		tific work /comin	ar							
TOTT	Workload total	900 hours =	30 FCTS credits	101							
d in hours	Course type and title	A Forma a ontact hours	l instruction b Pre- paration/ revision 160	B Auto- nomous work	C Final examination incl. pre- paration	Total 820					
oac	Scientific work	300	20	200		40					
orkl	Drecentation	20	20		20	20					
Š	Presentation				20	20					
	Total	400	180	280	<u> </u>	900					
_ В	Examination requirements	Seminar presentation									
e testir	Method(s) of assessment (duration)	Master thesis/defence									
lodul	Contribution to the final mark	Master thesis (70%), defence (30%)									
2	Module retake examination	See the general provisions of JLU §34 para. 2									
Frequ	ency	Annual	Annual Duration 1 semester Summer semester								
Intake	e capacity	30	30								
Langu	lage of instruction	German/English									