module code / module title

BMB-B (Models, Methods and Specialization – Integrative BMB)

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1	**INFORMATION ON THE MODULE**	
1a	module code	BMB-B
1b	module title *(German title)*	Modelle, Methoden und Spezialisierung – Integrativer BMB
1c	module title *(English title)*	Models, Methods and Specialization – Integrative BMB
1d	credit points	15
1e	responsible for the module	Prof. Dr. Ralf Dringen
1f	type of module	compulsory elective module
1g	programs using the module	M.Sc. Biochemistry and Molecular Biology (students in Microbial Systems specialization study module BMB-B-MSys instead)
1h	organizational unit offering the module	
1i	content-related prior knowledge or skills	Knowledge of the contents of the module BMB-A, basics in cell biology, chemistry and biochemistry is recommended.
1j	learning contents	**1) Organismic models for bioscience research (2 SWS lecture)** The lecture course provides an introduction to model systems that are frequently used in biomolecular research as organisms to study modern research questions. For each model system basic information on the structure of the organism, on the handling of the organisms as well as on advantages and disadvantages of the organismic model for various types of biomolecular research will be given. In addition, examples for modern biomolecular research questions that have been addressed or are currently addressed by using the respective model organism will be presented and discussed.

The organisms addressed by this lecture course may include (but may be modified according to recent developments):

- Bacteria
- Yeast
- *C. elegans*
- Drosophila
- *Arabidopsis*
- Poplar
- Mouse
- Rat
- Monkey
- Homo sapiens

2) Methods for biomolecular research (2 SWS lecture + 1 SWS seminar)

The lecture course provides an introduction to important methods that are frequently used for biomolecular research to study modern research questions. For each method principles and basic information will be provided as lecture and special aspects will be additionally addressed in the accompanying seminar or exercises. The methods addressed by this course may include (but may be modified according to recent developments):

- Physicochemical analysis of biomolecules (NMR, mass spectrometry, photometry, fluorometry, ...)
- Enzymatic methods (coupled enzymatic tests, cycling assays, ...)
- Immunological test systems (ELISA, immunocytochemistry, ...)
- Microscopy (light, fluorescence, confocal, atomic force, ...)
- Centrifugation
- Protein purification
- Viruses as vectors
- Cell cultures
- Isotope labeling and radioactivity
- Optogenetics
- Omic-technologies
- Bisulfite sequencing
- Chip sequencing

3) Block seminar with excursion

The one week excursion (in February or March) will introduce special research topics to the biochemistry master students, as an example for “field-based molecular research”.

		One option is an excursion to List. During the week in List the participants will learn about the mission of the research station. The overall objectives of this course are (1) to provide a basic understanding of concepts in marine (e.g. ecology & physiology) research topics; (2) to develop ideas for biomolecular research projects addressing marine research questions; (3) to develop ideas how to implement biomolecular methodology into this research and (4) how to adapt experimental setups for field research. **4) Specialization in one of the offered research fields (6 CP)** For the tutorial/seminar course of 6 CP in a specialized research field the students can choose between several options, such as: A) <u>Chemistry of Metabolism</u> The course covers essential and advanced aspects of the bioorganic chemistry of cellular metabolism. Topics addressed can include for example: • Energetics of chemical reactions • Functional groups and bonds of biomolecules • Redox reactions • Mechanisms involved in enzymatic catalysis and transport processes • Chemistry of basic metabolic pathways • Methods and models to study the metabolism and metabolic pathways The students will decide as team on the aspects and topics of the chemistry of metabolism that will be covered and on strategies that will be applied to improve the basal knowledge of each participating student. Self-structured learning sessions, team discussions and examinations by the team may be considered and tested as learning strategies. B) <u>Biophysics</u> The course aims to substantially improve the basic knowledge on the physical principles underlying cellular function. Acquisition of theoretical knowledge in lectures will be accompanied by experimental training in a laboratory course and augmented with a hands-on tutorial. C) Other courses offered as specialization courses
1k	learning outcomes/ competencies/ targeted competencies	**1) Organismic models for bioscience research (2 SWS lecture)** At the end of the course the student will know the organismic models that are frequently used for biomolecular research to study modern research questions. They will be aware of the advantages and disadvantages of these models, will be informed about safety, legal and ethical

issues connected with the use of the various organismic models and will be able to choose appropriate organismic models to answer new research questions in biomolecular research.

2) Methods for biomolecular research (2 SWS lecture + 1 SWS seminar)

At the end of the course the student will know the principles and concepts of selected methods and technologies that are frequently used for biomolecular research to study modern research questions. They will be aware of the advantages and disadvantages (such as sensitivities of methods, safety and legal issues, ethical aspects) of the various methods addressed and will be able to choose appropriate methods and technologies to answer new research questions in biomolecular research.

3) Block seminar with excursion (40 h with 8 h per 5 days, 2 h preparation and presentation).

The successful participants will be able (1) to understand basic concepts of a different discipline; (2) to combine concepts of biomolecular research with those of other disciplines; (3) integrate methods and the potential of model systems to address questions derived from other disciplines and (4) to develop ideas how to adapt experimental setups in the field to facilitate biomolecular research.

4) Specialization in one of the offered research fields (6 CP)

A) Chemistry of Metabolism

At the end of this course, the participating students have advanced knowledge on the chemical principles underlying the cell metabolism and on the methods used to study metabolism. In addition, they can communicate and present their work professionally and can work in a team. For example, students…

- know the chemistry that underlies cell metabolism
- can recognise repetitive chemical principles in metabolism
- can work in teams and to present their work
- can ask high quality questions.
- can present and discuss complex scientific topics at the white board
- can identify and solve scientific questions

B) Biophysics

At the end of the course, students have advanced knowledge on the physical principles underlying cellular function. Students can think in terms of physics. They can appreciate quantitative approaches and modelling. Students understand the reciprocal flow of knowledge from Biology to Physics and vice versa. In addition, they can communicate and present their work professionally and can work in a team. For example, students…

- know the physics that underlies cellular and molecular processes
- know molecular forces and interactions, principles of thermodynamics and chemical kinetics, pattern formation

		• can work in teams and present their work in presentations • can ask high quality questions. C) Learning outcomes of other courses offered as specialization courses

1l	calculation of student workload *(part a: calculation of presence time and working hours)*	**The total amount of the presence time and working hours of the module has to be calculated additionally in the detailed calculation a) to c).** **a)** detailed calculation: **SWS / presence time/working hours in each course of the module**						
		☒	2	lecture(s) with	4	SWS/ contact hours	56	hours of presence time
		☒	1	seminar(s) with	1	SWS/ contact hours	14	hours of presence time
		☐		exercise(s) with		SWS/ contact hours		hours of presence time
		☐		internship(s) with		sum of working hours		
		☐		seminar(s) with		SWS/ contact hours		total hours of presence time
		☐		laboratory/laboratories with		SWS/ contact hours		total hours of presence time
		☐		tutorial(s) with		SWS/ contact hours		
		☒	1	excursion(s) with	3	SWS contact hours in total	42	working hours

		☒ 1 other form of course (e.g. block seminar), namely this: tutorial or seminar course of 6 CP in a specialized research field with 4 SWS / with totaly 56 contact hours ☒ presence time ☐ working hours = sum of presence time and working hours: 168
	calculation of student workload *(part b: preparation time and follow-up work/self-study)*	**b) working hours for preparation/follow-up work of the course(s) and/or self-study** = sum of working hours: 242
	calculation of student workload *(part c: exam preparation etc.)*	**c) exam preparation (incl. examination)** = sum of working hours: 40
	calculation of student workload *(total amount of hours including a) - c))*	**Total amount of the presence time and working hours a) to c):** 450
1m	description of possible optional courses in the module	*Can a student choose between different courses within the module?* YES *Short description of selection option* For the tutorial/seminar course of 6 CP in a specialized research field the students can choose between several optional courses, such as: A) Chemistry of Metabolism B) Biophysics C) Other courses offered as specialization For more details on the content and the aims of these courses see 1j and 1k

1n	language(s) of instruction	☐ German ☒ English ☐ Spanish ☐ French ☐ Other, namely this: Klicken Sie hier, um Text einzugeben.
1o	frequency	*(regular cycle module is offered) e.g.: winter semester, yearly or summer semester, yearly or each semester* winter semester yearly Klicken Sie hier, um Text einzugeben.
1p	duration	one semester module Klicken Sie hier, um Text einzugeben.
1q	Literature (*optional*)	Klicken Sie hier, um Text einzugeben.
1r	more information on the module (*optional*)	For the tutorial/seminar course of 6 CP in a specialized research field the students can choose between several optional courses, such as: Chemistry of Metabolism: limited to 10 students per course Biophysics: limited to 10 students per course
2	**INFORMATION ON THE MODULE EXAMINATION** (see also AT Art. 5 section 8)	
2a	type of examination	☒ module exam; i.e. exam with only one component (MP) ☐ combination exam, i.e. exam with several components (administered by instructors) (KP) ☐ partial exam; i.e. exam with several components (administered by registrar) (TP)
2b	exam components or prerequisites *(type, number)*	***PL*** *= graded component of the examination* ***SL*** *= ungraded component of the examination, coursework* ***PVL*** *= prerequisite of the examination (see AT Art. 5 Section 10)* ☒ PL | 1 ☐ SL | ☐ PVL | justification If necessary, further explanations: MP: Oral examination with 3 examiners (the person in charge of selected specialized research field as well as an examiner from each of the lectures 1 and 2.

2c	Give this information for combination examinations only: Weights (in percentage) of component grades	PL 1: PL 2: PL 3: Klicken Sie hier, um Text einzugeben. PL 4: Klicken Sie hier, um Text einzugeben. If necessary, further comments: Klicken Sie hier, um Text einzugeben.
2d	form of examination (see AT BPO/AT MPO Art. 8, 9 and 10)	☐ Assignment ☒ Oral examination (single) ☐ Presentation, oral ☐ Written examination ☐ Group examination, oral ☐ Presentation and written assignment ☐ Portfolio ☐ Project report ☐ Bachelor Thesis ☐ Internship report ☐ Colloquium ☐ Master Thesis ☐ Other (concrete definition is given in the examination regulations):
2e	language(s) of instruction	☐ German ☒ English ☐ Spanish ☐ French ☐ Other, namely this: Klicken Sie hier, um Text einzugeben.