

module code /  
module title

## Module D-MRI-MRS/ MRI and MRS in biomedical research

date / version of the module  
description

27.10.2020

1	INFORMATION ON THE MODULE	
1a	module code	Module D-MRI-MRS
1b	module title (German title)	MRI und MRS in der biomedizinischen Forschung
1c	module title (English title)	MRI and MRS in biomedical research
1d	credit points	6
1e	responsible for the module	Prof. Dr. Ralf Dringen
1f	type of module	elective module
1g	programs using the module	M.Sc. Biochemistry and Molecular Biology
1h	organizational unit offering the module	Klicken Sie hier, um Text einzugeben.
1i	content-related prior knowledge or skills	
1j	learning contents	<p><i>Topics of the lecture:</i></p> <ul style="list-style-type: none"> <li>· NMR-Equipment</li> <li>· Principle of nuclear magnetic resonance</li> <li>· Basics of signal- and image formation</li> <li>· Relaxation</li> <li>· Intrinsic and extrinsic NMR contrasts</li> </ul>

		<ul style="list-style-type: none"><li>Basics of advanced NMR techniques (fast imaging, fMRI, ...)</li><li>Pathophysiological aspects of metabolic &amp; cardiovascular diseases, diseases of the central nervous system</li><li>Basic concepts of associated in-vivo models</li></ul> <p><i>Lab course:</i></p> <p>Execution of NMR experiments to get a deeper understanding of the following NMR aspects and the ability to analyze / calculate NMR parameters</p> <ul style="list-style-type: none"><li>NMR contrasts, Relaxation times, Diffusion ...</li><li>Relaxivity and contrast behavior of contrast agents</li><li>Artefacts</li></ul>																																																	
1k	learning outcomes/ competencies/ targeted competencies	Students have a fundamental and advanced knowledge in physical aspects of MR imaging and spectroscopy including basics of the development of MR sequences. Students can differentiate between typical imaging contrasts and analyse basic MR images. Students can develop a strategy for in-vivo experiments based on given pathophysiology.																																																	
1l	calculation of student workload  (part a: calculation of presence time and working hours)	<p><b>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).</b></p> <p><b>a) detailed calculation:</b> <b>SWS / presence time/working hours in each course of the module</b></p> <table><tr><td><input checked="" type="checkbox"/></td><td>1</td><td>lecture(s) with</td><td>2</td><td>SWS/ contact hours</td><td>28</td><td>hours of presence time</td></tr><tr><td><input checked="" type="checkbox"/></td><td>1</td><td>seminar(s) with</td><td>1</td><td>SWS/ contact hours</td><td>14</td><td>hours of presence time</td></tr><tr><td><input type="checkbox"/></td><td></td><td>exercise(s) with</td><td></td><td>SWS/ contact hours</td><td></td><td>hours of presence time</td></tr><tr><td><input type="checkbox"/></td><td></td><td>internship(s) with</td><td></td><td>sum of working hours</td><td></td><td></td></tr><tr><td><input type="checkbox"/></td><td></td><td>seminar(s) with</td><td></td><td>SWS/ contact hours</td><td></td><td>total hours of presence time</td></tr><tr><td><input checked="" type="checkbox"/></td><td>1</td><td>laboratory/laboratories with</td><td>1</td><td>SWS/ contact hours</td><td>14</td><td>total hours of presence time</td></tr><tr><td><input type="checkbox"/></td><td></td><td>tutorial(s) with</td><td></td><td>SWS/ contact hours</td><td></td><td></td></tr></table>	<input checked="" type="checkbox"/>	1	lecture(s) with	2	SWS/ contact hours	28	hours of presence time	<input checked="" type="checkbox"/>	1	seminar(s) with	1	SWS/ contact hours	14	hours of presence time	<input type="checkbox"/>		exercise(s) with		SWS/ contact hours		hours of presence time	<input type="checkbox"/>		internship(s) with		sum of working hours			<input type="checkbox"/>		seminar(s) with		SWS/ contact hours		total hours of presence time	<input checked="" type="checkbox"/>	1	laboratory/laboratories with	1	SWS/ contact hours	14	total hours of presence time	<input type="checkbox"/>		tutorial(s) with		SWS/ contact hours		
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		<input type="checkbox"/> excursion(s) with <div style="float: right;"> SWS contact hours in total <div style="float: right;">working hours</div> </div>
		<input type="checkbox"/> other form of course (e.g. block seminar), namely this: Klicken Sie hier, um Text einzugeben.
		<div style="display: flex; justify-content: space-between;"> <div>with SWS / with totally</div> <div>contact hours</div> <div> <input type="checkbox"/> presence time <input type="checkbox"/> working hours </div> </div>
		= sum of presence time and working hours:  56
	calculation of student workload  <i>(part b: preparation time and follow-up work/self-study)</i>	<b>b) working hours for preparation/follow-up work of the course(s) and/or self-study</b> = sum of working hours:  78
	calculation of student workload  <i>(part c: exam preparation etc.)</i>	<b>c) exam preparation (incl. examination)</b> = sum of working hours:  46
	calculation of student workload  <i>(total amount of hours including a) - c))</i>	<b>Total amount of the presence time and working hours a) to c):</b>  180
1m	description of possible optional courses in the module	<u>Can a student choose between different courses within the module?</u>  NO  <u>Short description of selection option</u>  Klicken Sie hier, um Text einzugeben.
1n	language(s) of instruction	<input type="checkbox"/> German <input checked="" type="checkbox"/> English <input type="checkbox"/> Spanish <input type="checkbox"/> French <input type="checkbox"/> Other, namely this: Klicken Sie hier, um Text einzugeben.

1o	frequency	<p><i>(regular cycle module is offered) e.g.: winter semester, yearly or summer semester, yearly or each semester</i></p> <p>summer semester yearly</p> <p>Klicken Sie hier, um Text einzugeben.</p>
1p	duration	<p>one semester module</p> <p>Klicken Sie hier, um Text einzugeben.</p>
1q	Literature <i>(optional)</i>	Klicken Sie hier, um Text einzugeben.
1r	more information on the module <i>(optional)</i>	Instructor: Claudia Neumann-Haefelin
2	<b>INFORMATION ON THE MODULE EXAMINATION</b> (see also AT Art. 5 section 8)	
2a	type of examination	<p><input type="checkbox"/> module exam; i.e. exam with only one component (MP)</p> <p><input checked="" type="checkbox"/> combination exam, i.e. exam with several components (administered by instructors) (KP)</p> <p><input type="checkbox"/> partial exam; i.e. exam with several components (administered by registrar) (TP)</p>
2b	exam components or prerequisites <i>(type, number)</i>	<p><i>PL = graded component of the examination</i></p> <p><i>SL = ungraded component of the examination, coursework</i></p> <p><i>PVL = prerequisite of the examination (see AT Art. 5 Section 10)</i></p> <p><input checked="" type="checkbox"/> PL   2      <input type="checkbox"/> SL        <input type="checkbox"/> PVL   justification</p> <p>If necessary, further explanations:</p>
2c	Give this information for combination examinations only: Weights (in percentage) of component grades	<p>PL 1: 40% presentation, oral (seminar talk)</p> <p>PL 2: 60% oral examination (in English or German)</p> <p>PL 3: Klicken Sie hier, um Text einzugeben.</p> <p>PL 4: Klicken Sie hier, um Text einzugeben.</p> <p>If necessary, further comments:</p> <p>Klicken Sie hier, um Text einzugeben.</p>

2d	form of examination (see AT BPO/AT MPO Art. 8, 9 and 10)	<div> <input type="checkbox"/> Assignment           <input checked="" type="checkbox"/> Oral examination (single)           <input checked="" type="checkbox"/> Presentation, oral         </div> <div> <input type="checkbox"/> Written examination           <input type="checkbox"/> Group examination, oral           <input type="checkbox"/> Presentation and written assignment         </div> <div> <input type="checkbox"/> Portfolio           <input type="checkbox"/> Project report           <input type="checkbox"/> Bachelor Thesis         </div> <div> <input type="checkbox"/> Internship report           <input type="checkbox"/> Colloquium           <input type="checkbox"/> Master Thesis         </div> <div> <input type="checkbox"/> Other (concrete definition is given in the examination regulations):         </div> <div> <a href="#">Klicken Sie hier, um Text einzugeben.</a> </div>
2e	language(s) of instruction	<div> <input type="checkbox"/> German           <input checked="" type="checkbox"/> English           <input type="checkbox"/> Spanish           <input type="checkbox"/> French         </div> <div> <input type="checkbox"/> Other, namely this:         </div> <div> <a href="#">Klicken Sie hier, um Text einzugeben.</a> </div>