

A stylized, dark blue graphic of laboratory equipment, including a rack of test tubes and a beaker, is positioned on the left side of the dark blue background. The top of the page features a horizontal bar with a red segment on the left and a yellow segment on the right.

Module catalogue

Research Master's BioMed

Responsible faculties

Faculty of Natural Sciences and Technology

Faculty of Medicine

Faculty of Mathematics and Computer Science

Responsible departments

Biosciences, Chemistry, Computer Science, Pharmaceutical Science, Physics
and the departments in the Faculty of Medicine

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Based on the Study Regulations of 5 June 2025

Enter date here

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1. Overview of modules

Module	Module element	Type	hrs/wk	Stand ard study seme ster ¹	Repeat cycle	ECT S cred its	Type of examination
Mandatory section, 52 ECTS credits							
Research modules (22 credits)	Research seminar	S	2	1	WS/SS	5	Presentation and report (b)
	Introduction to Academic Research	P	2	1	WS/SS	5	Presentation and report (u)
	Research Project	P	10	1	WS/SS	12	Presentation and report (b)
Master's thesis (30 credits)	Final thesis	Written thesis		2	WS/SS	30	Written thesis and thesis oral presentation (b)
Mandatory electives section: BioMed ^{2 3} , 5 credits							
Experimental Biophysics		V+Ü	3+1	1	WS/SS	5	Preliminary assessments: Practice exercises (u), written or oral examination (b)
Data Science in Medicine		V+Ü	3+1	1	WS/SS	5	Preliminary assessments: Practice exercises (u), written or oral examination

¹ The lower semester is meant as a guideline. The higher semester is the semester in which students typically take the course.

² Modules from biosciences, chemistry, computer science, pharmaceutical science, physics and the departments in the Faculty of Medicine can be chosen for the mandatory electives section. The Examination Board may decide to approve modules from other subjects. The modules listed are examples. An overview of possible modules will be published on an appropriate channel.

³ Students must complete at least one module comprising 5 credits from one of the BioMed subdisciplines.

							(b)
Single Cell Bioinformatics for BioMed		V+Ü	3+1	1	WS/SS	5	Preliminary assessments: Practice exercises (u), written or oral examination (b)
Mandatory electives section: Languages, 3 credits							
Foreign languages ⁴	German <u>or</u> another foreign language	SP	2	1	WS/SS	3	Written or oral examination (u)

⁴ Students who cannot provide proof of proficiency in German of at least B2 level on the Common European Framework of Reference for Languages must complete a 3 credit German course. Students with at least a B2 level in German can fulfil the language requirement by completing a course in another foreign language.

2. Study programme content and learning outcomes

Study programme outcomes/Learning outcomes

- **Subject-specific skills**

The Research Master's BioMed provides students with a deeper understanding of the subject and teaches them the skills and methods needed for them to undertake independent scientific work, develop innovative ideas, critically appraise research findings and act responsibly. Graduates are well prepared for a future career in research through the programme's strong foundation of required research seminars and practical skills classes, as well as mandatory elective modules and the six-month Master's thesis phase. Depending on the mandatory elective and research modules they select, including the modules that prepare them for their Master's thesis, students can choose their focus and fine-tune a professional profile based on their interests.

- **Interdisciplinary skills**

The degree programme is jointly facilitated by several departments from a breadth of natural science disciplines. With teaching staff from a range of fields and the opportunity to complete research in different departments, the programme is interdisciplinary at its core. By choosing relevant courses, students can acquire key digital skills which they can further refine in the research module and while completing their Master's thesis. Students also develop project-related skills by collaborating with research groups.

The programme's strong research focus allows graduates to develop a lasting awareness of their responsibility as researchers and good scientific practice. Students gain a strong sense of personal responsibility through the programme's emphasis on self-directed study and independent research. Through laboratory projects early on in the programme, students gain experience drafting academic research as well as analysing and interpreting data. The laboratory phase also helps students develop the discipline required to carry out planned projects and the ability to analyse and interpret research findings.

- **Professional skills**

There is currently a global push to educate qualified researchers at the axis of the fields of biology, biophysics, biotechnology, chemistry, pharmaceutical science and physics. Saarland

University plays a pioneering role in this development with the Research Master's BioMed. Building off existing mathematical and scientific foundations, the programme gives students the skills required to solve current technical and scientific problems. Although the degree programme is primarily research-oriented, it also prepares students for application-oriented work, for example in the field of biotechnology.

3. Module descriptions

Module					Abbreviated title:
Research module					FoMo
Semester	Usually completed in semester	Repeat cycle	Duration	hrs/wk	ECTS credits
1	1	WS/SS	1 semester	14	22

Module coordinator	Programme coordinator				
Lecturer	Lecturers from the Research Master's BioMed				
Type of module <i>Mandatory module, elective module, etc.</i>	Mandatory module				
Admission prerequisites <i>Prerequisite(s) for participation (in examinations)</i>	None				
Module elements <i>Teaching and learning formats; if applicable, expected number of students</i>	Teaching and learning format <i>Lecture, problem-solving class, ...</i>	Designation	hrs/wk	ECTS credits	
	Seminar	Research seminar	2	5	
	Practical training module	Introduction to Academic Research	2	5	
	Research training module	Research Project	10	12	
Student assessments <i>ECTS credits and grades: prerequisites for awarding ECTS credits</i>	Presentation and report (graded) for each module element				
Workload	Research seminar: Contact teaching time: 30 hours, preparing a presentation and a review of the scientific literature: 120 hours Introduction to Academic Research: Contact teaching time: 30 hours, preparation and follow-up work: 120 hours Research Project: Addressing the research question and preparing a report: 360 hours Total: 660 hours				
Breakdown of module grade <i>(cf. paragraph X of the examination regulations)</i>	Average of all grades, weighted by ECTS credits				
Learning outcomes/skills	After completing this module, students will have acquired the following skills: <ul style="list-style-type: none"> ▪ Conducting independent academic research in a structured setting ▪ Independently planning and carrying out research projects ▪ Preparing research documentation that includes the information necessary to reproduce results ▪ Presenting research findings in scientific language 				

	<ul style="list-style-type: none"> ▪ Applying research methodology to complete a Master's thesis
<p>Content</p>	<ul style="list-style-type: none"> • Guidance on systematic literature reviews in preparation for the Master's thesis • Developing a project outline and timeline for the Master's thesis with the guidance of a lecturer from the Research Master's BioMed • Guidance on proper project documentation • Introduction to research methods for the Master's thesis • Preparation for addressing the Master's thesis research question
<p>Additional information <i>Module compatibility</i> <i>Language of instruction</i> <i>Literature, if applicable</i></p>	<ul style="list-style-type: none"> • Language of instruction: English

Module Experimental Biophysics					Abbreviated title: EB
Semester	Usually completed in semester	Schedule	Duration	hrs/wk	ECTS credits
1	1	WS/SS	1 semester	4	5

Module coordinator	Lautenschläger				
Lecturers	Biophysics lecturers				
Type of module <i>Mandatory module, elective module, etc.</i>	Mandatory elective module				
Admission prerequisites <i>Prerequisite(s) for participation (in examinations)</i>	Preliminary assessment: Exercise assignments (ungraded)				
Module elements <i>Teaching and learning formats; if applicable, expected number of students</i>	Teaching and learning format <i>Lecture, problem-solving class, ...</i>	Designation	hrs/wk	ECTS credits	
	Lecture+ problem-solving class	Experimental Biophysics	3+1	5	
Student assessments <i>ECTS credits and grades: prerequisites for awarding ECTS credits</i>	Written or oral examination (graded)				
Workload	Contact teaching time: 60 hours Preparation and follow-up work: 90 hours Total: 150 hours				
Breakdown of module grade <i>(cf. paragraph X of the examination regulations)</i>	Written or oral examination grade				
Learning outcomes/skills:	<p>After completing this module, students will have acquired the following skills:</p> <ul style="list-style-type: none"> ▪ Identify methods from experimental and statistical physics to selected biological systems ▪ Describe the current key techniques in physics, both experimental and statistical, as well as identify their possible applications in technical scientific settings ▪ Explain the current essential research questions in contemporary biological physics research ▪ Recognize fields in life sciences where new physics-based approaches can be applied to biological research questions 				
Content	<ul style="list-style-type: none"> • Experimental methods in biological physics • Intermolecular forces • Biological transport processes 				

	<ul style="list-style-type: none"> • Physical aspects of cell mechanics and the cytoskeleton • Non-Gaussian distributions in biology • Evolution • Pattern formation in biology • In vivo and in vitro genetic circuits • Parallel measurements – microchips • Molecular networks
<p>Additional information <i>Module compatibility</i> <i>Language of instruction</i> <i>Literature, if applicable</i></p>	<p>Language of instruction: English</p> <p>Reference texts:</p> <ul style="list-style-type: none"> • Bruce Alberts, Rebecca Heald, Alexander Johnson, David Morgan, Martin Raff, Keith Roberts, Peter Walter „Molecular biology of the Cell“, Norton & Company (2022) • Harvey Lodish, Arnold Berk, Chris Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Kelsey C. Martin, Michael Yaffe, Angelika Amon „Molecular Cell Biology“(9th edition) Macmillan Learning (2021). • James D. Murray „Mathematical Biology“, Springer, 3. 2007 edition • Tamás Vicsek „Fluctuations and Scaling in Biology“, Oxford Univ. Press, 1. print (2001), online (2023). • Scientific literature published in journals – literature will be announced in the lecture

Module Data Science in Medicine					Abbreviated title: DSM
Semester	Usually completed in semester	Schedule	Duration	hrs/wk	ECTS credits
1	1	WS/SS	1 semester	2	5

Module coordinator	Keller				
Lecturer	Bioinformatics lecturers				
Type of module <i>Mandatory module, elective module, etc.</i>	Mandatory elective module				
Admission prerequisites <i>Prerequisite(s) for participation (in examinations)</i>	None				
Module elements <i>Teaching and learning formats; if applicable, expected number of students</i>	Teaching and learning format <i>Lecture, problem-solving class, ...</i>	Designation	hrs/wk	ECTS credits	
	Lecture+ problem-solving class	Data Science in Medicine	3+1	5	
Student assessments <i>ECTS credits and grades: prerequisites for awarding ECTS credits</i>	Written or oral examination (graded)				
Workload	Contact teaching time: 60 hours Preparation and follow-up work: 90 hours Total: 150 hours				
Breakdown of module grade <i>(cf. paragraph X of the examination regulations)</i>	Written or oral examination grade				
Learning outcomes/skills:	<p>After completing this module, students will have acquired the following skills:</p> <ul style="list-style-type: none"> ▪ Identify basic terms and concepts of data science in the medical context ▪ Classify various data types ▪ Interpret basic visualizations ▪ Perform statistical analyses ▪ Differentiate between machine learning, deep learning and classical statistics ▪ Identify typical applications in medicine ▪ Reflect on the opportunities and limits of data-driven approaches in medicine 				
Content	<ul style="list-style-type: none"> • Interdisciplinary introduction to data science approaches in medicine • Explanation of basic data types and formats • Graphic representations of medical data • Introduction to key concepts and methods of modern data analysis (statistics, machine learning, deep learning and artificial intelligence) • Algorithms for supervised and unsupervised learning 				

	<ul style="list-style-type: none">• Independent data analysis: importing data, creating graphic representations, performing simple analyses• Reflection on ethical questions, data protection and possible biases in AI-based approaches in medicine
<p>Additional information <i>Module compatibility</i> <i>Language of instruction</i> <i>Literature, if applicable</i></p>	<p>Language of instruction: English</p> <p>Reference texts:</p> <ul style="list-style-type: none">▪ Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani "An Introduction to Statistical Learning", Springer Texts in Statistics (STS) (2021) https://www.statlearning.com

Module					Abbreviated title:
Single Cell Bioinformatics for BioMed					SCB
Semester	Usually completed in semester	Schedule	Duration	hrs/wk	ECTS credits
1	1	WS/SS	1 semester	2	5

Module coordinator	Keller				
Lecturer	Bioinformatics lecturers				
Type of module <i>Mandatory module, elective module, etc.</i>	Mandatory elective module				
Admission prerequisites <i>Prerequisite(s) for participation (in examinations)</i>	None				
Module elements <i>Teaching and learning formats; if applicable, expected number of students</i>	Teaching and learning format <i>Lecture, problem-solving class, ...</i>	Designation	hrs/wk	ECTS credits	
	Lecture+problem-solving class	Single Cell Bioinformatics for BioMed	3+1	5	
Student assessments <i>ECTS credits and grades: prerequisites for awarding ECTS credits</i>	Written or oral examination (graded)				
Workload	Contact teaching time: 60 hours Preparation and follow-up work: 90 hours Total: 150 hours				
Breakdown of module grade <i>(cf. paragraph X of the examination regulations)</i>	Written or oral examination grade				
Learning outcomes/skills:	<p>After completing this module, students will have acquired the following skills:</p> <ul style="list-style-type: none"> ▪ Identify central concepts of single-cell omics including DNA-sequencing, transcriptomics, epigenomics, proteomics and spacial and multi-omics approaches ▪ Identify current developments in single-cell technologies and their applications in biomedical research ▪ Handle single-cell data, including quality control, processing, explorative analysis and differential analysis ▪ Model cell trajectories, pseudotime trajectories and regulatory networks ▪ Integrate multi-omics data ▪ Apply bioinformatics methods to real single-cell data sets ▪ Independently develop analysis pipelines 				

	<ul style="list-style-type: none"> ▪ Complete complex analysis tasks independently and in a structured manner ▪ Critically examine data quality, choice of analysis type and biological implications ▪ Learn and implement new methods and technologies independently and in a goal-oriented manner ▪ Effectively work with others to complete programming projects and coordinate shared analysis and problem-solving strategies ▪ Communicate results in discussions, presentations and reports effectively and with consideration of the target audience ▪ Provide and receive constructive feedback in the context of collaborative projects
<p>Content</p>	<p>Current laboratory techniques and bioinformatic methods will be explored:</p> <ul style="list-style-type: none"> ▪ Single-cell DNA sequencing and single-cell genomics ▪ Sequencing of individual molecules ▪ Single-cell transcriptomics ▪ Single-cell epigenomics, including chromatin accessibility, DNA methylation and profiling regulatory proteins ▪ Spatial transcriptomics ▪ Single-cell proteomics ▪ Single-cell multi-omics ▪ Single-cell perturbation experiments ▪ New technologies in development ▪ Quality control and processing of single cell sequencing data ▪ Explorative data analysis ▪ Differential analysis (ex. single-cell gene expression) ▪ Cell trajectory inference, pseudotime ▪ Data integration (data from different data sets and omics) ▪ Data-driven inference of gene regulation and regulatory networks
<p>Additional information <i>Module compatibility</i> <i>Language of instruction</i></p>	<p>Language of instruction: English</p> <p>Reference texts:</p>

Literature, if applicable

- Scientific literature published in journals – literature will be announced in the lecture
- Lecture slides will be made available.

Module Foreign languages					Abbreviated title: FS
Semester	Usually completed in semester	Schedule	Duration	hrs/wk	ECTS credits
1	1	WS/SS German language course only in summer semester	1 semester	2	3

Module coordinator	ISZ Saar (International Study Centre Saar) for German courses / Language Centre (other language courses)			
Lecturer	Instructors from ISZ Saar and the Language Centre			
Type of module <i>Mandatory module, elective module, etc.</i>	Mandatory elective module			
Admission prerequisites <i>Prerequisite(s) for participation (in examinations)</i>	None (diagnostic language test may be required)			
Module elements <i>Teaching and learning formats; if applicable, expected number of students</i>	Teaching and learning format <i>Lecture, problem-solving class, ...</i>	Designation	hrs/wk	ECTS credits
	Language Course	German <u>or</u> another foreign language	2	3
Student assessments <i>ECTS credits and grades: prerequisites for awarding ECTS credits</i>	Written or oral examination (u)			
Workload	90 hours total (contact teaching time and self-directed study)			
Breakdown of module grade <i>(cf. paragraph X of the examination regulations)</i>	ungraded			
Learning outcomes/skills:	<p>Dependent on the level of the language course (course level may be determined by a diagnostic language test)</p> <p>A1 – Beginner</p> <p>Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.</p>			

A2 – Basic knowledge

Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.

B1 – Intermediate

Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can deal with most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal interest. Can describe experiences and events, dreams, hopes and ambitions, and briefly give reasons and explanations for opinions and plans.

B2 – Independent use of language

Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialization. Can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party. Can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options.

C1 – Advanced

Can understand a wide range of demanding, longer texts, and recognize implicit meaning. Can express him/herself fluently and spontaneously without much obvious searching for expressions. Can use language flexibly and effectively for social, academic and professional purposes. Can produce clear, well-structured, detailed text on complex subjects,

	<p>showing controlled use of organizational patterns, connectors and cohesive devices.</p> <p>C2 – Approximate native speaker proficiency</p> <p>Can understand with ease virtually everything heard or read. Can summarize information from different spoken and written sources, reconstructing arguments and accounts in a coherent presentation. Can express themselves spontaneously, very fluently and precisely, differentiating finer shades of meaning even in more complex situations.</p>
<p>Content</p>	<ul style="list-style-type: none"> • Reading comprehension • Listening comprehension • Speaking • Grammar • Writing
<p>Further information <i>Module compatibility</i> <i>Language of instruction</i> <i>Literature, if applicable</i></p>	<p>Students who cannot provide proof of proficiency in German of at least B2 level on the Common European Framework of Reference for Languages must complete a 3-credit German course. Students with at least a B2 level in German can fulfil the language requirement by completing a course in another foreign language.</p>

Module Master's thesis					Abbreviated title: M
Semester	Usually completed in semester	Schedule	Duration	hrs/wk	ECTS credits
2	2	WS/SS	1 semester	20	30

Module coordinator	Programme coordinator				
Lecturer	Lecturers from the Research Master's BioMed				
Type of module <i>Mandatory module, elective module, etc.</i>	Mandatory module				
Admission prerequisites <i>Prerequisite(s) for participation (in examinations)</i>	Proof of a passing grade in the research module				
Module elements <i>Teaching and learning formats; if applicable, expected number of students</i>	Teaching and learning format <i>Lecture, problem-solving class, ...</i>	Designation	hrs/wk	ECTS credits	
	Written thesis	Final thesis	20	30	
Student assessments <i>ECTS credits and grades: prerequisites for awarding ECTS credits</i>	Written thesis and thesis oral presentation (graded)				
Workload	Planning, carrying out and documenting a research project and completing the written Master's thesis within 23 weeks Total: 900 hours				
Breakdown of module grade <i>(cf. paragraph X of the examination regulations)</i>	Grade awarded to the Master's thesis				
Learning outcomes/skills	After completing this module, students will have acquired the following skills: <ul style="list-style-type: none"> ▪ Conducting independent academic research in a structured setting ▪ Independently planning and carrying out research projects ▪ Preparing research documentation that includes the information necessary to reproduce results ▪ Presenting research findings in scientific language 				
Content	<ul style="list-style-type: none"> • Carry out a project related to a current research topic of one of the research groups in the Research Master's BioMed under the guidance of a thesis advisor • Complete the written Master's thesis 				
Additional information <i>Module compatibility Language of instruction Literature, if applicable</i>	Language of instruction: English Literature:				

- Relevant reference books from the BioMed disciplines
- Scientific literature published in journals

4. Example study plan

Modules	1. Sem.	2. Sem.
Research module	x	
Master's thesis		x
BioMed mandatory elective course e.g. Experimental Biophysics (Master's)	x	
Foreign language	x	
hrs/wk	20	
ECTS credits	30	30
Total ECTS credits	30	30