Module Handbook

Heidelberg University
Medical Faculty Mannheim
Master of Science “Translational Medical Research”

Period of Study:	Two semesters full time; yearly intake (winter term)
Type of Study:	Consecutive; research oriented
Areas of Study:	Molecular Biology; Clinical Research
Location:	Medical Faculty Mannheim/ UMM
Fees:	General fees at Heidelberg University https://www.uni-heidelberg.de/en/study/management-of-studies/semester-fees
ECTS credits:	60
Modules:	Four teaching modules with practical experience and a final research/thesis module
Target Group:	Graduates in medicine/ health sciences/ life sciences with 1st degree equivalent to 240 ECTS

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1 Quality objectives and overview

1.1 Preamble: Qualification objectives at Heidelberg University

In accordance with its mission statement and constitution, Heidelberg University's degree courses have subject-related, transdisciplinary and occupational objectives. They aim to provide a comprehensive academic education equipping graduates for the world of work.

Consequently, the following competence profile is included in module handbooks as a profile of skills valid for all disciplines. It is applied to the specific objectives of the individual courses and implemented in curricula and modules.
The main points of the competence profile are the following:

- Developing subject-related skills with a pronounced research orientation
- Developing the ability to engage in transdisciplinary dialogue
- Developing practice-related problem-solving skills
- Developing personal and social skills
- Promoting the willingness to assume social responsibility on the basis of the skills acquired

1.2 Profile of the degree programme MSc Translational Medical Research

One of the major aims of translational medical research is to translate knowledge, mechanisms, and techniques of basic molecular and cellular research into new approaches for diagnosis and therapy of disease, and also to translate clinical observations back to the laboratory, and back to basic research questions.
Therefore, this Master programme focuses on the interface between experimental basic science and clinical medicine, and methods and models required for translation across this interface. It trains students with a first university degree (e.g. BSc or medical degree) in the interdisciplinary field of translational medical research between research laboratory and clinics. The MSc Translational Medical Research programme's subject-related and transdisciplinary qualification objectives are closely interrelated.

1.3 Subject-related qualification objectives

Graduates of the MSc in Translational Medical Research (TMR) are able to

- judge and value the latest research in the fields of molecular and cellular biology of medical disorders
- describe and explain disease processes at the molecular and cellular levels
- appraise and critique clinical study design, drug development as well as ethical issues and formalities regarding research
- assess and discuss cutting-edge methods and current problems in diagnosis and therapy of medical disorders
- define and value key stakeholders involved in the translational process, including in the translation towards industry
- can apply their thorough knowledge about the principles of translational research techniques to a broad range of medical questions

They have acquired the ability to

- write a review article, create a research proposal and evaluate proposals from others
- present and defend their research orally using a variety of different media

- independently formulate research projects in translational medicine, including identifying the research question, the methodology for its solution, and the impact of the results at a practice and policy level
- autonomously work on a specific research project in a laboratory or clinical setting and participate actively in lab routines such as journal clubs, progress reports and academic discussion

In addition to all of the above topics, students have a deepened knowledge in the areas from which they have chosen practical courses.

MSc TMR graduates have a clear appreciation of the interdisciplinary action needed and the competence to communicate to bridge the gap between basic science and clinical research, diagnosis and therapy.

1.4 Trans- and multidisciplinary qualification objectives

Graduates of the MSc in Translational Medical Research (TMR) are able to:

- independently identify, select and acquire knowledge and apply this knowledge in practical situations
- identify, examine and critically analyze information from different sources in order to develop innovative and creative solutions to research problems
- write research proposals and review articles that demonstrate independent thinking
- discuss questions and findings with others in their field as well as in an interdisciplinary setting using a variety of media
- select the relevant practical tools to answer research questions and work with these tools in a collaborative setting
- design and manage projects, including appropriate timing and keeping of deadlines
- actively participate in an international, multi-cultural and multi-disciplinary team, through, e,g., contribution of experimental work and discussion
- provide, accept and consider constructive criticism

1.5 Possible career options

Students who successfully complete the translational medical research programme are ideally placed to take advantage of a broad range of employment opportunities in academia, clinics and industry. Progress in diagnosis and therapy in medicine, in particular concerning diseases such as cancer, vascular disorders, or nervous system disorders, is no longer achievable without the competent integration of know-how and knowledge at the levels of molecular biology, systems biology and clinical pathophysiology. Additionally, when it comes to developing a new diagnostic tool or therapeutic from the bench to the clinical application, the students graduating from the MSc in Translational Medical Research programme will have decisive advantages over students qualified in classical study tracks such as biology, engineering or medicine. Therefore, our graduates have good perspectives both in academia as well as in industry. They are well-prepared to continue with an MD or PhD programme in a basic or applied research or clinical setting. Qualified researchers with at least a Masters degree are also needed in other employment areas e.g. for the validation of translational safety biomarkers, surrogate markers for vascular endpoints, pain research, new tools for the development of novel therapies in psychiatric disorders and neurodegenerative diseases etc.

Examples for employers in academia include Universities, biomedical research organizations such as those found in the Helmholtz Gemeinschaft, Blaue Liste institutions and Max-Planck institutes. Examples in the pharmaceutical industry include Bayer Schering, Merck, Roche, Sanofi Aventis, Novartis and many more. Similar openings are available to TMR graduates in academic and industrial research organizations abroad. Furthermore, students who already obtained or will obtain a Medical degree often continue as clinician scientists and participate in clinical and/ or experimental laboratory studies.

1.6 Special aspects

1.6.1 Reasons for cumulative exams

Since the TMR Master program modules aim to endow students with a comprehensive skill set in the respective topic and area, a single final module exam would not be suitable. Instead, multiple choice exams in the key teaching modules are supplemented by written or oral assignments by individual students or in groups to adequately check the acquisition of competences, and to increase their long-term gain in knowledge and experience.

1.6.2 Types of teaching, learning and assessment

The types of teaching, learning and assessment are listed for each module. Details will also be communicated in the first information session of the program, and will also be distributed to the students in written form. Furthermore, specific evaluation criteria and evaluation sheets used for grading will be made available to the students in parallel to the respective assignments and during their preparation for exams.

1.6.3 The International Master in Innovative Medicine

A small number of students from the EACEA-supported Erasmus Mundus Joint Master Degree (EMJMD) "International Master in Innovative Medicine" (IMIM) study the TMR programme as one of their two semesters of a 120 ECTS (four semester) international Master's programme. They spend another year a partner university such as Uppsala Universitet (Sweden) or Rijksuniversiteit Groningen (The Netherlands) and will receive a double degree from the respective universities that they studied at. This track is only open if announced, to students who have applied for and have been accepted as students of the international EMJMD programme "IMIM" by the main partner, Rijksuniversiteit Groningen. For details of IMIM, please see https://www.innovativemedicine.eu/ and the specific handbooks of this study programme.

2 Model study plan

2.1 Mobility options and windows

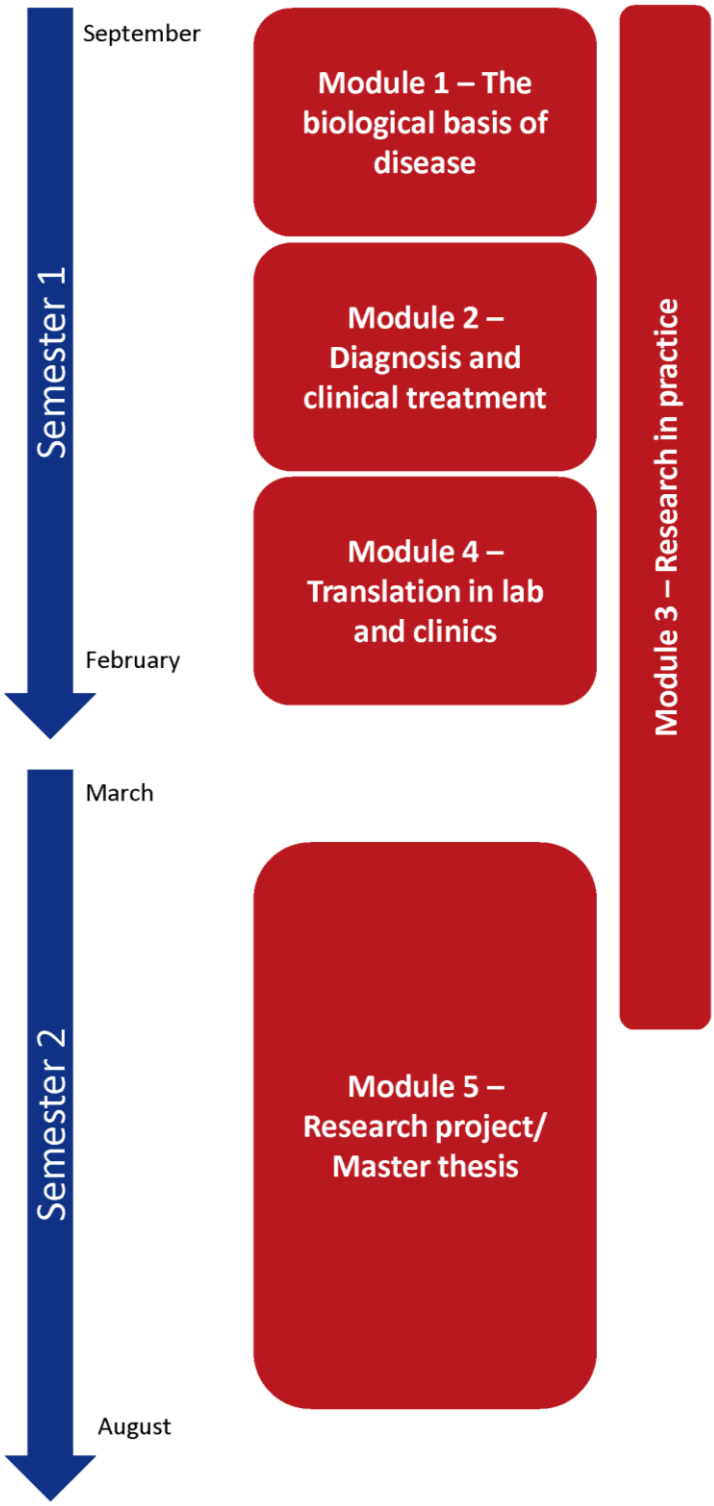
TMR students can perform their Master thesis work locally or in an academic group or company elsewhere (nationally or internationally), as long as the topic and content is suitable, and relevant for translational medical research. Internships abroad are ideal for the ERASMUS placement option, which offers the possibility of acquiring a small scholarship while funds are available (early applications are encouraged).

The bilateral agreement between the Medical Faculty Mannheim and the University of Naples, Italy (Università degli Studi di Napoli Federico II) in the context of the Erasmus+ programme offers further mobility options. Under the auspices of this agreement, students registered as TMR students can spend up to 9 months taking courses in the programme "MSc in Medical Biotechnologies". Early application and Italian language skills at B1 level are recommended. Students from the University of Naples' Master's program can also apply via ERASMUS for the available positions to join the TMR program.

Students from Anhui Medical University (AMU) profit from cooperation agreements with the Medical Faculty Mannheim and can join the TMR programme if they prove to be suitable candidates.

TMR students who are part of the IMIM programme spend one of their two study years at one of the partner universities (University of Groningen, The Netherlands; University of Uppsala, Sweden), and can in addition select to spend an internship at one of the four Latin American partner universities.

2.2 Simplified TMR study chart



3 Modules

3.1 Overview of the programme

The Master course „Translational Medical Research" is divided into 4 modules that focus on the "bench to bedside and back" paradigm during Semester 1. Module 1 teaches the basis of medical disorders and disease processes at the molecular and cellular level through the teaching of common hallmarks of disease. In Module 2 students acquire knowledge about current methods and challenges in the clinical diagnosis and treatment of disease, as well as current research approaches in these areas. Module 3 allows students to explore research in practise, for example in the context of bioinformatic and biostatistics, as well as project design and peer review. Module 4 focuses specifically on translational medicine, and covers a range of topics including case studies, intrastructure requirements, and the role of industry in commercial translation. In each of the theoretical modules, students can select from a range of short compact practical courses (Smorgasbord) that illustrate key aspects of the theoretical content of the module. In Semester 2, students carry out a Master's thesis research project, summarize their research as a written master thesis, and give a presentation and defence of their work in the form of a final master thesis exam (Module 5).

Module	Title	Course	Title	ECTS
1	The biological basis of disease	1.1	Scientific key competences – Part 1	7
		1.2	Cellular and molecular hallmarks of disease processes	
		1.3	Disease processes labs	
2	Diagnosis and clinical treatment	2.1	Scientific key competences – Part 2	6
		2.2	State of the art, cutting edge research and current challenges in diagnosis and clinical treatment	
		2.3	Diagnosis and clinical treatment labs	
3*	Research in practice	3.1	Data analysis courses including Biostatistics, Bioinformatics, R programming	10
		3.2	Translational project	
		3.3	Research proposal project	
4	Translation in lab and clinics	4.1	Case studies	7
		4.2	Infrastructure for translational research	
		4.3	Drug development	
		4.4	Translation labs	
		4.5	Industry and innovation	
5	Research project/ Master thesis		Research project with written and oral presentation	30
Total				**60**

Module 1 – The biological basis of disease

<table>
<tr><td rowspan="5">Module number
Module 1

(compulsory Module)</td><td colspan="2">Module title
The biological basis of disease</td><td>ECTS credits
7</td></tr>
<tr><td>Student Investment Time (SIT)
210 hours</td><td>Types of teaching, learning and assessment</td><td rowspan="4">Module offered
Annually in September - November

Duration
8-10 weeks</td></tr>
<tr><td>Lectures, seminars & tutorials ~70-80</td><td rowspan="3">Lectures, seminars and tutorials (topics taught plus Q&A) with final multiple-choice exam and group presentations (graded individually per student); practical laboratory courses to actively attend. Additional presentations (not graded). Self-study time includes the time required to prepare for and complete all module assessments.</td></tr>
<tr><td>Practical courses ~40</td></tr>
<tr><td>Self-study ~90-100</td></tr>
<tr><td>Topics covered/ Courses</td><td colspan="3">Compulsory courses:

1.0 Preparatory classes
• Refresher on cellular and molecular biology
• Compact course in either laboratory skills or about the principles of clinical medicine

1.1 Scientific key competences - Part 1:
• Critical paper reading and scientific ethics
• Presentation skills workshop

1.2 Cellular and molecular hallmarks of disease processes
• The course provides an overview of molecular and cellular pathology based on hallmarks that are common across many diseases. The main focus is on the identification and understanding of alterations in biological pathways and processes responsible for particular disorders, as well as on key pathological processes that are associated with certain diseases.

1.3 Disease processes labs (compulsory elective courses)
• Laboratory course in small groups: students choose from a variety of topics from molecular oncology, neurobiology, vascular medicine and others</td></tr>
<tr><td>Learning objectives</td><td colspan="3">After completing the module, students are able to:

(1) assess and apply the basis of good scientific practice and ethics.
(2) independently research and critically evaluate scientific literature.
(3) deliver oral presentations independently with a variety of media.
(4) explain and discuss basis and functions as well as the latest research of disease-relevant molecular and cellular biology.
(5) compare and assess cellular and molecular basis of disease processes.
(6) identify and analyse the possible cellular or molecular reason for a certain disease, and summarize and present their conclusions in small teams.
(7) identify and analyse the possible diseases that can arise from a molecular or cellular malfunction, and summarize and present their conclusions in small teams.
(8) apply and trouble-shoot basic molecular laboratory techniques such as PCR and Western Blot.
(9) showcase and execute the practical implementation of medical research.</td></tr>
</table>

Requirements/ Recommendations for participation	• Basic laboratory skills • Basic understanding of the principles of cell and molecular biology, genetics and biochemistry • Basics of literature research, paper reading and writing • *Enrolment in the M.Sc. programme Translational Medical Research*
Requirements for the assignment of credits & composition of the final grade of the module	Students' achievement of the learning outcomes of the module will be assessed through a combination of a multiple-choice exam (2 ECTS) and a group presentation on hallmarks of disease (1 ECTS, graded individually). Other group presentations on critical analysis of scientific evidence (1 ECTS), cell biology topics (1 ECTS) and an individual presentation are not graded. All exams and assignments need to be completed, in addition to active participation in laboratory practicals (2x 1 ECTS). The final module grade consists of the MC exam and the hallmarks presentation (German grading scale 1-5).
Module classification/ Application of the module	To be taken in Semester 1 of TMR, prerequisite for Module 2 (usability in other degree programmes unknown)

Module 2 – Diagnosis and clinical treatment

<table>
<tr><td>Module number
Module 2

(compulsory Module)</td><td colspan="2">Module title
Diagnosis and clinical treatment</td><td>ECTS credits
6</td></tr>
<tr><td rowspan="4"></td><td>Student Investment Time (SIT)
180 hours</td><td>Types of teaching, learning and assessment</td><td rowspan="4">Module offered
Annually in October/November

Duration
4-6 weeks</td></tr>
<tr><td>Lectures, seminars & tutorials ~50
Practical courses ~30
Self-study ~100</td><td>Lectures, seminars and tutorials (topics taught plus Q&A) with final multiple-choice exam; practical laboratory courses to actively attend; self-study time includes the time required to prepare for and complete all course assessments, which includes writing an essay in the form of a review article.</td></tr>
</table>

Topics covered/ Courses	<u>Compulsory courses</u>: 2.1 Scientific key competences - Part 2: • Literature research • Review/Extended Essay writing[1] 2.2 State of the art, cutting edge research and current challenges in diagnosis and clinical treatment e.g. from the fields of pathology, clinical chemistry, imaging, pharmacology, surgery, radiotherapy and psychotherapy. 2.3 Diagnosis and clinical treatment labs (compulsory elective courses) Laboratory courses in small groups: students choose from a variety of topics from molecular oncology, neurobiology, vascular medicine and others. [1]Review/ Extended Essay writing: The course provides students with an opportunity to perform literature research around a timely topic in translational research, then to write an extended essay in the form of a referenced review article. The essay should give an overview of the field in question, but also give more detail about research results in a subsection of the field.
Learning objectives	<u>After completing the module, students are able to:</u> (1) autonomously write a scientific review article. (2) assess and discuss the state of the art and current challenges regarding diagnosis and therapy in molecular pathology, clinical chemistry, imaging, pharmacology, surgery, radiotherapy, psychotherapy and other fields. (3) explain and apply selected examples of practical methods in clinical research, diagnosis and therapy, such as the basic principles and physics behind selected imaging techniques, as well as interpret their results from the data and explain how they are used in the clinical setting. (4) describe and discuss the practical implementation of research related to diagnosis and therapy.
Requirements/ Recommendations for participation	• Participation in Module 1 • Cellular and molecular basis of diseases, scientific key competences – part 1 • *Enrolment in the M.Sc. programme Translational Medical Research*
Requirements for the assignment of credits & composition of the final grade of the module	Students' achievement of the learning outcomes of the module will be assessed through a combination of multiple-choice exam (2 ECTS) and an individual writing assignment (2 ECTS) which result in the final module grade. Active participation in laboratory courses is also required (2x 1 ECTS). (German grading scale 1-5)
Module classification/ Application of the module	To be taken in Semester 1 of TMR, prerequisite for Module 4 (usability in other degree programmes unknown)

Module 3 – Research in practice

<table>
<tr><td rowspan="5">Module number
Module 3

(compulsory Module)</td><td colspan="3">Module title
Research in practice</td><td>ECTS credits
10</td></tr>
<tr><td colspan="2">Student Investment Time (SIT)
300 hours</td><td>Types of teaching, learning and assessment</td><td rowspan="4">Course offered
Annually from September until May/June
Duration
In parallel to Module 1-5</td></tr>
<tr><td>Lectures</td><td>~20</td><td rowspan="3">Lectures and practical computer-based tutorials/workshops, following demonstrations and individual follow-up in homework, with final multiple choice exam and presentation(s); individual project sketch and research proposal writing with peer-review, supported by instructions and meetings. Self-study time includes the time required to prepare for and complete all course assessments.</td></tr>
<tr><td>Practical courses (computer-based workshops)</td><td>~70</td></tr>
<tr><td>Self-study</td><td>~210</td></tr>
<tr><td>Topics covered/ Courses</td><td colspan="4">Compulsory courses:

3.1 Data analysis courses with Biostatistics, Bioinformatics, R programming
• Biostatistics Part 1: Statistical methods specific for laboratory research. Tutorials will provide the necessary practical support for the students as they begin to use the various statistical methods. Topics include statistical analysis and processing of selected examples with appropriate software.
• Biotatistics Part 2: The course focuses on the design and background of clinical studies and relevant statistical methods. Tutorials will provide the necessary practical support for the students as they begin to use the various statistical methods with appropriate software.
• Introduction to Bioinformatics: This course introduces students hands-on to Bioinformatics, using RNA-seq data analysis via the graphical user interface “Galaxy” as an entry point. Lecture parts are interspersed with hands-on computer tutorials in class and at home. Student groups are tasked to identify a publication of their interest which includes RNA-seq analysis which is then re-analyzed during the course and presented at the end.
• R Programming: This hands-on course introduces students to the basics of programming with R, using examples of plot types and statistical tests that are common in biological and medical research.
• Further content and courses regarding data analysis are offered such as an Image Analysis Workshop for processing e.g. microsopy images with appropriate software.

3.2 Translational project
Students select a Rare Disease from dedicated databases for which they identify research questions regarding improved basic understanding or improved diagnosis or treatment options, and compose a project sketch.

3.3 Research proposal project
For project planning, research proposal writing and evaluation, the students will have to carry out the following tasks in a long-term project that will develop a variety of soft skills:
(i) define a meaningful interdisciplinary translational research health problem
(ii) discuss the research problem with an interdisciplinary team
(iii) write a research proposal to address the identified health problem
(iv) review the completed research applications of other students</td></tr>
</table>

	(v) improve the research proposal taking the review into account and write a rebuttal to the review These tasks will be supported by lectures and tutorials. At the beginning of the programme students have been presented with documentation about the research interests of potential future thesis supervisors. The students can choose one of these topics (or one that they have defined themselves) and develop their research proposal as the basis of their future Masters thesis (TMR) or research internship (IMIM), or follow up on their translational project.
Learning objectives	<u>After completing the module, students are able to:</u> (1) choose the appropriate biostatistical method for a laboratory experiment with small sample size, apply it and interpret the result. (2) choose the appropriate biostatistical method for a clinical study, apply it and interpret the result. (3) explain and evaluate next-generation sequencing experiments, communicate about connected aspects and issues, and analyze such data with appropriate software by themselves. (4) apply basic skills acquired in the syntax of R programming to create graphs and statistical output. (5) explain and apply the principles of project management and design to develop their own project. (6) develop their own ideas for possible future translational therapies, and design a translational research project. (7) present and explain their research project using a variety of techniques (written, oral). (8) discuss their and others' research project/s within a group of peers and give constructive feedback on topics in similar and other research fields. (9) independently identify, examine and organize all relevant information for writing a practice research proposal to support their research work and write such a proposal. (10) explain and assess research proposals written by their peers and independently research all relevant information to constructively review other's research proposals. (11) create a written review of other's research proposals. (12) appraise and jugde constructive written criticism from their peers. (13) improve their research proposal while taking the criticism of their peers into account and write a rebuttal to the criticism.
Requirements/ Recommendations for participation	• Participation in Modules that take place in parallel and have related content is recommended. • Basics of literature research, critical paper reading and writing • Presentation skills • Basic computer skills • *Enrolment in the M.Sc. programme Translational Medical Research*
Requirements for the assignment of credits & composition of the final grade of the module	Students' achievement of the learning outcomes of the course will be assessed through a combination of a multiple-choice exam and group presentation(s) (4 ECTS in total), plus the evaluation of a project sketch (2 ECTS), a written research proposal, a peer review and a rebuttal of the reviewer's criticism (4 ECTS). The final module grade is composed proportionally by all graded parts (German grading scale 1-5).
Module classification/ Application of the module	To be taken throughout Semester 1 and 2 (usability in other degree programs unknown)

Module 4 – Translation in labs and clinics

<table>
<tr><td rowspan="5">Module number
Module 4

(compulsory Module)</td><td colspan="2">Module title
Translation in lab and clinics</td><td>ECTS credits
7</td></tr>
<tr><td>Student Investment Time (SIT) 210 hours</td><td>Types of teaching, learning and assessment</td><td rowspan="4">Course offered
Annually in January/February

Duration
~7-8 weeks</td></tr>
<tr><td>Lectures, seminars, workshops & tutorials ~90
Practical courses ~30
Self-study ~90</td><td rowspan="3">Lectures, seminars and tutorials (topics taught plus Q&A) with final multiple-choice exam and group presentations; practical laboratory courses to actively attend. Self-study time includes the time required to prepare for and complete all course assessments including a pitch of a business idea supported through a lecture/workshop series.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Topics covered/ Courses</td><td colspan="3">Compulsory courses:

4.1 Case studies
Provides an overview of established and experimental therapies and diagnostics, and gives an insight into how experimental therapies and diagnostics develop into accepted and established clinical procedures. Selected examples of targeted therapies and translational medicine will be explored in depth in the context of workshops and seminars in order to illustrate their principles, development and application in clinical practice.

4.2 Infrastructure for translational research
Infrastructure necessary for translational research, e.g. animal models, clinical studies and biobanking, is explored in depth.

4.3 Drug development
Provides an in-depth insight into the principle of drug development and design.

4.4 Translation labs (compulsory elective courses)
Laboratory courses in small groups: students choose from a variety of topics from molecular oncology, neurobiology, vascular medicine and others.

4.5 Industry and innovation
This course focuses on how to develop a translational outcome into a commercial application and is supplemented by project design and management contents. Additionally, lectures on public health, medical devices, technological solutions and implementation in industry broaden the perspective and understanding.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">After completing the module students are able to:

(1) explain current major translational therapy strategies, and how these are being developed and applied in the clinical setting based on case studies.
(2) discuss the theory behind experimental therapies and targeted therapies and deduce how they are actually put into practice through the analysis of real-life examples.
(3) explain the principles of biobanking and identify which formal requirements have to be taken into account before using samples from biobanks or before obtaining samples to be stored in biobanks.</td></tr>
</table>

	(4) assess for which experimental questions biobanked tissue can be meaningfully used. (5) design in theory a clinical trial, explain how clinical trials are executed and which national and international bodies are involved in the process. (6) formulate, critique and present ethics committee proposals. (7) explain the principles and examples of novel disease treatment currently under development, e.g. targeted molecular delivery, tools for regenerative medicine, stem cell therapy etc. (8) explain the current state of the art in genomics, proteomics and metabolomics and reproduce examples of their use for translational medicine. (9) describe and discuss in detail how a pharmaceutical drug is designed and developed from lead compound to end product. (10) describe and support how translation is taken beyond the clinic, e.g. into commercial applications. (11) showcase and execute the practical implementation of translational research
Requirements/ Recommendations for participation	• Participation in Modules 1 and 2 • *Enrolment in the M.Sc. programme Translational Medical Research*
Useful prior knowledge	• Laboratory methods • Biological basis of disease • Current challenges in diagnosis and therapy
Assessment methods	Students' achievement of the learning outcomes of the course will be assessed through a combination of colloquia, presentations, grading of ethics committee proposal, written tasks and evaluation of examinations of theoretical content at the end of module 4
Module classification/ Application of the module	To be taken in semester 1 of TMR, prerequisite for Module 5 (usability in other degree programs unknown)

Module 5 – Research project/ Master thesis

<table>
<tr><td rowspan="3">Module number
Module 5

(compulsory Module)</td><td colspan="3">Course title
Master thesis research project with written master thesis and oral presentation</td><td>ECTS credits
30</td></tr>
<tr><td colspan="2">Student Investment Time (SIT)
900 hours</td><td>Types of teaching, learning and assessment</td><td rowspan="2">Module offered
Continually; recommended start in March

Duration
5-7 months</td></tr>
<tr><td>Lectures, seminars, workshops & tutorials</td><td>~5</td><td rowspan="2">Individually supervised research project with final thesis report and oral defense.</td></tr>
<tr><td></td><td>Self-study (including individual laboratory work)</td><td>895</td><td></td></tr>
<tr><td>Topics covered</td><td colspan="4">Defined on an individual basis</td></tr>
<tr><td>Parts</td><td colspan="4">5.1 Master thesis research and writing
5.2 Master thesis presentation and defense</td></tr>
<tr><td>Learning objectives</td><td colspan="4"><u>After completing the module, students are able to:</u>

(1) independently research and evaluate the quality of a research group and interview the PI/project supervisor to determine if the research fits with their interests and career management
(2) formulate a research project in translational medicine and identify the methodology for the solution of the research question in collaboration with their supervisor
(3) autonomously work on a specific research project in a laboratory, industry or clinical setting
(4) participate actively in lab routines such as journal clubs, progress reports and academic discussion.
(5) acquire knowledge independently and apply this knowledge in practical situations
(6) seek, process and critically analyze information from different sources in order to develop innovative and creative solutions to research problems
(7) communicate questions and findings with others in their field as well as in an interdisciplinary setting using a variety of media
(8) select the relevant practical tools to answer research questions and work with these tools in a collaborative setting
(9) design and manage projects
(10) work in an international, multi-cultural and multi-disciplinary team, actively participating in discussion
(11) provide, accept and consider constructive criticism
(12) write a detailed scientific manuscript in the form of a thesis
(13) present and defend scientific information
(14) demonstrate their assimilation and critical reflexion of the topics covered in the Master’s degree course “Translational Medical Research”</td></tr>
<tr><td>Requirements/ Recommendations for participation</td><td colspan="4">• Participation in Modules 1-4
• Successful passing of examinations in the TMR course of at least 24 ECTS
• Laboratory research experience
• Enrolment in the M.Sc. programme Translational Medical Research</td></tr>
<tr><td>Recommended literature</td><td colspan="4">Individually defined according to research project and supervisor</td></tr>
</table>

Requirements for the assignment of credits & composition of the final grade of the module	The students' progress and development will be monitored through a combination of: Evaluation of written master thesis and personal competences as judged by individual supervision and discussions in informal lab meetings (22.5 ECTS) and final presentation of the research project in form of a thesis defense (7.5 ECTS). All parts need to be completed and the final module grade is calculated proportionally (German grading scale 1-5).
Module classification/ Application of the module	Usually taken in Semester 2 of TMR, prerequisite for course graduation (usability in other degree programmes unknown)