




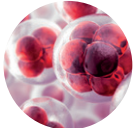


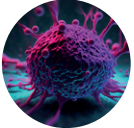

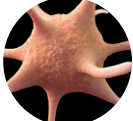
University of Tübingen

PHD PROGRAM  
EXPERIMENTAL MEDICINE





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## WELCOME BY THE DEAN AND THE CHAIR OF THE PHD PROGRAM:

**We welcome your interest in our international PhD program which was established in 2012 with the primary goal of providing strongly motivated medical doctors and natural scientists with excellent professional qualifications for advanced career options in biomedical and clinical research.**

Society depends on dynamic and innovative research carried out by excellent, well-educated investigators. With our program we have responded to the evolving demands of preparing tomorrow's medical science professionals, including state-of-the-art experience in a specialized research area, sound multidisciplinary proficiency, the establishment of networks with peers and collaborators and active participation in scientific discussions and communications.

The Faculty of Medicine Tübingen is one of the top medical schools in Germany and is characterized by interdisciplinary, international, and innovative research and teaching. We can look back at major advances in clinical and basic biomedical research. These achievements were reached by crossing the boundaries between basic and applied research and across subject areas to cover the entire field of the life sciences. We believe in the power of united resources and maintain

alliances for research with internationally respected interdisciplinary centers and major institutions around the world. Intense collaborations with national research entities like Max Planck Institutes, Leibniz Institutes, Helmholtz Centers, and Fraunhofer Institutes are important pillars in this network. Furthermore, we believe that the strong collaboration between our research institutes and clinical departments have played a key role in many important advances in human medicine. By further expanding opportunities for active physician-scientists, we strive to keep this momentum going.

As part of this strategy, we offer you a high-quality, personalized educational program, and close supervision/mentorship by internationally renowned scientists. While focus is placed on the experimental work on your research project, this is complemented with in-depth training in vari-

ous state-of-the-art methods as well as general professional skills. Our program is intended for the best international students in natural sciences and medicine. For medical doctors seeking an MD/PhD double degree, our program allows you to combine your drive to work as a clinical fellow (including the required internships) with your enthusiasm for active participation in clinical or basic medical research. This brochure presents the different components of our program, gives some insights into the research projects, and invites you to be part of our innovative team.



Professor Dr. Bernd Pichler  
Dean of the Faculty of Medicine



Professor Dr. Olga Garaschuk  
Program Chair



# THE PHD PROGRAM IN A NUTSHELL

**VISION**

To strengthen the link between science and applied medicine by preparing and equipping excellent PhD candidates for a career in life science

**OBJECTIVES**

To provide and support excellent young researchers in medicine and the life sciences with advanced professional qualifications for a career in research

**UNIVERSITY**

Faculty of Medicine of the Eberhard Karls Universität Tübingen, Germany

**REQUIRED DEGREE**

Degree in medicine or a Master of Science in life sciences or related disciplines

**RESEARCH AREA**

All areas of biomedical and clinical research, with a focus on Infection Medicine & Microbiology, Immunology, Oncology, Neurosciences, Cardiology, Pharmacology and Diabetology, Imaging Science, Biomedical Engineering, Health Services Research and Epidemiology, Clinical Research and Public Health

**DEGREE**

PhD in Experimental Medicine

**TUITION FEES**

None

**BEGINNING**

Winter semester (October) or summer semester (April)

**PROGRAM DURATION**

Six semesters (three years), with a possibility to combine the program with medical studies and/or medical residency and possibilities for extension

**APPLICATION DEADLINE**

for the summer semester 15.01.  
for the winter semester 15.06.

**WEBSITE**

» [www.medizin.uni-tuebingen.de/de/medizinische-fakultaet/promotionen/phd-studiengang](http://www.medizin.uni-tuebingen.de/de/medizinische-fakultaet/promotionen/phd-studiengang)

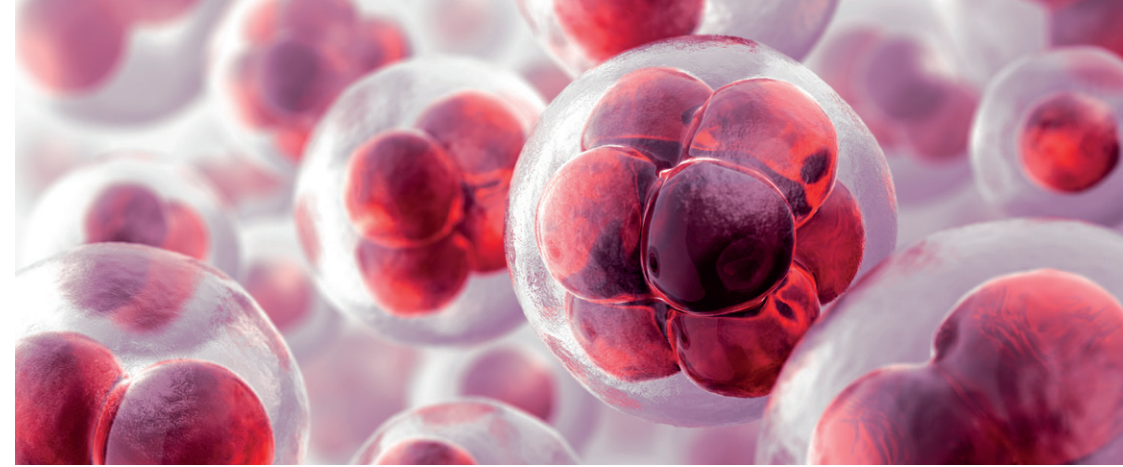
**COMPONENTS**

Individual research project under interdisciplinary supervision (150 ECTS) + academic training (30 ECTS) in compulsory and elective subjects

**FUNDING**

Funding is mostly arranged by the student (applying for scholarships) or the research group (through project funding). Useful information on funding a PhD study in Germany is supplied by the German Academic Exchange Service (DAAD).

# COMPONENTS OF THE PHD PROGRAM



The three-year PhD program consists of three pillars: your research, your supervision and your training.

## RESEARCH

The main component is the individual research project to be submitted in form of a doctoral thesis. Research projects are carried out in hospitals and institutes of the Faculty of Medicine or the Faculty of Science at the Eberhard Karls Universität Tübingen. These projects must promise a significant impact on medical research.

### As a doctoral candidate, you will

- pursue your research project independently,
- solve defined scientific problems within a set period of time,
- learn and apply appropriate scientific methods
- develop new ideas
- acquire new skills, tools and knowledge
- cooperate with colleagues
- communicate your research questions and results.

It is expected that important results will be published in peer-reviewed articles.

## SUPERVISION

During your PhD, you are supervised by a group of three excellent scientists from the Faculty of Medicine, the Faculty of Science or external research institutes. These supervisors form your doctoral committee. In the annual report meeting, you assess with your supervisors your progress and achievements, discuss potential problems, and set milestones and goals for your PhD and your scientific career.

## TRAINING

Specialized courses and seminars – compulsory and elective – are taught in small groups to equip you with useful knowledge and skills. Your individual training plan is designed in collaboration between you and your doctoral

committee and confirmed by the PhD board.

**Compulsory components** of your training include a lecture series where topics of broad interest like research funding, good scientific practice, animal care in research, data safety or “how to apply for a grant” are discussed.

- **Elective technical and practical modules** are offered in the faculty's main research focus areas. Training includes innovative teaching techniques like problem-based-learning courses, case studies and lab rotations.
- **The annual retreat** is an exclusive opportunity for PhD candidates to present their ongoing research with a talk or poster. The program of each retreat is jointly developed by the elected representatives of the PhD candidates, the coordination office, and the faculty. This two-day event brings together all PhD candidates in an open setting where they can receive feedback from an interdisciplinary audience, establish collaboration with other candidates

and researchers of the Faculty and have a great time in the beautiful town of Bad Urach situated at the foot of the Swabian Alb.

- **Elective additional courses** offered by the Talent Academy of the Faculty complement your previous training and qualify you for interdisciplinary research projects.

The multidisciplinary training within the PhD program is offered by representatives and experienced teaching staff of the research focus areas of the Faculty of Medicine Tübingen.

The elective program includes innovative techniques like problem-based learning courses, case studies and lab rotations. Training is further strengthened by taking advantage of the diverse networks between the research areas and access to state-of-the-art research facilities.

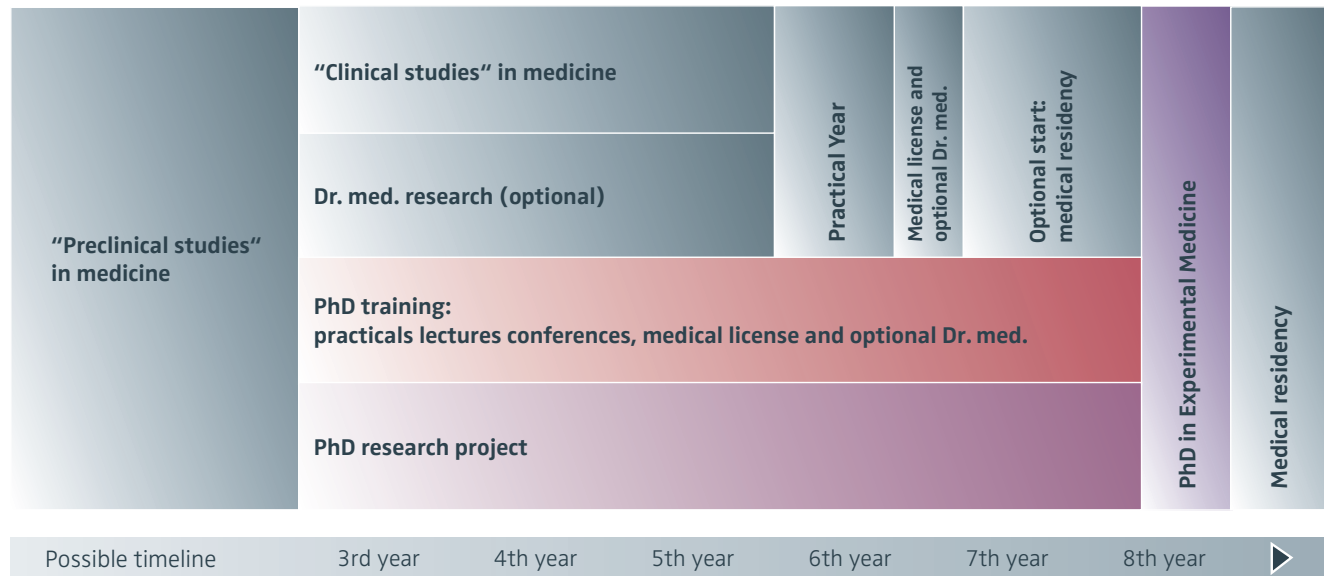


# PROGRAM SCHEDULE



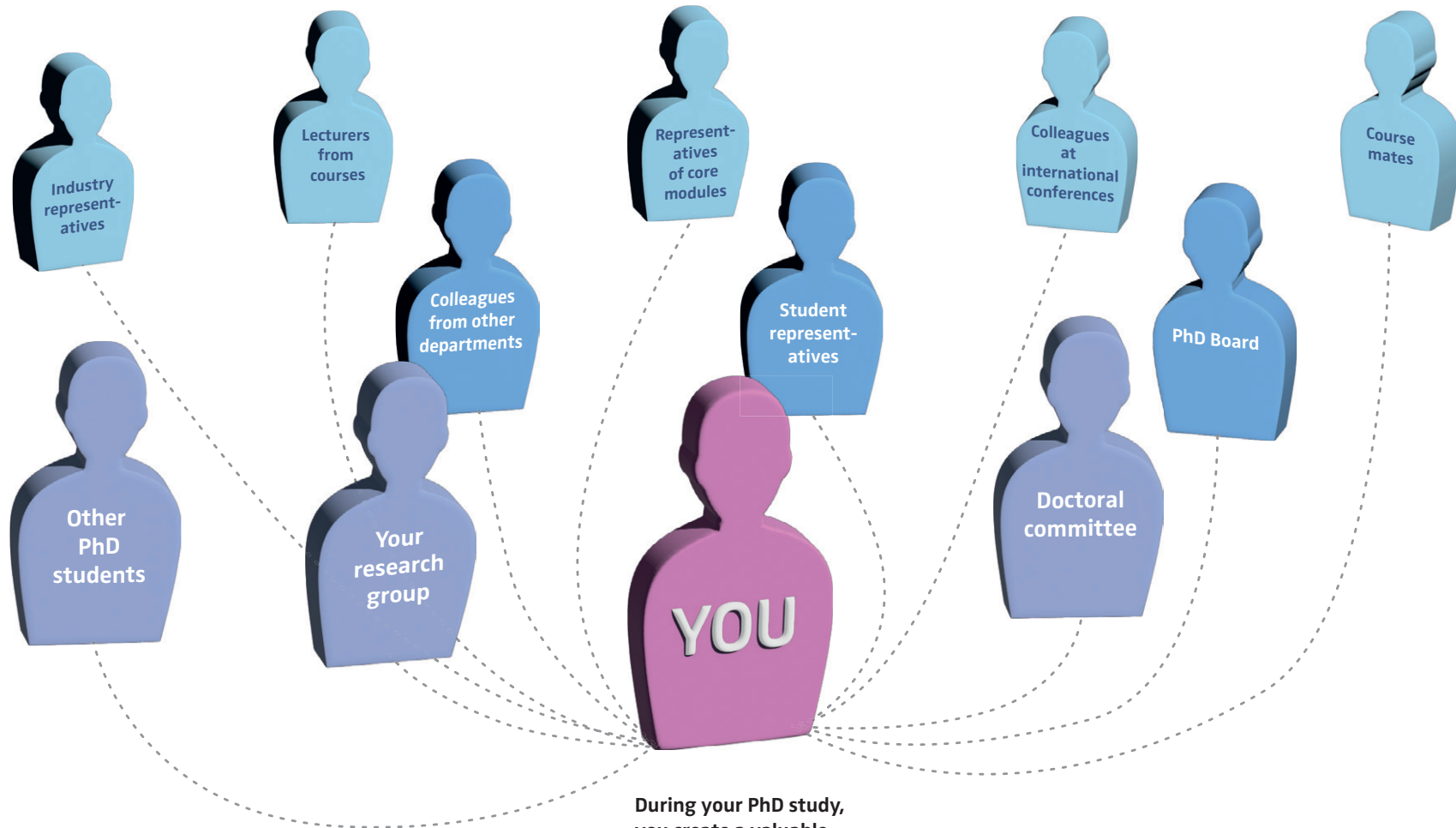
**The PhD program is designed for 3 years. Nevertheless, the time schedule can be adapted individually.**

A special feature of our program is the possibility of receiving the double academic degree MD/PhD\*. The double degree program is geared toward those students seeking a challenging, research-oriented medical education while acquiring in-depth scientific training at an early stage in their career. Its establishment pursues our strategic goal to strengthen the “bench-bed-side connection” through a second training line for those prospective physicians who want to focus on research and become qualified for a career in science. For these research-oriented physicians, we find individual solutions to allow them to combine medical education with PhD research.



\* In Germany, the academic title “Doctor in Medicine”, abbreviated with “Dr. med.” is acknowledged after the completion of medical studies and a research project culminating in a scientific dissertation. It is optional and additional to the academic studies of medicine, however, in Germany it is highly recommended for your career and reputation as a physician.

# CREATING A RESEARCH NETWORK



During your PhD study, you create a valuable research network for your future scientific career.

# SELECTION AND ADMISSION



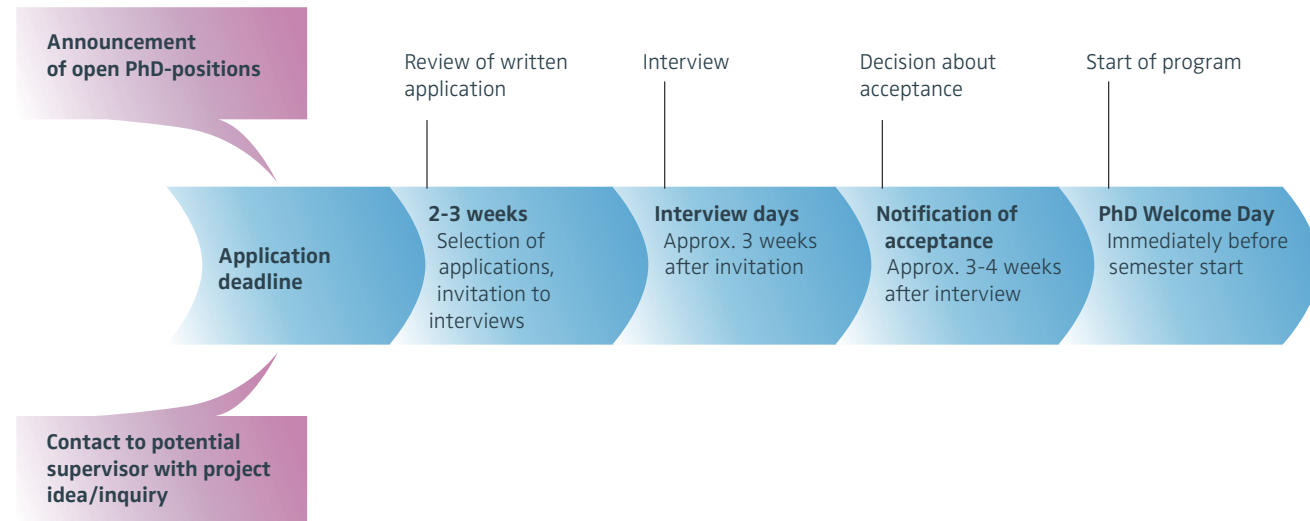
## APPLICATION STEP BY STEP

Prerequisites for admission to the PhD program are:

- A Graduation from medical school or a Master of Science or German diploma degree in the life sciences and related disciplines
- B Acceptance by an authorized academic supervisor at the Faculty of Medicine Tübingen
- C Excellent academic grades in previous studies and previous research experience.

There are two ways to start the application process: by applying to announcements of open PhD positions or by contacting a potential supervisor directly with your own project idea or inquiry. Applications are subjected to initial screening by the PhD Board based on the academic qualifications of the candidate and the feasibility of the proposed PhD project. Promising candidates will be notified within 2-3 weeks after the application deadline with regard to their participation in a personal interview.

The purpose of the interview is to determine the motivation, special scientific qualifications and the suitability of the candidate for the planned research project. The selection board consists of three members faculty who will assess the applicant's academic career up to that point, as well as the quality and the feasibility of the planned research project. The candidate will be expected to give a 10 min oral presentation in English about the proposed PhD project. The presentation is followed by a 15 min discussion where the candidate's qualifications and the proposed project will be evaluated in greater detail.







# ELIGIBLE MODULES IN THE PHD PROGRAM

Infection Medicine  
&  
Microbiology

Neurosciences

Health Services  
Research

Immunology

Imaging Science

Epidemiology,  
Clinical Research and  
Public Health

Oncology

Pharmacology,  
Cardiology  
& Diabetology

Biomedical  
Engineering

# INFECTION MEDICINE & MICROBIOLOGY

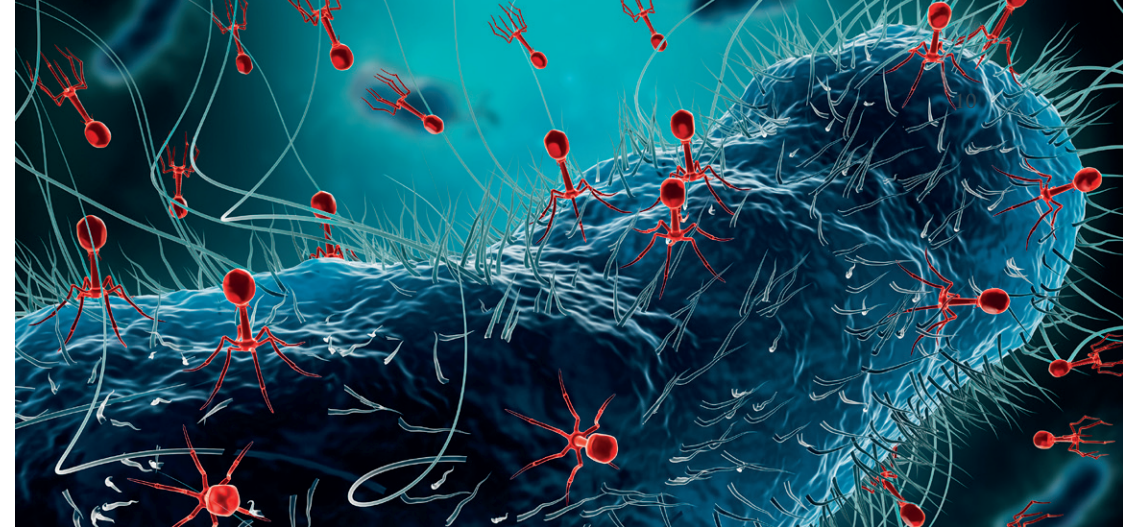
Microbes play a pivotal role in the world we live in. In recent years, two developments have shaped our understanding of modern microbiology: the sequencing of metagenomes showed us the complexity of microbial life in and around us, and infectious diseases once thought to be overcome have re-emerged and remain a global threat. The interplay between microbes and their human host is the subject of intensive investigation and understanding that interplay at the molecular level is a prerequisite both for the urgently needed development of novel anti-infectives and vaccines and for the establishment of probiotic therapy.

## Infection medicine and microbiology in Tübingen

Research in microbiology and infection medicine is a cross-faculty focus area at the University of Tübingen and enjoys an outstanding international reputation. The University of Tübingen boasts a strong and dynamic translational research community thanks to the close collaboration between first-class basic and clinical research units, in particular within the framework of the German Center for Infection Research (DZIF).

The module Infection Medicine and Microbiology is hosted jointly by the Interfaculty Institute of Microbiology and Infection Medicine Tübingen (IMIT) and the Institute of Tropical Medicine (ITM). Established in 2009, IMIT focuses

on infection biology, microbiomics, bacterial physiology, and antimicrobial compounds. The institute hosts the Excellence Cluster 'Controlling Microbes to Fight Infections' and the Transregio-Collaborative Research Center 261 'Cellular Mechanisms of Antibiotic Action and Production'. The ITM is one of Germany's foremost centers for tropical diseases and human parasitoses. It hosts the competence center for tropical medicine in southwest Germany and stands out with its international focus and strong expertise in clinical trials. Research at the ITM mainly focuses on infectious diseases and many projects are performed in collaboration with partner institutions in the tropics such as malaria chemotherapy and vaccine trials. In addition, models are established for malaria, schistosomiasis, and echinococcosis.



## Infection medicine and microbiology in the PhD program

Training within this research area is linked to the university's Interfaculty Graduate School of Infection Biology and Microbiology (IGIM), which aims to provide a comprehensive and multi-disciplinary structured education for post-graduate students. Among other things, the module Infection Medicine and Microbiology offers lecture courses with international speakers, literature seminars, and practical training courses in advanced microbial pathogenesis. Potential research projects for PhD candidates in this module include mechanisms of bacterial pathogenesis, metabolic adaptation and fitness of bacteria, novel anti-infectives, and host-associated bacterial communities. In addition, candidates are always encouraged to bring their own suggestions

for projects on related research topics. Research topics at the ITM include the development of improved diagnostics and therapies for tropical infectious diseases with a focus on malaria and schistosomiasis. Furthermore, the genetic characterization of pathogens and human genetic factors as well as the immune response to infectious diseases, especially malaria, is being investigated. Candidates are always welcome to join our team.

## MODULE COORDINATORS



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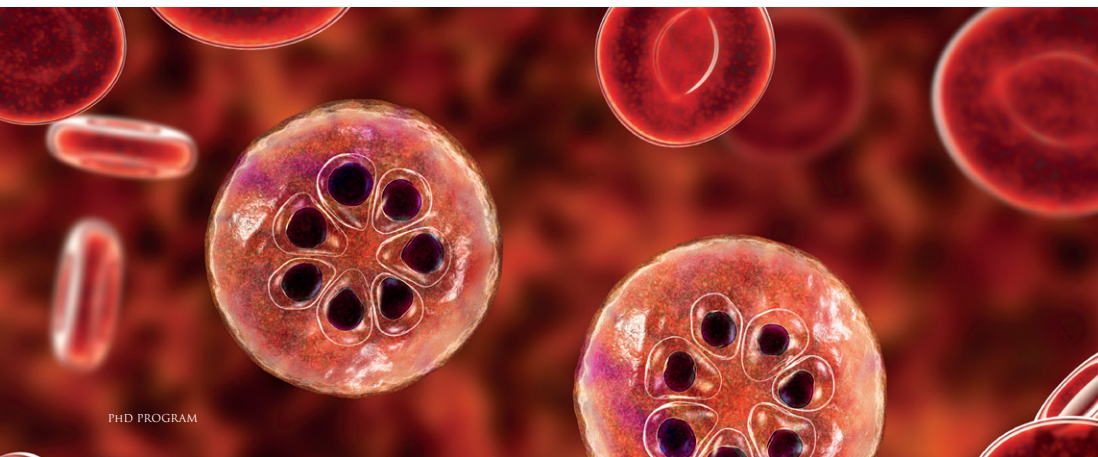
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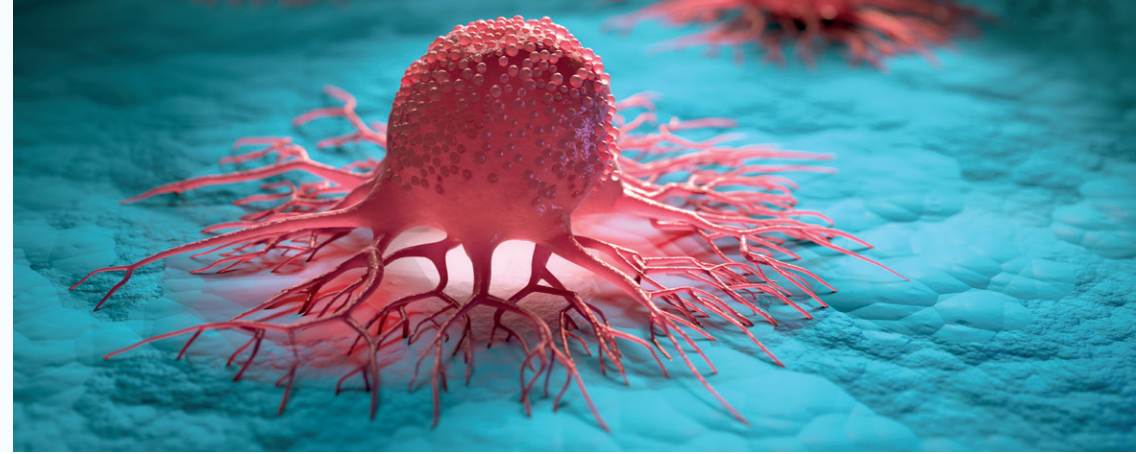
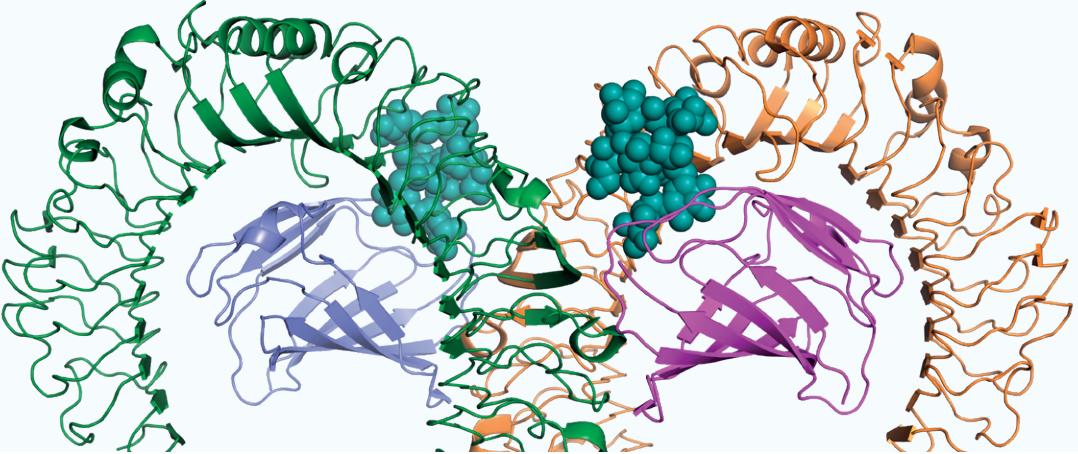


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» [www.cmf.uni-tuebingen.de](http://www.cmf.uni-tuebingen.de)





# IMMUNOLOGY

**Immunology is one of the key research areas in current biomedical science. Immunological processes influence not only a wide-range of infection-related diseases, inflammatory diseases, and cancer, but also diseases not previously thought to be related to the immune system such as cardiovascular, neurodegenerative or metabolic disorders. In addition, immunology has emerged as the key to a more effective therapy for many types of cancer. Both basic research and therapy are increasingly dependent on a thorough understanding of immunological processes in order to solve current problems in medical and life science research. Immunology is also a highly dynamic, competitive, and exciting research area. Furthermore, numerous analytical and diagnostic techniques are based on immunological principles. A profound theoretical and practical background on these principles has therefore become vital even for clinicians and for researchers in other life science disciplines. This is the reason why immunology is also a core area within the PhD Experimental Medicine.**

## Immunology in Tübingen

Immunological research at the University of Tübingen has an outstanding track record, spanning almost 40 years of research in innate and adaptive immunity, both in basic and translational research. This combined approach will also be reflected in the newly created Institute of Immunology, a research institute aiming to pioneer cutting edge basic and translational research. Its expertise is backed by state-of-the-art infrastructure and confirmed in the successful acquisition of funding through German and European funding programs. Key research initiatives include the role of the pattern recognition receptors of the innate immune system and how this system of danger sensors affects infections and inflammation. The latter research integrates biocomputational, biochemical, molecular biological, immunological, and epidemiological approaches with the goal of identifying points of intervention.

Moreover, the development of peptide- and vector-based vaccines against infections and for individualized immunotherapy of cancer with concomitant immuno-monitoring of cancer patients has been a hallmark of Tübingen immunology. Peptides are identified on tumor cells by state-of-the-art mass spectrometry. Both therapeutic peptides and antibodies are designed in in house and tested clinically in cooperation with the University Hospital Tübingen. Close ties exist especially with the Departments of Dermatology, Internal Medicine, Microbiology, and Pharmacology. In addition, there are important links with the new M3 institute, where the interaction with microbiome, metabolome, and malignome are studied and the Clusters of Excellence 2412 "Controlling Microbes to Fight Infection" (CMFI) and 2180 "Image-guided and Functionally Instructed Tumor Therapies" (iFIT). This exemplifies the importance of immunology as a cross-sectional research field in the medical faculty.

## Immunology in the PhD program

Due to the broad range of immunological research at Tübingen, potential research projects for PhD candidates may focus on molecular, cellular, and organismic levels in both human in vitro systems, and in patients and pre-clinical model organisms in vivo. To complement this research-oriented training for candidates in immunology-related PhD topics or for candidates from other fields with an interest in immunological background and/or techniques additional modules are available.

Sharing a common vision for excellence in graduate education, the Institute of Immunology and cooperating departments jointly offer immunological teaching and training within the PhD Experimental Medicine program either as a core module or in individually selected courses. At the core are seminars on the principles of innate and adaptive immunity. These seminars are multi-disciplinary and include candidates from multiple backgrounds, e.g. biochemistry, human medicine, molecular medicine. Moreover, they are organized around both basic knowledge as well as case studies aimed at illustrating their real-life importance. Additionally, a taught 1-week practical is offered in which students can acquire first hands-on experience and a theoretical background in key immunological methods such as flow cytometry, ELISA, immunohistochemistry, immune-precipitation, and immunoblot. A lecture series on advanced immunology complements the theoretical teaching by showcasing exciting research from Tübingen colleagues and by conveying advanced immunological knowledge.

## MODULE COORDINATORS



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# ONCOLOGY

The development of cancer immunotherapies has witnessed tremendous advances in recent years. Since the introduction of rituximab, an anti-CD20 antibody for the treatment of B cell malignancies more than 20 years ago, countless novel immunotherapies have been approved. More recently, the Nobel prizewinning discoveries of immune checkpoints (CTLA-4 and PD-1) and their targeting in various cancers using specific antibodies have led to significant improvements of survival, even to long-term cure in some patients. Moreover, so-called "living drugs", engineered immune cells that express a receptor targeting a cancer antigen, have been developed and are now approved for some hematological malignancies. Despite these advances, the majority of patients do not benefit from these immunotherapies, and we need to learn more about why these powerful therapies fail.

## Immunooncology in Tübingen

Immunology and oncology are major research focuses of the Faculties of Medicine and Science at the University of Tübingen. Over 25 departments perform basic, translational and clinical research in the field of immunooncology, with a major goal of translating research findings into novel treatment approaches and innovative clinical trials.

A central hub of our activities is the Comprehensive Cancer Center Tübingen-Stuttgart (CCC-TS), which has been awarded the status of 'Oncology Center of Excellence' as one of the first four cancer centers in Germany. The CCC provides multidisciplinary cancer diagnosis and treatment and carries out innovative clinical trials, competitive translational research programs and many training activities that are continuously evolving and improving. In addition, owing to its cutting-edge

cancer research, the University of Tübingen has been selected as a member of the German Consortium for Translational Cancer Research (DKTK), a long-term partnership of the German Cancer Research Center with seven German university sites, and it is involved in a number of research networks funded by national and European funding agencies.

Moreover, the University of Tübingen hosts the Excellence Cluster iFIT (image-guided and functionally instructed tumor therapies), the only oncology-focused excellence cluster in Germany. In this cluster, world-renowned experts and junior faculty members join their forces to advance immunooncology from various points of view.



## Oncology in the PhD Program

The main goal of the immunooncology module for PhD students is to gain an overview and hands on experience of current state-of-the-art technologies in immunooncology, including single-cell technologies, peptidomics and cellular in vitro assays. Lectures on various topics such as basic immunology, oncology and pathology, bioinformatics analysis techniques, and high-end imaging / microscopy will be provided. In addition, in the journal club students will learn how to read and analyze scientific research articles, and scholarly discuss them.

## MODULE COORDINATORS



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# NEUROSCIENCES

The scope of neuroscience has broadened and expanded enormously from molecular and cellular studies of individual nerve cells and neurogenetics to imaging of sensory systems and motor tasks in the healthy and pathological animal or human brain. The Neuroscience module of the Experimental Medicine program in Tübingen can, of course, only reflect parts of this increasing knowledge that is offered in different institutes that focus on topics of neuroscience within the Medical Faculty. Here we offer our candidates, who are trained in experimental medicine and particularly interested in the topics of Neuroscience, insight into the possibilities of neuroscientific training at the Medical Faculty by providing a wide range of courses.

## Neuroscience in Tübingen

A large variety of research groups in the Medical Faculty in Tübingen work in different fields of Neuroscience. We will briefly mention the main institutes and exemplarily topics the research groups focus on. Thus topics of neuroscience are found e.g. in the institutes (1) Medical Genetics (Institute of Medical Genetics and Applied Genomics) that comprises of groups spanning neuroscience research on Biomarkers (Jeannette Hübener-Schmid), Dystonia (Fubo Cheng), Genome analytics (Stephan Ossowski), Mental retardation (Rebecca Buchert-Lo), Oncogenetics (Christopher Schroeder), Parkinson's disease (Nicolas Casadei/Yogesh Singh), Neurodegradomics (Jonasz J. Weber), and Spinocerebellar ataxia (Thorsten Schmidt), (2) Hertie Institute for Clinical Brain Research (HIH) comprising groups that focus on neurovascular diseases (Ulf Ziemann), neurodegenerative diseases (Thomas Gasser), epileptology (Holger Lerche), Neurooncology (Ghazaleh Tabatabai), magnetoencephalography (Markus Siegel), or Alzheimer's disease (Mathias Jucker), (3) the Werner Reichardt Centre for Integrative Neuroscience (CIN) with groups working on e.g. Systems

Neurobiology (Aristides Arrenberg), Vision & Cognition (Andreas Bartels), Neuroethology (Jan Bender), Data Science for Vision (Philipp Berens), Computational Neuroscience (Matthias Bethge), Neural Circuits and Behaviour (Thomas Euler), Functional and Comparative Neuroanatomy (Henry Evrard), Neural Circuits of Vision (Katrin Franke), Physiology of Neural Circuits (Olga Garaschuk), Neurobiology of social communication (Steffen Hage), human verbal communication (Yulia Oganian), System Neurophysiology (Cornelius Schwarz), or animal physiology (Andreas Nieder) up to neural information processing (Felix Wichman), (4) the Eye Clinic that combines research in fields of the proteomics and system biology (Marius Ueffing), Preclinical imaging (Matthias Seelinger), Neuromodulation (Thomas Euler), Cell Death & Energy Metabolism (Francois Paquet Durand), Molecular Genetics and gene editing (Bernd Wissinger), visual perception (Frank Schaeffel), or Retinal Degeneration (Eberhardt Zrenner), or (5) the ENT (Ears, Nose and Throat) Clinic encompassing research on hearing & cognition (Marlies Knipper/Lukas Rüttiger), Pharma Therapy for hearing loss (Hubert Loewenheim), Gene Therapy (Ellen Reisinger), and Hearing devices (Ernst Dalhoff, Antony Gummer).

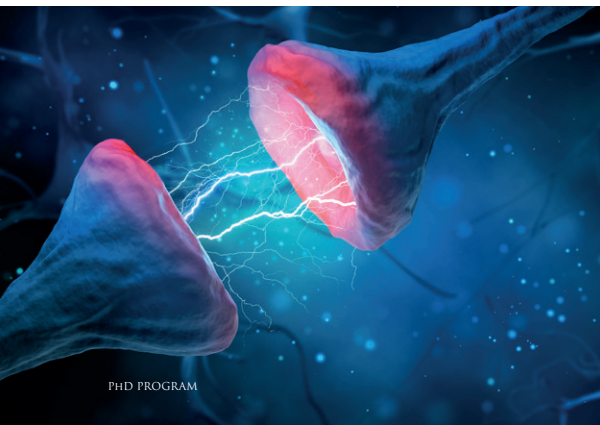


## Neuroscience in the PhD program

Reflecting the breadth of the research area and the large number of research groups involved, a huge variety of research topics can be offered within the framework of the training program. Potential PhD projects can be aimed, for example, at understanding age-dependent alterations of sensory transmission (visual, auditory, olfactory, mechanical) or assessing age-related alterations in the genome and proteome of sensory systems.

Within the framework of 4 practical courses, each comprising 1 full week and enabling the acquisition of 4 ECTS, the following specialist knowledge is to be conveyed, such as (i) electrophysiology, that provides training in basics of electrophysiology, intracellular, and extracellular recordings in situ and in vivo as well as electroretinography and audiometry (ii) molecular biology, offering insight in aspects of Proteomics, double detection of mRNA/

protein, methods for mRNA and protein detection, next generation sequencing (NGS), or mouse genotyping (iii) experimental diagnostics enabling to get a first insight in human diagnostics through e.g. neuromodulation, fMRI, or testing retinal or cochlear function (iv) optical imaging, that offers basics of light microscopy, imaging with ion-sensitive dyes and genetically-encoded indicators, insight in two-photon imaging, or optogenetics. These practical courses can be accomplished by an annual seminar series "Principles of Cellular Neuroscience" (3 ECST), where on the basis of current literature distinct chapters are discussed to obtain a deeper understanding. Finally, candidates with a focus in Neuroscience will enormously profit from joining the TNC-lecture series in Winter term and Summer term by the Neuro Campus enabling to obtain 0.5 ECTS. In addition, numerous practical courses, seminars, and lectures in neuroscience are also provided by the Graduate Training Centre of Neuroscience.



## MODULE COORDINATORS



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# PHARMACOLOGY, CARDIOLOGY, DIABETOLOGY

Pharmacology focuses on the effects of exogenous and endogenous substances on the organism and aims to elucidate and to modulate the (patho)physiological regulatory mechanisms for the benefit of patients. The application of modern molecular approaches, especially in cardiovascular and metabolic diseases, has led to novel insights into the development of innovative pharmacological interventions.

## Pharmacology, Cardiology and Diabetology in Tübingen

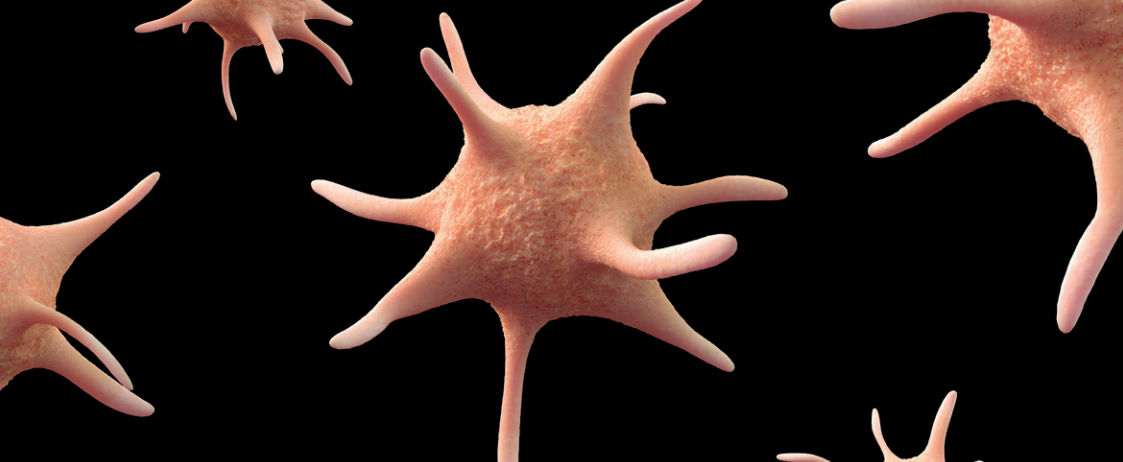
**Pharmacology** research in Tübingen is focused on G protein-dependent signaling. To uncover its underlying mechanisms, functions and consequences and to develop novel therapies, more intense research is urgently needed. The research focus of the Department of Pharmacology, Experimental Therapy and Toxicology lies e.g. in the understanding of G protein signaling focusing on cardiovascular diseases and hearing deficits, the inflammatory reaction in atherosclerosis and myocardial infarction or the analysis of CXCR4 and 7 signaling in regulating thrombosis and thrombo-inflammation. The Department of Clinical Pharmacology emphasizes on patient characterization, conduction of clinical trials and the development of prognostic biomarkers while the Department of Otolaryngology concentrates on auditory functions and the impact of mutations on hair cell biology. Research advances are promoted by the DFG-funded Research Training Group "Non-canonical G protein signaling pathways – Mechanisms, Functions, Consequences" (RTG2816), which tightly interacts with the PhD program.

**Cardiology** research in Tübingen focuses on cardiovascular thrombo-inflammation, arterial and venous thrombosis, myocarditis and inflammatory cardiomyopathy, as well as valvular inflammation and vascular biology. Additionally, further research topics are cardiac imaging and clinical studies to establish new antithrombotic therapy strategies.

The University Hospital for Cardiology and Angiology in Tübingen covers the entire interventional and pharmacological treatment spectrum of modern cardiovascular medicine, offering the interventional treatment of coronary diseases

and invasive electrophysiology to catheter-based valve therapy for structural heart disease and multimodal heart failure therapy with all devices for mechanical circulatory support.

For the Clinic for **Diabetology**, Endocrinology and Nephrology with the Institute for Diabetes Research and Metabolic Diseases as part of the Helmholtz Center Munich and the DZD (German Center for Diabetes Research), understanding factors that lead to the development of prediabetes, diabetes and its complications is the focus of our research with the mission for a life without diabetes. Phenotyping in humans like assessing insulin action in the brain, in utero fetal magnetic encephalography, assessment of peripheral insulin action, secretion and whole-body MRI for body composition make up a world-wide unique experimental setup which is characteristic for Tübingen. Novel clusters of patients in the prediabetic state have recently been identified in Tübingen enabling us to design and investigate tailored treatment approaches early on according to the individual risk for developing metabolic, cardiovascular,



neuronal and kidney complications. This research takes place within the DZD network allowing for large cohort recruitment and multi-center trials.

## Pharmacology, Cardiology and Diabetology in the PhD Program

Our training within the PhD program offers the opportunity to learn about many facets of pharmacology-oriented basic and clinically-oriented translational research. The Institute of Pharmacology offers exciting research projects and focus on a comprehensive pharmacological training in drug screening, pharmaco-dynamics, -kinetics ((L)ADME), -genetics as well as molecular and clinical pharmacology.

In the area of **Cardiology**, PhD candidates have the opportunity to get an insight into diverse interdisciplinary basic science, being introduced in relevant in vivo disease models of cardiovascular medicine. Moreover, by attending the work

in the cardiac catheterization laboratory, you experience the state-of-the-art treatment of investigated diseases directly. Through this unique combination of research and clinical practice, an impression of the important translational aspect of cardiovascular research can be gained as part of this module within the PhD course.

The **Diabetology** part of this program will address basic research techniques in vitro, ex vivo and in vivo combined with clinical research questions and specimen collection in affected patients. Candidates will have access to the clinical study center with multiple clinical studies. The program includes investigating the interactions of our gut microbiome and host metabolism, genetic editing, cell-based phenotyping and functional characterization of fat, muscle and pancreatic islets as well as complex data acquisition, management and processing in combination with clinical data derived from our large clinical cohorts.

## MODULE COORDINATORS



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**Veronika Leiss, Dr. rer. nat.**

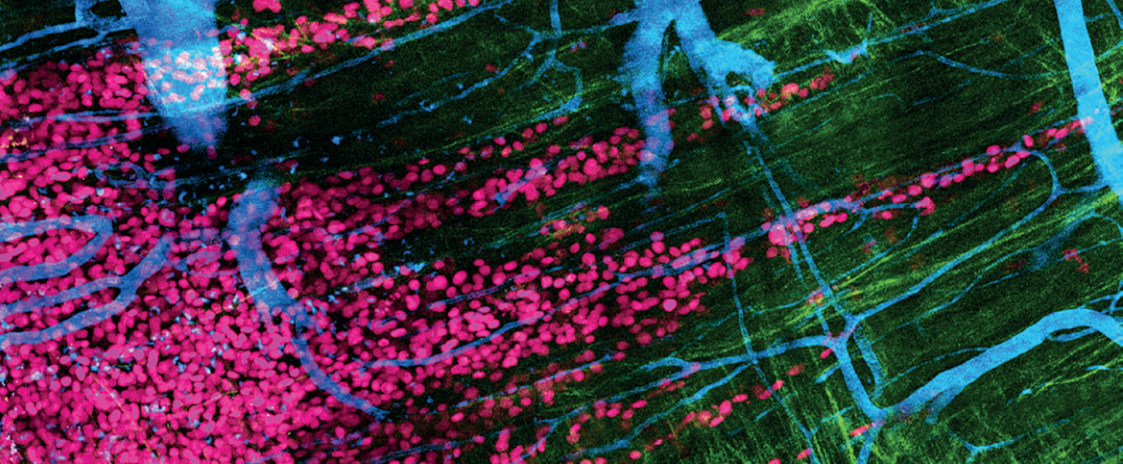
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# MODULE IMAGING SCIENCE

Modern imaging technology such as single-photon-emission computed tomography (SPECT), positron-emission tomography (PET), magnetic resonance imaging (MRI), computed tomography (CT) or combined systems such as SPECT/CT, PET/MRI or PET/CT are indispensable for clinical diagnosis. At the same time, dedicated small animal imaging modalities have become important biomedical research tools to decipher mechanisms of disease. Combining imaging technologies such as high-resolution intravital and light-sheet microscopy with preclinical hyperpolarized MR reveal cellular information about functional tissue states but also allow the quantitative measurement of specific biomarkers or imaging probes at different biological scales.

## Imaging Science in Tübingen

Imaging science is a major pillar of the Medical Faculty at the University of Tübingen. The Department of Radiology has five individual sub-departments: Diagnostic and Interventional Radiology, Nuclear Medicine and Clinical Molecular Imaging, Diagnostic and Interventional Neuroradiology, Preclinical Imaging, and Radiopharmacy, and Biomedical Magnetic Resonance.

PhD candidates encounter a vibrant, interdisciplinary environment with researchers from a variety of fields such as medicine, biology, biochemistry, chemistry, physics, mathematics, and engineering. The latest clinical imaging equipment (total-body PET/CT, PET/MR, SPECT/CT, 3T MRs, CT including Photon-counting CT) as well as preclinical imaging equipment (7T MRI, microPET, microSPECT/CT, optical imaging, intravital and light-sheet microscopy), and three state-of-the-art molecular and cell biology labs are complemented with high-end radiopharmacy labs including a cyclotron and

GMP synthesis labs with 18 hot cells for radiotracer labeling. This infrastructure allows cutting-edge basic research and provides an exceptional platform for translational and clinical studies. The Department of Radiology offers the full range of options for investigator-driven clinical research projects in the realm of oncology, neurology, cardiology, immunology, and infectious disease. Tübingen was the first clinical center world-wide to use PET/MRI in humans and its researchers contributed to major developments in PET/MRI. Various radiolabeled tracers have been developed in the department and are currently being translationally implemented and tested in Phase 1 / 2 studies. The Department is associated with the Max Planck Institutes in Tübingen and offers a world-class environment with a 9.4 T human MRI and a 14 T preclinical MRI.

## Imaging Science in the PhD Program

PhD candidates can become part of our research team, working on different topics like multiparametric tumor

imaging, imaging and “omics”, PET/MR imaging of brain metabolism, neurogenetics and imaging, cardiovascular imaging, and imaging in (tumor)-immunology, to name just a few. They are also invited to propose their own projects related to our preclinical and clinical research fields.

If you are interested in the latest developments in imaging science, select our training module which offers a rich program of practical courses, lectures, and seminars focusing on preclinical molecular, translational and clinical imaging. This includes hand-on training in our research labs, radiopharmacy division, and clinical departments.

## MODULE COORDINATORS



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# BIOMEDICAL ENGINEERING



**Biomedical Engineering is a rapidly evolving interdisciplinary field in medical research. Prominent topics in the field of biomedical engineering include gene editing, gene/protein replacement, RNA therapy and/or editing, stem cell biology, and epigenetic modification of aging and regeneration which are becoming increasingly important in our society. Therapies are constantly improving, however, permanent and safe curative strategies are still highly demanded.**

## Biomedical Engineering in Tübingen

The University of Tübingen hosts numerous institutions that are active in various modalities of biomedical engineering. mRNA based therapies (Departments of Pediatrics and Thoracic Surgery), small RNA based therapies (Departments of Medicine II and Neurology), RNA editing (Biochemistry Department), biomedically engineered cell therapies such as CAR T cells and others (Departments of Pediatrics and Medicine II), oncolytic viruses (Departments of Medicine I, Neurology, and Dermatology), gene/protein replacement therapies (Departments of Pediatrics, Medicine I and II, Ophthalmology, and Otolaryngology), and stem cell research (Departments of Traumatology, Medicine II, Pediatrics, Thoracic Surgery, Dentistry) are well represented in Tübingen.

The Department of Medicine II (Hematology, Oncology, Clinical Immunology, and Rheumatology) focuses on un-

derstanding the role of leukemia stem cells in leukemia development, the development of novel cell therapies to fight hematological and solid tumors, targeting malignant, autoimmune and alloimmune cells, or optimizing cell therapeutics using small RNAs (siRNAs, miRNAs, anti-miRs). Leukemia mouse models, primary immune cell cultures, various stem cell cultures, advanced CRISPR technology, fully chemically modified small RNA therapeutics are utilized. There is expertise on extracellular vesicles as either drug delivery moiety or a regenerative tool. Lipid nanoparticle-based delivery systems, protein design, and RNA sequencing are also represented.

The Siegfried Weller Institute for Trauma Research of the Department of Traumatology focuses on the improvement of bone healing. Different approaches to the promotion of bone regeneration and the impact of negative factors like chronic diseases or age are analyzed in depth, drawing on

contributions from various disciplines in the natural sciences. With the biomechanical approach, the influence of defined electromagnetic fields and the use of novel types of dynamic screws for the junction of bones are investigated in the context of their ability to promote healing. The cellular approach comprises the use of stem cells to heal broken bones. The establishment of methods to improve cell culture, like the use of bioreactors allowing the three-dimensional culture of cells, promotes stem cell research by providing a better representation of the in vivo situation than conventional two-dimensional culture methods. A third approach to enhancing bone regeneration focuses on the molecular level and includes the analysis of the aging process of cells and their regulating genes.

## Biomedical Engineering in the PhD Program

Potential research projects for PhD candidates incorporate exciting new developments in gene and RNA therapy. The role of diabetes type 2 in bone remodeling, the effect of small molecule inhibitors on aging and differentiation of mesenchymal stem cells, oncolytic viruses for glioblastoma, inherited neutropenia syndromes and their role in leukemia

induction, RNA targeting of graft versus host disease, CAR T cell and their RNA modified versions, RNA therapies for Aicardi Goutieres Syndrome, and SLE are investigated.

The Biomedical Engineering module offers a rich program of lectures and practical courses focusing on state-of-the-art developments in the area of in vivo gene and RNA therapies. You will learn about viral vectors, non-viral vectors, gene and transcript replacement therapy, conjugate mediated delivery of RNAs, state-of-the-art CRISPR technologies, lipid nanoparticles, extracellular vesicles, small RNA inhibitors, oncolytic viruses, and high throughput screening methods. Other components of the module introduce the basics of cellular and molecular biology. Some courses offer training in the use of bioreactors as a promising technique in the field of cell culture and in the application of epigenetics and its pivotal role in the research on the effects of aging on the regeneration and recovery of organs and bones. Additional training components address the interesting field of biomechanics with a focus on the restoration of broken legs and the rehabilitation of the complete range of motion in humans.

## MODULE COORDINATORS



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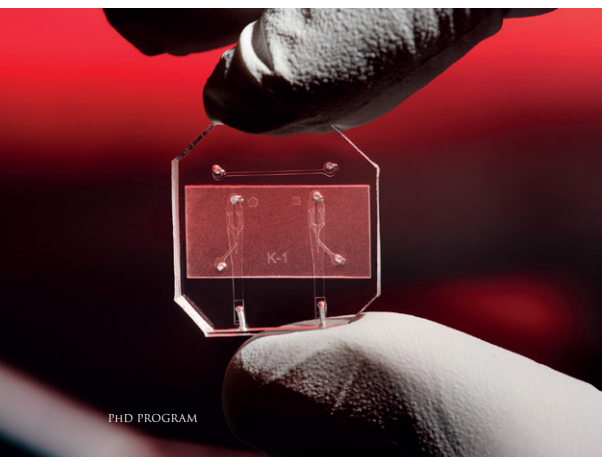
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# BIOMETRY, EPIDEMIOLOGY, POPULATION HEALTH AND CLINICAL RESEARCH

**Biometry is the implementation of statistical methods in life sciences. Nearly every student is facing the challenge during his or her PhD, to choose and apply these methods correctly. The fact that in many studies, statistical training is subordinately treated explains that students frequently fail to implement statistics in a proper manner.**

The goal of population health science is to better understand the causes of health states in a population or group of individuals and to improve health and prevent injury, illness, and premature death by informing policies, programs and interventions. . Population health often works with big datasets and epidemiological and statistical methods to identify patterns in the diseases and health of large populations.

## BIOMETRY AND EPIDEMIOLOGY IN TÜBINGEN

The Institute of Clinical Epidemiology and applied Biometry in Tübingen (IKEaB) consists of an interdisciplinary team (mathematicians, statisticians, biologists, social scientists and physicians) and supports members of the Medical Faculty in the planning and evaluation of scientific experiments and studies. Our research focus follows the concrete needs of our medical partners and lies in the development

of new methods for the planning and analysis of clinical and experimental studies. Recently, a new focus on genetic epidemiology/analysis of high dimensional data has been established in cooperation with other departments of the University. Further projects focus on healthcare research.

## POPULATION HEALTH IN TÜBINGEN

The Department of Population-Based Medicine consists of an interdisciplinary team of researchers. Our research focuses on the relationship between behavioural factors, mental health and physical conditions. We are conducting prospective, population-based studies, and we are working with international researchers on population-health-related projects. Measurement of health behaviour, including digital methods, as well as the development and application of advanced epidemiological and statistical methods in population-based studies, are other topics of our research program.



## BIOMETRY IN THE PhD PROGRAM

The IKEaB offers several courses, of which “Analysis of Variance” and “Biometry in Clinical Studies” are especially relevant for PhD students in Experimental Medicine. Additionally, we offer an introduction to Statistics for those who lack basic knowledge in this field. Moreover, individual advice in statistics are offered by the institute. Besides these services, the institute supervises PhD projects, e.g. the development of new methods of survival analysis in the combination of clinical and demographical data. The vast majority of projects rely on cooperations with clinical partners. You are also welcome to come up with own ideas.

## EPIDEMIOLOGY AND POPULATION HEALTH IN THE PhD PROGRAM:

The Department of Population-Based Medicine offers an international MSc program in Population-Based Medicine. Some of the courses in this program are also relevant for PhD students (e.g. Population Health, Social and Behavioral Medicine, Public mental health, etc.). We supervise PhD students, and we work with international population-based studies like CartAge, Lifelines, Health & Retirement Study, English Longitudinal Study on Aging, etc). Students are welcome to work with existing studies.



## MODULE COORDINATORS



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## HEALTH SERVICES RESEARCH

**Health Services Research is a central pillar of patient-oriented research, investigating which factors may influence the effectiveness of health-related interventions. Research projects focus on patients, specific groups of the general population, caregivers, health care institutions or the (intern)national framework conditions for delivery of health-related interventions. Different research methods are combined to answer research questions, i.e. qualitative and quantitative methods of empirical social research like interviews or surveys, analysis of routine data on patient care or from health insurance companies or complex interventional research designs with formative and summative evaluation. The research area is located at the interface of clinical, psychological, social science, economic and legal research and is increasingly important worldwide.**

### Health Services Research in Tuebingen

At the Medical Faculty Tuebingen, currently four institutions have a main research focus in health services research, but respective research projects are performed in many other clinical or methodological disciplines. Research of the Institute of General Practice and Interprofessional Care focusses on practical issues in primary care and its interfaces like innovative forms of care with special consideration of digitalization and interprofessional collaboration, (post/long) COVID, health in climate change, health promotion and prevention as well as complementary and integrative medicine. On the methodological level, the institute has a broad expertise of qualitative and quantitative methods and a wide range of experience with large collaborative projects for the implementation and evaluation of complex interventions. Research in the Department of Nursing Science at the Institute of Health Sciences addresses patient-centered collaborative practice in outpatient and inpatient health care. Both quantitative and qualitative methods of empirical research are used to generate new scientific knowledge. Issues in a

real care setting and associated research projects are often complex interventions and require a participatory approach for investigation and subsequent implementation. Research foci are in outpatient and inpatient health care and interprofessional collaboration with other care providers, such as the use of integrative nursing applications, drug therapy safety or the establishment of digital innovations in nursing care. At the Institute of Occupational and Social Medicine and Health Services Research, research addresses the development, implementation and evaluation of health-related services in and at the interface with companies, including occupational health management and the work of occupational health physicians. A second research focus is the (intersectoral) design of health care to maintain working capacity and employability in the changing world of work. Research projects focus on mental health, (work-related) health literacy, occupational safety culture, and social inequality as well as the design of working conditions for employees in health service and the consideration of special employee groups. Methodologically, mainly methods of empirical social science are used and there is a broad interdisciplinary collaboration

with other methodological specialists.

The Center for Public Health and Health Services Research (ZÖGV) was founded in 2019 by the Institute of Occupational and Social Medicine and Health Services Research, the Institute of General Practice and Interprofessional Care and the Ministry of Social Affairs, Health and Integration Baden-Württemberg. The main goal is to strengthen and develop health services research and public health services in the university setting by conducting own research projects with an interprofessional team, offering consultancy in research projects and participating in student and postgraduate teaching. As hub of health services research in Tübingen, ZÖGV conducts numerous workshops on methods of health services research including quantitative and qualitative methods which are supplemented by participatory methods and methods for the analysis of routine and registry data. Research addresses public health, population medicine, prevention, and climate influences, as well as structural or system-related questions or their participants. In addition, the interfaces to occupational medicine, general practice, interprofessional connection and questions of emergency care are of importance.

### Health Services Research in the PhD program

PhD projects in Health services research investigate all aspects of health-relevant interventions or products under everyday conditions in individuals, patient or population groups (multi-method approach). All levels (micro, meso, macro) can be

addressed. We offer a wide range of training in research methods, both in quantitative methods related to statistics or e.g. questionnaire development, as well as qualitative methods of empirical social research such as content analysis, interviews, etc.. This offer is constantly being developed, also based on the respective needs related to single research projects within the PhD program. Thus, further training on systematic reviews and critical appraisal of literature complement the offer, as well as on scientific work or scientific publications in health services research in general. Ultimately, health services research makes use of all useful methods, e.g. social or behavioural sciences. PhD candidates are supervised by senior scientists and get constructive feedback from an interdisciplinary environment in team meetings or the seminar on health services research.

### MODULE COORDINATORS



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# SUPPORT FOR OUR CANDIDATES

During your application and admission process after arrival, the coordination office of the PhD program helps you with many different issues, such as the individual organization of the PhD project, your enrolment at the University of Tübingen and the organization of your training plan.

At the start of each semester, a welcome event for new PhD candidates is organized, where the coordination office invites you to an introduction to the program. This event provides an in-depth look at the PhD program and introduces the training offered in our curriculum modules. At this event, PhD representatives are at your disposal to introduce you to the group of PhD students and take you to a first social gathering.

For day-to-day issues, the Welcome Center of the Faculty of Medicine Tübingen and the Welcome Center of the University of Tübingen provide international scholars with the support they need to get started in Tübingen, including a welcome package with information material and checklists for arrival. In addition, numerous orientation activities are available for students of the university and the Faculty of Medicine. Tips in finding accommodations can be provided by the Welcome Center, so please contact them as soon as possible. A number of rooms are reserved in university dormitories for PhD students in Experimental Medicine.

## USEFUL LINKS

PhD Experimental Medicine  
» [www.medizin.uni-tuebingen.de/en-de/medizinische-fakultaet/promotionen/phd-studiengang](http://www.medizin.uni-tuebingen.de/en-de/medizinische-fakultaet/promotionen/phd-studiengang)

Faculty of Medicine Tübingen  
» [www.medizin.uni-tuebingen.de](http://www.medizin.uni-tuebingen.de)

Organization of medical student representatives in Tübingen  
» [www.fachschafftmedizin.de](http://www.fachschafftmedizin.de)

Welcome Center of the University of Tübingen  
» [www.uni-tuebingen.de/en/international/welcome-center/registration/](http://www.uni-tuebingen.de/en/international/welcome-center/registration/)

General information for PhD students (German Academic Exchange Service DAAD)  
» [www.research-in-germany.de](http://www.research-in-germany.de)

## COORDINATION

### OFFICE OF THE PhD PROGRAM

The coordination office assists PhD candidates with inquiries and concerns regarding academic matters, program activities, course registrations, transcripts, and personal issues. In addition, the Coordination Office is in constant contact with the Doctoral Committee and communicates decisions to candidates regarding new policies, admissions, and special inquiries.

**Inka Montero, Dr. rer. nat.**

**Lina Maria Bandholz-Cajamarca, Dr. rer. nat.**

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## PhD Representatives

The PhD Representatives are three to four candidates selected by the PhD candidates for a period of two years. They are in close contact with the coordination office and the faculty and report any concerns, feedback, or ideas from the PhD candidates regarding all aspects of the program.





# THE TOWN OF TÜBINGEN AND SURROUNDING

**Tübingen** is a traditional historic university town situated on the river Neckar, 40 km southwest of Stuttgart on the fringes of the Swabian mountains and in close proximity to the Black Forest. The city officially first appears in records in 1191, but the local castle has records back to the year 1078.

Nowadays, Tübingen is a small town with 90,000 inhabitants and 28,000 students, making Tübingen the city with the youngest average population in Germany. Life in the city is dominated by its many students, combining the flair of a lovingly restored medieval center of town with the colorful bustle and typical atmosphere of a young and cosmopolitan students' town.

The active cultural scene offers events, museums and collections as well as festivals, concerts, stage plays and readings with poets of international reputation.

Numerous parks, gardens, and forested areas invite explorations by foot or bicycle. The immediate surroundings of the town provide an outstanding environment for outdoor activities such as swimming, cycling and hiking, or cross-country skiing in the winter.

» [www.tuebingen.de](http://www.tuebingen.de)

## STUTT GART

The closest major city to Tübingen is Stuttgart, located 40 km northeast from Tübingen. Stuttgart, the capital of Baden-Württemberg, provides all the shopping possibilities and cultural lifestyle of a large city. It has a wide range of cultural offerings including several museums, theaters and an opera.

» [www.stuttgart-tourist.de](http://www.stuttgart-tourist.de)

## SWABI AN MOUNTAINS (SCHWÄBISCHE ALB)

Situated close to Tübingen are the Swabian mountains, a high plateau with the highest mountain (Lemberg) reaching up to 1015 m. The spectacular landscape and magnificent natural environment make it attractive for hiking and cycling. Also, worth a visit are the numerous castles, churches and monasteries as well as caves and places of discovery of important fossils and historical findings.

» [www.schwaebischealb.de](http://www.schwaebischealb.de)

## BLACK FOREST (SCHWARZWALD)

The Black Forest starts about 40 km west of Tübingen. It offers several opportunities for sporting activities such as hiking and cycling as well as great nature and cities that are worth a visit. With mountains up to 1,493 m (Feldberg) it is also a popular skiing region in winter.

» [www.blackforest-tourism.com](http://www.blackforest-tourism.com)

## How to reach us

Situated in the heart of Europe, Tübingen is reached easily by plane, train or car:

**By plane:** The nearest international airport is Stuttgart (code: STR). From the airport, you can reach our office within 20 min by car or taxi.

**By train:** You can reach our office from Tübingen Main Station in 10 min by taxi, or by bus line No. 5 in 7 min to the stop "Uni-Kliniken Tal".

**By car:** From the Autobahn A8 (Munich-Stuttgart or Karlsruhe-Stuttgart) via the exit "B27" near Stuttgart or from Autobahn A81 (Stuttgart-Singen) exit to Tübingen via "B28".





## THE UNIVERSITY OF TÜBINGEN

Innovative. Interdisciplinary. International. These have been our guiding principles in research and teaching from the very beginning. Founded in 1477, Tübingen is one of Europe's oldest, most respected institutions of higher education. Tübingen's success in the German government's Excellence programs since 2012 has placed it among the most outstanding universities in Germany. The University is also well-placed in international higher education rankings.

With its wide spectrum of subjects, the University of Tübingen offers many opportunities for learning and for teaching – often in interdisciplinary programs which draw on a number of different subjects. Internationally, we have a large number of student exchange options with partners around the globe. Excellent research at the University of Tübingen goes hand-in-hand with the latest teaching methods to provide the best possible foundation for studies for students from Germany and around the world. This attractive learning environment is further enriched by a large variety of cultural and sporting activities.

## THE FACULTY OF MEDICINE

As one of the founding faculties of the University of Tübingen, the Faculty of Medicine can look back on a long history and tradition which has shaped the visions, goals and ideas since 1477 and is thus one of the oldest universities in Europe. At the Medical Faculty of Tübingen, research, study and teaching are combined in a unique way to offer our students, staff and researchers an excellent environment where they can live up to their potential and thrive.

The Medical Faculty of Tübingen is known especially for its main research areas Neurosciences, Oncology & Oncoimmunology, Medical Infection Research and Diabetes & Vascular Medicine. But as interdisciplinarity is a key element in our goal to conduct boundless research, our cross-sectional research areas play an important role as well, such as Data Sciences & Artificial Intelligence in Medicine, Imaging Sciences, Immunology, Medical Technology and Prevention and Health Services Research. The variety and diversity of our research areas find each other in our study programs. With its currently 15 undergraduate and graduate programs the Medical Faculty is one of Germany's manifold medical educational institutions.

Embedded in an outstanding research environment in the city of Tübingen called "Tübingen Research Campus", the Medical Faculty has close ties to excellent research institutions, such as the Cyber Valley with the Max Planck Institute for Biological Cybernetics, the Max Planck Institute for Intelligent Systems, two Hertie Institutes and the Werner Siemens Imaging Center to name but a few. In addition, the Medical Faculty has an excellent partner for translational research in the University Hospital of Tübingen. Moreover, the University of Tübingen has been awarded the title of Excellence University, making it to one of the best universities in the country.

To put it in a nutshell, we see ourselves as a research-intensive medical faculty that values diversity and equips future leaders with the flexibility and resourcefulness they need to meet the challenges of the future.

## THE TÜBINGEN UNIVERSITY HOSPITAL

Founded in 1805, the Tübingen University Hospital is one of the 36 university hospitals in Germany that contribute to the successful combination of high-performance medicine, research and teaching. It is a reliable partner in four of the six German Centres for Health Research initiated by the Federal Government. The University Hospital of Tübingen welcomes patients from all over the world who are treated in 17 clinics and wish to benefit from the high standards in research, patient care and nursing. In 2021, more than 450,000 patients were treated in Tübingen with a maximum capacity of over 1,500 beds. It is home to over 10,500 employees who ensure top-level medicine and research.

# IMPRINT

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