



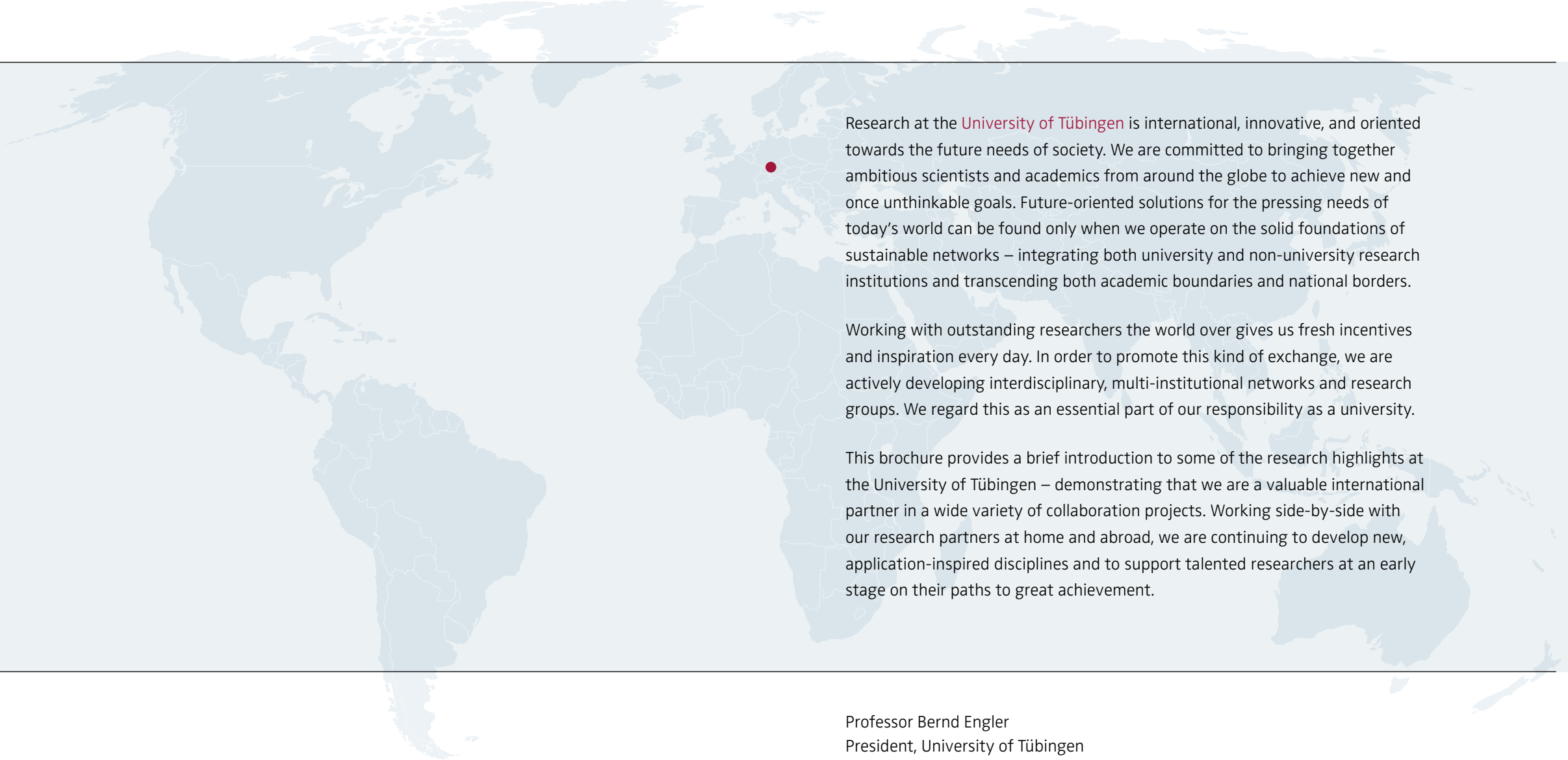
# Committed to the Future

Artificial Intelligence and Machine Learning | Life Sciences | Geoscience and Environmental



Research | Human Evolution and Archaeology | Humanities | Social Sciences | Ethics in Research

## Excellence in Research



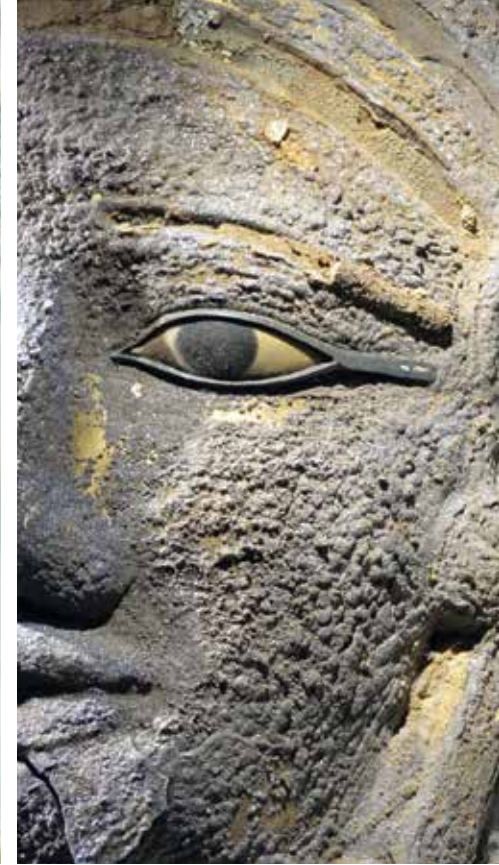
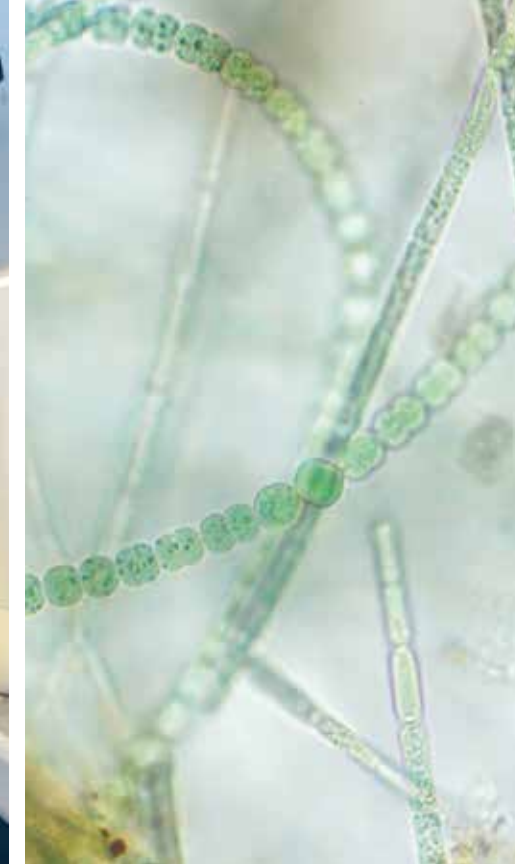
Research at the **University of Tübingen** is international, innovative, and oriented towards the future needs of society. We are committed to bringing together ambitious scientists and academics from around the globe to achieve new and once unthinkable goals. Future-oriented solutions for the pressing needs of today's world can be found only when we operate on the solid foundations of sustainable networks – integrating both university and non-university research institutions and transcending both academic boundaries and national borders.

Working with outstanding researchers the world over gives us fresh incentives and inspiration every day. In order to promote this kind of exchange, we are actively developing interdisciplinary, multi-institutional networks and research groups. We regard this as an essential part of our responsibility as a university.

This brochure provides a brief introduction to some of the research highlights at the University of Tübingen – demonstrating that we are a valuable international partner in a wide variety of collaboration projects. Working side-by-side with our research partners at home and abroad, we are continuing to develop new, application-inspired disciplines and to support talented researchers at an early stage on their paths to great achievement.

Professor Bernd Engler  
President, University of Tübingen

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## The home of excellence



Tübingen is a university town shaped by its academic life and traditions. With its more than 500-year history, the University of Tübingen is one of Europe's oldest institutions of higher education. The University has always supported the finest research across a broad spectrum of disciplines, and this has earned us an outstanding international reputation. That in turn has enabled us to attract numerous independent research institutions to Tübingen – including four Max Planck Institutes, four partner locations of German Centers for Health Research, and three Leibniz Institutes. Our numerous non-university research partners help create a vital research environment which is complemented by a number of strongly research-based companies. All this contributes to Tübingen's reputation as a seat of learning, research and innovation.

The numbers speak for themselves – the town, with a total of 88,000 inhabitants, is currently home to about 27,000 students. Around 5,000 academics teach and conduct research at our seven faculties. Many of them are among the world's best in their fields. The University and the University Hospitals employ more than 14,000 people – making them together the biggest employer in the area. The University has buildings in nearly every part of the town. The humanities, economics and social sciences, the theologues and law are concentrated near the town center, while the modern buildings for research and teaching in

the sciences are located on new campuses outside the historic heart of the town. The short distances within Tübingen make it easy for researchers from different disciplines to meet one another. Visitors to the city appreciate the flair of the old town, which it has preserved for centuries, and its proximity to fields, forests and streams.

Outstanding achievements in basic research – combined with a strong focus on potential applications – make the University of Tübingen stand out in many very different research areas. Our structures are supported by dedicated researchers and a culture of commitment and cooperation, which makes cooperation possible across the boundaries of disciplines and faculties. This enables the University to focus its energies on ambitious goals. This is demonstrated not least by our outstanding success in the German government's Excellence Strategy. The University of Tübingen is currently home to three research clusters and receives funding as one of Germany's universities of excellence. International rankings also provide regular confirmation of the University of Tübingen's place among the world's finest institutions of higher education.

*In its more than 500-year history, the University of Tübingen has always combined the traditional with the contemporary.*

## Centuries of innovation

For over 500 years, the University of Tübingen has been setting standards in all fields of research across the sciences and humanities. Since the University's founding in 1477, Tübingen researchers' discoveries have written academic history, stimulating the ideas underlying some of the disciplines which exist today.

Over the centuries, the sciences in particular have made a name for themselves. The first independent faculty of science in Germany was established in Tübingen in 1863. As early as 1818, the university had set up a chemistry laboratory in Tübingen Castle, which soon became one of the world's first research facilities for biochemistry. There, Felix Hoppe-Seyler (1825-1895) examined the red color in blood and named it haemoglobin. In 1869, his pupil Friedrich Miescher discovered a substance he called nuclein. We now know it as deoxyribonucleic acid, or DNA. As the carrier of genetic information, it is now more than ever the subject of intense research.

Medicine, too, is one of Tübingen's outstanding branches of research, with deep roots in the University tradition. Three Tübingen alumni received the Nobel Prize for Medicine in the 1990s.

Against the background of this highly productive history with its many contributions to progress, Tübingen researchers continue to address current issues and to help shape the future with their work. This includes opening up new fields of research and expanding our basic knowledge while seeking results which will have practical applications.

The University of Tübingen's research is closely tied to its teaching. With more than 200 subjects on offer, the University of Tübingen gives prospective students a wide range of choices. The range of programs is continually being expanded to include innovative new fields such as nanoscience, media informatics, medical technologies, scientific ethics, and machine learning. Students can work toward Bachelor's or Master's degrees, the Staatsexamen or a doctorate in varied combinations of subjects; what they all have in common is the close integration of research and teaching.





## Successful together – Tübingen Research Campus

The increasing specialization in many subjects and our rapidly expanding knowledge mean that major current research questions can only be solved through exchange and close cooperation between researchers in different disciplines. The Tübingen Research Campus (TRC), an amalgamation of several local research institutions, creates new opportunities to master academic and scientific challenges and to gain new knowledge.

In recent decades, a number of highly-respected non-University research institutions have become established in the vicinity of the University of Tübingen and University Hospitals. They include four Max Planck Institutes, four partner locations of German Centers for Health Research, three Leibniz Institutes and the Hertie Institute for Clinical Brain Research (HIH), which is funded by the

Hertie Foundation. They all pursue a common goal within the TRC – cutting-edge research at the highest level achieved through even closer cooperation across the boundaries of disciplines and institutions. The TRC thus strengthens Tübingen’s research profile and makes Tübingen even more attractive to outstanding researchers from around the globe.

The joint use of technical infrastructure such as high-tech machinery, cooperation in collaborative projects and the joint further development of research priorities are the keys to cooperation in the TRC. The excellent supervision and support of early-career researchers is also an important concern for all partners. By running joint graduate and postgraduate programs, the institutions ensure their support right where it is needed. The partners work together primarily in neuroscience, imaging technologies, infection and cancer research, robotics, computer science and bioinformatics, developmental biology and molecular biology, paleontology and education.

Last but not least, cooperation with the business community also plays an important role. The TRC partners seek to expand their existing excellent connections with world-renowned companies and to further boost the dialogue between basic research and industry. This can help enable a rapid transfer of new scientific knowledge into commercial applications.

→ [www.tuebingenresearchcampus.com](http://www.tuebingenresearchcampus.com)

## Research networking across borders

Individuals or groups working in isolation are hard pressed to conduct successful research today due to the complexity of contemporary research topics. To increase the breadth and depth of our knowledge, we need to carry out our research as parts of networks. That is why the University of Tübingen seeks cooperation at all levels.

The broad spectrum of disciplines at the University of Tübingen forms an ideal basis for cooperation between different subjects. As central units of its excellence strategy, the University has set up interdisciplinary platforms to promote and accelerate exchange. Beyond the University, there are particularly strong local links with the Max Planck Institutes for Developmental Biology, for Intelligent Systems and for Biological Cybernetics, as well as to the Friedrich Miescher Laboratory, a research training institution administered by the Max Planck Society. The University also cooperates closely with the HIH and the Leibniz Association. An important partner in education research in Tübingen is the IWM media research center, a Leibniz Institute. At the Senckenberg Center for Human Evolution and Palaeoenvironment (SHEP), both University and Senckenberg Society researchers are jointly investigating very early human history with input from various disciplines.

Tübingen’s compact size benefits academic cooperation – next to research excellence one of the prime reasons why the town was chosen to host branches of four German Centers for Health

Research – for research into infection medicine, neurodegenerative diseases, diabetes, and for translational cancer research. The University is building bridges to industry via its cooperation with the Natural and Medical Sciences Institute, an associated institute with a focus on applied research, located in the neighboring town of Reutlingen.

The University of Tübingen is also well connected and highly active at the national and European levels. Between 2010 and 2020, more than 250 Tübingen research projects were funded by the EU. The University is a founding member of the German U15 – a higher education network of institutions strong in research and medical teaching and development – as well as The Guild, an association of research-intensive European universities. Working with its partners, the University also addresses strategic and research policy issues.

Together with universities from Australia, Canada, New Zealand, Sweden, the United Kingdom and the United States, Tübingen founded the Matariki Network in 2010. It is dedicated to such topics as conflict research, sustainability, cyber security, and quantum research. Tübingen has also joined forces with seven other European universities in the European Civic University alliance CIVIS. The partners in this grouping seek to promote international student exchange, European civil society and cooperation with Africa and the Middle East.



## Committed to excellence – helping to shape the society of tomorrow

The University of Tübingen has joined the quest to meet the many challenges facing our society. We are continually discovering and exploring new fields across the spectrum of academic research which focus on fundamental issues and at the same time may lead to practical applications. This approach is also the keystone of our strategy as a university of excellence, a status we first attained in 2012 and reaffirmed in 2019 following thorough appraisal under the German government's excellence program. We are guided by the motto Research – Relevance – Responsibility: Open to New Challenges and a Global Scope of Action. Thus we define our University as a home of top-level research with a global responsibility. We want to establish a spirit of excellence right across the University and recruit respected researchers from all over the world. In this way, we seek to raise our international profile and to secure our status as one of the world's best research institutions in the long term.

A central element of our strategy in Tübingen is to further enhance our attractive and productive research environment. For example, when we attained excellence status in 2012, we utilized some of the funding to build first-class infrastructure for the humanities, natural and life sciences. Our Core Facilities pool state-of-the-art equipment and expertise, made accessible via a range of support services. LISA+, for example, specializes in micro- and nano-structuring and surface analysis for physics and phys-

ical chemistry. The Quantitative Biology Center (QBiC) is the central facility and research unit for bioinformatics and omics technologies, and the eScience Center offers services in the field of digital humanities. QBiC and the eScience Center also assist with research data management – from project planning to data processing and archiving.

Since 2019, the University has been building two more Core Facilities. The Tübingen Structural Microscopy center pools the capacities in electron and ion microscopy for investigations on the micro- and nano-levels – of vital use in the geosciences, life sciences and materials sciences. The Methods Center conducts basic research into interdisciplinary methods and new data analysis techniques in psychology, economics and the social sciences, and develops new approaches to model building.

The establishment of four interdisciplinary research platforms within Tübingen's excellence strategy has also proven to be highly beneficial. They provide a forum for researchers to work on cross-sectional topics in areas such as clinical research and drug development, medical technologies, environmental systems analysis, and globalization. The platforms promote broader, more in-depth cooperation between university and non-university research and are an important source of new insights. This form of cooperation has already led to several



successful, broadly connected research networks in the fields of cancer research, geoscience and environmental research, and in personalized medicine.

The University strives to be a contact point and cooperative partner for outstanding international researchers. Tübingen has had considerable success in securing Humboldt Professorships, Germany's most valuable research award. The Professorship, granted by the Alexander von Humboldt Foundation, is endowed with five million euros and serves to attract top international researchers to Germany. Under the program, the University of Tübingen has so far been able to attract five highly renowned researchers from Canada, the United King-

dom and the United States. The highly sought-after Humboldt Professorships promote international cooperation in the respective research fields.

Another element of our strategy is the College of Fellows for international postdocs and professors. Fellows are given the opportunity to spend up to two years working on a research project in Tübingen. At the same time, they bring new perspectives to our research and teaching. The College is meant as a forum in which the Fellows can meet each other as well as the many guest lecturers working in Tübingen. It is a center for lively interdisciplinary exchange and debate, for example in lectures, workshops and summer schools.

*The three R's – Research, Relevance, Responsibility – reflect Tübingen's institutional strategy as a university of excellence that aims to tackle global challenges using an interdisciplinary approach, and to open up basic research to application-oriented aspects.*

## Open to new challenges and a global scope of action

Scientific progress is accelerating and innovation cycles are becoming shorter and shorter. This gives rise to technological advances which can change our knowledge and society in the long term. High-throughput analysis in the life sciences and the application potential of machine learning are just two examples of such developments. The University of Tübingen has increased its ability to respond quickly to new challenges – especially in emerging new research areas.

The establishment of Cyber Valley, a major network in the field of artificial intelligence, is a prime example of how a future-oriented field of research can be successfully developed. The Universities of Tübingen and Stuttgart as well as the Max Planck Society have joined forces with numerous other players in politics, industry and the world of academia to make the region one of the world's leading centers in research into artificial intelligence and machine learning – and their applications. This dynamic process has also ensured that the spirit of innovation spreads to other fields – leading to increased openness to innovative ideas. The University is welcoming this process with new funding programs to give new impetus to strategically important research areas.

The University of Tübingen is active in research worldwide and is integrated into numerous international networks. As part of a global awareness program, it is seeking to encourage its employees and students to become more open to global issues and to acquire intercultural competence in order to be able to act responsibly in the globalized and networked world. In the awareness that internationalization begins at home, the University has been strengthening its international profile for many years. The new program adds further teaching and training components to the existing strategy. The University will continue to increase the number of courses conducted in languages other than German, and will focus increasingly on global issues. It is also expanding its courses in interculturality and environmental sustainability.

The University gives its researchers incentives to focus their work on global topics and areas of action. Since 2020, a new research platform, Global Encounters, has been founded on the established collaboration between the social sciences and humanities. The participating researchers are focusing on the trans-historical and transnational social and cultural effects of

mobility, new forms of communication, and international economic networks. They are also examining encounters between societies – from the micro-level of everyday interactions to the macro-level of entire systems, whether caused by violent means or through peaceful exchange. In addition, the University has established the Interdisciplinary Center for Global South Studies, a center that builds on a network of academics from Africa, Latin America and the Asia-Pacific region who are investigating the challenges of the Global South. It also runs summer schools, conferences and workshops on a wide range of topics and offers a Master's program and a PhD program in Global South Studies.

Global awareness also means that sustainable development is an important focus for the University. In order to anchor this objective structurally, the University has established a Competence Center for Sustainable Development. The center promotes the integration of sustainable development issues into research and teaching, supports student projects, and participates in transfer and outreach activities, for example the annual Sustainability Lecture. In 2016 and 2019, the Competence Center for Sustainable Development was recognized by UNESCO for its

“outstanding work on the structural anchoring of education for sustainable development in Germany.”

The University of Tübingen and its researchers not only want to understand the world; they also want to shape it and change it positively. To this end, the University is gradually expanding its social commitment. It attaches great importance to the transfer of academic knowledge in a broad sense. On the one hand, the University supports the dissemination and use of knowledge and research results – for example, by joining in current debates; and on the other hand, it supports application-oriented research and the transfer of innovations into useful products.

In order to support a start-up culture for technological developments as well as for social projects, the University is establishing an Innovation Center to jointly support start-up activities, providing flexible and unbureaucratic help and offering appropriate infrastructure. The University of Tübingen is convinced that these and other measures will help to bring the academic world closer to society as a whole, while also strengthening ties between academia and industry – to the benefit of all.



## Teaching computers to think

# Artificial Intelligence

Digitalization has become a part of our lives – from daily communication, to mobility, to our health care systems. New technologies based on machine learning are set to make even greater changes to our world in the coming decades – changes affecting all aspects of our lives. Recent breakthroughs in the area of machine learning are making many new applications possible. Unlike humans, algorithms don't get tired or make mistakes – and they are able to crunch vast sets of data. As they learn to solve ever more complex problems, automatic systems are making inroads into areas requiring uniquely human skills, such as driving, translation, and image recognition.

The Tübingen-based cluster of excellence in **Machine Learning: New Perspectives for Science** focuses on developments in the field of machine learning and the effects it may have on widely differing areas of science and academia. For a number of years, machine learning methods have been used in research to resolve isolated prediction problems. But science has yet to exploit the field's full potential.

At the heart of the cluster's research are algorithms which recognize complex structures and causal links in data sets, and methods to quantify uncertainties in data-driven scientific models. The cluster is also exploring techniques which enable

the researchers to better understand and interpret phases of machine learning – so that they can intervene and direct them. Additionally, the researchers are investigating the ethical and scientific theory issues which arise when algorithms take on an ever-greater role in unlocking new scientific and academic knowledge.

Researchers from a number of different disciplines come together in the cluster – from the natural sciences, the humanities and the social sciences. They are exploring possible applications in very different subject areas, from medicine, to earth sciences, to social sciences. University of Tübingen academics in the Machine Learning excellence cluster work alongside members of the Max Planck Institute for Intelligent Systems and the Knowledge Media Research Center (IWM), a Leibniz Association institute.

The **Max Planck Institute for Intelligent Systems** is one of the University's key partners, and it has helped to make Tübingen a leading international location for machine learning research. Our strong showing in the field led to the decision by Germany's Ministry of Education and Research to fund a competence center for machine learning – one of only five of its kind across Germany. Dubbed the **Tübingen AI Center**, our



## Training machines to see

A great challenge for machine learning is to reproduce the robustness of human intelligence in artificial systems. The collaborative research center **Robust Vision – Inference Principles and Neural Mechanisms** (SFB 1233) is tackling the issues at the very foundation of how biological organisms see – and how machines can learn from them. Here, too, University researchers are cooperating with colleagues at the Max Planck Institute for Intelligent Systems.

Human sight allows us to draw reliable conclusions about our surroundings on the basis of limited visual information, even under highly variable conditions. This ability to make robust visual inferences is the result of complex calculations made by neurons in our visual systems. Artificial vision systems – for example, in self-driving cars – are making progress in reproducing the visual skills of humans. Yet they are frequently unable to assess new or unexpected conditions. For example, image recognition systems meant to recognize and prevent the uploading of violent images to social media can be fooled by minor pixelation. They fail to recognize relevant material and wrongly classify it as safe.

The collaborative research center seeks to better understand the principles and algorithms underlying the calculations of biological visual systems that enable robust vision. To this end, the researchers take an integrated approach, using methods from neuroscience, computer vision research, and machine learning. They are concentrating on the fields in which there are fundamental differences between the neurobiology of vision and the current algorithms of machine vision. This approach with a focus on the differences will generate new momentum for the disciplines involved.

competence center provides research groups at the University and at the Max Planck Institute for Intelligent Systems with a joint organization in which to develop learning systems. The goal is to develop new concepts and methods to make these systems more robust. The researchers are teaching algorithms to deal with external and unforeseen influences. At the same time, the algorithms' output needs to become more predictable and transparent. The Center seeks to build a bridge between basic and applied research in the field.

Members of the Tübingen AI Center are also involved in establishing new start-ups – putting new applications to commercially viable uses. The Center will also focus on the question of misuse of artificial intelligence technologies, investigating them in a number of its projects. One junior research group is looking at ways of protecting sensitive data and is seeking to develop appropriate solutions. The other centers of this kind are located in Berlin, Dortmund, Dresden/Leipzig and Munich. Together, the five institutions are to play a key role in the German government's artificial intelligence strategy.

*Tübingen researchers have helped to develop an algorithm that allows photos to be displayed in various artistic styles.*

# Machine Learning

→ Machine Learning: [uni-tuebingen.de/en/133840](http://uni-tuebingen.de/en/133840)  
Max Planck Institute for Intelligent Systems: [is.mpg.de](http://is.mpg.de)  
Tübingen AI Center: [tuebingen.ai](http://tuebingen.ai)  
Robust Vision: [uni-tuebingen.de/robust-vision](http://uni-tuebingen.de/robust-vision)



→ Cyber Valley: [cyber-valley.de](http://cyber-valley.de)

Machine Learning cluster: [uni-tuebingen.de/en/133840](http://uni-tuebingen.de/en/133840)

IMPRS-IS: [imprs.is.mpg.de/](http://imprs.is.mpg.de/)

## Cyber Valley – research alliance for artificial intelligence

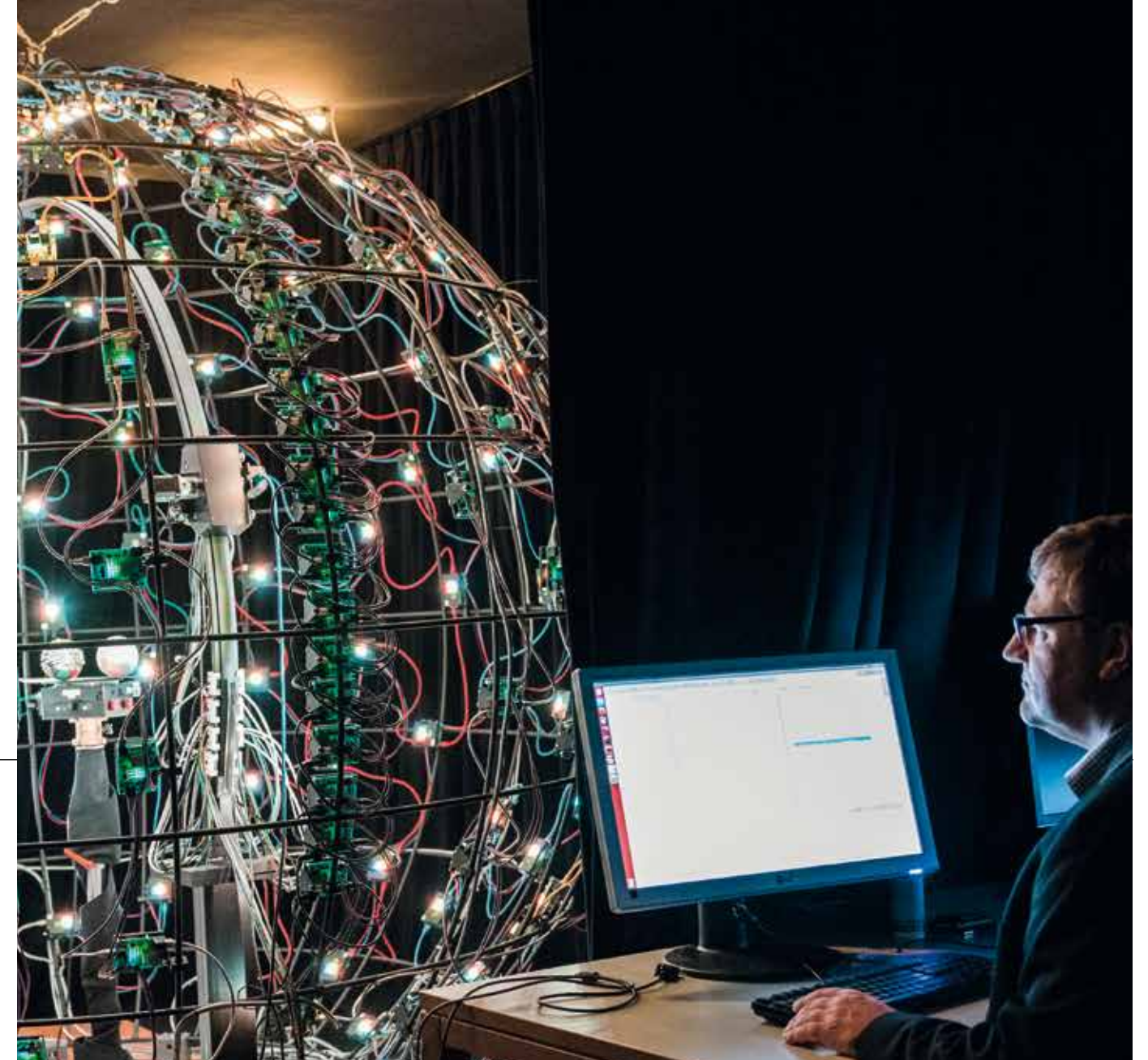
Tübingen has grown dynamically in the fields of artificial intelligence and machine learning, and is considered one of the leading places for research in these areas worldwide. A visible sign of this strength is the **Cyber Valley Initiative**, established in 2016. It is a network of researchers in both science and industry who are working together to investigate and develop the potential of artificial intelligence. Along with the Universities of Tübingen and Stuttgart, the Max Planck Society and the Fraunhofer-Gesellschaft, the state of Baden-Württemberg, and many global industrial enterprises are also on board. Numerous new research groups have been established since the Cyber Valley Initiative was launched. They have comprehensive support, including the state-of-the-art equipment required, and they are headed by top young researchers recruited from around the world in a highly competitive process.

As the initiative develops, it is attracting a growing number of leading scientists. More than ten new professorships have been established; they include endowed professorships funded by engineering and technology company Bosch, Daimler and the Carl Zeiss Foundation, backed by the optical systems manufacturer of the same name. In addition to this, companies have seized the opportunity to send their own artificial intelligence researchers to work collaboratively with researchers at the University of Tübingen. Within the framework of Industry-on-Campus profes-

sorships, industry scientists set up their own research groups, work side-by-side with their University colleagues; and at the same time, they share their knowledge and expertise with students. In cooperation with the Fraunhofer-Gesellschaft, the Cyber Valley Initiative is also hosting a research and transfer center for artificial intelligence; its focus is primarily on applications benefiting small and mid-sized enterprises.

Thanks to the Cyber Valley Initiative, the number of professorships and research groups dedicated to artificial intelligence has grown swiftly since 2016. More than 30 research groups in Tübingen now focus on issues of machine learning, computer vision and robotics. Various rankings have repeatedly placed the Tübingen-Stuttgart region first among Europe's locations for basic research in artificial intelligence, and in the top ten around the world.

Established in 2019, the **Machine Learning: New Perspectives for Science** cluster of excellence at the University of Tübingen testifies to this success. The University considers it a duty to chart the future course of artificial intelligence research and teaching in such a way that it serves the best interests of society and protects humans from potential risks. In line with these aims, the University's research into artificial intelligence also tackles ethical questions arising from technologies affecting almost all aspects of our lives.



A new artificial intelligence and machine learning research campus is being developed at the technology park on Tübingen's northern edge. It is located close to the Max Planck Institutes for Intelligent Systems, Biological Cybernetics, and Developmental Biology; major companies such as Bosch and Amazon are also establishing research centers there. The physical proximity of researchers from the University, from independent research institutions and from industry helps those involved to cooperate more closely in their work.

The Universities of Tübingen and Stuttgart, along with the Max Planck Institute for Intelligent Systems, are also working together to support talented researchers in the early stages of their careers. In 2017, they founded the **International Max**

**Planck Research School for Intelligent Systems (IMPRS-IS)**. It is a graduate school offering top-level training for international junior researchers in the fields of computer science, cognitive sciences and neurosciences, mathematics, engineering and materials sciences. Hundreds of skilled young researchers from around the world apply every year for the opportunity to do their doctorate with scientists who are at the forefront of their fields. The goal of IMPRS-IS is to follow the example of biologically intelligent systems to develop artificial intelligence systems, which will be able to act autonomously, interact, learn, and adapt in complex environments. The results of this work could be used for applications in such areas as robotics, autonomous vehicles, medical technologies, and sustainable energy management.

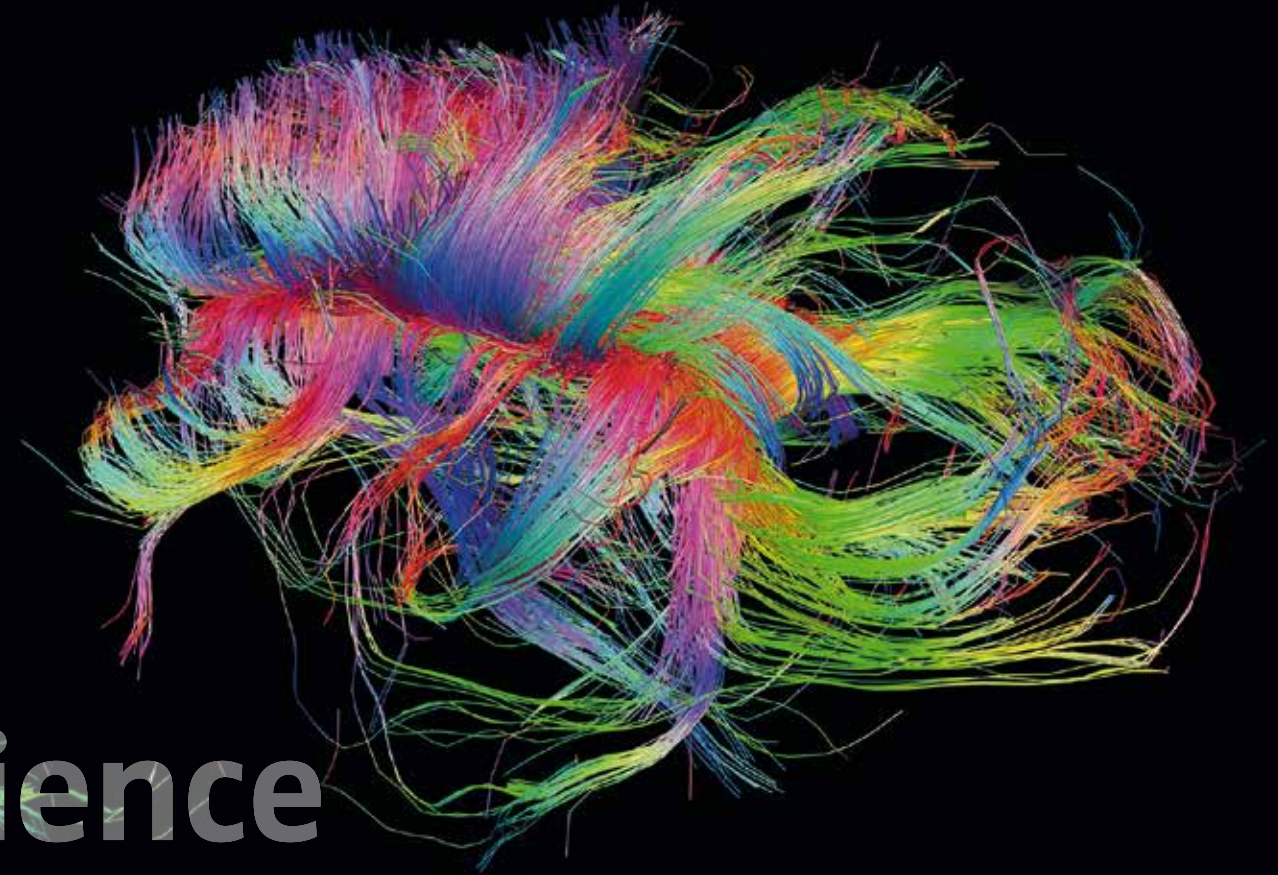
*AI researcher Professor Hendrik Lensch uses an apparatus to record all visual characteristics of real scenes as training data for computer vision.*



# Life Sciences

World-class brain research » Neuro

# science



For more than 30 years, Tübingen has been a top international address for brain research. From the very beginning, the neurosciences in Tübingen have relied on interdisciplinary collaboration and have established strong networks locally and internationally. The **Hertie Institute for Clinical Brain Research (HIH)** combines public and private funding in a unique way. The HIH and the University Hospitals' Neurological Clinic together make up the **Center for Neurology**. The center brings together top-level research, training and patient care. The focus is on research into neurodegenerative and inflammatory brain diseases, epilepsy, strokes and brain tumors. The focus on these disorders is sharpened by research into the underlying phenomena of perception, consciousness, motor skills and learning. Translational research approaches are typical of the HIH's work. The goal is to incorporate scientific findings quickly into improved treatments.

Around 400 employees in 28 research groups work at the Hertie Institute. The HIH pools its resources via an interdisciplinary organizational structure; this opens up excellent prospects, particularly for junior researchers, to conduct independent research



in small teams at an early stage of their careers. Germany's key academic policy advisory body, the German Science Council, has praised the HIH's combination of basic research and clinical practice as an outstanding example of university medicine in Germany. Since the end of 2019, the HIH has been part of the Hertie Network of Excellence in Clinical Neuroscience, which connects top institutions in the clinical neurosciences and promotes early-career researchers.

One of the Hertie Institute's important partners in Tübingen is the **Werner Reichardt Center for Integrative Neuroscience (CIN)**. CIN emerged from the cluster of excellence of the same name and is the joint platform for systems-oriented neurosciences at the university. Scientists from three faculties cooperate here with non-university partners, including the Bernstein Center for Computational Neuroscience Tübingen, the Max Planck Institutes for Biological Cybernetics and for Intelligent Systems, the German Center for Neurodegenerative Diseases in Tübingen, and the Fraunhofer Institute for Manufacturing Engineering and Automation in Stuttgart. In five complementary research areas, researchers at CIN investigate how the brain carries out functions such as perception, memory, emotions, communication and action – and how brain diseases affect these functions. The researchers also take an interactive approach in order to understand the function of individual nerve cells and their

Left: CIN researchers prepare nerve cells under the microscope.  
Right: The CIN building on the neuroscience campus.

complex interaction in circuits and networks. This enables the scientists to discover the information theory and biological basis of the brain's many functions. This is essential for developing more effective treatments for neurological diseases, or for improving systems of artificial intelligence.

Another pillar of the neurosciences is the **Center for Neurosensory Systems (ZfN)**, a merger of the Department of Ophthalmology and the Ear, Nose, and Throat Hospital. The ZfN conducts systemic analyses of the causes and treatment of neurosensory diseases. More than 25 million people in Germany alone are affected by chronic hearing and vision disorders. Hearing and vision loss is an important risk factor for the loss of cognitive abilities up to and including dementia. The Department of Ophthalmology conducts clinical gene therapy studies which have pioneered new treatments for genetic retinal diseases; while the Ear, Nose and Throat Hospital is a leader in the development of cochlear implants.

A key non-university player in brain research is the **German Center for Neurodegenerative Diseases (DZNE)** in Tübingen. Researchers at this Helmholtz Association institution are investigating how diseases such as Alzheimer's and Parkinson's develop, and are seeking new strategies for diagnosing, preventing and treating them. Since 2015, the DZNE has been located

Reconstruction of nerve fibers using diffusion tensor imaging.

next to the CIN and HIH, within easy reach of the University Hospitals. This physical proximity supports cooperation between basic research, clinical research and patient care – a special feature of brain research in Tübingen.

The collaboration was formalized in 2018 with the establishment of the **Tübingen NeuroCampus (TNC)**. The TNC acts as an umbrella structure and forum for the more than one hundred neuroscience research groups working at various institutions in Tübingen. The aim of the network is to promote local collaboration, introduce new experimental methods and research approaches, and make Tübingen an attractive place for top scientists from around the world.

All members of the TNC also contribute to the training of junior researchers. The **Graduate Training Center of Neuroscience** offers three complementary and closely interlinked Master's programs and a PhD program, conducted in cooperation with the Max Planck Institute for Biological Cybernetics. These programs make up the International Max Planck Research School for Cognitive & Systems Neuroscience, with interdisciplinary programs covering all aspects of neuroscience and conducted in English.

- HIH: [hih-tuebingen.de](http://hih-tuebingen.de)
- Center for Neurology: [medizin.uni-tuebingen.de/de/das-klinikum/einrichtungen/kliniken/neurologie#kooperationen](http://medizin.uni-tuebingen.de/de/das-klinikum/einrichtungen/kliniken/neurologie#kooperationen)
- CIN: [www.cin.uni-tuebingen.de/](http://www.cin.uni-tuebingen.de/)
- DZNE: [dzne.de](http://dzne.de)
- TNC: [tuebingenresearchcampus.com/tnc](http://tuebingenresearchcampus.com/tnc)
- Graduate Training Center: [neuroschool-tuebingen.de](http://neuroschool-tuebingen.de)





## New strategies to tackle tumors

# » Translational Immunology and Cancer Research

Tumors represent a major challenge for our health care system; and they are a challenge for researchers too – as there are more than 200 different types of cancer. Many of them are still considered incurable. In Tübingen, experts from a variety of disciplines are working together to develop new and better diagnostics and treatments for many different kinds of tumors.

The University of Tübingen has played a leading role in cancer research in Germany and in Europe for many years. We were the only university to have a cluster of excellence funded under the German government's 2018 Excellence Strategy that is dedicated to oncology research, **Image-Guided and Functionally Instructed Tumor Therapies (iFIT)**. The cluster seeks a comprehensive understanding of the biological processes which take place inside tumors, and will use this knowledge to devise clinical studies for the development of sustainable, personalized cancer treatments.

Many of the therapies currently in use are not effective in the long term. Modern cancer treatments enable doctors to slow the growth of many types of tumor, even if the cancer is at an advanced stage. Yet the disease can develop resistance to the treatment – and the tumors begin to grow again.

Researchers in the iFIT cluster are using functional genetic techniques to find the tumors' weak points – places where new drugs can most effectively attack. The cluster pools the expertise of oncologists, immunologists, and clinical imaging experts with that of researchers from the Max Planck Institutes for Developmental Biology and for Intelligent Systems, the Natural and Medical Sciences Institute in Reutlingen, and the Margarete-Fischer-Bosch Institute for Clinical Pharmacology in Stuttgart.

Liver cancer is the fifth most common form of cancer worldwide, with one of the highest mortality rates. It remains unclear how liver carcinomas arise from the known risk factors of infection, cirrhosis, and metabolic disorders. The transregional collaborative research center **Liver Cancer – New Mechanistic and Therapeutic Concepts in a Solid Tumor Model** (TRR 209) seeks to fill the gaps in our knowledge, combining subprojects in basic and clinical research. The researchers are focusing, on the one hand, on how tumors get started during chronic viral infections and liver inflammation by pathogens such as the Hepatitis B and Hepatitis C viruses. On the other hand, they are looking into the mutations within the tumor cells and the relationships between the tumor and the surrounding tissue. Tübingen scientists in the collaborative research center are working with colleagues from the University of Heidelberg and the Hannover Medical School.

The DFG-sponsored research unit **Targeting Therapeutic Windows in Essential Cellular Processes for Tumor Therapy** (FOR 2314) is investigating hard-to-treat solid tumors. Researchers from Tübingen and the University of Würzburg are collaborating here to identify vital processes in the tumor cells – and to exploit these in innovative new treatments. While investigating new approaches for treatment, the researchers have increasingly focused on the genes present in the tumors, particularly on the genes which are essential to cancer cells. In the past, new drugs were developed to inhibit the function of proteins in the respective cells, with promising results in the case of some forms of leukemia. However, when it came to solid tumors such as carcinomas, the tumor cells responded dynamically, developing resistance to these molecular therapies; patients suffered relapses. The research unit is now focusing on metabolism and other essential processes. Such processes appear to work the same in healthy and in cancerous cells; yet a closer examination shows that there are clear differences.

*Professor Lars Zender (2nd from right) received the Leibniz Prize in 2014 for his research into boosting the regeneration of damaged livers and into immune surveillance of senescent cells to suppress tumor growth.*

This is where another of Tübingen oncology's core research areas comes in – the investigation of the mutual effects cancer has with the microbiome. The microbiome is the entire community of microbes living in an organism, including all the associated metabolic processes. The University of Tübingen is establishing a new institute focusing on the interplay of these previously little-regarded factors – the **M3 Research Institute**. M3 stands for malignome, metabolome and microbiome. Some 200 scientists at the institute will integrate tumor research with research into microbiome and metabolic disorders, seeking and developing new and more effective treatment for various forms of cancer.

The DFG-sponsored research training group **Intraoperative Multi-Sensor Tissue Identification in Oncology** (GRK 2543) aims to make great strides in cancer surgery. The scientists at the Universities of Tübingen and Stuttgart are seeking to develop new methods of distinguishing tumors from healthy tissue. This will help surgeons to more quickly and reliably identify cancerous tissue which is to be removed, and healthy tissue which is to be preserved. Members of the research training group are investigating cells and tissue inside the living body for signs of malignancy – either using minimally-invasive surgery or during major surgery – to give surgeons feedback in real time. The aim is to increase the safety and quality of life of patients, and to cut back on time spent operating.

## Working together to fight cancer

In all its complexity and its many manifestations, cancer presents enormous challenges for medicine. To further improve the diagnosis, treatment and prevention of cancer, it is important to integrate the knowledge of experts from various fields. Tübingen's cancer research activities are concentrated in the **Comprehensive Cancer Center Tübingen-Stuttgart (CCC)**, which is part of the University Hospitals. The CCC is funded by Deutsche Krebshilfe as one of the country's top oncological centers; it cooperates with the Robert Bosch Hospital in Stuttgart. In addition, the German government has decided to establish one of five locations of the National Center for Tumor Diseases in Tübingen by 2022.

At the Comprehensive Cancer Center, experts from 14 institutions specializing in the treatment of various types of tumors work closely together to ensure the best possible treatment of patients based on state-of-the-art medical knowledge. The CCC combines multidisciplinary patient care with the finest research, teaching, education and training. The center maintains continual feedback between the relevant fields of scientific research and clinical practice. This broad-based translational research helps scientists at the center contribute to an ever-greater understanding of cancer and the further development of targeted, personalized treatments. The approach ensures that the Comprehensive Cancer Center is a regular source of impetus for improvements to the care and treatment of cancer patients in the region.

The Comprehensive Cancer Center is also a partner in the **German Consortium for Translational Cancer Research (DKTK)**. The DKTK is one of six major government-backed health research networks. It connects universities and hospitals in Germany which focus on oncology and is coordinated by the German Cancer Research Center in Heidelberg. The DKTK's mission is furthered by Tübingen's expertise in functional genomics, drug development and molecular imaging. In addition, the Tübingen University researchers work in close cooperation with the Werner Siemens Imaging Center and the Tübingen Center for Academic Drug Discovery (TüCAD<sub>2</sub>) – where innovative approaches to translational cancer research go hand-in-hand with clinical practice.

A special focus at the Comprehensive Cancer Center is on cancer immunotherapy, in which researchers seek to turn the patient's own immune system against cancer cells. For example, the CCC is developing vaccines based on peptides. The Tübingen scientists are also investigating vaccine enhancers known as adjuvants, which can improve the immune response caused by vaccinations. Another major focus is the development of antibodies for cancer treatment. This includes the targeted use of T-cells – part of the body's immune defenses – against cancer cells, for example in various forms of leukemia.

→ CCC: [ccc-tuebingen.de](http://ccc-tuebingen.de) | DKTK: [dktk.dkfz.de](http://dktk.dkfz.de) |

## Understanding the immune system

In the transregional collaborative research center **The Skin as a Sensor and Effector Organ Orchestrating Local and Systemic Immune Responses** (SFB/TR 156), researchers from Tübingen and their colleagues at the Universities of Heidelberg and Mainz are investigating the skin's key protective mechanisms; this involves the disciplines of dermatology, immunology and microbiology. The skin is our bodies' mechanical and immunological barrier against our environment. The skin's interaction with the immune system allows it to communicate with the entire body. The researchers in this group are investigating how the individual cells in the skin's microenvironment interact with each other, and how the interaction between microorganisms and skin contributes to the development of inflammatory diseases. The Tübingen researchers are chiefly interested in how the early phases of the inflammatory reaction occur. How does the skin communicate with microbes that normally colonize it – as opposed to pathogens? Researchers are making a precise analysis of the key messenger chemicals to help develop more specific treatments – with fewer side effects – for skin diseases. They are also investigating the natural balance between the skin and its environment as well as the early warning signals that trigger, regulate and control systemic reactions when this balance is lost. The collaborative research center's aim is to develop new treatments for inflammatory skin diseases, particularly for atopic dermatitis, psoriasis and scleroderma.

The Skin: [klinikum.uni-heidelberg.de/sfbs/sfb-trr156/welcome](http://klinikum.uni-heidelberg.de/sfbs/sfb-trr156/welcome) | IFIZ: [uni-tuebingen.de/en/31703](http://uni-tuebingen.de/en/31703)



**The Interfaculty Institute of Cell Biology (IFIZ)** brings together experts from the fields of biology, medicine, chemistry and pharmacy. Its particular strength lies in translational immunology. IFIZ researchers laid the foundations which led to the development of new immunotherapies to combat various types of cancer. Immunotherapy seeks to activate the patient's immune system so that it will actively recognize and eliminate tumor cells. In addition to cancer-fighting antibodies, Tübingen researchers are working on various vaccines based on the body's own proteins. The greatest challenge is finding treatments which can be adapted, as each patient has different immune defenses, and every tumor is different. Researchers at IFIZ are therefore working to develop vaccines which are tailored to specific patients and are designed to immunize them against their own cancer cells. The aim is to identify the best vaccines and subsequently design an individualized therapy. While the body's immune defenses need to be strengthened for cancer treatment, when it comes to autoimmune diseases such as multiple sclerosis it is important to weaken or suppress them – here too, IFIZ researchers are working on solutions.



# Data and images for healing

## » Imaging



Imaging techniques enable us to look inside living organisms. They are an important tool for basic research in the life sciences. In medicine, they are vital both to diagnostics and to the precise monitoring of many treatments. Researchers at the **Werner Siemens Imaging Center** are working to further develop a number of different imaging methods.

The Center, part of the University of Tübingen's Faculty of Medicine, is home to several interdisciplinary research groups which are analyzing and developing functional and multi-parametric imaging methods. Their goal is to make the processes in the human body visible – in detail, right down to the molecular level – and in real time. This will help doctors to identify tumors, conditions such as Alzheimer's or Parkinson's Disease, and infectious diseases earlier and more reliably – and without having to use invasive surgery. This raises the chances that medical professionals will be able to tackle a wide variety of diseases more effectively, with more precisely-targeted therapies.

The Center's innovative technological approaches provide researchers in the field of imaging with answers to biological and medical questions. For example, new multi-modal technologies are being tested that combine established methods such as magnetic resonance imaging (MRI) and positron emission tomography (PET); and new imaging probes, known as tracers, are being developed to observe the conditions and processes in patients' bodies over the course of a disease. Scientists at the Werner Siemens Imaging Center are also pioneering multi-scale approaches by combining microscopic and macroscopic imaging methods. And the researchers are going even further – integrating image data from clinical routine and the laboratory with omics data from fields such as genomics, proteomics, and metabolomics.

Once obtained, these big data sets can be analyzed by intelligent algorithms. By integrating such detailed and multifaceted data, the researchers seek to better understand the complex interrelationships of diseases overall – and to tailor treatments to the ailment of the individual patient. A major aim of all these projects is to transfer new findings from the laboratory into clinical practice safely and as quickly as possible.

The Imaging Center – funded by the Werner Siemens Foundation – is equipped with state-of-the-art devices for the non-invasive imaging of small laboratory animals and has laboratories for cell culture, PCR and microscopy. The Center has excellent international connections and offers regular workshops to train scientists from all over the world in the latest imaging

techniques. The work done at the Center not only benefits basic research and clinical diagnostics in the fields of oncology, neurology, immunology and infectious diseases; it also helps the manufacturers of imaging equipment. Scientists at the Center are central to the imaging cluster of excellence, Image-Guided and Functionally Instructed Tumor Therapies (iFIT), which seeks a comprehensive understanding of the biological processes in tumors in order to develop innovative and sustainable treatments for different forms of cancer.

Research in the life sciences is generating a swiftly growing amount of data. To manage these enormous data sets, the University of Tübingen and the Max Planck Institute for Developmental Biology operate the **Center for Quantitative Biology (QBiC)**, a central university facility providing expertise for high-throughput technologies and bioinformatics. QBiC offers comprehensive data storage and processing services for all kinds of bioscientific research – whether it focuses on the genome of a plant or animal cell or on the proteins in cancer cells. Researchers can also get advice on how to best design their experiments. The experts at QBiC come up with tailored solutions to fit the scientific problem perfectly. QBiC has the latest technology for generating and processing very large amounts of data which arise from genome sequencing and in

transcriptomic, metabolomic and proteomic analysis. The Center for Quantitative Biology is one of the Core Facilities set up at the University of Tübingen using funding from the German government's Excellence Initiative and maintained with sponsorship from the subsequent research funding program, the Excellence Strategy.

QBiC and the Medical Faculty further expanded their capacity for high-throughput sequencing by initiating the **NGS Competence Center Tübingen (NCCT)** in 2018 – one of only four such institutions sponsored by the German Research Foundation in Germany. The NGS Competence Center Tübingen will provide highly specialized infrastructure to support the latest methods in sequencing and bioinformatic analysis. It will be supported by QBiC as well as by two medical units. Researchers from the Institute of Medical Genetics and Applied Genomics and the Institute of Medical Microbiology and Hygiene will contribute their expertise in the field of next-generation sequencing. This will enable the NGS Competence Center Tübingen to offer the latest sequencing services adapted to diverse scientific questions and research topics ranging from single-cell sequencing to long-read sequencing; the analysis of transcriptomes and epigenomes in microorganisms, plants and various animal species, as well as in humans.

The Werner Siemens Imaging Center develops imaging processes aimed at benefiting patients directly.

## Spearheading the search for new drugs

# » Pharmaceutical

# Research

→ Platform Drug Discovery & Development:  
uni-tuebingen.de/de/46182

TüCAD<sub>2</sub>: uni-tuebingen.de/de/90744

ZPM: uni-tuebingen.de/de/64728

ICEPHA: icepha.dew

As part of its Excellence Initiative innovation, the University of Tübingen formed a new interdisciplinary platform called **Clinical Research and Academic Drug Discovery & Development**. It is a forum in which medical researchers work with pharmacologists and bioinformatics specialists. One focus of this collaboration is on finding and developing new medications and testing them in clinical studies – and also to improve personalized medicine, in which treatments are tailored to the individual patient. The researchers are examining the molecular structures and signal pathways in which particular drugs take effect. One of their goals is to find out how to stop the growing resistance of many germs to antibiotics. Along with oncology and infectiology, immunology is a further important focus of the platform's research. Vast sets of clinical and experimental data, analyzed using artificial intelligence tools, enable the researchers to make new discoveries. They can now identify new biomarkers, such as genes, genetic products, and molecules which indicate that processes involving diseases or other disorders are underway in the body; this can provide starting-points for possible new treatments.

The Clinical Research and Academic Drug Discovery & Development platform has led to the establishment of two institutions which are working on different aspects of these medical research problems, and which are now cooperating to their mutual benefit. The **Tübingen Center for Academic Drug Discov-**

**ery (TüCAD<sub>2</sub>)** is responsible for developing new pharmaceuticals, while the **Center for Personalized Medicine (ZPM)** matches medical data with new treatments and corresponding clinical testing; once the treatments are proven safe, the ZPM integrates them into patient care. TüCAD<sub>2</sub> combines various strategies in pharmaceuticals research with the goal of finding drugs likely to prove effective in treatments. TüCAD<sub>2</sub> focuses on the fight against cancer, infectious and cardiovascular diseases, and on liver regeneration. A special feature of TüCAD<sub>2</sub> research is functional genetic screening based on RNA interference. These RNAi tests are carried out in vivo on mice, enabling researchers to identify the genes at the root of the diseases. The next step is pharmacological validation. TüCAD<sub>2</sub> is well equipped for this, having a unique proprietary collection of compounds (TüKIC – Tübingen Kinase Inhibitor Collection) as well as considerable experience in the chemical development of medicines. As part of the Academic Drug Discovery Consortium, an association of 150 drugs research institutions worldwide, TüCAD<sub>2</sub> has outstanding international connections.

The second major institution is the Center for Personalized Medicine (ZPM). It is run jointly by the University and the University Hospitals. It complements the work of TüCAD<sub>2</sub>, primarily in the area of medical data management and the swift, safe translation of research results from individualized diagnostics into clinical

applications. The ZPM receives omics data from high-throughput analyses, information from clinical imaging processes, and other clinical data. These large data sets can be partially analyzed using machine learning procedures to pinpoint information which will enable researchers to develop treatments tailored to the individual patient. The evaluated data can also be used in the development of new clinical imaging techniques which can help doctors better assess a patient's condition and the processes at work in his or her illness. A further goal is to discover new potential applications for drugs which have already been approved. In order to integrate individualized medications into clinical routines, the ZPM also conducts personalized studies – known as basket trials – with small groups of patients.

An important partner for the researchers at TüCAD<sub>2</sub> and the ZPM is the **Tübingen Center for Good Manufacturing Practice (GMP)**. The GMP Center produces new active substances which are tailored to a particular patient; these are delivered to the researchers at the University Hospitals in the form of vaccines and antibodies. Both the time it would take and the cost of this development and production of individualized treatments would be many times higher in the pharmaceuticals industry. A further advantage is that the GMP Center is able to make quick and direct alterations to the medications to increase their effectiveness.

Another key institution in the individualized medicine is the **Interfaculty Center for Pharmacogenomics and Drug Research (ICEPHA)**. ICEPHA brings together University pharmacologists, toxicology researchers, doctors at the University Hospitals' Department of Internal Medicine, and researchers at the Institute of Clinical Pharmacology and the Robert Bosch Hospital in Stuttgart. They seek to understand the connections between individual DNA, the disposition to diseases, and the mechanisms by which drugs take effect. The aim is to individualize medications for treating diabetes, cardiovascular diseases, tumors and autoimmune disorders – and to better predict the course a disease will take in each patient. This enables doctors to intervene earlier, and to prevent or delay damage caused by the disease. Furthermore, ICEPHA's graduate program in personalized cancer treatments provides first-rate training for early-career researchers in pharmacogenomics and pharmacogenetics.

Such research has enormous potential for clinical applications – a fact reflected in successful new companies launched by Tübingen researchers, firms like CureVac, Immutics and SynImmune. These three businesses are involved in finding immunotherapies for cancer and are working to further develop this approach into products ripe for clinical use and the commercial market. They have received international attention and wield considerable influence in their special field.



## Investigating pathogens – protecting people

→ IMIT: [uni-tuebingen.de/en/7335](http://uni-tuebingen.de/en/7335)

MPI for Developmental Biology: [eb.tuebingen.mpg.de](http://eb.tuebingen.mpg.de)

DZIF: [dzif.de](http://dzif.de)

CMFI: [uni-tuebingen.de/cmfi](http://uni-tuebingen.de/cmfi)



Infections are the most common cause of disease and the second most common cause of death worldwide. New epidemics – and the increasing resistance of pathogens to known drugs – represent a major challenge for research. Yet, many microbes also have an enormous potential to synthesize products which are of great value both pharmaceutically and biotechnologically. Researching the threats posed by microbial pathogens, while developing effective drugs to combat them, is the goal of the **Interfaculty Institute for Microbiology and Infection Medicine at the University of Tübingen (IMIT)**, founded in 2009. As the first and only institute of its kind in Germany, IMIT integrates biology expertise regarding pathogens with the medical experience of infections. The institute's areas of core research are in the physiology of bacteria, antibiotics research, and infection and microbiome research. The aim is to improve the diagnosis and treatment of infectious diseases in order to prevent the spread of hard-to-treat pathogens.

IMIT works closely with the **Max Planck Institute for Developmental Biology**. This institute conducts basic research on the development and evolution of microbes, plants and animals. This work frequently overlaps with IMIT's infection research –

from investigating microbiomes, to the molecular biology of bacteria, to the evolution of proteins. To make the most of this, scientists at the two institutions cultivate an intense methodological exchange – and share the existing infrastructure.

IMIT's outstanding profile and its collaborative work with other local institutions were behind the decision to approve Tübingen as a location for the **German Center for Infection Research (DZIF)**. The DZIF's Tübingen location brings together researchers from the University of Tübingen, the University Hospitals and the Max Planck Institute for Developmental Biology. The goal of all partners is to promote translational research and to develop new methods for the diagnosis, prevention and treatment of infectious diseases – with the support of industry right up to approval for commercial use. Among other things, Tübingen's researchers contribute expertise regarding tropical diseases and the development of antibiotics.

In recent years, biomedical research into microorganisms has increasingly looked at the communities of microbes that colonize the human body. This is known as the microbiome. The importance of the relationships between microbes and their

hosts, for example on the skin or in the gastrointestinal system, was not understood for a long time; today we know that these interactions play a central role in many physiological processes. Along with bacteria which have a positive effect on human health, microbiomes may contain common yet potentially life-threatening pathogens. In the past, broad-spectrum antibiotics have often been used to combat them. Nowadays we know that this scattergun approach not only promotes resistance to antibiotics – in many cases it also damages the microbiome as a whole. That means we need new strategies to combat infections. That is the goal of the researchers in the University of Tübingen's cluster of excellence **Controlling Microbes to Fight Infections (CMFI)**, which was approved in 2018 under the German government's Excellence Strategy.

The researchers at CMFI study the microbiome and analyze the interactions of the microorganisms with each other and with their host. Instead of killing off the pathogens along with many other organisms, their aim is to develop specifically-targeted agents which will have a positive effect on the microbiome overall. We know that useful bacteria help to keep down the harmful ones. In order to understand and exploit the underlying

mechanisms, the excellence cluster brings together researchers from the fields of molecular, bioinformatics and clinical disciplines. Working alongside the University's scientists are researchers from the University Hospitals, the Max Planck Institute for Developmental Biology, and the DZIF. The cluster pursues an integrative approach. Medical microbiology is mainly concerned with pathogens as the cause of infections, while molecular microbiology usually looks at individual mechanisms and metabolic processes. The cluster brings both of these together and also involves environmental microbiologists and bioinformaticians in order to identify and research useful, "probiotic" bacteria and to understand microbial communities in all their complexity. From in-vitro models to controlled human colonization studies, participants in the cluster are investigating how the microbiome is able to fend off invading pathogens. Novel microbiome-specific interventions will be tested in preclinical and early clinical studies.

*Infection research at the University of Tübingen combines microbiologists' expertise in pathogens and medical know-how in order to develop new treatments.*

# » Microbiology and Infection Research

## New ways to beat infections

The collaborative research center **ANTIBIOTIC CellMAP – Cellular Mechanisms of Antibiotic Action and Production** (TRR 261) enables researchers from the disciplines of microbiology, bioinformatics, biochemistry, chemistry, pharmacy and medicine to work together to investigate the molecular production and active mechanisms of antibiotics. More than any other medicines, antibiotics have increased our life expectancy. Yet now, more and more pathogens are exhibiting multiple resistances to them. Despite the great need for new antibiotics, few are in development. This is partly due to the fact that we still do not fully understand how antibiotics work, nor do we know everything about the biology of the pathogens against which we use them. Nor do we have a full understanding of the processes by which some microorganisms themselves produce antibiotics. The aim of basic research in the collaborative research center is to better understand these processes at the cellular level. To achieve this, the Tübingen scientists are working with researchers from the University of Bonn.

Even with tried and tested antibiotics, it is often not entirely clear which cascade of effects they trigger in bacteria, or which specific event leads to cell death. Many successful antibiotics intervene in the bacterial metabolism at several points. The collaborative research center is investigating this antibiotic activity in the target cells. The researchers hope to derive principles from these molecular mechanisms so they can better select and develop new

antibiotics. The majority of classes of active agents which are useful as antibiotics are produced naturally by bacteria. These antibiotic-producing bacteria have the same cell apparatus as their target bacteria and can use it against them. The overall aim is to gain a better understanding of how antibiotic-producing bacteria make their deadly products and how they alter their metabolism during this process. Experts estimate that nature has a far greater potential to produce antibiotics than any laboratory. In the future, the findings of this research may enable the production of new bacteria-grown antibiotics under laboratory conditions.

Infections caused by viruses are the focus of the research group **VIROCARB: Glycans Controlling Non-Enveloped Virus Infections** (FOR 2327). The participants are investigating the role of complex sugar structures, called glycans. Viral infections always start when the virus makes contact with a receptor molecule on a target cell. The receptors are often glycans; these poorly understood structures "decorate" cell surfaces and enable the communication between cells as well as the sending of signals in the immune response. In particular, glycans determine how a particular virus enters the cell and often how severely the disease breaks out. Alongside the structural description of glycans, the research group also hopes to shed light on the mechanisms of interaction between glycans and viruses. These will be investigated using mass spectrometry and NMR spectroscopy.



*Tübingen researchers are among the world's leading experts in the fight against tropical diseases such as malaria. They work in close cooperation with partners at the Centre de Recherches Médicales de Lambaréné in Gabon.*

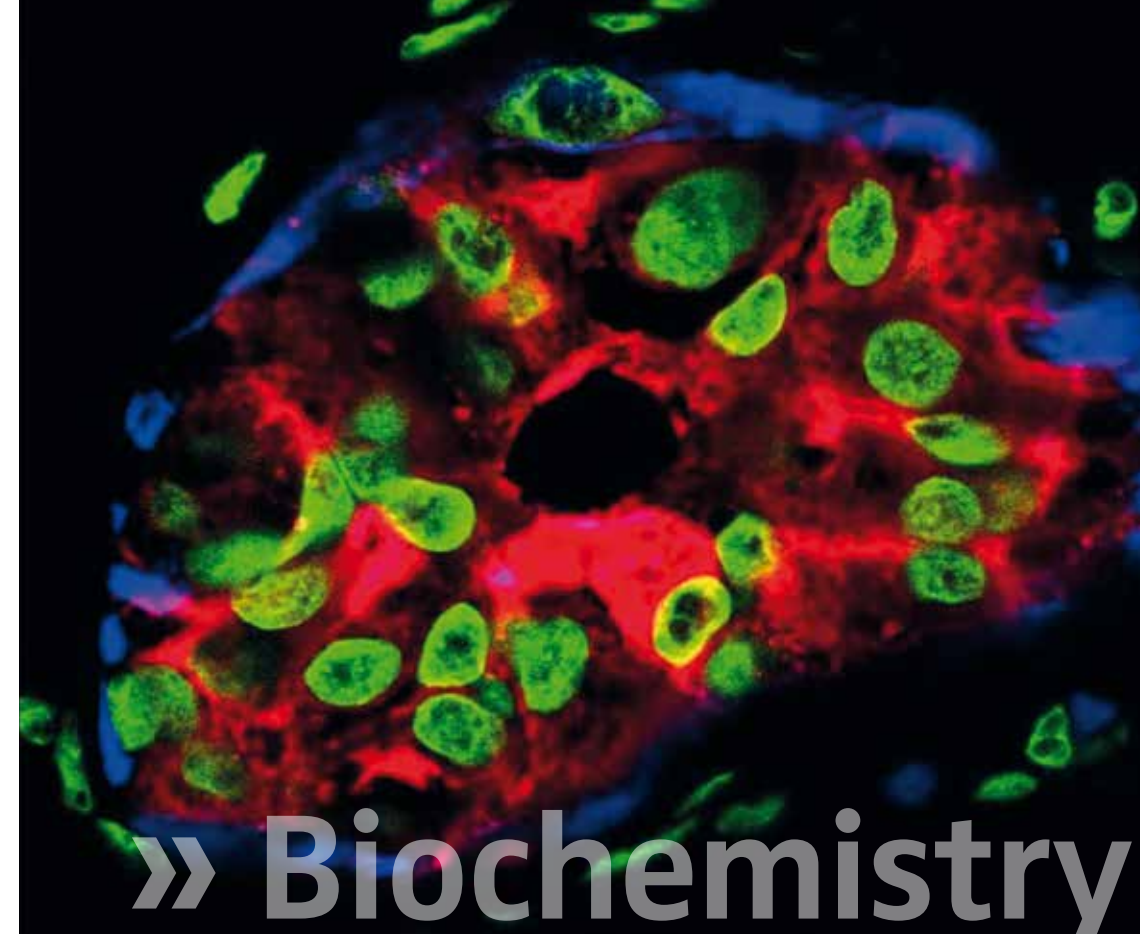
The VIROCARB research unit comprises Tübingen scientists from the Interfaculty Institute of Biochemistry cooperating with researchers from six other universities and research institutions in Germany. Tübingen researchers are investigating the atomic structures and the traits which allow glycans to connect with polyomaviruses. These viruses are particularly dangerous to patients with a compromised immune system and can lead to life-threatening conditions such as Merkel-cell carcinoma and progressive multifocal leukoencephalopathy. The research group also investigates papilloma viruses and noroviruses. Glycovi-rology is a relatively new field of research that may open up new perspectives in the treatment of viral diseases.

The **Institute of Tropical Medicine, Travel Medicine and Human Parasitology** is also an important institution in Tübingen's infection research. It has been selected as a center of excellence by the state of Baden-Württemberg and is one of the world's leading institutes for research into often fatal tropical diseases. One area of core research here is the development and clinical testing of new drugs and vaccines to treat *Plasmodium falciparum*, which causes malaria. The institute also conducts research into viral hepatitis, multi-resistant tuberculosis or a variety of worm infections. A key partner for the Tübingen Institute of Tropical Medicine is the Albert Schweitzer Hospital and Centre de Recherches Médicales de Lambaréné (CERMEL) in Gabon. The close links between the University of Tübingen and CERMEL are underscored by the Faculty of Medicine's establishment of a Professorship of Immuno-epidemiology and Clinical Infection Research in Lambaréné in 2016. It is part of the University of Tübingen's increased commitment in Africa.



→ ANTIBIOTIC CellMAP: [uni-tuebingen.de/en/160423](http://uni-tuebingen.de/en/160423)  
VIROCARB: [virocarb.de](http://virocarb.de)  
Tropical Medicine: [medizin.uni-tuebingen.de/tropenmedizin](http://medizin.uni-tuebingen.de/tropenmedizin)





An immunofluorescent image  
of a sweat gland

## Seeking treatments within the cell

Researchers at the **Interfaculty Institute of Biochemistry (IFIB)** investigate all the dimensions of modern biochemical research – from the level of atoms and molecules to cells and organisms. Their goal is to understand the molecular mechanisms underlying biological and biochemical processes – and how dysfunction in these processes leads to disease. Their work focuses on host-pathogen interactions, communication within the cell and between cells, and tumor biology. Among the things our researchers seek to explain is how pathogens gain entry to body cells and use them as hosts. This knowledge could be used to develop drugs that act directly inside the cell – an approach that opens up new perspectives in the fight against previously untreatable infectious diseases. The researchers are also seeking to improve treatments for tumors and degenerative diseases.

IFIB hosts the research training group **cGMP: From bedside to bench** (GRK 2381). Doctoral candidates in the group are probing the messenger chemical cyclic guanosine monophosphate (cGMP). In cells, cGMP is responsible for signal transduction and is already used in drugs to treat cardiovascular diseases. Recent findings indicate that agents which influence cGMP signaling pathways could be used on a much broader scale. The research training group is therefore looking to shed more light on the significance of cGMP in various cell types and in the tissue of both healthy and diseased organisms. The researchers will evaluate data on treatments using cGMP pharmaceuticals and will use that as a foundation for investigations in the laboratory into the mechanisms of such drugs and into potential further applications. The research training group builds on many years

of expertise in cGMP research. GRK 2381 is the second major project on cGMP signaling pathways sponsored by the German Research Foundation in Tübingen. The group also cooperates closely with research units at Harvard Medical School and Tufts University School of Medicine in Boston.

IFIB also hosts a second research training group – **MOMbrane** (GRK 2364), which focuses on the multifaceted functions and dynamics of the mitochondrial outer membrane (MOM). Mitochondria are cell organelles providing energy-rich molecules for the entire cell. Their outer membrane forms an interface with the rest of the cell and plays a central role in many cellular processes, such as metabolism and the immune response. If the membrane or the proteins it contains are defective, diseases

can develop. Despite their importance, the processes and functions of the mitochondrial outer membrane have not yet been studied in detail. This is where the work of the research training group begins – the doctoral students' goal is to better understand the interrelationships of this biological system and to discover how defective cellular processes in the membrane contribute to the development of diseases. The research training group cooperates closely with the Weizmann Institute of Science (WIS) in Rehovot, Israel – the early-career scientists are supervised by one mentor each from Tübingen and Rehovot. This project is also funded by the German Research Foundation.

→ IFIB: [uni-tuebingen.de/en/8013](http://uni-tuebingen.de/en/8013)  
cGMP: [uni-tuebingen.de/en/141767](http://uni-tuebingen.de/en/141767)  
MOMbrane: [www.mombrane.de](http://www.mombrane.de)

## Interpreting plant signals

# » Plant Molecular

# Biology

The cell, containing all genetic information of an organism, is the key component of all living things. Molecular biology is dedicated to studying the structures and functions of the cell in order to understand biological processes such as cell division and metabolism at the basic level. But it is also the study of communication between the cells of an organism and cell communication between different organisms, such as bacteria and fungi. Molecular biology as a discipline provides insights into the physiological mechanisms that underpin the life of all living things – both when they are healthy and when they are sick. The University of Tübingen is home to a number of institutions and collaborative projects where scientists are conducting basic research into the molecular biology of very different organisms. Their work benefits a wide range of disciplines – from agricultural science to medicine. Their interest is focused on both single-cell organisms in microbiology and on multicellular systems such as fungi, plants, animals and humans – up to the complex interaction between organisms.

Research at the **Center for Plant Molecular Biology (ZMBP)** is on mechanisms at the cellular and molecular level which influence plant growth and sensory perception. Many of the questions about the complex processes in plants can only be answered with input from a number of different disciplines.

Therefore, the ZMBP has taken an interdisciplinary approach since its founding in 1999, bringing in scientists from fields as diverse as genetics, molecular biology, biochemistry, cell biology, physiology, developmental biology and microbiology. Using the model organism thale cress (*Arabidopsis thaliana*) and widely cultivated plants such as tomatoes and maize, the researchers are investigating how plants grow and develop, how they communicate with each other and with other living things, as well as how they adapt to environmental influences and changes – such as pests and diseases, drought, and competition for nutrients. Solutions developed at the ZMBP are a valuable contribution to food security for a growing world population – not least against the background of climate change. The center works with the Faculty of Agricultural Sciences at the University of Hohenheim to put the results of its basic research into practical applications. The ZMBP is also a sought-after partner in national and international research networks. Its collaboration with the Max Planck Institute for Developmental Biology in Tübingen is particularly close. Together with the Max Planck Society's Friedrich Miescher Laboratory, the ZMBP is a partner in the **International Max Planck Research School From Molecules to Organisms**. It attracts many talented, early career-phase researchers from all over the world – by offering first-rate interdisciplinary training in biology, biochemistry, microbiology and bioinformatics.



Since 2014, the ZMBP has also been home to the collaborative research center **Molecular Encoding of Specificity in Plant Processes** (SFB 1101). In recent years, the researchers have identified numerous key proteins contributing significantly to plant development – such as the formation of leaves and flowers – and how they adapt to environmental factors such as light or a lack of water. The collaborative researchers are investigating the principles behind these processes – how they are regulated, and how they affect one another in detail. Using fast-growing thale cress, the scientists are experimenting to find out exactly how key proteins trigger individual processes and enable particular activities. To this end, the scientists are carrying out

investigations at various levels – from the structural analysis of key proteins at the atomic level to the interaction of cells in tissues and organs. In addition, the collaborative research center is refining high-resolution microscopic methods which can be used to collect data for mathematical modeling and simulation of specificity-coding mechanisms. In the long term, the collaborative research center's aim is to contribute to the creation of new functional cell properties in plants using a synthetic biological approach. In addition to scientists from the University of Tübingen, researchers from the Max Planck Institute for Developmental Biology in Tübingen and the Universities of Heidelberg and Hohenheim are involved in this interdisciplinary network.

*Basic research in plants  
is the focus of  
Tübingen's ZMBP.*

→ ZMBP: [uni-tuebingen.de/zmbp](http://uni-tuebingen.de/zmbp)  
IMPRS From Molecules to Organisms: [imprs.tuebingen.mpg.de](http://imprs.tuebingen.mpg.de)  
Molecular Encoding of Specificity: [uni-tuebingen.de/en/48287](http://uni-tuebingen.de/en/48287)





## Enriching soils and protecting crops

In the DFG-funded research unit The **Autotrophy-Heterotrophy Switch in Cyanobacteria: Coherent Decision-Making at Multiple Regulatory Layers** (FOR 2816) Tübingen scientists are investigating the metabolism of cyanobacteria. Like green plants, these unicellular organisms can carry out photosynthesis and are regarded as precursors of chloroplasts, which are responsible for the same process inside plant cells. In photosynthesis, cyanobacteria – like green plants – convert carbon dioxide from the air and water into carbohydrates with the aid of sunlight, thereby producing oxygen. At night or in certain stressful situations, they switch their metabolism to break the carbohydrates back down. That releases energy which they can use for vital functions. In the research unit, the scientists plan to investigate how the switch is flipped. The group is a supra-regional network in which Tübingen scientists from the Interfaculty Institute for Microbiology and Infection Medicine and the Proteome Center

work together with colleagues from the Universities of Freiburg, Duisburg-Essen and Rostock and from the Max Planck Institute for Molecular Plant Physiology in Potsdam.

When cyanobacteria are active, a large number of interrelated metabolic processes take place simultaneously. The researchers are interested in how the organisms can switch between the two types of metabolism – carbon dioxide fixation and the breakdown of carbohydrates – without creating chaos in the cell. They are therefore studying the function and control of individual enzymes, pathways and regulators in the bacteria – and how they interact. The aim is to identify the different regulatory layers through which cyanobacteria organize their metabolism. Since green plants also have to constantly change between light and darkness, the results are of far-reaching significance for modern plant research.

Cyanobacteria colonize every part of the biosphere where there is light. In places where plants cannot grow, they form the start of the food chains, for example in the oceans, in deserts or high up in the mountains. Cyanobacteria also have an ability that plants do not have – they can fix nitrogen from the air to make cell material from it. In doing so, they contribute to soil fertility and are often the first colonists on bare surfaces such as rocks or concrete. So research into cyanobacteria offers the prospect of valuable applications. There are now increasing attempts to use cyanobacteria as a kind of green-cell factory for the production of nutrients.

Another research project at the Center for Plant Molecular Biology (ZMBP) and the Interfaculty Institute for Microbiology and Infection Medicine (IMIT) deals with the potential of microbial communities to protect plants from pests and disease. The **Knowledge-based design of complex synthetic microbial communities for plant protection (DeCoCt)** project led by Eric Kemen is funded by the European Research Council with an ERC Consolidator Grant.

Complex microbial communities, called microbiota, colonize the surfaces of all higher organisms and significantly influence their health. On the one hand, they contribute to vital functions such as nutrient uptake, stress tolerance, improved reproduction and

→ The Autotrophy-Heterotrophy Switch: [uni-tuebingen.de/en/142724](https://uni-tuebingen.de/en/142724)  
DeCoCt: [uni-tuebingen.de/en/180859](https://uni-tuebingen.de/en/180859)

*Cyanobacteria are unicellular organisms that can carry out photosynthesis. Tübingen scientists are investigating their metabolic processes.*

resistance to pathogens. On the other hand, they can promote or even cause the outbreak of diseases in plants, animals and humans. How and why microbial communities change from a state of being beneficial to an organism to being harmful is largely unexplored. Understanding these processes, however, holds great potential, especially for the protection of crops. The DeCoCt team has set itself the goal of learning how to alter unfavorable compositions of microbiota that could become dangerous for the host plant. To this end, the researchers are seeking to decipher the complex processes within the microbial communities and to develop probiotics. These are beneficial microbial communities with favorable properties that can be put together in a targeted and stable manner on the basis of statistical and experimental data. First, a large number of microbial communities are tested under controlled conditions in the laboratory for their effect on various pathogens and environmental factors. Subsequently, promising combinations will be tested in field trials. Just as antibiotic-resistant germs promote the spread of dangerous diseases, fungi that attack and damage crops are becoming increasingly resistant to conventional fungicides. In order to secure the supply of staple crops, researchers around the world are working on solutions to this problem. DeCoCt is a new approach that may lead to the development of alternatives to the current use of chemical pest- and fungicides.



# Geoscience and Environmental Research

## Focus on water, energy and the environment

Climate change, intensive agriculture and human intervention in the water cycle are changing the Earth and present a long-term threat to the Earth as a habitat. Tübingen's geoscience and environment researchers are investigating anthropogenic interventions in nature and the environment worldwide – and the effects of this human activity on the Earth's ecosystems. Against the backdrop of the wider conflict between environmental and economic interests, the scientists investigate environmental systems and the corresponding material cycles to develop potential measures which could be taken.

This approach is typical of research at the **Tübingen Center for Applied Geoscience (ZAG)**. Covering numerous fields of expertise ranging from geomicrobiology to environmental toxicology, the center investigates diverse and complex questions.

The spectrum extends from basic research to practical applications, from the functioning of biogeochemical processes to the sustainable use of raw materials. Tübingen's geoscientists frequently focus on highly topical issues such as the availability of clean water, the use of resources and the development of new energy sources, the influence of a changing climate and the effects of pollution in the environment. The center addresses these global issues while working with partners around the world. The ZAG is part of comprehensive networks and enjoys an excellent international reputation.

Cooperation in Tübingen's geoscience and environmental research goes far beyond the center itself; as part of the German government's Excellence Initiative, the University of Tübingen established an interdisciplinary **Platform for Environmental Systems**. This

created a forum linking the geosciences with the associated disciplines of biology, chemistry and physics and also involves economists and social scientists, lawyers and ethicists. Close cooperation with the nearby universities of Stuttgart and Hohenheim broadens the spectrum to include engineering and agricultural sciences as well as socioeconomics. Members of this dynamic network conduct research in cooperation with environmental authorities, consulting firms and national research laboratories. They provide a forum for scientists, representatives from industry and commerce, NGOs and politics to present research results on socially relevant issues. With the Environmental Systems platform, the University of Tübingen is contributing to the search for solutions to global challenges relating to climate change, water supplies and pollution, thereby giving its research greater international visibility and impact.

Outstanding research also requires a corresponding infrastructure. The new Environmental and Geoscience Center (GUZ), completed in late 2019, provides 10,000 square meters of state-of-the-art laboratories with outstanding technical equipment. The GUZ brings together all research areas of environmental and geoscientific research under one roof. With the latest equipment for high-resolution mass spectrometry and electron microscopy, the GUZ offers ideal working conditions.

Its broad application-oriented research spectrum, its excellent track record and its many years of expertise make Tübingen's environmental and geoscientific research one of the University's beacons of excellence. Strengthened by the infrastructure of the new GUZ, Tübingen is ideally positioned to further expand this leading role in international competition.

→ ZAG: [uni-tuebingen.de/de/84385](https://uni-tuebingen.de/de/84385)

Platform Environmental Systems:  
[uni-tuebingen.de/en/42152index.html](https://uni-tuebingen.de/en/42152index.html)



## Earth surface and atmosphere

We have long known that the surface of the Earth is shaped primarily by erosion and tectonic processes. **EarthShape: Earth Surface Shaping by Biota** is a DFG-sponsored priority program coordinated by the University of Tübingen that seeks to expand and improve our knowledge of these processes. Its participating researchers investigate biological processes – such as the activity of microorganisms – as factors influencing the Earth’s surface. While the effects of such biological processes are still little known, they may yet turn out to be very important in the way climate change alters the face of the Earth. The program’s research focuses on the mountainous coast of Chile as a model region, where climatic extremes are close together and are reflected in biological differences – a natural laboratory with near-ideal conditions where researchers can observe how biology and topography influence one another. In the EarthShape program, geoscientists, geographers and environmental researchers from the University of Tübingen are working with scientists from more than ten universities and research institutions in the German-speaking world, as well as with leading researchers at Chilean universities. It is a unique collaboration, dealing with a topic of major relevance to the future of human habitation. Research into biological influences on topography is crucial to the understanding of how future climate and biological changes will affect the Earth’s surface.

In the project **From the Origin of Earth’s Volatiles to Atmospheric Oxygenation (O2RIGIN)**, a working group headed by Dr. Stephan König is investigating the relationships between processes inside the Earth and the creation of the atmosphere. The project is funded by a European Research Council Starting Grant. Its core research areas are the movement of tectonic plates, volcanism, and the formation of new continents in geological history. The researchers aim to find out how these processes affected the increase of oxygen in the Earth’s atmosphere. To achieve this, they are investigating minerals enclosed within substances such as diamond. These minerals function as time capsules, providing information about past geological processes. Levels of atmospheric oxygen began to increase steeply some two to three billion years ago. The latest geochemical methods enable the geoscientists to both date and describe the minerals and draw conclusions about the increase in oxygen levels in the atmosphere – and understand processes which made our planet habitable for complex life. The findings make it possible to predict changes to the Earth system in the future, and to assess the effects of human activity on these changes.

→ EarthShape: [earthshape.net](http://earthshape.net) | O2RIGIN: [uni-tuebingen.de/en/105759](http://uni-tuebingen.de/en/105759)

# Human Evolution and Archaeology

## Tracing the early paths of humankind

Few things capture our imagination like the origin of mankind. World-renowned researchers at the University's **Institute of Prehistory, Early History and Medieval Archaeology** and the Senckenberg Center for Human Evolution and Palaeoenvironment Tübingen are seeking the paths walked by early humans. In a special alliance of disciplines, a number of University institutes have joined forces under the umbrella of the **Tübingen Center for Archaeology (TZA)**, an interfaculty institution dedicated to archaeological research spanning the entire arc from the Palaeolithic to the Middle Ages. All these researchers benefit from the new perspectives of other disciplines; their collaboration also enables them to employ the latest scientific methods of analysis.

Paleoanthropologists from Tübingen have made several groundbreaking discoveries in recent years. Skeletal remains of a previously unknown primate species found in the Allgäu region of southern Germany indicated the primate could walk upright. Dubbed *Danuvius guggenmosi*, the find challenges previous hypotheses on the evolution of the upright gait. And some of the oldest pieces of figurative art have been excavated in caves in the Swabian Jura – animal figures, flutes and jewelry made of mammoth ivory and bone. These pieces – evidence of the art, music and religious beliefs of early mankind – were created during the last Ice Age some 40,000 years ago. Both the items and the sites at which they were discovered were declared part of the UNESCO World Heritage in 2017.

*The analysis of the fossils of Danuvius shows that this previously unknown primate species was able to walk on two legs nearly twelve million years ago.*

In the **Senckenberg Center for Human Evolution and Palaeoenvironment (SHEP)**, the University of Tübingen has entered into a highly productive collaboration with the Senckenberg Society for Nature Research. The SHEP is part of the Leibniz Association and is funded with 2.8 million euros annually by the German federal and state governments. It comprises seven working groups, which are headed by professors from the University. Their work focuses on the biological and cultural evolution of humans. The researchers at SHEP say that human development was – at an early stage – significantly influenced by environmental and climate changes; and that, from the time around 2.5 million years ago, cultural evolution played an increasingly important role.

The researchers are investigating the complex relationships between biology, culture and the environment as factors in human development, bringing them together in an integrative approach. For this, the researchers employ a wide range of methods ranging from artifact analysis to geochemical and geochronological methods and reconstructions of past environmental conditions. This careful processing of information enables fossil finds to provide information on earlier ecosystems. The researchers of the SHEP are active worldwide and involved in numerous important excavations; time and again they attract considerable attention with groundbreaking publications. The unique features of the Senckenberg Center for Human Evolution and Palaeoenvironment Tübingen include the internationally outstanding paleontological collections.

An important joint project that builds bridges from the SHEP to linguistics and the cognitive sciences is the center for advanced studies known as **Words, Bones, Genes, Tools: Tracking Linguistic, Cultural and Biological Trajectories of the Human Past** (FOR 2237). This center has the ambitious goal of overcoming disciplinary boundaries between the sciences and the humanities. Among their activities, the researchers are investigating the origins and the bio-cultural diversity of modern humans and are seeking to map how mankind spread around the world. They also analyze the mechanisms of language change and investigate how natural selection and genetic drift in biology and culture interact in the process of evolution. Another focus is the development of new quantitative methods to combine the data sets from different disciplines. Through colloquia, annual symposia, and a fellowship program, the center for advanced studies invites renowned international guests, including linguists, paleoanthropologists, geneticists, and archaeologists, to share their expertise. With an eye to training new talent in the field, the center incorporates three research groups for early-career researchers, two of them sponsored by the German Research Foundation's Emmy Noether program.

The central methodological approach in research into human evolution and archaeology is archaeometry – the use of scientific techniques to determine the origin, age or authenticity of archaeological finds or to solve questions concerning the technical or cognitive development of mankind. This includes dating methods such as the radiocarbon method and dendrochronology as well as the latest chemical, physical and biological analyses to provide information about ancient materials. The field therefore combines a wide range of disciplines. The **Institute for Archaeological Sciences** and the **Competence Center Archaeometry – Baden-Württemberg (CCA-BW)** at the University of Tübingen specialize in archaeometric methods and their further development. The University also benefits from collaboration with the **Curt Engelhorn Center for Archaeometry (CEZA)** in Mannheim.

The University is seeking to promote paleogenetics as a field of research. It has established a new tenure track-professorship of paleogenetics, and works closely with scientists from the Max Planck Institute for the Science of Human History in Jena.



→ Institute of Prehistory, Early History and Medieval Archaeology: [uni-tuebingen.de/en/16141](http://uni-tuebingen.de/en/16141)  
TZA: [uni-tuebingen.de/en/26419](http://uni-tuebingen.de/en/26419)  
SHEP: [senckenberg.de/shep](http://senckenberg.de/shep)  
Words, Bones, Genes, Tools: [www.wordsandbones.uni-tuebingen.de](http://www.wordsandbones.uni-tuebingen.de)  
Institute for Archaeological Sciences: [uni-tuebingen.de/de/84538](http://uni-tuebingen.de/de/84538)  
CCA-BW: [uni-tuebingen.de/en/88437](http://uni-tuebingen.de/en/88437)  
CEZA: <https://www.ceza.de>



## On the trail of human evolution

→ CROSSROADS: [www.crossroads.ifu.uni-tuebingen.de](http://www.crossroads.ifu.uni-tuebingen.de)  
PALAEOSILKROAD: [www.palaeosilkroad.eu](http://www.palaeosilkroad.eu)  
STONECULT: [sites.google.com/view/stonecult](https://sites.google.com/view/stonecult)  
ROCEEH: [roceeh.net](http://roceeh.net)

We do not know exactly where humans originated – nor whether there is a single “cradle” of our species – and which paths were taken by the ancestors of *Homo sapiens* as they spread out around the globe. Professor Katerina Harvati’s research project **Human Evolution at the Crossroads (CROSSROADS)** aims to gain new insights into early human migratory movements in southeastern Europe, and into the behavior of early humans.

Professor Harvati’s work is carried out at the Senckenberg Center for Human Evolution and Palaeoenvironment at the University of Tübingen. According to current research, the first early humans migrated from Africa to Europe around 1.2 million years ago. Due to their geographical location, the Balkans are considered the gateway for this migration. Harvati and her team are therefore investigating in the region for hidden evidence of a very early and possibly continuous presence of early humans there.

CROSSROADS researchers are seeking answers to many questions. Did the first early humans arrive in southeastern Europe at about the same time as archaeological finds indicate settlement in western Europe, or were they earlier? What were the climatic and environmental conditions they lived under, and to what extent did these conditions affect their behavior and human evolution overall? Is there a greater diversity of species of

the genus *Homo* in this region and what made the ancestors of *Homo sapiens* so special that their line ultimately prevailed over the others?

In the course of their work, the researchers have dated a *Homo sapiens* skull discovered in Greece to an age of around 210,000 years – making it the oldest modern human ever found in Eurasia. The CROSSROADS project is carried out in collaboration with various institutions and universities in Greece and is funded by a Consolidator Grant from the European Research Council.

The project **A Silk Road in the Palaeolithic: Reconstructing Late Pleistocene Hominin Dispersals and Adaptations in Central Asia (PALAEOSILKROAD)** focuses on the Stone Age settlement of central Asia. The research team headed by paleo-anthropologist Dr. Radu Iovita at the Institute of Early Prehistory and Quaternary Ecology is looking for new sites of early human habitation in the foothills along the Silk Road route in Kazakhstan. Goods were traded along this ancient route between east Asia and what is now the Middle East thousands of years ago; this led to both a cultural and a genetic exchange. This likely goes back to the last Ice Age, 115,000 to 11,000 years ago, when three different species of humans inhabited central Asia and southern Siberia at the same time.

*In numerous projects, Tübingen researchers investigate the origin of humankind and look into early migratory movements and the development of cultural forms.*



The researchers aim to discover how people in this vast region survived the extremes of climate during the ice age cycles, and how they dispersed or merged into different populations. This could give us new knowledge of how humans spread across the earth, how early humans dealt with environmental challenges, and how modern humans came to be the only remaining *Homo* species. The PALAEOSILKROAD is sponsored by a European Research Council Starting Grant.

Another ERC Starting Grant recipient is the behavioral researcher Dr. Claudio Tennie, also from the Institute of Prehistory, Early History and Medieval Archaeology. His project, **STONECULT – Do early stone tools indicate a hominin ability to accumulate?** focuses on the emergence of cumulative learning – the ability of humans to integrate the knowledge of other individuals into their own experience and to pass it on – an important prerequisite for the emergence of culture and complex knowledge structures. Very early stone tools are a promising subject for investigation. Recent research suggests that the making of such tools was primarily the result of individual learning – something other species, such as apes, can do, too.

Tennie hypothesizes that the shapes of early tools are too uniform to be explained by today’s cultural forms. According to his theories, cultural and cumulative learning would have produced

more varying tools. The STONECULT researchers seek to clarify whether the production and use of very early stone tools links them to human technology or to apes. The results will help to identify which human cultural forms arose when.

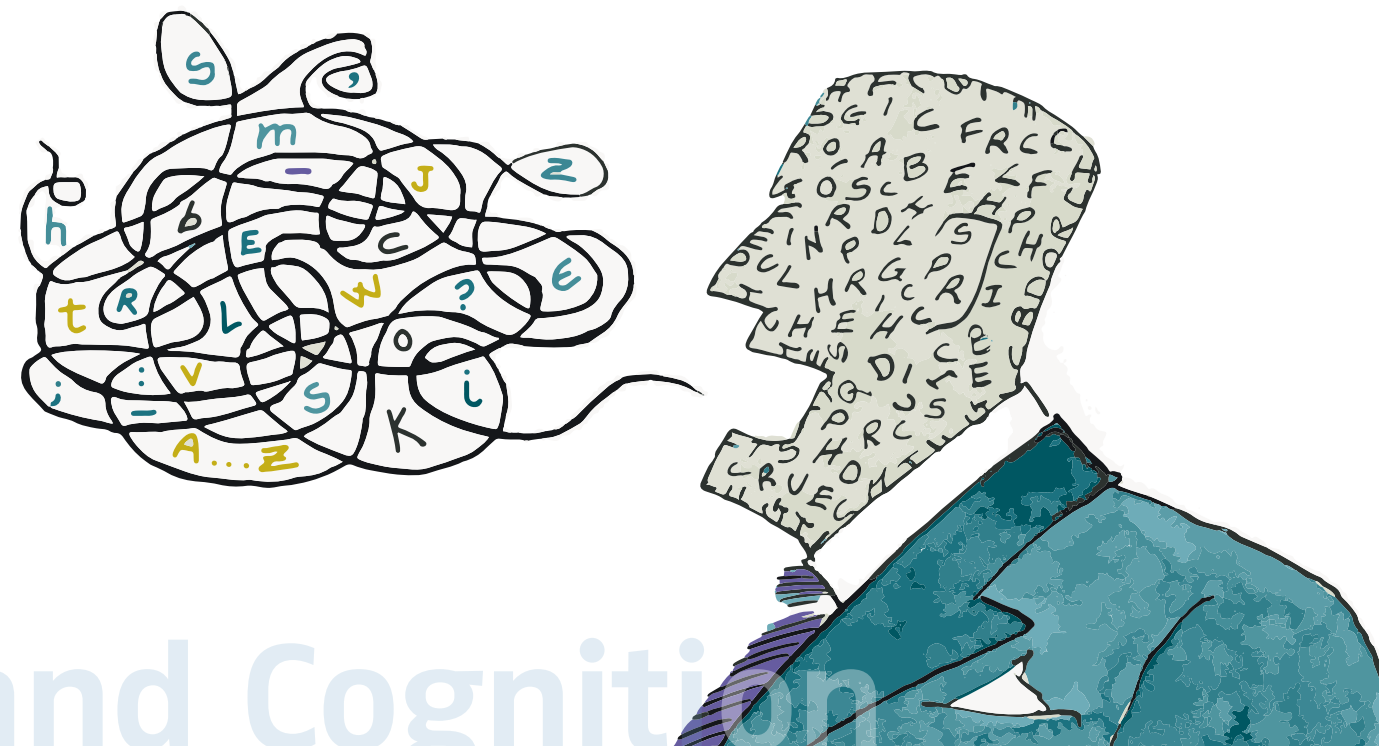
Due to the University’s strong core research in palaeoanthropology in collaboration with the Senckenberg Nature Research Society, the Heidelberg Academy of Sciences and Humanities supports a long-term project at the two institutions – **The Role of Culture in Early Expansions of Humans (ROCEEH)**. It is run by archaeologists from Tübingen in cooperation with their colleagues from the Senckenberg institute in Frankfurt. The development of the genus *Homo* is characterized by expansions of cultural abilities, resource fields and the movement of various human species into new territories.

Researchers are investigating the conditions under which different forms of human expansion took place, and the effects it had in Africa and Eurasia in the period between 3 million years and 20,000 years ago. The aim is to gain a comprehensive understanding of human development through the analysis of archaeological, geographic, paleoanthropological and paleoenvironmental data. The interdisciplinary approach makes the biological and cultural history of mankind more tangible in its evolutionary, historical, social and ecological dimensions.

# Humanities

## Linguistic perspectives

### » Language and Cognition



The University of Tübingen has a number of highly innovative, interdisciplinary research efforts in the field of Linguistics. They have yielded many new insights into the complex processes involved in language evolution and use.

The **Tübingen Center for Linguistics (TüZLi)** brings together researchers from the fields of general and theoretical linguistics, the institutes of various languages, and from computational linguistics. They are investigating language structures and developmental processes, language acquisition and processing, and the interpretation of language. In this work, the TüZLi researchers also draw on expertise in the fields of biology, information and cognition science, and cultural studies.

Our understanding of language enables us to process acoustic signals in a fraction of a second. The TüZLi researchers seek to develop an integrative understanding of the processes at work when this happens. They regard language as a phenomenon with biological foundations; one that requires cognitive skills and which is subject to cultural influences. Their work integrates the methodology of the humanities with approaches from cognition science and the neurosciences.

The collaborative research center 833, **The Construction of Meaning: The Dynamics and Adaptivity of Linguistic Structures**, also has a strong interdisciplinary focus. Its aim is to

discover how meaning is created – both in language-related and in non-verbal contexts, during language processing and under the specific conditions of how each language is constructed and used, and of how it has developed. Some 100 researchers from all subfields of linguistics, as well as from literature studies and cognition psychology, are participating. The interdisciplinary approach enables a comprehensive overview of language with regard to the structures and processes involved in the creation of meaning. The center's investigations combine approaches from theoretical and experimental linguistics with aspects of language use, such as language processing, situational dependency and language variation. This enables the center's researchers to develop new theories, for instance on semantic processing and on the changing and development of language.

The linguists in Tübingen have special expertise in the computer-assisted collation and analysis of large data sets drawn from language corpora. Among the sources they draw upon are digital text collections, data from experiments and questionnaires, as well as multi-language and diachronic studies. Ultimately, the results of the research are also to be put to practical use – for example, in language teaching. The Construction of Meaning is now the third linguistics collaborative research center in a row to be backed by the German Research Foundation in Tübingen – underlining the University's strength in the field.

One particular facet of language and meaning is the object of the research training group 1808, **Ambiguity – Production and Perception**. Whether it is a statement by a politician, a poem, or simply chit-chat – ambiguity is a constant companion of language and communication. With members from the institutes of various languages and from the disciplines of psychology, philosophy, computer science, rhetoric, theology and law, this research training group integrates many different academic approaches. The researchers aim to discover how communication is successful despite – or maybe because of – multiple meanings; how it can fail for these same reasons, and what the effects of this may be. Along with linguistic analyses of language itself, the research training group's members are examining the formal language of the disciplines involved – for example in legislation, speeches and the Bible. At the same time, this integrative approach creates the foundations for extending the analysis to non-language sign systems such as music.

The discipline of Linguistics at the University of Tübingen can also boast two cutting-edge projects sponsored by the European Research Council with Advanced Grants. Professor Harald Baayen's project, **Wide Incremental learning with Discrimination nEtworks (WIDE)**, looks at how we create and understand words in spoken language. Baayen is going beyond conventional research in the field by transcending letters and phonemes – instead focusing on the details of language signals.

He is feeding these signals into artificial neural networks and seeking to discover whether the networks can learn meanings by trial and error. The project uses German, but also Mandarin Chinese, a tonal language; and Estonian, a highly complex language with up to forty different noun forms. The aim is to better understand the foundations of human language abilities.

The other project, Professor Gerhard Jäger's **Cross-Linguistic Statistical Inference Using Hierarchical Bayesian Models (CrossLingference)**, seeks to explain the variation of certain language phenomena, such as word order, on a greater scale than in any one given language. The project connects the methods of typology – which looks at the spectrum of common features – with the diachronic approach of historical linguistics, which requires in-depth analysis. Using a statistical method, Bayesian hierarchical models, Jäger aims to expand the horizons of phylogenetic linguistics, which deals with the evolution of language families over time, to include models which will cover more than one family. That could lead to new ways of explaining language variation, as well as to the formulation of laws for how language changes; that in turn offers the exciting prospect of automatic reconstruction of the vocabulary of prehistoric languages.

→ TüZLi: [uni-tuebingen.de/en/64280](http://uni-tuebingen.de/en/64280)

The Construction of Meaning: [uni-tuebingen.de/en/2965](http://uni-tuebingen.de/en/2965)

Ambiguity – Production and Perception: [uni-tuebingen.de/en/34380](http://uni-tuebingen.de/en/34380)

WIDE: [uni-tuebingen.de/en/134641](http://uni-tuebingen.de/en/134641)

CrossLingference: [uni-tuebingen.de/en/163612](http://uni-tuebingen.de/en/163612)





→ Institute of Asian and Oriental Studies: [uni-tuebingen.de/en/1691](http://uni-tuebingen.de/en/1691)

Japanese Studies: [uni-tuebingen.de/en/36159](http://uni-tuebingen.de/en/36159)

Korean Studies: [uni-tuebingen.de/en/22459](http://uni-tuebingen.de/en/22459)

Chinese Studies: [uni-tuebingen.de/en/20610](http://uni-tuebingen.de/en/20610)

## Bridges to Asia and Cultural Studies

The University of Tübingen maintains good relations all around the world. We have particularly close ties with a number of Asian countries, including Japan, South Korea, China and Taiwan, in a region subject to great political, social and cultural dynamics in the course of globalization. With the founding of the **Institute of Asian and Oriental Studies** in 2008, the University pooled its research activity focusing on Asia within one institution. In addition to Japanology, Korean Studies and Chinese Studies, the institute also includes Indian Studies and Comparative Religion, Middle Eastern Studies, and Cultural Anthropology.

Tübingen has one of the largest institutions for **Japanese Studies** in the German-speaking world. Its three professorships focus on the areas of Modern Japan, Religion and Intellectual History, and Linguistics. In 1993, the University of Tübingen established the **Tübingen Center for Japanese Studies** at Doshisha University in Kyoto – the first and to date the only branch of a German university at a university in Japan. At the center, Tübingen students take part in comprehensive language and regional studies classes, and are introduced to Japanese culture by their host families. In addition, the center regularly organizes symposia and guest lectures, thus providing up-to-date insights into international Japan-related research. As a counterpart to the Tübingen Center

in Kyoto, a branch office of Doshisha University in Tübingen was established, opening with symposia in Kyoto in 2018 and Tübingen in 2019. Known as the **Doshisha EU Campus**, it is the only branch of the renowned Japanese university in Europe. The Doshisha EU Campus coordinates cooperation and exchanges between Doshisha and the University of Tübingen – such as joint conferences, language programs and intercultural training. Furthermore, it initiates and supports Doshisha's cooperation and projects with partners throughout Europe.

Growing interest in Korea has made **Korean Studies** in Tübingen increasingly popular. In research and teaching, the discipline focuses on the history, culture and society of modern Korea. The **Tübingen Center for Korean Studies at Korea University (TUCKU)** in Seoul, South Korea, was established in 2012. At the center, students become familiar with Korean language and culture as part of an integrated one-year study abroad program. The two-year Master's program also enables students to obtain a double Master of Korean European Studies in cooperation with Seoul National University, a program which is unique in Europe. In addition, the Center for Korean Studies promotes cultural and academic exchange with Korea via guest professorships, lectures, readings by authors, international research projects and confer-

ences. Tübingen's Korean Studies section also has strong ties with the **King Sejong Institute Tübingen**, an educational institution sponsored by the Republic of Korea, offering an extensive language and culture program for the general public.

China's role as a world power has had a strong influence on **Chinese Studies**; China expertise is increasingly in demand. Chinese Studies in Tübingen cover a broad spectrum of research that focuses on China, its internal structure and its place in the process of globalization since the 16th century. Much of this work is done in projects and courses conducted jointly with other subjects in the humanities, economics and social sciences. In order to give students the opportunity to experience the Chinese world directly, the University of Tübingen founded the **European Center for Chinese Studies (ECCS)** on the campus of and in cooperation with Beijing University in 2001. Intensive language instruction is a cornerstone of the overall concept of language training and thus a trademark of Chinese Studies in Tübingen. In addition, the ECCS promotes contacts and cooperation between German and Chinese academics, for example via guest lectureships, doctoral student exchanges and conferences; and it organizes a Beijing Summer School for Tübingen students from any faculty.

The **China Center Tübingen (CCT)**, which was established at the university in 2016, also builds a bridge to China. The CCT aims to increase China competence at the entire university. Based on the conviction that China will continue to grow in importance in the future, the CCT serves as a communication interface for all China-related topics. One focus is to teach professional competence in China's business culture. Integrated into the CCT is the Erich Paulun Institute, which promotes the long-term establishment of Chinese as a school subject.

**Taiwan** is a further focus of Tübingen's Asia research. The **European Research Center on Contemporary Taiwan (ERCCT)** is a joint project between the University of Tübingen and Taiwan's Chiang Ching-kuo Foundation for International Scholarly Exchange. The center offers graduate students from all over Europe a forum for the discussion of social science-related Taiwan research, especially with regard to politics, law, economics and society. Exchange between Europe and Taiwan is promoted through various fellowship programs for early-career researchers and via contacts with respected academics from Taiwan and Europe who are conducting research as visiting scholars at the ERCCT. Last but not least, the center offers support to students seeking to carry out field research projects in Taiwan.

→ Tübingen Center for Japanese Studies: [ni-tuebingen.de/en/6237](http://ni-tuebingen.de/en/6237)

Doshisha EU Campus: [uni-tuebingen.de/en/177489](http://uni-tuebingen.de/en/177489)

TUCKU: [uni-tuebingen.de/en/22463](http://uni-tuebingen.de/en/22463)

King Sejong Institute Tübingen: [uni-tuebingen.de/en/33832](http://uni-tuebingen.de/en/33832)

ECCS: [uni-tuebingen.de/en/21860](http://uni-tuebingen.de/en/21860)

CCT: [cct.uni-tuebingen.de/](http://cct.uni-tuebingen.de/)

ERCCT: [uni-tuebingen.de/en/153249](http://uni-tuebingen.de/en/153249)





*Rayen Castle from the Sasanian period (3rd to 7th century CE) in Kerman Province, Iran, is one of the sites where members of the ResourceCultures collaborative research center have been working.*

## How societies develop

How do raw materials, products and networks contribute to social cohesion? What social developments result from the exploitation of such resources? Some 70 researchers from a wide range of disciplines are investigating these questions at the **ResourceCultures** collaborative research center (SFB 1070). Perspectives from disciplines such as archaeology, geography, classical philology and ethnology are being used to shed light on what resources are and what they mean to societies, using examples from various cultures around the world and over a period of more than 30,000 years. The collaborative research center's 21 subprojects include topics such as violence and social development among the Vikings, the role of resources in the Roman colonization of North Africa, and the importance of traditional medicine in modern

southern India. The researchers are looking beyond the conventional economic definition of 'resources' to include sociological and cultural dimensions. This means that, in addition to raw materials and goods, the research also focuses on intangible things such as knowledge and services. The decisive factor in what defines resources is that people consider them valuable to their common life in society. The research focuses primarily on processes and events that bring about a change in resources – which could, for example become the cause of migration or war. These are phenomena that we continue to observe. The work of the ResourceCultures collaborative research center can therefore open up new perspectives on challenges in the world today.

## An essential partner

The **eScience Center** is an essential partner for Tübingen researchers. It provides advice and support in dealing with digital resources, methods and tools – especially in the field of digital humanities. This part of the University's sustainable research infrastructure is developed and operated in cooperation with the Center for Information, Communication and Media. The eScience Center draws on many years of experience in research projects of different scope – from individual projects to collaborative research centers. One of its key services is providing technology and know-how for spatial and object-related disciplines such as art history and archaeology to assist them in dealing with geographic information systems and in constructing virtual environments.

Another important focus is research data management. The eScience Center's repository, known as FDAT, is a platform for the long-term archiving and publication of research data. The team at the center provides support to research projects from the application stage to completion, advising researchers in their selection of the appropriate workflows and data processing tools, and in compiling research data for long-term storage and re-use according to FAIR principles. Last but not least, the experts at the eScience Center pass on their knowledge to researchers so as to establish essential skills in the field of data analysis and management widely across the University.

→ ResourceCultures: [uni-tuebingen.de/en/39724](https://uni-tuebingen.de/en/39724)  
eScience Center: [uni-tuebingen.de/en/35032](https://uni-tuebingen.de/en/35032)



## Exploring ancient cultures

Researchers at the **Institute for Ancient Near Eastern Studies** (IANES) are dedicated to studying the cultural development of civilization in the Mediterranean and Middle East regions. Since 2013, Tübingen Egyptologists have been investigating a burial site in the necropolis of Saqqara on the western bank of the Nile. Dignitaries and military officers were buried there in the Saitic-Persian period (664-404 BC). It consists of several shaft graves, some of which are more than thirty meters deep. A team from the Tübingen eScience Center has now fully documented them using the latest 3D methods. In addition to the architecture, the grave inscriptions have also been recorded. These religious texts are important sources of information about the funeral rituals of the time. The researchers found numerous mummies, sarcophagi and grave goods. One of the most spectacular finds is a gilded silver mask – an extremely rare artifact. The Egyptologists also discovered the remains of a workshop where the deceased were mummified, as well as vessels bearing the names of oils and other substances used. Chemical analyses are now to provide new insights into this process. The findings will be combined to form a history of mummification, enabling researchers to further investigate the cultural and religious significance of this practice.

Tübingen archaeologists are also active in northern Iraq. In the province of Duhok, part of the Kurdish autonomous region, field surveys by the researchers have turned up signs of around 500 previously unknown settlement sites – proof that this region was a highly developed cultural area as early as the Bronze Age. Among the most significant discoveries are the remains of a 50-hectare urban complex near the present-day Kurdish village of Bassetki. Cuneiform tablets found during excavations at the palace there enabled the researchers to determine that this was the ancient city of Mardaman. The settlement was founded around 3000 BC and flourished for more than 1200 years. It offers ideal conditions for researching the development of an urban center against the background of changing economic, political, social and ecological conditions. To date, Tübingen's archaeologists have found a total of 26 settlement layers from eight different eras in Mardaman. With further excavations and the evaluation of finds, the researchers hope to shed more light on the history of the settlement and its urbanization. Among other things, they are interested in the role of the city in the expansion of the Akkadian Empire to the north and its functions in Old and Middle Assyrian times, when it was a center of trade and provincial administration.

*This funeral mask, made of gilded silver, was found on the mummy of a priest in Saqqara. Very few masks of precious metal have been preserved to the present day.*

→ IANES: [uni-tuebingen.de/en/3331](http://uni-tuebingen.de/en/3331)





## The function of art

In the arts, the question of aesthetics has always been fundamental and omnipresent. What do we mean when we talk about art? Why does art move us? How do we measure the aesthetic value of texts, images and objects? In the 18th and early 19th centuries, art's claim to autonomy increasingly asserted itself as a formative criterion – the idea that art follows its own laws independently of the social context of its creation. Yet works of art from antiquity, the Middle Ages, and the early modern era cannot be understood using modern aesthetic categories; they have their own, different aesthetics. The collaborative research center **Different Aesthetics** (SFB 1391) focuses on this 2000-year-old history of art and culture prior to the artistic developments of the 18th century. Its aim is to identify and reflect on aesthetic practices, manifestations and concepts that open up alternatives to the traditional notion of modernity, in which the aesthetic is defined above all by its freedom of purpose. The researchers seek to initiate a change of perspective in the aesthetic discussion by focusing on the question of the function of art. To this end, researchers from 16 disciplines ranging from archaeology, art and musicology, ancient and modern philology to history and theology are working together in 18 subprojects within the interdisciplinary network.

Their work ties in with current debates in society. Aesthetic questions are increasingly a source of public and academic de-

bate – the 'aesthetic turn' has been proclaimed on several occasions. It seems there is a new interest in aesthetics, as can be seen, for example, in the record attendance at exhibitions and in the public discussions about the quality of works of art which have emerged, for instance, in the course of the recent discussions on sexual harassment and exploitation known as the me-too debate.

The central concept of Different Aesthetics is that these phenomena cannot be understood in the tradition of modern concepts of autonomy. This is where the new perspective of Different Aesthetics comes in. Works of art from the pre-modern era are always in an interactive relationship between technical and artistic demands on the one hand and social practice on the other. Roman coins, for example, were not only artifacts artistically designed with text and images; they were also currency. By taking pragmatic aspects of art into account, the collaborative research center takes up ideas such as the aestheticization of our surroundings, identified by sociologists in the late 20th and early 21st centuries. We increasingly perceive our everyday life and lifestyle from an aesthetic point of view – although purely autonomy-aesthetic interpretations do not necessarily apply.

The art of the pre-modern age and the present day have one thing in common – there is no clearly-defined border between



the everyday world and the arts; works of art are part of the social space, are always in relation to it, and take on very specific functions in it. In order to focus clearly on these functions, researchers in the Different Aesthetics network analyze aesthetic acts and artifacts in two ways. They look at works of art via the works' own artistic logic, i.e. the way they use knowledge of form and design. At the same time, the researchers reflect on the concrete function for their audience in certain social contexts. They do not see these dimensions as opposites, but rather investigate them as a dynamic interactive framework. In this way, pre-modern aesthetic phenomena with their strong references to the world around them can be more finely differ-

entiated. For example, researchers in the subproject Different Aesthetics of Ancient Economic Areas in the Late Republic and Early Roman Empire deal with department stores in the ancient world. The architecture is not simply 'beautiful' – it aims to control buying behavior as these types of buildings are designated for retail.

The Different Aesthetics collaborative research center thus focuses on phenomena at the interface between art and social practice. The aim of its work is to provide a historical foundation for the current debates on the relevance of aesthetics and at the same time to make a contribution to current debates in art and society.



→ Threatened Orders:  
[uni-tuebingen.de/en/24861](http://uni-tuebingen.de/en/24861)

Migration and Mobility:  
[uni-tuebingen.de/en/93696](http://uni-tuebingen.de/en/93696)

World Chronicle of John Malalas:  
[hadw-bw.de/forschung/forschungsstelle/malalas-kommentar](http://hadw-bw.de/forschung/forschungsstelle/malalas-kommentar)

## Learning from the past

# » History

“The past is never dead. It's not even past.” The line from William Faulkner underscores the guiding principle of historical scholarship at the University of Tübingen, where research into the past should always shed light on the problems of today. Researchers at the collaborative research center **Threatened Orders** (SFB 923) examine how people in different eras and cultures dealt with crises, disasters and social upheavals, and what insights can be gained for the present day.

Along with historians, the team includes researchers from the disciplines of English, German, Classics, Historical and Cultural Anthropology, the Protestant and Catholic theologies, Medical Ethics, Sociology, Political Science and Law. Together, they study societies and social groups that feel existentially threatened and are forced to renegotiate and redesign an order that has ceased to function properly. In doing so, the researchers focus on different times and places. Examples include the shortage of men, both as laborers and as household heads, in what is now Italy during the expansion of the Roman Empire in the 2nd and 1st centuries BCE; stock market crashes and their consequences in Europe of the 18th and 19th centuries; or the Ebola epidemic in West Africa in the years 2013 to 2016.

The collaborative research center's special approach is that it examines the basic patterns of social order at brief moments of threat. By relating threat and order in this way, the researchers can compare the existential nature of the threat on the one hand and the constancy or variance of order on the other. The researchers assume that similar patterns of dealing with threats appear at different times in different societies. The aim is to develop a model for threatened orders from examples which are far apart in space and time and that can be applied across disciplines from antiquity to the present. The researchers' work has often contributed to debates on threats and crises of our own time. In a transfer project, the collaborative research center has also developed a virtual exhibition – called “Threatened Orders” – for the general public. It was nominated for the 2019 Grimme Online Award, given to high-quality internet publications.

Another research group, the center for advanced studies **Migration and Mobility in Late Antiquity and the Early Middle Ages** (FOR 2496) also deals with an epoch of upheaval. The historians in this project seek to break away from traditional approaches which focused on the migratory movements of populations during this period – often referred to as the “migration



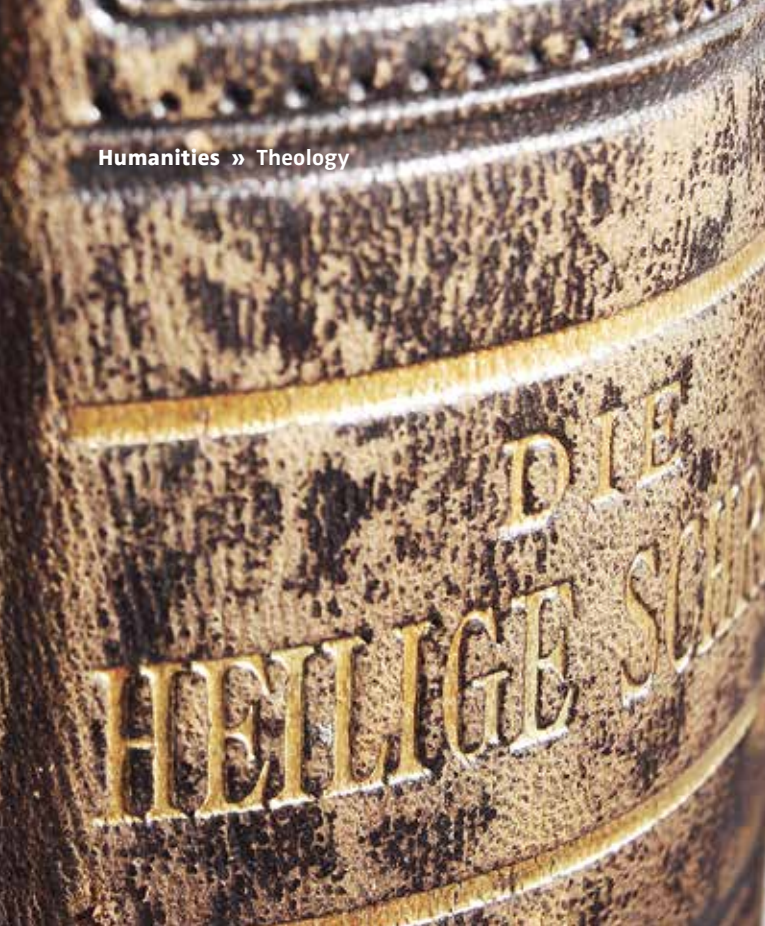
period.” While research has so far focused primarily on wars, invasions, and the ethnic affiliation and identity of the actors, researchers in Tübingen take a wider view of mobility in the period around 250-900 CE. Their work takes into account a variety of socially and historically relevant aspects – some as basic as everyday forms of mobility and migration, both of individuals and of social groups. Comparative analyses and new theories and methods from Sociology allow the researchers to compile data and results that can be applied across epochs – and to illuminate contemporary phenomena. Last but not least, the research group also investigates the economic conditions underlying migration and mobility and their effects on local societies.

Further proof of Tübingen's outstanding historical scholarship is evidenced by the research unit **Historical-Philological Commentary on the World Chronicle of John Malalas**. The project,

sponsored by the Heidelberg Academy of Sciences and Humanities, began in 2013 and is scheduled to run for twelve years. The aim is to produce a comprehensive historical-philological commentary on the world history written in the 6th century CE by Malalas, a Byzantine historiographer. His work will also be used to gain new insights into how the past was conceived during the period of upheaval between Late Antiquity and the Early Middle Ages. Malalas' Chronicle begins with Adam and runs to Malalas' own time. It is the earliest surviving example of a Byzantine world history, a genre that had a lasting influence on other medieval and later forms of historiography. John Malalas' work also yields important information about the political history of the 5th to 6th centuries as well as giving insights into the mentality, culture and religion of the time. With the findings from the unique source provided by Malalas' chronicle, the Tübingen historians are making significant contributions to the study of late ancient and medieval historiography.

*A mosaic in the Basilica of San Vitale in Ravenna depicts Emperor Justinian I (482-565), who reigned during the period in which John Malalas wrote his Chronographia.*





# » Theology

→ Catholic Theology: [uni-tuebingen.de/en/6354](http://uni-tuebingen.de/en/6354)

Protestant Theology: [uni-tuebingen.de/en/54849](http://uni-tuebingen.de/en/54849)

ZITH: [uni-tuebingen.de/en/134107](http://uni-tuebingen.de/en/134107)

Global Ethics: [weltethos-institut.org/en/](http://weltethos-institut.org/en/)

## Seeking interfaith dialogue

Over the centuries the University of Tübingen has produced outstanding theological thinkers, contributing significantly to the University's extraordinary international reputation in the theological disciplines.

Since the 1960s, the Protestant and Catholic theologies at the University of Tübingen have focused on working across denominational boundaries. Since that time, the Institute for Ecumenical and Interreligious Research, which is part of the **Faculty of Catholic Theology**, has actively promoted fruitful cooperation between the two main Christian theologies. Its counterpart at the **Faculty of Protestant Theology** is the Institute for Hermeneutics and Dialogue of Cultures. The theological researchers there seek to promote both interreligious as well as interdisci-

plinary exchange – especially with the humanities, cultural and social sciences. Both faculties regularly offer courses promoting a deeper knowledge of other denominations and religions as well as interreligious dialogue. This gives students a platform from which to reflect on their own theological positions.

Since 2011, the **Center for Islamic Theology (ZITH)** has complemented the theological profile of the University of Tübingen. The ZITH is sponsored by the German Ministry of Education and Research and was one of the first institutions of its kind. Germany now has several institutes of Islamic Theology which provide training for Muslim theologians and for teachers of religion in state schools. The center's long-term goal is to better represent the approximately four million Muslims living in Germany and to promote knowledge about Islam and initiate interreligious dialogue. Research at ZITH covers the entire spectrum of Muslim theology, from historical topics to systematic approaches and practical theology.

*Christianity, Judaism and Islam are among the major world religions which are the subject of research at the Faculties of Theology and the Center for Islamic Theology at the University of Tübingen.*

A new building for the Center for Islamic Theology is under construction next to the current location of the two Christian theologies. The intention is to create a joint campus of the theologies – a project unique in Germany. Bringing the structures and the people closer together will promote interreligious dialogue and step up cooperation between the theologies in research and teaching. The Faculty of Protestant Theology, together with the Chair of Religious Studies and Jewish Studies, has also established the Institutum Judaicum, which, in cooperation with the Faculty of Philosophy, will enable a focus on Judaism in teaching and research.

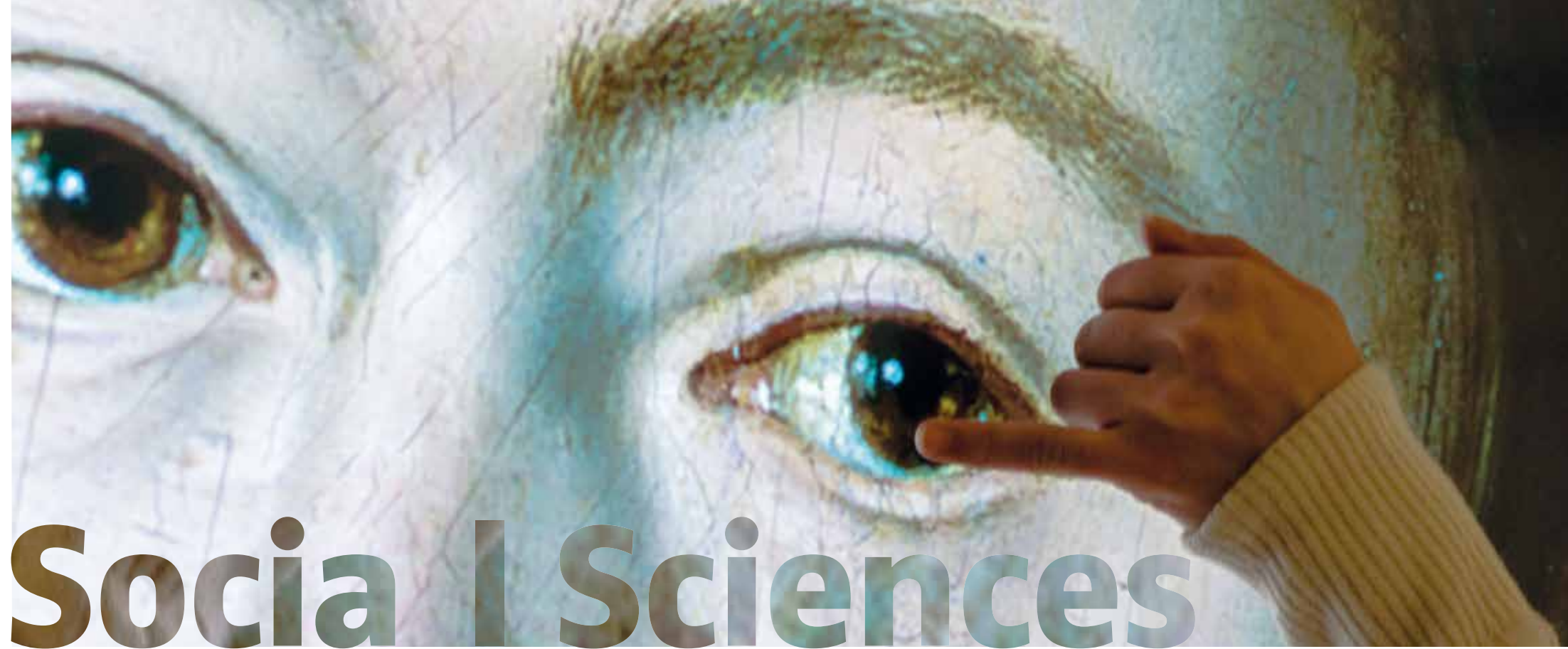
The theologies attach great importance to the transfer of knowledge to the wider society and to dialogue with the public. The Faculty of Protestant Theology honors outstanding achievements in the field of intellectual history and theology as well as a special commitment to tolerance and intercultural understanding with the Dr. Leopold Lucas Prize. Among the

prominent laureates are Moshe Zimmermann, Seyla Benhabib and Joachim Gauck. The Alfons Auer Ethics Prize, awarded by the Faculty of Catholic Theology and the Academy of the Diocese of Rottenburg-Stuttgart, honors persons who have distinguished themselves through outstanding ethical commitment in the religious, scientific or social field. Among those who have received it are the Canadian political scientist and philosopher Charles Taylor and the former Irish president, Mary McAleese.

The **Global Ethics Institute** at the University of Tübingen, initiated by the Tübingen theologian Hans Küng, also contributes significantly to promoting dialogue between cultures. It is involved in research and teaching in order to create an academic foundation for globally binding ethics in society and the global economy. As a non-denominational institution, it complements the work of the three theologies with regard to the values that unite all people.



## Research on education in the 21st century



Social changes have a big effect on our education system. Over the past two decades, there have been fundamental changes in the conditions under which learning and teaching take place. The transformation into a knowledge society, lifelong learning, and digitization are just some of the developments that have initiated or accelerated these changes. How can learners at school, university, or in training programs get the best possible education to master challenges in their future studies or jobs? How can digitization help with learning – what are the skills required? And most importantly, which factors make a real difference when it comes to successful learning? Answering these questions is one of the aims of the research on education carried out at various institutions in Tübingen – the Hector Research Institute of

Education Sciences and Psychology, the LEAD Graduate School & Research Network, and the Leibniz Association's IWM media research center. All of these institutions focus on practice-inspired basic research. Their research seeks to lay new foundations for evidence-based education policy and practice.

At the **Hector Research Institute of Education Sciences and Psychology**, some 40 researchers are investigating which individual, social and institutional factors influence successful teaching and learning – from primary school level through to working life. The research program is interdisciplinary and has an international orientation. It comprises five main areas – educational effectiveness, teaching quality and professional competence of teachers, talent development and giftedness, personality, and motivation. The researchers at the institute are seeking the best possible answers to the big questions in the field of education. Among other things, they study the effects of enrichment classes on gifted students; analyze how teachers need to design lessons so that pupils are motivated to learn; and examine how digitization is also changing teacher training and teaching at universities. To this end, the researchers work with innovative methods such as systematic sets of randomized controlled field trials; virtual reality to simulate various learning environments; and eye tracking to discover what really attracts the attention of those teaching and those learning. To get the big picture, they carry out major longitudinal studies. For example, in the TOSCA project, the researchers carry out long-term analyses of thousands of education biographies so as to draw conclusions about the effectiveness of the school system; in the TRAIN study, they investigate how different learning environments influence student development. Collaborating with the IWM the researchers are analyzing how tablet computers can support learning in class.



The Hector Institute is funded by the Hector Foundation II and the state of Baden-Württemberg. Since it was established in 2014, the institute has continuously expanded its ambitious research program and has developed into an internationally-recognized institution that is active both in research and in policy advice.

Researchers at the Hector Institute are also central to the **LEAD Graduate School & Research Network**. LEAD stands for Learning, Educational Achievement, and Life Course Development. The network brings together over 100 researchers from biology, computer sciences, economics, education science, empirical education research, language and linguistics, mathematics, psychiatry and psychotherapy, psychology, sociology and sports science. Using various methodological approaches, study designs and data analysis techniques, the researchers seek to understand and promote educational processes. The focus is on language and education, learning in core domains, self-regulation in education, technology-enhanced teaching and learning, and theory testing in educational field trials. Another focus of the LEAD network is the practical and theoretical training of early-career researchers. LEAD offers a structured training program for doctoral students as well as a program for postdoctoral candidates which is jointly run by LEAD and the Tübingen Postdoctoral Academy for Research on Education (PACE). The aim is to

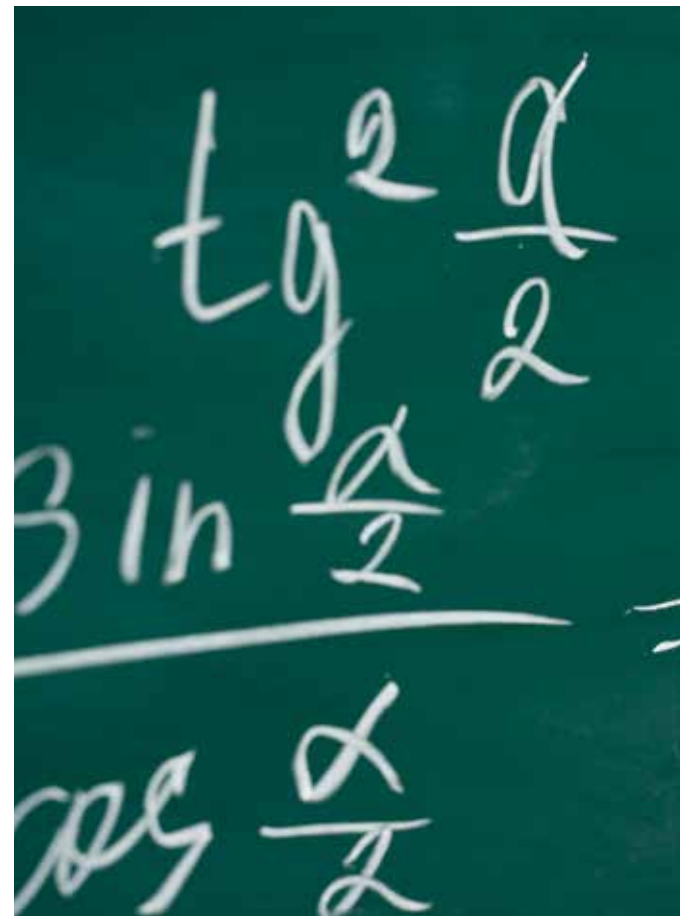
support high potential early-career academics as they develop their careers and to create a research environment promoting creativity and early independence. Graduates of these programs are highly qualified experts who will help shape the future education landscape.

An important external partner in Tübingen is the Leibniz Association's **IWM media research center**. Its research focuses on the use of digital technologies in teaching. The IWM cooperates closely with the university's education research bodies. Knowledge is a key resource in our society, and digital media have an increasing influence on how it is created, acquired, shared and passed on. The interdisciplinary team of researchers at the IWM seeks to discover how these media can improve knowledge processes to promote deeper thought and better understanding, and how they can be used sensibly – in conventional places of learning such as schools and universities, as well as in museums and in the workplace. What is the best way to design digital education platforms and information in museums to promote learning? Does it influence the way we process information if we can "touch" it on a touch screen? Alongside its basic research, the IWM also seeks to translate its findings into practical applications – for example in the development of digital media in the form of learning programs and teaching materials.

# Education and Media Research

→ Hector Research Institute: [uni-tuebingen.de/en/80946](http://uni-tuebingen.de/en/80946)  
LEAD: [uni-tuebingen.de/en/35356](http://uni-tuebingen.de/en/35356)  
IWM: [www.iwm-tuebingen.de](http://www.iwm-tuebingen.de)

## New dimensions in teacher training



Teachers have an enormous social responsibility – they are required to educate generations of children and young people in the best possible way and prepare them for future challenges. Good teachers can motivate students to achieve outstanding results. Good teaching in turn requires high-quality teacher training. This plays an essential role in passing on knowledge and culture in society. The University of Tübingen is well aware of this responsibility. In founding the **Tübingen School of Education (TüSE)** in 2015 with 15 new professorships in Didactics and Education, it established an inter-faculty institution that promotes teacher training at the highest level. The Tübingen School of Education's mission addresses the manifold aspects of modern teacher training and promotes innovation in all areas of teacher education.

The Tübingen School of Education is designed to integrate all teacher-training actors and activities. It includes TüSE Research, a unit which brings together research on education and training – particularly at the Institute of Education, the Hector Research Institute of Education Sciences and Psychology and the IWM knowledge media research center – with the University's expertise in the more than 25 subjects in which we train teachers. All parties are involved in research and development projects for research into teacher education, school organization and lesson design.

Furthermore, the Tübingen School of Education and its partners provide a flexible framework for the promotion of early-career researchers. The Tübingen School of Education's academic training program (TüNAPro) seeks to offer the best possible support and qualifications for fledgling researchers in the fields of didactics and education, for example helping with empirical research methods and open science.

In addition, there is close cooperation with the second and third phases of teacher training – pre-service teaching and advanced training – and with schools. This collaboration helps to establish and further promote a culture of research which is both trans- and interdisciplinary. The Tübingen School of Education strengthens the practical and application-oriented skills of future teachers with measures aligning studies with the target profession. There is also a focus on inclusion and diversity – for instance in dealing with an increasingly heterogeneous student body, in language-sensitive teaching, and in the use of digital media. In this way, TüSE's regular and advanced training programs prepare both students and teachers for a complex profession.

In cooperation with its partners, particularly the IWM knowledge media institute, the Tübingen School of Education is a prominent location for teaching and learning with digital media.

At the heart of its efforts is the **Teacher Training Digitalization Center (TüDiLB)** and the Professorship of Education with a focus on teaching and learning with digital media. Numerous teaching, research and development projects converge here, some of which are also supported by federal and state funding programs. The **Tübingen Digital Teaching Lab (TüDiLab)** is one of the best equipped laboratories for communicating and investigating digital media-supported learning processes in Germany and Europe. Its researchers want to find out what makes media-based teaching different, and what effect the use of different media has. How is this affected by the teacher's expertise and didactic skills and by the differing skill levels among students? With the results obtained, digital teaching concepts and learning materials can be further developed.

The Tübingen School of Education runs teacher-training degree programs as well as offering student counselling, professional orientation, research paths, qualification for early-career researchers, and training in diversity and inclusion, internationalization and digitization. All these measures seek to achieve noticeable improvements for student teachers and in basic and applied research, and to further improve the quality of teacher training.

→ Tübingen School of Education: [uni-tuebingen.de/en/75417](http://uni-tuebingen.de/en/75417)  
 Digitalization Center TüDiLB: [tuedilb-tuebingen.de](http://tuedilb-tuebingen.de)  
 Tübingen Digital Teaching Lab TüDiLab: [tuedilab-tuebingen.de](http://tuedilab-tuebingen.de)





# Ethics

# in Research

→ IZEW: [uni-tuebingen.de/en/8682](http://uni-tuebingen.de/en/8682)

Ethics and History of Medicine:  
[www.iegm.uni-tuebingen.de/index.php/en](http://www.iegm.uni-tuebingen.de/index.php/en)

Ethics of Genome Editing:  
[www.iegm.uni-tuebingen.de/index.php/en/ege](http://www.iegm.uni-tuebingen.de/index.php/en/ege)

## Responsibility in research

Biotechnology, genome editing, artificial intelligence and quantum computing are just a few examples of research fields in which enormous progress has been made in recent years – but which at the same time raise difficult social and ethical questions. For the University of Tübingen, taking responsibility for the future also means addressing topical issues. To this end, the University established the **International Center for Ethics in the Sciences and Humanities (IZEW)** in 1990. The IZEW brings together over 60 researchers from the sciences, humanities and social sciences. They investigate ethical and moral problems arising in the sciences and humanities – critical reflection of their own disciplines is thus an important part of the center's research.

Researchers at the IZEW concentrate on three main areas. In Ethics and Education they are concerned with the foundations of ethical judgement and how it is transferred, for example to schools, universities and adult education. What ethical competencies do managers and future teachers need? What are the ethical implications of certain organizational structures, for example in companies? In practice-oriented projects, the researchers seek to improve the ability of educational institutions and society in general to reflect on ethics.

Researchers in the area of Society, Culture, and Technological Change deal with such questions as those arising from security measures – e.g. the automated analysis of video surveillance data. What level of security is desirable for a society and for individuals? What is the right price – in terms of freedom and privacy? The researchers also examine how new technologies affect values and norms, such as our image of humanity and ideas about what makes a good life.

The third research area, Nature and Sustainable Development, deals with questions of justice and responsibility in society's interaction with nature. The researchers here work on bioeconomy projects such as the switch from fossil to renewable raw materials, or on questions of preserving threatened biological di-

versity, and investigate the area of conflict between individual consumption and its effects on society's sustainable development. IZEW researchers are integrated into numerous national and international networks. The center also maintains one of Europe's largest libraries on the ethics of science and the humanities.

Academics at the **Institute of Ethics and History of Medicine** conduct research and teaching in this twofold subject. On the one hand, they look at topics ranging from the history of psychiatry to medicine under National Socialism to contemporary medical history. On the other hand, they focus on ethical implications of the medical profession and of biomedical progress. What does demographic change mean for the medicine of the future? What is truly good care for the dying? How can economic constraints be reconciled with the needs of patients?

Since 2017, the institute has been home to the **Ethics of Genome Editing** research group. New procedures in the life sciences make it possible to modify genes easily and precisely, for example by using the CRISPR/Cas method. The group documents these developments and the public discussion of them with the aim of creating a basis for ethical reflection on the technology. In terms of its possible applications, the opportunities and risks go hand-in-hand. Somatic gene therapies can be

used to treat diseases such as cancer. They act on cells in the body, and the changes they cause are not hereditary. The situation is different with genetic transfer therapies, for example to prevent hereditary diseases. These gene modifications are passed on to subsequent generations. Such interventions are therefore considered particularly risky. This means that any potential for a cure must be weighed against questions of safety. And ultimately, gene modifications for the improvement of certain characteristics (enhancement) are also conceivable. Genome editing has the potential to change our understanding of health and disease and thus our view of humankind. The research group is dedicated to the numerous ethical, legal and social questions arising from this new technology and its potential applications.

Ethics are at the heart of research at the International Center for Ethics in the Sciences and Humanities and the Institute of Ethics and History of Medicine. Yet ethical questions arising from research are considered in many individual disciplines, for example in the context of Cyber Valley and the Machine Learning cluster of excellence. Ethical considerations have become more important than ever with the University of Tübingen's greater focus on global encounters and global awareness – in line with its excellence strategy.

*Technological progress often raises ethical questions. In Tübingen, the implications of research are considered in many individual disciplines.*

## Collaborative Research Centers (SFB)

### Collaborative Research Centers at the University of Tübingen

#### Different Aesthetics (SFB 1391)

Spokesperson: Professor Annette Gerok-Reiter – Institute of German Language and Literatures  
Duration: 2019 - 2023 · [uni-tuebingen.de/en/159334](http://uni-tuebingen.de/en/159334)

#### Robust Vision – Inference Principles and Neural Mechanisms (SFB 1233)

Spokesperson: Professor Matthias Bethge – Werner Reichardt Center for Integrative Neuroscience (CIN) and Institute for Theoretical Physics · Duration: 2017 - 2024  
[uni-tuebingen.de/robust-vision](http://uni-tuebingen.de/robust-vision)

#### Molecular Encoding of Specificity in Plant Processes (SFB 1101)

Spokesperson: Professor Klaus Harter – Center for Plant Molecular Biology (ZMBP) · Duration: 2014 - 2021  
[uni-tuebingen.de/en/48287](http://uni-tuebingen.de/en/48287)

#### ResourceCultures – Socio-cultural Dynamics in the Use of Resources (SFB 1070)

Spokesperson: Professor Martin Bartelheim – Institute of Prehistory, Early History and Medieval Archaeology  
Duration: 2013 - 2021 · [uni-tuebingen.de/en/39724](http://uni-tuebingen.de/en/39724)

#### Threatened Orders – Societies under Stress (SFB 923)

Spokesperson: Professor Mischa Meier – Institute of Ancient History · Duration: 2011 - 2023 · [uni-tuebingen.de/en/24861](http://uni-tuebingen.de/en/24861)

#### The Construction of Meaning – The Dynamics and Adaptivity of Linguistic Structures (SFB 833)

Spokesperson: Professor Sigrid Beck – English Languages and Literatures · Duration: 2009 - 2021  
[uni-tuebingen.de/en/2965](http://uni-tuebingen.de/en/2965)

### Transregional Collaborative Research Centers (TRR)

#### ANTIBIOTIC CellMAP – Cellular Mechanisms of Antibiotic Action and Production (TRR 261)

Spokesperson: Professor Heike Brötz-Oesterhelt – Interfaculty Institute of Microbiology and Infection Medicine Tübingen (IMIT)  
Duration: 2019 - 2023 · [uni-tuebingen.de/en/160423](http://uni-tuebingen.de/en/160423)

### Transregional Collaborative Research Centers (TRR) with Tübingen participation

#### Platelets – Molecular, Cellular and Systemic Functions under Physiological and Pathological Conditions (TRR 240)

Tübingen spokesperson: Professor Meinrad Gawaz – Medical Hospital, Internal Medicine III · Duration: 2018 - 2022  
[platelets.eu/tr240](http://platelets.eu/tr240)

#### Liver Cancer – New Mechanistic and Therapeutic Concepts in a Solid Tumor Model (TRR 209)

Tübingen spokesperson: Professor Nisar Malek – Medical Hospital, Internal Medicine I · Duration: 2017 - 2021 · [livercancer.de](http://livercancer.de)

#### The Skin as a Sensor and Effector Organ Orchestrating Local and Systemic Immune Responses (TRR 156)

Tübingen spokesperson: Professor Martin Röcken – Department of Dermatology · Duration: 2015 - 2023  
[klinikum.uni-heidelberg.de/sfbs/sfb-trr156/welcome](http://klinikum.uni-heidelberg.de/sfbs/sfb-trr156/welcome)

## Research Units (FOR)

#### Being Catholic in the German Federal Republic. Semantics, Practices, and Emotions in Western Germany's Society 1965-1989/90 (FOR 2973)

Spokesperson: Professor Andreas Holzem – Faculty of Catholic Theology, Church History in the Middle and Modern Ages  
Duration: 2020 - 2023

#### Understanding the Behavior of Multinational Corporations in the Context of International Tax Institutions (FOR 2738)

Spokesperson: Professor Georg Wamser – School of Business and Economics · Duration: 2019 - 2022  
[rsit-uni-tuebingen.de/for-2738](http://rsit-uni-tuebingen.de/for-2738)

#### Modal and Amodal Cognition: Functions and Interactions (FOR 2718)

Spokesperson: Professor Barbara Kaup – Department of Psychology · Duration: 2019 - 2022  
[uni-tuebingen.de/en/169941](http://uni-tuebingen.de/en/169941)

## Research Training Groups (GRK)

#### Intraoperative Multi-Sensor Tissue Identification in Oncology (GRK 2543)

Tübingen Spokesperson: Professor Arnulf Stenzl – Department of Urology · Duration: 2020 - 2024 · [uro-tuebingen.de/die-klinik/forschung/graduierntenkolleg-2543](http://uro-tuebingen.de/die-klinik/forschung/graduierntenkolleg-2543)

#### cGMP – From Bedside to Bench (GRK 2381)

Spokesperson: Professor Robert Feil – Interfaculty Institute of Biochemistry (IFIB) · Duration: 2019 - 2023  
[uni-tuebingen.de/en/141767](http://uni-tuebingen.de/en/141767)

#### MOMbrane – The Multifaceted Functions and Dynamics of the Mitochondrial Outer Membrane (MOM) (GRK 2364)

Spokesperson: Professor Doron Rapaport – Interfaculty Institute of Biochemistry (IFIB) · Duration: 2018 - 2022 · [mombrane.de](http://mombrane.de)

#### SMiP – Statistical Modeling in Psychology (GRK 2277)

Tübingen spokespersons: Professor Mandy Hütter and Professor Rolf Ulrich – Department of Psychology  
Duration: 2017 - 2022 · [smip.uni-mannheim.de](http://smip.uni-mannheim.de)

#### Doing Transitions – Shaping Transitions throughout Life (GRK 2105)

Tübingen spokesperson: Professor Barbara Stauber – Institute of Education · Duration: 2017 - 2025 · [doingtransitions.org](http://doingtransitions.org)

#### Ambiguity – Production and Perception (GRK 1808)

Spokesperson: Professor Matthias Bauer – English Department  
Duration: 2013 - 2022 · [uni-tuebingen.de/en/34380](http://uni-tuebingen.de/en/34380)

#### Integrated Hydrosystem Modelling (GRK 1829)

Spokesperson: Professor Olaf Cirpka – Center for Applied Geoscience (ZAG) · Duration: 2012 - 2021  
[www.hydromod.uni-tuebingen.de](http://www.hydromod.uni-tuebingen.de)

#### Molecular Principles of Bacterial Survival Strategies (GRK 1708)

Spokesperson: Professor Karl Forchhammer – Interfaculty Institute of Microbiology and Infection Medicine  
Duration: 2012 - 2021 · [uni-tuebingen.de/en/24556](http://uni-tuebingen.de/en/24556)



## Clusters of Excellence

### Controlling Microbes to Fight Infections (CMFI)

Spokesperson: Professor Andreas Peschel – Interfaculty Institute of Microbiology and Infection Medicine  
Duration: January 1, 2019 - December 31, 2025 · [uni-tuebingen.de/cmfi](http://uni-tuebingen.de/cmfi)

### Image-Guided and Functionally Instructed Tumor Therapies (iFIT)

Spokesperson: Professor Lars Zender – Medical Hospital, Internal Medicine VIII  
Duration: January 1, 2019 - December 31, 2025 · [uni-tuebingen.de/en/127863](http://uni-tuebingen.de/en/127863)

### Machine Learning: New Perspectives for Science

Spokespersons: Professor Ulrike von Luxburg – Department of Computer Science, Philipp Berens – Institute of Ophthalmic Research  
Duration: January 1, 2019 - December 31, 2025 · [uni-tuebingen.de/en/133840](http://uni-tuebingen.de/en/133840)

## Core Facilities

### Center for Light-Matter Interaction, Sensors and Analytics (LISA+)

[uni-tuebingen.de/en/29437](http://uni-tuebingen.de/en/29437)

### Center for Methods in Empirical Research

[uni-tuebingen.de/en/128147](http://uni-tuebingen.de/en/128147)

### eScience Center

[escience.uni-tuebingen.de](http://escience.uni-tuebingen.de)

### Quantitative Biology Center (QBiC)

[uni-tuebingen.de/en/26032](http://uni-tuebingen.de/en/26032)

### Tübingen Structural Microscopy (TSM)

## European Research Council Grants

23 ERC Starting Grants      8 ERC Advanced Grants      2 ERC Proof of Concept Grants  
10 ERC Consolidator Grants      2 ERC Synergy Grants

## Leibniz Prize Winners from the University of Tübingen and the Tübingen Max Planck Institutes

- 2021 **Professor Katerina Harvati-Papatheodorou** – Palaeoanthropology (University of Tübingen and Senckenberg Center for Human Evolution and Palaeoenvironment)
- 2018 **Professor Bernhard Schölkopf** – Machine Learning (MPI for Intelligent Systems)
- 2014 **Professor Lars Zender** – Hepatology/Oncology (University Hospitals)
- 2008 **Professor Elisa Izaurralde** – Biochemistry (MPI for Developmental Biology)
- 2007 **Professor Detlef Weigel** – Plant developmental biology (MPI for Developmental Biology)
- 2001 **Professor Hans Keppler** – Mineralogy (University of Tübingen)
- 1999 **Professor Volker Mosbrugger** – Palaeontology (University of Tübingen)
- 1998 **Professor Wolf Bernd Frommer** – Molecular plant physiology (University of Tübingen)
- 1996 **Professor Dieter Langewiesche** – Modern history (University of Tübingen)
- 1995 **Professor Niels Birbaumer** – Psychophysiology (University of Tübingen)
- 1995 **Professor Gerd Jürgens** – Molecular plant development (University of Tübingen)
- 1992 **Professor Hans-Georg Rammensee** – Immunology (MPI for Biology)
- 1988 **Professor Walter Haug** – Medieval German literature (University of Tübingen)
- 1988 **Professor Burghart Wachinger** – Medieval German literature (University of Tübingen)
- 1986 **Professor Herbert Jäckle** – Biology (MPI for Developmental Biology)
- 1986 **Professor Christiane Nüsslein-Volhard** – Biology (MPI for Developmental Biology)

## Alexander von Humboldt Professorships at the University of Tübingen

- 2021 **Professor Kou Murayama** – Education sciences
- 2020 **Professor Peter Dayan** – Neuroscience
- 2017 **Professor Largus T. Angenent** – Geosciences
- 2015 **Professor Marja Timmermans** – Plant molecular genetics
- 2012 **Professor Rolf Harald Baayen** – Linguistics

## Nobel Laureates Associated with the University of Tübingen

- 1999 **Professor Günter Blobel** – Medicine  
For the discovery that proteins have intrinsic signals that govern their transport and localization in the cell
- 1995 **Professor Christiane Nüsslein-Volhard** – Medicine  
For discoveries concerning the genetic control of early embryonic development
- 1991 **Professor Bert Sakmann** – Medicine  
For his discoveries concerning the function of single ion channels in cells
- 1988 **Professor Hartmut Michel** – Chemistry  
For the determination of the three-dimensional structure of a photosynthetic reaction center
- 1979 **Professor Georg Wittig** – Chemistry  
For the development of the use of boron- and phosphorus-containing compounds into important reagents in organic synthesis
- 1967 **Professor Hans Bethe** – Physics  
For his contributions to the theory of nuclear reactions, especially his discoveries concerning the energy production in stars
- 1939 **Professor Adolf Butenandt** – Chemistry  
For his work on sex hormones
- 1923 **Professor Fritz Pregl** – Chemistry  
For his invention of the method of microanalysis of organic substances
- 1909 **Professor Ferdinand Braun** – Physics  
In recognition of his contribution to the development of wireless telegraphy
- 1907 **Professor Eduard Buchner** – Chemistry  
For his biochemical research and discovery of cell-free fermentation
- 1904 **Professor William Ramsey** – Chemistry  
In recognition of his services in the discovery of the inert gaseous elements in air, and his determination of their place in the periodic system

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