

# EBERHARD KARLS UNIVERSITÄT TÜBINGEN



COMMITTED TO THE FUTURE  
Science Networks and International Cooperation

UNIVERSITY OF TÜBINGEN	3
PLANT MOLECULAR BIOLOGY	10
NEUROSCIENCES	12
CELL BIOCHEMISTRY	16
INFECTIOUS DISEASE RESEARCH	18
OVERCOMING RESISTANCE TO TREATMENT	20
ASTRO AND PARTICLE PHYSICS	22
GEO AND ENVIRONMENTAL RESEARCH	24
DRUG RESEARCH	28
QUANTUM PHYSICS AND NANOTECHNOLOGY	30
ARCHAEOLOGY AND ANCIENT HISTORY	32
LINGUISTICS	33
HUMANITIES	34
MEDICAL TECHNOLOGY	36
IMAGING TECHNOLOGY	37
ASIAN RESEARCH	38
OUTLOOK FOR THE FUTURE	40
TÜBINGEN CAMPUS	42

# Research Thrives on the Exchange of Ideas

“International research since 1477” is a phrase that neatly encapsulates the history of academic exchange in Tübingen. Indeed, it is difficult to imagine a viable future for any university without intense and fruitful interaction among researchers across the globe.

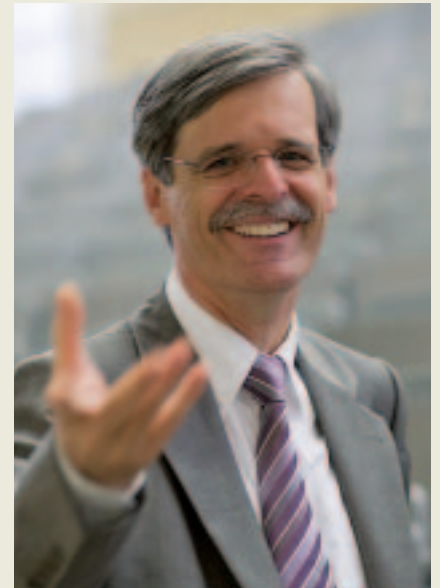
We attach great importance to research collaboration, not least in view of the fundamental changes affecting today’s university landscape. Amidst a climate of international competition, academic institutions are striving to reposition themselves. Soon, only the finest universities – with first-class partners – will be able to maintain their status. With its strong focus on research, the University of Tübingen is well positioned to compete on a global basis for the best minds and the most exciting research projects. From the humanities to the natural and life sciences, we offer our researchers and junior academics an excellent research environment and outstanding career opportunities.

This brochure presents just a few highlights of Tübingen’s research. It demonstrates that today the University of Tübingen already enjoys a reputation as a sought-after international partner in the field of academic research and also among the business community. Accordingly, we in Tübingen are committed to continuing along the path of mutually beneficial academic collaboration. Within the near future, we aim to be among the world’s 100 top research universities – an objective that will also benefit our partners.

In pursuit of this objective, we will further strengthen the application-oriented disciplines, while continuing to foster and cultivate our young academics. By doing so, the University of Tübingen will remain a premier institution for research.



Professor Bernd Engler  
President, University of Tübingen





# A Historic Seat of Learning

Few cities in Germany are defined by their university to the same extent as Tübingen. Teaching and research take place in a vibrant context that blends past and future. Since it was founded over 500 years ago, the university has played a major part in the city's development: it has attracted and produced some of Europe's greatest thinkers – many squares, streets and buildings bear their names today.

The genius loci remains modern and exciting, as new branches of learning are established on the hills surrounding the Old Town, while the student population fills the city with life around the clock.

Tübingen is a city dominated by research and teaching. The numbers speak for themselves – the city has some 85,000 residents, compared with a student population of 24,000, drawn from Germany and beyond. The University and Tübingen University Hospital provide employment for approximately 10,000 people, making it the largest employer in the entire region. The university's faculties are staffed by 450 professors and more than 2,000 other academics. The campus extends from the historic Old Town to a complete new research district. Over the decades, other research institutes and ambitious high-tech companies have chosen Tübingen as their home, leading to further growth. Teaching and research truly define the heartbeat of the city, imbuing it with intellectual and cultural flair.

### Historic roots

The university's growth began in 1477, when Graf Eberhard im Bart, Count of Württemberg, was given permission by the pope to establish an academic institution. He appointed 15 professors to teach at faculties of theology, jurisprudence, medicine and philosophy – the four standard subject areas of the time. A few years later, the new university was given a purpose-built home, the Burse, which contained residential accommodation for students and a lecture theatre. This oldest part of the University of Tübingen remains in use today, after having been modified several times over the centuries. In 1805, it was used to house and treat the first patients of the University Hospital founded in that year.

Another major historic building has also played a key role in the history of the University – Hohentübingen Castle, which mostly dates back to the 16th century and features an impressive Renaissance portal. An observatory was installed here back in 1752, while in the 19th century the castle provided space for the emerging natural science disciplines, including the very biochemistry laboratory in which DNA was discovered. This imposing building is still home to some of the University's departments, such as Archaeology and Cultural Sciences. The Castle is also the site of a museum containing fascinating scientific collections, such as Ice Age ivory carvings found in the surrounding area, which is rich in archaeological interest.

With its strong humanistic tradition, Tübingen is closely associated with important social developments in Germany. It is the birthplace of the German Idealism movement, for example, which was an important element in the civic emancipation movements of the 18th and 19th centuries.



The University has a unique influence on the character and rhythm of life in Tübingen.

### Growing out and up

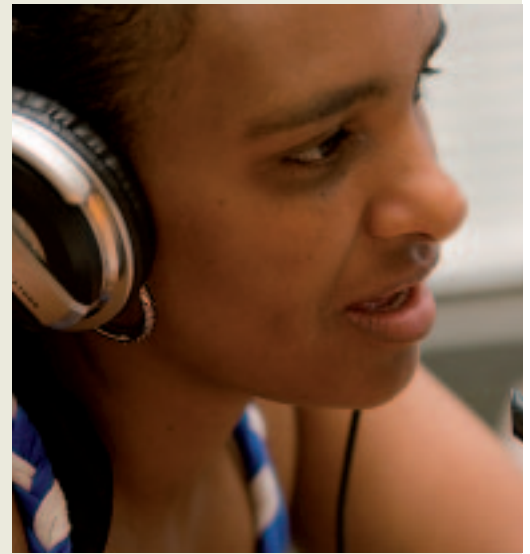
Dramatic growth is the hallmark of the latest stage in the University's development. Medicine, the life sciences and other science-based subjects are all booming, as reflected by recent and ongoing construction work. Due to lack of space in the historic Old Town, with its half-timbered Renaissance houses, locations have been selected on the town's surrounding hills. The Morgenstelle site in particular, which lies north of the Old Town, offers ample room for research and teaching and continues to grow.

Teaching activity at the University reflects its strong research profile in the natural sciences and humanities. Over 70 courses are offered by its faculties, ranging from Archaeology to Zoology. Innovative new options are constantly being added, such as International Economics, Medical Technology, Geoecology, Bioinformatics and Media Informatics. Students can choose from several different target qualifications, including Bachelor's and Master's degrees, the German Diplom, German state examinations and a PhD. Many combinations of courses are also possible.

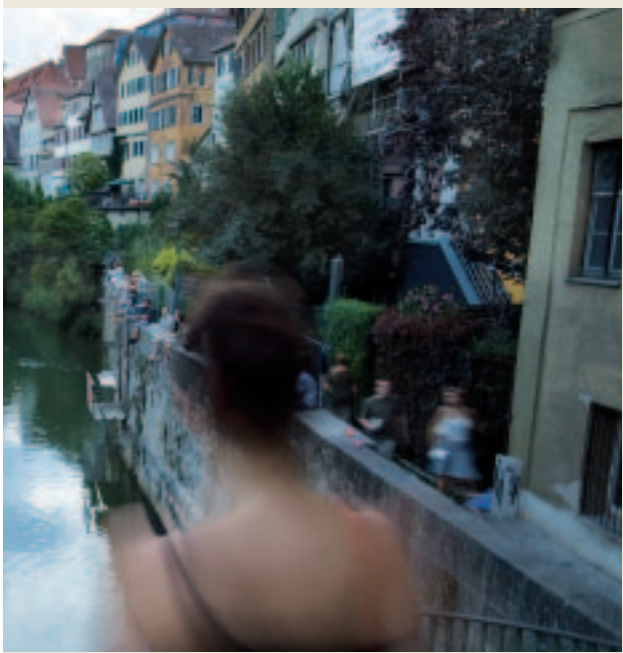
### Tübingen and the world

Like research, teaching activity at Tübingen has become increasingly international. Agreements with foreign universities make it possible to acquire a dual degree in selected fields of study, for example, such as economics and business administration, history, physics, mathematics and literature, with students spending one or more semesters in the relevant country. International Master's courses held in English are a further option. These are already well established in applied environmental and geosciences, neurology and behavioural research, computer linguistics, and international economics and finance. The University's international reach is correspondingly impressive: over 15% of the student population come from outside Germany, and every year 800 students participate in exchange programs with foreign research institutions and universities.

Teaching staff and researchers are also part of a worldwide network of contacts, from Argentina and Australia to the United States and Venezuela. Visiting academics and research grant recipients teach and conduct research in Tübingen, while Tübingen's professors are regular visitors to partner universities in Europe and other continents.



Centuries-old half-timbered houses, lovingly restored, give Tübingen's streets their warm appeal, along with steep Renaissance gables, while the verdant banks of the River Neckar and the surrounding countryside add to the charm of the city's location. But Tübingen is above all a city of learning and knowledge, making it a mecca for book lovers.



### **Where academic learning is at home**

"Tübingen doesn't have a University – Tübingen is a university", in the words of a local saying. Additionally, the city is at the geographic centre of Germany's southernmost state. A mere 40 kilometres separate it from the state capital, Stuttgart, and its international airport. Tübingen is also easily reached by car. The city is hugely popular with visitors from within Germany and further afield. Apart from its architectural attractions, it offers a wide choice of things to do and see. Recreational areas are never far away, such as the Neckar Valley and Neckar Island, Botanical Gardens and the gardens surrounding the castle.

It is said that there is barely a house or square in the Old Town that is not linked in some way with a famous scholar. Herder, Hölderlin and Schelling, Eduard Mörike and Ludwig Uhland, Johannes Stöckler and Johannes Kepler – all of these romantic poets, philosophers, exponents of the Enlightenment, politicians and natural scientists are part of the city's living heritage. But Tübingen is not a shrine dedicated to the past. Rather, its historic sites form an inspirational backdrop to the colourful, bustling lives of today's students and academics. Those who live here also learn to appreciate the city's compact layout – most shops, tourist attractions, cafes, restaurants, bars, cinemas, clubs, theatres, libraries, public offices and other facilities are centrally located and easy to reach on foot. For all other destinations, public transport provides a reliable and convenient alternative.

### **A city of books**

Given the city's academic traditions, it is hardly surprising that Tübingen is widely regarded as Germany's "book capital", with more bookshops per capita than any other city in the country. The stacks at the university library alone hold 6 million titles.

# Pioneer of Progress



**For over 500 years, the University of Tübingen has played a pioneering research role across all areas of the natural sciences and humanities. Today, the same commitment drives research forward at an unprecedented level of intensity. This also means continually engaging in new fields of research and generating basic knowledge that will open up new avenues of practical application.**

Rather than being opposites, tradition and innovation complement each other at the University of Tübingen. A distinguished heritage encourages today's researchers to work at the very highest levels in their search for new insights. Major role models from the University's early years include Tübingen professors Leonhart Fuchs (1501–1566) and Wilhelm Schickhard (1592–1635). Fuchs is regarded as the founder of botanical sciences, while Schickhard invented the first mechanical calculator, based on a principle that is still used in today's computers. Many more outstanding achievements could be cited, covering nearly every discipline and extending down to the present day.

## **The discovery of DNA**

Over the centuries, Tübingen's scientific research has repeatedly earned it the esteem of the global academic community. As early as 1863, Germany's first independent Faculty of Natural Sciences was established here. Its teaching staff included Felix Hoppe-Seyler (1825–1895), who gave the blood pigment haemoglobin its name and is considered the father of modern biochemistry. One of his pupils, Friedrich Miescher (1844–1895), isolated a substance that he called "nucleic acid" while working in his laboratory at Hohentübingen Castle on white blood cells. Based on its chemical composition, it was later re-classified as deoxyribonucleic acid (DNA) and identified as the carrier of hereditary information. It has, of course, since become the focus of intensive research.

Like biochemistry, medicine is among Tübingen's outstanding specialisms, with deep roots in the University's past. Earlier than at other universities, the study of medicine was geared towards investigating diseases in patients, rather than being restricted to the acquisition of theoretical knowledge. For the first time, patients were thus able to benefit directly from new findings. Germany's first university hospital, founded in 1805, was part of this new approach.



Tübingen continues to set new benchmarks in all areas of the natural sciences and humanities. The University is continually developing and defining new fields of research that encompass both basic research and application-oriented approaches. Multi-disciplinary topics are a particular focus, based on the awareness that working on subjects in isolation is no longer satisfactory. Nowadays the generation of new knowledge is so fast and diversified that researchers are confronted with the necessity of keeping track of new developments in neighbouring disciplines. It is therefore essential to base all research endeavour on an interdisciplinary approach.

#### **A track record of excellence**

Outstanding achievement in basic research, whether in individual projects or collaborative research schemes, is a distinguishing feature at Tübingen. This is true of the whole range of subjects, from the social sciences (including political science and educational studies) to mathematics and the cognitive sciences (which combine cognitive processes at human and machine level, including psychology and information technology), through to applied research, which probes the interplay of materials and sensors with living systems. The latest university rankings place the University of Tübingen among the top universities in Germany and Europe. In the humanities and natural sciences in particular, it was rated very highly by the Centre for Higher Education Development (CHE).

The broad range of externally funded projects also underscores the quality of Tübingen's research work. One of the most important sources here is the German Research Foundation (DFG), which primarily fosters high-level basic research and outstanding junior academics. It does so by way of different programmes (such as local and trans-regional Collaborative Research Centres, "excellence clusters", Research Training Groups and sponsored research groups). Currently, nine Collaborative Research Centres (CRCs) are in place at the University of Tübingen, along with ten Research Training Groups, across many specialist areas. All of these research projects – some concentrated in Tübingen, others based on partnerships with institutions in Germany or other countries – are aimed at boosting broad-based multidisciplinary research.



At Tübingen, institutes equipped with state-of-the-art facilities go hand in hand with a rich research heritage. Staffed by ambitious academics who are eager to push back the boundaries of their fields, the result is an extremely fruitful alliance.



# Plant Signals

**The Center for Plant Molecular Biology is dedicated to studying the life processes of plants as they respond to different environmental factors, such as heat, cold, aridity or moisture, and to pathogens and competition for nutrients. These issues, which highlight the complex processes by which plants function, communicate, adapt and develop, are the focus of cross-disciplinary research by scientists at the Tübingen Center.**

The Center for Plant Molecular Biology (ZMBP) is an interdisciplinary research institute at the University of Tübingen. Established in 1999, it brings together the competencies of two faculties: Biology, and Chemistry and Pharmacy. The cooperation between the plant disciplines of genetics, molecular biology, biochemistry, cell biology, physiology and developmental biology has earned the Center an international reputation both for the quality of its research and as a place of learning for budding scientists. With its open structure and close ties between the individual groups, the ZMBP provides an ideal environment for studying the extremely complex issues involved in modern plant research. To improve the research environment yet further, in 2011 the Center will move to a new, 36-million-euro building offering 5,400 square metres of space, which will allow all ZMBP research groups to work under one roof.

## **Intensive regional cooperation**

The 16 independent research groups that make up the ZMBP are much in demand as partners by national and international research associations. Over the past eight years, the scientists have been offered more than 20 professorships in Germany and abroad – a testament to the Center's outstanding research environment. The ZMBP enjoys particularly close ties with the neighbouring Max Planck Institute for Developmental Biology, the two institutes having joined forces to conduct research on thale cress (*Arabidopsis thaliana*), to take just one example. The ZMBP's own research specialties include tobacco and potatoes. There are many areas of common interest, ranging from molecular biology to genetics and protein evolution. The exchange of methodologies is correspondingly intensive between the two groups of scientists, who also share the available facilities. Links also exist with the institutes for applied plant sciences at the University of Hohenheim, the aim being to find efficient ways of turn-

ing insights gained from basic research into practical agricultural applications.

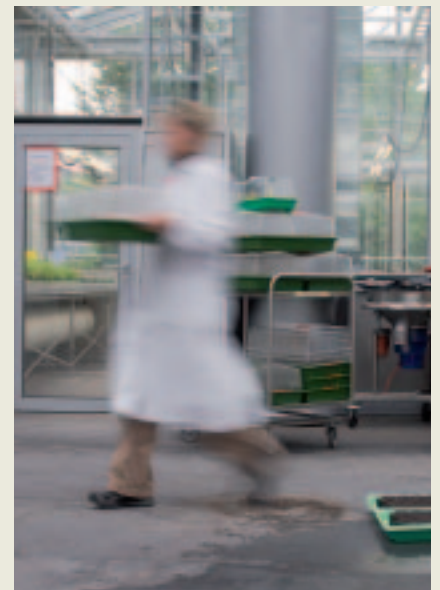
Another key project involving particularly close collaboration is the Arabidopsis Functional Genomics Network (AFGN), which features contributions from Tübingen and numerous partners in Germany and the USA. For the first time, international research work is also being funded internationally, with this ambitious long-term project being jointly supported by the German Research Foundation (DFG) and the National Science Foundation in the USA. Using thale cress, researchers are analysing the complex variety of plant processes, reactions, adaptation mechanisms and developmental steps. They are also attempting to determine the function of its almost 23,000 genes – a major task.

#### Plant and animal cells in their environment

Collaborative Research Centre 446, which was established in 1997 to study cell behaviour mechanisms in eukaryotes, has been similarly successful. Scientists of various disciplines are engaged in analysing the reaction of cells to environmental and developmental signals. Benefits of this work include an improved understanding of the cellular similarities and differences between protozoans, plants and animals.

Plant research is also of relevance to medicine. ZMBP researchers are working on a joint project coordinated by the Charité hospital in Berlin devoted to the study of ubiquitins, short-chain proteins occurring in all animal and plant cells. Their most prominent function is protein breakdown in cells, which makes ubiquitins of great interest with regard to the analysis of abnormalities in such processes – such as pathological disorders, which can result in cells dying.

As this example illustrates, plant research is a highly accessible method of investigating and understanding fundamental life processes, which has the additional advantage of being safe for humans.



#### Center for Plant Molecular Biology (ZMBP)

Auf der Morgenstelle 1

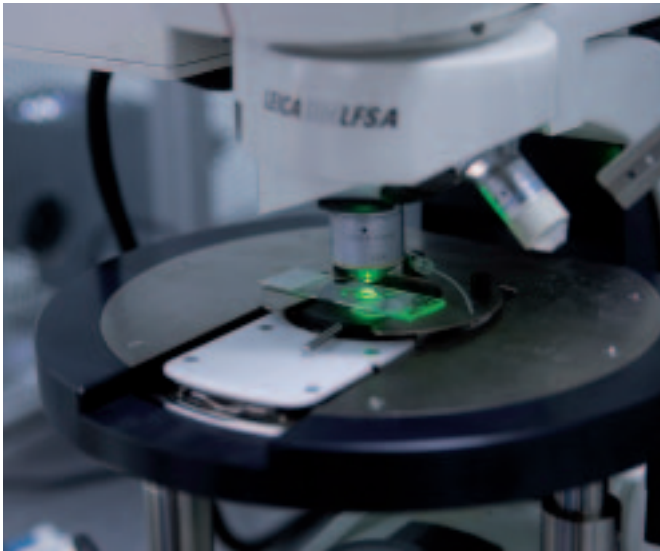
72076 Tübingen, Germany

Tel: +49 7071 29 78805

Fax: +49 7071 29 3287

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

# Excellent Teamwork in Neurology



**For more than 20 years, Tübingen has been internationally renowned in the field of neurological research. This is partly because the scientists involved embraced interdisciplinary methods right from day one, and have constantly developed new investigative procedures. The expertise of several institutes at the University of Tübingen has also been integrated and extended in recent years. The interdisciplinary Centre for Integrative Neuroscience was selected for inclusion in Germany's "Federal Initiative for Excellence", thereby underscoring Tübingen's high level of achievement in this field.**

The interdisciplinary Werner Reichardt Centre for Integrative Neuroscience (CIN) in Tübingen features an exceptionally rich diversity of study areas, reflecting the sheer complexity of the subject matter being investigated. For example, a group of scientists at Tübingen are working to decode the neural foundations of higher brain functions. Understanding aspects such as perception, memory, communications and behaviour requires analysis at a variety of levels. This also includes research into processes in the brain based on genetics and molecular biology.

One of these brain functions is the combination of recognition and memory: Among the thousands of faces people see each day, familiar ones are instantly recognised. Simultaneously, emotions are mobilised and memories of shared experiences activated. The CIN seeks to examine these processes by using a variety of methods. Beside non-invasive experimental research procedures on the human brain (such as functional magnetic resonance imaging and magnetic encephalography), scientists use computer simulations and animal-based studies. These studies on the functional aspects of the brain are also geared towards improving our understanding of neurological diseases. New and improved diagnostic procedures for neurologists are another important focus of scientific work at the CIN. Linguists, information specialists and philosophers can thus be found working side-by-side with the Centre's physicians and biologists.

The CIN is extremely well resourced in terms of staff, with half of the approximately 50 full-time employees being professors. They are joined by a number of junior scientists. Among other sources of funding, this work is made possible through the support of the German Research Foundation (DFG), which provides the Centre with annual funding of € 6.5 million.

### Research and medical care, hand-in-hand

The University of Tübingen is home to the Centre for Neurology, a multifunctional facility that combines research excellence with practical applications, giving it a unique status in the area of neurological studies. Founded in 2001, the Centre owes its existence to an agreement between several entities: the non-profit Hertie Foundation, the State of Baden Württemberg, the Medical Faculty of the University of Tübingen, and Tübingen University Hospital. The scientific activities are concentrated in the Hertie Institute for Clinical Brain Research (HIH), which was expressly created for this purpose. The non-profit Hertie Foundation has provided the HIH with substantial funding over recent years.

The aim of the HIH is to ensure that neurological research projects are broadly based across multiple disciplines. In terms of its scientific work, the Institute concentrates on neurodegenerative illnesses such as Alzheimer's and Parkinson's disease, which are becoming more common in line with increased life expectancy. Here too, the Institute is committed to converting research findings into medical care as efficiently as possible. Scientific projects on other brain diseases supplement the Institute's primary objective. Brain tumours and inflammatory diseases are among the subjects studied, together with the neural mechanisms behind perception, memory and language. In terms of method and substance, this work is critical for our understanding of neurodegenerative diseases. The Hertie Institute for Clinical Brain Research consists of four departments with 20 work groups, 10 professors and some 160 employees.

The parties to HIH's founding agreement used this reform project to establish innovative organisational structures. The HIH largely does away with the hierarchies and structures typically found in academic institutions. Instead, an interdisciplinary



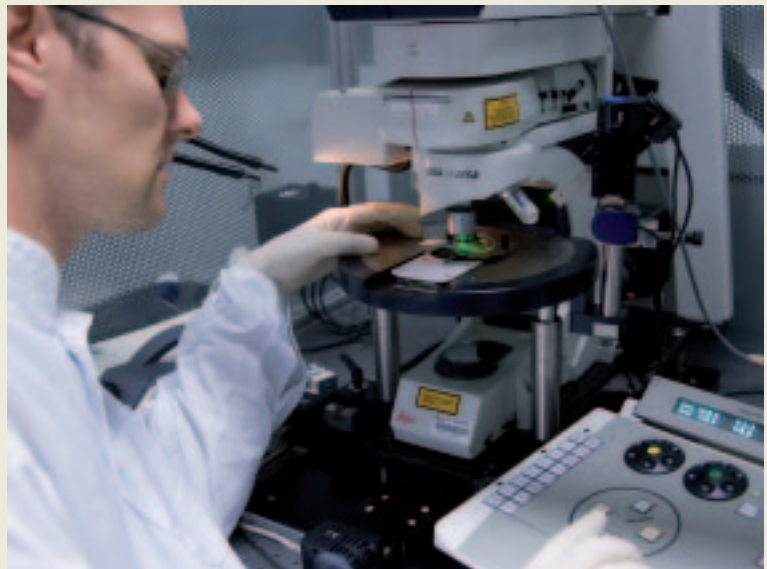
“THE NEW BRAIN RESEARCH CENTRE WILL ENABLE AN EXCHANGE OF SCIENTIFIC IDEAS THAT IS UNIQUE IN EUROPE. IT WILL HELP PUT TÜBINGEN AT THE FOREFRONT OF INTERNATIONAL NEUROSCIENCE RESEARCH INSTITUTIONS.”

**Professor Hans-Peter Thier**

Head, CIN

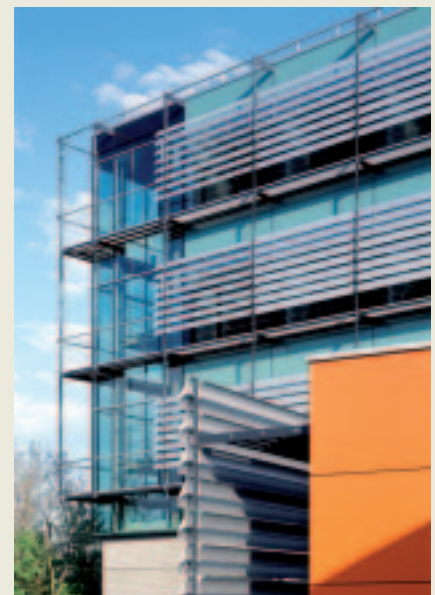


Neurological research at Tübingen cuts across subject and faculty boundaries to investigate neurodegenerative illnesses such as Alzheimer's and Parkinson's disease. The focus is also on the neuronal mechanisms behind perception, memory and language. Physicians and biologists join with researchers from the humanities to study fundamental links between insights at different levels.



organisational structure provides a shared scientific infrastructure, backed by a highly flexible approach to research grants that creates an incentive to perform. This arrangement benefits both individual scientists and complete research teams. The Hertie Institute thus offers highly attractive conditions, especially for young scientists, who are often able to conduct independent research in small teams at a very early stage of their career.

Numerous research projects initiated by the HIH are pursued jointly with other institutes at the University of Tübingen and with institutions not affiliated with the university, such as the Max Planck Institute for Biological Cybernetics, as well as other domestic and foreign universities. Collaborative Research Centre 550, which bears the title "Recognition, Localisation and Behaviour: Neurocognitive Mechanisms and their Flexibility", is a prime example. This research project is currently being funded for a third period by the German Research Foundation. The scientists involved are seeking to improve our understanding of brain activities such as consciousness, language and memory, as well as emotion and motivation. This entails use of all non-invasive imaging technologies, e.g. magnetic resonance imaging, magnetic electroencephalograms (MEG) and EEGs, along with animal-based approaches. In addition to physicians, this Collaborative Research Centre includes zoologists and biologists, whose related work on brain functions is a particularly valuable addition. By assembling such a diversity of scientific disciplines, the Centre – currently staffed by 16 professors, 22 post-docs and 26 doctoral candidates – has become a leading international focus for cognitive neuroscience. The doctoral candidates are members of an integrated Research Training Group within the Centre, thereby ensuring structured professional development for the next generation of scientists.



**Hertie Institute for Clinical  
Brain Research (HIH)**

Otfried-Müller-Str. 27  
72076 Tübingen, Germany  
Tel: +49 70 71 29 87641  
Fax: +49 70 71 29 5326  
[www.hih-tuebingen.de](http://www.hih-tuebingen.de)

**Werner Reichardt Centre for  
Integrative Neurosciences (CIN)**

Waldhäuserstr. 64a  
72076 Tübingen, Germany  
Tel: +49 7071 96 4590  
Fax: +49 7071 96 4591  
[www.neuroscience-tuebingen.de/cin](http://www.neuroscience-tuebingen.de/cin)



# Living Processes in Cells under the Spotlight

**The living cell – rudimentary building block of all life forms – is the focus of research at the Interfaculty Institute for Biochemistry. Looking beyond the limits of their individual fields, the scientists here have joined forces in the quest for answers to two fundamental questions: What basic molecular mechanisms drive biological and biochemical processes in cells? And how do these mechanisms and processes change if the organism becomes diseased?**

There is increasing overlap between research conducted at the Faculty for Chemistry and Pharmacy and at the Faculty of Medicine, across a number of areas. Tübingen's scientists are keen to exploit this fact, not least in order to achieve cost-saving synergies, but it requires knowledge of what work is in progress. Since this information was not always available, in 2004 the Physiological-Chemical Institute gave way to a new Interfaculty Institute for Biochemistry (IFIB). The two faculties now carry out research together – with a core focus on medical applications.

Individual teams are engaged in investigating topics such as the interaction of pathogenic viruses, bacteria and protozoa, as well as their binding partners, at a cellular level. The aim is to understand how pathogens manage to penetrate a somatic cell, use it as a host and hide themselves from the immune system. Scientists can use this knowledge to develop new medications that directly infiltrate the cells, opening up the prospect of combating previously untreatable infectious diseases.

Another area of focus is “stress behaviour” of cells: When does it lead to cell death? What causes premature cellular aging? What causes defective cell division, known as “mitotic catastrophe”? Understanding these processes will have an impact on the development of new treatments against tumours and degenerative diseases.

A new generation of highly motivated young scientists have brought additional research topics with them to the IFIB that round out the spectrum of conventional biochemistry. The work group headed by Professor Ralf-Peter Jansen, to name just one example, studies the detailed regulation of protein synthesis in human and animal cell cultures, in terms of space and time. Using biochemistry, cell biology and the latest imaging techniques, they are



“MODERN RESEARCH IN BIOCHEMISTRY AND MEDICINE IS BECOMING INCREASINGLY COMPLEX. INTERNATIONAL COLLABORATION AMONG MULTIPLE RESEARCH TEAMS IS THEREFORE ESSENTIAL.”

**Professor Thilo Stehle**

Director, IFIB

investigating the regulatory mechanisms between messenger RNA and associated proteins.

**Education is the future**

The education of students and junior scientists is a priority task at the IFIB. Tübingen's outstanding research environment attracts ambitious young researchers from all over Germany and many other countries. In addition to superb laboratory facilities and exciting research opportunities, the University provides excellent scientific mentoring – an added incentive for dedicated junior scientists.

The IFIB is notable for its national and international research relationships. Members of the IFIB are involved in many high-profile projects. These include the Collaborative Research Centres for “Immunotherapy: From the Molecular Basis to Clinical Application” and “Therapy Resistance of Solid Tumours and How to Overcome It”. Distinguished US institutions, such as the National Institutes of Health, the United Mitochondrial Disease Foundation and the Consortium for Functional Glycomics, are among the Institute's cooperation partners. Other partners include a number of private foundations, major pharmaceutical companies and the State Foundation of Baden-Württemberg.

There is a particularly close relationship with the University of Tübingen's Center for Plant Molecular Biology (ZMBP), at both personnel and structural levels.



**Interfaculty Institute for Biochemistry (IFIB)**

Hoppe-Seyler-Str. 4

72076 Tübingen, Germany

Tel: +49 7071 29 76390

Fax: +49 7071 29 5565

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

# Battle against Infectious Diseases



**Its research into infectious diseases has made the University of Tübingen one of the world's leading centres for microbiology. Researchers are seeking new insights that will allow us to combat infectious diseases more effectively. Without an interdisciplinary exchange of ideas, such complex objectives are barely achievable. The benefits of such an exchange are particularly apparent in two Collaborative Research Centres that study the cell envelopes of bacteria and their properties, and focus on the battle against staphylococci. Here, concerted teamwork takes the place of research in isolation.**

Medicine, biology, biochemistry, pharmacy and bioinformatics have successfully worked hand-in-hand in Tübingen for decades, acting as a powerful alliance for progress. Together with the Tübingen-based Max Planck Institute for Developmental Biology, this has given rise to a research network that addresses pressing issues in infectious biology research that are elementary to our understanding. The German Research Foundation, the EU and a number of other organisations provide significant funding for Tübingen's research into infectious diseases.

## **Spotlight on the bacterial envelope (CRC 766)**

The cell envelope of bacteria, which is the main focus of Collaborative Research Centre 766, is of huge importance for new strategies in the battle against infection. Bacterial cell envelopes fulfil more functions associated with organising living processes than in higher life forms, whose cells are substantially larger and hence more structured. The significance of the bacterial cell envelope in infectious outbreaks and with regard to how antibiotics work is well established. But when it comes to basic facts about the cell envelope on a molecular level, in regard to its configuration and function, science has astonishingly little to say so far. A team of scientists at Tübingen, led by microbiologist Professor Wolfgang Wohlleben, is intent on filling in these gaps in our knowledge. Examples of their activities include current research into the synthesis of cell envelopes and their composition in selected bacterial species.

Their findings will provide the basis for several other research projects. For example, many bacteria produce substances that have an antimicrobial effect, such as antibiotics, but it remains unclear how they protect themselves from the toxic effects of these substances. The objective here is to

establish how the antibiotics are passed through the cell envelope.

A second research focus within the Collaborative Research Centre is the interaction between cells, particularly between bacteria and their host cells. Which signal molecules on the cell surface are used for mutual recognition? What molecular mechanisms are involved in the life cycle of an infection and how is the innate immune defence system stimulated – or immobilised? Scientists are investigating these topics using an array of cellular modelling systems that originate either from humans, mice or plants. In addition, bioinformatics specialists simulate the processes involved in the genesis of infections and immune defences to yield new ideas for developing more effective antimicrobial substances and medicines. In the long term, the work of CRC 766 is targeted at expanding our knowledge of bacterial cell envelopes and their role in contagion and disease. The results of these research efforts will enable more efficient ways of fighting infections, while supporting and strengthening the immune defences not only of human beings, but also of plants and animals.

#### **United against staphylococci (CRC TR 34)**

Collaborative Research Centre TR 34 is devoted to an equally important area – exploring and studying the *Staphylococcus aureus* bacterium. This bacterial species has managed to colonise, unbeknown to its hosts, approximately 40% of the population and can be extremely dangerous to older persons and the immune compromised. As a cause of severe infections, such as septicaemia, wound infections, pulmonary or cardiac valve inflammation, staphylococci have become one of the most common causes of death in Germany. Their growing resistance to antibiotics is particularly alarming; staphylococci infections are increasingly testing the limits of treatability. In association with the Universities of Greifswald and Würzburg, Tübingen's scientists are actively engaged in this pressing issue. The primary objective of CRC TR 34 is to establish the facts about the cell physiology and infection biology of this bacterium with the aid of functional genome research. Based on the research findings, therapies will then be developed that allow staphylococci infections to be treated more effectively in the future.

With regard to investigating the physiology of staphylococci, important common ground exists between Collaborative Research Centres 34 and 766. The scientists at CRC 766 are studying how the bacterium's cell envelope works, with the aim of developing new active pharmaceutical agents.



#### **CRC 766 – The Bacterial Cell Envelope: Structure, Function and Infection Interface**

Auf der Morgenstelle 28  
72076 Tübingen, Germany  
Tel: +49 7071 29 76484  
Fax: +49 7071 29 5979

[www.sfb766.uni-tuebingen.de](http://www.sfb766.uni-tuebingen.de)

#### **CRC TR 34 – Pathophysiology of Staphylococci in the Post-Genome-Era**

Auf der Morgenstelle 28  
72076 Tübingen, Germany  
Tel: +49 7071 29 74635  
Fax: +49 7071 29 5937

[www.uni-greifswald.de/forschen/sonderforschungsbereiche/staphylokokken.html](http://www.uni-greifswald.de/forschen/sonderforschungsbereiche/staphylokokken.html)



# Research Teams against Cancer

**Two quite different aspects of cancer research are the focus of separate Collaborative Research Centres: the molecular fundamentals of immune therapy, and overcoming the resistance to treatment exhibited by solid tumours.**

**The funding provided for these ambitious projects by the German Research Foundation once again underscores Tübingen's exceptional standing.**

Immune therapy offers enormous potential in the fight against cancer and autoimmune diseases. Accordingly, Collaborative Research Centre 685 has been working on this complex topic since 2005 under the leadership of Tübingen immunologist Professor Hans-Georg Rammensee from the Interfaculty Institute for Cell Biology. A unique combination of scientific approaches has brought together two opposing strategies: With cancer treatment, the aim is to strengthen the body's own immune defence system, whereas with autoimmune diseases (such as multiple sclerosis), the system needs to be weakened or even shut down. Groups of researchers from completely different fields, with their respective theoretical and practical tools, have joined forces here to share their insights and develop new options.

## **New options for immune therapy**

T-cells are particularly significant for this work. Science has achieved some impressive successes here that point the way towards individualised cancer therapy, but real breakthroughs are still a long way off. We already know that, for genetic reasons, a specific part of the natural immune defence system responds differently from person to person. On chromosome 6, a combination of various membrane proteins are coded like a "genetic key" that allows the immune system to distinguish the body's own cells from foreign invaders. Current theories assume that this code lies behind a predisposition to multiple sclerosis or certain forms of diabetes. When the immune system encounters pathogens whose detection patterns closely match the body's own patterns, this can stimulate a defence reaction against certain body cells from that point on. In contrast to this, the immune defences frequently malfunction or collapse when faced with cancer cells. Knowledge of the body's individual code makes it possible to take targeted action that alerts the immune system to cancer-specific changes,

but the path ahead for scientists is still a long one. While patients have been vaccinated with specific tumour proteins that triggered an immune response, the effect is not strong enough to kill the tumour. More research is needed to find the appropriate conditions and to translate immune therapy into successful medical applications.

### **The fight against resistant cancer (CRC 773)**

The most recent addition in the trio of biomedical Collaborative Research Centres, designated number 773, commenced its work in July 2008. Its research objective is to discover why solid tumours are resistant to treatment, and to develop strategies for overcoming this resistance. For this purpose, cell biologist Professor Sebastian Wesselborg has assembled a team that includes natural scientists and physicians with various specialisations – dermatologists, neurosurgeons, neurologists, pharmacologists, radiologists and internists. They are conducting a detailed investigation of the known resistance mechanisms that tumours use to defy the destructive effects of radiation and chemotherapy. For example, tumour cells have the ability to suppress the built-in suicide programme found in all cells that is normally responsible for cell death and destroying defective body cells. They can also deactivate the ordinary cell aging process, or initiate signal pathways to activate the cell's own survival programme. Tumour stem cells also play a significant role, since they can allow the emergence of new tumours following successful cancer therapy.

Tübingen's scientists are seeking to understand the fight against these complex opponents at molecular level – what controls normal growth and cell death processes in tumour tissues? Finding the answer to this question will allow previously treatment-resistant tumours to be destroyed. The Collaborative Research Centre maintains close ties with the Comprehensive Cancer Centre Tübingen (Südwestdeutsches Tumorzentrum Tübingen) to ensure that severely ill cancer patients can benefit from these scientific findings as soon as possible.

“WHAT MOTIVATES US EACH AND EVERY DAY IS THE VISION OF BEING ABLE TO DO SOMETHING AGAINST CANCER.”

**Prof. Hans-Georg Rammensee**

Interfaculty Institute for Cell Biology



### **CRC 685 – Immunotherapy: From the Molecular Basis to Clinical Application**

Auf der Morgenstelle 15  
72076 Tübingen, Germany  
Tel: +49 7071 29 87625  
Fax: +49 7071 29 5653  
[www.sfb685.de](http://www.sfb685.de)

### **CRC 773 – Therapy Resistance of Solid Tumours and How to Overcome It**

Otfried-Müller-Str. 10  
72076 Tübingen, Germany  
Tel: +49 7071 29 84113  
Fax: +49 7071 29 5865  
[www.medizin.uni-tuebingen.de/en/Research/Focal+Points+of+Research-p-1464.html](http://www.medizin.uni-tuebingen.de/en/Research/Focal+Points+of+Research-p-1464.html)

# Space – the Ultimate Lab



**Research activity at the Kepler Center for Astro and Particle Physics extends from the largest to the smallest objects in physics – from the universe to neutrinos. Occupying the interface between particle physics, astrophysics and cosmology, the Kepler Center brings together the relevant disciplines under one roof, from both experimental and theoretical physics. Astronomers and astrophysicists use their diverse methods to pursue the same questions about the origins and structure of our universe, and about the properties of elementary particles under extreme conditions.**

Astroparticle physics is one of the newest, fastest growing interdisciplinary branches of physics. Subjects that were always studied separately just a few years ago are increasingly converging, with the universe offering excellent opportunities to examine elementary particles and their behaviour. These particles can be found here, from natural sources, as can the basic conditions for their existence. Creating the same conditions on Earth is hugely difficult and expensive. At the same time, observing particles in space provides new insights into their sources, such as black holes, neutron stars and supernovas. The evolution of stars and planetary systems is one of the key issues in astronomy today, not least because of its significance for the origins of life itself. The aim of the Kepler Center, which was established in February 2008, is to advance this new field of study by leveraging a set of resources that is currently unique anywhere in the world.

In addition to formidable scientific expertise, the Center offers superb conditions for future research success in the form of its lavish technical facilities. These include an underground particle laboratory, a particle accelerator for neutrons and ions, as well as several laboratories for space technology. The latter are used for setting up experiments intended for international space missions. Given the complexity of these research fields, international collaboration with other scientists and research institutes through long-term research projects is equally important.

### **Taking a closer look at gravity**

Einstein's Theory of General Relativity predicts the existence of gravitational waves that occur when black holes collide or as a result of the explosion of a supernova, for example. CRC TR 7 brings together groups of scientists from the Universities of Jena, Tübingen and Hannover, as well as the Max Planck Institutes in Garching, Hannover and

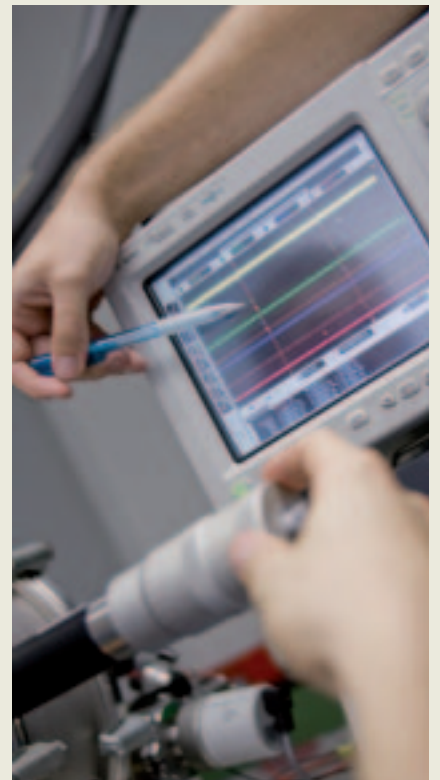
Potsdam, with the aim of developing methods to measure this rare phenomenon. Close collaboration with astrophysicists from the USA, Italy, France, the UK and Japan is a further feature of this work. To date, there has been only indirect proof of the existence of such waves, which are based on a crucial underlying force of the universe. If they can be successfully measured, this could lead to completely new insights into the structure and evolution of the universe. Today's knowledge primarily comes from the measurement and observation of electromagnetic radiation.

### On the trail of neutrinos

The tiniest (and, together with photons, the most common) building blocks of the universe are likewise a key research focus, namely neutrinos. As part of CRC TR 27, the Tübingen scientists have joined with researchers from München, Karlsruhe and Heidelberg to extend our knowledge in this intriguing field. Since the majority of neutrinos probably originated with the Big Bang, studying them will provide unique insights into the universe and help answer some fundamental questions. Why does mass exist, for example? And why is there so much more matter than antimatter in the universe? Since neutrinos hardly interact with other particles, they can also deliver information on inaccessible locations such as the core of the earth or the sun, or about the nature of dark matter.

The way the Kepler Center is structured automatically involves a high level of international exchange, with major research project groups working closely with other institutions. To prepare for and carry out space missions for astronomic research purposes, additional relationships exist with the major space agencies, such as ESA, NASA and ROSCOSMOS. Scientific exchange opens up many opportunities for researchers and students to establish contacts worldwide. Similarly, scientists from across Germany and around the world welcome the chance to spend time at the Kepler Center and work on joint projects.

Supporting and training young scientists also plays a major role. One example is the European Graduate College "Hadrons in Vacuum, Nuclei and Stars", which is coordinated from Tübingen and allows aspiring astroparticle physicists from Germany, Austria and Switzerland to acquire the skills, knowledge and abilities necessary for a scientific career.



**Kepler Center for  
Astro and Particle Physics**

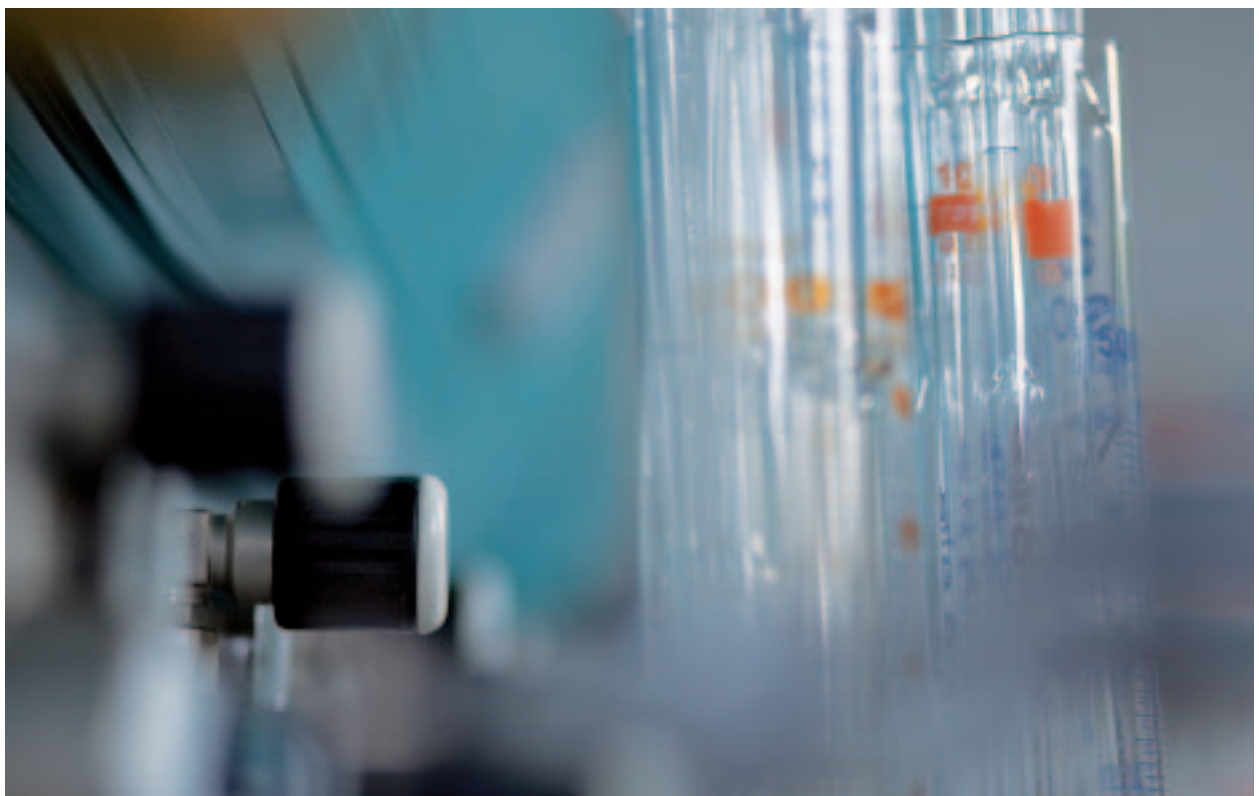
Auf der Morgenstelle 14  
72076 Tübingen, Germany  
Tel: +49 7071 29 74453  
Fax: +49 7071 29 5373

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

# A Health Check for the Earth

**The geoscientists at the University of Tübingen are engaged in practical research into water, soil, raw materials and the dynamic development of planet Earth. Working closely with specialists in other fields, such as chemistry and biology, their objective is to identify options for the future based on analysing the events of the past millennia. In doing so, they can build on a long tradition – geosciences have been an established area of study at Tübingen for more than a century, making a key contribution in this field. Prestigious funding sources and international cooperation continue to be a feature of current projects.**

Industry, agriculture, cars and private households are all sources of pollutants, but what happens to these substances in water and soil in the long term? AquaTerra, a five-year EU research project, is designed to answer that question. Spearheaded by Tübingen's Center for Applied Geoscience (ZAG), 45 teams of researchers from 13 EU member states, Switzerland and Serbia are investigating the impact of extraneous pollutants on sediment, soil and water quality at selected sites along the Danube, Elbe, Ebro, Meuse and Brévilles rivers. These large-scale field studies are devoted to topics such as the extent to which pollutants degrade naturally or become embedded – and finding out the conditions under which they are released again. The primary research objective is to provide a better understanding of processes in the soil-groundwater-river-sediment system. In view of anticipated climate change, this field is particularly important. Increasing temperatures and a changed water balance could release pollutants in sediments which contaminate the



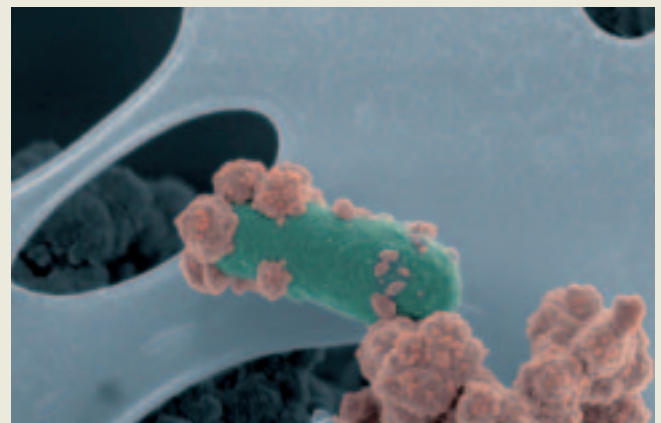
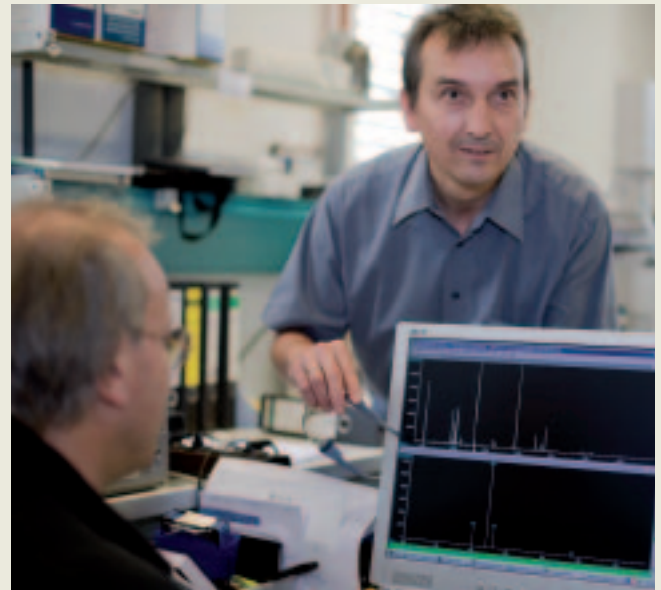


groundwater over a period of decades. The research findings of the ZAG will thus also yield specific recommendations for future action.

### Complex questions for specialist teams

With its expertise in the fields of hydrogeochemistry, environmental mineralogy and chemistry, geomicrobiology, hydrogeology/modelling, geophysics and sedimentology, the ZAG offers broad-based strengths that are primarily focused on complex environmental research. The Center's activities cover the full range from basic research to practical application, while the individual topics extend from biogeochemical processes to tapping geological resources, i.e. mineral raw materials or fossil fuels. Given this profile, Tübingen's scientists are regularly confronted with some of today's most pressing questions – the availability of clean water in various world regions, the commodity supply, climate change and its implications, and last but not least environmental pollution. The outstanding technical facilities at the ZAG are an important prerequisite for this work, with laboratories equipped for high resolution mass spectrometry, electron microscopy, carbon petrography and many other procedures to enable characterisation of rocks and minerals, isotope geochemistry (including dating), pollutant analysis, microbiology and micropaleontology. The international teams of researchers thus benefit from the very best working conditions.

An exceptional feature is the ZAG's sediment core laboratory with spacious core warehouse that allows micropaleontologists, climate researchers and scientists from many other disciplines to achieve in-depth insights. New methods, including complex computer simulation of the material and energy flows in the Earth System, enable scientists to continue pushing back boundaries within the international research landscape. The fact that Tübingen attracts extended visits from ambitious young scientists and numerous



Tübingen's geoscientists can use the latest analytical methods to study the various processes in the upper soil layers. Combining different methods and research approaches often delivers completely new insights.

For example, geomicrobiology provides information about pollutant reactions in soil.

“OUR RESEARCH WILL REVEAL FOR THE FIRST TIME HOW DUST PARTICLES COLLECT IN THE SOIL AND WHAT EFFECT THEY HAVE THERE.”

**Professor Peter Grathwohl**

Center for Applied Geoscience

visiting lecturers from world-leading institutes confirms its status as a top research facility in this field. Geoscientists from the ZAG are sought-after research partners around the world, with one prominent example being the German Research Foundation's Priority Programme to study the Tibetan Plateau, launched in 2008. Led by Tübingen-based geophysicist Professor Erwin Appel, German and Chinese scientists are jointly studying the creation of this high plateau over the past millennia, as well as its climatic development during the last thousands of years. The consequences of human intervention – past, present and future – are also being examined. The Tibetan Plateau is of particular interest to geoscientists because, together with the Arctic and Antarctic, it is a key region of the earth where any changes have far-reaching effects on global environmental development.

#### **A new centre for environmental and georesearch**

The success of interdisciplinary collaboration and a focus on increasingly complex environmental issues have paved the way for even greater integration at Tübingen. The University's planned new Geo and Environmental Center (GUZ) will bring all relevant departments together under one roof, in an ultramodern building complex. At the new centre, the applied geosciences with their core focus on “Water and Environment” will work closely with biogeology (“Evolution”), geodynamics and mineralogy. This is unique in Germany and noteworthy at international level. The outstanding technical facilities already available to the geosciences at Tübingen will be further extended as part of this new development.



Empirical georesearch is a particular strength at Tübingen: Major field studies require extensive sample-taking using special techniques. The rocks, sediments and water samples are then split and prepared for the relevant analysis method – either in

the field, or back at the laboratory. Another special feature of the University of Tübingen is its comprehensive sediment core archive.



The range of subjects within the GUZ will include hydrogeology, hydrogeochemistry, geophysics, sediment geology, geomicrobiology, geocology, micropaleontology, biogeology of vertebrates and invertebrates, general and structural geology, applied mineralogy, environmental mineralogy, petrology, geochemistry and the environmental sciences, with the latter being established at the University for the first time.

Researchers from these different disciplines will join together to analyse the processes by which the Earth progressed from the Ice Age to the age of the greenhouse effect, and to seek efficient ways of protecting water and soil from pollutants. The new interdisciplinary centre could also consider the following questions: How can the greenhouse gas carbon dioxide be stored in underground geological formations? To what extent can geothermal energy be used as a renewable resource? How can we resolve the conflict between protecting the environment and food production, between intensive agriculture and biodiversity as land use changes? Another important area is the development of computer simulations and geological forecasting models for various future scenarios, in order to recommend specific courses of action.

The various partners involved in this ambitious scheme include the Leipzig-based Helmholtz Centre for Environmental Research (UFZ), which is Germany's largest non-university research organisation in this field of study. The Institute is interested in a long-term research partnership with the new centre, focused on hydrological geosciences. The University of Tübingen has already created a highly successful regional competence centre for environmental science and technology in conjunction with the Universities of Hohenheim and Stuttgart. The establishment of a Helmholtz UFZ partner institute in Tübingen will serve to strengthen this facility. At the same time, the University of Tübingen's policy of establishing close ties with leading institutes working in the same field continues its traditional commitment to the geosciences. The existing international collaboration will be further extended in the future.



**Center for Applied Geoscience (ZAG)**

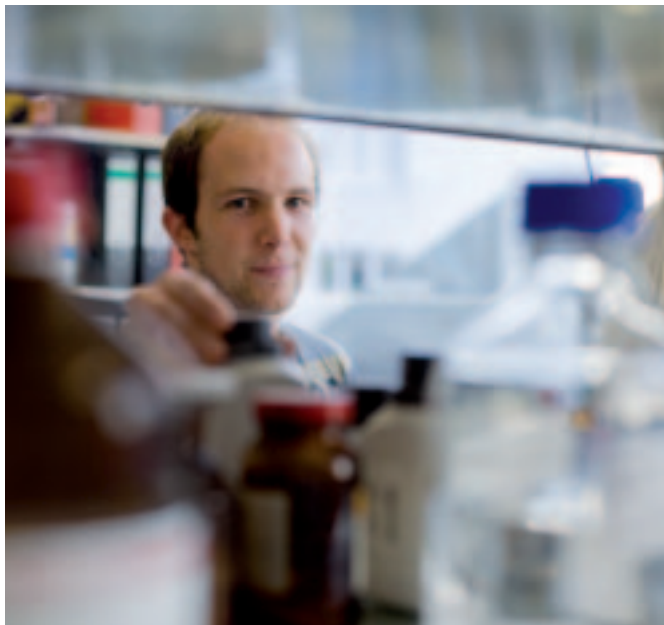
Sigwartstr. 10

72076 Tübingen, Germany

Tel: +49 7071 29 74692

Fax: +49 7071 29 5059

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



# Personalised Medication

**Not everyone responds the same way to medication, even with simple things like aspirin or antibiotics. Such varying responses represent a particularly critical problem in the case of life-threatening illnesses. Different reactions are mostly due to hereditary predisposition, which is why researchers at the Interfaculty Center for Pharmacogenomics and Drug Research are seeking to understand the relationship between individual hereditary traits, predisposition to disease and the way medications work.**

The Interfaculty Center for Pharmacogenomics and Drug Research (IZEPHA) brings together researchers from the Faculty of Chemistry and Pharmacy as well as the Faculty of Medicine, plus physicians from Tübingen University Hospital and Robert Bosch Hospital in Stuttgart. With significant funding from the Robert Bosch Foundation and close links with other institutions in the region, the Center participates in both international and national EU-funded projects.

The researchers' vision is personalised medication for individual patients. To take one example, a specific enzyme plays a role in breaking down the active agents of tamoxifen, which is used in hormone therapy for breast cancer. The patient's genome determines which variant of this enzyme is found in the body, which in turn decides whether treatment succeeds or fails. If patients can be screened in advance using a genetic test, this knowledge would save women and physicians significant time in identifying appropriate treatment options – and could even save lives. Researchers are also pursuing similar strategies with regard to other oncological diseases (such as childhood leukaemia), metabolism-related vascular diseases and inflammatory intestinal diseases.

## **The answer lies in the genome**

The starting point for this research is identifying genes, and individual gene variants, that play a part in the emergence of illness. Based on this knowledge, scientists hope to develop effective analytical methods for practical application in medicine. The identified target genes and lead structures should also make it possible to develop new agents and medications that directly intervene in the pathogenesis process. At the forefront of this research is the idea of personalised therapy, which has already shown tremendous promise in a number of areas.

Facilities available to the scientists for conducting basic research include an exten-

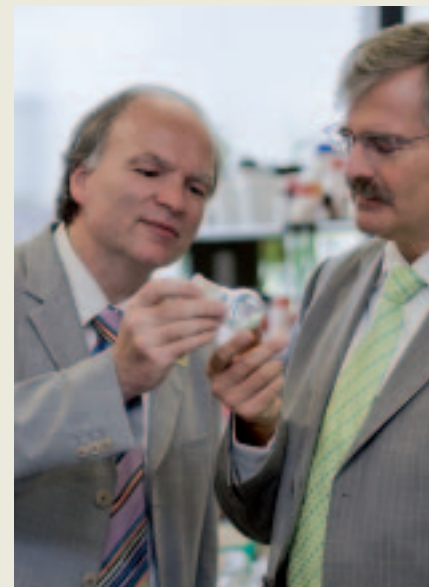
“KNOWING HOW GENES WORK  
HELPS US TO UNDERSTAND  
WHY PEOPLE RESPOND SO  
DIFFERENTLY TO MEDICINES.”

**Professor Matthias Schwab**

Member of the Executive Committee, IZEPHA

sively equipped “mouse clinic”. Special target genes, the way they work and the extent to which they can be influenced can all be studied in living organisms. The identified mechanisms are then investigated in more detail in cellular systems, with the results being used as input for developing improved pharmacotherapy for patients.

Ultimately, all this research work is geared towards application in clinical practice. Like any new generation of medical procedures, pharmacogenomics must first demonstrate its efficacy and harmlessness in carefully designed and properly executed trials. Designing and conducting such cohort studies on selected patient groups is all part of the research work at the IZEPHA.



**Interfaculty Center for Pharmacogenomics and Drug Research (IZEPHA)**

Auf der Morgenstelle 8

72076 Tübingen, Germany

Tel: +49 7071 29 76781

Fax: +49 7071 29 2476

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

# Physicists in the Realm of Quanta



**Quantum physics is a science of extremes: it involves the tiniest components of matter and favours temperatures that approach absolute zero. The realm of quanta is governed by its own laws that enable phenomena such as superconductivity and superfluidity, which seem to contravene the classic laws of physics. The purpose of the Center for Collective Quantum Phenomena and their Applications at the University of Tübingen is to investigate these extreme states. Taking this work further by successfully generating new quantum states has the potential to yield completely new technical possibilities, such as new quantum sensors or even a quantum computer.**

The Center for Collective Quantum Phenomena and their Applications (CQ) focuses on three key research areas in modern physics: the quantum physics of atoms, quantum physics of solid state bodies, and nanotechnology. Since its foundation in July 2007, researchers at the CQ have been engaged in the controlled production of quantum matter in which individual atoms or electrons lose their autonomy and behave collectively in accordance with the laws of quantum physics. Clusters of several tens of thousands of atoms indicate the dimensions involved in nanophysics, while also defining the field in which solid state physicists operate. Collaboration in these areas is particularly beneficial where the properties of quantum matter are deliberately manipulated. The three different disciplines of physics complement each other perfectly with regard to their ability to manipulate and control matter, making exciting new strategies possible. The huge potential benefits for basic research and applications in quantum physics extend far beyond the boundaries of these fields – and would be inconceivable without this collaborative approach. The scientists at the CQ also receive valuable input via their close collaboration within CRC TR 21 with specialist colleagues from the Universities of Ulm and Stuttgart, as well as the Max Planck Institute for Solid State Research.

## **Research into super gas**

Central to this research activity are fundamental questions about quantum matter, primarily involving the study of quantum gases and nanostructured solid state systems. A huge range of physical phenomena are already familiar – superfluidity, for example, along with superconductivity, and Bose-Einstein condensation, where atoms are transformed into a super-gaseous state.

Uncovering more effects of this kind calls for the design of systems that enable dynamic control within a precisely defined environment and geometry. Of special scientific interest is the coupling of atoms, light and solid state nanostructures. Developing new measuring instruments is the next task for the Center for Collective Quantum Phenomena and their Applications in order to get closer to this objective. Instrument sensitivity needs to be extendable right up to the quantum limit. If this step is successfully taken, completely new potential applications become possible. The spectrum ranges from highly sensitive acceleration sensors and biological and chemical probes to integrated atomic clocks and quantum computers.

It will be readily apparent that these ambitious plans require an intensive exchange between the disciplines involved. Each discipline, and in some cases each individual research group, has painstakingly acquired its own insights into quantum phenomena. Accordingly, researchers profit enormously from the experience of different groups and institutions. Ambitious young scientists, post-docs, and doctoral candidates at other universities and research institutions around the world offer the CQ outstanding scope for enhancing our knowledge of quantum physics.

“OUR DEVELOPMENT WORK  
WILL ALLOW ATOMS AND  
SOLID STATE BODIES TO TAKE  
QUANTUM TECHNOLOGY TO  
A NEW LEVEL.”

**Professor József Fortágh**

Institute of Physics



**Center for Collective Quantum  
Phenomena and their Applications  
(CQ)**

Auf der Morgenstelle 14  
72076 Tübingen, Germany

Tel: +49 7071 29 76270

Fax: +49 7071 29 5829

[www.cq.physik.uni-tuebingen.de](http://www.cq.physik.uni-tuebingen.de)

# Africa: Cradle of Civilisation



**The cultural evolution of the first hominids into modern man is one of the key research areas at Tübingen's Institute for Pre- and Early History. From the early origins 2.5 million years ago through to the Lower Palaeolithic Age, scientists are gradually piecing together a fascinating development that spans several continents.**

For many decades, the scientific consensus was that the evolution of modern man took place simultaneously in different parts of the world. But the 1990s yielded mounting evidence that the various waves of expansion all had a common origin in Africa. This new insight gives rise to one particularly compelling question: What was so special about the ancestors of *Homo sapiens* that allowed them to displace all other hominids and colonise the entire planet?

A joint project in this field by the University of Tübingen, the Heidelberg Academy of Sciences and Humanities and the Frankfurt-based Senckenberg Research Institute has a special focus on the significance of cultural aspects. Perhaps the Oldowan culture that existed 2.5 million years ago in Ethiopia provided the key evolutionary advantages? Their stone tools are the oldest human cultural artefacts found to date. Similar findings in Georgia, which are 700,000 years younger, make it possible to recreate the migratory movements of early humans.

In the context of changing environmental conditions and biological foundations, the researchers led by Tübingen's Professor of Prehistory, Nicholas Conard, analyse archaeological finds from all corners of the globe. They are looking for common elements that challenge or support the theory that Africa is the key continent. The results of a global DNA study have already bolstered the view that mankind does indeed have a shared African origin.

In particular, researchers are searching for evidence of events that necessitated the development of cultural skills. If it can be demonstrated that early humans were only able to survive climatic and environmental changes by acquiring new abilities, that would be an important aid to assessing the role of culture in the evolutionary process. By taking this approach, it may also be possible to establish when humans made the transition from biological to cultural beings, and what triggered this process.

## **Research Center on The Role of Culture in Early Expansions of Humans (ROCEEH)**

Rümelinstr. 23

72070 Tübingen, Germany

Tel: +49 7071 29 72416

Fax: +49 7071 29 5714

[www.rocee.net](http://www.rocee.net)





# Perspectives in Linguistics

**The Tübingen Center for Linguistics brings together researchers into general and theoretical linguistics with those who specialise in language-specific studies and computer linguistics. It also ties in experts in psychology, neurology, the cultural sciences and information technology. Linguistics research at the University of Tübingen thus bridges the divide between the humanities and natural sciences to open up new perspectives.**

Language is a unique distinguishing feature that separates humans from other higher-developed animals. Despite the fact that humans master their own mother tongue with apparent ease and can use language to interact in a huge range of settings, little is known about the extremely complex processes this entails. Close interdisciplinary collaboration is vital in order to drive forward basic research in this field. At Tübingen's Center for Linguistics (TüZLi), it has been possible to assemble all the necessary research competencies under one roof.

The research team includes linguists who specialise in individual languages, such as English, German and Romance and Slavic languages, experts in general and theoretical language studies, as well as computer linguists. Their focus is on questions relating to

linguistic structures, language acquisition, processing and interpretation. This interdisciplinary work is supplemented by collaboration with researchers from the faculties of biology, information sciences, cognitive sciences, cultural sciences and medicine.

The main spotlight at the TüZLi is on the link between language, culture and cognition, which lies at the heart of our ability to hear acoustic signals and ascribe meaning to them within fractions of a second. The objective is to examine the various aspects of the automated processes involved and to develop an integrated perspective on language as a natural and cultural phenomenon. The strategy employed for this purpose combines humanist approaches with the latest language technologies, backed by ideas borrowed from the cognitive and neurological sciences.

TüZLi is able to access a rich repertoire of methods for its research work. The Tübingen-based linguists have formidable expertise in the computer-assisted collection, analysis and storage of extensive linguistic data sets. These include large, electronically accessible text collections, data on language acquisition, and experimental data.

Twenty years of continuous funding support via linguistic Collaborative Research Centres CRC 340 and 441 are proof of Tübingen's exceptional success in the field of joint language research and will drive this work forward in the future.

## **Tübingen Center for Linguistics (TüZLi)**

Wilhelmstr. 50  
72074 Tübingen, Germany  
Tel: +49 7071 29 72952  
Fax: +49 7071 29 4253  
[www.tuezli.uni-tuebingen.de](http://www.tuezli.uni-tuebingen.de)

# Answers for Yesterday, Today and Tomorrow



**Tübingen has been strongly associated with the humanities for more than 300 years. Great minds have studied, researched and taught here, including Schelling, Hegel and Hölderlin. More recently, Lord Dahrendorf founded the Tübingen Institute for Sociology, Theodor Eschenburg became Tübingen's first professor of political sciences, and Walter Jens established rhetoric as a major subject. Great importance is still attached to the humanities today: the 2006 Funding Ranking compiled by the German Research Federation (DFG) saw Tübingen achieve an excellent second place, while actually coming first for external funding. Literature and linguistics, archaeology, history and the cultural sciences are all particularly prominent.**

Ever since the philosophers of the Enlightenment and the movement of German Idealism, Tübingen and the academics who work here have enjoyed an outstanding reputation. The University of Tübingen is committed to maintaining this centuries-old tradition by continuing to set global standards in the humanities. One example is linguistics, which is no longer considered as merely a part of philology. Rather, it has evolved into an independent discipline in the area of cognitive sciences. The focus of current research is on language acquisition, mental representation and processing. The linguistic disciplines represented at the University of Tübingen are notable for their open approach to collaboration and a thriving interdisciplinary network. The most obvious manifestation of this are Collaborative Research Centre 441, "Linguistic Data Structures: Theoretical and Empirical Principles of Grammar Research", and the Tübingen Center for Linguistics.

## Researching the origins

By joining forces with the natural sciences, the Department of Ancient History at the University of Tübingen has taken a highly successful step forward. The Center for Archaeological Science (ZNA) makes a number of innovative research strategies possible, particularly in the fields of archaeological botany, archaeological zoology, geoarchaeology, paleoanthropology and archaeometry. Tübingen's archaeologists engage in research at many sites worldwide, including Turkey, France, the United Arab Emirates, Syria, South Africa, Spain and Cuba. Digs also take place closer to home in Germany, where one team of archaeologists unearthed several ivory artworks dating from the Ice Age when re-excavating the Vogelherd cave in Lonetal. The 35,000-year-old carvings are among the oldest works of figurative art ever found. A miniature but fully intact and richly detailed mammoth sculpture measuring just 3.7 centimetres in length, found in 2007, was particularly spectacular. Global media atten-

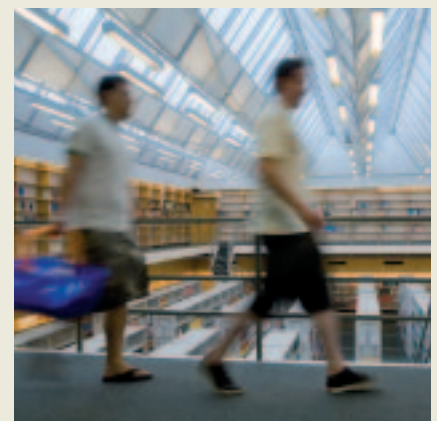
tion was also triggered by the recommencement of excavations in Troy. After a 50-year break, international research groups are again working at the legendary city to gain new insights into settlement activity and the different building phases. The researchers are also studying the way of life, illnesses, nutritional habits and life expectancy of Troy's inhabitants, as well as the flora and fauna in the area.

Tübingen's archaeologists maintain close contacts with other universities and disciplines, especially the geosciences, to ensure that they remain at the forefront of academic opportunities in their field. In 2004, a geoarchaeological research group was set up in Tübingen, whose members have since grown to include specialists from many German and international research institutions. In addition to promoting academic exchange, this group seeks to support the training of junior academics.

#### Interdisciplinary historians, combined Asian/Oriental research

The research work undertaken by the University of Tübingen's Historical Seminar highlights the importance of interdisciplinary discourse in the humanities. The breadth of this subject area leads to many points of contact with neighbouring disciplines, such as philosophy, theology, the history of law, economic history, the history of medicine, empirical cultural sciences, political sciences, sociology, modern languages, ancient history and geography. In addition to joint research projects and interdisciplinary lectures, this cross-disciplinary collaboration involves participation in DFG Research Training Groups and Priority Programmes, as well as the lead role played by Tübingen historians in Collaborative Research Centre 437, whose remit is "War Experiences. War and Society in the Modern Era".

Joint research is also the objective of the Asia Orient Institute, founded in 2008. Creating this alliance between Oriental Studies, Ethnology, Indology, Japanology, Sinology and Korean Studies creates a broader foundation for the research activities that commenced in Tübingen 500 years ago. The Institute has a special focus on history, the history of science and the interaction between religion, politics and society. Its ethos and comprehensive interest in the cultures of the Near East to Far East make the AOI a unique partner and a valued contributor to international research projects.



#### **CRC 441 – Linguistic Data Structures**

Nauklerstr. 35  
72074 Tübingen, Germany  
Tel: +49 7071 29 77151  
Fax: +49 7071 29 5830  
[www.sfb441.uni-tuebingen.de/  
index-engl.html](http://www.sfb441.uni-tuebingen.de/index-engl.html)

#### **Center for Archaeological Science (ZNA)**

Rümelinstr. 19–23  
72070 Tübingen, Germany  
Tel: +49 7071 29 72130  
Fax: +49 7071 29 4465  
[www.urgeschichte.uni-tuebingen.de/  
index.php?id=380&L=1](http://www.urgeschichte.uni-tuebingen.de/index.php?id=380&L=1)

#### **Asia Orient Institute (AOI)**

Wilhelmstr. 90  
72074 Tübingen, Germany  
Tel: +49 7071 29 76985  
Fax: +49 7071 55 1486  
[www.aoi.uni-tuebingen.de](http://www.aoi.uni-tuebingen.de)



# Test Track for Operating Teams

**Tübingen University Hospital, the University's Faculty of Medicine and the University of Stuttgart set up an experimental operating theatre to enable optimisation of operating theatre management and the testing of new procedures, technologies and equipment. Backed by financial support from the State of Baden Württemberg and opened in 2008, the facility also offers other universities, non-university research institutions and business enterprises a platform for research, practical tests and training.**

The operating theatre is the heart of any hospital. The safe and efficient functioning of the operating theatre therefore often has a decisive impact on business success. Up until recently, though, there was nowhere to study, try out and analyse operating procedures and the related infrastructure under realistic conditions in a laboratory environment.

In response to this need, the University of Tübingen created one of the world's first experimental operating theatres in 2006. Housed in an industrial building, it comprises an entire operating suite covering more than 1,300 square metres, with two operating theatres, training rooms and equipment rooms, fitted out with all the relevant medical technology, instruments and building infrastructure (such as air conditioning).

One of the research team's goals is to optimise work processes within operating theatre teams. In the experimental facility, real-world conditions can be simulated, documented and analysed. Areas of study include basic equipment issues, such as system cabling, which can represent a trip hazard for theatre staff and also endanger patients. Manufacturers can examine these and other matters under realistic conditions – something that is particularly beneficial when developing new equipment and instruments. The experimental operating theatre also allows technical aspects such as air quality, lighting and the ergonomics of surgical instruments to be put to the test.

The team works closely with all surgical disciplines at Tübingen University Hospital. Additional cooperation partners include the medical equipment industry, architects, engineers, organisations like the Association of German Engineers (VDI) and non-university research institutions.

All these groups share a commitment to leveraging their specific expertise to improve safety for all future patients and thus enhance their recovery prospects.

## **Operating Theatre Simulation Centre and Ergonomics**

Ernst-Simon-Str. 16,  
72072 Tübingen, Germany  
Tel: +49 7071 97 7320  
Fax: +49 7071 97 73229

[www.experimental-op.de/en/index.pml](http://www.experimental-op.de/en/index.pml)

# Providing Images for Research

**The Laboratory for Preclinical Imaging and Imaging Technology at the Medical Faculty and the Department of Radiology focuses on the application and development of medical imaging procedures such as magnetic resonance tomography (MRT) and positron emissions tomography (PET). A professorship funded by the Swiss-based Werner Siemens Foundation is attached to the laboratory. A further objective of basic biomedical research is to study physiological events and pathological changes with the aid of imaging diagnostics.**

The objective is clear: to use the latest imaging procedures to diagnose tumours, Alzheimer's, Parkinson's disease and impending vascular occlusion at an earlier stage and with greater reliability, without resorting to invasive procedures. The main benefit would



be a significantly greater chance of treating these diseases effectively.

To achieve this, the scientists at the Laboratory for Preclinical Imaging and Imaging Technology seek to answer biological and medical questions with the help of engineering. New technologies like PET/MRT are tested in a variety of ways, including animal testing, to allow earlier detection and more precise localisation of tumours, while also making it easier to distinguish tumours from healthy tissue.

This research work, which enjoys an international profile, yields benefits for basic biomedical research; for clinical diagnostics in the fields of oncology, neurology, cardiac and vascular disease, and immunology; and for manufacturers of imaging equipment. Combining clinical and preclinical research projects under one roof enables faster and more effective introduction of new therapeutic methods into the patient care environment.

The Laboratory collaborates highly successfully with a number of international research institutions, primarily in the USA. As one of three reference laboratories for US-based equipment manufacturer Siemens Preclinical Solutions, scientists from all over the world visit Tübingen to attend workshops. The Laboratory possesses many state-of-the-art systems for non-invasive imaging of small laboratory test animals. The initiators summed up the facility's visionary concept in the phrase: "From mouse to man – from bench to bedside".

**Laboratory for Preclinical Imaging and Imaging Technology of the Werner Siemens Foundation**

Röntgenweg 13  
72076 Tübingen, Germany  
Tel: +49 7071 29 83427  
Fax: +49 7071 29 4451

[www.preclinicalimaging.org](http://www.preclinicalimaging.org)

# Qiáliáng – Bridge to Asia

**Japan, China, Taiwan – these three countries are the focus of international research projects in which the University of Tübingen plays a leading role. In the case of China and Japan, activity is based in the respective countries: the European Center for Chinese Studies is located at Peking University, while Doshisha University in Kyoto is home to the Center for Japanese Language and Culture. Tübingen hosts the European Research Center on Contemporary Taiwan, which has proved equally successful. It provides European postgraduates with a platform for academic dialogue and conducting research on Taiwanese politics, economics and society.**



The time has long since passed when Sinology was dismissed as an exotic irrelevance. The political opening of China and its subsequent emergence as an economic powerhouse have made Chinese Studies a popular subject, with employers competing for every graduate. The University of Tübingen was among the first to recognise this trend and played a pioneering role within Europe. To maximise the practical value of its Chinese Studies programme, Tübingen's specialists established the European Center for Chinese Studies (ECCS) at Peking University in 2001. In conjunction with the University of Copenhagen, Tübingen's cultural scientists initiated a collaborative research project with the Beijing-based Faculty of Philosophy, which has since attracted additional partners. Today, the Universities of Würzburg and Frankfurt are also part of the ECCS team, and the University of Turku (Finland) is set to join soon.

Each year, some 180 European students of Chinese Studies spend a semester in Beijing at the ECCS. For Tübingen students enrolled in the BA programme in Sinology, a 4th semester at the ECCS in China is a mandatory part of the curriculum, with the focus being on intensive, practical language training. Language teaching has always been a top priority at Tübingen, enjoying an excellent reputation for quality, and it has become a key element in the wider didactic approach to Sinology studies.

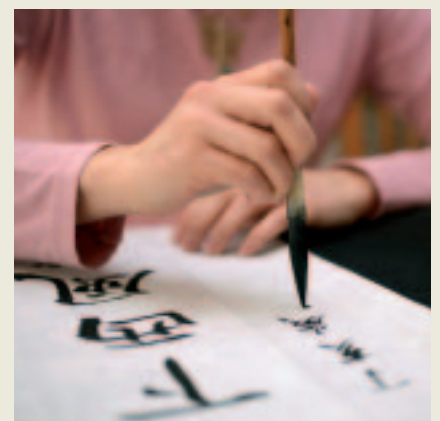
In addition to providing courses for European students, the Center's activities include building relationships with Chinese academics. Contact is particularly close with the Centre for German Studies at Peking University and the Chinese-German Centre for Science Promotion, jointly sponsored by the National Natural Science Foundation of China (NSFC) and the German Research Foundation (DFG). This will facilitate the development of the ECCS as the focus of Sinology and China-related research.

### Taiwan expertise in Europe

The European Research Center on Contemporary Taiwan (ERCCT) specialises in another aspect of East Asian studies. This new Center for promoting contemporary Taiwan studies was founded in 2008 and is a joint project between the University of Tübingen and Taiwan's Chiang Ching-kuo Foundation for Scholarly Research. Situated in Tübingen, the ERCCT primarily aims to bring together Europe's top up-and-coming researchers in one location. Postgraduates and doctoral candidates from all over Europe who are engaged in empirical studies of Taiwan's politics, economics and society come to the ERCCT to prepare for their field research in East Asia. A core element is close collaboration with a number of highly regarded Taiwanese universities and the Academia Sinica in Taipei. The vision for the future is that the Center will evolve into a platform for intensive dialogue between European and Taiwanese researchers.

### Japanese studies in Japan

The University of Tübingen set up the Center for Japanese Language and Culture at Doshisha University, Kyoto, in 1993, making it the first satellite campus of a German university in Japan. The Center is intended to benefit Tübingen students of Japanology, who can gain first-hand experience of the Japanese language and culture at an early stage. In addition, special one-year courses on intercultural competency have been designed to meet the needs of graduates.



### European Research Center on Contemporary Taiwan (ERCCT)

Wilhelmstr. 19

72074 Tübingen, Germany

Tel: +49 7071 29 72717

Fax: +49 7071 29 5733

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

# Science Needs Cooperation



**Research in all areas at the University of Tübingen takes place at the highest international level. A key contributor here is the broad scope of subjects covered. By overcoming the former strict separation between the different branches of the humanities and natural sciences, enormous mutual benefits accrue.**

**The University aims to support and accelerate this process by adopting radical new structures.**

The broad spectrum of disciplines is both a distinguishing feature of Tübingen and one of its special strengths. Never before in human history has the sum of knowledge grown as quickly as today. The University is leveraging this dynamism to develop new and exciting fields of research at the interfaces between traditionally separate disciplines. The areas of research presented in this brochure are proof of how well this cross-disciplinary interaction is already working in practice. These top quality programmes now contribute significantly to Tübingen's academic profile. The University also continues to monitor the latest developments and incorporate them into its existing profile. New interdisciplinary structures are planned that will prepare the way for additional innovative research fields. An innovation pool has already been created that

helps researchers to realign existing activities or establish new fields of investigation.

Over the medium term, a Center for Research Management will stimulate additional growth, help researchers to obtain external funding and support them in the management of large research partnerships. In the future, translating academic findings into practical applications with minimum delay will also become increasingly important. A special technology transfer department is therefore being created to make the most efficient commercial use possible of research results. In addition, applied research centres are planned for biomaterials, medical technology, environmental and resource utilisation. The University also supports the established research areas to ensure that they can remain competitive in the international academic arena.

Another key factor for academic excellence is the systematic training and development of junior academics. To promote creativity, transparency, quality and interdisciplinary collaboration, the University of Tübingen plans to offer its doctoral candidates structured programmes of study based on the best international practice. This will involve setting up a Graduate Academy with four major divisions: medicine; natural sciences; humanities and cultural sciences; legal, economic, social and behavioural sciences. Here again, these measures are intended to ensure that the University retains its position among the leading international institutions.





# A Global Network

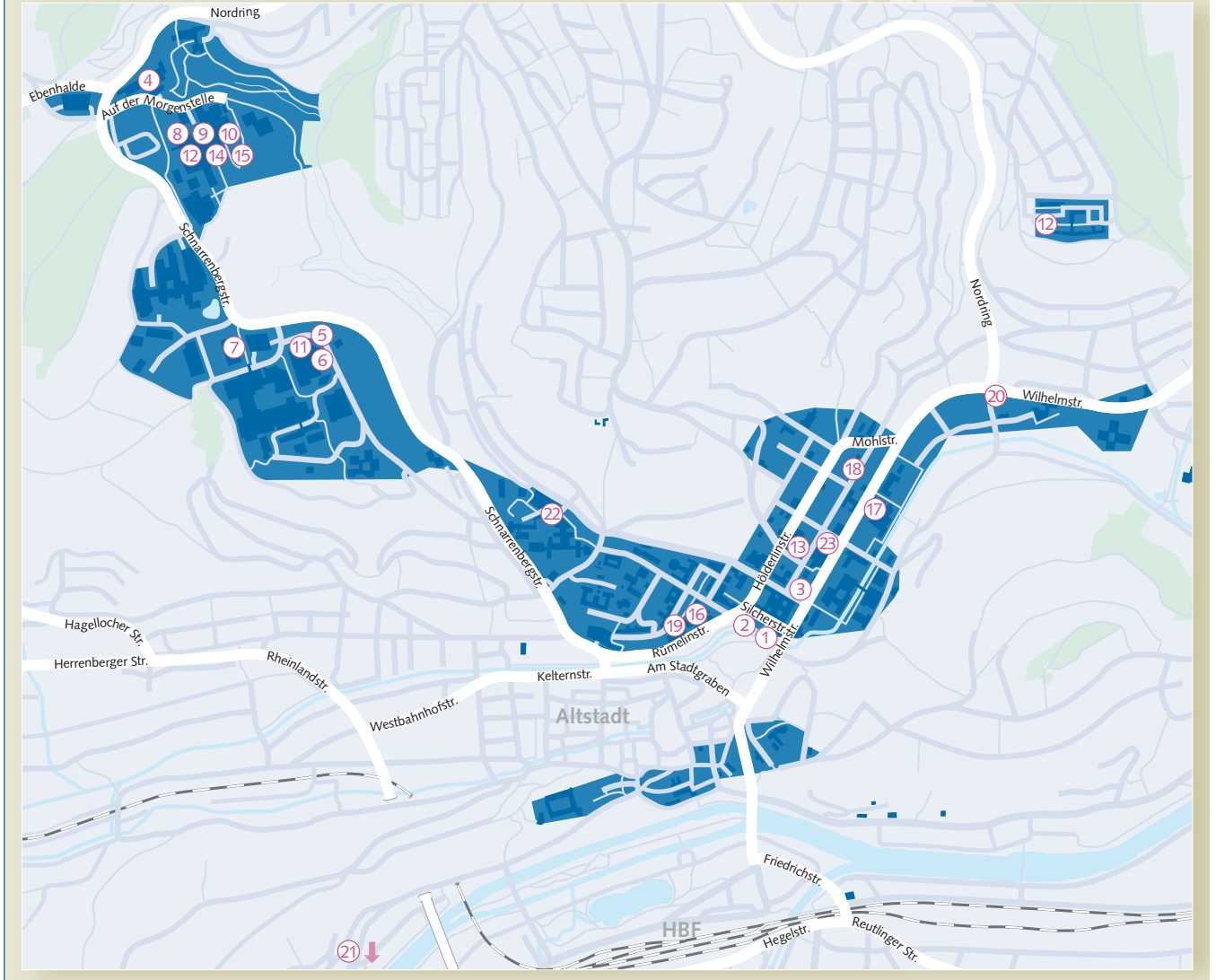
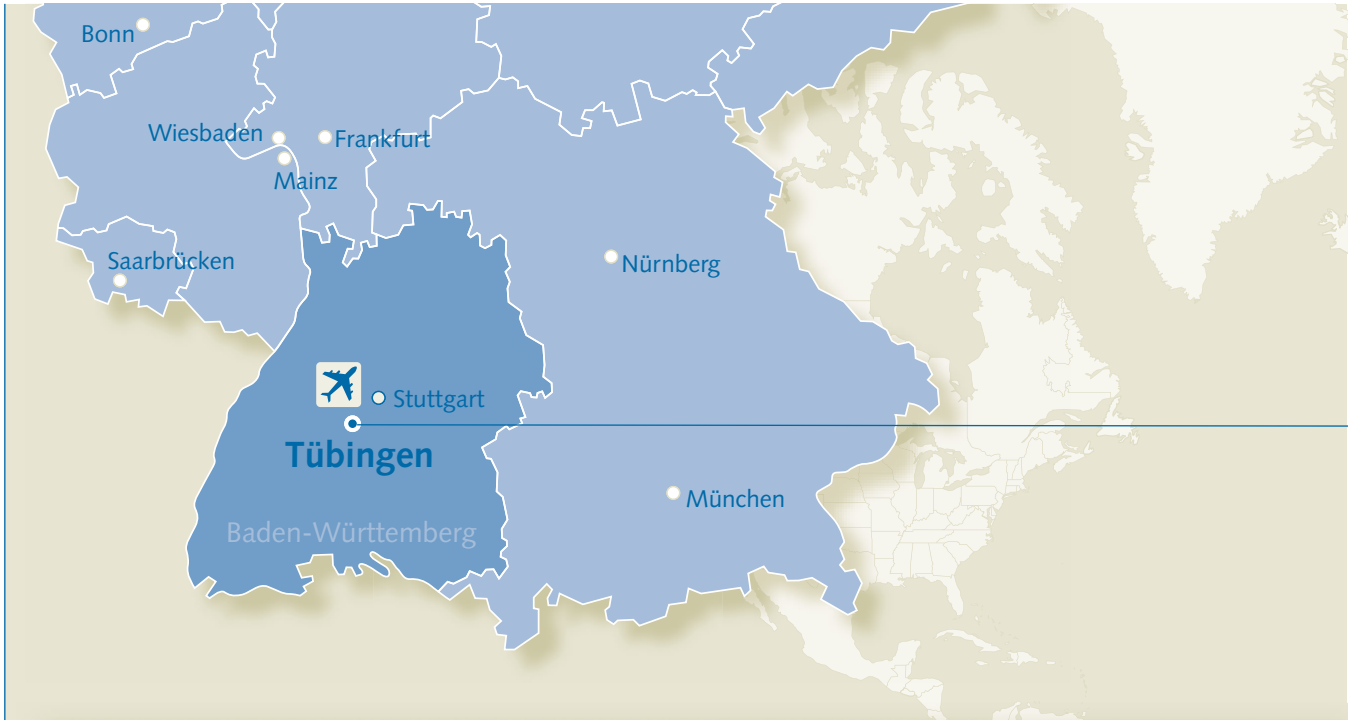
**The increasing complexity of research topics means that individual academics or research groups working in isolation have little chance of achieving success. Worldwide, new knowledge is continuously being added through collaborative partnerships. Tübingen has established itself here as an important “node” in the global academic network.**

The University of Tübingen initiates and engages in joint research activities not only within its own campus, but also worldwide – hence some teams are just a few hundred metres from each other, while others work on the far side of the globe, thousands of kilometres away. Partners include universities in Germany, Europe, the USA and many other countries. The University also works with non-university research institutions, as well as regional, national and international funding bodies.

Similarities of direction and geographic proximity naturally give rise to particularly close relationships within the city of Tübingen. Key examples include the two Max Planck Institutes – for Developmental Biology and Biological Cybernetics – and the Leibniz Kolleg for Empirical Educational Research. All three have worked closely together for years with various departments at the University on joint projects. Based on the insight that proximity can greatly facilitate collaboration, the Helmholtz Institute plans to establish non-university institutes in Tübingen to carry out environmental research and to study dementia.

In the field of archaeology, the University collaborates particularly closely with the internationally renowned Senckenberg Research Institute (Frankfurt) and Mannheim-based Curt-Engelhorn Center for Archaeometry. The University's research network in medicine and the biosciences is also extensive, including the Dr. Margarete Fischer-Bosch Institute for Clinical Pharmacology in Stuttgart, the Natural and Medical Science Institute (NMI) at the University of Tübingen (which is supported by its own foundation) and the Hertie Foundation.

Tübingen's East Asian research activities provide further evidence of the wide-ranging partnerships that have been created. Academic alliances with many other leading international universities and institutes are planned for the future.





# Overview

- 1 President's Office, University Administration

---

- 2 Research Transfer

---

- 3 International Relations Office

---

- 4 Centre for Plant Molecular Biology (ZMBP)

---

- 5 Hertie Institute for Clinical Brain Research (HIH)

---

- 6 Werner-Reichardt-Centre for Integrative Neurosciences (CIN)

---

- 7 Interfaculty Institute for Biochemistry (IFIB)

---

- 8 CRC 766 – The Bacterial Cell Envelope: Structure, Function and Infection Interface

---

- 9 CRC TR 34 – Pathophysiology of Staphylococci in the Post-Genome-Era

---

- 10 CRC 685 – Immunotherapy: Molecular Basis and Clinical Application

---

- 11 CRC 773 – Therapy Resistance of Solid Tumours and How to Overcome it

---

- 12 Kepler Center for Astro and Particle Physics

---

- 13 Center for Applied Geoscience (ZAG)

---

- 14 Interfaculty Center for Pharmacogenomics and Drug Research (IZEPHA)

---

- 15 Center for Collective Quantum Phenomena and their Applications (CQ)

---

- 16 Research Center on The Role of Culture in Early Expansions of Humans (ROCEEH)

---

- 17 Tübingen Center for Linguistics (TüZLi)

---

- 18 CRC 441 – Linguistic Data Structures

---

- 19 Center for Scientific Archaeology (ZNA)

---

- 20 Asia Orient Institute (AOI)

---

- 21 Operating Theatre Simulation Centre and Ergonomics

---

- 22 Laboratory for Preclinical Imaging and Imaging Technology (Werner Siemens Foundation)

---

- 23 European Research Center on Contemporary Taiwan (ERCCT)

---

**The President**  
**Eberhard Karls University of Tübingen**

Wilhelmstr. 5  
72074 Tübingen  
Germany  
Tel: +49 7071 29 72513  
Fax: +49 7071 29 5300

**Research Transfer**

Wilhelmstr. 5  
72074 Tübingen  
Germany  
Tel: +49 7071 29 76453  
Fax: +49 7071 29 5990

**International Relations Office**

Wilhelmstr. 9  
72074 Tübingen  
Germany  
Tel: +49 7071 29 72938  
Fax: +49 7071 29 5404



PUBLISHED BY:

Eberhard Karls University of Tübingen

The President

Wilhelmstr. 5

72074 Tübingen

Germany

Tel: +49 7071 29 72513

Fax: +49 7071 29 5300

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

IMAGES:

Blickpunktstudios Inga Paas und Christoph Reichelt

Eberhard Karls Universität Tübingen

Fotodesigner Stefan Müller-Naumann

imagesource

iStockphoto.com

© PLEON 2008