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Medicine

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Human medicine in Germany

Studying human medicine in Germany – there is hardly any other career plan that is more flexible and more reliable at the same time. For there is a wealth of opportunities open to graduates in medicine: besides employment in a hospital or in general practice, there are also jobs in research, in industry, in the public health service or in management consulting.

The practical and high-quality training at German universities enjoys an excellent reputation internationally and is integrated into a network of hospitals, universities, research institutes and business enterprises. Teaching, patient care and research therefore form an integrated whole from which everyone involved benefits – especially the students.

The state examination and the doctorate leading to the title of “Dr. med.” are by no means the only academic training opportunities in Germany. Via a multitude of international master’s or doctoral programmes, students of human medicine are able to specialise and enter very different fields of research, whether in basic research, clinical research, the pharmaceutical industry or in the medical engineering sector.

This magazine is intended to provide an overview of university medicine in Germany for anyone abroad who is interested in study-

ing medicine or in pursuing academic or medical further training. The first articles deal with the importance and performance of university hospitals, health centres and medical competence networks.

The higher education landscape and various degree course concepts are presented under the heading “studying medicine”. Foreign students are also given tips on how to get a place at university and the best way to commence studying.

Another section is dedicated to doctoral studies and international post-graduate programmes, most of which are conducted entirely in English and guarantee special support for foreign graduates or doctoral students both in issues related to their studies and in general issues. These programmes generally lay the foundations for an academic career.

Finally the excellent career prospects of graduates in human medicine on the German labour market are examined. The development which is becoming apparent for the coming years is likely to open up good job opportunities also to foreign graduates and to all foreign students who are considering the idea of staying in German after finishing their degrees.

We hope you enjoy reading the magazine!

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Everything under one roof

University medicine is the backbone of Germany's health care system. How this is to be understood is best seen from the structure and function of a university hospital. Medical training, medical research and patient care take place virtually under one roof there, as can be shown from the example of the University Hospital Regensburg.



This is top-class medicine: in 2009 17 hearts, 61 livers and 64 kidneys were transplanted at the University Hospital Regensburg, and bone marrow was transplanted 109 times.

The University Hospital Regensburg is situated on extensive premises in the south of the city in eastern Bavaria, right next to the University of Regensburg. Founded about 20 years ago, it is one of the most modern and most efficient hospitals in Germany and has dedicated itself to high-performance medicine. "Appendectomies and other standard operations are conducted at the hospitals that cooperate with us," says Professor Bernhard Weber, dean of the Faculty of Medicine, describing the orientation of the hospital. "We specialise in serious progressions of diseases and sophisticated diagnostics." A development of this type in the field of high-performance medicine is only possible because the University Hospital Regensburg

is closely linked with hospitals in the region providing other health care levels.

1.7 million patients per year

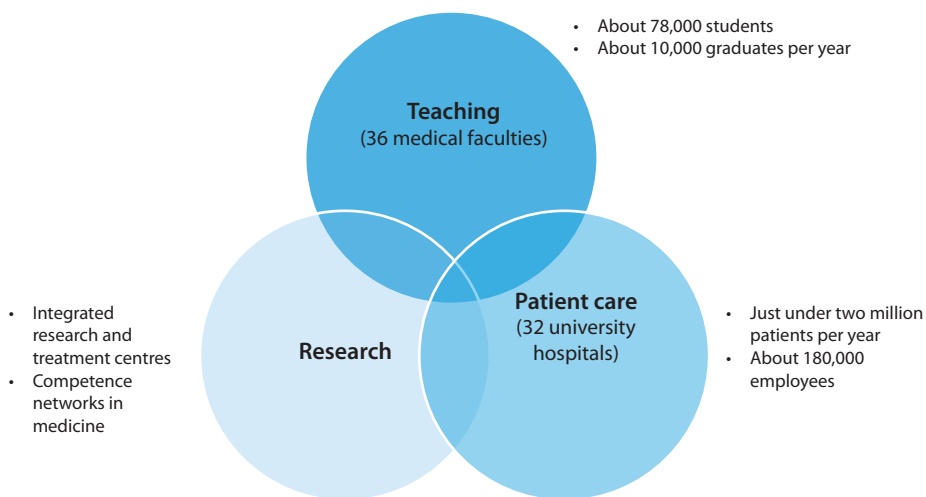
Rüdiger Strehl, secretary-general of the Association of University Hospitals in Germany (Verband der Universitätsklinika Deutschlands – VUD), expresses it very clearly: "Without university hospitals there would not be a German health care system functioning at such a high level." They cover ten percent of all hospital treatment in Germany and are an important employer of medical practitioners. They employ a total of over 26,000 doctors and scientists. "About 1.7 million patients are treated as in-patients at the university hospitals per year, with

about four times as many being treated as out-patients," Rüdiger Strehl says, substantiating the situation with the relevant figures.



Professor Bernhard Weber is the dean of the Faculty of Medicine at the University of Regensburg.

Tasks of university medicine



Taken together the university hospitals provide the entire spectrum of medical services. Each one has its own specialist fields. In Regensburg they are transplantation medicine and intestinal and metabolic diseases. They are complemented scientifically by special research expertise in immunopathology and immunotherapy and in integrated functional genomics. "It makes sense to concentrate highly specialised procedures in just a few locations," Rüdiger Strehl emphasises, "in order to bring together expensive structures and specialists there."

State-of-the-art, high-tech equipment

What is also important is the fact that the university hospitals function as role models for other hospitals. Rüdiger Strehl says, "New procedures are often developed at university hospitals. This makes them strong in specialised operations, such as in the field of neurosurgery or in the treatment of special progressions of diseases." In Regensburg, for example, a so-called "pacemaker for pain" is used to treat patients with chronic back pain. This is a neurostimulator which is unique in the world and registers how the patient's body position changes and automatically adjusts the stimulation in order to provide adequate pain relief.

To be able to provide patients with the highest level of care and to take research forward, "more than € 100 million are invested in high-tech equipment at university hospitals every year," VUD secretary-general Strehl knows. Particular progress has been made, for example, in the development

of computed tomography (CRT) in recent years. Regensburg University Hospital has purchased the latest 128-slice computed tomography scanner, which facilitates in particular the diagnosis of coronary heart disease. This miracle of technology manages to create 128 cross-sectional images of the body simultaneously, each with a density of less than one millimetre. This means that the coronary arteries can be examined in detail, which used to be a difficult procedure due to the beating of the heart. "In addition there is other expenditure for smaller equipment, such as special incubators for premature babies, which also have to be state-of-the-art," Rüdiger Strehl adds.

Transplantation – domain of university hospitals

"Transplantation is traditionally a field of activity of the university hospitals," VUD secretary-general Strehl continues. The University Hospital Regensburg, too, is well-known for its transplantation centre where all organs apart from lungs are transplanted. At the Paediatric University Hospital of Eastern Bavaria (KinderUniKlinik Ostbayern – KUNO) liver transplants are also conducted on children and babies. What is more, so far more than 30 artificial heart systems have been implanted in Regensburg.

From the example of transplantation medicine it becomes clear how patient care, research and teaching are linked in university medicine and how effectively the interaction is organised: "Medical research relies on the link to clinical application and contact with

patients," Rüdiger Strehl emphasises. "This so-called translation takes place above all at university hospitals. A broad exchange of specialised information is also possible by means of contact with the other faculties of the universities."

New treatment concepts

In this way the transplant patients benefit from the medical faculty located at the University Hospital Regensburg and the scientific research conducted in Regensburg. For in addition to actually treating patients, new treatment concepts are also developed and tested in clinical studies. For example, the doctors and scientists want to make transplants function longer and to reduce the side effects suffered by the patients. The clinical and operative work is supported above all by research into immunology. How can the body be prevented from rejecting a transplanted organ? This and other questions are the focus of numerous scientists and doctors-to-be, including doctoral students and undergraduates who are already involved in research during their medical degree courses.



A donor organ arrives – part of everyday life at the University Hospital Regensburg.

Training for patient care and research

In principle the university hospitals train doctors and cover the majority of medical further training. At the Student Training Centre (Studentisches Ausbildungs- und Trainingzentrum) of the University of Regensburg (STATUR) the students can, for example, practise examining and treating patients on simulation dolls or prepare for communicating with patients. The first contact with patients is generally in case presentations with interdisciplinary questions-and-answers sessions. The University Hospital Regensburg currently works together with eight aca-



In the labs of the University Hospital Regensburg research is conducted in the field of immunopathology, immunotherapy and integrated functional genomics.

demic teaching hospitals in the region where the students do their practical training in the clinical year. "The big advantage of teaching cooperations is that doctors-to-be are also able to gain practical experience outside the university hospital," dean Weber emphasises.

The young doctors are also introduced to medical research. "Our students do excellent work in the labs," the Regensburg dean says, full of praise for a major career step taken by about 10 percent of medical students each year. "In the SCIENCE MED programme our students are able to acquire research skills on a voluntary basis and at an early stage in their studies. The courses are conducted by the Competence Centre for Medical Didactics (Kompetenzzentrum für Medizindidaktik) and provide a structured training programme aimed at improving scientific skills, for example for work in the lab or the application of statistical procedures in research." Participation in SCIENCE MED is also an

advantage for obtaining one of the coveted places on the scholarship programme which is funded by the faculty and provides financial support for six to eight students per year who wish to spend a semester conducting research abroad.

INFORMATION

Verband der Universitätsklinika Deutschlands e.V. (VUD) (Association of University Hospitals in Germany)
www.uniklinika.de

Landkarte Hochschulmedizin
www.landkarte-hochschulmedizin.de

University Hospital Regensburg
www.uniklinikum-regensburg.de

Interview with Rüdiger Strehl, secretary-general of the VUD

University hospitals stand for top-class medicine

Rüdiger Strehl, the secretary-general of the Association of University Hospitals in Germany (Verband der Universitätsklinika Deutschlands – VUD), speaks of the important role of the university hospitals in medical training and explains forward-looking trends in university medicine.



How does medical training benefit from the university hospitals having a strengthened position?

Basic medical training and medical specialty training benefit from the fact that research and teaching can be linked directly with patient care in university hospitals. Strong university hospitals are successful in the entire task network of research, teaching and patient care; they deliver excellent quality in a broad spectrum of treatment at economically competitive prices. Students and especially

doctors doing medical specialty training therefore benefit from strong university hospitals because they are able to experience top-class medicine in all medical fields there.

How is the economic situation of university hospitals? What support structures are there?

The university hospitals are largely dependent on public funding, which provides for investments and the funding of research and teaching. The payment for medical services does not differ in principle from that in other hospitals.

New forms of funding are being tested in university medicine. For example, the government is promoting German Centres of Health Research on various widespread diseases, each working at several locations. It remains to be seen how the support structures will develop during the next decade.

What forward-looking trends can be seen at university hospitals?

One trend in medicine is the shift away from in-patient treatment towards more out-patient treatment. This development is important for the university hospitals for several reasons. First, they have to display the traditional medical core subjects in order to be able to train doctors and to maintain the link to research. Second, specialist care in Germany is reserved for practice-based physicians more strictly than in any other country. We need to strike out in new directions in this respect. The huge levels of investment required for university medicine makes the state governments consider privatisation or partial privatisation again and again. For this reason in 2006 the University Hospital of Gießen-Marburg was the first university hospital in Germany to be sold to a private investor. It is still too early to say whether this model for a university hospital will be permanently successful.

Interview with Nobel Laureate Professor Harald zur Hausen

Combining and linking competences

Professor Harald zur Hausen is a highly esteemed German cancer researcher. In 2008 he received the Nobel Prize in Medicine for discovering the papillomaviruses that cause cervical cancer. As a long-standing scientific director of the German Cancer Research Center (Deutsches Krebsforschungszentrum) in Heidelberg he provided for a groundbreaking link between basic research and clinical practice.



Professor zur Hausen, what do you see as the advantage of the medical competence centres or competence networks that are being initiated and promoted by the Federal Ministry of Education and Research?

I regard the setting up of a network of competence centres in health research as correct and important. As early as the 1990s I spoke in favour of promoting large research centres and made suggestions. Today I am happy to see these ideas being put into practice. By combining competences, research findings can move

more rapidly from the basic and clinical research stages into medical care, thus reaching the patients more quickly. The best groups of medical researchers from universities and research establishments outside universities work closely together at these centres and also integrate industry. In this way path-breaking findings should be obtained as quickly as possible and treatment opportunities should be established. It is also important, however, for the university institutions and the specialised research institutions to be recognised and respected as equal. Germany is on the right track on the whole with this research policy.

What importance do you attach to international researcher networking?

We rely on the international exchange of knowledge and information. When I look at my own research activity at the German Cancer Research Center, then I realise that essential parts of it are based on the progress made and knowledge gained in worldwide molecular biology and technology. We received a lot of help from abroad when we asked laboratories throughout the world for samples of cancer cells in our search for the different types of human papillomaviruses. In return we made copies of our virus cultures unreservedly available to foreign research centres, which were thus able to benefit from our insights. What was important to me in this respect was speeding up progress in cancer prevention.

In which areas do you expect new success in cancer research?

We understand more and more about the fundamental causes of cancer and how it develops. What is important now is to integrate this knowledge as quickly as possible into the clinical care of people suffering from cancer. With regard to my own field of research, into infec-

tious diseases, I see a wealth of challenges to be tackled. Where I also expect key successes for the prevention of cancer, however, is in the identification of further possible risk factors. I am also confident that new methods of individualised cancer treatment will emerge in the light of findings in molecular biology. We continue to make progress in basic research, too, for instance in stem cell research and in sequence analyses of genetic changes in cancer cells. Last but not least cancer research is focusing on the further development of established standard treatments, for instance the targeted use of chemotherapy for tumours, known among experts as “targeted chemotherapy”. I am a passionate researcher and see that there is still so much to do.

Are passion and enthusiasm necessary driving forces for researchers?

Yes, I think enthusiasm is an important prerequisite for exceptional achievements in science and research. The field of virology, which was still young at the time, triggered this enthusiasm in me very early on. However, enthusiasm is only a driving force for often tedious research activity. From my own experience I regard stamina and discipline as additional important characteristics that researchers should possess. A healthy amount of belief in the correctness of one’s own hypotheses is also necessary, since as a researcher one frequently has to defend them with good arguments and scientific evidence.

INFORMATION

In 2010 the German Cancer Research Center (Deutsches Krebsforschungszentrum) took on the function of a core centre cooperating with excellent university-based cancer centres in seven locations. It is therefore one of the total of six **German Centres of Health Research** initiated by the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung – BMBF).

In addition there are currently 21 **Competence Networks in Medicine** which are funded by the Federal Ministry of Education and Research and conduct research into various diseases. True to the motto of “disease-oriented research, expertise networking, knowledge transfer”, scientists, doctors and patient organisations have joined together in these networks.

In the **umbrella organisation TMF e.V.** the competence networks work together with other medical research associations in order to solve general issues and to improve quality standards.

www.kompetenznetze-medizin.de

Learning for tomorrow's medicine

Anyone opting to study medicine in Germany can expect challenging and at the same time fascinating studies. For medical training is embedded in an excellent research environment in the faculties of medicine and is closely linked with the professional medical care at the university hospitals. Modern teaching concepts bring the future doctors to the bedside at ever earlier stages in order to prepare them optimally for their profession.



The students already wear white coats – medical degree courses involve a large proportion of practical training.

In Germany medical training takes place solely at universities. Across the whole of Germany the degree course in human medicine is offered at 35 state universities and one private university. At the universities human medicine is a key element in the spectrum of life sciences. Some 11,000 university places are available for new students of human medicine between Kiel and Munich, and between Aachen and Dresden

every year. About 1,700 of the freshman students are from abroad.

What all universities have in common is their high-quality standards in training. This applies equally to the teaching staff and the students. Anyone interested in studying medicine should therefore have excellent school marks in biology, chemistry and physics as well as a basic understanding of medicine and natural sciences, a good spatial sense and

powers of observation, as well as communication skills. Good German language skills are essential in order to be able to follow lectures or to talk to patients. Good English language skills are also required for reading specialist literature, much of which is written in English. Knowledge of Latin, on the other hand, is not absolutely necessary. Studying medicine is very time-intensive and involves a lot of examinations. You therefore need comparatively high levels of personal resilience.



»» *During a language course in Berlin I decided to start studying medicine in Germany. There were a lot of factors that influenced me in this decision, including the good reputation of German universities, the fact that the tuition fees are not so high, and the hospitality of the country. The first semester was complicated because I first had to get used to student life and to overcome language barriers, but both the professors and my fellow students were always very open and helpful. My experiences were positive throughout.* ««

Tess Nuñez Quiroga comes from Mexico and is in her second semester of a degree in human medicine at the Martin Luther University Halle-Wittenberg.

High training standards

The contents and requirements of medical degree courses and the practical training in the hospitals and doctors' surgeries are regulated in Germany by the "Medical Licensure Act" ("Approbationsordnung für Ärzte" – ÄAppO). This guarantees high-quality teaching which is patient-oriented and follows pre-defined standards (see also the interview about the teaching model on page 15). In a year of practical training at the end of the degree course the students are prepared for professional practice (article on page 16).



»» *When I was in Germany the first time five years ago I already liked it here very much. Then I started to learn German, partly because I have a lot of German friends. They are much more fun than I used to think, by the way. I am very interested in the German health system and in medicine, especially the field of surgery. In addition I wanted to get to know German working methods.* ««

Pablo García Gonzalez comes from Spain and is in his tenth semester of a degree in human medicine at the University of Hamburg.

The Medical Licensure Act (ÄAppO) and the good reputation of the medical degrees abroad also guarantee unrestricted occupational mobility within Europe (see also the interview on page 10 regarding the international comparability of the medical degrees). The proximity to university and clinical research guarantees that medical training keeps up with the latest research. It provides students and graduates with diverse opportunities to enter academic careers at universities and research institutions.

The state examination is a quality seal

Standardised training standards do not mean uniformity, however. The faculties of medicine make use of the freedom they have in organising their degree courses and constantly strive to integrate new medical knowledge and new social challenges into their syllabuses. In order to optimise medical teaching, motivating and practical forms of learning are being developed, for example, by setting up skills labs or by using multimedia-based and interactive forms of teaching and examinations (see article starting on page 12). Innovative teaching concepts are currently being tested at seven universities in

the context of so-called “new degree courses in medicine” (see article on page 14).

The quality of medical training is also clear from the high success rates: 95 percent of all students who start a degree in human medicine graduate successfully (Federal Statistical Office, Hochschulen auf einen Blick, 2011). In contrast to the majority of degree courses at German universities, which lead to bachelor's or master's degrees, a degree in medicine ends with the national Final Examination for Doctors (Zweite Ärztliche Prüfung), also known as the “state examination”. Those who pass this examination can then go on to apply for their licence to practise medicine (“Approbation”) and are allowed to work as a doctor.

INFORMATION

www.hochschulkompass.de

Information provided by the German Rectors' Conference (Hochschulrektorenkonferenz - HRK) about higher education opportunities, universities and colleges, doctorate opportunities and international cooperations with German higher education institutions

www.hochschulstart.de

Internet portal of the Foundation for Higher Education Admission (Stiftung für Hochschulzulassung) for applications for degree courses in medicine and other subjects with national admission restrictions in Germany

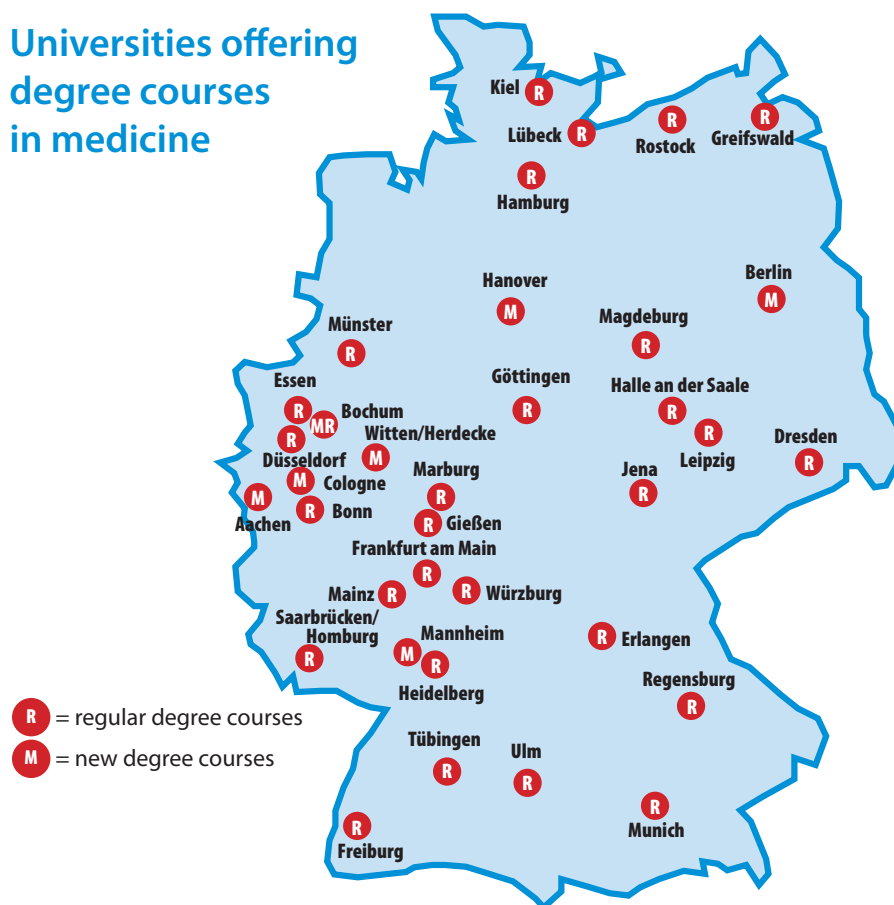
www.uni-assist.de

Internet portal of the University Application Service for International Students (Arbeits- und Servicestelle für ausländische Studienbewerber)

www.anabin.de

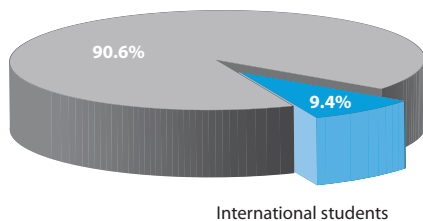
Information system of the Central Office for Foreign Education Systems “Zentralstelle für Ausländisches Bildungswesen” for the recognition and evaluation of foreign educational qualifications

Universities offering degree courses in medicine



Students of human medicine in 2010

German students



International students

Students in general:	78,314
of which German students:	70,974
of which international students (foreign students):	7,340

Sources: Wissenschaft weltoffen 2011, www.wissenschaft-weltoffen.de; Studentenstatistik Statistisches Bundesamt (student statistics of the Federal Statistical Office), www.destatis.de

A place at university in Germany – admission restrictions, application, admission

There are admission restrictions for degree courses in medicine at all universities in Germany. When selecting applicants the universities can take into account not only the average mark of the qualifications entitling the applicant to go to university but also other criteria, for example grades in certain subjects, the results of an interview, a vocational qualification gained before applying to university, the student's preferred university etc. What is also important is the waiting period for a university place.

University applicants from a member state of the European Union (EU), from Iceland, Liechtenstein and Norway or foreign nationals and stateless persons who have gained German qualifications

entitling them to go to university (so-called "Bildungsinländer") are treated as equal to German applicants and, like them, always have to apply via the Internet portal of the Foundation for Higher Education Admission (Stiftung für Hochschulzulassung)

hochschulstart.de.

All other international applicants for university places who fulfil the basic requirements for starting a degree course at a German university apply directly to their preferred university, which will also inform them about admission requirements for the degree course. Depending on the university, up to five percent of the university places are reserved for this group of applicants. For a number of universities,

applications have to be submitted via the University Application Service for International Students, **uni-assist**. You can find details about the member universities and detailed information about the application procedure at www.uni-assist.de.

In general the application for admission must have arrived at hochschulstart.de or at the relevant university by 15th July for the winter semester and by 15th January for the summer semester. The application deadlines may differ from this depending on the university, however.

Anyone interested in postgraduate studies (Master, PhD) has to apply directly to the university or to uni-assist.

Interview with Professor Dieter Bitter-Suermann (MFT)

Effective training with great chances of success

Degree courses in medicine in Germany differ in various aspects from those in other European countries. Professor Dieter Bitter-Suermann, President of the Association of the German Medical Faculties (Medizinischer Fakultätentag der Bundesrepublik Deutschland – MFT) explains why this is not a disadvantage and what requirements foreign students should fulfil.



Medical degree courses in Anglo-Saxon countries have the reputation of being especially practice-oriented. The language barrier is also lower there for most foreigners interested in studying. Is studying medicine in Germany attractive to international students in your opinion?

Yes, definitely. Medical degree courses in Germany have become far more practice-oriented in recent years. Clinical subjects are also considerably more prominent right at the beginning of the course. In this respect I see

no substantial differences compared with medical training in our neighbouring countries. A degree success rate of over 95 percent is also a clear indicator of how effective the training at our universities is.

Adequate knowledge of the German language is essential, however. It is very important for the students to be able to communicate with the patients. If the students have already gained some knowledge of the German language in their home countries, for example at school, that gives them a better start in their studies here. In the field of research, English is of course common as the language of science at German universities, too.

The faculties of medicine continue to hold on to the "state examination" and are not planning to introduce bachelor's and master's degrees in medicine. Could that not be an obstacle to the graduates' international mobility?

Not at all, this impression is misleading. Only about a third of the faculties of medicine in Europe offer bachelor's and master's degrees in medi-

cine. In countries such as Great Britain, the Netherlands or Switzerland, where there are bachelor's and master's degrees in human medicine, training is continuous and is aimed at the master's degree from the outset as the qualification required in order to be able to practise as a doctor. There are no doctors with bachelor's degrees in these countries either. In this respect I do not see any disadvantages for our graduates if we hold on to the "state examination" in Germany. Incidentally, students of medicine are some of the most mobile at German universities. They spend an average of four months of their degree courses studying in another country and more than a quarter of the students spend part of their clinical year abroad.

As a professor, what do you expect of students who come to Germany to study medicine?

A degree course in medicine is a challenging course of studies, demanding the students' total commitment. They should be aware of that. Actual linguistic competence is very important in order to be able to follow the lectures and to be able to cope with the theoretical and practical workload. Language certificates that the students have gained are not always a guarantee of this.

Apart from that, I would wish international students to take the opportunity to get to know Germany outside of the lecture theatres more often and to get to know the country and its people. It is certainly also one of the faculties' tasks to encourage this.

Association of the German Medical Faculties (Medizinischer Fakultätentag der Bundesrepublik Deutschland e.V.)

www.mft-online.de

MENTORING

Helping foreign students to get started

Many German universities have integration schemes that help freshman students from abroad to settle down in their new environment. Most of these initial support schemes are open to all faculties. Others, however, such as “MENTORING international” at the Julius Maximilian University of Würzburg, are aimed specifically at students of medicine.



Learning together: the degree success of international students depends essentially on their successful integration

One central idea is essentially pursued by all of the schemes: they are aimed at both German and international students at the same time. They focus on learning and experiencing together because it has been proven that integration works best that way and that success in studying sets in sooner.

The “PIASTA” integration programme run by the University of Hamburg comprises a number of components that are aimed in

principle at all students. One of these components is the “International Welcome Week”, when a varied programme helps students to get to know Hamburg and the university and to make first contacts. The PIASTA mentors support students from all faculties in their first and second semesters, helping them with learning and practising the most important basic skills. When, for example, pairs of students form so-called tandem partner-

ships, in which each partner learns the other partner’s native language, this increases both students’ intercultural competence.

“MENTORING international” is a project run by the University of Würzburg and is aimed specifically at students in the faculty of medicine. Like in the inter-faculty services provided by other universities, the student mentors explore the city of Würzburg with their foreign fellow students or give them a tour of the university campus. Intercultural seminars are also organised for participants in the scheme and for members of the university administration staff, and contacts are arranged. Everything else refers directly to the subject of medicine, for example when the mentors introduce the hospital or help the international students to organise the study plan for their medical studies and to cope with German medical terminology.



»» *My experiences with “MENTORING international” were very good. As a result of the scheme I was able to get to know international and German fellow students. By means of tutorials and clinical events mentoring gives especially international students ideal opportunities for the best possible start to their studies. I am doing my medical degree in Germany, by the way, because I believe that the German health and education systems are among the best in Europe.* ««

Dejan Krajnc comes from Slovenia and is in his second semester of a degree in human medicine at the University of Würzburg.

INFORMATION

PIASTA – Intercultural Living and Learning at the University of Hamburg

www.uni-hamburg.de/piasta

Mentoring International at the University of Würzburg

www.uni-wuerzburg.de/ueber/fakultae ten/medizin/studium_und_lehre/mentoring/ > Mentoring International

Training with simulators

Medical faculties in Germany combine tried-and-tested training methods with innovative teaching concepts. One example is the Universität Leipzig, where they have seen measurable success: 98.2 percent of the students in Leipzig passed the written part of the Final Examination in Medicine in autumn 2009. That put the Universität Leipzig at the top of the list in Germany.



Students at the "LernKlinik" in Leipzig practise resuscitation on a simulation doll.

Tobias Uhing is in his tenth semester of a degree in human medicine at the Universität Leipzig and is one of the tutors in the newly set up "LernKlinik Leipzig". This training centre has been available to Leipzig students since the end of 2010. The centre consists of a total of 14 sections where the students can train in practical medical skills, such as taking blood, performing ultrasound examinations, listening to the heart, performing various medical check-ups and suturing techniques, on more than 200 lifelike models and simulators. "The practice opportunities are a great help – you gain more confidence for practical use. That is also a huge advantage for the patients," Uhing says with certainty.

That is one reason why some two thirds of Germany's medical faculties have already set up facilities like the LernKlinik Leipzig, often called "skills labs", as an integral part of a modern teaching concept.

Practising emergency procedures on dolls

"The practice opportunities go down very well with the students," the 26-year-old

tutor says, summing up his experiences. He instructs groups of three to six participants in the fields of basic life support and advanced life support. On two simulation dolls the students realistically practise how to conduct basic resuscitation, what to do in cases of ventricular fibrillation or how to use emergency equipment correctly. It is vital that every step taken is right. The dolls are equipped with skills-reporters, which give immediate optical feedback on the measures that have just been conducted. On another doll you can perform an ECG and defibrillate if necessary, measure blood pressure and perform intubation.

Actors simulate patients

In room E 07 Mister K., the cardiology patient simulator, is waiting. "I'm sure we are often envied for our cardiac auscultation simulator," says Tobias Uhing. "With this device we can simulate all heart sounds and murmurs and obtain over 80 different results. The equipment wasn't exactly cheap," he adds.

Communication with the patients, for example when asking questions about

their medical histories (anamnesis), is also practised in the LernKlinik. Specially trained actor-patients simulate the role of the patients for this. The group observes the interview from an adjoining room and evaluates a video recording of the conversation together afterwards.

It is not only the routine medical techniques that are trained in the LernKlinik. "Less common procedures can also be trained here," the young tutor explains, "such as central venous catheterisation, where a thin plastic tube is inserted into a vein and pushed towards the heart."

Other components of the modern teaching concept in Leipzig are a mentoring programme (MedMentoL), E-learning opportunities and regular lecturer training, teaching evaluation and PBL ...

Close to everyday routine in the hospital

The abbreviation "PBL" stands for "problem-based learning", a teaching method that was originally developed in Canada and is also used in medical training at numerous German universities. "The students feel better prepared as a result of PBL as they have run through the entire process thoroughly, from diagnosis through to treatment," Tobias Uhing explains.

PBL always starts out from a specific case drawn from medical practice. The students solve complex problems or patient cases independently in small groups under the supervision of a specially trained tutor. This starts with obtaining medical results, diagnostics and treatment and goes right through to pathogenesis. Closely approxi-





Problem-based learning right from the start: students of medicine at the University of Hamburg interpret X-rays and CAT scans on a modern hospital trolley.

mating reality in everyday hospital life, this means that they can put their knowledge into patient-oriented practice at a very early stage. Any questions remaining unanswered are then discussed in a tutorial.

Almost like House M.D.

“We often deal with more routine cases, such as an elderly patient’s femoral neck fracture and the possible complications. Sometimes, however, the cases concern rare diseases – though not quite such tricky cases as those of House M.D.,” the doctor-to-be explains. What he and most of his fellow students in Leipzig appreciate about PBL is that this teaching concept leaves a relatively large amount of freedom for their own studies. “It is worth the effort in order to learn medical thinking and decision-making as early as possible,” Tobias Uhing is convinced.

Structure of regular degree courses in medicine

Part 1		
Semester	Practical training, courses and seminars	Additional achievements
1	Scientific basis of medicine:	First-aid course
2	Physics, chemistry and biology for doctors	
3	Physiology, biochemistry/molecular biology, anatomy	Nursing service 3 months
4	Medical psychology and medical sociology Introduction to clinical medicine (with case presentations), introduction to careers in medicine, medical terminology	
Intermediate Examination in Medicine		

Part 2			
Semester	Practical training, courses and seminars	Additional achievements	
5	General clinical studies; pathology, microbiology and immunology, pharmacology and toxicology, human genetics, radiology, biomathematics and others	Clinical elective 4 months	
6			
7			
8			
9			
10	Practical-clinical training in all major clinical sub-disciplines (general medicine, surgery, internal medicine, paediatrics, gynaecology, ophthalmology, urology, orthopaedics etc.) and interdisciplinary subjects (epidemiology, history and ethics, emergency medicine, health economics and health care, preventive medicine, radiography and others)		
11	Clinical year (48 weeks) at a teaching hospital or university hospital: 16 weeks each in internal medicine and surgery, as well as in either general medicine or another clinical-practical discipline		
12			
Final Examination in Medicine			

Medical degree courses in a state of change?

More practical elements with early patient contact, the removal of the rigid boundaries between the pre-clinical and the clinical stage, interdisciplinary teaching instead of subject-centred teaching – these are just a few of the features characterising the new degree courses in human medicine that are being introduced in pilot projects.



Practical training in the learning and examination centre at Witten/Herdecke University.

Even though the structure and the subject-related requirements of medical degrees are regulated uniformly in Germany via the Medical Licensure Act (Ärztliche Approbationsordnung – ÄAppO) – the universities have the possibility to break new ground in medical training. Seven universities have so far developed and introduced reform concepts for reorganising the teaching and the syllabuses (see map).

These concepts do not just place greater emphasis on self-regulated learning, they pursue a new philosophy: “problem- and solution-oriented learning and the model of an ‘adaptive medical personality’ are some of the fundamental pillars of medical training in Witten, as is patient contact from the first semester,” Marzellus Hofmann, head of the deanery of human medicine in the Faculty of Health at Witten/Herdecke University

explains to define the orientation of the new course of studies. The clinical-practical training at the bedside also takes place at cooperating hospitals providing all stages of care. “In addition there is the general medicine adoption programme, where students are introduced to outpatient care in doctor’s surgeries,” the head of the Witten deanery explains.

Combining theory and practice

Unlike in the regular medical degree courses (“Regelstudiengänge”), there is no longer a division between the pre-clinical stage – with its predominantly scientific syllabus and examinations – and the clinical stage. The result is a stronger link between scientific theory and clinical practice.

In the teaching, for example, the anatomical, physiological or clinical aspects of an organ are no longer dealt with one by one in isolation in the individual disciplines. Instead, the students get to know the organs or entire organ systems of the human body as topic areas. Within one subject area they learn, for example, about the structure and function of the human liver, how it can be examined, how liver diseases arise and develop and how they can be treated.

In line with this concept new types of examinations have been introduced in the new degree courses: instead of the preliminary examination in medicine (“Physikum”) at the



» From the first semester onwards we have direct contact with patients; first we take medical histories, later we conduct physical examinations and finally we learn how to deal with patients receiving palliative care. The specialist knowledge that we acquire initially refers to patient cases and later to complex case histories. Instead of working chapter by chapter through books which are structured according to subjects, I had to learn from the first semester onwards that many problems are “undisciplined” and that physiology, biochemistry and anatomy can be grasped more quickly if they are combined. After the numerous blocks of practical training in the hospital we practise how to deal systematically with complex diseases in differential diagnosis weeks, when we are often also able to build on knowledge acquired in the patient cases of the first semester. «

Giovanni Federico Torsello comes from Italy and is in his ninth semester of a degree in human medicine at Witten/Herdecke University.



end of the fourth semester, assessment tests are conducted at regular intervals. Here not only knowledge is tested but also medical skills. At the end of the degree course, however, all medical students take the same final examination, no matter whether they took a regular degree course or a new degree course.

Owing to the different teaching concepts of the individual new degree courses, however, it is more difficult to change university. This is generally not possible or only to a limited extent.

Choosing your own specialities

Some of the new degree courses allow the students to select their own individual

specialist areas, often also in cooperation with other faculties. For instance, the students on the new degree programme at RWTH Aachen University can acquire a quite specific qualification profile by combining courses from the fields of clinical neurosciences, public health or communication sciences. Marzellus Hofmann explains the 'studium fundamentale' at Witten/Herdecke University, which is an integral component of the new degree programme there, "here subjects from art, philosophy, politics and culture are dealt with from an interdisciplinary perspective. The curriculum also includes ethics, science, communication and health policy/health economics."

Trainings paths

An even more far-reaching focus is provided for in the new degree programme at Heidelberg University (Mannheim Faculty of Medicine). Here, while training as a doctor, the students are able to do additional training aimed at their desired occupational field: the qualification "Clinical Practice" specifically promotes practical medical skills. "Medicine plus Master's" enables the students to take a Master's degree in health economics or medical physics at the same time as studying medicine. "Medical Research" teaches skills in molecular medicine as well as knowledge of experimental diagnostics and experimental therapy.

Interview with Professor Stefanie Ritz-Timme, Dean of Studies at Düsseldorf University

A lively culture of teaching and learning

Supported in academic and personal matters and accompanied by the lecturer right through to working life – what student would not want that? At the Heinrich Heine University Düsseldorf (HHU) great emphasis is placed on such intensive support for students. Professor Stefanie Ritz-Timme, dean and director of the Institute for Forensic Medicine at the HHU explains the "teaching model" developed jointly by teachers and students of the Faculty of Medicine there in 2009.



What self-image did the Faculty of Medicine formulate in its teaching model?

The self-image of the whole faculty is formulated in the "teaching model", including the students who were actively involved in developing the model. That is why it says in the preamble, "the Faculty of Medicine is a community of students and teachers which develops with lively interaction and mutual esteem." According to this principle our teaching staff do not see themselves simply as

lecturers with didactic skills but also as contact persons, confidants and role models, who engage in dialogue with the students and with one another. The teaching model stands for a lively culture of teaching and learning.

What does this mean for the training of the future doctors?

We do not only want to prepare our students for the state examinations – we want to accompany them into a fulfilled and successful working life. This requires more than just knowledge that is tested in the state examinations. Being a doctor or a scientist involves various fields of competence. Against this background the faculty formulated primary learning objectives. This applies, for example, not only to the fields of diagnosis, therapy and prevention, but also to social, ethical and communicative competence. In future we will be giving the students more options and more freedom to foster and demand their own initiative in their studies and their own development. In order to be able to support our students on a personal level, too, we are currently setting up a mentoring scheme.

What role will E-learning and learning information systems play in medical training in future?

In order to cover the fields of competence listed above you need a lot of practical, patient-oriented teaching in small groups. This teaching can only be done during the time when the students are actually on site. E-learning opportunities and learning information systems are valuable additions because knowledge can be imparted and consolidated in this way without the students having to be on site longer; a free choice of when to learn provides for additional freedom. These options also make it possible to depict clearly what we require of our students and what opportunities we are offering them.

In Düsseldorf the students are able to submit assessments of lectures and courses. What are the actual consequences of this teaching evaluation?

The results of the course evaluations constitute valuable feedback from the students. To critics who say that the students only give "well-being marks", we can reply that the students also give constantly good assessments over long periods for "strict" lecturers and courses with "difficult" examinations. Together with my colleagues, I myself have developed our teaching over time, partly with reference to the comments and evaluations submitted by the students – with the result that the teaching is now very practice-oriented and lively and is a pleasure for both the students and my colleagues.

Teaching model

of the Faculty of Medicine of the Heinrich Heine University Düsseldorf:
www.medizinstudium.uni-duesseldorf.de > Studieninteressierte > Medizin in Düsseldorf

It becomes routine some time

Taking blood and holding hooks – students are confronted with these or similar tasks for the first time in their year of practical training, the clinical year. The Finnish student Elina Puska began this final part of her degree course at Rostock University Hospital with the necessary portion of pragmatism and was therefore soon accepted by the doctors as a member of the team.



Test of endurance in the hospital – students are coached by the responsible doctors during the clinical year.

For Elina Puska it was clear: “You can’t assume that you will be given new tasks every day.” The clinical year is designed in such a way that routine tasks are the order of the day. In this way the students can gain the necessary confidence for their future work. This includes introducing patients during the morning rounds just as much as inserting a urinary catheter. At the same time the clinical year is one of the best opportunities to sound out which specialist field of medicine

you prefer. The feedback from the senior physicians and consultants gives you an important indication of the direction of your medical career.

Training in three parts

The clinical year consists of three periods lasting three months each, one to be completed in surgery, one in internal medicine and the other in either general medicine or another discipline of clinical medicine. Elina

Puska is considering becoming a general practitioner later on, so she completed the general medicine part of her training at a GP surgery in Rostock.

Why does she want to work in a doctor’s surgery later on? “As a GP you know your patients and have a special relationship of trust with them. Working close to people appeals to me more than scientific work. I would also like to have time for my family in addition to working.” During the two periods of work in the hospital Elina Puska worked normal working hours from 7 a.m. to 4 p.m. and had the weekends off, so she was able to organise childcare for her young son more easily.

Demonstrating initiative

Especially younger doctors who completed their degrees and their clinical years not so long ago generally make a great effort to look after the students, as the 30-year-old knows from her own experience. “If you show commitment you will be regarded as an equal member of the team. It depends on how you treat people. If you get on well with the senior house officers and win their confidence, they hand over lots of tasks and you are also given more responsibility.”

She has always got along well with the patients, too – after more than seven years in Germany she speaks German with hardly any trace of an accent. Only her name sometimes arouses the patients’ curiosity. “A question about my nationality has always been a good conversation starter when talking to patients. I like it when people are interested in where I come from.”

Lectures and learning in addition

The students doing their clinical year at Rostock University Hospital are always off-duty on Fridays. On these days, the students attend compulsory lectures from the various disciplines. The afternoon is reserved for private study. In addition, Elina Puska tells us, there are “special events where the students can talk and exchange information interactively, and there are lectures and classes conducted by the doctors.”



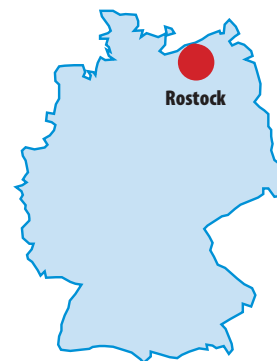
Elina Puska comes from Finland and is doing her clinical year at Rostock University Hospital.

Nonetheless the clinical year does not always leave enough freedom for the students to manage the required amount of studying, especially if, like Elina Puska, they have a family. "During the clinical year I didn't do much additional learning from books in addition to my daily work at the hospital."

Despite that she is still confident of passing the "Final Examination in Medicine". For during the clinical year she had enough time to put into practice the theoretical

knowledge she had acquired in the previous semesters. "The theory becomes more tangible and eventually things like taking blood or inserting a peripheral venous catheter become routine."

What Elina Puska sees as the greatest success of the clinical year is "the certainty that your decision to study medicine was the right one and that you will be a good doctor one day."



Medical ethics

Seeing eye to eye with the patient

In order to prepare future doctors for the moral and ethical conflicts in medical practice or in connection with their research activity, the subject "history, theory and ethics of medicine" is an integral part of medical training. Professor Bettina Schöne-Seifert, head of the medical ethics department at Münster University, talks about the ethical challenges of modern medicine.



How does a department for medical ethics contribute to topics such as the admissibility of prenatal diagnosis or embryonic stem cell research, euthanasia, living wills or assisted suicide?

First of all medical ethics gives the students opportunities to examine the issues mentioned. When they begin to see medical ethics in systematic relationships and to debate with one another in the seminars, they not only increase their own sensitivity in dealing with issues of medical ethics, they also learn

to take other people's opinions seriously.

Anyone who deals with medical ethics on a professional basis can help to analyse and position the problems and opinions more precisely and to get to the heart of the controversies. However, we do not have a professional head-start in the search for the ultimately "right" bioethical and biopolitical answers by any means. This can already be seen from the fact that there are just as many different opinions concerning the issues you mentioned among professional ethicists as there are among laymen or politicians.

I consider it important that our future doctors do not learn to perceive conflicts in the field of medical ethics primarily as a nuisance and an additional burden of their occupation, but as enriching challenges.

How can the future doctors be prepared specifically for the decisional conflicts in everyday medical life?

Take the way that living wills are dealt with as an example. As is well known, living wills concern the possibility to decide while you are still healthy how you wish to be treated should you one day no longer be able to make such decisions – for example if you are in a coma or have advanced dementia.

In summer 2009 the German Federal Parliament (Bundestag) passed a law recognising such documents of "preemptive self-determination" as absolutely binding if they fulfil certain conditions. However, it all remains ethically controversial and, moreover, is frequently interpreted incorrectly.

Here medical students require profound knowledge of the legal ethical situation and the ethical controversies. For their future work they have to learn to distinguish between genuine problems of medical practice, such as decision-making processes in the case of vague living wills, and illusory problems, such as conflicts with a carer when a living will is clear.

Another example, which is less conflict-ridden but even more important in daily life, has to do with decisions about treatment towards the end of life in the case of patients who are able to give their consent. Here it makes no difference how detailed the legislation is, the crucial starting point for advising the patients successfully is an ethical attitude – a virtue if you like – namely respect and goodwill on an eye-to-eye level. You don't learn to develop this by theorising about ethical issues but you can learn to understand that this is a key issue of good doctor-patient relationships.

Occasionally one has the impression that medical research in Germany is hampered by ethical regulations. Is that really the case?

The answer of course depends whether you are more worried with regard to biomedical research and its possibilities for misuse or whether you are optimistically pro-research. I myself belong more to the second camp under today's conditions of very extensive research control and transparency. From this point of view, the "obstacles" in the shape of ethics commissions that have to assess all biomedical research projects involving people and then authorise them from an ethical standpoint are perhaps wearisome but they are in principle very welcome. Ethics commissions rightly "hamper" research.

Alternatives to “Dr. med.”

Licence to practise medicine, doctoral studies, residency with further training to become a specialist – the medical career path in Germany used to be fairly clear cut. Now the options for academic further training have become more diverse and newly qualified medical practitioners can begin a career in research in structured doctoral programmes or graduate schools. A master’s degree can be taken before or after gaining the “Dr. med.” title, for example, in neurosciences, molecular biology or medical engineering.



Doctors conduct research in many areas, for example in human genetics: here a chromosome analysis is being conducted.

You do not need a doctorate to work as a doctor. Nevertheless medicine produces more doctorates at German universities than any other subject apart from biology and chemistry, even among students from abroad. In 2009, 481 foreign students graduated in medicine in Germany with 414 doctorates completed in the same year.

After gaining their licence to practise medicine, most medical practitioners in Germany study for a doctorate following the traditional model of one-to-one supervision by a doctoral supervisor. A doctorate is proof of

the graduate’s ability to conduct independent research. For most medical practitioners, however, it is not intended to be the first step of a career in research. Nonetheless, the “Dr. med.” title is acquired by medical graduates almost as if it were mandatory because it is part of the self-image of a doctor and inspires confidence in patients.

Structured doctoral programmes

The structures of academic further education have expanded over the past few years: anyone wishing to go into research or at

least retain the option of doing so can apply for a place in one of the structured doctoral programmes or graduate schools.

These include

- Research Training Groups of the German Research Foundation (Deutsche Forschungsgemeinschaft),
- Graduate schools at universities,
- Doctoral programmes at universities,
- Helmholtz International Graduate or Research Schools and
- International Max Planck Research Schools.



»» *During my two-week practical training at the department of otolaryngology, head and neck surgery at the University of Mainz, the director, Professor Mann, offered me the opportunity to take a doctorate under his supervision. Because the Mainz University Medical Center has a good reputation, it was obvious to me that I would make use of this opportunity. I am convinced that the German “Dr. med.” title will open doors for me outside Germany, too. In fact, my impression is that any doctorate from a German university is highly regarded in many parts of the world. It is also a chance for me to get to know Germany, its culture, language and people.* ««

Martynas Drigotas comes from Lithuania and is working towards a doctorate in cancer research at the Mainz University Medical Center.

Graduate schools or research schools (article on page 24) are usually international in nature and are supported by a number of closely cooperating research groups. Especially when looking from abroad, it is easier to get an overall picture of the options in Germany than with traditional individually supervised doctoral studies. International doctoral candidates find their feet more quickly in a team with intensive support from several professors. The research activities of the individual participants are integrated into the overall project. The interdisciplinary environment permits research work at the highest level.

Some programmes have a narrow focus while others allow a wide choice of research topic. The range offered for medical graduates includes “Life Sciences”, “Molecular Biology”, “Neurosciences”, “Infection Research”, “Bioengineering”, “International Health”, “Cellular Stress Responses in Ageing-Associated Diseases”, “Physiology of the Brain” and “Oligonucleotides in Cell Biology and Therapy”.

Master’s programme as an entry route to research

One reason why medical practitioners might enrol on a master’s course is to enter research and obtain a solid grounding in a particular scientific discipline. Many medical graduates applying from abroad do not yet have a doctorate and aim to acquire a doctorate in a connected PhD programme after completing their master’s degree. Other medical practitioners complete a master’s degree prior to or parallel to their specialist training to augment their qualification profile, for example, in medical neurosciences at the Charité in Berlin (article on page 20).

Interdisciplinary studies are available at the master’s level, too: the programmes offered provide interfaces to neurobiology and ethology, medical engineering (article on page 23), computer science, psychology, public health, environmental science and development cooperation (article on page 21).



»» *I deliberately opted for the structured doctoral course at the Graduate School of Neural and Behavioural Sciences in Tübingen because I would like to work in international research later on. The course here prepares us perfectly for such a career as it is taught in English and we work in multicultural and interdisciplinary teams. If I have a question to do with mathematics or statistics I can simply go downstairs and visit the mathematicians. If it is a question of physics I go upstairs and ask for advice there.* ««

Natalia Zaretska comes from Russia and is a doctoral student at the Werner Reichardt Centre for Integrative Neuroscience (CIN) at the International Max Planck Research School (IMPRS).

INFORMATION

DAAD – International Programmes in Germany

On the website of the German Academic Exchange Service (Deutscher Akademischer Austauschdienst), you can search for internationally recognised, accredited bachelor’s, master’s and doctoral programmes in the field of medicine, most of them taught in English. All the programmes offered in the database ensure special course-related and personal support for students and doctoral candidates from abroad.

www.daad.de/international-programmes

You will find a list of postgraduate courses related to development under:

www.daad.de/entwicklung > Information for Students and Alumni > Postgraduate Education > Postgraduate Courses

Further links

to find out about the programmes offered for graduates and postgraduates:

www.hochschulkompass.de

German Rectors’ Conference (HRK)

www.dfg.de

German Research Foundation (Deutsche Forschungsgemeinschaft – DFG)

www.research-explorer.de

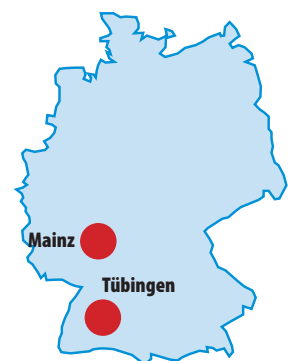
The Research Explorer of the DAAD and the DFG

www.helmholtz.de

Helmholtz Association

www.mpg.de

Max Planck Society



An interdisciplinary look into the brain

What happens when basic mechanisms in our brain no longer function correctly? How do dementia, Parkinson's or chronic pain arise? Students on the "Medical Neurosciences" master's programme at the Charité University Hospital in Berlin are conducting research into these and other questions.



How does a diseased brain differ from one that functions properly? This is the key question investigated in medical neurosciences.

Programme coordinator Lutz Steiner knows that his four-semester master's programme held completely in English arouses the interest of many students. And there are good reasons for that: "The neurosciences are a very young discipline that is very much characterised by interdisciplinary links, for example, with medicine, microbiology, psychology and even philosophy."

Research into the complex processes in our brain and nervous system are the focus

of several scientific disciplines. The breadth of the training is therefore one of the hallmarks of the Berlin master's programme: the students learn both about the neurobiological basis and about physiological and pathophysiological changes in the brain and the resulting clinical diseases. Neurodegenerative diseases, which are occurring more frequently due to the demographic development of the population, can be investigated from different angles with this approach.



»» *During my medical studies, I always wanted to deal with disorders of the brain. It was the right decision to join the International Graduate Programme at the Charité on graduating. Here, I can gain the basic theoretical knowledge that I need to be successful later on in my clinical work. As part of my studies, I have numerous opportunities to attend lectures by excellent researchers in neuroanatomy, neurophysiology and neuropathology and to work on my own research project in the laboratory. I am convinced that the experience I have gained here will give me a competitive advantage during my*

time as a house officer at the hospital. ««

Natalia Denisova comes from Russia, graduated in medicine and is now studying "Medical Neurosciences" at the Charité University Hospital in Berlin.

Technology also plays an important role. "Neuroscience research has been given a boost by developments in imaging methods enabling brain activities to be represented as images", Dr Benedikt Salmen, research coordinator of the programme, explains.

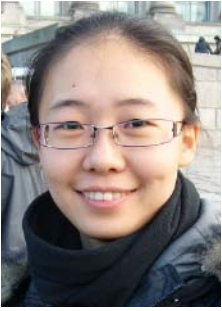
From bench to bedside

A further aim of the programme is to create the preconditions to enable scientific knowledge from fundamental research to be translated into clinical practice (translation). "In our case, the main fields concerned are stroke research, epilepsy research, neuroimmunology and multiple-sclerosis research. The name of our programme 'Medical Neurosciences' is therefore an apt description of what we intend to achieve", Lutz Steiner explains.

Dr Salmen illustrates translation using an example from epilepsy research: "We examined the physiological processes in febrile seizures in early childhood, which may be the cause of epilepsy occurring later on. It emerged that the faster respiration resulting from the raised body temperature is one cause of the cerebral attack. It results in an increase in the pH value of the blood which triggers convulsion." This result is significant for clinical practice because it shows how simple therapies can be once you know the background: "For example, it would be conceivable to have children breathe into a bag during an attack. This raises the CO₂ content of the blood again and the cerebral attack ceases."

An appealing route to research

"Our international students, in particular, currently around two thirds of the participants, appreciate the possibility of entering neuroscience research," Lutz Steiner reports. "Almost all graduates of the master's programme subsequently continue their neuroscience research; about one third remain in Berlin and complete doctorates as part of our 'Medical Neurosciences' PhD programme. The course is also interesting for medical graduates who would like to combine their training as a specialist with research work," Dr Salmen



»» *In the past two years, the Medical Neuroscience master's programme has given me, as a student of medicine, a comprehensive overview both of the basic knowledge of neurosciences and of the latest studies on different neurological diseases. The time I spent on my three lab rotations was characterised by a very open and friendly atmosphere. My main focus is on stroke research. I will do my doctorate here in Berlin, which I see as one of the best places for highly qualified training in the field of neuroscience.* ««

Tian Zhang comes from the People's Republic of China, is a graduate in medicine and is studying Medical Neurosciences at the Charité University Hospital in Berlin.

says, explaining the career plans of the medical target group.

Well networked community

"With our mentoring programme, we support all new students during the first six months of their studies. That helps the students to bond into a group quickly," programme coordinator Steiner explains.

The curriculum gives students enough freedom to define their own research focus. They can access the research infrastructure of the neuroscience community in Berlin, which

is very well networked. This also includes the cluster of excellence "NeuroCure", an interdisciplinary research network, which awards PhD and master's grants for the Medical Neuroscience programme. In addition to the Charité University Hospital in Berlin, neuroscientists of the Freie Universität Berlin, the Humboldt Universität zu Berlin and the non-university research institutes Max Delbrück Center for Molecular Medicine (MDC), Leibniz-Institut für Molekulare Pharmakologie (FMP) and the Deutsche Rheuma-Forschungszentrum Berlin (DRFZ) are all members of the consortium.



INFORMATION

International Graduate Program for Medical Neurosciences at the Charité University Hospital in Berlin

www.medical-neurosciences.de/en/program/master/

NeuroCure, Cluster of Excellence at the Charité University Hospital in Berlin

www.neurocure.de

Master of Science in International Health

Health for everyone

In many parts of the world, especially in developing and emerging countries, even the most rudimentary requirements for an effective public health care system are not met. In the International Health programmes specialists like Dr Nicholas Kyei from Ghana are trained to set up such systems.



Improvements in health care in developing and emerging countries can be achieved by means of cooperation at international, national and local level.

"In my home country, Ghana, and in many other developing countries, diseases such as AIDS, tuberculosis or malaria do a lot of damage," Dr Nicholas Kyei says, who knows it from his own experience. In order to be able to contribute more to strengthening health care systems in the future, he enrolled on the master's course in "International Health" at the University of Heidelberg. "As a practising doctor I became aware that there are factors outside of medical practice which make an important contribution to good-quality medical care."

Health care systems in developing and emerging countries

Analysing these factors is one of the emphases of this master's course in Heidelberg, which takes a close look at elements and structures of public health systems and the demands on health care in developing

Dr Nicholas Kyei comes from Ghana and is a student on the master's programme in International Health at Heidelberg University.



Dr Annelies Wilder-Smith is Mercator Professor and Director of Teaching at the Institute of Public Health.



and emerging countries. "With our master's course in International Health we want to impart the specialist knowledge and methodology which is urgently needed for managerial tasks in the public health sector," Dr Annelies Wilder-Smith, Mercator Professor and Director of Teaching at the Institute of Public Health, explains summarising the objectives of the master's course.

Eradicating diseases

The syllabus in Heidelberg covers, for example, current global campaigns aimed at eradicating diseases. "It is even more important to tackle health problems from a social perspective and to prevent them from reoccurring, than it is to treat individual members of the community after they have become sick or injured," Nicholas Kyei says. This perspective also includes examining a country's basic conditions such as the situation regarding nutrition, working conditions, social and cultural circumstances or environmental factors. Especially in developing countries a concept of this kind can provide many points of departure for improvements in health care.

The master's degree in International Health is aimed at university graduates who already have work experience in public health. It is highly interdisciplinary in nature and integrates topics from medicine, anthropology, biology, nursing science, epidemiology, economics and tropical medicine, to name just a few. The students not only acquire a foundation in the field of organisation and management but also consider how to promote cooperation at international, national and local level.

Participants from 14 countries, most of them from Europe or developing and emerging countries, are currently enrolled on the master's course. "This combination of nationalities triggers a variety of group-dynamics processes that are very productive

for our studies," Dr Wilder-Smith emphasises. The integration into the European "tropEd" network for education and training in international health contributes substantially to the internationality of the programme, which is taught entirely in English. For example, all the students in the part-time track use this network for courses at over 30 partner establishments in Africa, Asia, Europe and Latin America.

"From regular contact with people who have completed this course we know that the course helped them to obtain managerial or executive positions in transnational organisations, national development agencies and health authorities, in administration, with NGOs or at university institutions," Mercator Professor Wilder-Smith emphasises. And Nicholas Kyei adds, "With my master's degree in International Health I hope to find a job in international health care in order to help to fight global epidemics and alleviate diseases."

Help with funding

Both the one-year full-time course in Heidelberg (Residential Track) and the part-time course (European Track) are subject to tuition fees. "The University of Heidelberg is not able to grant any scholarships. The German Academic Exchange Service (Deutsche Akademischer Austauschdienst – DAAD) is a major provider of scholarships, however, and selects six to eight candidates for the Residential Track for a scholarship each year," the course coordinator explains and adds, "Funding is also often provided by institutions in the sending countries." For Dr Nicholas Kyei, too, the decisive factor for him starting the course was a DAAD scholarship: "This meant that I was able to live in the beautiful city of Heidelberg, get to know the German language and culture and enjoy the privilege of studying at this internationally renowned university."

Know-how from Heidelberg is much sought-after

Students of medicine from African, Asian and Latin-American countries who study at other German universities also benefit from the know-how in Heidelberg: in the context of the DAAD medical programme the Institute for Public Health organises weekend seminars on specific subjects in the field of "Health in Developing Countries". These seminars are seen as a supplement to university education and help students in their personal and academic orientation.



INFORMATION

Master's course in International Health at the University of Heidelberg

www.uni-heidelberg.de/studium/interesse/faecher/int_health.html

"tropEd" European Network for Education in International Health

www.troped.org

Biomedical Engineering master's programme

Looking into the body and growing organs

Doctors have to deal with technology every day: ultrasound scanners, pacemakers or computer tomography have become indispensable in modern medicine. In order to continue developing medical technology, master's students at RWTH Aachen University who are from different countries and different scientific disciplines are conducting research together on the international "Biomedical Engineering" programme.



An operating theatre is a high-tech room: patient records and x-rays can be examined at an information terminal there.

"I chose this course because later on I would like to work in a research team which drives ahead medical technology and also clinical diagnostics," Simone Laffar, master's student on the "Biomedical Engineering" programme, says. In order to achieve this goal she took the bold step from clinical medicine into medical engineering. After completing her basic medical training, the 31-year-old had already begun medical specialty training in psychiatry before deciding to take an engineering course: "In the hospital I noticed that technical equipment and procedures, such as magnetic resonance tomography (MRT), are gaining importance in diagnosis, therapy

and follow-up, and that there is a huge development potential for it. That aroused my interest."

A research-intensive, future-oriented sector

In Germany, medical engineering is an innovative, future-oriented industry and one of the focuses of the High-Tech-Strategy of the Federal Ministry for Education and Research (Bundesministerium für Bildung und Forschung – BMBF). In this sector, interdisciplinary teams are constantly developing new equipment, be it for operating procedures using so-called keyhole techniques or the

tinest telemetric blood pressure capsules. Experts from industry and science see German manufacturers' special strengths in imaging techniques, minimal invasive surgery, micro- and nanosystems, diagnostic imaging, endoscopy, biomaterials and active and passive implants.

The specialised modules of the course in Aachen that the students can choose from in the second and third semesters cover many of these fields: "Tissue Engineering", "Medical Imaging/Guided Therapy" and "Artificial Organs/Devices". In tissue engineering, biological processes and engineering techniques are used to produce natural tissue in the laboratory. The scientists often combine these tissues with metal or plastic parts to produce implants such as heart valves and stents, or artificial organs. Medical imaging covers all techniques that enable us to look into the human body. Diagnostic imaging therefore covers ultrasound, MRT, computer tomography and nuclear medicine.

Bringing knowledge levels into line

"The course is a potpourri of all possible disciplines," Simone Laffar says, describing the interdisciplinary composition of the programme. "There are graduates in mechanical engineering, molecular biology and electronics as well as students from the field of chemistry or medicine in our ranks." The different levels of knowledge have to be aligned: "That is why the students with technical degrees, such as mechanical engineering or electronics, attend courses in, say, anatomy and physiology in the first semester, whereas we medical graduates first deepen our knowledge of mathematics and physics and learn the basics of electronics," Simone Laffar explains.

Cambridge or TOEFL

The 30 course participants came to Aachen from all over the world. "The multicultural and international composition makes the course so special. Because students from Europe, Mexico, Thailand, Pakistan and other countries work together we also expand our intercultural competence while studying," Si-

Dr Simone Laffar is a student on the biomedical engineering master's programme at the RWTH University in Aachen.



DOCTORAL STUDIES AND GRADUATE PROGRAMMES

mone Laffar says. The language of instruction on the biomedical engineering programme is English, so all applicants have to have an international language certificate such as Cambridge or TOEFL.

There is a wealth of opportunities for graduates of the biomedical engineering master's course. In addition to the medical

engineering industry and the health care sector they are also sought after in research laboratories. Their tasks include research and development, production and product advice, sales and marketing and servicing for medical products. Simone Laffar already has plans for her career at any rate. Later on she would like to work in diagnostic imaging,

stem cell research or the development of biomaterials, such as artificial organs.



»» *At the Lampang Cancer Center we lacked know-how in the field of biomedical engineering. That is why I was awarded a grant by the government of Thailand to attend the master's programme in Aachen. I have a doctorate in medicine and it was not easy for me to start studying engineering. But in my future job as "Chief of Technology Transfer and Academic Supporting Division" I will be fully committed. My task will be to coordinate the transfer of technical knowledge in cancer treatment and research and specialised medicine. I will develop new medical technologies and set up information systems in the field of cancer research. One important aspect in this respect will be cooperation with other universities in Thailand that offer courses in biomedical engineering.* ««

Donsuk Pongnikorn comes from Thailand and is studying on the Biomedical Engineering master's programme at the RWTH University of Aachen.

Structured doctoral studies in Infection Research

War of the cells – how the body defends itself

At the Institute for Immunology of Hanover Medical School, Professor Reinhold Förster and his team investigate the dynamic processes which the immune system undergoes while fighting pathogens like bacteria, viruses, parasites and fungi. Dr Stephan Halle is a member of the team.



The processes occurring in organs during viral infections are examined using various microscopy techniques.

"During my basic medical training at Hanover Medical School I already dealt with immunobiology intensively. I found it fascinating and it aroused my interest in working in research," the 31-year-old doctor remembers. Today he is a doctoral student at the Helmholtz International Research School for Infection Biology (HIRSIB) studying on the "Infection Biology" PhD programme at Hanover Medical School. The aim of the three-year structured programme is to provide intensive training for young researchers in the field of infection biology.

Observing what happens in a cell

"I was able to build on my previous medical research here and am now using modern microscopy techniques to examine the processes occurring in organs during viral infections. Thanks to the two-photon microscope that we have here we are able to observe three-dimensional biological cell

INFORMATION

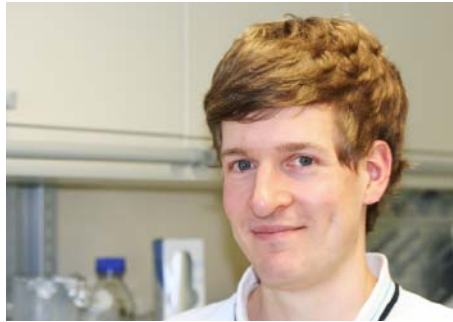
RWTH University Aachen (Rheinisch-Westfälische Technische Hochschule Aachen - RWTH)

www.rwth-aachen.de/go/id/liu/

Aachen University Hospital (Universitätsklinikum Aachen)

www.ukaachen.de > Studierende & Lehrende > Biomedical Engineering M.Sc.

Dr Stephan Halle is a doctoral student on the "Infection Biology" PhD programme at the Hanover Biomedical Research School (HBRS) at the Institute for Immunology of Hanover Medical School.



populations and tissues as well as immune responses. This is fundamental research. However, we also examine clinically relevant viruses," he says, describing his field of research.

Vaccines

Together with approximately 20 colleagues from all over the world who are selected each year in a rigorous selection procedure, he is interested in clarifying the fundamental cellular and molecular mechanisms of the immune system. The information they discover is the prerequisite for the future development of vaccines. "The H1 virus showed us that there is still such a lot to research before suitable vaccines become available," Dr Halle explains.

He sees the clear structure of the graduate programme as a definite advantage: "You are well integrated right from the start and communication with colleagues from the virology or immunology departments is intensive. Attending seminars in addition to conducting your own research in the laboratory is a challenge with regard to time management, but it can be done," the doctoral students knows.

Stephan Halle assesses his working conditions at the Helmholtz International Research School for Infection Biology as excellent. He does not only mean the excellent technical equipment. "My work is supported intensively by a group of supervisors and there are always competent contacts available." The doctoral students' research work is closely connected with the partner institutions and can therefore cover the essential aspects of the interactions between microbial pathogens and the immune system as well as their implementation in new strategies for the prevention, diagnosis and treatment of infectious diseases. Lecturers and courses from partner institutes such as the Helmholtz Centre for Infection Research in Braunschweig or guest scientists are also integrated into the teaching.

English opens (almost all) doors

As roughly half of the doctoral students are from abroad, the atmosphere at the institute is very international. The working language of the entire programme is English, so communication is no problem. That said, he tells us that his international colleagues have reported difficulties making themselves

understood in English in the administrative departments. "In my opinion that is an area with room for improvement," is Dr Halle's assessment.

With his doctorate in his pocket, the doctor of medicine has not yet decided what project he wants to begin after completing his research work. On the one hand he would like to stay in basic medical research in the field of infection biology, but on the other hand he would also like to train as a specialist. "Perhaps I can combine the two things," he says optimistically.



»» *The research environment at our institute is quite diversified. There is a team of experts for almost every technique and concept of immunology. I think it is one of the best laboratories for work in the field of fundamental immunology. The group is highly interested in exchanging ideas and participates effectively in discussion groups. The social environment is pleasant and cooperative. As an international student I had no trouble exchanging information or getting to know the other members of the laboratory.* ««

Pooja Mishra comes from India and is a doctoral student on the Infection Biology PhD programme of the Hanover Biomedical Research School (HBRS) at the Institute for Immunology of Hanover Medical School.

INFORMATION

Infection Biology PhD programme at Hanover Medical School

www.mh-hannover.de/zib.html

International Research School for Infection Biology (HIRSIB) and Hanover Biomedical Research School (HBRS)

www.mh-hannover.de/zib_schools.html

Helmholtz Centre for Infection Research

www.helmholtz-hzi.de

Shortage of doctors creates career opportunities

Doctors trained in Germany enjoy an excellent reputation all over the world. They are therefore in demand throughout the world in hospitals and medical care centres, in the public health service, in research institutes and in the pharmaceutical sector. More and more doctors opt for jobs in industry and research. This means that there are vacancies in hospitals, and successors are being sought for doctors' surgeries.



48.5 percent of doctors of medicine were working in a hospital in 2009.

Being unable to find a job is a problem that doctors of medicine are unlikely to face. "The last study of the number of doctors conducted by the German Medical Association (Bundesärztekammer - BÄK) made it clear that there is already a shortage of at least 6,700 doctors in out-patient and in-patient care," the vice president of the German Medical Association, Dr Martina Wenker, explains. In 2009 80 percent of the hospitals reported that they were unable to fill vacancies for doctors. In the out-patient sector, too, there is a shortage of doctors which will increase in the coming years. "By the year 2020 the replacement demand in the out-patient sector will total more than 51,000 doctors," Martina Wenker says with regard to the GMA's forecasts.

The largest group of doctors of medicine, amounting to 48.5 percent, worked in a

hospital in 2009. 32.5 percent had their own private practice or were employed in one. At least 24.2 percent were not working as doctors – an indication of the broad spectrum of employment options for doctors.

In 2010 the labour market report of the Federal Employment Agency (Bundesagentur für Arbeit) ascertained with regard to the graduate labour market in Germany that salaried doctors mainly work full-time but that there is a trend towards a reduction of working hours, which is being intensified by an increase in the proportion of female doctors. In 2010 one in seven doctors worked part-time, in 2000 it was only one in ten.

Medical specialty training

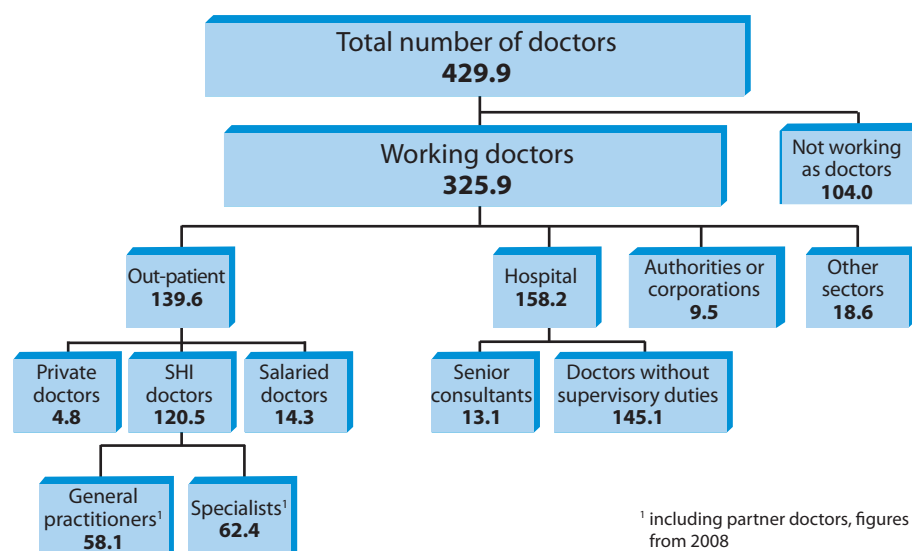
After receiving the state licence to practise medicine (Approbation) most doctors go on to train as specialists (see report on page 30),

which can take four to six years and is an important qualification level. During this time doctors gather clinical experience: they are employed as house officers in a hospital and specialise in one particular field, for example in general medicine, orthopaedics, surgery, anaesthesiology or radiology. In 2009 a good 70 percent of all working doctors could call themselves specialists.

Successors for doctors' surgeries wanted

The path to a doctor having his or her own surgery generally begins with training as a specialist at a hospital. For only doctors who have passed the examination following medical specialty training can obtain the authorisation to work as a Statutory Health Insurance Physician (Vertragsarzt) and can therefore lay the foundations for a

Structure of the medical profession in 2009 (figures in thousands)



Source: Statistics from the German Medical Association (Bundesärztekammer) and the National Association of Statutory Health Insurance Physicians (Kassenärztliche Bundesvereinigung) 2010

professional livelihood and good potential earnings. Business administration skills are required for organising a surgery, as in addition to actually caring for the patients, an independent doctor also has to deal with a large amount of administrative work.

Especially for general practitioners in the countryside this can lead to considerable workloads. On the other hand, this is an area where there are good job prospects. "The situation in the primary care sector is particularly pressing. By the year 2020 almost 24,000 GPs will have retired. A considerable replacement demand is developing in the eastern states of Germany," Martina Wenker from the German Medical Association says of the problems involved in finding successors for general practitioners.

Health service, pharmaceutical industry & Co.

Surgeries and hospitals are not the only career paths for doctors, however. Many medical practitioners find jobs in line with their idea of work-life balance, for example, in the public health service, in medical laboratories, in rehabilitation centres, in nursing services for the sick or the elderly or in hospices. Company medical officers or occupational health physicians, for example, help to prevent the employees in companies from developing health problems. In addition to that medical practitioners can

work for health insurance providers, medical associations or in some cases in management consultancies or in medical journalism.

The pharmaceutical industry also continues to be an attractive employer for medical practitioners. They can be found in the meantime not only in clinical research and drug safety but also in pre-clinical research, human pharmacology, marketing and drug registration (see interview on page 29). Work in this sector demands a certain "capability for marketing" as it involves not only research and development but also the launching of pharmaceutical products on the market. In virtually all areas it is necessary to work together in interdisciplinary teams and to be able to communicate results. For this reason one of the requirements is the ability to speak English clearly and fluently, and preferably another language, too, such as Spanish, French or German; skills in an Asian language would be an advantage.

Research is very popular

"Anyone working in research should be inquisitive and creative and be able to abstract well," Dr Simone Breitkopf, doctor and head of the "Clinical Research and Drug Safety" division of the German Pharmaceutical Industry Association (Bundesverband der Pharmazeutischen Industrie e.V. - BPI) says, describing the requirements of the sector. "Especially in pre-clinical and clinical research you must not be

discouraged by setbacks, after all only very few pharmaceutical products become marketable commodities and are registered."

Clinical experience is an important criterion for recruitment in the pharmaceutical industry. "Moving into research is easiest for specialists or for medical practitioners with advanced medical specialty training who know the diseases in question very well," Dr Simone Breitkopf emphasises.

However, a doctor with a permanent position at a hospital, too, can work in research occasionally or switch to a job in industry. Pharmaceutical firms, for example, work together with selected hospitals and research institutes in the context of clinical studies. This path begins at the Competence Centre of Clinical Studies (Kompetenzzentrum für Klinische Studien - KKS) of the respective hospital. "Models have been created which make it easier to exchange doctors between the KKS and industry," Dr Breitkopf explains. The report on page 28 shows one example of doctors finding interesting work environments in the clinical testing of drugs or procedures, in this case in plasma medicine.

INFORMATION

German Medical Association (Bundesärztekammer - BÄK), Syndicate of German Chambers of Physicians (Arbeitsgemeinschaft der Deutschen Ärztekammern)

www.bundesaerztekammer.de

German Pharmaceutical Industry Association (Bundesverband der Pharmazeutischen Industrie e.V. - BPI)

www.bpi.de

Deutsches Ärzteblatt

www.aerzteblatt.de

Deutscher Ärztinnenbund

www.aerztinnenbund.de

Deutsche Gesellschaft für Pharmazeutische Medizin e.V. (DGPharMed) (German Society for Pharmaceutical Medicine)

www.dgpharmed.de

Freie Ärzteschaft e.V.

www.freie-aerzteschaft.de

Hartmannbund

www.hartmannbund.de

Marburger Bund

www.marburger-bund.de

Cold plasma – hot stuff

At Schwabing Hospital in Munich a clinical study has been running since 2005 in which patients with chronically infected wounds are treated with cold plasma. The success speaks for itself, since the number of bacteria can be reduced considerably irrespective of its type and the resistance pattern – entirely without pain or side effects.

“So far we have successfully treated about 200 patients with plasma as an add-on procedure in more than 200,000 applications, in addition to the conventional forms of treatment,” says Dr Georg Isbary, a dermatologist at Schwabing Hospital who is in charge of the study under the supervision of Professor Wilhelm Stolz.

The project is a prime example of how research and hospitals work together even beyond the boundaries of medical science. Georg Isbary is supported by colleagues from the microbiology and neuropathology departments of Schwabing Hospital and is in constant contact with researchers at the Max Planck Institute for Extraterrestrial Physics in



Dr Georg Isbary is in charge of plasma research at the Clinic for Dermatology, Allergology and Environmental Medicine in Munich-Schwabing.

Interview with Dr Martina Wenker, vice president of the German Medical Association (BÄK)

Removing obstacles for young doctors

The figures speak for themselves: doctors of medicine have first-rate career prospects, including graduates from abroad. The vice president of the German Medical Association (Bundesärztekammer – BÄK), Dr Martina Wenker, explains why and, in the light of the shortage of doctors, outlines the need to create even better conditions for starting a career in medicine.



Many older doctors are retiring. Will we soon not have enough doctors?

The demographic development has long since caught up with the medical profession, too. In the meantime only about one in six working doctors is under the age of 35; the large proportion of colleagues aged over 50 (some 56 percent) and over 60 (some 16 percent) is growing constantly. Many of them will be unable to find successors in the future if the current conditions do not change soon.

In the hospitals almost 20,000 senior physicians and consultants will retire in the next ten years. So the shortage of doctors is going to intensify.

In this situation, what opportunities are there for graduates from abroad to gain a foothold as doctors in Germany?

The growing shortage of doctors in towns and in the countryside of course provides students from abroad with opportunities to work in Germany. In recent years there has been a substantial increase in the number of foreign doctors moving to Germany. In 2009 more than 1,900 doctors immigrated to Germany. Between 2000 and 2009 the annual immigration rate rose from 2.5 percent to 7.7 percent.

What are the reasons for the shortage of doctors?

Unfortunately more and more trained doctors decide against taking up a work in curative medicine and go into other occupational fields or move abroad. A total of twelve percent of medical graduates plan to work in other fields than preventive or curative medicine. The major factor underlying this decision is their assessment of the working conditions, the pay or the compatibility of work and family. Excessive bureaucracy and administrative tasks can also put people off. We urgently need to remove these obstacles.

How can the compatibility of work and family be improved?

Especially young doctors consider a good work-life balance to be important, especially as the proportion of female doctors is increasing. This trend has emerged in recent years and appears to be persisting. In times when we have a shortage of doctors this means that we have to enable our young colleagues to develop their careers even if they have families. In the health service this process seems to be taking longer. Many hospitals are only gradually realising that the hospitals which promote the compatibility of work and family deliberately and actively have a clear location and competitive advantage when it comes to finding qualified doctors. Some pioneering examples of child-care models in hospitals or medical faculties are presented for example in the German Medical Association manual “Familienfreundlicher Arbeitsplatz für Ärztinnen und Ärzte – Lebensqualität in der Berufsausübung” (“The family-friendly workplace for male and female doctors – quality of life while working” – only available in German).

Garching, which is conducting the physics-related groundwork.

No risks or side effects

“So far we have not found any side effects at all. The patients only feel a breath of warm air at 20 to 30 degrees Celsius, so the treatment is absolutely painless. This is due to the special composition of the so-called cold plasma,” Dr Isbary explains. This develops when only the electrons are stimulated by energy, but not the heavy neutrons and ions. This means that the plasma does not become much warmer than the ambient air but does not forfeit any of the advantages of other plasma procedures. The challenge here is to develop the plasma in such a way that the bacteria are destroyed but not the human cells,” Isbary says.

In the meantime 34 percent more bacteria can be destroyed in infected wounds using plasma therapy than using

conventional procedures alone. In order to verify this effect the wounds are divided into a treatment area (for the plasma treatment) and a control area (conventional wound treatment). After removing the dressing the wound is photographed and the bacterial colonisation of both areas is recorded using nitrocellulose filters. During the actual treatment the wound is exposed to the streams of plasma for two minutes. After the plasma treatment, filters are applied again to make it possible to compare the bacterial colonisation before and after the treatment.

Plasma has already been in use in medicine for a long time. For example, hot plasma is used to stop bleeding or to cauterise tumours. Plasmas in a vacuum are used to sterilise medical instruments.

In the meantime the researchers surrounding Dr Georg Isbary in Schwabing and cooperating teams no longer use the plasma

only to treat chronic wounds but also to treat other diseases caused by bacteria, fungi, viruses or other microorganisms, such as pruritic conditions or warts.

Plasma for household use?

Plasma is gaining ground, not only in medicine but also in dentistry, for treating caries, or in the field of hygiene. Dr Isbary sees it as quite “conceivable that alcohol-based hand disinfection will have been replaced by plasma disinfection in a few years and every general practitioner will have equipment for disinfecting hands in his surgery.” Who knows? Maybe one day in the distant future it will replace conventional deodorants, serve to prevent athlete’s foot and be used to disinfect toilet seats. Plasma could also be used in connection with food safety, for example, by installing plasma equipment in supermarkets where vegetables could be freed of germs before they are bought.

Interview: Doctors in the pharmaceutical sector

From fundamental research to market launch

“Doctors are involved in the entire lifecycle management of a pharmaceutical product,” Dr Simone Breitskopf reports, herself a doctor and head of the “Clinical Research and Drug Safety” division of the German Pharmaceutical Industry Association (Bundesverband der Pharmazeutischen Industrie – BPI), which represents 260 companies with around 72,000 employees.



How great is the demand for doctors of medicine in the pharmaceutical industry?

Demand is rising again after a dip in the late 1990s because many fields that used to employ mainly scientists and other specialists are now being staffed by doctors. One such field is drug safety.

Are pharmacology specialists especially in demand?

Yes and no. This particular medical speciality may be the ideal preparation for entering research but it is not essential. It always depends on the company, the product or the research project which type of specialist has the best chances. Clinical experience is always desirable.

How large is the proportion of foreign graduates? Is any recruiting done abroad?

Much of the pharmaceutical industry is international. The employees are recruited in the country where they are currently needed for a project. That is why our member companies employ a relatively large number of foreign graduates in medicine. The doctors they employ very often rotate, working, for example, at the corporate head office in Germany

and then at a branch office in the USA. This ensures constant exchange. This especially applies to the trainee programmes for managers.

What are the main tasks performed by doctors of medicine in the pharmaceutical industry?

Basically, doctors are employed throughout the lifecycle management of a pharmaceutical product. In pre-clinical and fundamental research, they primarily work with pharmacologists, chemists or biologists. In human pharmacology, that is when drugs are tested on human beings for the first time, all processes require medical supervision. During clinical development, doctors and other scientists are responsible for planning and conducting the clinical studies and looking into the question: How can you record what effect the medicine has on the patient? I am not aware of a single case in which the clinical testing is not headed by a doctor. Doctors can also be entrusted with approving drugs although that is usually still the province of the pharmacologists and chemists. Doctors now predominate in drug safety, monitoring product quality, effectiveness and safety after the drugs have been approved. Managerial positions in marketing or medical science departments (medical directors) are frequently staffed with doctors, partly to appeal to the medical community or because contacts at the health insurance providers, for example, are also doctors.

Anaesthesia requires training

Year after year, thousands of foreign medical graduates come to Germany to train as specialists, to obtain additional qualifications or to work as doctors. Dejan Arsic is one of them. He really appreciates both the training regulated by the State Chambers of Physicians and the clinical environment in Germany.



Anaesthesiology specialists are also responsible for intubation and the artificial respiration of patients.

“I missed Europe and clinical medicine”, is how Dejan Arsic, who has dual Serbian and New Zealand citizenship, explains his decision to return to Germany. Born in Germany, he returned to his parents’ native Serbia at the age of seven. There he graduated in medicine and went on to train as a specialist in laboratory medicine. In the late 1990s, he felt the urge to travel and emigrated to New Zealand, where he first completed a doctorate and then worked in internal medicine for two years. This was followed by another eight years in research.

Good prospects in Germany

He made the decision to return to Germany in 2010: “I had already toyed with the idea earlier because I really admire the German healthcare system, but the situation for doctors was not so good ten years ago as it is now.” As he spent part of his childhood in Germany, the German language and culture are no problem for him. He finally chose Gießen and Marburg University Hospital because they had given him most support. “My senior consultant helped me a lot with obtaining my temporary licence to practise.”

Dejan Arsic is working as a first-year house officer in the anaesthesia department. He explains his decision to go into this field with the wide range of tasks: “Anaesthesia is the interface between many branches of medicine, for example, internal medicine, cardiology or intensive-care and emergency medicine.”

In the operating theatre most of the time

As a house officer in the anaesthesia department, the 42-year-old spends most of his time in the operating theatre. “The house officers induce the anaesthesia independently and monitor the patient during the operation. In an emergency, however, a specialist is only one call away”, Dejan Arsic assures us. This activity can last up to six hours for major surgery, for example, on the thorax or abdomen.

Dejan Arsic’s tasks also include pre-operative and post-operative treatment of patients: “After major operations, we check the pain pumps on the patients and before operations, we conduct premedication outpatient examinations. We also supervise intensive-care transports.”

One important part of a specialist’s training is comprehensive documentation of the work performed. Using a logbook, which is conveniently in electronic form in anaesthesiology, the house officers keep a record of their work. “Because all anaesthetists are supported by the computer and information about the patient and the anaesthetic techniques used are recorded electronically, the doctor present only needs to enter his or her name. In other departments, the log has to be filled in manually.”

Weekly further training

Alongside their daily work, the house officers attend weekly further training on a range of different topics concerning anaesthesiology, such as resuscitation or anaesthesia for children. A feedback meeting with the senior consultant is scheduled once a year to assess the house officer’s performance.

Dejan Arsic feels well looked after and encourages his medical colleagues to take the opportunity of working as a doctor in Germany: “We could certainly use more house officers and specialists here.”



Dr Dejan Arsic comes from Serbia and is training as a specialist in anaesthesiology at Gießen and Marburg University Hospital.

Important links at a glance

Preparation and overview of degree courses

www.daad.de

Website of the German Academic Exchange Service (Deutscher Akademischer Austauschdienst – DAAD): first point of contact for reliable information regarding first degree courses and doctoral studies in Germany

www.daad.de/international-programmes

Possibility to search for internationally recognised, accredited bachelor's, master's and doctoral programmes at German universities, most of them taught in English

www.daad.de/entwicklung

> Information for students and alumni

> postgraduate education

> postgraduate courses

List of postgraduate courses with relevance to developing countries for young professionals from developing countries

> Information for students and alumni

> medical programme

Currently funded projects aimed at further medical training in the DAAD PAGEL programme

www.hochschulkompass.de

Information portal of the German Rectors' Conference (Hochschulrektorenkonferenz – HRK) with information on German higher education institutions, their courses and opportunities for doctoral studies, as well as international cooperations

Support and service

www.internationale-studierende.de

Information portal of the student unions (Studentenwerke) in Germany with information about economic, social, health and cultural support for international students at German universities

Application, admission

www.hochschulstart.de

Internet portal of the Foundation for Higher Education Admission (Stiftung für Hochschulzulassung) for applications for medical degree courses at universities in Germany

www.uni-assist.de

Internet portal of the University Application Service for International Students (Arbeits- und Servicestelle für ausländische Studienbewerber)

www.anabin.de

Information system for the recognition of foreign educational qualifications run by the Central Office for Foreign Education Systems (Zentralstelle für Ausländisches Bildungswesen – ZAB)

University medicine

www.uniklinika.de

Association of University Hospitals in Germany (Verband der Universitätsklinika Deutschlands e.V. – VUD)

www.mft-online.de

Association of the German Medical Faculties (Medizinischer Fakultätentag der Bundesrepublik Deutschland e.V. – MFT)

www.landkarte-hochschulmedizin.de

Comprehensive statistics on the research, teaching and patient care covered by university medicine in Germany

Scientific organisations, medical networks

www.dfg.de

German Research Foundation (Deutsche Forschungsgemeinschaft – DFG)

www.research-explorer.de

Research explorer of the DAAD and the DFG

www.helmholtz.de

Helmholtz Association (Helmholtz-Gemeinschaft e.V.)

www.mpg.de

Max Planck Society (Max-Planck-Gesellschaft e.V.)

www.kompetenznetze-medizin.de

Website of the 21 Competence Networks in Medicine on different diseases, which are funded by the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung – BMBF)

Funding

www.funding-guide.de

Information on various types of funding offered by the DAAD and a database of scholarships offered by other funding organisations

Associations, organisations

www.bundesaerztekammer.de

German Medical Association (Bundesärztekammer, Arbeitsgemeinschaft der Deutschen Ärztekammern – BÄK)

www.hartmannbund.de

Association of physicians in Germany (Hartmannbund, Verband der Ärzte Deutschlands e.V.)

www.marburger-bund.de

Association of employed physicians in Germany (Marburger Bund, Verband der angestellten und beamteten Ärztinnen und Ärzte Deutschlands e.V.)

www.aerztinnenbund.de

Network of female doctors and dentists from all disciplines and fields of activity (Deutscher Ärztinnenbund e.V.)

www.freie-aerzteschaft.de

An association of physicians which has set itself the task of improving the economic, legal and socio-political situation of practice-based physicians (Freie Ärzteschaft e.V.)

www.bvmd.de

German Medical Students' Association (Bundesvertretung der Medizinstudierenden in Deutschland – bvmd)

www.bpi.de

German Pharmaceutical Industry Association (Bundesverband der Pharmazeutischen Industrie e.V. – BPI)

www.dgpharmed.de

German Society for Pharmaceutical Medicine (Deutsche Gesellschaft für Pharmazeutische Medizin e.V. – DGPharMed)

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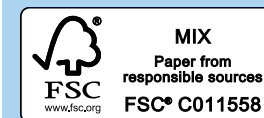
www.bwverlag.de

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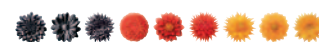
“If research and science are the biggest things on your mind, do what we did: study in Germany!”

The two South Koreans Kim Jin-Su and You-Kyung Byun are studying together at Bielefeld University.

Picture taken at the Brockhaus booth at the Frankfurt Book Fair. The Brockhaus is Germany's best known encyclopaedia.

www.study-in.de

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