



Molecular Medicine – the challenge of the 21st Century

What is Molecular Medicine?

The discovery of microorganisms as the cause of infectious diseases and penicillin as an effective weapon to combat them revolutionized the field of medicine in the last century. Today, medicine is again going through a phase of radical change. It has become clear that the causes of many human diseases reside in the cells, namely, the genes and the proteins they produce. To broaden this knowledge and use it for the well-being of patients is the aim of the new interdisciplinary scientific subject of *Molecular Medicine*. Scientists working in the field of Molecular Medicine analyse the molecular mechanisms of the origin of diseases with the long-term goal of developing innovative diagnostic and therapeutical concepts and strategies. Their experimental findings are highly relevant for society since cardiovascular diseases, cancer and metabolic disorders, to name but a few, are deemed to be the major causes of death worldwide. Moreover, dementia, such as Alzheimer's Disease and other diseases linked to ageing, will increase the costs for our health systems dramatically, especially in view of the dramatic demographic changes in population structure. Because of the significance of Molecular Medicine for modern society, the need to provide highly trained scientists will be of immense relevance for the future.

PhD training in Molecular Medicine at Ulm University

Modern concepts in Molecular Medicine utilize interdisciplinary approaches combining methods from the areas of molecular biology and genetics with those from informatics, mathematics, physics and engineering. In the past, PhD studies in Germany lasted many years and were marked by a strong dependency on one scientific supervisor. Today's training concepts are now based on a well structured and defined schedule

with a broader approach to supervision. In October 2005, the Medical Faculty of Ulm University launched a three year doctoral training programme entitled *International PhD Programme in Molecular Medicine*. The major aims of this programme are:

- to improve graduate training by creating an active and motivating research environment
- to encourage graduates to perform independent scientific research by adopting a multilevel supervision and mentoring approach
- to steer graduate education by establishing a definitive programme structure
- to advance graduate career opportunities in the academic world and in industry.

Our *International PhD Programme in Molecular Medicine* leads to the international degree of *Doctor of Philosophy* or the German degree *Doctor rerum naturalium*. Each PhD student has an interdisciplinary Thesis Advisory Committee (TAC) consisting of scientists from Ulm University and abroad who offer scientific advice from a wide range of perspectives. The graduates perform their research in the different institutes of Ulm University and come together for common training activities and to attend optional courses organized by the Graduate School. During the three year programme, the students have two intermediate examinations before their TAC to ensure appropriate progress in their scientific project.

Training in clinical research

To strengthen the training of medical students in clinical research, the Graduate School also runs the programme *Experimental Medicine*. In order to participate in this programme, students of human medicine have to interrupt their course of studies for nine months to work full time in a laboratory. During this period the students are supported by a fellowship of the Medical Faculty of € 500 per month. Besides their lab work, the doctoral students have to visit seminars, have to prepare literature reports and have to give progress reports. It is expected that with this structured programme for MD thesis work, the quality of the medical dissertations will increase significantly. In addition, medical students are excellently prepared for a PhD training.

Proven excellence

In 2006, the *Molecular Medicine* study programmes of Ulm University have been integrated into the newly founded *International Graduate School in Molecular Medicine Ulm*. One year later, the school's training concept received official recognition of its excellence through funding from the *Excellence Initiative of the German federal and state governments* amounting to € 1 million per annum for a period of 5 years. The 'Excellence Initiative' was started in 2005 to grant competitive awards to the best performing German universities – a great success for our Graduate School, the Medical Faculty and Ulm University.

Recently, our Bachelor, Master and PhD programmes have been accredited by the 'Central Evaluation and Accreditation Agency Hannover' (*ZevA, Zentrale Evaluations- und Akkreditierungsagentur Hannover*). This is yet another endorsement of the high scientific and educational quality of the programmes we offer.



International and Interdisciplinary:

Our TAC members are from:

Aachen/Germany
 Bellinzona/Switzerland
 Berlin/Germany
 Bonn/Germany
 Chapel Hill/USA
 Copenhagen/Denmark
 Dijon/France
 Essen/Germany
 Florence/Italy
 Freiburg/Germany
 Galway/Ireland
 Geneva/Switzerland
 Giessen/Germany
 Göttingen/Germany
 Gosselies/Belgium
 Halle/Germany
 Hamburg/Germany
 Hannover/Germany
 Heidelberg/Germany
 Karlsruhe/Germany
 Konstanz/Germany
 Leuven/Belgium
 Ljubljana/Slovenia
 London/Great Britain
 Lund/Sweden
 Magdeburg/Germany
 Mainz/Germany
 Mannheim/Germany
 Munich/Germany
 Newcastle/Great Britain
 Oulu/Finland
 Padova/Italy
 Pittsburgh/USA
 Regensburg/Germany
 Reutlingen/Germany
 Rome/Italy
 Rostock/Germany
 Tübingen/Germany
 Würzburg/Germany
 Wuhan/China

Mentoring of PhD students

Scientific mentoring

Scientific excellence depends on excellently trained young researchers. The training of such researchers is the key task of the *International Graduate School in Molecular Medicine Ulm*. As mentioned before, our major aims in this respect are:

- cutting-edge research training of young scientists
- scientific independence and self-responsibility of PhD students
- improvement of employability through training in key competences.

Each doctoral student is supervised by a Thesis Advisory Committee (TAC) consisting of three members: the group leader of the laboratory where the thesis work is performed; a scientist from another institute of Ulm University; and an external reviewer either from industry or from a research institute. The external reviewer can be a national or an international scientist. Within each TAC, scientists from different disciplines are involved to ensure interdisciplinary training and mentoring in research. The TAC supervises PhD students in their daily laboratory work to help them with formal or technical problems and evaluates oral examinations as well as the written dissertation. This multiple supervision approach supports the independence of our PhD students as young researchers.

From the beginning of their PhD studies, doctoral students are organized and trained in smaller, thematically focussed **Research Training Groups** which concentrate on specific research areas in Molecular Medicine implemented at Ulm University and defined by the externally funded cooperative research networks like Collaborative Research Centres or Clinical Research Units. One of these Research Training Groups (GRK 1041: Molecular Diabetology and Endocrinology in Medicine) gets a special fund by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG).

The Graduate School's Research Training Groups (August 2009)

Research Training Group	Coordinators	Principal Investigators	Research Objectives
Signalling Networks in Development and Degeneration	Böckers, Gierschik	Böckers, Gierschik, Kestler, Knöchel, Kühl, Lehmann-Horn, Liss, Ludolph, Nienhaus, Scharffetter-Kochanek, Rudolph, Schöning, Wirth	Understanding the principles of cellular signal reception/detection, intracellular signal transduction networks, knowing the fundamental aspects of the regulation of embryonic and postembryonic development and survival by signal transduction and genetic regulatory networks as well as epigenetic influences; knowing the molecular determinants of neural development; elucidating the mechanisms of degenerative conditions and diseases such as ageing and neuro-degeneration.
Signalling Networks in the Hematopoietic System and Oncology	Fulda, Wirth	Debatin, Döhner, Fehling, Fulda, Huber-Lang, Kestler, Kirchhoff, Rodewald Walther, Wirth	Understanding the principles of hematopoiesis and immune cell function, understanding the molecular mechanisms underlying malignant transformation including regulation of apoptosis
Signalling Networks in CardioMetabolic Disorders (Funded by the DFG: GRK 1041: Molecular Diabetology and Endocrinology in Medicine)	Böhm, Spindler	Böhm, Fehling, Fischer, Lehmann-Horn, Scharffetter-Kochanek, Spindler, Walther, Wirth	Understanding molecular principles of hormone action, understanding physiology and pathobiology of diabetes including autoimmunity, β -cell loss and vascular complication
Signalling Networks in Infectious Diseases	Mertens	NN	The research objectives and profile will be defined in 2010.

The graduates are actively integrated into the international scientific community: Each year the Graduate School organizes international meetings where students give presentations or talks and seek advice for their work from professional international scientists. We also hold scientific retreats where graduates have the opportunity to exchange ideas among themselves and with senior scientists in a relaxed atmosphere. Furthermore, our PhD students have the chance to attend meetings and conferences abroad with the financial support of a travel grant from the Graduate School.

In order to prepare our doctoral candidates for the job market, we offer a variety of soft skill courses and key competence seminars in such subjects as project management, bioethics and patent law. In addition, we regularly organize career workshops and excursions to pharmaceutical companies.



Multilevel social mentoring

Apart from their scientific training, our doctoral students are offered mentoring on different levels to facilitate their stay in Ulm and to help them concentrate fully on their academic performance in their chosen field of scientific research.

Our coordination office assists graduates with the organization of their studies within the *International PhD Programme in Molecular Medicine* and their study life in general. It is the first point of contact for applicants and assists them from their first acceptance into the programme, and throughout the period of their PhD studies to their final graduation. It also advises on issues concerning visas, contracts, work permits, accommodation, health insurance, etc.

M4M – Mentorship for Molecular Medicine PhD Students is the name of a social mentoring programme that brings together doctoral students and mature persons living in Ulm (so-called senior consultants) for mutual exchange and support. The idea of the programme is to give our international students a positive impression of everyday German culture through such social activities as excursions and themed evenings. This personal contact and individual support offers them the chance to integrate into German society more easily.



Each year the graduates elect a student to represent their interests on the different boards and committees of the Graduate School and to act as their official contact on student issues.

Last but not least, we have several student tutors who give new students advice concerning the PhD programme from a student's perspective and who assist them to become more familiar with the university and its facilities (i.e. internet access, university library etc.).





The Graduate School's international networking

Scientific excellence not only depends on the outstanding performance of talented young researchers but also on the close cooperation with a worldwide network of renowned partner institutions. Consequently, the Graduate School is making strong efforts to develop a doctoral training programme within an international context. A central element of our internationalization strategy is the previously mentioned Spring and Fall Meetings attended by speakers of international renown. A second important element is the promotion of international cooperation in the form of exchange programmes and international PhD programmes.

Since its foundation in 2006, the Graduate School has established close cooperation with the following international partner institutions:

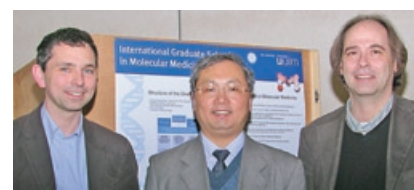
- Our most long-standing international relationship is that with the Biocenter Oulu, Finland. The Biocenter Oulu regularly invites students from the Graduate School to summer schools in Finland. Likewise, the Graduate School shares the insights of its research in Germany to Finnish graduates by inviting them to attend meetings and visit our laboratories. German and Finnish students also have the possibility of participating in practical training courses at either institution.
- Each year we organize summer schools abroad with the ultimate goal of presenting Ulm-based research in order to increase the international visibility of the school and to recruit highly qualified PhD candidates. In 2009, the Third Summer School on Signalling will be held at Huazhong University of Science and Technology/Tongji Medical College in Wuhan, China. A similar event took place in Timisoara, Romania in 2008 and Beijing, China in 2009.



Huazhong University
of Science & Technology



DEUTSCH-CHINESISCHES
Jahr der Wissenschaft und Bildung
2009/10





- A joint PhD programme with the University of Padua in Italy will be launched in the course of 2009. Doctoral students taking part in this programme will be supervised by Thesis Advisory Committees consisting of scientists from Ulm and Padua, and will spend a part of their studies at both universities.
- A tri-national PhD programme in Endocrinology has been established in collaboration with Bart's and Queen Mary's College (London), the Università 'Campus Bio-Medico' di Roma (Rome) and Universitat autònoma de Barcelona (Barcelona).
- The Graduate School is currently working on a new partnership with the University of North Carolina at Chapel Hill, USA. Some of the PhD students joining our programme in October 2009 will perform scientific cooperation projects between Ulm and Chapel Hill. These PhD students will spend a part of their studies at both universities.



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL



Besides the activities of the Graduate School itself, scientists from Ulm University are involved in externally reviewed international collaborative research networks, for example, Marie Curie Research Training Networks or NIH-funded groups. In addition, extensive international contacts are regularly established with individual scientists whose works are published jointly. These contacts provide the Graduate School with the additional opportunity for doctoral student exchanges.



Additional Benefits for PhD Students

Our programme offers additional benefits for PhD students. The most frequently requested programmes include:

Mobility Programme

In order to enhance the integration of our PhD students into the international scientific community, the Graduate School offers a mobility programme awarding financial support to PhD students who wish to participate in meetings and practical training abroad. Students can obtain funding for short visits to international conferences or for long-term stays at foreign laboratories lasting up to several months.

Doctoral Student Award

To motivate doctoral students and to honour extraordinary achievements, the Doctoral Student Award is presented once a year on Graduation Day by the Graduate School. Awards are conferred for excellent research as documented in publications or as talks given at international scientific conferences, and for the development and implementation of innovative novel methods. Interdisciplinary projects are given preferential consideration. The award amounts to € 2,500 and is presented to the doctoral student in person. The student is free to use it for any purpose that helps to promote his/her career in the field of science.



Postdoc Fellowships

The Graduate School provides postdoctoral fellowships for a period of 3-6 months and these are intended for outstanding doctoral students planning to apply for a postdoctoral academic position abroad. This is an important benefit since applications for postdoctoral fellowships are normally evaluated over a period of up to 6 months. Soft skill courses also offer assistance in writing grant applications and have proved useful for those beginning a new postdoctoral career.

Child Care Programme

At present, up to 66 % of our doctoral candidates are female. To maintain this standard, special initiatives have been adopted for the benefit of female doctoral students, single parent doctoral students and doctoral students with children. For example, our child care programme provides financial support for child day care and practical help in finding the right day care centre. Re-entry fellowships are provided for doctoral students who may have had to interrupt their work due to maternity leave.

Alumni Network

The Graduate School is currently establishing an alumni network so that on our yearly alumni day, former students can be informed about the annual development of the Graduate School. These former students are invited to give talks about their careers and experiences, regarding, for example, the transition from studying at university to working in industry. Our alumni are also invited to attend science meetings and seminars organized by the Graduate School. These events bring former and current doctoral students together to promote an enthusiastic doctoral culture at the Graduate School.



What do our alumni think about the Graduate School?

Anton Lebedev, Clinic of Dermatology and Allergic Diseases

Former Student Speaker

How do you create an excellent Graduate school? Simple! Just invite the right people to the right place. As a recent alumnus, I can say that Ulm is the spot, the place to be to carry out research, to enjoy fruitful discussions and finally graduate with a PhD in your pocket. It's all about people who create a great atmosphere for learning and sharing their knowledge. And I am very proud of all my small contributions to the Graduate School's development over the years since 2005.

What now? Yes...I am very excited about joining an outstanding 'cancer' lab at the McGill University in Montreal.



Sandrine Sander, Institute of Physiological Chemistry

After finishing medical school, the PhD programme offered by the International Graduate School in Molecular Medicine Ulm gave me the possibility of becoming a basic research scientist. Through my training at the Institute of Physiological Chemistry and by attending numerous seminars, lectures, workshops etc., organized by the Graduate School, I was able to increase my knowledge in molecular biology and improve my scientific skills. Working within a multidisciplinary program was sometimes challenging but also very fascinating.

Having obtained my PhD, I now feel well prepared to pursue a career in academic science. I am still interested in the field of leukaemia and lymphoma research and have now the chance to join the Immune Disease Institute at Harvard Medical School as a postdoctoral fellow. Thus, the PhD programme in Molecular Medicine at the International Graduate School in Ulm offers a great opportunity for all enthusiastic students to achieve their goals.



Michael Retlich, Institute of Pharmacology and Toxicology

The International PhD Program in Molecular Medicine at Ulm University is timely and unique. I got hands-on research training in a collaborative and state-of-the-art scientific environment that was not just confined to my own group. My work included aspects of pharmacology, biochemistry, molecular and cell biology as well as biophysics. With generous funding from the German government, the programme includes retreats, international conferences, workshops and training courses. And there are also soft skill courses such as scientific writing, journal clubs and, of course, a community of other PhD students from all over the world. I can highly recommend this programme to anyone aiming for a PhD!

