

DFG Establishes 23 New Research Training Groups

New Approaches to Doctorates in Medicine / Nine International Partnerships

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) is establishing 23 new Research Training Groups to further support early career researchers in Germany. This decision was made by the relevant Grants Committee in Bonn. The new Research Training Groups will offer doctoral researchers the chance to complete their theses in a structured research and qualification programme at a high academic level.

Nine of the new groups will be International Research Training Groups, which will work closely with universities in Canada, the USA, China, the Netherlands and Australia. The international aspect will increase the attractiveness of doctoral research within a Research Training Group. In addition, the interdisciplinary nature will promote international collaboration with universities and non-university institutions. The different forms of collaboration will also further support the structural development of the doctoral programme.

A number of Research Training Groups will offer novel approaches to doctoral training in medicine. Through international partnerships, a systematic recruitment process and an improved doctoral curriculum, doctoral researchers will be able to combine high-level research with practical clinical training. For the first time, an International Research Training Group has been established with an Australian university to promote the structured international training of early career researchers.

During the first funding period of four and a half years, the new doctoral programmes will receive approximately 78 million euros from the DFG (including an allowance for indirect project costs). In addition to establishing the 23 new Research Training Groups, the Grants Committee also approved extending seven existing groups. The DFG currently funds 226 Research Training Groups, including 48 international groups.

The new Research Training Groups (RTG) and International Research Training Groups (IRTG) (in alphabetical order by host university):

The mobility industry is responding to global changes in energy production and distribution with technical advances such as hybrid and battery technology. However, current electrical storage devices do not provide adequate energy or power density. The RTG **Integrated Energy Supply Modules for On-Road Electromobility** therefore seeks to study the physical principles of electrochemical storage devices for mobile drive systems and combine these devices with new fuel-driven range extender modules. These modules allow the size of the electrical storage device to be adapted to energy requirements while enabling the thermal regulation of the electrochemical storage system and efficient climate control inside the vehicle. The RTG will bring together expertise from a wide range of scientific and engineering disciplines in order to study research topics

relating to electrochemistry, heat and mass transfer, thermodynamics, control systems and simulation.

(Host University: RWTH Aachen University; Spokesperson: Prof. Dr.-Ing. Stefan Pischinger)

The range of measuring instruments currently available for the scientific analysis of complex and dynamic economic data and structures is inadequate. The IRTG **High-Dimensional Non-Stationary Time Series** intends to address this issue through a partnership between researchers in Germany and China. The researchers will investigate whether it is possible to identify low-dimensional indicators which are required in order to make predictions and structural analyses in the higher - that is more complex - dimension. To what extent can we predict the future development of a high-dimensional system, for example in neuroeconomics, using low-dimensional indicators? To answer this question, the researchers aim to develop dimension reduction techniques and study the three core research areas of high dimensionality, non-stationarity and temporary dependencies with the aid of experiments and models.

(Host University: Humboldt University of Berlin; Spokesperson: Prof. Dr. Wolfgang Härdle; Spokesperson for the Partner Institution: Professor Yongmiao Hong, Ph.D., Xiamen University, China)

The acquisition of experimental data in the natural sciences is becoming increasingly faster. In molecular biology and genetics, for example, billions of DNA base pairs from complex samples can be read in a matter of days with the help of state-of-the-art sequencing technologies – and the rate of technological progress shows no signs of slowing down. This progress also enables us to study entirely new questions, for example about the relationships between individuals in large populations. In many cases, however, analytical methods cannot keep pace with ever greater and more complex volumes of data. This is the key area that will be addressed by the IRTG **Computational Methods for the Analysis of the Diversity and Dynamics of Genomes**. Scientists will develop methods in bioinformatics for genome research in order to better define genome diversity and dynamics. The German-Canadian partnership will be primarily concerned with developing new algorithms to better analyse and understand variation between individuals (diversity) and changes over time within populations (dynamics).

(Host University: University of Bielefeld; Spokesperson: Prof. Dr. Jens Stoye; Spokesperson for the Partner Institution: Prof. Dr. S. Cenk Sahinalp, Simon Fraser University Surrey, Canada)

The RTG **Pharmacology of 7TM Receptors and Downstream Signal Paths** will study pharmacologically relevant signal paths in order to understand drug effects and disease mechanisms. The group brings together researchers from the fields of pharmacology, toxicology, pharmaceutical biology, medical and pharmaceutical chemistry, physiology and bioinformatics. Projects will be designed to address the following basic questions: How is the specificity of cell responses achieved given the sheer number of signal components and their possible interactions? How are signal paths interconnected? How can signal paths be efficiently and specifically modulated with pharmaceutical products? By way of example, the scientists intend to study an extremely important group of drug target molecules in the cell: receptors with seven transmembrane domains, known as 7TM receptors. In 2012 the Nobel Prize for Chemistry was awarded for their discovery. These receptors and their signal paths control many fundamental cellular functions and are the target of a wide range of drugs. An understanding of how these receptors work is needed in order to develop more effective drugs with fewer side effects.

(Host University: University of Bonn; Spokesperson: Prof. Dr. Alexander Pfeifer)

The aim of the RTG **The Photographic Dispositif** is to understand images. Researchers will focus on the theory and practice of photography, seeing photographic images not merely as pictures, but as a complex pattern of actions or "dispositif". In considering an image, we must take into account the technical, social, cultural and aesthetic framework in which it was produced. The researchers are also interested in the use and perception of images, for example the act of exhibiting photographs. It is assumed that when an image is exhibited, photography as a medium is reconstructed and imbued with various meanings. The research team, specialising in art and media sciences, visual art and design, intends firstly to construct a theoretically sound definition of dispositif specifically for photography. Through research in photographic museums and archives, the group will endeavour to understand this photographic dispositif as a knowledge order. By developing a definition of dispositif specific to photography, the RTG hopes to trace historical developments in photography from its beginnings to the present day and establish innovative methods and prospects for photography research.

(Host University: Braunschweig University of Art; Spokesperson: Prof. Dr. Katharina Sykora)

The Arctic climate and environment are changing more noticeably than anywhere else on the planet. This is due to polar amplification, a complex system of feedback processes that connect the Arctic ice sheet, the ocean and the atmosphere. A German-Canadian partnership, the IRTG **ArcTrain – Processes and Impacts of Climate Change in the North Atlantic Ocean and the Canadian Arctic**, will study the impacts of rising temperatures, the loss of sea ice and the melting of continental ice masses in the Arctic on global ocean circulation. Current models of complex feedback processes are not sufficiently precise, and this produces uncertainties in predictions. The researchers in this IRTG will take this problem as their starting point, seeking to achieve a more accurate understanding of the variability of the Arctic Ocean and the ice sheet on time-scales ranging from decades to millennia. The interdisciplinary environment combines marine geosciences, environmental physics and expertise in Arctic sea ice and ice sheet modelling.

(Host University: University of Bremen; Spokesperson: Prof. Dr. Michal Kucera; Spokesperson for the Partner Institution: Prof. Dr. Anne de Vernal, Université du Québec à Montreal, Canada)

The RTG **Micro-, Meso- and Macroporous Non-Metallic Materials: Principles and Applications (MIMENIMA)** will pursue a pioneering research idea: Scientists will study new types of porous ceramic structures and their surfaces in relation to potential applications in power engineering, environmental engineering, process engineering and the aerospace industry. Ceramic materials are highly resistant to corrosion and high temperatures, but are also very difficult to manufacture and condition. The scientists will employ new ceramic manufacturing techniques with which the required complex material structure and surface chemistry for the particular application can be achieved.

(Host University: University of Bremen; Spokesperson: Prof. Dr.-Ing. Kuroschi Rezwan)

The increasing scarcity of resources is placing more stringent demands on technical systems in manufacturing, logistics and IT. The RTG **Discrete Optimization of Technical Systems Under Uncertainty** will investigate how decisions in the development process for these systems can be optimised with due consideration of uncertainty factors. To date, attempts at system optimisation have been inadequate due to the need to drastically simplify many practical problems in order to achieve an algorithmic solution. To study discrete optimisation, the group will examine questions in algorithmics, statistics, applied sciences and psychology. The researchers will consider humans

and human decisions in the optimisation process and examine concrete application scenarios. Through this approach, the Dortmund-based RTG intends to obtain a comprehensive and interdisciplinary view of discrete optimisation.

(Host University: Technical University of Dortmund; Spokesperson: Prof. Dr. Peter Buchholz)

Hydrogels are chemical compounds with interesting properties: They can absorb and release huge amounts of water and in so doing increase or decrease in volume. The swelling process is triggered by physical or chemical variables such as temperature or pH value and depends on the structure and composition of the hydrogel; it is also reversible. This gives hydrogels interesting potential applications in microsystems, for example in medical technology. The RTG **Hydrogel-Based Microsystems** intends to obtain fundamental insights for the technical use of hydrogels in cost-effective microsystem solutions. They will achieve this firstly by testing special materials and processes, and secondly by using these materials and the techniques used to manufacture them to study microsystems such as biochemical sensors or chemical transistors. Through this interdisciplinary approach, which combines microsystem technology, structural and flow mechanics and chemical aspects, the RTG will make an important contribution to the solution of current problems in hydrogel applications.

(Host University: Technical University of Dresden; Spokesperson: Prof. Dr. Gerald Gerlach)

G-protein-coupled receptors (GPCRs) are proteins that play an important role in the human body in the transmission of sensory signals and the communication between cells and their environment. The importance of these receptors was emphasised earlier this year when the Nobel Prize for Chemistry was awarded to the scientists Brian Kobilka and Robert Lefkowitz. Because this class of proteins is involved in many essential processes in the body, any malfunctions can trigger serious diseases. However, this involvement in many of the body's processes also offers promising possibilities for new treatments. One-third of the drugs currently approved work by binding to these receptors. The RTG **Medicinal Chemistry of Selective GPCR Ligands** is dedicated to studying the molecular function of these receptors, with a focus on the synthesis of suitable and, especially, selective binding partners and their use in functional studies. The scientists will also analyse the suitability of these "ligands" as active substances for the treatment of chronic inflammatory cardiovascular disease and diseases of the central nervous system. The objective is to acquire a detailed understanding of the function of G-protein-coupled receptors in order to develop selective substances with minimal side effects.

(Host Universities: University of Erlangen-Nürnberg, University of Regensburg; Spokespersons: Prof. Dr. Peter Gmeiner, Prof. Dr. Armin Buschauer)

To date, not enough research has been done into the causes of male infertility. The IRTG **Molecular Pathogenesis of Male Reproductive Disorders** is concerned with male reproductive biology and medicine and thus with a very important field of research. The German-Australian partnership will focus on reproductive immunology and the role of growth factors and hormones in the normal and pathological function of the male reproductive tract. The IRTG will confer joint doctoral degrees from both universities. The doctoral training programme will include molecular and cell biology and translational aspects.

(Host University: University of Giessen; Spokesperson: Prof. Dr. Andreas Meinhardt; Spokesperson for the Partner Institution: Prof. Kate Loveland, Ph.D., Monash University, Australia)

Cardiac insufficiency (heart failure) is one of the most common causes of death worldwide. In spite of intensive research into the pathological changes that weaken the heart over an extended period of time, the specific molecular mechanisms of the disease are poorly understood. This is the main area of interest of the IRTG **Phosphorylation- and Redox-Mediated Signalling Mechanisms in the Failing Heart**, which brings together researchers based in Göttingen and London. By carrying out quantitative and qualitative analyses of redox- and phosphorylation-mediated signal paths, the scientists hope to improve our understanding of how even the smallest subcellular changes can result in arrhythmia or dysfunctions in the contraction of the heart muscles. To do this, they will identify and characterise individual modulators in these signal paths more precisely and study their cell type-specific characteristics. In the long term, the international team hopes to use this knowledge to develop new treatment strategies.

(Host University: University of Göttingen; Spokesperson: Prof. Dr. Dörthe Katschinski; Spokesperson for the Partner Institution: Prof. Metin Avkiran, King's College London, UK)

The RTG **Literature and the Dissemination of Literature in the Age of Digitization** will combine theory and practice. Researchers will examine how the literature of the past 30 years, its actors and its institutions have developed and the role played by new formats and digital communication channels in literature production. Researchers will also be given an early opportunity to gain practical experience in the dissemination of literature through six-month research stays with publishers, literary institutes, museums and archives. In this way, the RTG will innovatively combine the fundamental analysis of literature in the context of social and media history against a background of increasing digitisation with practical experience in the production, reception and dissemination of literature.

(Host University: University of Göttingen, Spokespersons: Prof. Dr. Claudia Stockinger, Prof. Dr. Simone Winko)

The RTG **Signalling at the Plant-Soil Interface** will take an analytical look beneath the surface of the soil to study how roots absorb signals from the soil and process them for plant growth. The soil can be understood as a complex signalling space in which plants are involved in different interactions with microbial partners, for example symbiotic or pathogenic interactions. The varying availability of nutrients, to which plants react, produces another set of interactions in the plant-soil system. Researchers will devote their attention equally to these biotic and abiotic interactions. In so doing they hope to answer questions about similarities and differences in plants' signal perception and processing, the fundamental mechanisms at work in this process, and the influence of signals from the soil on the plant's complete metabolism.

(Host University: University of Hannover; Spokesperson: Prof. Dr. Helge Küster)

The fight against diabetes, a fast-growing disease of our time, requires a joint research effort. The IRTG **Diabetic Microvascular Complications (DIAMICOM)** will bring together researchers from medicine and the life sciences to study complications of diabetes in the eyes, kidneys and nerves at the microvascular level. The partnership between German and Dutch researchers will focus on the underlying mechanisms of raised blood sugar and the genes and factors that offer protection against the damage it causes. The scientific focus will be on complications which are caused by increased blood sugar and are significant in both type 1 and type 2 diabetes. The partnership between researchers in Heidelberg and Groningen, which has been supporting the next generation of medical researchers since 2003, is based on a reformed medical curriculum that fol-

lows the recommendations of the DFG Senate Commission on Clinical Research to counter the shortage of early career researchers.

(Host University: University of Heidelberg; Spokesperson: Prof. Dr. Hans-Peter Hammes; Spokesperson for the Partner Institution: Prof. Dr. Han Moshage, Rijksuniversiteit Groningen, Netherlands)

Pattern recognition receptors (PRR) serve primarily to recognise microbial structures and trigger inflammatory reactions to fight and destroy pathogens. However, PRRs can also be activated by allergens, in which case they have a harmful effect. The IRTG **Immune Regulation of Inflammation in Allergy and Infection** is a German-American partnership that will study how this immune regulation works, from the molecular level to the level of the whole organism. Working at the interface between allergy and infection research, the scientists will seek to acquire new insights into the signal paths that trigger, sustain and terminate chronic infections and allergies. Using a wide spectrum of in vitro systems and in vivo models of inflammatory diseases, they will develop new approaches to treatment.

(Host University: University of Lübeck, Spokesperson: Prof. Dr. Jörg Köhl; Spokesperson for the Partner Institution: Prof. David Hildemann, Ph.D., Cincinnati Children's Hospital Medical Center, USA)

The RTG **Early Concepts of Man and Nature: Universal, Local, Borrowed** will study early concepts of man and nature in Southwest Asia, Northeast Africa and Europe. By analysing textual, pictorial and material sources covering a period from approximately 3200 BC to the Middle Ages, the team will endeavour to reach conclusions about concepts of man and nature. They will also examine the question of how these concepts were developed and transmitted between cultures and epochs. Using selected examples, the researchers will examine views on the origins of the world and the elements from prehistory to the medieval period, early concepts of natural phenomena and natural forces, descriptions of flora, fauna and landscape and perspectives of the human body, sickness and healing. The researchers' work will involve close collaboration between the humanities and the natural sciences and life sciences.

(Host University: University of Mainz; Spokesperson: Prof. Dr. Tanja Pommerening)

Human perceptions and actions are the result of complex neuronal processes. The aim of the IRTG **The Brain in Action** is to find out how the two processes in the brain influence each other. In cooperation with three Canadian universities, scientists will consider three key areas: the control of actions in natural environments, multisensory perception for actions, and the spatial representation of target stimuli for actions. Using innovative experimental and methodical approaches, the group of psychologists, physicists, engineers, sports scientists and medical scientists will collaborate to obtain comprehensive insights into systems neuroscience.

(Host Universities: University of Marburg, University of Giessen; Spokespersons: Prof. Dr. Frank Bremmer, Prof. Dr. Katja Fiehler; Spokespersons for the Partner Institutions: Prof. Dr. Douglas P. Munoz, Queen's University at Kingston, Canada; Prof. Dr. Jody Culham, University of Western Ontario, Canada; Prof. Dr. Doug Crawford, York University Toronto, Canada)

Reality, as it is described in literature, is directly dependent on the chosen artistic form. This connection, almost a tenet of the study of literature, will be examined in the context of the model concept of literary reality by the RTG **Literary Form. Historical and Cultural Formations of Aesthetic Models**. Insight on the significance of fiction and form in a given modelling of reality

has spread beyond the field of literature to the study of history, the social sciences and the natural sciences. The RTG will reexamine theoretical debates surrounding the contribution of literary forms within the literary discipline and discuss and analyse the basic problem of fictionality for general research in the theory and history of knowledge. By considering traditional questions about the formation of literary forms under the more general aspect of the formation of models, the researchers will seek to acquire insights of relevance to general knowledge culture and debate. (Host University: University of Münster; Spokesperson: Prof. Dr. Klaus Stierstorfer)

The research programme of the RTG **Molecular Basis of Sensory Biology** is concerned with senses and sensory processing. Scientists will investigate how sensory signals, whether sight, hearing, smell, magnetoception or bacterial chemoreception, are received and transmitted at the molecular level. Specifically, it will analyse the function of molecular switches and receptor-mediated signal transduction mechanisms. Through cell and molecular biology experiments and the development of physical model systems, the researchers expect to increase our understanding of fundamental molecular processes in the processing of sensory signals and thus drive the development of new technical systems, for example in biomedicine. (Host University: University of Oldenburg; Spokesperson: Prof. Dr. Karl-Wilhelm Koch)

The new IRTG **Diversity: Mediating Difference in Transcultural Spaces** is situated at the interface of the scientifically, politically and socially contentious subjects of multiculturalism and diversity. Within this interdisciplinary collaboration, the researchers intend to examine paradigm shifts and historical change processes in the handling of multicultural realities in North America and Europe since the end of the 18th century. Researchers will start from the premise that diversity is a constructed variable which is linked to the historical moment. To establish how cultural difference is expressed and construed over time, researchers will focus on three interdisciplinary topics: policies, practices and (historical) narratives of diversity. The international partnership with experts from Québec promises to yield fruitful approaches for the research programme, since Canada was the first country to introduce an official policy of multiculturalism and is still a point of reference for European debate. The interdisciplinary perspective also underlines the extent to which diversity is a spatially and temporally dynamic concept in which political, social and scientific ideas are interwoven. (Host University: University of Trier; Spokesperson: Prof. Dr. Ursula Lehmkuhl; Spokesperson for the Partner Institution: Prof. Dr. Laurence McFalls, Université de Montréal, Canada)

From shop talk to small talk, ambiguity is a characteristic feature of language and communication. It is therefore a central concept in linguistics and in all disciplines concerned with language-based utterances. The RTG **Ambiguity: Production and Perception** will bring together for the first time different language-related research approaches in order to understand why communication succeeds in spite of, or indeed as a result of, ambiguity, why it may also fail as a result, and what effects are triggered by ambiguity. By overcoming disciplinary isolation the group intends to obtain new insights as to how ambiguity is produced and perceived, triggered and resolved. These insights will lay the foundations for the future expansion of the question into non-language sign systems such as images and music. (Host University: University of Tübingen; Spokesperson: Prof. Dr. Matthias Bauer)

In view of current demographic change and our aging society, the question of healthy aging is becoming increasingly important. This is the issue that will be addressed by the RTG **Cellular and**

Molecular Mechanisms in Aging (CEMMA). The research programme will focus on age-related diseases such as neurodegenerative diseases, immunological dysfunctions and cancer. With a better understanding of how stem cells and differentiated cell types or organ systems age, we will be able to develop new treatments and prevention strategies. The RTG therefore represents a translational approach that combines basic research with application-oriented age research. (Host University: University of Ulm, Spokesperson: Prof. Dr. Hartmut Geiger)

Further Information

For more information about individual Research Training Groups, please contact the relevant spokesperson(s). You can also find out more about the programme and funded RTGs at:
www.dfg.de/gk/en/

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