Friedrich-Alexander-Universität
Faculty of Engineering
Faculty of Sciences
Faculty of Medicine

SyMoCADS

Research Positions for Doctoral and Postdoctoral Researchers (m/f/d)

- Research Training Group 2950 SyMoCADS

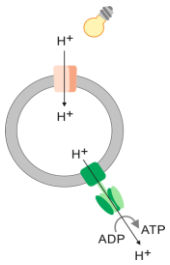
Research Training Group (RTG) 2950 - **Synthetic Molecular Communications Across Different Scales: From Theory to Experiments (SyMoCADS)** is a **research training program** funded by the **German Research Foundation (DFG)** with the aim to educate **scientists and engineers in this emerging interdisciplinary field** of research. The RTG comprises ten principal advisors (PAs) from the Faculty of Engineering, Faculty of Science, the Medical Faculty, and the University Hospital. Research takes place in an excellent scientific environment at FAU, with top-notch instrumentation in the laboratories of the participating principal advisors (PAs).

The research program consists of **9 research projects and is** organized in **3 clusters (C1-C3)** and **a cross-cluster postdoctoral project.** A structured qualification program aims to equip the participating researchers with the knowledge and skill set needed to significantly advance the field of molecular communication (MC) and to bring it to the realm of practical applications. **The first cohort of doctoral and postdoctoral researchers started in June 2024. Now, applications for the second cohort are invited.**

Cluster C1 focuses on the use of MC for the **design, monitoring, and control of bioprocesses on a microliter scale** and invites applications for the doctoral positions in the following three projects:

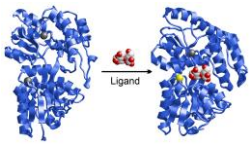
Project P1: Nanodevices for MC-Based Sensing and Control in Microliter-scale Bioreactors

- **PA**: Prof. Kathrin Castiglione (Institute of Bioprocess Engineering)
- **Project aim**: A light-driven energy-converting nanodevice to provide energy in form of ATP is to be developed. Key components of the device are membrane transport proteins with different spectral properties acting as high-precision pumps. These proteins are inserted into nanoscale polymer vesicles, so-called polymersomes, which serve as a structural chassis.
- **Qualification profile**: Master degree in Biotechnology, Life Science Engineering or a related field



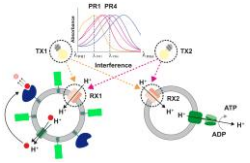
Project P2: Design and Characterization of Protein Modules for MC-Based Sensing and Control in Microliter-scale Bioreactors

- **PA**: Prof. Heinrich Sticht (Institute of Biochemistry)
- **Project aim**: Protein-based substrate-detection modules, which allow the measurement of the concentration of substrates and/or products in microliter-scale bioreactors that will be investigated and developed. The most promising designs will be used as part of the microliter-scale bioreactors in P1.
- **Qualification profile**: Master degree in Biochemistry or a related field



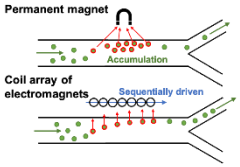
Project P3: MC-based Modelling, Monitoring, and Control of Microliter-scale Bioreactors

- **PA**: Prof. Robert Schober (Institute for Digital Communication)
- **Project aim**: The communication-theoretical modelling and the optimization of the joint operation of the pH-control nanodevice and the energy-converting nanodevice to provide the required ATP for the substrate-feeding nanodevice is the goal of this project. The main challenge is the development of concepts for the efficient and reliable joint operation of both nanodevices.
- **Qualification profile**: Master degree in Electrical Engineering with specialization in Communications or a related field



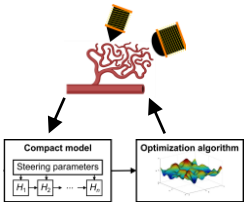
Cluster C2 focuses on the MC-based modelling, analysis, and design of magnetic steering systems for superparamagnetic iron oxide nanoparticles (**SPIONs**) and invites applications for the doctoral positions in the following three projects:

Project P4: Forces, Limitations, and Concepts for SPION Steering



- **PA:** Prof. Georg Fischer (Institute for Electronics Engineering)
- **Project aim:** Agglomerates of multiple SPIONs constitute a single magnetic domain of increased magnetic permeability. This motivates the exploitation of reluctance-induced forces, which are conventionally used in linear electrical motors. Therefore, the reluctance principle will be exploited for steering of SPION agglomerates with a propagating magnetic field generated by a sequentially driven coil array to avoid fixed locations of high magnetic field strength. The linear drive will be studied first via COMSOL Multiphysics simulation and then experimentally with a one-dimensional coil array to evaluate the reduction in SPION accumulation. The achievable SPION steering performance will be evaluated both in a simple tube system, as well as jointly with P5 in the vascular structures of the tumor models developed in P6.
- **Qualification profile:** Master degree in Electrical Engineering or a related field

Project P5: Lumped-Parameter Models for and Optimization of SPION Steering in Highly Branched Vascular and Tissue Structures



- **PA**: Prof. Jens Kirchner (Institute for Electronics Engineering)
- **Project aim**: In this doctoral project, the developed lumped-parameter models for SPION propagation in the considered MC channel will be exploited for the optimization of particle steering to to maximize the SPION concentration in the target area (i.e., at the MC receiver). Therefore, metaheuristic approaches will be investigated for solving the formulated optimization problem. The resulting SPION steering algorithms will be validated and refined via computer simulations based on the comprehensive MC channel model and via experiments using the tumor models from P6.
- **Qualification profile**: Master degree in Electrical Engineering, Medical Engineering, Physics or a related field

Project P6: Development of Tumor Models for MC based on Additive Manufacturing Approaches

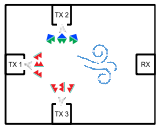
- **PA**: Prof. Dietmar Drummer (Institute of Polymer Technology)
- **Project aim**: In this doctoral project, the insights gained for tumor models and the SPION steering process will be leveraged for the generation of models with elastic materials. Therefore, the developed methodologies will be reviewed and adapted to elastic models. The methodology will be enhanced in terms of validating the elastic properties of the tumor model with the mechanics of tumor tissue with special emphasis to modelling of the complex capillary bed inside a tumor and the interface between this structure and the supplying channels.
- **Qualification profile**: Master degree in Medical Engineering, Mechanical Engineering, Chemical Engineering or a related field; Experience with polymers

Cluster C3 focuses on the development of models, designs, and system architectures for airborne MC and invites applications for the doctoral positions in the following three projects:

Project P7: Transmitter Systems for Releasing and Sending Airborne MC Signals as "Odor Objects"

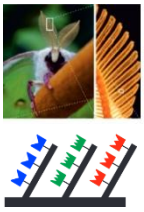
- **PA**: Prof. Andrea Büttner (Chair of Aroma and Smell Research)
- **Project aim**: In this project, combinations of microdosing systems, spray nozzles and orifices, either as single components spatially arranged, or as joint cluster and array systems, and olfactometer combinatory systems, will be used to study different release mechanisms. Physical testbeds will be first theoretically elaborated, in close collaboration with P9.
- **Qualification profile**: Master degree in Chemical Engineering, Electrical Engineering, Sensor Technology, Physics, Chemistry or a related field


Spatial distribution of pheromone glands (sg, tg, slg, fg, and mg) in a termite



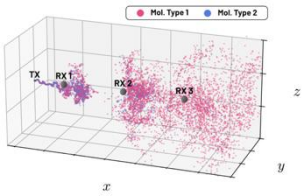
Project P8: Receiver Architectures for Information Recovery from Airborne MC Signals

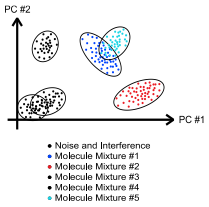
- **PA**: Dr. Helene Loos (Chair of Aroma and Smell Research)
- **Project aim**: The focus of the project is the reception of odor objects by employment of more sophisticated receiver architectures with multiple reception sites, including two main aspects: a) the presence of two or more receiver nodes related to the odor source; b) complex system architectures comprising two or more individual reception sites on a receiver system.
- **Qualification profile**: Master degree in Physics, Chemistry, Engineering or a related field



Project P9: Theoretical Modelling, Design, and Analysis of Olfaction-inspired Molecule-Mixture Communications

- **PA**: Prof. Vahid Jamali (Resilient Communication Systems)
- **Project aim**: In this, we will first investigate communication techniques and algorithms for efficient operation of the transmitter and receiver and optimize the system parameters for further performance improvement. Of particular interest is the optimization of the 3D arrangement of the release and sensing sites as well as investigation of the impact of turbulent odor plume on information exchange via molecular mixtures. The outputs of this project include communication-theoretical models and functional, optimized designs for airborne MC systems, which will be cross-validated with measurement data from the proof-of-concept testbeds in P7 and P8.
- **Qualification profile**: Master degree in Electrical Engineering with specialization in Communications or a related field



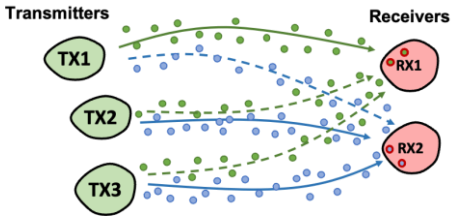


The **cross-cluster postdoctoral project** investigates the implications of specific properties of MC systems (e.g., length scale, transport mechanism, propagation environment, communication task, and constraints imposed on transmitter and receiver), particularly those considered in the doctoral projects of SyMoCADS, for **performance metrics**, **encoding of information**, **mathematical analysis**, and **efficient simulation**. The postdoctoral project cuts across all three clusters of SyMoCADS, connecting them and unveiling conceptual synergies and differences.

Moreover, the researcher working in the **postdoctoral project** will be supported by a mentoring team to establish her/himself as an independent researcher with the national and international visibility needed to qualify for an academic career.

Crossed-Cluster Postdoctoral Project (P10): Task-oriented and Environment-dependent Modelling, Analysis, and Design of MC Systems

- **PA**: Prof. Robert Schober (Institute for Digital Communications)
- **Project aim**: In this postdoctoral project, we will consider task-oriented multi-user MC systems involving multiple transmitters and multiple receivers. Depending on the level of cooperation between the different transmitters/receivers, from an information-theoretical point of view, such multi-user systems include multiple access channels, broadcast channels, and interference channels. Therefore, in this project, design concepts for task-oriented multiple access, broadcast, and interference MC systems for different length scales, transport mechanisms, environmental conditions, and communication tasks will be developed.



- **Qualification profile**: Doctoral degree (Ph.D.) in Electrical Engineering with specialization in Communications or a related field.

We offer

- TV-L E13 position (doctoral researchers, according to the DFG discipline specific guidelines) / TV-L E14 position (postdoctoral researcher) for up to four years starting on **1. December 2026**
- High quality interdisciplinary research in an emerging and fascinating field of research
- A structured supervision and qualification program
- Support through childcare services

Applicants for doctoral researcher positions are expected to have achieved outstanding grades in their Bachelor and Master programs. Prior publications are an asset but not required.

Prior high-quality research in the field of MC, documented through journal publications and awards, is expected from applicants for a **postdoctoral position**.

Application via e-mail

Please submit a **single pdf file**, including a **motivation letter** (max. 1 page, specifying which project you would like to work on and why you feel you are well qualified for the project), **curriculum vitae** (max. 2 pages), and **copies of graduation certificates** and **transcript of records** to symocads-info@fau.de by **June 30, 2026**. Later applications might also be considered but some positions may not be available anymore.

In its pursuit of academic excellence, FAU is committed to equality of opportunity and to a proactive and inclusive approach, which supports and encourages all under-represented groups, promotes an inclusive culture and values diversity. FAU promotes professional equality for women. Female applicants are therefore particularly encouraged to apply.

For further information contact PD Dr. Anna Maria Becker (symocads-info@fau.de).